MITSUBISHI ELECTRIC

INVERTER
A800 Plus
ROLL TO ROLL FUNCTION MANUAL

FR-A820-00046(0.4K)-04750(90K)-R2R
FR-A840-00023(0.4K)-06830(280K)-R2R
FR-A842-07700(315K)-12120(500K)-R2R

Roll to Roll Function

The FR-A800-R2R inverter has dedicated functions for roll to roll applications, in addition to the functions of the standard type FR-A800 inverter.
This Roll to Roll Function Manual explains the functions dedicated to the FR-A800-R2R inverter. For the functions not found in this Function Manual, refer to the Instruction Manual of the FR-A800 inverter.
In addition to this Roll to Roll Function Manual, please read the Instruction Manual of the FR-A800 inverter carefully. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.
Please forward this Function Manual to the end user.

A800-R2R

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1 INTRODUCTION

1.1 FR-A800-R2R overview

- The FR-A800-R2R inverter with dedicated functions is useful for winding machines with dancer rolls when a difference between the minimum diameter and the maximum diameter is large, a fast feeding speed is required, etc.
- This product is also useful for roll to roll winding applications such as for wire drawing machines and paper rolling machines for printers.
- The following four control functions are available for keeping a constant tension on the workpiece.

Control function	Description
Dancer feedback speed control	Speed control to keep the line speed and the dancer roll position constant.
Tension sensor feedback speed control	Speed control to keep the line speed and the tension sensor feedback constant.
Tension sensorless torque control	Torque control to keep a constant tension on the workpiece without using a dancer roll and a tension controller.
Tension sensor feedback torque control	Torque control to more accurately keep a constant tension on the workpiece using feedback from the tension sensor.

- The following table shows the main parameter settings required to enable the four control functions.

Control function	Pr.178 to Pr.186 (Input terminal function selection)	Pr.128 PID action selection	Control method
Dancer feedback speed control*1*2	114 (Assign the X114 signal to an input terminal.)	40 or 41	Vector control or Real sensorless vector control is recommended.
Tension sensor feedback speed control*1*2			
Tension sensorless torque control		Setting not required	
Tension sensor feedback torque control		40 or 41	

*1 To use the winding diameter calculation function during speed control without feedback, set **Pr.128** = "40 or 41" and turn ON the X114 signal.

*2 To feed paper or wire, turn ON all X114, X115, and X116 signals and disable winding diameter compensation and PID compensation so that the line speed command for tension control (dancer feedback speed control / tension sensor feedback speed control) is used for the feed operation.

- The following table shows the combinations of control method/mode of the inverter and the validity of the four control functions.

Pr.80 (Pr.453), Pr.81 (Pr.454)	Pr.800 setting *3	Pr.451 setting *3	Control method	Control mode	Validity of control function			
					Dancer feedback speed control / tension sensor feedback speed control		Tension sensorless torque control / tension sensor feedback torque control	
					MC-ON	MC-OFF	MC-ON	MC-OFF
Motor capacity, number of motor poles	0, 100	—	Vector control*4	Speed control	○		×	
	1, 101	—		Torque control	×		○	
	2, 102	—		Speed control/torque control switchover	×*6	○*6	○*6	×*6
	9, 109	—	Vector control test operation		×	×	×	×
	10, 110		Real sensorless vector control	Speed control	○		×	
	11, 111			Torque control	×		○	
	12, 112			Speed control/torque control switchover	×*6	○*6	○*6	×*6
	20 (initial value)	20	Advanced magnetic flux vector control	Speed control	○		×	
	—	9999 (initial value)	Advanced magnetic flux vector control for the second motor		○		×	
9999*5	—		V/F control		○		×	

○: Valid, ×: Invalid

*3 The setting values of 100 and above are used when the fast-response operation is selected. (For the SND rating, the fast-response operation is not available.)

*4 Advanced magnetic flux vector control is applied if a vector control compatible option is not installed.

*5 V/F control is applied when **Pr.80** or **Pr.81** is "9999", regardless of the **Pr.800** setting.

*6 The control method can be changed using the MC signal while the inverter is stopped.

◆Speed command / torque command information

The speed command / torque command differs depending on whether the controls are enabled or disabled as follows.

Dancer feedback speed control /Tension sensor feedback speed control	Speed command
Disabled	Frequency [Hz]
Enabled	Line speed [m/min]

Tension sensorless torque control / Tension sensor feedback torque control	Torque command
Disabled	Torque [%]
Enabled	Tension [N]

◆Speed command / torque command and calibration parameters

The following tables show the speed command / torque command which differ depending on the combination of the X114 signal (Tension control selection) and **Pr.128 PID action selection**, and calibration parameters for each command.

• Speed command during dancer feedback speed control / tension sensor feedback speed control

X114 signal (Tension control selection)	Pr.128 setting (PID action selection)	Dancer feedback speed control / Tension sensor feedback speed control	Speed command	Analog input calibration	
				Speed command setting unit	Calibration parameter
OFF	0 (initial value)	Disabled	Frequency*1 *2	Hz	**Pr.125, Pr.126, C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918)**
	40 or 41				
ON	0 (initial value)				
	40 or 41	Enabled	Line speed	m/min*3	**Pr.350 to Pr.353**

• Torque command during tension sensorless torque control

X114 signal (Tension control selection)	Tension sensorless torque control	Torque command	Analog input calibration	
			Torque command setting increment	Calibration parameter
OFF	Disabled	Torque	%	**C16 (Pr.919) to C19 (Pr.920), C38 (Pr.932) to C41 (Pr.933)**
ON	Enabled	Tension	N*4	**Pr.1402 to Pr.1405**

• Torque command during tension sensor feedback torque control

X114 signal (Tension control selection)	Pr.128 setting (PID action selection)	Tension sensor feedback Torque control	Torque command	Analog input calibration	
				Torque command setting increment	Calibration parameter
OFF	0 (initial value)	Disabled	Torque	%	**C16 (Pr.919) to C19 (Pr.920), C38 (Pr.932) to C41 (Pr.933)**
	40 or 41				
ON	0 (initial value)				
	40 or 41	Enabled	Tension	N*4	**Pr.1402 to Pr.1405**

*1 The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. Set "0" in **Pr.361** to input a frequency command. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.)
Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command.
In this case, the bias and gain parameter settings must be consistent for both command types.
Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918)**
Calibration parameters for line speed command input: **Pr.350 to Pr.353**

*2 To feed paper or wire, turn ON all X114, X115, and X116 signals and disable winding diameter compensation and PID compensation so that the line speed command for tension control (dancer feedback speed control / tension sensor feedback speed control) is used for the feed operation.

*3 The setting unit can be selected by using **Pr.358 Line speed unit**.

*4 The setting increment can be selected by using **Pr.1401 Tension command increment**.

⚠CAUTION

- **The X114 signal and Pr.128 must be set in any combination shown in the tables above to prevent the motor from operating at an unintended speed.**
- **Before operating the inverter, use parameters shown in the tables above to calibrate each command value according to whether each control is enabled or disabled.**

◆Inverter model

Unpack the product and check the rating plate and the capacity plate of the inverter to ensure that the model agrees with the order and the product is intact.

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Structure, functionality
0	Standard model
2	Separated converter type

Symbol	Description
00023 to 12120	Inverter SLD rated current (A)
0.4K to 500K	Inverter ND rated capacity (kW)

Symbol	Type *1	Communication type
1	FM	RS-485
2	CA	
E1	FM	Ethernet
E2	CA	

FR-A820-00046-1-60R2R

Symbol	Circuit board coating (IEC60721-3-3: 1994 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	Without
06 *1	With	With

Symbol	Application
R2R	Roll to roll dedicated model

*1 Applicable for the FR-A820-00340(5.5K) or higher, and the FR-A840-00170(5.5K) or higher.

◆FR-A800-R2R dedicated functions

The FR-A800-R2R has the following dedicated functions for roll to roll applications, in addition to the functions of the standard FR-A800 inverter. For information on the other functional differences, refer to page 235.

FR-A800-R2R dedicated functions
• Dancer feedback speed control function
• Tension sensor feedback speed control function
• Tension sensorless torque control function
• Tension sensor feedback torque control function
• Winding diameter compensation function

◆Abbreviations

Abbreviation / generic name	Description
DU	Operation panel (FR-DU08)
Operation panel	Operation panel (FR-DU08) and LCD operation panel (FR-LU08)
Parameter unit	Parameter unit (FR-PU07)
PU	Operation panel and parameter unit
Inverter	Mitsubishi Electric FR-A800 series inverter
FR-A800-R2R	FR-A800-R2R roll to roll dedicated inverter
Vector control compatible option	FR-A8AP/FR-A8AL/FR-A8APR/FR-A8APS (plug-in option), FR-A8TP (control terminal option)
Pr.	Parameter number (Number assigned to function)
Vector control dedicated motor	SF-V5RU
High-performance energy-saving motor with encoder	SF-PR-SC

◆Notes on descriptions in this Instruction Manual

• Connection diagrams in this Instruction Manual appear with the control logic of the input terminals as sink logic, unless otherwise specified.

1.2 SND rating

1.2.1 Multiple rating setting

Five rating types of different rated current and permissible load are available. The optimal inverter rating can be chosen in accordance with the application, enabling equipment size to be reduced.
As well as the ratings of the FR-A800 standard type inverters, the SND rating is available for the FR-A800-R2R series.

Pr.	Name	Initial value	Setting range	Description (overload current rating, surrounding air temperature)
570 **E301**	**Multiple rating setting**	2	0	SLD rating 110% 60 s, 120% 3 s (inverse-time characteristics) Surrounding air temperature of 40°C
			1	LD rating 120% 60 s, 150% 3 s (inverse-time characteristics) Surrounding air temperature of 50°C
			2	ND rating 150% 60 s, 200% 3 s (inverse-time characteristics) Surrounding air temperature of 50°C
			3	HD rating 200% 60 s, 250% 3 s (inverse-time characteristics) Surrounding air temperature of 50°C
			12	SND rating 150% 60 s (inverse-time characteristics) Surrounding air temperature of 50°C

◆Changeover of the parameter initial values and setting ranges

- When inverter reset and all parameter clear are performed after setting **Pr.570**, the parameter initial values are changed according to each rating as follows.

Pr.	Name	Pr.570 setting				
		0	1	2 (initial value)	3	12
0	Torque boost	*1	*1	*1	*1	*1
7	Acceleration time	*1	*1	*1	*1	*1
8	Deceleration time	*1	*1	*1	*1	*1
9	Electronic thermal O/L relay	SLD rated current*2	LD rated current*2	ND rated current*2*3	HD rated current*2*3	SND rated current*2
12	DC injection brake operation voltage	*1	*1	*1	*1	*1
22	Stall prevention operation level	110%	120%	150%	200%	150%
48	Second stall prevention operation level	110%	120%	150%	200%	150%
56	Current monitoring reference	SLD rated current*2	LD rated current*2	ND rated current*2	HD rated current*2	SND rated current*2
114	Third stall prevention operation level	110%	120%	150%	200%	150%
148	Stall prevention level at 0 V input	110%	120%	150%	200%	150%
149	Stall prevention level at 10 V input	120%	150%	200%	250%	200%
150	Output current detection level	110%	120%	150%	200%	150%
165	Stall prevention operation level for restart	110%	120%	150%	200%	150%
557	Current average value monitor signal output reference current	SLD rated current*2	LD rated current*2	ND rated current*2	HD rated current*2	SND rated current*2
874	OLT level setting	110%	120%	150%	200%	150%
893	Energy saving monitor reference (motor capacity)	SLD rated motor capacity*2	LD rated motor capacity*2	ND rated motor capacity*2	HD rated motor capacity*2	SND rated motor capacity*2

*1 Initial values differ depending on the rating as follows. The value in the parentheses is the initial value for the 400 V class.

Pr.	Pr.570 setting	200 V class: FR-A820-[]-R2R																
		00046 (0.4K)	00077 (0.75K)	00105 (1.5K)	00167 (2.2K)	00250 (3.7K)	00340 (5.5K)	00490 (7.5K)	00630 (11K)	00770 (15K)	00930 (18.5K)	01250 (22K)	01540 (30K)	01870 (37K)	02330 (45K)	03160 (55K)	03800 (75K)	04750 (90K)
		400 V class: FR-A840-[]-R2R																
		00023 (0.4K)	00038 (0.75K)	00052 (1.5K)	00083 (2.2K)	00126 (3.7K)	00170 (5.5K)	00250 (7.5K)	00310 (11K)	00380 (15K)	00470 (18.5K)	00620 (22K)	00770 (30K)	00930 (37K)	01160 (45K)	01800 (55K)	02160 (75K)	02600 (90K) or higher
0 (%)	0, 1	6	4	4	4	3	3	2	2	2	2	2	2	1.5	1.5	1	1	1
	2	6	6	4	4	4	3	3	2	2	2	2	2	2	2	2	1	1
	3	6	6	6	4	4	4	3	3	2	2	2	2	2	2	2	2	1
	12	6	4	4	4	3	3	3 (2)	2	2	2	2	2	1.5	1.5	1.5	1	1
7 (s)	0, 1	5	5	5	5	5	5	15	15	15	15	15	15	15	15	15	15	15
	2	5	5	5	5	5	5	5	15	15	15	15	15	15	15	15	15	15
	3	5	5	5	5	5	5	5	5	15	15	15	15	15	15	15	15	15
	12	5	5	5	5	5	5	5 (15)	15	15	15	15	15	15	15	15	15	15
8 (s)	0, 1	10	10	10	10	10	10	30	30	30	30	30	30	30	30	30	30	30
	2	5	5	5	5	5	5	5	15	15	15	15	15	15	15	15	15	15
	3	5	5	5	5	5	5	5	5	15	15	15	15	15	15	15	15	15
	12	5	5	5	5	5	5	5 (15)	15	15	15	15	15	15	15	15	15	15
12 (%)	0, 1	4	4	4	4	4	4	2	2	2	2	2	2	2	2	1	1	1
	2	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	1	1
	3	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	1
	12	4	4	4	4	4	4	4 (2)	2	2	2	2	2	2	2	2	1	1

*2 The rated current and motor capacity values differ according to the inverter capacity. For the inverter rated specifications, refer to the Instruction Manual (Startup/Hardware) of the inverter.

*3 The initial value for the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower is set to the 85% of the inverter rated current.

NOTE

- When **Pr.570** = "0" (SLD rating), carrier frequency automatic reduction is enabled regardless of the setting in **Pr.260 PWM frequency automatic switchover**.
- To use FR-A820-03160(55K) / FR-A840-01800(55K) inverter with the LD or SLD rating, the DC reactor corresponding to the applied motor, which is available as an option, is required.
- When the FR-A820-03160(55K) / FR-A840-01800(55K) inverter is used with the LD or SLD rating, the setting increment and the setting range of the parameters in the FR-A820-03800(75K) / FR-A840-02160(75K) or higher inverter are applied. In an example of **Pr.9**, the setting increment changes from 0.01 A to 0.1 A and the setting range changes from "0 to 500 A" to "0 to 3600 A".

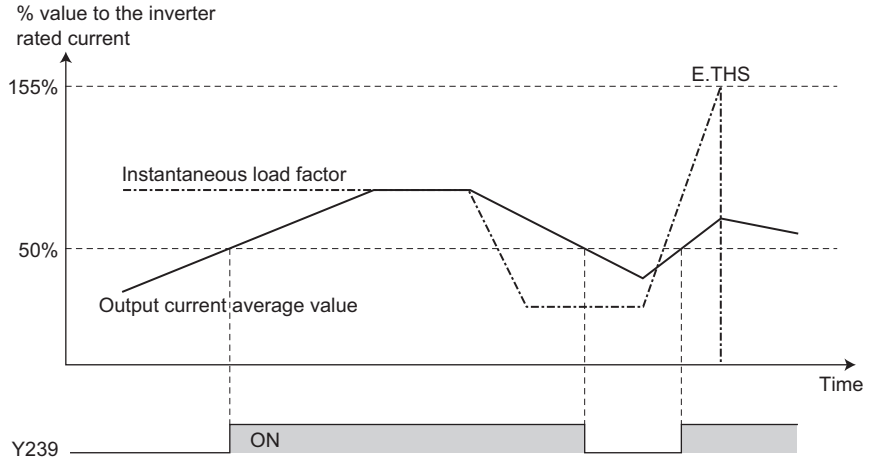
◆Restrictions

- For setting the SND rating, the following limitations apply.

Item	Description
Maximum frequency	The setting range of **Pr.18 High speed maximum frequency** is limited to 0 to 200 Hz.
Carrier frequency	The carrier frequency is fixed at 2 kHz. **Pr.72 PWM frequency selection** is invalid.
Fast-response operation	The fast-response operation setting is not available. For **Pr.800 Control method selection** and **Pr.451 Second motor control method selection**, setting "100 to 102, 106, 109 (**Pr.800** only), 110 to 112" is invalid.

◆Average current load detection

- For the SND rating, the Y239 signal is output when the output current average value reaches or exceeds 50% of the inverter rated current.
- For the SND rating, when the instantaneous load factor reaches or exceeds 155% of the inverter rated current while the output current average value is 50% or more of the inverter rated current, the protective function (E.THS) is activated, shutting off the inverter output.



NOTE

- The output current average value is reset to the initial value by the inverter's power reset or the reset signal input. Avoid unnecessary reset and power-OFF.
- E.THS is available for the FR-A840-03250(110K) or higher.

Operation panel indication	E.THS	E. THS	FR-LU08 indication	Fault 12
Name	Overload trip (Data code: 252 (HFC))*1			
Description	For the SND rating, when the instantaneous load factor reaches or exceeds 155% of the inverter rated current while the output current average value is 50% or more of the inverter rated current, the inverter trips.			
Check point	• Check that acceleration/deceleration time is not too short. • Check that torque boost setting is not too large (small). • Check that load pattern selection setting is appropriate for the load pattern of the machine. • Check the motor for the use under overload. • Check that the encoder wiring and the specifications (encoder power supply, resolution, differential/ complementary) are correct. Check also that the motor wiring (U, V, W) is correct (under vector control).			
Corrective action	• Set the acceleration time longer. • Adjust the torque boost setting. • Set the load pattern selection setting according to the load pattern of the using machine. • Reduce the load. • Check the wiring and specifications of the encoder and the motor. Perform the setting according to the specifications of the encoder and the motor (under vector control).			

*1 The data code is used for checking the fault detail via communication or for setting **Pr.997 Fault initiation**. (Refer to the Instruction Manual (Detailed) of the FR-A800 inverter.)

2 PARAMETER LIST

2.1 Parameter list (by parameter number)

For simple variable-speed operation of the inverter, the initial values of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter's setting, change and check can be made on the operation panel (FR-DU08).

NOTE

- Simple indicates simple mode parameters. Use **Pr.160 User group read selection** to indicate the simple mode parameters only (initial setting is to indicate the extended mode parameters).
- The changing of the parameter settings may be restricted in some operating statuses. Use **Pr.77 Parameter write selection** to change the setting of the restriction.
- Refer to page 261 for instruction codes for communication and availability of Parameter clear, all clear, and Parameter copy.

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value FM	Initial value CA	Refer to page	Customer setting
0	G000	Torque boost Simple	0 to 30%	0.1%	6% *1 4% *1 3% *1 2% *1 1% *1		—*17	
1	H400	Maximum frequency Simple	0 to 120 Hz	0.01 Hz	120 Hz *2 60 Hz *3		146	
2	H401	Minimum frequency Simple	0 to 120 Hz	0.01 Hz	0 Hz		—*17	
3	G001	Base frequency Simple	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
4	D301	Multi-speed setting (high speed) Simple	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
5	D302	Multi-speed setting (middle speed) Simple	0 to 590 Hz	0.01 Hz	30 Hz		—*17	
6	D303	Multi-speed setting (low speed) Simple	0 to 590 Hz	0.01 Hz	10 Hz		—*17	
7	F010	Acceleration time Simple	0 to 3600 s	0.1 s	5 s *4 15 s *5		—*17	
8	F011	Deceleration time Simple	0 to 3600 s	0.1 s	5 s *4 15 s *5		—*17	
9	H000	Electronic thermal O/L relay Simple	0 to 500 A *2 0 to 3600 A *3	0.01 A*2 0.1 A*3	Inverter rated current		—*17	
10	G100	DC injection brake operation frequency	0 to 120 Hz, 9999	0.01 Hz	3 Hz		—*17	
11	G101	DC injection brake operation time	0 to 10 s, 8888	0.1 s	0.5 s		—*17	
12	G110	DC injection brake operation voltage	0 to 30%	0.1%	4% *6 2% *6 1% *6		—*17	
13	F102	Starting frequency	0 to 60 Hz	0.01 Hz	0.5 Hz		208	
14	G003	Load pattern selection	0 to 5, 12 to 15	1	0		—*17	
15	D200	Jog frequency	0 to 590 Hz	0.01 Hz	5 Hz		227	
16	F002	Jog acceleration/deceleration time	0 to 3600 s	0.1 s	0.5 s		227	
17	T720	MRS input selection	0, 2, 4	1	0		—*17	
18	H402	High speed maximum frequency	0 to 590 Hz	0.01 Hz	120 Hz *2 60 Hz *3		—*17	
19	G002	Base frequency voltage	0 to 1000 V, 8888, 9999	0.1 V	9999	8888	—*17	
20	F000	Acceleration/deceleration reference frequency	1 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
21	F001	Acceleration/deceleration time increments	0, 1	1	0		79	
22	H500	Stall prevention operation level (Torque limit level)	0 to 400%	0.1%	150%		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
23	H610	Stall prevention operation level compensation factor at double speed	0 to 200%, 9999	0.1%	9999		—*17	
24 to 27	D304 to D307	Multi-speed setting (4 speed to 7 speed)	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
28	D300	Multi-speed input compensation selection	0, 1	1	0		—*17	
29	F100	Acceleration/deceleration pattern selection	0 to 6	1	0		—*17	
30	E300	Regenerative function selection	0 to 2, 10, 11, 20, 21, 100 to 102, 110, 111, 120, 121	1	0		—*17	
31	H420	Frequency jump 1A	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
32	H421	Frequency jump 1B			9999		—*17	
33	H422	Frequency jump 2A			9999		—*17	
34	H423	Frequency jump 2B			9999		—*17	
35	H424	Frequency jump 3A			9999		—*17	
36	H425	Frequency jump 3B			9999		—*17	
37	M000	Speed display	0, 1 to 9998	1	0		—*17	
41	M441	Up-to-frequency sensitivity	0 to 100%	0.1%	10%		—*17	
42	M442	Output frequency detection	0 to 590 Hz	0.01 Hz	6 Hz		—*17	
43	M443	Output frequency detection for reverse rotation	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
44	F020	Second acceleration/ deceleration time	0 to 3600 s	0.1 s	5 s		—*17	
45	F021	Second deceleration time	0 to 3600 s, 9999	0.1 s	9999		—*17	
46	G010	Second torque boost	0 to 30%, 9999	0.1%	9999		—*17	
47	G011	Second V/F (base frequency)	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
48	H600	Second stall prevention operation level	0 to 400%	0.1%	150%		—*17	
49	H601	Second stall prevention operation frequency	0 to 590 Hz, 9999	0.01 Hz	0 Hz		—*17	
50	M444	Second output frequency detection	0 to 590 Hz	0.01 Hz	30 Hz		—*17	
51	H010	Second electronic thermal O/L relay	0 to 500 A, 9999 *2	0.01 A*2	9999		—*17	
			0 to 3600 A, 9999 *3	0.1 A*3				
52	M100	Operation panel main monitor selection	0, 5 to 14, 17 to 20, 22 to 36, 38, 40 to 46, 50 to 57, 61 to 64, 67, 71 to 74, 81 to 93, 95 to 98, 100	1	0		218	
54	M300	FM/CA terminal function selection	1 to 3, 5 to 14, 17 to 19, 21, 22, 24, 26 to 28, 30, 32 to 34, 36, 46, 50, 61, 62, 70, 81, 87 to 90, 92, 93, 95 to 98	1	1		108, 218	
55	M040	Frequency monitoring reference	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	218	
56	M041	Current monitoring reference	0 to 500 A *2	0.01 A*2	Inverter rated current		218	
			0 to 3600 A *3	0.1 A*3				
57	A702	Restart coasting time	0, 0.1 to 30 s, 9999	0.1 s	9999		—*17	
58	A703	Restart cushion time	0 to 60 s	0.1 s	1 s		—*17	
60	G030	Energy saving control selection	0, 4, 9	1	0		—*17	
65	H300	Retry selection	0 to 5	1	0		—*17	
66	H611	Stall prevention operation reduction starting frequency	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
67	H301	Number of retries at fault occurrence	0 to 10, 101 to 110	1	0		—*17	
68	H302	Retry waiting time	0.1 to 600 s	0.1 s	1 s		—*17	
69	H303	Retry count display erase	0	1	0		—*17	
70	G107	Special regenerative brake duty	0 to 100%	0.1%	0%		—*17	
71	C100	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0		55	
72	E600	PWM frequency selection	0 to 15 *2	1	2		—*17	
			0 to 6, 25 *3					

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value FM	Initial value CA	Refer to page	Customer setting
73	T000	Analog input selection	0 to 7, 10 to 17	1	1		76, 208	
74	T002	Input filter time constant	0 to 8	1	1		67, 108, 140	
75	—	Reset selection/disconnected PU detection/PU stop selection	0 to 3, 14 to 17, 1000 to 1003, 1014 to 1017 *2	1	14		—*17	
			0 to 3, 14 to 17, 100 to 103, 114 to 117, 1000 to 1003, 1014 to 1017, 1100 to 1103, 1114 to 1117 *3					
	E100	Reset selection	0 to 3		0			
	E101	Disconnected PU detection	0, 1					
	E102	PU stop selection			1			
	E107	Reset limit	0*2		0			
			0, 1*3					
76	M510	Fault code output selection	0 to 2	1	0		—*17	
77	E400	Parameter write selection	0 to 2	1	0		237	
78	D020	Reverse rotation prevention selection	0 to 2	1	0		208	
79	D000	Operation mode selection Simple	0 to 4, 6, 7	1	0		—*17	
80	C101	Motor capacity	0.4 to 55 kW, 9999 *2	0.01 kW	9999		55	
			0 to 3600 kW, 9999 *3	0.1 kW				
81	C102	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999		55, 195	
82	C125	Motor excitation current	0 to 500 A, 9999 *2	0.01 A	9999		—*17	
			0 to 3600 A, 9999 *3	0.1 A				
83	C104	Rated motor voltage	0 to 1000 V	0.1 V	200 V *7		55	
					400 V *8			
84	C105	Rated motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999		55	
85	G201	Excitation current break point	0 to 400 Hz, 9999	0.01 Hz	9999		—*17	
86	G202	Excitation current low-speed scaling factor	0 to 300%, 9999	0.1%	9999		—*17	
89	G932	Speed control gain (Advanced magnetic flux vector)	0 to 200%, 9999	0.1%	9999		—*17	
90	C120	Motor constant (R1)	0 to 50 Ω, 9999 *2	0.001 Ω*2	9999		—*17	
			0 to 400 mΩ, 9999 *3	0.01 mΩ*3				
91	C121	Motor constant (R2)	0 to 50 Ω, 9999 *2	0.001 Ω*2	9999		—*17	
			0 to 400 mΩ, 9999 *3	0.01 mΩ*3				
92	C122	Motor constant (L1)	0 to 6000 mH, 9999 *2	0.1 mH*2	9999		—*17	
			0 to 400 mH, 9999 *3	0.01 mH*3				
93	C123	Motor constant (L2)	0 to 6000 mH, 9999 *2	0.1 mH*2	9999		—*17	
			0 to 400 mH, 9999 *3	0.01 mH*3				
94	C124	Motor constant (X)	0 to 100%, 9999	0.1%*2	9999		—*17	
				0.01%*3				
95	C111	Online auto tuning selection	0 to 2	1	0		—*17	
96	C110	Auto tuning setting/status	0, 1, 11, 101	1	0		55	
100	R253	Second acceleration time for line speed command	0 to 3600 s	0.1 s	15 s		79	
101	R254	Second deceleration time for line speed command	0 to 3600 s	0.1 s	15 s		79	
102	R255	Third acceleration time for line speed command	0 to 3600 s	0.1 s	15 s		79	
103	R256	Third deceleration time for line speed command	0 to 3600 s	0.1 s	15 s		79	
110	F030	Third acceleration/deceleration time	0 to 3600 s, 9999	0.1 s	9999		—*17	
111	F031	Third deceleration time	0 to 3600 s, 9999	0.1 s	9999		—*17	
112	G020	Third torque boost	0 to 30%, 9999	0.1%	9999		—*17	
113	G021	Third V/F (base frequency)	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
114	H602	Third stall prevention operation level	0 to 400%	0.1%	150%		—*17	
115	H603	Third stall prevention operation frequency	0 to 590 Hz	0.01 Hz	0 Hz		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
116	M445	Third output frequency detection	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
117	N020	PU communication station number	0 to 31	1	0		—*17	
118	N021	PU communication speed	48, 96, 192, 384, 576, 768, 1152	1	192		—*17	
119	—	PU communication stop bit length / data length	0, 1, 10, 11	1	1		—*17	
	N022	PU communication data length	0, 1		0			
	N023	PU communication stop bit length	0, 1		1			
120	N024	PU communication parity check	0 to 2	1	2		—*17	
121	N025	Number of PU communication retries	0 to 10, 9999	1	1		—*17	
122	N026	PU communication check time interval	0, 0.1 to 999.8 s, 9999	0.1 s	9999		—*17	
123	N027	PU communication waiting time setting	0 to 150 ms, 9999	1 ms	9999		—*17	
124	N028	PU communication CR/LF selection	0 to 2	1	1		—*17	
125	T022	Terminal 2 frequency setting gain frequency *Simple*	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	6	
126	T042	Terminal 4 frequency setting gain frequency *Simple*	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	6	
127	A612	PID control automatic switchover frequency	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
128	A610	PID action selection	0, 40, 41	1	0		65, 177	
	R100							
129	A613	PID proportional band	0.1 to 1000%, 9999	0.1%	100%		99	
	R110							
130	A614	PID integral time	0.1 to 3600 s, 9999	0.1 s	1 s		99	
	R111							
131	A601	PID upper limit	400 to 600%, 9999	0.1%	9999		89, 127, 180	
132	A602	PID lower limit	400 to 600%, 9999	0.1%	9999		89, 127, 180	
133	A611	PID action set point	400 to 600%	0.01%	500%		85, 124	
	R101							
134	A615	PID differential time	0.01 to 10 s, 9999	0.01 s	9999		99	
	R112							
135	R161	Integral clamp (positive polarity)	0 to 100%, 9999	0.1%	9999		100	
136	R162	Integral clamp (negative polarity)	0 to 100%, 9999	0.1%	9999		100	
137	R163	PID upper/lower limit hysteresis width	0 to 100%, 9999	0.1%	9999		89, 127, 180	
140	F200	Backlash acceleration stopping frequency	0 to 590 Hz	0.01 Hz	1 Hz		—*17	
141	F201	Backlash acceleration stopping time	0 to 360 s	0.1 s	0.5 s		—*17	
142	F202	Backlash deceleration stopping frequency	0 to 590 Hz	0.01 Hz	1 Hz		—*17	
143	F203	Backlash deceleration stopping time	0 to 360 s	0.1 s	0.5 s		—*17	
144	M002	Speed setting switchover	0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112	1	4		—*17	
145	E103	PU display language selection	0 to 7	1	—		—*17	
147	F022	Acceleration/deceleration time switching frequency	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
148	H620	Stall prevention level at 0 V input	0 to 400%	0.1%	150%		—*17	
149	H621	Stall prevention level at 10 V input	0 to 400%	0.1%	200%		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
150	M460	Output current detection level	0 to 400%	0.1%	150%		—*17	
151	M461	Output current detection signal delay time	0 to 10 s	0.1 s	0 s		—*17	
152	M462	Zero current detection level	0 to 400%	0.1%	5%		—*17	
153	M463	Zero current detection time	0 to 10 s	0.01 s	0.5 s		—*17	
154	H631	Voltage reduction selection during stall prevention operation	0, 1, 10, 11	1	1		—*17	
155	T730	RT signal function validity condition selection	0, 10	1	0		—*17	
156	H501	Stall prevention operation selection	0 to 31, 100, 101	1	0		—*17	
157	M430	OL signal output timer	0 to 25 s, 9999	0.1 s	0 s		—*17	
158	M301	AM terminal function selection	1 to 3, 5 to 14, 17 to 19, 21, 22, 24, 26 to 28, 30, 32 to 34, 36, 46, 50, 52 to 54, 61, 62, 67, 70, 81 to 84, 87 to 93, 95 to 98	1	1		108, 218	
159 *16	R450	DA1 output sign selection	0 to 2	1	0		218	
160	E440	User group read selection *Simple*	0, 1, 9999	1	0		—*17	
161	E200	Frequency setting/key lock operation selection	0, 1, 10, 11	1	0		—*17	
162	A700	Automatic restart after instantaneous power failure selection	0 to 3, 10 to 13	1	0		—*17	
163	A704	First cushion time for restart	0 to 20 s	0.1 s	0 s		—*17	
164	A705	First cushion voltage for restart	0 to 100%	0.1%	0%		—*17	
165	A710	Stall prevention operation level for restart	0 to 400%	0.1%	150%		—*17	
166	M433	Output current detection signal retention time	0 to 10 s, 9999	0.1 s	0.1 s		—*17	
167	M464	Output current detection operation selection	0, 1, 10, 11	1	0		—*17	
168	E000	Parameter for manufacturer setting. Do not set.						
	E080							
169	E001							
	E081							
170	M020	Watt-hour meter clear	0, 10, 9999	1	9999		—*17	
171	M030	Operation hour meter clear	0, 9999	1	9999		—*17	
172	E441	User group registered display/ batch clear	9999, (0 to 16)	1	0		—*17	
173	E442	User group registration	0 to 1999, 9999	1	9999		—*17	
174	E443	User group clear	0 to 1999, 9999	1	9999		—*17	
178	T700	STF terminal function selection	0 to 13, 16 to 18, 20, 23 to 28, 32, 42 to 44, 46 to 48, 50 to 53, 60, 62, 64 to 67, 70 to 72, 74, 81, 92, 93, 100 to 109, 111 to 117, 120 to 126, 9999	1	60		227	
179	T701	STR terminal function selection	0 to 13, 16 to 18, 20, 23 to 28, 32, 42 to 44, 46 to 48, 50 to 53, 61, 62, 64 to 67, 70 to 72, 74, 81, 92, 93, 100 to 109, 111 to 117, 120 to 126, 9999	1	61		227	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
180	T702	RL terminal function selection	0 to 13, 16 to 18, 20, 23 to 28, 32, 42 to 44, 46 to 48, 50 to 53, 62, 64 to 67, 70 to 72, 74, 81, 92, 93, 100 to 109, 111 to 117, 120 to 126, 9999	1	0		227	
181	T703	RM terminal function selection		1	1		227	
182	T704	RH terminal function selection		1	2		227	
183	T705	RT terminal function selection		1	3		227	
184	T706	AU terminal function selection		1	4		227	
185	T707	JOG terminal function selection		1	5		227	
186	T708	CS terminal function selection		1	6		227	
187	T709	MRS terminal function selection		1	24*14 10*15		227	
188	T710	STOP terminal function selection		1	25		227	
189	T711	RES terminal function selection		1	62		227	
190	M400	RUN terminal function selection	0 to 8, 10 to 16, 25, 26, 30 to 35, 39 to 48, 55, 64, 67, 68, 79, 80, 85, 90 to 99, 100 to 108, 110 to 116, 125, 126, 130 to 135, 139 to 148, 155, 164, 167, 168, 179, 180, 185, 190 to 199, 206 to 208, 211 to 213, 231 to 239, 306 to 308, 311 to 313, 331 to 339, 9999	1	0		230	
191	M401	SU terminal function selection		1	1		230	
192	M402	IPF terminal function selection		1	2*14 9999*15		230	
193	M403	OL terminal function selection		1	3		230	
194	M404	FU terminal function selection		1	4		230	
195	M405	ABC1 terminal function selection	0 to 8, 10 to 16, 25, 26, 30 to 35, 39 to 48, 55, 64, 67, 68, 79, 80, 85, 90, 91, 94 to 99, 100 to 108, 110 to 116, 125, 126, 130 to 135, 139 to 148, 155, 164, 167, 168, 179, 180, 185, 190, 191, 194 to 199, 206 to 208, 211 to 213, 231 to 239, 306 to 308, 311 to 313, 331 to 339, 9999	1	99		230	
196	M406	ABC2 terminal function selection		1	9999		230	
232 to 239	D308 to D315	Multi-speed setting (8 speed to 15 speed)	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
240	E601	Soft-PWM operation selection	0, 1	1	1		—*17	
241	M043	Analog input display unit switchover	0, 1	1	0		—*17	
242	T021	Terminal 1 added compensation amount (terminal 2)	0 to 100%	0.1%	100%		—*17	
243	T041	Terminal 1 added compensation amount (terminal 4)	0 to 100%	0.1%	75%		—*17	
244	H100	Cooling fan operation selection	0, 1, 101 to 105	1	1		—*17	
245	G203	Rated slip	0 to 50%, 9999	0.01%	9999		—*17	
246	G204	Slip compensation time constant	0.01 to 10 s	0.01 s	0.5 s		—*17	
247	G205	Constant-power range slip compensation selection	0, 9999	1	9999		—*17	
249	H101	Earth (ground) fault detection at start	0, 1	1	0		—*17	
250	G106	Stop selection	0 to 100 s, 1000 to 1100 s, 8888, 9999	0.1 s	9999		—*17	
251	H200	Output phase loss protection selection	0, 1	1	1		—*17	
252	T050	Override bias	0 to 1000%	0.1%	50%		76	
253	T051	Override gain	0 to 1000%	0.1%	150%		76	
255	E700	Life alarm status display	(0 to 15)	1	0		—*17	
256	E701	Inrush current limit circuit life display	(0 to 100%)	1%	100%		—*17	
257	E702	Control circuit capacitor life display	(0 to 100%)	1%	100%		—*17	
258	E703	Main circuit capacitor life display	(0 to 100%)	1%	100%		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
259	E704	Main circuit capacitor life measuring	0, 1	1	0		—*17	
260	E602	PWM frequency automatic switchover	0, 1	1	1		—*17	
261	A730	Power failure stop selection	0 to 2, 11, 12, 21, 22	1	0		—*17	
262	A731	Subtracted frequency at deceleration start	0 to 20 Hz	0.01 Hz	3 Hz		—*17	
263	A732	Subtraction starting frequency	0 to 590 Hz, 9999	0.01 Hz	60 Hz	50 Hz	—*17	
264	A733	Power-failure deceleration time 1	0 to 3600 s	0.1 s	5 s		—*17	
265	A734	Power-failure deceleration time 2	0 to 3600 s, 9999	0.1 s	9999		—*17	
266	A735	Power failure deceleration time switchover frequency	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
267	T001	Terminal 4 input selection	0 to 2	1	0		—*17	
268	M022	Monitor decimal digits selection	0, 1, 9999	1	9999		—*17	
269	E023	Parameter for manufacturer setting. Do not set.						
270	R342	Acceleration/deceleration time during stall condition	0 to 3600 s	0.1 s	15 s		165	
271	R537	Second acceleration time for inertia compensation	0 to 3600 s	0.1 s	15 s		157	
272	R538	Second deceleration time for inertia compensation	0 to 3600 s	0.1 s	15 s		157	
276	R400	Line speed monitoring reference	0 to 6553.4 m/min*11	0.1 m/min*11	1000 m/min*11		218, 224	
278	R051	Actual line speed voltage/ current gain	0 to 100%, 9999	0.1%	9999		199	
279	R052	Actual line speed gain	0 to 6553.4 m/min*11, 9999	0.1 m/min*11	9999		199	
280	R053	Actual line speed voltage/ current bias	0 to 100%, 9999	0.1%	9999		199	
281	R054	Actual line speed bias	0 to 6553.4 m/min*11, 9999	0.1 m/min*11	9999		199	
282	R055	Actual line speed pulse input bias	0 to 500, 9999	0.01	9999		199	
283	R056	Actual line speed pulse input gain	0 to 500, 9999	0.01	9999		199	
284	R057	Actual line speed input filter time constant	0 to 5 s	0.01 s	0.02 s		199	
285	A107 / H416	Overspeed detection frequency / Speed deviation excess detection frequency	0 to 30 Hz, 9999	0.01 Hz	9999		—*17	
286	G400	Droop gain	0 to 100%	0.1%	0%		—*17	
287	G401	Droop filter time constant	0 to 1 s	0.01 s	0.3 s		—*17	
288	G402	Droop function activation selection	0, 1, 2, 10, 11, 20 to 22	1	0		—*17	
289	M431	Inverter output terminal filter	5 to 50 ms, 9999	1 ms	9999		—*17	
290	M044	Monitor negative output selection	0 to 7	1	0		218	
291	D100	Pulse train I/O selection	[FM type] 0, 1, 10, 11, 20, 21, 100 / [AM type] 0, 1	1	0		—*17	
294	A785	UV avoidance voltage gain	0 to 200%	0.1%	100%		—*17	
295	E201	Frequency change increment amount setting	0, 0.01, 0.10, 1.00, 10.00	0.01	0		—*17	
296	E410	Password lock level	0 to 6, 99, 100 to 106, 199, 9999	1	9999		—*17	
297	E411	Password lock/unlock	(0 to 5), 1000 to 9998, 9999	1	9999		—*17	
298	A711	Frequency search gain	0 to 32767, 9999	1	9999		—*17	
299	A701	Rotation direction detection selection at restarting	0, 1, 9999	1	0		—*17	
331	N030	RS-485 communication station number	0 to 31 (0 to 247)	1	0		—*17	
332	N031	RS-485 communication speed	3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152	1	96		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
333	—	RS-485 communication stop bit length / data length	0, 1, 10, 11	1	1		—*17	
	N032	RS-485 communication data length	0, 1	1	0			
	N033	RS-485 communication stop bit length	0, 1	1	1			
334	N034	RS-485 communication parity check selection	0 to 2	1	2		—*17	
335	N035	RS-485 communication retry count	0 to 10, 9999	1	1		—*17	
336	N036	RS-485 communication check time interval	0 to 999.8 s, 9999	0.1 s	0 s		—*17	
337	N037	RS-485 communication waiting time setting	0 to 150 ms, 9999	1 ms	9999		—*17	
338	D010	Communication operation command source	0, 1	1	0		233	
339	D011	Communication speed command source	0 to 2	1	0		233	
340	D001	Communication startup mode selection	0 to 2, 10, 12	1	0		—*17	
341	N038	RS-485 communication CR/LF selection	0 to 2	1	1		—*17	
342	N001	Communication EEPROM write selection	0, 1	1	0		—*17	
343	N080	Communication error count	—	1	0		—*17	
350	R210	Line speed command voltage/ current bias	0 to 100%	0.1%	0%		67	
351	R211	Line speed command bias	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
352	R212	Line speed command voltage/ current gain	0 to 100%	0.1%	50%		67	
353	R213	Line speed command gain	0 to 6553.4 m/min*11, 9999	0.1 m/min*11	0 m/min*11		67	
354	R220	Line speed command pulse input bias	0 to 500	0.01	0		67	
355	R221	Line speed command pulse input gain	0 to 500	0.01	100		67	
356	R222	Line speed command digital input bias	0 to 65535	1	0		67	
357	R223	Line speed command digital input gain	0 to 65535	1	65535		67	
358	R201	Line speed unit	0 to 3	1	0		67, 224	
359 *9	C141	Encoder rotation direction	0, 1, 100, 101	1	1		—*17	
360	R202	Line speed command value	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
361	R200	Line speed command input selection	0 to 8, 10, 9999	1	9999		67	
362	R050	Actual line speed input selection	0 to 7, 9, 9999	1	0		199	
363	R102	Dancer / tension sensor feedback input selection	3 to 6, 9, 9999	1	9999		85, 124, 178	
364	R411	Dancer tension setting input selection / taper function enable/ disable selection for tension sensor feedback speed control 1	3 to 6, 9999	1	9999		108	
365	R302	Tension command value (RAM)	0 to 500 N*13	0.01 N*13	0 N		140	
366	R303	Tension command value (RAM, EEPROM)	0 to 500 N*13	0.01 N*13	0 N		140	
367 *9	G240	Speed feedback range	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
368 *9	G241	Feedback gain	0 to 100	0.1	1		—*17	
369 *9	C140	Number of encoder pulses	0 to 4096	1	1024		—*17	
374	H800	Overspeed detection level	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value FM	Initial value CA	Refer to page	Customer setting
376 *9	C148	Encoder signal loss detection enable/disable selection	0, 1	1	0		—*17	
380	F300	Acceleration S-pattern 1	0 to 50%	1%	0		—*17	
381	F301	Deceleration S-pattern 1	0 to 50%	1%	0		—*17	
382	F302	Acceleration S-pattern 2	0 to 50%	1%	0		—*17	
383	F303	Deceleration S-pattern 2	0 to 50%	1%	0		—*17	
384	D101	Input pulse division scaling factor	0 to 250	1	0		67, 199	
385	D110	Frequency for zero input pulse	0 to 590 Hz	0.01 Hz	0		—*17	
386	D111	Frequency for maximum input pulse	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
393	R250	Line speed command acceleration/deceleration reference	1 to 6553.4 m/min*11	0.1 m/min*11	1000 m/min*11		79	
394	R251	First acceleration time for line speed command	0 to 3600 s	0.1 s	15 s		79	
395	R252	First deceleration time for line speed command	0 to 3600 s	0.1 s	15 s		79	
398	R203	Draw rate	0 to 200%	0.01%	100%		67	
414	A800	PLC function operation selection	0 to 2, 11, 12	1	0		—*17	
415	A801	Inverter operation lock mode setting	0, 1	1	0		—*17	
416	A802	Pre-scale function selection	0 to 5	1	0		—*17	
417	A803	Pre-scale setting value	0 to 32767	1	1		—*17	
422	B003	Position control gain	0 to 150 sec^{-1}	1 sec^{-1}	25 sec^{-1}		—*17	
423	R422	Dancer / tension sensor feedback detection level	0 to 100%	0.01%	10%		88, 126	
424	R104	Dancer / tension sensor feedback input offset	400 to 600%	0.01%	500%		88, 126	
425	R160	Break detection waiting time	0 to 100 s, 9999	0.01 s	9999		89, 127, 180	
426	R412	Dancer tension setting bias	0 to 200%	0.1%	0%		108	
427	R413	Dancer tension setting gain	0 to 200%	0.1%	100%		108	
428	B009	Command pulse selection	0 to 5	1	0		67	
430	R410	Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2	1 to 100, 9999	0.1	100		108	
432 *9	D120	Pulse train torque command bias	0 to 400%	1%	0%		—*18	
433 *9	D121	Pulse train torque command gain	0 to 400%	1%	150%		—*18	
450	C200	Second applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 9999	1	9999		55	
451	G300	Second motor control method selection	10 to 12, 20, 110 to 112, 9999	1	9999		5	
453	C201	Second motor capacity	0.4 to 55 kW, 9999 *2 0 to 3600 kW, 9999 *3	0.01 kW*2 0.1 kW*3	9999		55	
454	C202	Number of second motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999		55	
455	C225	Second motor excitation current	0 to 500 A, 9999 *2 0 to 3600 A, 9999 *3	0.01 A*2 0.1 A*3	9999		—*17	
456	C204	Rated second motor voltage	0 to 1000 V	0.1 V	200 V *7 400 V *8		55	
457	C205	Rated second motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999		55	
458	C220	Second motor constant (R1)	0 to 50 Ω, 9999 *2 0 to 400 mΩ, 9999 *3	0.001 Ω*2 0.01 mΩ*3	9999		—*17	
459	C221	Second motor constant (R2)	0 to 50 Ω, 9999 *2 0 to 400 mΩ, 9999 *3	0.001 Ω*2 0.01 mΩ*3	9999		—*17	
460	C222	Second motor constant (L1)	0 to 6000 mH, 9999 *2 0 to 400 mH, 9999 *3	0.1 mH*2 0.01 mH*3	9999		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value FM	Initial value CA	Refer to page	Customer setting
461	C223	Second motor constant (L2)	0 to 6000 mH, 9999 *2 0 to 400 mH, 9999 *3	0.1 mH*2 0.01 mH*3	9999		—*17	
462	C224	Second motor constant (X)	0 to 100%, 9999	0.1% 0.01%	9999		—*17	
463	C210	Second motor auto tuning setting/status	0, 1, 11, 101	1	0		55	
464	R113	PID proportional band for values below set point	0.1 to 1000%, 9999	0.1%	9999		101	
465	R114	PID integral time for values below set point	0.1 to 3600 s, 9999	0.1 s	9999		101	
466	R115	PID differential time for values below set point	0.01 to 10 s, 9999	0.01 s	9999		101	
467	R116	Second PID proportional band	0.1 to 1000%, 9999	0.1%	9999		101	
468	R117	Second PID integral time	0.1 to 3600 s, 9999	0.1 s	9999		101	
469	R118	Second PID differential time	0.01 to 10 s, 9999	0.01 s	9999		101	
470	R119	Second PID proportional band for values below set point	0.1 to 1000%, 9999	0.1%	9999		101	
471	R120	Second PID integral time for values below set point	0.1 to 3600 s, 9999	0.1 s	9999		101	
472	R121	Second PID differential time for values below set point	0.01 to 10 s, 9999	0.01 s	9999		101	
473	R122	Third PID proportional band	0.1 to 1000%, 9999	0.1%	9999		101	
474	R123	Third PID integral time	0.1 to 3600 s, 9999	0.1 s	9999		101	
475	R124	Third PID differential time	0.01 to 10 s, 9999	0.01 s	9999		101	
476	R125	Third PID proportional band for values below set point	0.1 to 1000%, 9999	0.1%	9999		101	
477	R126	Third PID integral time for values below set point	0.1 to 3600 s, 9999	0.1 s	9999		101	
478	R127	Third PID differential time for values below set point	0.01 to 10 s, 9999	0.01 s	9999		101	
479	R128	Fourth PID proportional band	0.1 to 1000%, 9999	0.1%	9999		101	
480	R129	Fourth PID integral time	0.1 to 3600 s, 9999	0.1 s	9999		101	
481	R130	Fourth PID differential time	0.01 to 10 s, 9999	0.01 s	9999		101	
482	R131	Fourth PID proportional band for values below set point	0.1 to 1000%, 9999	0.1%	9999		101	
483	R132	Fourth PID integral time for values below set point	0.1 to 3600 s, 9999	0.1 s	9999		101	
484	R133	Fourth PID differential time for values below set point	0.01 to 10 s, 9999	0.01 s	9999		101	
485	R149	Integral control activation	0 to 3	1	0		100	
486	R140	Deviation A	400.1 to 600%	0.1%	600%		101	
487	R141	Deviation B	400 to 599.9%	0.1%	400%		101	
488	R142	Deviation C1	400.1 to 599.9%, 9999	0.1%	9999		101	
489	R143	Deviation C2	400.1 to 599.9%, 9999	0.1%	9999		101	
490	R144	PID gain A	0.1 to 1000%, 9999	0.1%	9999		101	
491	R145	PID gain B	0.1 to 1000%, 9999	0.1%	9999		101	
492	R146	PID gain C1	0.1 to 1000%, 9999	0.1%	9999		101	
493	R147	PID gain C2	0.1 to 1000%, 9999	0.1%	9999		101	
494	R148	PID gain D	0.1 to 1000%, 9999	0.1%	9999		101	
495	M500	Remote output selection	0, 1, 10, 11	1	0		—*17	
496	M501	Remote output data 1	0 to 4095	1	0		—*17	
497	M502	Remote output data 2	0 to 4095	1	0		—*17	
498	A804	PLC function flash memory clear	0, 9696 (0 to 9999)	1	0		—*17	
502	N013	Stop mode selection at communication error	0 to 2, 11, 12	1	0		—*17	
503	E710	Maintenance timer 1	0 (1 to 9998)	1	0		—*17	
504	E711	Maintenance timer 1 warning output set time	0 to 9998, 9999	1	9999		—*17	
505	M001	Speed setting reference	1 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
516	F400	S-pattern time at a start of acceleration	0.1 to 2.5 s	0.1 s	0.1 s		—*17	
517	F401	S-pattern time at a completion of acceleration	0.1 to 2.5 s	0.1 s	0.1 s		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
518	F402	S-pattern time at a start of deceleration	0.1 to 2.5 s	0.1 s	0.1 s		—*17	
519	F403	S-pattern time at a completion of deceleration	0.1 to 2.5 s	0.1 s	0.1 s		—*17	
539	N002	MODBUS RTU communication check time interval	0 to 999.8 s, 9999	0.1 s	9999		—*17	
547	N040	USB communication station number	0 to 31	1	0		—*17	
548	N041	USB communication check time interval	0 to 999.8 s, 9999	0.1 s	9999		—*17	
549	N000	Protocol selection	0, 1	1	0		—*17	
550	D012	NET mode operation command source selection	0, 1, 9999	1	9999		—*17	
551	D013	PU mode operation command source selection	1 to 3, 9999	1	9999		—*17	
552	H429	Frequency jump range	0 to 30 Hz, 9999	0.01 Hz	9999		—*17	
553	A603	PID deviation limit	0.0 to 100.0%, 9999	0.1%	9999		89, 127, 180	
554	A604	PID signal operation selection	0 to 3	1	0		89, 91, 127, 180	
555	E720	Current average time	0.1 to 1 s	0.1 s	1 s		—*17	
556	E721	Data output mask time	0 to 20 s	0.1 s	0 s		—*17	
557	E722	Current average value monitor signal output reference current	0 to 500 A *2	0.01 A*2	Inverter rated current		—*17	
			0 to 3600 A *3	0.1 A*3				
560	A712	Second frequency search gain	0 to 32767, 9999	1	9999		—*17	
561	H020	PTC thermistor protection level	0.5 to 30 kΩ, 9999	0.01 kΩ	9999		—*17	
563	M021	Energization time carrying-over times	(0 to 65535)	1	0		—*17	
564	M031	Operating time carrying-over times	(0 to 65535)	1	0		—*17	
565	G301	Second motor excitation current break point	0 to 400 Hz, 9999	0.01 Hz	9999		—*17	
566	G302	Second motor excitation current low-speed scaling factor	0 to 300%, 9999	0.1%	9999		—*17	
569	G942	Second motor speed control gain	0 to 200%, 9999	0.1%	9999		—*17	
570	E301	Multiple rating setting	0 to 3, 12	1	2		8	
571	F103	Holding time at a start	0 to 10 s, 9999	0.1 s	9999		—*17	
573	A680 T052	4 mA input check selection	1 to 3, 9999	1	9999		—*17	
574	C211	Second motor online auto tuning	0, 1	1	0		—*17	
598	H102	Undervoltage level	350 to 430 V, 9999	0.1 V	9999		—*17	
599	T721	X10 terminal input selection	0, 1	1	0*14		—*17	
					1*15			
600	H001	First free thermal reduction frequency 1	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
601	H002	First free thermal reduction ratio 1	1 to 100%	1%	100%		—*17	
602	H003	First free thermal reduction frequency 2	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
603	H004	First free thermal reduction ratio 2	1 to 100%	1%	100%		—*17	
604	H005	First free thermal reduction frequency 3	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
606	T722	Power failure stop external signal input selection	0, 1	1	1		—*17	
607	H006	Motor permissible load level	110 to 250%	1%	150%		—*17	
608	H016	Second motor permissible load level	110 to 250%, 9999	1%	9999		—*17	
609	R430	PID measured tension monitor filter	0 to 5 s	0.01 s	0 s		226	
610	R431	PID measured tension monitor increment	0 to 2, 9999	1	9999		226	
611	F003	Acceleration time at a restart	0 to 3600 s, 9999	0.1 s	9999		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
617	G080	Reverse rotation excitation current low-speed scaling factor	0 to 300%, 9999	0.1%	9999		—*17	
620	R570	Line speed bias for reel change	0 to 2000 m/min*11	0.1 m/min*11	1000 m/min*11		106	
621	R423	Allowable deviation from target line speed	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		79, 106	
622	R204	Line speed command for starting	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
635	R214	Line speed command added compensation value voltage/ current bias	0 to 100%, 9999	0.1%	9999		76	
636	R215	Line speed command added compensation value bias	0 to 6553.4 m/min*11, 9999	0.1 m/min*11	9999		76	
637	R216	Line speed command added compensation value voltage/ current gain	0 to 100%, 9999	0.1%	9999		76	
638	R217	Line speed command added compensation value gain	0 to 6553.4 m/min*11, 9999	0.1 m/min*11	9999		76	
639	R030	Speed control proportional term applied diameter 1	1 to 99%, 9999	1%	9999		216	
640	R031	Speed control proportional term applied diameter 2	1 to 99%, 9999	1%	9999		216	
641	R032	Speed control proportional gain 1	0 to 1000%, 9999	1%	9999		216	
642	R033	Speed control proportional gain 2	0 to 1000%, 9999	1%	9999		216	
643	R034	Speed control proportional gain 3	0 to 1000%, 9999	1%	9999		216	
644	R035	Speed control proportional gain 4	0 to 1000%, 9999	1%	9999		216	
645	R004	Winding diameter storage selection	0, 1	1	0		213	
646	R003	Stored winding diameter	1 to 6553 mm	1 mm	1 mm		213	
647	R041	Operation time with stored winding diameter	0 to 100 s	0.01 s	0 s		213	
648	R420	Target winding diameter	1 to 6553 mm	1 mm	1 mm		213	
650	R270	Terminal 4 input compensation selection	0, 1	1	0		76	
653	G410	Speed smoothing control	0 to 200%	0.1%	0		—*17	
654	G411	Speed smoothing cutoff frequency	0 to 120 Hz	0.01	20 Hz		—*17	
655	M530	Analog remote output selection	0, 1, 10, 11	1	0		—*17	
656	M531	Analog remote output 1	800 to 1200%	0.1%	1000%		—*17	
657	M532	Analog remote output 2		0.1%	1000%		—*17	
658	M533	Analog remote output 3		0.1%	1000%		—*17	
659	M534	Analog remote output 4		0.1%	1000%		—*17	
663	M060	Control circuit temperature signal output level	0 to 100°C	1°C	0°C		—*17	
665	G125	Regeneration avoidance frequency gain	0 to 200%	0.1%	100%		—*17	
668	A786	Power failure stop frequency gain	0 to 200%	0.1%	100%		—*17	
673	G060	SF-PR slip amount adjustment operation selection	2, 4, 6, 9999	1	9999		—*17	
674	G061	SF-PR slip amount adjustment gain	0 to 500%	0.1%	100%		—*17	
675	A805	User parameter auto storage function selection	1, 9999	1	9999		—*17	
679	G420	Second droop gain	0 to 100%, 9999	0.1%	9999		—*17	
680	G421	Second droop filter time constant	0 to 1 s, 9999	0.01 s	9999		—*17	
681	G422	Second droop function activation selection	0, 1, 2, 10, 11, 20 to 22, 9999	1	9999		—*17	
682	G423	Second droop break point gain	0.1 to 100%, 9999	0.1%	9999		—*17	
683	G424	Second droop break point torque	0.1 to 100%, 9999	0.1%	9999		—*17	
684	C000	Tuning data unit switchover	0, 1	1	0		—*17	
686	E712	Maintenance timer 2	0 (1 to 9998)	1	0		—*17	
687	E713	Maintenance timer 2 warning output set time	0 to 9998, 9999	1	9999		—*17	
688	E714	Maintenance timer 3	0 (1 to 9998)	1	0		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
689	E715	Maintenance timer 3 warning output set time	0 to 9998, 9999	1	9999		—*17	
690	H881	Deceleration check time	0 to 3600 s, 9999	0.1 s	1 s		—*17	
692	H011	Second free thermal reduction frequency 1	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
693	H012	Second free thermal reduction ratio 1	1 to 100%	1%	100%		—*17	
694	H013	Second free thermal reduction frequency 2	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
695	H014	Second free thermal reduction ratio 2	1 to 100%	1%	100%		—*17	
696	H015	Second free thermal reduction frequency 3	0 to 590 Hz, 9999	0.01 Hz	9999		—*17	
699	T740	Input terminal filter	5 to 50 ms, 9999	1 ms	9999		—*17	
707	C107	Motor inertia (integer)	10 to 999, 9999	1	9999		55, 157	
724	C108	Motor inertia (exponent)	0 to 7, 9999	1	9999		55, 157	
744	C207	Second motor inertia (integer)	10 to 999, 9999	1	9999		55, 157	
745	C208	Second motor inertia (exponent)	0 to 7, 9999	1	9999		55, 157	
753	R539	Empty reel inertia (integer)	10 to 999, 9999	1	9999		157	
754	R540	Empty reel inertia (exponent)	0 to 7, 101 to 104, 9999	1	9999		157	
755 *9	M610	Cumulative pulse clear signal selection	0 to 3	1	0		—*17	
756 *9	M611	Cumulative pulse division scaling factor	1 to 16384	1	1		—*17	
757 *9	M612	Control terminal option-Cumulative pulse division scaling factor	1 to 16384	1	1		—*17	
758 *9	M613	Cumulative pulse storage	0 to 3	1	0		—*17	
774	M101	Operation panel monitor selection 1	1 to 3, 5 to 14, 17 to 20, 22 to 36, 38, 40 to 46, 50 to 57, 61 to 64, 67, 71 to 74, 81 to 93, 95 to 98, 100, 9999	1	9999		218	
775	M102	Operation panel monitor selection 2		1	9999		218	
776	M103	Operation panel monitor selection 3		1	9999		218	
778	A682 / T054	4 mA input check filter	0 to 10 s	0.01 s	0 s		—*17	
799	M520	Pulse increment setting for output power	0.1, 1, 10, 100, 1000 kWh	0.1 kWh	1 kWh		—*17	
800	G200	Control method selection	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20		5	
801	H704	Output limit level	0 to 400%, 9999	0.1%	9999		—*17	
802	G102	Pre-excitation selection	0, 1	1	0		—*17	
803	G210	Constant output range torque characteristic selection	0 to 2, 10, 11	1	0		—*17	
804	R300 / D400	Tension / Torque command source selection	0 to 6	1	0		140	
805	D401	Torque command value (RAM)	600 to 1400%	1%	1000%		—*17	
806	D402	Torque command value (RAM,EEPROM)	600 to 1400%	1%	1000%		—*17	
807	H410	Speed limit selection	0 to 2	1	0		146	
808	H411	Forward rotation speed limit/ speed limit	0 to 400 Hz	0.01 Hz	60 Hz	50 Hz	146	
809	H412	Reverse rotation speed limit/ reverse-side speed limit	0 to 400 Hz, 9999	0.01 Hz	9999		146	
810	H700	Torque limit input method selection	0 to 2	1	0		—*17	
811	D030	Set resolution switchover	0, 1, 10, 11	1	0		—*17	
812	H701	Torque limit level (regeneration)	0 to 400%, 9999	0.1%	9999		—*17	
813	H702	Torque limit level (3rd quadrant)	0 to 400%, 9999	0.1%	9999		—*17	
814	H703	Torque limit level (4th quadrant)	0 to 400%, 9999	0.1%	9999		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
815	H710	Torque limit level 2	0 to 400%, 9999	0.1%	9999		—*17	
816	H720	Torque limit level during acceleration	0 to 400%, 9999	0.1%	9999		—*17	
817	H721	Torque limit level during deceleration	0 to 400%, 9999	0.1%	9999		—*17	
818	C112	Easy gain tuning response level setting	1 to 15	1	2		59	
819	C113	Easy gain tuning selection	0 to 2	1	0		59	
820	G211	Speed control P gain 1	0 to 1000%	1%	60%		59	
821	G212	Speed control integral time 1	0 to 20 s	0.001 s	0.333 s		59	
822	T003	Speed setting filter 1	0 to 5 s, 9999	0.001 s	9999		67	
823 *9	G215	Speed detection filter 1	0 to 0.1 s	0.001 s	0.001 s		—*17	
824	G213	Torque control P gain 1 (current loop proportional gain)	0 to 500%	1%	100%		—*17	
825	G214	Torque control integral time 1 (current loop integral time)	0 to 500 ms	0.1 ms	5 ms		—*17	
826	T004	Torque setting filter 1	0 to 5 s, 9999	0.001 s	9999		140	
827	G216	Torque detection filter 1	0 to 0.1 s	0.001 s	0 s		—*17	
828	G224	Model speed control gain	0 to 1000%	1%	60%		—*17	
829	R504	Taper ratio setting input filter time constant	0 to 5 s	0.01 s	0.02 s		151	
830	G311	Speed control P gain 2	0 to 1000%, 9999	1%	9999		—*17	
831	G312	Speed control integral time 2	0 to 20 s, 9999	0.001 s	9999		—*17	
832	T005	Speed setting filter 2	0 to 5 s, 9999	0.001 s	9999		67	
833 *9	G315	Speed detection filter 2	0 to 0.1 s, 9999	0.001 s	9999		—*17	
834	G313	Torque control P gain 2	0 to 500%, 9999	1%	9999		—*17	
835	G314	Torque control integral time 2	0 to 500 ms, 9999	0.1 ms	9999		—*17	
836	T006	Torque setting filter 2	0 to 5 s, 9999	0.001 s	9999		140	
837	G316	Torque detection filter 2	0 to 0.1 s, 9999	0.001 s	9999		—*17	
840	G230	Torque bias selection	0 to 3, 24, 25, 9999	1	9999		—*17	
841	G231	Torque bias 1	600 to 1400%, 9999	1%	9999		—*17	
842	G232	Torque bias 2	600 to 1400%, 9999	1%	9999		—*17	
843	G233	Torque bias 3	600 to 1400%, 9999	1%	9999		—*17	
844	G234	Torque bias filter	0 to 5 s, 9999	0.001 s	9999		—*17	
845	G235	Torque bias operation time	0 to 5 s, 9999	0.01 s	9999		—*17	
846	G236	Torque bias balance compensation	0 to 10 V, 9999	0.1 V	9999		—*17	
847	G237	Fall-time torque bias terminal 1 bias	0 to 400%, 9999	1%	9999		—*17	
848	G238	Fall-time torque bias terminal 1 gain	0 to 400%, 9999	1%	9999		—*17	
849	T007	Analog input offset adjustment	0 to 200%	0.1%	100%		—*17	
850	G103	Brake operation selection	0 to 2	1	0		—*17	
851 *9	C240	Control terminal option-Number of encoder pulses	0 to 4096	1	2048		—*17	
852 *9	C241	Control terminal option-Encoder rotation direction	0, 1, 100, 101	1	1		—*17	
853 *9	H417	Speed deviation time	0 to 100 s	0.1 s	1 s		—*17	
854	G217	Excitation ratio	0 to 100%	1%	100%		—*17	
855 *9	C248	Control terminal option-Signal loss detection enable/disable selection	0, 1	1	0		—*17	
858	T040	Terminal 4 function assignment	0, 1, 4, 9999	1	0		—*17	
859	C126	Torque current/Rated PM motor current	0 to 500 A, 9999 *2	0.01 A *2	9999		—*17	
			0 to 3600 A, 9999 *3	0.1 A *3				
860	C226	Second motor torque current/ Rated PM motor current	0 to 500 A, 9999 *2	0.01 A *2	9999		—*17	
			0 to 3600 A, 9999 *3	0.1 A *3				
862 *9	C242	Encoder option selection	0, 1	1	0		234	
863 *9	M600	Control terminal option-Encoder pulse division ratio	1 to 32767	1	1		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
864	M470	Torque detection	0 to 400%	0.1%	150%		—*17	
865	M446	Low speed detection	0 to 590 Hz	0.01 Hz	1.5 Hz		—*17	
866	M042	Torque monitoring reference	0 to 400%	0.1%	150%		218, 224	
867	M321	AM output filter	0 to 5 s	0.01 s	0.01 s		—*17	
868	T010	Terminal 1 function assignment	0 to 6, 9999	1	0		76, 140	
869	M334	Current output filter	0 to 5 s	0.01 s	—	0.02 s	—*17	
870	M440	Speed detection hysteresis	0 to 5 Hz	0.01 Hz	0 Hz		—*17	
872	H201	Input phase loss protection selection	0, 1	1	0		—*17	
873 *9	H415	Speed limit	0 to 400 Hz	0.01 Hz	20 Hz		—*17	
874	H730	OLT level setting	0 to 400%	0.1%	150%		—*17	
875	H030	Fault definition	0, 1	1	0		—*17	
876 *9	H022	Thermal protector input	0, 1	1	1		—*17	
877	G220	Speed feed forward control/ model adaptive speed control selection	0 to 2	1	0		—*17	
878	G221	Speed feed forward filter	0 to 1 s	0.01 s	0 s		—*17	
879	G222	Speed feed forward torque limit	0 to 400%	0.1%	150%		—*17	
880	C114	Load inertia ratio	0 to 200 times	0.1 times	7 times		59	
881	G223	Speed feed forward gain	0 to 1000%	1%	0%		—*17	
882	G120	Regeneration avoidance operation selection	0 to 2	1	0		—*17	
883	G121	Regeneration avoidance operation level	300 to 1000 V	0.1 V	380 VDC *7 760 VDC*8		—*17	
884	G122	Regeneration avoidance at deceleration detection sensitivity	0 to 5	1	0		—*17	
885	G123	Regeneration avoidance compensation frequency limit value	0 to 590 Hz, 9999	0.01 Hz	6 Hz		—*17	
886	G124	Regeneration avoidance voltage gain	0 to 200%	0.1%	100%		—*17	
888	E420	Free parameter 1	0 to 9999	1	9999		—*17	
889	E421	Free parameter 2	0 to 9999	1	9999		—*17	
891	M023	Cumulative power monitor digit shifted times	0 to 4, 9999	1	9999		—*17	
892	M200	Load factor	30 to 150%	0.1%	100%		—*17	
893	M201	Energy saving monitor reference (motor capacity)	0.1 to 55 kW *2 0 to 3600 kW *3	0.01 kW *2 0.1 kW *3	Inverter rated capacity		—*17	
894	M202	Control selection during commercial power-supply operation	0 to 3	1	0		—*17	
895	M203	Power saving rate reference value	0, 1, 9999	1	9999		—*17	
896	M204	Power unit cost	0 to 500, 9999	0.01	9999		—*17	
897	M205	Power saving monitor average time	0, 1 to 1000 h, 9999	1 h	9999		—*17	
898	M206	Power saving cumulative monitor clear	0, 1, 10, 9999	1	9999		—*17	
899	M207	Operation time rate (estimated value)	0 to 100%, 9999	0.1%	9999		—*17	
C0 (900) *10	M310	FM/CA terminal calibration	—	—	—		108	
C1 (901) *10	M320	AM terminal calibration	—	—	—		108	
C2 (902) *10	T200	Terminal 2 frequency setting bias frequency	0 to 590 Hz	0.01 Hz	0 Hz		6	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
C3 (902) *10	T201	Terminal 2 frequency setting bias	0 to 300%	0.1%	0%		6, 108, 124, 151	
125 (903) *10	T202	Terminal 2 frequency setting gain frequency	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	6	
C4 (903) *10	T203	Terminal 2 frequency setting gain	0 to 300%	0.1%	100%		6, 108, 124, 151	
C5 (904) *10	T400	Terminal 4 frequency setting bias frequency	0 to 590 Hz	0.01 Hz	0 Hz		6	
C6 (904) *10	T401	Terminal 4 frequency setting bias	0 to 300%	0.1%	20%		6, 108, 124, 151	
126 (905) *10	T402	Terminal 4 frequency setting gain frequency	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	6	
C7 (905) *10	T403	Terminal 4 frequency setting gain	0 to 300%	0.1%	100%		6, 108, 124, 151	
C12 (917) *10	T100	Terminal 1 bias frequency (speed)	0 to 590 Hz	0.01 Hz	0 Hz		6	
C13 (917) *10	T101	Terminal 1 bias (speed)	0 to 300%	0.1%	0%		6, 108, 124, 151	
C14 (918) *10	T102	Terminal 1 gain frequency (speed)	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	6	
C15 (918) *10	T103	Terminal 1 gain (speed)	0 to 300%	0.1%	100%		6, 108, 124, 151	
C16 (919) *10	T110	Terminal 1 bias command (torque/magnetic flux)	0 to 400%	0.1%	0%		6	
C17 (919) *10	T111	Terminal 1 bias (torque/ magnetic flux)	0 to 300%	0.1%	0%		6	
C18 (920) *10	T112	Terminal 1 gain command (torque/magnetic flux)	0 to 400%	0.1%	150%		6	
C19 (920) *10	T113	Terminal 1 gain (torque/ magnetic flux)	0 to 300%	0.1%	100%		6	
C8 (930) *10	M330	Current output bias signal	0 to 100%	0.1%	—	0%	—*17	
C9 (930) *10	M331	Current output bias current	0 to 100%	0.1%	—	0%	—*17	
C10 (931) *10	M332	Current output gain signal	0 to 100%	0.1%	—	100%	—*17	
C11 (931) *10	M333	Current output gain current	0 to 100%	0.1%	—	100%	—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
C38 (932) *10	T410	Terminal 4 bias command (torque/magnetic flux)	0 to 400%	0.1%	0%		6	
C39 (932) *10	T411	Terminal 4 bias (torque/ magnetic flux)	0 to 300%	0.1%	20%		6	
C40 (933) *10	T412	Terminal 4 gain command (torque/magnetic flux)	0 to 400%	0.1%	150%		6	
C41 (933) *10	T413	Terminal 4 gain (torque/ magnetic flux)	0 to 300%	0.1%	100%		6	
977	E302	Input voltage mode selection	0, 1	1	0		—*17	
989	E490	Parameter copy alarm release	10 *2 100 *3	1	10 *2 100 *3		—*17	
990	E104	PU buzzer control	0, 1	1	1		—*17	
991	E105	PU contrast adjustment	0 to 63	1	58		—*17	
992	M104	Operation panel setting dial push monitor selection	0 to 3, 5 to 14, 17 to 20, 22 to 36, 38, 40 to 46, 50 to 57, 61 to 64, 67, 71 to 74, 81 to 93, 95 to 98, 100	1	0		218	
994	G403	Droop break point gain	0.1 to 100%, 9999	0.1%	9999		—*17	
995	G404	Droop break point torque	0.1 to 100%	0.1%	100%		—*17	
997	H103	Fault initiation	0 to 255, 9999	1	9999		—*17	
999	E431	Automatic parameter setting Simple	1, 2, 10 to 13, 20, 21, 9999	1	9999		—*17	
1000	E108	Direct setting selection	0 to 2	1	0		—*17	
1003	G601	Notch filter frequency	0, 8 to 1250 Hz	1 Hz	0		—*17	
1004	G602	Notch filter depth	0 to 3	1	0		—*17	
1005	G603	Notch filter width	0 to 3	1	0		—*17	
1006	E020	Clock (year)	2000 to 2099	1	2000		—*17	
1007	E021	Clock (month, day)	101 to 131, 201 to 229, 301 to 331, 401 to 430, 501 to 531, 601 to 630, 701 to 731, 801 to 831, 901 to 930, 1001 to 1031, 1101 to 1130, 1201 to 1231	1	101		—*17	
1008	E022	Clock (hour, minute)	0 to 59, 100 to 159, 200 to 259, 300 to 359, 400 to 459, 500 to 559, 600 to 659, 700 to 759, 800 to 859, 900 to 959, 1000 to 1059, 1100 to 1159, 1200 to 1259, 1300 to 1359, 1400 to 1459, 1500 to 1559, 1600 to 1659, 1700 to 1759, 1800 to 1859, 1900 to 1959, 2000 to 2059, 2100 to 2159, 2200 to 2259, 2300 to 2359	1	0		—*17	
1015	A607	Integral stop selection at limited manipulated amount	0, 1	1	0		100	
1016	H021	PTC thermistor protection detection time	0 to 60 s	1 s	0 s		—*17	
1018	M045	Monitor with sign selection	0, 9999	1	9999		—*17	
1020	A900	Trace operation selection	0 to 4	1	0		—*17	
1021	A901	Trace mode selection	0 to 2	1	0		—*17	
1022	A902	Sampling cycle	0 to 9	1	2		—*17	
1023	A903	Number of analog channels	1 to 8	1	4		—*17	
1024	A904	Sampling auto start	0, 1	1	0		—*17	
1025	A905	Trigger mode selection	0 to 4	1	0		—*17	
1026	A906	Number of sampling before trigger	0 to 100%	1%	90%		—*17	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
1027	A910	Analog source selection (1ch)	1 to 3, 5 to 14, 17 to 20, 22 to 24, 26 to 36, 40 to 42, 46, 52 to 54, 61 to 64, 67, 71 to 74, 81 to 93, 95 to 98, 201 to 213, 230 to 232, 235 to 238	1	201		218	
1028	A911	Analog source selection (2ch)			202		218	
1029	A912	Analog source selection (3ch)			203		218	
1030	A913	Analog source selection (4ch)			204		218	
1031	A914	Analog source selection (5ch)			205		218	
1032	A915	Analog source selection (6ch)			206		218	
1033	A916	Analog source selection (7ch)			207		218	
1034	A917	Analog source selection (8ch)			208		218	
1035	A918	Analog trigger channel	1 to 8	1	1		—*17	
1036	A919	Analog trigger operation selection	0, 1	1	0		—*17	
1037	A920	Analog trigger level	600 to 1400	1	1000		—*17	
1038	A930	Digital source selection (1ch)	1 to 255	1	1		—*17	
1039	A931	Digital source selection (2ch)			2		—*17	
1040	A932	Digital source selection (3ch)			3		—*17	
1041	A933	Digital source selection (4ch)			4		—*17	
1042	A934	Digital source selection (5ch)			5		—*17	
1043	A935	Digital source selection (6ch)			6		—*17	
1044	A936	Digital source selection (7ch)			7		—*17	
1045	A937	Digital source selection (8ch)			8		—*17	
1046	A938	Digital trigger channel	1 to 8	1	1		—*17	
1047	A939	Digital trigger operation selection	0, 1	1	0		—*17	
1048	E106	Display-off waiting time	0 to 60 min	1 min	0 min		—*17	
1049	E110	USB host reset	0, 1	1	0		—*17	
1072	R304	Tension reverse selection	0, 1	1	0		143	
1103	F040	Deceleration time at emergency stop	0 to 3600 s	0.1 s	5 s		180	
1106	M050	Torque monitor filter	0 to 5 s, 9999	0.01 s	9999		—*17	
1107	M051	Running speed monitor filter	0 to 5 s, 9999	0.01 s	9999		—*17	
1108	M052	Excitation current monitor filter	0 to 5 s, 9999	0.01 s	9999		—*17	
1113	H414	Speed limit method selection	0 to 2, 10	1	0		146	
1114	D403 R305	Torque command reverse selection	0, 1	1	0		143	
1115	G218	Speed control integral term clear time	0 to 9998 ms	1 ms	0 s		—*17	
1116	G206	Constant output range speed control P gain compensation	0 to 100%	0.1%	0%		—*17	
1117	G261	Speed control P gain 1 (per-unit system)	0 to 300, 9999	0.01	9999		—*17	
1118	G361	Speed control P gain 2 (per-unit system)	0 to 300, 9999	0.01	9999		—*17	
1119	G262	Model speed control gain (per-unit system)	0 to 300, 9999	0.01	9999		—*17	
1121	G260	Per-unit speed control reference frequency	0 to 400 Hz	0.01 Hz	120 Hz*2 60 Hz*3		—*17	
1134	A605	PID upper limit manipulated value	0 to 100%	0.1%	100%		104	
1135	A606	PID lower limit manipulated value	0 to 100%	0.1%	100%		104	
1136	R330	Tension sensor feedback voltage/current bias	0 to 100%	0.1%	0%		178	
1137	R331	Tension sensor feedback bias	0 to 500N*13	0.01N*13	0N		178	
1138	R332	Tension sensor feedback voltage/current gain	0 to 100%	0.1%	100%		178	
1139	R333	Tension sensor feedback gain	0 to 500N*13	0.01N*13	0N*13		178	
1140	R334	Signed winding diameter compensation torque command selection	0, 9999	1	0		183	
1141	R290	Line speed command acceleration/deceleration pattern	0, 1	1	0		82	
1142	R291	Line speed command acceleration start S-curve time	0.1 to 2.5 s	0.1 s	0.1 s		82	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
1143	R292	Line speed command acceleration completion S-curve time	0.1 to 2.5 s	0.1 s	0.1 s		82	
1144	R293	Line speed command deceleration start S-curve time	0.1 to 2.5 s	0.1 s	0.1 s		82	
1145	R294	Line speed command deceleration completion S-curve time	0.1 to 2.5 s	0.1 s	0.1 s		82	
1146	R224	Line speed command input filter time constant	0 to 5 s	0.01 s	0 s		67	
1147	R205	Line speed command maximum value	0 to 6553.4 m/min*11	0.1 m/min*11	6553.4 m/min*11		67	
1148	R105	PID manipulated line speed bias	0 to 6553.4 m/min*11	0.1 m/min*11	6553.4 m/min*11		104	
1149	R106	PID manipulated line speed gain	0 to 6553.4 m/min*11	0.1 m/min*11	9999		104	
1150 to 1199	A810 to A859	User parameters 1 to 50	0 to 65535	1	0		—*17	
1211	R171	Tension PI gain tuning timeout time	1 to 9999 s	1 s	50 s		91	
1215	R172	Limit cycle output upper limit	0 to 100%	0.1%	0%		91	
1217	R173	Limit cycle hysteresis	0.1 to 10%	0.1%	1%		91	
1219	R170	Tension PI gain tuning start/ status	1, 8 (0, 2, 3, 9, 12, 13, 90 to 96)	1	0		91	
1222	R175	Target amplitude	0 to 100%, 9999	0.1%	9999		91	
1223	R174	Manipulated amount for operation	0 to 10%	0.1%	1%		91	
1226	R176	Tension PI gain tuning response level setting	1 to 7	1	2		91	
1227	R103	Dancer / tension sensor feedback input filter time constant	0 to 5 s	0.01 s	0 s		85, 124, 178	
1230	R002	Winding/unwinding selection	0, 1	1	0		67, 163, 178	
1231	R010	Material thickness d1	0 to 20 mm, 9999	0.001 mm	9999		203	
1232	R011	Material thickness d2	0 to 20 mm	0.001 mm	1 mm		203	
1233	R012	Material thickness d3	0 to 20 mm	0.001 mm	1 mm		203	
1234	R013	Material thickness d4	0 to 20 mm	0.001 mm	1 mm		203	
1235	R020	Maximum winding diameter 1	1 to 6553 mm	1 mm	2 mm		206	
1236	R021	Minimum winding diameter 1	1 to 6553 mm	1 mm	1 mm		206	
1237	R022	Maximum winding diameter 2	1 to 6553 mm	1 mm	2 mm		206	
1238	R023	Minimum winding diameter 2	1 to 6553 mm	1 mm	1 mm		206	
1239	R024	Maximum winding diameter 3	1 to 6553 mm	1 mm	2 mm		206	
1240	R025	Minimum winding diameter 3	1 to 6553 mm	1 mm	1 mm		206	
1241	R026	Maximum winding diameter 4	1 to 6553 mm	1 mm	2 mm		206	
1242	R027	Minimum winding diameter 4	1 to 6553 mm	1 mm	1 mm		206	
1243	R600	Gear ratio numerator	1 to 65534	1	1		197	
1244	R601	Gear ratio denominator	1 to 65534	1	1		197	
1245	R042	Sampling time for winding diameter calculation	0.01 to 1 s, 9999	0.01 s	9999		199	
1246	R040	Line speed at winding diameter calculated value activation	0 to 6553.4 m/min*11	0.1 m/min*11	1 m/min*11		204	
1247	R000	Winding diameter change increment amount limit	0 to 9.998 mm, 9999	0.001 mm	9999		197	
1248	R001	Winding diameter change limit disable time	0 to 100 s	0.01 s	0 s		197	
1249	R043	Number of averaging for winding diameter calculation	0 to 10	1	4		205	
1250	R260	Winding diameter compensation speed filtering waiting time	0 to 100 s	0.01 s	0 s		207	
1251	R261	Winding diameter compensation speed filter time constant	0 to 100 s	0.01 s	0 s		207	
1252	R070	Dancer lower limit position	400 to 600%	0.01%	400%		208	
1253	R071	Initial winding diameter calculation deadband	0 to 50%	0.1%	1%		208	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
1254	R072	Initial winding diameter calculation deadband 2	0 to 50%, 9999	0.1%	9999		208	
1255	R073	Accumulated amount	1 to 5000 mm, 8888, 9999	1 mm	9999		208	
1256	R074	Speed control P gain at start	0 to 1000%	1%	60%		208	
1257	R075	Speed control integral time at start	0 to 20 s	0.001 s	2 s		208	
1258	R076	Integral term limit at start	0 to 100%	0.1%	2.5%		208	
1259	R077	PID term limit at start	0 to 100%	0.1%	2.5%		208	
1262	R005	Winding length increment	0 to 5	1	3		213, 224	
1263	R006	Stored winding length (lower 4 digits)	0 to 9999(m*12)	1(m*12)	0(m*12)		213	
1264	R421	Winding length detection (lower 4 digits)	0 to 9999(m*12)	1(m*12)	1000(m*12)		213	
1265	R230	Line multi-speed setting (high-speed)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1266	R231	Line multi-speed setting (middle-speed)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1267	R232	Line multi-speed setting (low-speed)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1268	R233	Line multi-speed setting (speed 4)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1269	R234	Line multi-speed setting (speed 5)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1270	R235	Line multi-speed setting (speed 6)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1271	R236	Line multi-speed setting (speed 7)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1272	R237	Line multi-speed setting (speed 8)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1273	R238	Line multi-speed setting (speed 9)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1274	R239	Line multi-speed setting (speed 10)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1275	R240	Line multi-speed setting (speed 11)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1276	R241	Line multi-speed setting (speed 12)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1277	R242	Line multi-speed setting (speed 13)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1278	R243	Line multi-speed setting (speed 14)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1279	R244	Line multi-speed setting (speed 15)	0 to 6553.4 m/min*11	0.1 m/min*11	0 m/min*11		67	
1280	R401	Winding diameter monitoring reference	1 to 6553 mm	1 mm	1000 mm		218, 224	
1281	R402	Commanded tension monitoring reference	0 to 500 N*13	0.01 N*13	100 N*13		218, 224	
1282	R320	Tension command cushion time	0 to 360 s	0.01 s	0 s		151	
1283	R321	Cushion time reference tension	0.01 to 500 N*13	0.01 N*13	100 N*13		151	
1284	R500	Taper mode selection	0 to 4	1	0		108, 151	
1285	R501	Taper setting analog input selection	3 to 6, 9999	1	9999		108, 151	
1286	R503	Winding diameter at taper start	0 to 6553 mm, 9999	1 mm	9999		108, 151	
1287	R502	Taper ratio setting	0 to 100%, 9999	0.1%	0%		108, 151	
1288	R510	Data table winding diameter 1	0 to 6553 mm, 9999	1 mm	9999		108, 151	
1289	R511	Data table taper ratio 1	0 to 100%	0.1%	0%		108, 151	
1290	R512	Data table winding diameter 2	0 to 6553 mm, 9999	1 mm	9999		108, 151	
1291	R513	Data table taper ratio 2	0 to 100%	0.1%	0%		108, 151	
1292	R514	Data table winding diameter 3	0 to 6553 mm, 9999	1 mm	9999		108, 151	
1293	R515	Data table taper ratio 3	0 to 100%	0.1%	0%		108, 151	
1294	R516	Data table winding diameter 4	0 to 6553 mm, 9999	1 mm	9999		108, 151	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
1295	R517	Data table taper ratio 4	0 to 100%	0.1%	0%		108, 151	
1296	R518	Data table winding diameter 5	0 to 6553 mm, 9999	1 mm	9999		108, 151	
1297	R519	Data table taper ratio 5	0 to 100%	0.1%	0%		108, 151	
1298	R007	Stored winding length (upper 4 digits)	0 to 9999(m*12)	1(m*12)	0(m*12)		213	
1299	R008	Stored winding length increment	0 to 2	1	0		213	
1300 to 1343	N500 to N543	Communication option parameters. For details, refer to the Instruction Manual of the option.						
1346	R424	Winding length detection (upper 4 digits)	0 to 9999(m*12)	1(m*12)	0(m*12)		213	
1348	G263	P/PI control switchover frequency	0 to 400 Hz	0.01 Hz	0 Hz		—*17	
1349	G264	Emergency stop operation selection	0, 1, 10, 11	1	0		—*17	
1350 to 1359	N550 to N559	Communication option parameters. For details, refer to the Instruction Manual of the option.						
1382	R150	PID set point cushion time	0 to 360 s	0.01 s	0 s		85	
1383	R335	PID torque control manipulated tension bias [N]	0 to 500 N*13	0.01 N*13	0 N		183	
1384	R336	PID torque control manipulated tension gain [N]	0 to 500 N*13 , 9999	0.01 N*13	9999		183	
1401	R301	Tension command increment	0 to 2	1	0		140, 224	
1402	R310	Tension command input voltage bias	0 to 100%	0.1%	0%		140	
1403	R311	Tension command bias	0 to 500 N*13	0.01 N*13	0 N		140	
1404	R312	Tension command input voltage gain	0 to 100%	0.1%	100%		140	
1405	R313	Tension command gain	0 to 500 N*13	0.01 N*13	100 N*13		140	
1406	R340	Commanded tension reduction scaling factor during stall condition	0 to 200%	0.1%	20%		165	
1407	R341	Speed limit during stall condition	0 to 60 Hz	0.01 Hz	1 Hz		165	
1409	R343	Tension command cushion time during stall condition	0 to 360 s, 9999	0.01 s	9999		165	
1410	R530	Motor inertia	0 to 500 kg·m^2, 9999	0.01 kg·m^2	0 kg·m^2		157	
1411	R531	Empty reel inertia	0 to 500 kg·m^2, 9999	0.01 kg·m^2	0 kg·m^2		157	
1412	R532	Roll width	0 to 5000 mm	1 mm	0 mm		157	
1413	R533	Material specific gravity	0 to 20 g/cm^3	0.001 g/cm^3	0 g/cm^3		157	
1414	R535	First acceleration time for inertia compensation	0 to 3600 s	0.1 s	15 s		157	
1415	R536	First deceleration time for inertia compensation	0 to 3600 s	0.1 s	15 s		157	
1418	R534	Inertia compensation cushion time	0 to 360 s	0.01 s	0 s		157	
1419	R550	Mechanical loss setting frequency bias	900 to 1100%	0.1%	1000%		163	
1420	R551	Mechanical loss setting frequency 1	0 to 400 Hz, 9999	0.01 Hz	9999		163	
1421	R552	Mechanical loss 1	900 to 1100%	0.1%	1000%		163	
1422	R553	Mechanical loss setting frequency 2	0 to 400 Hz, 9999	0.01 Hz	9999		163	
1423	R554	Mechanical loss 2	900 to 1100%	0.1%	1000%		163	
1424	R555	Mechanical loss setting frequency 3	0 to 400 Hz, 9999	0.01 Hz	9999		163	
1425	R556	Mechanical loss 3	900 to 1100%	0.1%	1000%		163	
1426	R557	Mechanical loss setting frequency 4	0 to 400 Hz, 9999	0.01 Hz	9999		163	

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value		Refer to page	Customer setting
					FM	CA		
1427	R558	Mechanical loss 4	900 to 1100%	0.1%	1000%		163	
1428	R559	Mechanical loss setting frequency 5	0 to 400 Hz, 9999	0.01 Hz	9999		163	
1429	R560	Mechanical loss 5	900 to 1100%	0.1%	1000%		163	
1480	H520	Load characteristics measurement mode	0, 1 (2 to 5, 81 to 85)	1	0		—*17	
1481	H521	Load characteristics load reference 1	0 to 400%, 8888, 9999	0.1%	9999		—*17	
1482	H522	Load characteristics load reference 2	0 to 400%, 8888, 9999	0.1%	9999		—*17	
1483	H523	Load characteristics load reference 3	0 to 400%, 8888, 9999	0.1%	9999		—*17	
1484	H524	Load characteristics load reference 4	0 to 400%, 8888, 9999	0.1%	9999		—*17	
1485	H525	Load characteristics load reference 5	0 to 400%, 8888, 9999	0.1%	9999		—*17	
1486	H526	Load characteristics maximum frequency	0 to 590 Hz	0.01 Hz	60 Hz	50 Hz	—*17	
1487	H527	Load characteristics minimum frequency	0 to 590 Hz	0.01 Hz	6 Hz		—*17	
1488	H531	Upper limit warning detection width	0 to 400%, 9999	0.1%	20%		—*17	
1489	H532	Lower limit warning detection width	0 to 400%, 9999	0.1%	20%		—*17	
1490	H533	Upper limit fault detection width	0 to 400%, 9999	0.1%	9999		—*17	
1491	H534	Lower limit fault detection width	0 to 400%, 9999	0.1%	9999		—*17	
1492	H535	Load status detection signal delay time / load reference measurement waiting time	0 to 60 s	0.1s	1s		—*17	
1499	E415	Parameter for manufacturer setting. Do not set.						
Pr.CLR		Parameter clear	(0,)1	1	0		—*17	
ALL.CL		All parameter clear	(0,)1	1	0		—*17	
Err.CL		Fault history clear	(0,)1	1	0		—*17	
Pr.CPY		Parameter copy	(0,)1 to 3	1	0		—*17	
Pr.CHG		Initial value change list	—	—	—		—*17	
AUTO		Automatic parameter setting	—	—	—		—*17	
Pr.Md		Group parameter setting	(0,)1, 2	1	0		—*17	

*1 Differs according to the capacity.
- 6%: FR-A820-00046(0.4K), 00077(0.75K), FR-A840-00023(0.4K), 00038(0.75K)
- 4%: FR-A820-00105(1.5K) to 00250(3.7K), FR-A840-00052(1.5K) to 00126(3.7K)
- 3%: FR-A820-00340(5.5K), 00490(7.5K), FR-A840-00170(5.5K), 00250(7.5K)
- 2%: FR-A820-00630(11K) to 03160(55K), FR-A840-00310(11K) to 01800(55K)
- 1%: FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher

*2 The setting range or initial value for the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*3 The setting range or initial value for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

*4 The initial value for the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.

*5 The initial value for the FR-A820-00630(11K) or higher and FR-A840-00310(11K) and higher.

*6 Differs according to the capacity.
- 4%: FR-A820-00490(7.5K) or lower, FR-A840-00250(7.5K) or lower
- 2%: FR-A820-00630(11K) to 03160(55K), FR-A840-00310(11K) to 01800(55K)
- 1%: FR-A820-03800(75K) or higher, FR-A840-02160(75K)or higher

*7 The value for the 200 V class.

*8 The value for the 400 V class.

*9 The setting is available only when a plug-in option that supports Vector control is installed. For details of the Vector control compatible options supporting the parameter, refer to the Instruction Manual (Detailed) of the FR-A800 inverter or the Instruction Manual of the Vector control compatible option.

*10 The parameter number in parentheses is that used (displayed) on the LCD operation panel and the parameter unit.

*11 The increment varies depending on the **Pr.358** setting.

*12 The increment varies depending on the **Pr.1262** setting.

*13 The setting varies with the **Pr.1401** setting.

*14 The initial value is for standard models.

*15 The initial value is for separated converter types.

*16 The setting is available only when the FR-A8AZ is installed.

*17 For details, refer to the FR-A800 Instruction Manual (Detailed).

*18 For the details, refer to the Instruction Manual of the FR-A8AL.

2.2 Parameter list (by function group)

◆R: Roll to roll function setting

Parameters that set the roll to roll functions.

Pr. group	Pr.	Name	Refer to page
R000	1247	Winding diameter change increment amount limit	197
R001	1248	Winding diameter change limit disable time	197
R002	1230	Winding/unwinding selection	67, 163, 178
R003	646	Stored winding diameter	213
R004	645	Winding diameter storage selection	213
R005	1262	Winding length increment	213, 224
R006	1263	Stored winding length (lower 4 digits)	213
R007	1298	Stored winding length (upper 4 digits)	213
R008	1299	Stored winding length increment	213
R010	1231	Material thickness d1	203
R011	1232	Material thickness d2	203
R012	1233	Material thickness d3	203
R013	1234	Material thickness d4	203
R020	1235	Maximum winding diameter 1	206
R021	1236	Minimum winding diameter 1	206
R022	1237	Maximum winding diameter 2	206
R023	1238	Minimum winding diameter 2	206
R024	1239	Maximum winding diameter 3	206
R025	1240	Minimum winding diameter 3	206
R026	1241	Maximum winding diameter 4	206
R027	1242	Minimum winding diameter 4	206
R030	639	Speed control proportional term applied diameter 1	216
R031	640	Speed control proportional term applied diameter 2	216
R032	641	Speed control proportional gain 1	216
R033	642	Speed control proportional gain 2	216
R034	643	Speed control proportional gain 3	216
R035	644	Speed control proportional gain 4	216
R040	1246	Line speed at winding diameter calculated value activation	204
R041	647	Operation time with stored winding diameter	213
R042	1245	Sampling time for winding diameter calculation	199
R043	1249	Number of averaging for winding diameter calculation	205
R050	362	Actual line speed input selection	199
R051	278	Actual line speed voltage/current gain	199
R052	279	Actual line speed gain	199
R053	280	Actual line speed voltage/current bias	199
R054	281	Actual line speed bias	199
R055	282	Actual line speed pulse input bias	199
R056	283	Actual line speed pulse input gain	199
R057	284	Actual line speed input filter time constant	199
R070	1252	Dancer lower limit position	208
R071	1253	Initial winding diameter calculation deadband	208
R072	1254	Initial winding diameter calculation deadband 2	208
R073	1255	Accumulated amount	208
R074	1256	Speed control P gain at start	208
R075	1257	Speed control integral time at start	208
R076	1258	Integral term limit at start	208
R077	1259	PID term limit at start	208
R100	128	PID action selection	65, 177
R101	133	PID action set point	65, 124
R102	363	Dancer / tension sensor feedback input selection	85, 124, 178
R103	1227	Dancer / tension sensor feedback input filter time constant	85, 124, 178
R104	424	Dancer / tension sensor feedback input offset	88, 126
R105	1148	PID manipulated line speed bias	104
R106	1149	PID manipulated line speed gain	104
R110	129	PID proportional band	99
R111	130	PID integral time	99
R112	134	PID differential time	99
R113	464	PID proportional band for values below set point	101
R114	465	PID integral time for values below set point	101
R115	466	PID differential time for values below set point	101
R116	467	Second PID proportional band	101
R117	468	Second PID integral time	101
R118	469	Second PID differential time	101
R119	470	Second PID proportional band for values below set point	101
R120	471	Second PID integral time for values below set point	101
R121	472	Second PID differential time for values below set point	101
R122	473	Third PID proportional band	101
R123	474	Third PID integral time	101
R124	475	Third PID differential time	101
R125	476	Third PID proportional band for values below set point	101
R126	477	Third PID integral time for values below set point	101
R127	478	Third PID differential time for values below set point	101
R128	479	Fourth PID proportional band	101
R129	480	Fourth PID integral time	101
R130	481	Fourth PID differential time	101
R131	482	Fourth PID proportional band for values below set point	101
R132	483	Fourth PID integral time for values below set point	101
R133	484	Fourth PID differential time for values below set point	101
R140	486	Deviation A	101
R141	487	Deviation B	101

Pr. group	Pr.	Name	Refer to page
R142	488	Deviation C1	101
R143	489	Deviation C2	101
R144	490	PID gain A	101
R145	491	PID gain B	101
R146	492	PID gain C1	101
R147	493	PID gain C2	101
R148	494	PID gain D	101
R149	485	Integral control activation	100
R150	1382	PID set point cushion time	85
R160	425	Break detection waiting time	89, 180
R161	135	Integral clamp (positive polarity)	100
R162	136	Integral clamp (negative polarity)	100
R163	137	PID upper/lower limit hysteresis width	89, 127, 180
R170	1219	Tension PI gain tuning start/ status	91
R171	1211	Tension PI gain tuning timeout time	91
R172	1215	Limit cycle output upper limit	91
R173	1217	Limit cycle hysteresis	91
R174	1223	Manipulated amount for operation	91
R175	1222	Target amplitude	91
R176	1226	Tension PI gain tuning response level setting	91
R200	361	Line speed command input selection	67
R201	358	Line speed unit	67, 224
R202	360	Line speed command value	67
R203	398	Draw rate	67
R204	622	Line speed command for starting	67
R205	1147	Line speed command maximum value	67
R210	350	Line speed command voltage/ current bias	67
R211	351	Line speed command bias	67
R212	352	Line speed command voltage/ current gain	67
R213	353	Line speed command gain	67
R214	635	Line speed command added compensation value voltage/ current bias	76
R215	636	Line speed command added compensation value bias	76
R216	637	Line speed command added compensation value voltage/ current gain	76
R217	638	Line speed command added compensation value gain	76
R220	354	Line speed command pulse input bias	67
R221	355	Line speed command pulse input gain	67
R222	356	Line speed command digital input bias	67
R223	357	Line speed command digital input gain	67
R224	1146	Line speed command input filter time constant	67
R230	1265	Line multi-speed setting (high-speed)	67
R231	1266	Line multi-speed setting (middle-speed)	67
R232	1267	Line multi-speed setting (low-speed)	67
R233	1268	Line multi-speed setting (speed 4)	67
R234	1269	Line multi-speed setting (speed 5)	67
R235	1270	Line multi-speed setting (speed 6)	67
R236	1271	Line multi-speed setting (speed 7)	67
R237	1272	Line multi-speed setting (speed 8)	67
R238	1273	Line multi-speed setting (speed 9)	67
R239	1274	Line multi-speed setting (speed 10)	67
R240	1275	Line multi-speed setting (speed 11)	67
R241	1276	Line multi-speed setting (speed 12)	67
R242	1277	Line multi-speed setting (speed 13)	67
R243	1278	Line multi-speed setting (speed 14)	67
R244	1279	Line multi-speed setting (speed 15)	67
R250	393	Line speed command acceleration/deceleration reference	79
R251	394	First acceleration time for line speed command	79
R252	395	First deceleration time for line speed command	79
R253	100	Second acceleration time for line speed command	79
R254	101	Second deceleration time for line speed command	79
R255	102	Third acceleration time for line speed command	79
R256	103	Third deceleration time for line speed command	79
R260	1250	Winding diameter compensation speed filtering waiting time	207
R261	1251	Winding diameter compensation speed filter time constant	207
R270	650	Terminal 4 input compensation selection	76
R290	1141	Line speed command acceleration/deceleration pattern	82
R291	1142	Line speed command acceleration start S-curve time	82
R292	1143	Line speed command acceleration completion S-curve time	82
R293	1144	Line speed command deceleration start S-curve time	82
R294	1145	Line speed command deceleration completion S-curve time	82
R300	804	Tension / Torque command source selection	140
R301	1401	Tension command increment	140, 224
R302	365	Tension command value (RAM)	140
R303	366	Tension command value (RAM, EEPROM)	140
R304	1072	Tension reverse selection	143

Pr. group	Pr.	Name	Refer to page
R305	1114	Torque command reverse selection	143
R310	1402	Tension command input voltage bias	140
R311	1403	Tension command bias	140
R312	1404	Tension command input voltage gain	140
R313	1405	Tension command gain	140
R320	1282	Tension command cushion time	151
R321	1283	Cushion time reference tension	151
R330	1136	Tension sensor feedback voltage/ current bias	178
R331	1137	Tension sensor feedback bias	178
R332	1138	Tension sensor feedback voltage/ current gain	178
R333	1139	Tension sensor feedback gain	178
R334	1140	Signed winding diameter compensation torque command selection	183
R335	1383	PID torque control manipulated tension bias [N]	183
R336	1384	PID torque control manipulated tension gain [N]	183
R340	1406	Commanded tension reduction scaling factor during stall condition	165
R341	1407	Speed limit during stall condition	165
R342	270	Acceleration/deceleration time during stall condition	165
R343	1409	Tension command cushion time during stall condition	165
R400	276	Line speed monitoring reference	218, 224
R401	1280	Winding diameter monitoring reference	218, 224
R402	1281	Commanded tension monitoring reference	218, 224
R410	430	Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2	108
R411	364	Dancer tension setting input selection / taper function enable/ disable selection for tension sensor feedback speed control 1	108
R412	426	Dancer tension setting bias	108
R413	427	Dancer tension setting gain	108
R420	648	Target winding diameter	213
R421	1264	Winding length detection (lower 4 digits)	213
R422	423	Dancer / tension sensor feedback detection level	88, 126
R423	621	Allowable deviation from target line speed	79, 106
R424	1346	Winding length detection (upper 4 digits)	213
R430	609	PID measured tension monitor filter	226
R431	610	PID measured tension monitor increment	226
R450	159*5	DA1 output sign selection	218
R500	1284	Taper mode selection	108, 151
R501	1285	Taper setting analog input selection	108, 151
R502	1287	Taper ratio setting	108, 151
R503	1286	Winding diameter at taper start	108, 151
R504	829	Taper ratio setting input filter time constant	151
R510	1288	Data table winding diameter 1	108, 151
R511	1289	Data table taper ratio 1	108, 151
R512	1290	Data table winding diameter 2	108, 151
R513	1291	Data table taper ratio 2	108, 151
R514	1292	Data table winding diameter 3	108, 151
R515	1293	Data table taper ratio 3	108, 151
R516	1294	Data table winding diameter 4	108, 151
R517	1295	Data table taper ratio 4	108, 151
R518	1296	Data table winding diameter 5	108, 151
R519	1297	Data table taper ratio 5	108, 151
R530	1410	Motor inertia	157
R531	1411	Empty reel inertia	157
R532	1412	Roll width	157
R533	1413	Material specific gravity	157
R534	1418	Inertia compensation cushion time	157
R535	1414	First acceleration time for inertia compensation	157
R536	1415	First deceleration time for inertia compensation	157
R537	271	Second acceleration time for inertia compensation	157
R538	272	Second deceleration time for inertia compensation	157
R539	753	Empty reel inertia (integer)	157
R540	754	Empty reel inertia (exponent)	157
R550	1419	Mechanical loss setting frequency bias	163
R551	1420	Mechanical loss setting frequency 1	163
R552	1421	Mechanical loss 1	163
R553	1422	Mechanical loss setting frequency 2	163
R554	1423	Mechanical loss 2	163
R555	1424	Mechanical loss setting frequency 3	163
R556	1425	Mechanical loss 3	163
R557	1426	Mechanical loss setting frequency 4	163
R558	1427	Mechanical loss 4	163
R559	1428	Mechanical loss setting frequency 5	163
R560	1429	Mechanical loss 5	163
R570	620	Line speed bias for reel change	106
R600	1243	Gear ratio numerator	197
R601	1244	Gear ratio denominator	197

◆E: Environment setting

parameters

Parameters that set the inverter operation characteristics.

Pr. group	Pr.	Name	Refer to page
E000	168	Parameter for manufacturer setting. Do not set.	
E001	169	Parameter for manufacturer setting. Do not set.	
E020	1006	Clock (year)	—*6
E021	1007	Clock (month, day)	—*6
E022	1008	Clock (hour, minute)	—*6
E023	269	Parameter for manufacturer setting. Do not set.	
E080	168	Parameter for manufacturer setting. Do not set.	
E081	169	Parameter for manufacturer setting. Do not set.	
E100	75	Reset selection	—*6
E101	75	Disconnected PU detection	—*6
E102	75	PU stop selection	—*6
E103	145	PU display language selection	—*6
E104	990	PU buzzer control	—*6
E105	991	PU contrast adjustment	—*6
E106	1048	Display-off waiting time	—*6
E107	75	Reset limit	—*6
E108	1000	Direct setting selection	—*6
E110	1049	USB host reset	—*6
E200	161	Frequency setting/key lock operation selection	—*6
E201	295	Frequency change increment amount setting	—*6
E300	30	Regenerative function selection	—*6
E301	570	Multiple rating setting	8
E302	977	Input voltage mode selection	—*6
E400	77	Parameter write selection	237
E410	296	Password lock level	—*6
E411	297	Password lock/unlock	—*6
E415	1499	Parameter for manufacturer setting. Do not set.	
E420	888	Free parameter 1	—*6
E421	889	Free parameter 2	—*6
E431	999	Automatic parameter setting	—*6
E440	160	User group read selection	—*6
E441	172	User group registered display/ batch clear	—*6
E442	173	User group registration	—*6
E443	174	User group clear	—*6
E490	989	Parameter copy alarm release	—*6
E600	72	PWM frequency selection	—*6
E601	240	Soft-PWM operation selection	—*6
E602	260	PWM frequency automatic switchover	—*6
E700	255	Life alarm status display	—*6
E701	256	Inrush current limit circuit life display	—*6
E702	257	Control circuit capacitor life display	—*6
E703	258	Main circuit capacitor life display	—*6
E704	259	Main circuit capacitor life measuring	—*6
E710	503	Maintenance timer 1	—*6
E711	504	Maintenance timer 1 warning output set time	—*6
E712	686	Maintenance timer 2	—*6
E713	687	Maintenance timer 2 warning output set time	—*6
E714	688	Maintenance timer 3	—*6
E715	689	Maintenance timer 3 warning output set time	—*6
E720	555	Current average time	—*6
E721	556	Data output mask time	—*6
E722	557	Current average value monitor signal output reference current	—*6

◆F: Parameters for the settings of the acceleration/deceleration time and the acceleration/deceleration pattern

Parameters for the motor acceleration/deceleration characteristics.

Pr. group	Pr.	Name	Refer to page
F000	20	Acceleration/deceleration reference frequency	—*6
F001	21	Acceleration/deceleration time increments	79
F002	16	Jog acceleration/deceleration time	227
F003	611	Acceleration time at a restart	—*6
F010	7	Acceleration time	—*6
F011	8	Deceleration time	—*6
F020	44	Second acceleration/deceleration time	—*6
F021	45	Second deceleration time	—*6
F022	147	Acceleration/deceleration time switching frequency	—*6
F030	110	Third acceleration/deceleration time	—*6
F031	111	Third deceleration time	—*6
F040	1103	Deceleration time at emergency stop	180
F100	29	Acceleration/deceleration pattern selection	—*6
F102	13	Starting frequency	208
F103	571	Holding time at a start	—*6
F200	140	Backlash acceleration stopping frequency	—*6
F201	141	Backlash acceleration stopping time	—*6
F202	142	Backlash deceleration stopping frequency	—*6
F203	143	Backlash deceleration stopping time	—*6
F300	380	Acceleration S-pattern 1	—*6
F301	381	Deceleration S-pattern 1	—*6
F302	382	Acceleration S-pattern 2	—*6
F303	383	Deceleration S-pattern 2	—*6
F400	516	S-pattern time at a start of acceleration	—*6
F401	517	S-pattern time at a completion of acceleration	—*6
F402	518	S-pattern time at a start of deceleration	—*6

Pr. group	Pr.	Name	Refer to page
F403	519	S-pattern time at a completion of deceleration	—*6

◆D: Operation command and frequency command

Parameters that specify the inverter's command source, and parameters that set the motor driving frequency and torque.

Pr. group	Pr.	Name	Refer to page
D000	79	Operation mode selection	—*6
D001	340	Communication startup mode selection	—*6
D010	338	Communication operation command source	233
D011	339	Communication speed command source	233
D012	550	NET mode operation command source selection	—*6
D013	551	PU mode operation command source selection	—*6
D020	78	Reverse rotation prevention selection	208
D030	811	Set resolution switchover	—*6
D100	291	Pulse train I/O selection	—*6
D101	384	Input pulse division scaling factor	—*6
D110	385	Frequency for zero input pulse	—*6
D111	386	Frequency for maximum input pulse	—*6
D120	432*1	Pulse train torque command bias	—*7
D121	433*1	Pulse train torque command gain	—*7
D200	15	Jog frequency	227
D300	28	Multi-speed input compensation selection	—*6
D301	4	Multi-speed setting (high speed)	—*6
D302	5	Multi-speed setting (middle speed)	—*6
D303	6	Multi-speed setting (low speed)	—*6
D304 to D307	24 to 27	Multi-speed setting (4 speed to 7 speed)	—*6
D308 to D315	232 to 239	Multi-speed setting (8 speed to 15 speed)	—*6
D400	804	Tension / Torque command source selection	140
D401	805	Torque command value (RAM)	—*6
D402	806	Torque command value (RAM,EEPROM)	—*6
D403	1114	Torque command reverse selection	143

◆H: Protective function parameters

Parameters to protect the motor and the inverter.

Pr. group	Pr.	Name	Refer to page
H000	9	Electronic thermal O/L relay	—*6
H001	600	First free thermal reduction frequency 1	—*6
H002	601	First free thermal reduction ratio 1	—*6
H003	602	First free thermal reduction frequency 2	—*6
H004	603	First free thermal reduction ratio 2	—*6
H005	604	First free thermal reduction frequency 3	—*6
H006	607	Motor permissible load level	—*6
H010	51	Second electronic thermal O/L relay	—*6
H011	692	Second free thermal reduction frequency 1	—*6
H012	693	Second free thermal reduction ratio 1	—*6
H013	694	Second free thermal reduction frequency 2	—*6
H014	695	Second free thermal reduction ratio 2	—*6
H015	696	Second free thermal reduction frequency 3	—*6
H016	608	Second motor permissible load level	—*6
H020	561	PTC thermistor protection level	—*6
H021	1016	PTC thermistor protection detection time	—*6
H022	876 *1	Thermal protector input	—*6
H030	875	Fault definition	—*6
H100	244	Cooling fan operation selection	—*6
H101	249	Earth (ground) fault detection at start	—*6
H102	598	Undervoltage level	—*6
H103	997	Fault initiation	—*6
H200	251	Output phase loss protection selection	—*6
H201	872	Input phase loss protection selection	—*6
H300	65	Retry selection	—*6
H301	67	Number of retries at fault occurrence	—*6
H302	68	Retry waiting time	—*6
H303	69	Retry count display erase	—*6
H400	1	Maximum frequency	146
H401	2	Minimum frequency	—*6
H402	18	High speed maximum frequency	—*6
H410	807	Speed limit selection	146
H411	808	Forward rotation speed limit/ speed limit	146
H412	809	Reverse rotation speed limit/ reverse-side speed limit	146
H414	1113	Speed limit method selection	146
H415	873 *1	Speed limit	—*6
H416	285	Speed deviation excess detection frequency	—*6
H417	853 *1	Speed deviation time	—*6
H420	31	Frequency jump 1A	—*6
H421	32	Frequency jump 1B	—*6
H422	33	Frequency jump 2A	—*6
H423	34	Frequency jump 2B	—*6
H424	35	Frequency jump 3A	—*6
H425	36	Frequency jump 3B	—*6

Pr. group	Pr.	Name	Refer to page
H429	552	Frequency jump range	—*6
H500	22	Stall prevention operation level (Torque limit level)	—*6
H501	156	Stall prevention operation selection	—*6
H520	1480	Load characteristics measurement mode	—*6
H521	1481	Load characteristics load reference 1	—*6
H522	1482	Load characteristics load reference 2	—*6
H523	1483	Load characteristics load reference 3	—*6
H524	1484	Load characteristics load reference 4	—*6
H525	1485	Load characteristics load reference 5	—*6
H526	1486	Load characteristics maximum frequency	—*6
H527	1487	Load characteristics minimum frequency	—*6
H531	1488	Upper limit warning detection width	—*6
H532	1489	Lower limit warning detection width	—*6
H533	1490	Upper limit fault detection width	—*6
H534	1491	Lower limit fault detection width	—*6
H535	1492	Load status detection signal delay time / load reference measurement waiting time	—*6
H600	48	Second stall prevention operation level	—*6
H601	49	Second stall prevention operation frequency	—*6
H602	114	Third stall prevention operation level	—*6
H603	115	Third stall prevention operation frequency	—*6
H610	23	Stall prevention operation level compensation factor at double speed	—*6
H611	66	Stall prevention operation reduction starting frequency	—*6
H620	148	Stall prevention level at 0 V input	—*6
H621	149	Stall prevention level at 10 V input	—*6
H631	154	Voltage reduction selection during stall prevention operation	—*6
H700	810	Torque limit input method selection	—*6
H701	812	Torque limit level (regeneration)	—*6
H702	813	Torque limit level (3rd quadrant)	—*6
H703	814	Torque limit level (4th quadrant)	—*6
H704	801	Output limit level	—*6
H710	815	Torque limit level 2	—*6
H720	816	Torque limit level during acceleration	—*6
H721	817	Torque limit level during deceleration	—*6
H730	874	OLT level setting	—*6
H800	374	Overspeed detection level	—*6
H881	690	Deceleration check time	—*6

◆M: Monitor display and monitor output signal

Parameters regarding the inverter's operating status. These parameters are used to set the monitors and output signals.

Pr. group	Pr.	Name	Refer to page
M000	37	Speed display	—*6
M001	505	Speed setting reference	—*6
M002	144	Speed setting switchover	—*6
M020	170	Watt-hour meter clear	—*6
M021	563	Energization time carrying-over times	—*6
M022	268	Monitor decimal digits selection	—*6
M023	891	Cumulative power monitor digit shifted times	—*6
M030	171	Operation hour meter clear	—*6
M031	564	Operating time carrying-over times	—*6
M040	55	Frequency monitoring reference	218
M041	56	Current monitoring reference	218
M042	866	Torque monitoring reference	218, 224
M043	241	Analog input display unit switchover	—*6
M044	290	Monitor negative output selection	218
M045	1018	Monitor with sign selection	—*6
M050	1106	Torque monitor filter	—*6
M051	1107	Running speed monitor filter	—*6
M052	1108	Excitation current monitor filter	—*6
M060	663	Control circuit temperature signal output level	—*6
M100	52	Operation panel main monitor selection	218
M101	774	Operation panel monitor selection 1	218
M102	775	Operation panel monitor selection 2	218
M103	776	Operation panel monitor selection 3	218
M104	992	Operation panel setting dial push monitor selection	218
M200	892	Load factor	—*6
M201	893	Energy saving monitor reference (motor capacity)	—*6
M202	894	Control selection during commercial power-supply operation	—*6
M203	895	Power saving rate reference value	—*6
M204	896	Power unit cost	—*6
M205	897	Power saving monitor average time	—*6
M206	898	Power saving cumulative monitor clear	—*6
M207	899	Operation time rate (estimated value)	—*6
M300	54	FM/CA terminal function selection	108, 218
M301	158	AM terminal function selection	108, 218
M310	C0 (900) *2	FM/CA terminal calibration	108
M320	C1 (901) *2	AM terminal calibration	108

Pr. group	Pr.	Name	Refer to page
M321	867	AM output filter	—*6
M330	C8 (930) *2	Current output bias signal	—*6
M331	C9 (930) *2	Current output bias current	—*6
M332	C10 (931) *2	Current output gain signal	—*6
M333	C11 (931) *2	Current output gain current	—*6
M334	869	Current output filter	—*6
M400	190	RUN terminal function selection	230
M401	191	SU terminal function selection	230
M402	192	IPF terminal function selection	230
M403	193	OL terminal function selection	230
M404	194	FU terminal function selection	230
M405	195	ABC1 terminal function selection	230
M406	196	ABC2 terminal function selection	230
M430	157	OL signal output timer	—*6
M431	289	Inverter output terminal filter	—*6
M433	166	Output current detection signal retention time	—*6
M440	870	Speed detection hysteresis	—*6
M441	41	Up-to-frequency sensitivity	—*6
M442	42	Output frequency detection	—*6
M443	43	Output frequency detection for reverse rotation	—*6
M444	50	Second output frequency detection	—*6
M445	116	Third output frequency detection	—*6
M446	865	Low speed detection	—*6
M460	150	Output current detection level	—*6
M461	151	Output current detection signal delay time	—*6
M462	152	Zero current detection level	—*6
M463	153	Zero current detection time	—*6
M464	167	Output current detection operation selection	—*6
M470	864	Torque detection	—*6
M500	495	Remote output selection	—*6
M501	496	Remote output data 1	—*6
M502	497	Remote output data 2	—*6
M510	76	Fault code output selection	—*6
M520	799	Pulse increment setting for output power	—*6
M530	655	Analog remote output selection	—*6
M531	656	Analog remote output 1	—*6
M532	657	Analog remote output 2	—*6
M533	658	Analog remote output 3	—*6
M534	659	Analog remote output 4	—*6
M600	863*1	Control terminal option-Encoder pulse division ratio	—*6
M610	755*1	Cumulative pulse clear signal selection	—*6
M611	756*1	Cumulative pulse division scaling factor	—*6
M612	757*1	Control terminal option-Cumulative pulse division scaling factor	—*6
M613	758*1	Cumulative pulse storage	—*6

◆T: Multi-function input terminal parameters

Parameters for the input terminals where inverter commands are received through.

Pr. group	Pr.	Name	Refer to page
T000	73	Analog input selection	76, 208
T001	267	Terminal 4 input selection	—*6
T002	74	Input filter time constant	67, 108, 140
T003	822	Speed setting filter 1	67
T004	826	Torque setting filter 1	140
T005	832	Speed setting filter 2	67
T006	836	Torque setting filter 2	140
T007	849	Analog input offset adjustment	—*6
T010	868	Terminal 1 function assignment	76, 140
T021	242	Terminal 1 added compensation amount (terminal 2)	—*6
T022	125	Terminal 2 frequency setting gain frequency	6
T040	858	Terminal 4 function assignment	—*6
T041	243	Terminal 1 added compensation amount (terminal 4)	—*6
T042	126	Terminal 4 frequency setting gain frequency	6
T050	252	Override bias	76
T051	253	Override gain	76
T052	573	4 mA input check selection	—*6
T054	778	4 mA input check filter	—*6
T100	C12 (917) *2	Terminal 1 bias frequency (speed)	6
T101	C13 (917) *2	Terminal 1 bias (speed)	6, 85, 108, 124, 151
T102	C14 (918) *2	Terminal 1 gain frequency (speed)	6
T103	C15 (918) *2	Terminal 1 gain (speed)	6, 85, 108, 124, 151
T110	C16 (919) *2	Terminal 1 bias command (torque/magnetic flux)	6
T111	C17 (919) *2	Terminal 1 bias (torque/magnetic flux)	6
T112	C18 (920) *2	Terminal 1 gain command (torque/magnetic flux)	6
T113	C19 (920) *2	Terminal 1 gain (torque/magnetic flux)	6
T200	C2 (902) *2	Terminal 2 frequency setting bias frequency	6
T201	C3 (902) *2	Terminal 2 frequency setting bias	6, 85, 108, 124, 151

Pr. group	Pr.	Name	Refer to page
T202	125 (903) *2	Terminal 2 frequency setting gain frequency	6
T203	C4 (903) *2	Terminal 2 frequency setting gain	6, 85, 108, 124, 151
T400	C5 (904) *2	Terminal 4 frequency setting bias frequency	6
T401	C6 (904) *2	Terminal 4 frequency setting bias	6, 85, 108, 124, 151
T402	126 (905) *2	Terminal 4 frequency setting gain frequency	6
T403	C7 (905) *2	Terminal 4 frequency setting gain	6, 85, 108, 124, 151
T410	C38 (932) *2	Terminal 4 bias command (torque/magnetic flux)	6
T411	C39 (932) *2	Terminal 4 bias (torque/magnetic flux)	6
T412	C40 (933) *2	Terminal 4 gain command (torque/magnetic flux)	6
T413	C41 (933) *2	Terminal 4 gain (torque/magnetic flux)	6
T700	178	STF terminal function selection	227
T701	179	STR terminal function selection	227
T702	180	RL terminal function selection	227
T703	181	RM terminal function selection	227
T704	182	RH terminal function selection	227
T705	183	RT terminal function selection	227
T706	184	AU terminal function selection	227
T707	185	JOG terminal function selection	227
T708	186	CS terminal function selection	227
T709	187	MRS terminal function selection	227
T710	188	STOP terminal function selection	227
T711	189	RES terminal function selection	227
T720	17	MRS input selection	—*6
T721	599	X10 terminal input selection	—*6
T722	606	Power failure stop external signal input selection	—*6
T730	155	RT signal function validity condition selection	—*6
T740	699	Input terminal filter	—*6

◆C: Motor constant parameters

Parameters for the applied motor setting.

Pr. group	Pr.	Name	Refer to page
C000	684	Tuning data unit switchover	—*6
C100	71	Applied motor	55
C101	80	Motor capacity	55
C102	81	Number of motor poles	55, 195
C104	83	Rated motor voltage	55
C105	84	Rated motor frequency	55
C107	707	Motor inertia (integer)	55, 157
C108	724	Motor inertia (exponent)	55, 157
C110	96	Auto tuning setting/status	55
C111	95	Online auto tuning selection	—*6
C112	818	Easy gain tuning response level setting	59
C113	819	Easy gain tuning selection	59
C114	880	Load inertia ratio	59
C120	90	Motor constant (R1)	—*6
C121	91	Motor constant (R2)	—*6
C122	92	Motor constant (L1)	—*6
C123	93	Motor constant (L2)	—*6
C124	94	Motor constant (X)	—*6
C125	82	Motor excitation current	—*6
C126	859	Torque current/Rated PM motor current	—*6
C140	369 *1	Number of encoder pulses	—*6
C141	359 *1	Encoder rotation direction	—*6
C148	376 *1	Encoder signal loss detection enable/disable selection	—*6
C200	450	Second applied motor	55
C201	453	Second motor capacity	55
C202	454	Number of second motor poles	55
C204	456	Rated second motor voltage	55
C205	457	Rated second motor frequency	55
C207	744	Second motor inertia (integer)	55, 157
C208	745	Second motor inertia (exponent)	55, 157
C210	463	Second motor auto tuning setting/status	55
C211	574	Second motor online auto tuning	—*6
C220	458	Second motor constant (R1)	—*6
C221	459	Second motor constant (R2)	—*6
C222	460	Second motor constant (L1)	—*6
C223	461	Second motor constant (L2)	—*6
C224	462	Second motor constant (X)	—*6
C225	455	Second motor excitation current	—*6
C226	860	Second motor torque current/ Rated PM motor current	—*6
C240	851 *1	Control terminal option-Number of encoder pulses	—*6
C241	852 *1	Control terminal option-Encoder rotation direction	—*6
C242	862*1	Encoder option selection	234
C248	855 *1	Control terminal option-Signal loss detection enable/disable selection	—*6

◆A: Application parameters

Parameters to set a specific application.

Pr. group	Pr.	Name	Refer to page
A107	285	Overspeed detection frequency	—*6
A601	131	PID upper limit	89, 127, 180
A602	132	PID lower limit	89, 127, 180

Pr. group	Pr.	Name	Refer to page
A603	553	PID deviation limit	89, 127, 180
A604	554	PID signal operation selection	89, 91, 127, 180
A605	1134	PID upper limit manipulated value	104
A606	1135	PID lower limit manipulated value	104
A607	1015	Integral stop selection at limited manipulated amount	100
A610	128	PID action selection	65, 177
A611	133	PID action set point	65, 124
A612	127	PID control automatic switchover frequency	—*6
A613	129	PID proportional band	99
A614	130	PID integral time	99
A615	134	PID differential time	99
A680	573	4 mA input check selection	—*6
A682	778	4 mA input check filter	—*6
A700	162	Automatic restart after instantaneous power failure selection	—*6
A701	299	Rotation direction detection selection at restarting	—*6
A702	57	Restart coasting time	—*6
A703	58	Restart cushion time	—*6
A704	163	First cushion time for restart	—*6
A705	164	First cushion voltage for restart	—*6
A710	165	Stall prevention operation level for restart	—*6
A711	298	Frequency search gain	—*6
A712	560	Second frequency search gain	—*6
A730	261	Power failure stop selection	—*6
A731	262	Subtracted frequency at deceleration start	—*6
A732	263	Subtraction starting frequency	—*6
A733	264	Power-failure deceleration time 1	—*6
A734	265	Power-failure deceleration time 2	—*6
A735	266	Power failure deceleration time switchover frequency	—*6
A785	294	UV avoidance voltage gain	—*6
A786	668	Power failure stop frequency gain	—*6
A800	414	PLC function operation selection	—*6
A801	415	Inverter operation lock mode setting	—*6
A802	416	Pre-scale function selection	—*6
A803	417	Pre-scale setting value	—*6
A804	498	PLC function flash memory clear	—*6
A805	675	User parameter auto storage function selection	—*6
A810 to A859	1150 to 1199	User parameters 1 to 50	—*6
A900	1020	Trace operation selection	—*6
A901	1021	Trace mode selection	—*6
A902	1022	Sampling cycle	—*6
A903	1023	Number of analog channels	—*6
A904	1024	Sampling auto start	—*6
A905	1025	Trigger mode selection	—*6
A906	1026	Number of sampling before trigger	—*6
A910	1027	Analog source selection (1ch)	218
A911	1028	Analog source selection (2ch)	218
A912	1029	Analog source selection (3ch)	218
A913	1030	Analog source selection (4ch)	218
A914	1031	Analog source selection (5ch)	218
A915	1032	Analog source selection (6ch)	218
A916	1033	Analog source selection (7ch)	218
A917	1034	Analog source selection (8ch)	218
A918	1035	Analog trigger channel	—*6
A919	1036	Analog trigger operation selection	—*6
A920	1037	Analog trigger level	—*6
A930	1038	Digital source selection (1ch)	—*6
A931	1039	Digital source selection (2ch)	—*6
A932	1040	Digital source selection (3ch)	—*6
A933	1041	Digital source selection (4ch)	—*6
A934	1042	Digital source selection (5ch)	—*6
A935	1043	Digital source selection (6ch)	—*6
A936	1044	Digital source selection (7ch)	—*6
A937	1045	Digital source selection (8ch)	—*6
A938	1046	Digital trigger channel	—*6
A939	1047	Digital trigger operation selection	—*6

◆B: Position control parameters

Parameters for the position control setting.

Pr. group	Pr.	Name	Refer to page
B003	422	Position control gain	—*6
B009	428	Command pulse selection	67

◆N: Operation via communication and its settings

Parameters for communication operation. These parameters set the communication specifications and operation.

Pr. group	Pr.	Name	Refer to page
N000	549	Protocol selection	—*6
N001	342	Communication EEPROM write selection	—*6
N002	539	MODBUS RTU communication check time interval	—*6
N013	502	Stop mode selection at communication error	—*6
N020	117	PU communication station number	—*6
N021	118	PU communication speed	—*6
N022	119	PU communication data length	—*6
N023	119	PU communication stop bit length	—*6
N024	120	PU communication parity check	—*6
N025	121	Number of PU communication retries	—*6
N026	122	PU communication check time interval	—*6
N027	123	PU communication waiting time setting	—*6
N028	124	PU communication CR/LF selection	—*6

Pr. group	Pr.	Name	Refer to page
N030	331	RS-485 communication station number	—*6
N031	332	RS-485 communication speed	—*6
N032	333	RS-485 communication data length	—*6
N033	333	RS-485 communication stop bit length	—*6
N034	334	RS-485 communication parity check selection	—*6
N035	335	RS-485 communication retry count	—*6
N036	336	RS-485 communication check time interval	—*6
N037	337	RS-485 communication waiting time setting	—*6
N038	341	RS-485 communication CR/LF selection	—*6
N040	547	USB communication station number	—*6
N041	548	USB communication check time interval	—*6
N080	343	Communication error count	—*6
N500 to N543	1300 to 1343	Communication option parameters. For details, refer to the Instruction Manual of the option.	
N550 to N559	1350 to 1359	Communication option parameters. For details, refer to the Instruction Manual of the option.	

◆G: Control Parameters

Parameters for motor control.

Pr. group	Pr.	Name	Refer to page
G000	0	Torque boost	—*6
G001	3	Base frequency	—*6
G002	19	Base frequency voltage	—*6
G003	14	Load pattern selection	—*6
G010	46	Second torque boost	—*6
G011	47	Second V/F (base frequency)	—*6
G020	112	Third torque boost	—*6
G021	113	Third V/F (base frequency)	—*6
G030	60	Energy saving control selection	—*6
G060	673	SF-PR slip amount adjustment operation selection	—*6
G061	674	SF-PR slip amount adjustment gain	—*6
G080	617	Reverse rotation excitation current low-speed scaling factor	—*6
G100	10	DC injection brake operation frequency	—*6
G101	11	DC injection brake operation time	—*6
G102	802	Pre-excitation selection	—*6
G103	850	Brake operation selection	—*6
G106	250	Stop selection	—*6
G107	70	Special regenerative brake duty	—*6
G110	12	DC injection brake operation voltage	—*6
G120	882	Regeneration avoidance operation selection	—*6
G121	883	Regeneration avoidance operation level	—*6
G122	884	Regeneration avoidance at deceleration detection sensitivity	—*6
G123	885	Regeneration avoidance compensation frequency limit value	—*6
G124	886	Regeneration avoidance voltage gain	—*6
G125	665	Regeneration avoidance frequency gain	—*6
G200	800	Control method selection	5
G201	85	Excitation current break point	—*6
G202	86	Excitation current low-speed scaling factor	—*6
G203	245	Rated slip	—*6
G204	246	Slip compensation time constant	—*6
G205	247	Constant-power range slip compensation selection	—*6
G206	1116	Constant output range speed control P gain compensation	—*6
G210	803	Constant output range torque characteristic selection	—*6
G211	820	Speed control P gain 1	59
G212	821	Speed control integral time 1	59
G213	824	Torque control P gain 1 (current loop proportional gain)	—*6
G214	825	Torque control integral time 1 (current loop integral time)	—*6
G215	823 *1	Speed detection filter 1	—*6
G216	827	Torque detection filter 1	—*6
G217	854	Excitation ratio	—*6
G218	1115	Speed control integral term clear time	—*6
G220	877	Speed feed forward control/ model adaptive speed control selection	—*6
G221	878	Speed feed forward filter	—*6
G222	879	Speed feed forward torque limit	—*6
G223	881	Speed feed forward gain	—*6
G224	828	Model speed control gain	—*6
G230	840	Torque bias selection	—*6
G231	841	Torque bias 1	—*6
G232	842	Torque bias 2	—*6
G233	843	Torque bias 3	—*6
G234	844	Torque bias filter	—*6
G235	845	Torque bias operation time	—*6
G236	846	Torque bias balance compensation	—*6
G237	847	Fall-time torque bias terminal 1 bias	—*6
G238	848	Fall-time torque bias terminal 1 gain	—*6
G240	367 *1	Speed feedback range	—*6
G241	368 *1	Feedback gain	—*6
G260	1121	Per-unit speed control reference frequency	—*6
G261	1117	Speed control P gain 1 (per-unit system)	—*6
G262	1119	Model speed control gain (per-unit system)	—*6
G263	1348	P/PI control switchover frequency	—*6
G264	1349	Emergency stop operation selection	—*6

Pr. group	Pr.	Name	Refer to page
G300	451	Second motor control method selection	5
G301	565	Second motor excitation current break point	—*6
G302	566	Second motor excitation current low-speed scaling factor	—*6
G311	830	Speed control P gain 2	—*6
G312	831	Speed control integral time 2	—*6
G313	834	Torque control P gain 2	—*6
G314	835	Torque control integral time 2	—*6
G315	833 *1	Speed detection filter 2	—*6
G316	837	Torque detection filter 2	—*6
G361	1118	Speed control P gain 2 (per-unit system)	—*6
G400	286	Droop gain	—*6
G401	287	Droop filter time constant	—*6
G402	288	Droop function activation selection	—*6
G403	994	Droop break point gain	—*6
G404	995	Droop break point torque	—*6
G410	653	Speed smoothing control	—*6
G411	654	Speed smoothing cutoff frequency	—*6
G420	679	Second droop gain	—*6
G421	680	Second droop filter time constant	—*6
G422	681	Second droop function activation selection	—*6
G423	682	Second droop break point gain	—*6
G424	683	Second droop break point torque	—*6
G601	1003	Notch filter frequency	—*6
G602	1004	Notch filter depth	—*6
G603	1005	Notch filter width	—*6
G932	89	Speed control gain (Advanced magnetic flux vector)	—*6
G942	569	Second motor speed control gain	—*6

*1 The setting is available only when a plug-in option that supports Vector control is installed.
*2 The parameter number in parentheses is that used (displayed) on the LCD operation panel and the parameter unit.
*3 The initial value is for standard models.
*4 The initial value is for separated converter types.
*5 The setting is available only when the FR-A8AZ is installed.
*6 For details, refer to the FR-A800 Instruction Manual (Detailed).
*7 For the details, refer to the Instruction Manual of the FR-A8AL.

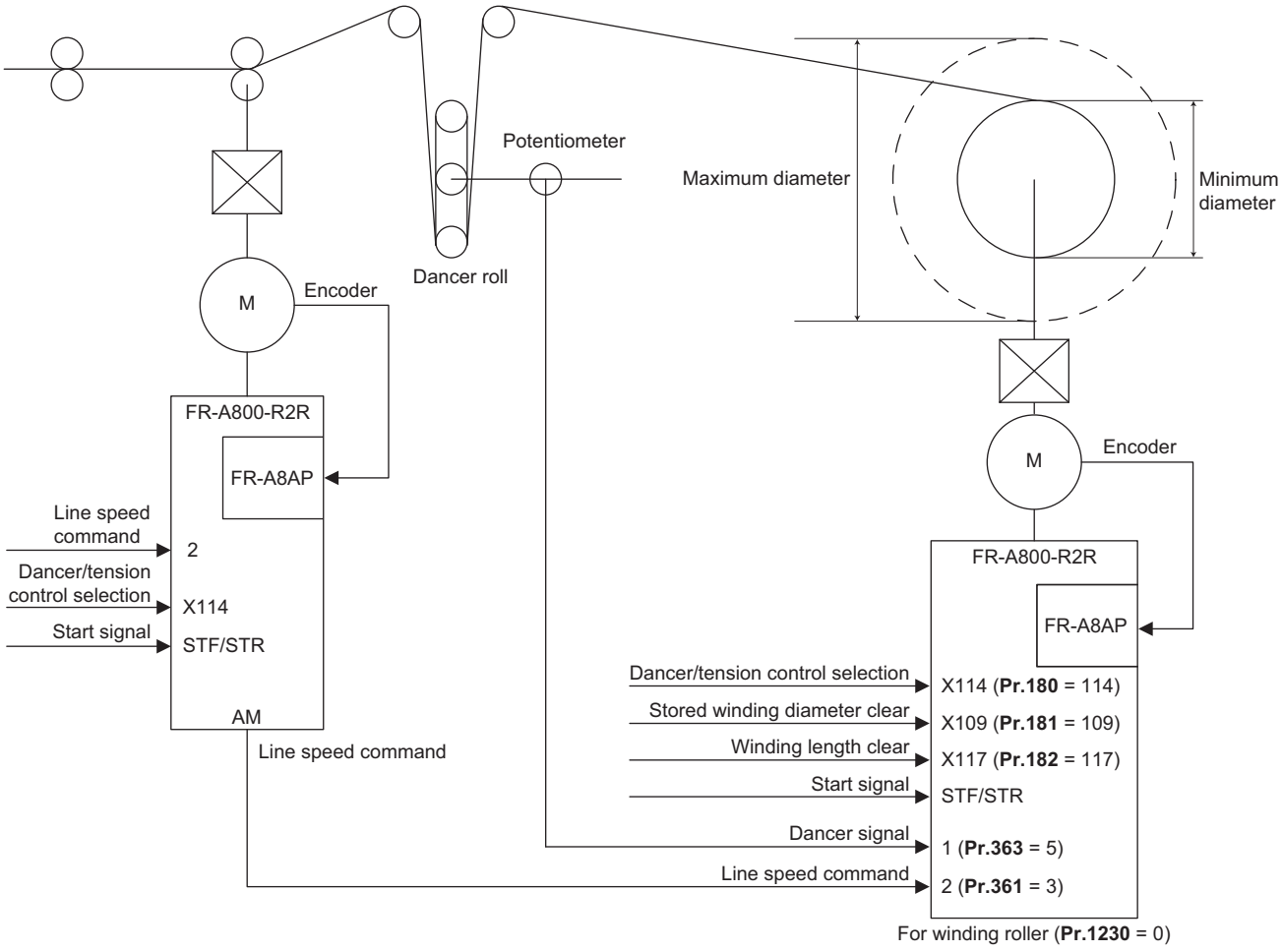
3 DANCER FEEDBACK SPEED CONTROL

Dancer feedback speed control is a control function to keep the line speed and the dancer roll position constant.
To perform dancer feedback speed control on the winding/unwinding shaft of the system, the line speed and the dancer roll position can be kept constant in combination with the winding diameter calculation function.

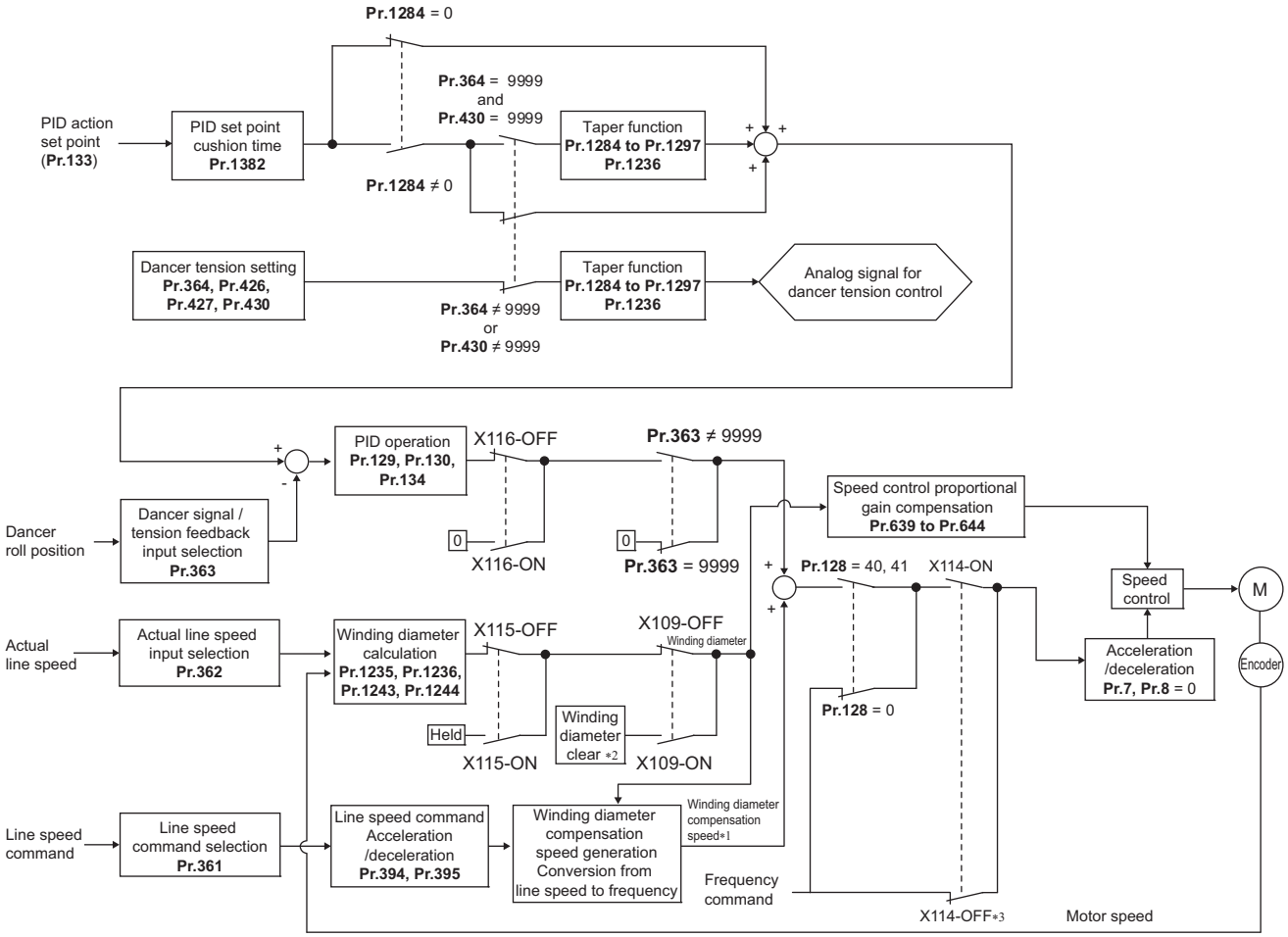
3.1 Dedicated function list

Item		Description
Dancer feedback speed control	Control method	PID control, PI control, P control, and PD control can be selected. Gain switchover by dancer position is available. Gain switchover by external terminal input is available.
	Dancer roll position setting	Set a point with a parameter.
	Dancer roll position detection signal	Use an analog terminal for the signal input. (Terminal 1, 2, 4, or 6 is selectable.)
	Line speed acceleration/deceleration function	Available. Three patterns are selectable with external contact signal.
	Additional function	Material break detection function
Winding diameter compensation	Constant line speed control	Available
	Winding diameter calculation	Calculation based on the line speed detection and the motor rotation speed and calculation based on the material thickness and the number of motor rotations are selectable.
	Actual line speed detection	Pulse train input (A/B phase, single phase) and analog input are selectable.
	Reduction ratio setting	Available
	Maximum/minimum winding diameter setting	Available. (Four patterns are selectable with external signal.)
	Speed control proportional gain compensation function	Available. (Straight movement (with three break points) against the winding diameter can be performed.)
	Winding diameter storage	Available
Common	Dedicated input signal	Dancer/tension control selection, Winding diameter compensation selection, PID gain switchover, PID integral term reset (P control selection), Line speed acceleration/deceleration selection, Winding diameter selection, Stored winding diameter clear, Winding/unwinding selection, Two-way operation.
	Dedicated output signal	Upper limit, Lower limit, Dancer roll position, Break detection, Initial winding diameter calculation completion, Target winding diameter achieved, Winding/unwinding completion
	Dedicated monitor	Set point, measured value, deviation, line speed command, roll diameter, actual line speed, compensation speed, winding length.

3.2 System configuration example



3.3 Control block diagram



*1 Winding diameter compensation speed = $\frac{\text{Line speed command}}{\pi \times \text{Winding diameter} \times \text{Gear ratio}}$

*2 After clearing, the value becomes the minimum winding diameter when **Pr.1230** = "0" (winding), and the maximum winding diameter when **Pr.1230** = "1" (unwinding).

*3 The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.) Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command. In this case, the bias and gain parameter settings must be consistent for both command types.
Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902)** to **C7 (Pr.905), C12 (Pr.917)** to **C15 (Pr.918)**
Calibration parameters for line speed command input: **Pr.350** to **Pr.353**

3.3.1 Analog input signals and pulse train input signals

- Refer to the following table and set the parameters to input the signals.
- For analog input terminals, calibration is available with maximum and minimum input values.
- Use **Pr.73 Analog input selection** (**Pr.267 Terminal 4 input selection**) and the voltage/current input selection switch to switch among input of 0 to 5 V, 0 to 10 V, and 0 to 20 mA. Always calibrate the input after changing the voltage/current input signal with **Pr.73** (**Pr.267**) and the voltage/current input selection switch. (For details, refer to the FR-A800 Instruction Manual (Detailed).)

Parameter	Analog input				Refer to page
	Terminal 1 (-10 to 10 V)	Terminal 2 (0 to 5 V)	Terminal 4 (4 to 20 mA)	Terminal 6 (-10 to 10 V)*4	
Pr.363 Dancer / tension sensor feedback input selection*1	5	3	4	6	85
Pr.361 Line speed command input selection*2	5	3	4	6	67
Pr.362 Actual line speed input selection	5	3	4	6	199
Pr.1285 Taper setting analog input selection	5	3	4	6	108, 151
Pr.364 Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1*3	5	3	4	6	108

Parameter	Single-phase pulse train input		Encoder pulse train input*5	Parameter input (Pr.360)	Refer to page
	Terminal JOG	FR-A8AL			
Pr.363 Dancer / tension sensor feedback input selection*1	—	—	—	—	85
Pr.361 Line speed command input selection*2	1*6	7	2	8	67
Pr.362 Actual line speed input selection	1*6	7	2	—	199
Pr.1285 Taper setting analog input selection	—	—	—	—	108, 151
Pr.364 Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1*3	—	—	—	—	108

—: Setting not available

*1 The parameter is invalid during tension sensorless torque control.

*2 When **Pr.362** = "0" during tension sensorless torque control or tension sensor feedback torque control, the line speed command value is used as the actual line speed. The line speed command setting is not used as it is. The actual line speed command output value in consideration of acceleration/deceleration is applied.

*3 The parameter is invalid during tension sensorless torque control or tension sensor feedback torque control.

*4 The FR-A8AZ plug-in option is required.

*5 The FR-A8AP/FR-A8AL plug-in option or the FR-A8TP control terminal option is required.

*6 The setting is valid when **Pr.291**="1, 11, 21, or 100".

NOTE

- The **Pr.361 to Pr.364** (dedicated function selection) and **Pr.1285** settings have higher precedence over the other assigned terminal settings such as **Pr.868, Pr.858**, and **Pr.406**. (Example: When **Pr.363**="5", and **Pr.868**="0", terminal 1 is set to the dancer signal input.)
- The dedicated function parameters take the following precedence over each other. When two or more signals are assigned to a terminal, a signal with lower precedence is ineffective.
  Dancer signal input (**Pr.363**) > Actual line speed input (**Pr.362**) > Tension command input (**Pr.804**) > Line speed command input (**Pr.361**≠0) > Taper setting input (**Pr.1285**) > Dancer tension setting input (**Pr.364**) > Line speed command compensation input > Line speed command input (**Pr.361**=0) = Speed command during speed control
- When **Pr.361 Line speed command input selection**="0" while tension sensorless torque control is valid, the line speed command is input in the same way as the frequency command.

3.4 Parameter setting procedure for dancer feedback speed control

The following procedure shows the parameter setting example for the dancer feedback speed control.

3.4.1 Parameter setting procedure

1 Wiring

Perform secure wiring.

NOTE

- Do not feed the workpiece through the machine.

2 Control method selection

Select the control method according to the application and the motor.

Pr.	Name	Setting range	Minimum setting increments	Initial value
71	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0
9	Electronic thermal O/L relay	0 to 500 A *3	0.01 A*3	Inverter rated current
		0 to 3600 A *4	0.1 A*4	
80	Motor capacity	0.4 to 55 kW, 9999 *3	0.01 kW	9999
		0 to 3600 kW, 9999 *4	0.1 kW	
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999
83	Rated motor voltage	0 to 1000 V	0.1 V	200 V (200 V class)
				400 V (400 V class)
84	Rated motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999
800	Control method selection*1	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20
810	Torque limit input method selection	0 to 2	1	0
359	Encoder rotation direction	0, 1, 100, 101	1	1
369	Number of encoder pulses	0 to 4096	1	1024
707	Motor inertia (integer)*2	10 to 999, 9999	1	9999
724	Motor inertia (exponent)*2	0 to 7, 9999	1	9999
862	Encoder option selection	0, 1	1	0

*1 For the control method, vector control is recommended.

*2 Setting is required for a motor other than a Mitsubishi Electric motor (the SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or SF-V5RU (1500 r/min series) motor).

*3 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*4 For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

NOTE

- Select Vector control for regenerative driving in a low-speed range (about 10 Hz or lower).
- For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

3 Offline auto tuning

Perform offline auto tuning as required. For offline auto tuning, refer to page 55.

Pr.	Name	Setting range	Minimum setting increments	Initial value
96	Auto tuning setting/status	0, 1, 11, 101	1	0

After the offline auto tuning, perform the test run of the motor alone to make sure that no fault is found in the motor's behavior.

4 Speed control gain adjustment

Adjust the speed control gain. Refer to page 59 for the speed control gain adjustment.

5 Mechanical specifications setting

Set the following parameters according to the specifications of the machine used. Refer to 11.6 (Application examples) on page 243.

Pr.	Name	Setting	Intermediate shaft	Winding/ unwinding shaft	Remarks
1235	Maximum winding diameter 1	*1	○	○	For the intermediate shaft, set the roller (reel) diameter in millimeters (1 to 6553 mm) for both **Pr.1235** and **Pr.1236**.
1236	Minimum winding diameter 1	*1	○	○	
178 to 189	Input terminal function selection	114	○	○	Set "114" for the X114 signal.
		109	—	○	Set "109" for using the Stored winding diameter clear (X109) signal.
		117	—	○	Set "117" for using the Winding length clear (X117) signal.
1230	Winding/unwinding selection	*1	—	○	0: Winding shaft 1: Unwinding shaft
645	Winding diameter storage selection	*1	—	○	0: Not stored. 1: The present roll diameter is stored.
1247	Winding diameter change increment amount limit	*1	○	○	Set the maximum change in 0.001 mm increments (0 to 9.998 mm or 9999) per roll diameter calculation.
1243	Gear ratio numerator	*1	○	○	Set a gear ratio in 1 increments (1 to 65534) when the motor shaft has a reduction gear.
1244	Gear ratio denominator	*1	○	○	
7	Acceleration time	0 s	○	○	0 to 3600 seconds, in 0.1 second increments*2
8	Deceleration time	0 s	○	○	
394	First acceleration time for line speed command	*1	○	○	Setting is required in 0.1 second increments*2 (0 to 3600 seconds) when the cushion time is not considered for the line speed command.
395	First deceleration time for line speed command	*1	○	○	
101	Second deceleration time for line speed command	*1	○	○	Set the time in 0.1 second increments*2 (0 to 3600 seconds) as required (for example, for rapid deceleration). Turn ON the X105 signal to enable the setting.
393	Line speed command acceleration/deceleration reference	*1	○	○	Set the reference line speed (travel amount per minute) in 0.1 m/min increments*3 (1 to 6553.4 m/min) for the acceleration/deceleration time for the line speed command.
1141	Line speed command acceleration/deceleration pattern	*1	○	○	Set S-curve acceleration/deceleration to reduce shock during line speed acceleration/deceleration operation. (Refer to page 82.)
1142	Line speed command acceleration start S-curve time	*1	○	○	
1143	Line speed command acceleration completion S-curve time	*1	○	○	
1144	Line speed command deceleration start S-curve time	*1	○	○	
1145	Line speed command deceleration completion S-curve time	*1	○	○	
1231	Material thickness d1	*1	—	○	Setting is required in 0.001 mm increments (0 to 20 mm or 9999) when thickness is used for winding diameter calculation.
1252	Dancer lower limit position	*1	—	○	Setting is required when the initial winding diameter calculation is necessary for dancer feedback speed control (0.01% increments (400 to 600%) for **Pr.1252**, 1 mm increments (1 to 5000 mm, 8888, or 9999) for **Pr.1255**).
1255	Accumulated amount	*1	—	○	

*1 Set the parameter according to the specification of the machine used.

*2 The increment applies when **Pr.21** = "0 (initial value)".

*3 The increment applies when **Pr.358** = "0 (initial value)".

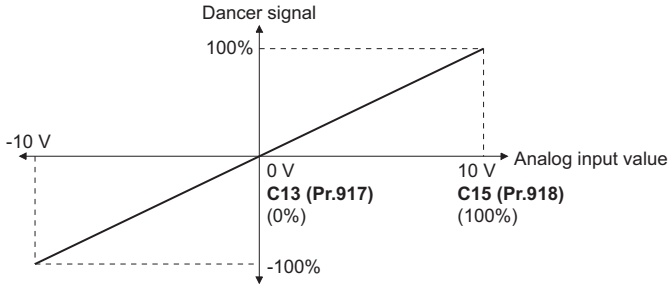
6 Dancer signal input setting

Set the following parameter according to the dancer signal input method when the dancer roll is used.

Pr.	Name	Setting	Input method
363	Dancer / tension sensor feedback input selection	3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*1
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*1
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*1
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*1
		9	CC-Link or CC-Link IE Field Network Basic (-100 to 100%)
		9999 (initial value)	No function

*1 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

Item	Setting example
Dancer signal input method	Setting by analog voltage (-10 to 10 V) input through terminal 1 (**Pr.363** = "5") 
Parameter setting	**C13 (Pr.917) Terminal 1 bias (speed)** = 0% **C15 (Pr.918) Terminal 1 gain (speed)** = 100%

7 Line speed command input setting

Set **Pr.361** according to the line speed command value input method.

Pr.	Name	Setting	Input method
361	Line speed command input selection	0	According to the priority of the speed command sources. (Refer to page 70)
		1	Terminal JOG single-phase pulse train input (Refer to page 71)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 71)
		3*3*4	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 73)
		4*3*4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 73)
		5*3*4	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73)
		6*3*4	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73)
		7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to page 71)
		8	Line speed command according to the **Pr.360** setting (Refer to page 73)
		10	Inverter-to-inverter link function (Available only for the FR-A800-E-R2R. For details, refer to the Ethernet Function Manual.)
		9999 (initial value)	No function

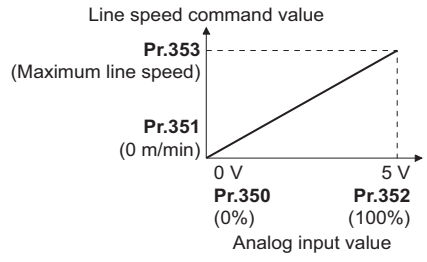
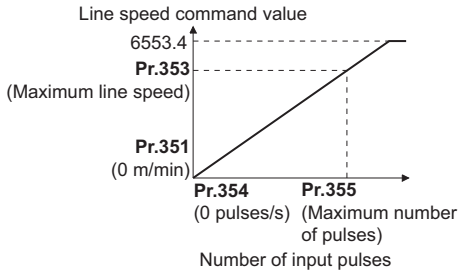
*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

*3 The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.)
Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command. In this case, the bias and gain parameter settings must be consistent for both command types.
Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918)**
Calibration parameters for line speed command input: **Pr.350 to Pr.353**

*4 To feed paper or wire, turn ON all X114, X115, and X116 signals and disable winding diameter compensation and PID compensation so that the line speed command for tension control (dancer feedback speed control / tension sensor feedback speed control) is used for the feed operation.

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Line speed command input method	Setting by analog voltage (0 to 5 V) input through terminal 2 (**Pr.361** = "3") 	Setting by pulse train input through terminal JOG (**Pr.361** = "1") 
Parameter setting	**Pr.350 Line speed command voltage/current bias** = 0% **Pr.351 Line speed command bias** = 0 m/min **Pr.352 Line speed command voltage/current gain** = 100% **Pr.353 Line speed command gain** = Maximum line speed **Pr.73 Analog input selection**= "1 (initial value)"	**Pr.384 Input pulse division scaling factor** = "1"*5 **Pr.351 Line speed command bias** = 0 m/min **Pr.354 Line speed command pulse input bias** = "0" **Pr.353 Line speed command gain** = Maximum line speed **Pr.355 Line speed command pulse input gain** = Maximum number of pulses

*5 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.351** = 0 m/min, **Pr.353** = 100 m/min, **Pr.354** = 0 pulses/s, **Pr.355** = 50k pulses/s, and **Pr.384** = "2", the line speed will be 50 m/min.

8 Actual line speed input setting

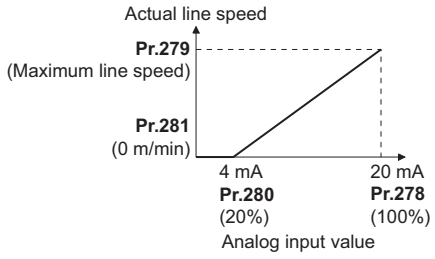
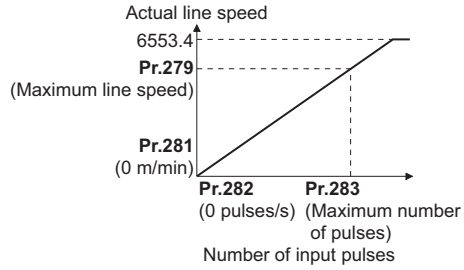
Set **Pr.362** according to the line speed command value input method for calculating the winding diameter (actual line speed method). (Setting is not required for the intermediate shaft.)

Pr.	Name	Setting	Input method
362	Actual line speed input selection	0 (initial value)	V* (line speed command)
		1	Terminal JOG single-phase pulse train input (Refer to **page 200**)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to **page 200**)
		3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to **page 202**)
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to **page 202**)
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to **page 202**)
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to **page 202**)
		7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to **page 200**)
		9	CC-Link or CC-Link IE Field Network Basic (0 to 65534)
		9999	No function

*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to **page 47**.)

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Actual line speed input method	Setting by analog current (4 to 20 mA) input through terminal 4 (**Pr.362** = "4")  	Setting by pulse train input through terminal JOG (**Pr.362** = "1") 
Parameter setting	**Pr.280 Actual line speed voltage/current bias** = 20% **Pr.281 Actual line speed bias** = 0 m/min **Pr.278 Actual line speed voltage/current gain** = 100% **Pr.279 Actual line speed gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*3 **Pr.281 Actual line speed bias** = 0 m/min **Pr.282 Actual line speed pulse input bias** = 0 pulses/s **Pr.279 Actual line speed gain** = Maximum line speed **Pr.283 Actual line speed pulse input gain** = Maximum number of pulses

*3 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.281** = 0 m/min, **Pr.279** = 100 m/min, **Pr.282** = 0 pulses/s, **Pr.283** = 50k pulses/s, and **Pr.384** = "2", the actual line speed will be 50 m/min.

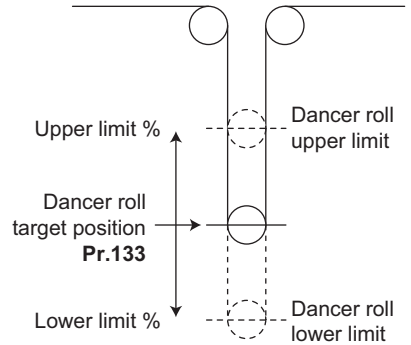
9 PID control action setting

Set the following parameters for PID control.

Pr.	Name	Setting	Remarks
128	PID action selection	40 or 41	40: Dancer feedback speed control (reverse action) 41: Dancer feedback speed control (forward action)
131	PID upper limit	*1	Set the value in 0.1% increments (400 to 600% or 9999) for outputting the PID upper limit (FUP) signal.
132	PID lower limit	*1	Set the value in 0.1% increments (400 to 600% or 9999) for outputting the PID lower limit (FDN) signal.
133	PID action set point	*1	Set the set point in 0.01% increments (400 to 600%) for the dancer roll control.
1382	PID set point cushion time	*1	Set the cushion time for the PID set point. (Refer to page 85.)

*1 Set the parameter according to the specification of the machine used.

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Target position setting method	Setting the target position in the middle between the upper and lower limits	Setting the target position directly
Parameter setting	Set **Pr.52** = "86" (terminal 1 input voltage monitor in %) and record the value when the dancer position is at the lower limit (% at lower limit) and the value when the dancer position is at the upper limit (% at upper limit). Set the value obtained from: **Pr.133** = $\frac{\text{Upper limit \% - Lower limit \%}}{2}$ + % at lower limit - 500% 	Move the dancer roll to the middle position and monitor the percentage of the voltage input through terminal 1. Subtract 500 from the monitored value, and set the remaining value in **Pr.133**.*2

*2 The reference value for the offset setting is 1000% for the voltage (monitored in percentage) input through terminal 1, and 500% for the **Pr.133** setting. Therefore, 500% is subtracted from the monitored value.

NOTE

- The setting unit for manipulated amount of PID control is initially set to Hz (frequency). To change the unit to m/min (line speed), set the amount using **Pr.1148** and **Pr.1149**. (Refer to page 104.)

10 PID control action check (example)

Set the dancer roll approximately around the target position.
Input a line speed command of 0 m/min.
Input the X114 signal and start command.
Start the motor without feeding the workpiece.
Change the dancer roll position during motor operation, and check that the following motor speed conditions.
If any inconsistency is found, check the **Pr.128** setting.

Winding/ unwinding	Dancer roll position	Motor speed
Winding	Current position > Target position	Deceleration
	Current position < Target position	Acceleration
Unwinding	Current position > Target position	Acceleration
	Current position < Target position	Deceleration

11 PID control gain adjustment

Feed the workpiece through the system and adjust the tension PI gain. Refer to **page 63** for the tension PI gain adjustment.

12 Test run

Operate the system starting from the maximum-diameter roll to the minimum-diameter roll and vice versa and check that no fault is found in the system behavior.

3.4.2 Offline auto tuning

◆Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- A value other than "9999" is set in **Pr.80** and **Pr.81**, and Advanced magnetic flux vector control, Real sensorless vector control or vector control is selected (with **Pr.800**).
- A motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- The motor capacity is equal to or one rank lower than the inverter capacity. (It must be 0.4 kW or higher.)
  Using a motor with the rated current substantially lower than the rated inverter current will cause torque ripples, etc. and degrade the speed and torque accuracies. As a reference, select the motor with the rated motor current that is 40% or higher of the inverter rated current.
- The target motor is other than a high-slip motor, a high-speed motor, or a special motor.
- The highest frequency is 400 Hz.
- The motor may rotate slightly even if the offline auto tuning without motor rotation (**Pr.96 Auto tuning setting/status** = "1") is selected. (The slight motor rotation does not affect the tuning performance.) Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates.
- Check the following points for the offline auto tuning with motor rotation (**Pr.96 Auto tuning setting/status** = "101").
  Torque is not sufficient during tuning.
  The motor can be rotated up to the speed close to the rated speed.
  The mechanical brake is released.
- Offline auto tuning is not performed correctly when the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) is inserted between the inverter and motor. Be sure to remove them before performing tuning.
- Make sure to connect the encoder to the motor without coaxial misalignment during vector control. Set the speed ratio to 1:1.

◆Setting

- To perform tuning, set the following parameters about the motor.

First motor Pr.	Second motor Pr.	Name	Initial value	Description
80	453	Motor capacity	9999 (V/F control)	Set the motor capacity (kW).
81	454	Number of motor poles	9999 (V/F control)	Set the number of motor poles (2 to 12).
800	451	Control method selection	20	Set this parameter when using vector control or Real sensorless vector control.
9	51	Electronic thermal O/L relay	Inverter rated current	Set the rated motor current (A).
83	456	Rated motor voltage	200 V/400 V*1	Set the rated motor voltage (V) printed on the motor's rating plate.*2
84	457	Rated motor frequency	9999	Set the rated motor frequency (Hz).*2 When the setting is "9999", the **Pr.3 Base frequency** setting is used.
71	450	Applied motor	0 (standard motor)	Set this parameter according to the motor.*3 Three types of motor constant setting ranges, units and tuning data can be stored according to settings.
96	463	Auto tuning setting/ status	0	Set "1" or "101". 1: Performs tuning without rotating the motor. (Excitation noise occurs at this point.) 101: Performs tuning by rotating the motor. The motor can rotate up to the speed near the rated motor frequency.

*1 Differs according to the voltage class. (200 V/400 V)

*2 For the details to set SF-V5RU, refer to the FR-A800 Instruction Manual (Detailed).

*3 Set **Pr.71 Applied motor** according to the motor to be used and the motor constant setting range. According to the **Pr.71** setting, the range of the motor constant parameter setting values and units can be changed.

Parameter setting procedure for dancer feedback speed control

Motor		Pr.71 setting		
		Motor constant parameter mH, %, and A unit setting	Motor constant parameter internal data setting	Motor constant parameter Ω, mΩ, and A unit setting
Mitsubishi Electric standard motor Mitsubishi Electric high-efficiency motor	SF-JR, SF-TH	0 (initial value)	3 (4)	—
	SF-JR 4P 1.5 kW or lower	20	23 (24)	—
	SF-HR	40	43 (44)	—
	Others	0 (initial value)	3 (4)	—
Mitsubishi Electric constant-torque motor	SF-JRCA 4P, SF-TH (constant-torque)	1	13 (14)	—
	SF-HRCA	50	53 (54)	—
	Other (SF-JRC, etc.)	1	13 (14)	—
Mitsubishi Electric high-performance energy-saving motor with encoder	SF-PR-SC	70	73 (74)	—
Vector control dedicated motor	SF-V5RU (1500 r/min series) SF-THY	30	33 (34)	—
	SF-V5RU (other than the 1500 r/min series)	1	13 (14)	—
Other manufacturer's standard motor	—	0 (initial value)	3 (4)	5 (star connection motor) 6 (delta connection motor)
Other manufacturer's constant-torque motor	—	1	13 (14)	15 (star connection motor) 16 (delta connection motor)

NOTE

- If the SF-V5RU (other than the 1500 r/min series) is used, be sure to perform auto tuning after setting "1, 13, or 14" in **Pr.71** and setting **Pr.83** and **Pr.84**.
- If **Pr.11 DC injection brake operation time** = "0" or **Pr.12 DC injection brake operation voltage** = "0", offline auto tuning is performed considering **Pr.11** or **Pr.12** is set to the initial value.
- If the star connection or delta connection is incorrectly selected in **Pr.71** , Advanced magnetic flux vector control, Real sensorless vector control and vector control are not performed normally.

- For tuning accuracy improvement, set the following parameters when the motor constants are known in advance.

First motor Pr.	Second motor Pr.	Name	Mitsubishi Electric motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU)	Other motors
707	744	Motor inertia (integer)	9999 (initial value)	Motor inertia*4 Jm = **Pr.707** × 10^(-**Pr.724**) (kg·m^2)
724	745	Motor inertia (exponent)		

*4 The setting is valid only when a value other than "9999" is set in both **Pr.707 (Pr.744)** and **Pr.724 (Pr.745).**

◆Performing tuning

POINT

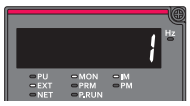
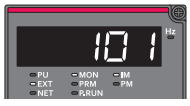
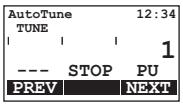
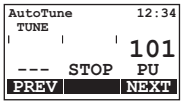
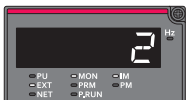
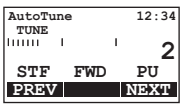
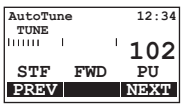
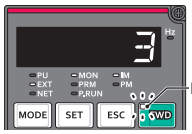
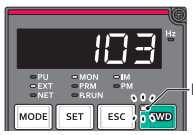
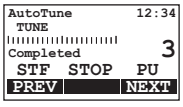
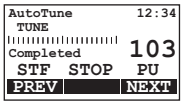
- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. Turning ON the start command while tuning is unavailable starts the motor.

- In the PU operation mode, press the FWD or REV key on the operation panel.
  For External operation, turn ON the start command (STF signal or STR signal). Tuning will start.

NOTE

- Satisfy the required inverter start conditions to start offline auto tuning. For example, stop input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or press the STOP/RESET key on the operation panel. (Turning the start signal (STF signal or STR signal) OFF also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid. (initial value)
  Input terminals <effective signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
  Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and SO
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in fifteen steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- Setting offline auto tuning (**Pr.96 Auto tuning setting/status** = "1 or 101") will make pre-excitation invalid.
- When the offline auto tuning is selected (**Pr.96 Auto tuning setting/status** = "101"), the motor rotates. Take caution and ensure the safety.
- Since the Inverter running (RUN) signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While **Pr.79 Operation mode selection** = "7", turn the PU operation external interlock (X12) signal ON to tune in the PU operation mode.

- During tuning, the monitor is displayed on the operation panel as follows.

Pr.96 setting	1	101	1	101
	Operation panel (FR-DU08) display		LCD operation panel (FR-LU08) display	
(1) Setting				
(2) During tuning				
(3) Normal completion	 Blinking	 Blinking		

Parameter setting procedure for dancer feedback speed control

- Note: Offline auto tuning time (with the initial setting)

Offline auto tuning setting	Time
No motor rotation (**Pr.96** = "1")	Approx. 25 to 120 s (The time depends on the inverter capacity and motor type.)
With motor rotation (**Pr.96** = "101")	Approx. 40 s (The following offline auto tuning time is set according to the acceleration/ deceleration time setting. Offline auto tuning time = Acceleration time + Deceleration time + Approx. 30 s)

- When offline auto tuning ends, press the STOP/RESET key on the operation panel during PU operation. For External operation, turn OFF the start signal (STF or STR signal).
  This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication.
  (Without this operation, next operation cannot be started.)

NOTE

- The motor constants measured once in the offline auto tuning are stored as parameters and their data are held until the offline auto tuning is performed again. However, performing all parameter clear resets the tuning data.
- Changing **Pr.71 (Pr.450)** after tuning completion will change the motor constant. For example, if **Pr.71** = "3" is set after tuning is performed with **Pr.71** ="0", the tuning data becomes invalid. Set **Pr.71** = "0" again for using the tuning data.

- If offline auto tuning has ended in error (see the table below), motor constants are not set. Perform an inverter reset and restart tuning.

Error display	Error cause	Countermeasures
8	Forced end	Set **Pr.96** = "1 or 101" and try again.
9	Inverter protective function operation	Make the setting again.
91	The current limit (stall prevention) function is activated.	Set the acceleration/deceleration time longer. Set **Pr.156 Stall prevention operation selection** = "1".
92	The converter output voltage fell to 75% of the rated voltage.	Check for the power supply voltage fluctuation. Check the **Pr.84 Rated motor frequency** setting.
93	Calculation error The motor is not connected.	Check the **Pr.83** and **Pr.84** settings. Check the motor wiring and make the setting again.
94	Rotation tuning frequency setting error (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.)	Check the **Pr.1 Maximum frequency** and **Pr.31 to Pr.36 Frequency jump** settings.

- When offline auto tuning with motor rotation is performed under vector control, the protective function (E.EPS) may be activated.

Operation panel indication	**E.EPS** Vector	E. EPS	**FR-LU08 indication**	**Fault 15**
Name	Encoder pulse number setting error (Data code: 255 (HFF))*1			
Description	When the rotation speed deviates from the command value range while auto tuning with motor rotation is performed under vector control, the inverter trips.			
Check point	• Check the encoder setting (**Pr.369, Pr.851,** differential line driver / complementary) and wiring. • The external power supply for the encoder is not wired correctly. • Load inertia is too high, or the acceleration time is too short. • Check that the load is not too large.			
Corrective action	• Check the encoder setting and wiring. • Wire an external power supply. • Set the acceleration time longer. • Reduce the load.			

*1 The data code is used for checking the fault detail via communication or for setting **Pr.997 Fault initiation**. (Refer to the Instruction Manual (Detailed) of the FR-A800 inverter.)

- When tuning is ended forcibly by pressing the STOP/RESET key or turning OFF the start signal (STF or STR signal) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.)
  Perform an inverter reset and restart tuning.

- If using a motor falling under the following conditions, set the value of **Pr.9 Electronic thermal O/L relay** as shown below after tuning is complete.
  a) If the rated power supply of the motor is 200/220 V (400/440 V) 60 Hz, set the rated motor current multiplied by 1.1 in **Pr.9**.
  b) If using a motor with a temperature detector such as PTC thermistor and Klixon and performs motor overheat protection, set **Pr.9** = "0" (disables the motor overheat protection feature of the inverter).

NOTE

- An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor runs in the forward (reverse) rotation.
- Any alarm occurring during tuning is handled as in the normal operation. Note that even if a retry operation has been set, retry is not performed.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

⚠Caution

- **Note that the motor may start running suddenly.**
- **For the offline auto tuning in vertical lift applications, etc., caution is required to avoid falling due to insufficient torque.**

3.4.3 Speed control gain adjustment

- The load inertia ratio (load moment of inertia) for the motor is calculated from the torque command and rotation speed during motor driving by the vector control. Because the optimum gain for speed control of dancer feedback / tension sensor feedback is calculated automatically from the load inertia ratio and the response level, the work required for gain adjustment is reduced (Easy gain tuning).
- By manually entering the load inertia ratio (if known), the control gain is set automatically.
- Manual gain adjustment is useful for achieving optimum machine performance or improving unfavorable conditions, such as vibration and acoustic noise during operation with high load inertia.
- For gain adjustment, rolls of minimum, medium, and maximum diameters are used.

POINT

- If a roll of medium diameter is not available, refer to the procedure for the case where the medium-diameter roll is not available ("No medium-diameter roll").

◆Adjustment by easy gain tuning (recommended)

1 Installation of the minimum-diameter roll

Install the minimum-diameter roll.

2 Motor inertia setting

Set an accurate motor inertia value using **Pr.707 and Pr.724**.

3 Easy gain tuning response level setting (tuning with the minimum-diameter roll)

Set the response level in **Pr.818 Easy gain tuning response level setting**.
Setting this parameter higher improves the trackability for commands, but setting it too high causes vibration. Set the value measured shortly before vibration occurs in **Pr.818**.

Pr.818 setting	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Response level	Slow response ← → Medium response ← → Fast response														
Estimated mechanical resonance frequency (Hz)	8	10	12	15	18	22	28	34	42	52	64	79	98	122	150

4 Easy gain tuning (tuning with the minimum diameter-roll)

	Vector control	Real sensorless vector control Vector control with the load inertia ratio manual input
1	When **Pr.819 Easy gain tuning selection** = "1", the load inertia ratio is estimated during acceleration/deceleration, and the gain for each control is set automatically from this value and the value of **Pr.818 Easy gain tuning response level setting**. Use **Pr.880 Load inertia ratio** as the initial value for tuning. During tuning, the estimated value is set in **Pr.880**.	Set the load inertia ratio for the motor in **Pr.880 Load inertia ratio**.
2	Press the FWD or REV key to calculate the continuous load inertia ratio, or calculate the gain. (The operation command during External operation is the STF or STR signal.)	Set "2" (easy gain tuning enabled) in **Pr.819 Easy gain tuning selection**. When set, **Pr.820 Speed control P gain 1** and **Pr.821 Speed control integral time 1** are set automatically. Operation is performed with the adjusted gain from the next operation.
3	Start and stop the inverter repeatedly until the **Pr.820** and **Pr.880** settings are stabilized.	Perform a test run, and set the response level in **Pr.818 Easy gain tuning response level setting**. Setting this parameter higher improves the trackability for commands, but setting it too high causes vibration. (The response level can be adjusted during operation when **Pr.77 Parameter write selection** = "2" (parameters can be written during operation).)

NOTE

- When **Pr.819** = "1 or 2" is set, even if the **Pr.819** setting value is returned to "0" after tuning is performed, the data that was set in each parameter is retained in the tuning results.
- If good precision cannot be obtained even after executing easy gain tuning, because of external disturbances or other reasons, perform fine adjustment manually. At this time, set the **Pr.819** setting to "0" (no easy gain tuning).
- The calculation of the load inertia ratio may take excessive time or otherwise not be performed properly if the following conditions are not satisfied.
  - The time in acceleration/deceleration driving until 1500 r/min is reached in 5 s or less.
  - The rotation speed in driving is 150 r/min or higher.
  - The acceleration/deceleration torque is 10% or higher.
  - No sudden external disturbances during acceleration/deceleration.
  - The load inertia ratio is about 30-fold or lower.
  - No gear backlash or belt sagging.
- If the load inertia ratio is known in advance during vector control, the tuning procedure for Real sensorless vector control operation is applicable by setting "2" in **Pr.819**.

5 Gain adjustment (tuning with the minimum diameter-roll)

After the easy gain tuning, increase the **Pr.818** setting and perform easy gain tuning again.

Gradually increase the **Pr.818** setting and repeat the procedure. In the end, set the value measured shortly before vibration occurs in **Pr.818**.

Then, perform easy gain tuning again, and set the automatically set final **Pr.820** value in **Pr.641 Speed control proportional gain 1**.

6 Installation of the maximum-diameter roll

Install the maximum-diameter roll.

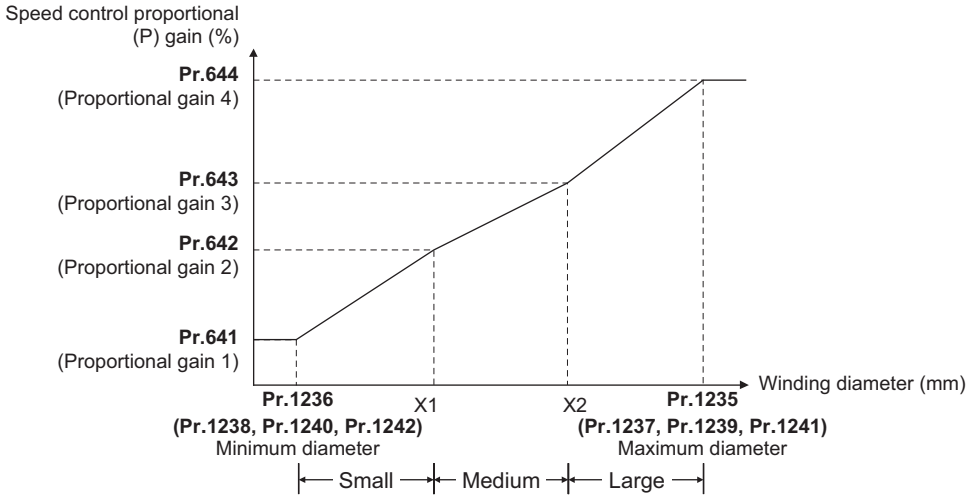
7 Tuning with the maximum-diameter roll

Perform easy gain tuning in the same way used for the tuning with the minimum-diameter roll.

Take a note of the **Pr.820** value and set it in **Pr.644 Speed control proportional gain 4**.

8 Calculation of the medium diameter gain

	With medium-diameter roll	No medium-diameter roll
1	Tuning with the medium-diameter roll 1 Perform easy gain tuning in the same way used for the tuning with the minimum-diameter roll. Then, set the **Pr.820** value in **Pr.642**.	Set the result of the following calculation in **Pr.642 Speed control proportional gain 2**. $\mathbf{Pr.642} = \frac{\mathbf{Pr.644} - \mathbf{Pr.641}}{5} + \mathbf{Pr.641}$
2	Tuning with the medium-diameter roll 2 Perform easy gain tuning in the same way used for the tuning with the minimum-diameter roll. Then, set the **Pr.820** value in **Pr.643**.	Set the result of the following calculation in **Pr.643 Speed control proportional gain 3**. $\mathbf{Pr.643} = 8 \times \frac{\mathbf{Pr.644} - \mathbf{Pr.641}}{15} + \mathbf{Pr.641}$
3	Set the diameters of the medium-diameter rolls. Medium-diameter roll 1 **Pr.639 Speed control proportional term applied diameter 1** = (Medium diameter 1 - Minimum diameter)/(Maximum diameter - Minimum diameter) × 100 (%) Medium-diameter roll 2 **Pr.640 Speed control proportional term applied diameter 2** = (Medium diameter 2 - Minimum diameter)/(Maximum diameter - Minimum diameter) × 100 (%)	Set "9999" (initial value) in **Pr.639** and **Pr.640**.



X1 = ((Maximum winding diameter - Minimum winding diameter) × **Pr.639**/100) + Minimum winding diameter

X2 = ((Maximum winding diameter - Minimum winding diameter) × **Pr.640**/100) + Minimum winding diameter

9 Tuning completion

Set **Pr.819** back to "0" to complete the easy gain tuning.

10 Speed control integral time setting

Set "0" in **Pr.821 Speed control integral time 1**.

◆Manual adjustment

1 Installation of the minimum-diameter roll

Install the minimum-diameter roll.

2 Speed control integral time setting

Set "0" in **Pr.821 Speed control integral time 1**. (The initial value is 0.333 s.)

3 Adjustment with the minimum-diameter roll

Increase **Pr.820 Speed control P gain 1** by 10%, and adjust the gain to a 80 to 90 % value of the setting immediately before vibration/noise starts in the range from the minimum number of rotations to the maximum number of rotations.

Then, set the **Pr.820** value in **Pr.641**.

4 Installation of the maximum-diameter roll

Install the maximum-diameter roll.

NOTE

- If the maximum-diameter roll is not available, perform the "PID gain adjustment" (refer to page 63), and wind the material up to the maximum diameter while adjusting **Pr.820 Speed control P gain 1**.

5 Adjustment with the maximum-diameter roll

Adjust the **Pr.820** setting in the same way used for the tuning with the minimum-diameter roll. Then, set the **Pr.820** value in **Pr.644**.

6 Calculation of the medium diameter gain

	With medium-diameter roll	No medium-diameter roll
1	Tuning with the medium-diameter roll 1 Adjust the **Pr.820** setting in the same way used for the tuning with the minimum-diameter roll. Then, set the **Pr.820** value in **Pr.642**.	Set the result of the following calculation in **Pr.642 Speed control proportional gain 2**. $\mathbf{Pr.642} = \frac{\mathbf{Pr.644} - \mathbf{Pr.641}}{5} + \mathbf{Pr.641}$
2	Tuning with the medium-diameter roll 2 Adjust the **Pr.820** setting in the same way used for the tuning with the minimum-diameter roll. Then, set the **Pr.820** value in **Pr.643**.	Set the result of the following calculation in **Pr.643 Speed control proportional gain 3**. $\mathbf{Pr.643} = 8 \times \frac{\mathbf{Pr.644} - \mathbf{Pr.641}}{15} + \mathbf{Pr.641}$
3	Set the diameters of the medium-diameter rolls. Medium-diameter roll 1 **Pr.639 Speed control proportional term applied diameter 1** = (Medium diameter 1 - Minimum diameter)/(Maximum diameter - Minimum diameter) × 100 (%) Medium-diameter roll 2 **Pr.640 Speed control proportional term applied diameter 2** = (Medium diameter 2 - Minimum diameter)/(Maximum diameter - Minimum diameter) × 100 (%)	Set "9999" (initial value) in **Pr.639 and Pr.640**.

3.4.4 PID gain adjustment

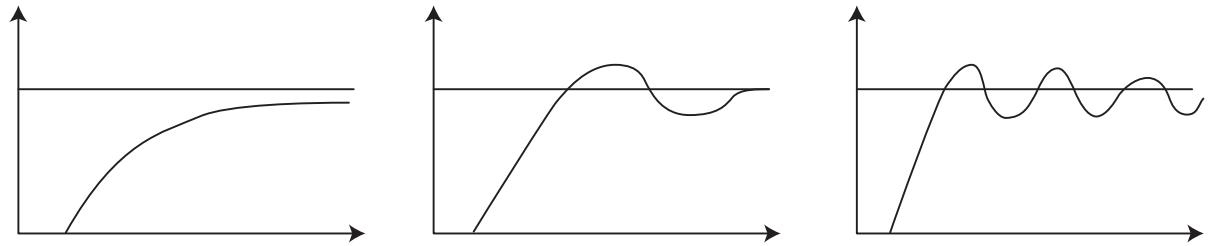
Adjust the PID gain of dancer feedback speed control.

◆Adjustment by tension PI gain tuning (recommended)

The PID gain is adjusted by tension PI gain tuning (refer to page 91). Tension PI gain tuning is recommended for PID gain adjustment.

◆Manual adjustment

- Set the minimum-diameter roll for winding and the maximum-diameter roll for unwinding. Connect the material from the beginning to the end of the machine, and increase the line speed gradually while observing the movement of the dancer roll. Adjust the line speed so that the dancer roll moves properly.
- Adjust the PID gain so that the dancer roll works without problems at acceleration, constant speed, deceleration, and sudden deceleration.
- It is important to adjust the dancer PI gain as high as possible for the minimum-diameter roll.
- Normally, adjust the gain with **Pr.129 PID proportional band** and **Pr.130 PID integral time**.



Slow response
(the dancer roll position is too low)

Proper condition

Fast response
(hunting occurs too frequently)

POINT

- Adjust the gain so that overshooting occurs once or so before the dancer roll returns to the set position.

- Refer to the following according to the dancer roll condition.

Status	Adjustment method
When the response is slow (the dancer roll position is too low)	• Decrease **Pr.129 PID proportional band** by 10%. • Decrease **Pr.130 PID integral time** by 0.1 s. • Repeat the adjustment procedure in the range from the minimum diameter to the maximum diameter so that the dancer roll moves properly at acceleration, constant speed, deceleration, and sudden deceleration.
When the response is fast (hunting occurs too frequently)	• Increase **Pr.129 PID proportional band** by 10%. • Increase **Pr.130 PID integral time** by 0.1 s. • Repeat the adjustment procedure in the range from the minimum diameter to the maximum diameter so that the dancer roll moves properly at acceleration, constant speed, deceleration, and sudden deceleration.

NOTE

- Set **Pr.134 PID differential time** only when it is necessary as it causes hunting. However, set a small value in **Pr.134** to cease fluctuation of the dancer roll by disturbance and such at an early point. (Set 0.01 s at first and gradually increase the value.)

3.5 Dancer feedback speed control details

Purpose	Parameter to set			Refer to page
To select forward/reverse action for PID control	PID action selection	P.R100	Pr.128	65
To select winding or unwinding for a shaft	Winding/unwinding selection	P.R002	Pr.1230	67
To select the line speed command input method	Line speed command input selection	P.R200	Pr.361	67
To select a unit of the line speed	Line speed unit	P.R201	Pr.358	67
To set a draw rate for the line speed command value	Draw control	P.R203	Pr.398	67
To set a filter time for pulse train input	Line speed command input filter	P.R224	Pr.1146	67
To set the maximum value for the line speed command	Line speed command maximum value	P.R205	Pr.1147	67
To input the line speed command using multi-speed setting	Line multi-speed setting	P.R230 to P.R244	Pr.1265 to Pr.1279	67
To calibrate the line speed command value	Line speed command bias/gain	P.R210 to P.R213, P.R220 to P.R223	Pr.350 to Pr.357	67
To set the line speed command to start operation	Line speed command for starting	P.R204	Pr.622	67
To calibrate the compensation value added to the line speed command value	Line speed command added compensation value bias/gain	P.R214 to P.R217	Pr.635 to Pr.638	76
To set acceleration/deceleration time to increase/decrease the line speed command value	Acceleration/ deceleration time selection for line speed command	P.R253 to P.R256, P.R250 to P.R252	Pr.100 to Pr.103, Pr.393 to Pr.395	79
To set the acceleration/deceleration pattern suitable for an application	Line speed command acceleration/ deceleration pattern	P.R290 to P.R294	Pr.1141 to Pr.1145	82
To detect malposition of the dancer roll due to a fault such as a break	Dancer roll malposition detection (break detection)	P.A601 to P.A604, P.R160, P.R163	Pr.131, Pr.132, Pr.137, Pr.425, Pr.553, Pr.554	89
To enable automatic tuning for complex PI gain calculation	Tension PI gain tuning	P.R170 to P.R176	Pr.1211, Pr.1215, Pr.1217, Pr.1219, Pr.1222, Pr.1223, Pr.1226	91
To enable manual input of gains for PID control	PID control gain setting	P.R110 to P.R112	Pr.129, Pr.130, Pr.134	99
To set the upper and lower limits of the PID compensation amount	PID compensation amount upper/lower limit setting	P.A605, P.A606	Pr.1134, Pr.1135	104

POINT

- To enable the dancer feedback speed control and the winding diameter compensation function, turn ON the X114 signal and set "40 or 41" in **Pr.128 PID action selection**. (When the X114 signal is OFF or "0" is set in **Pr.128**, the dancer feedback speed control and the winding diameter compensation function are disabled.)
- Dancer feedback speed control may be performed without using the winding diameter compensation (with the winding diameter retained) for example for the intermediate shafts. In such cases, turn ON the X114 signal while the X115 signal is ON or **Pr.1247 Winding diameter change increment amount limit** = "9999" (no winding diameter calculation).
- For the X114 and X115 signals, assign the function by setting "114 (X114)" or "115 (X115)" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

3.5.1 Dancer feedback speed control function selection

Select forward/reverse action for dancer feedback speed control.

Pr.	Name	Initial value	Setting range	Description	
128 R100 (A610)	PID action selection	0	0	Dancer feedback speed control invalid	
			40	Dancer feedback speed control valid	Reverse action
			41		Forward action

◆PID action selection (Pr.128)

- Set forward or reverse action according to the control target.
- The following table shows the input method for the set point, dancer signal, and line speed command for the dancer feedback speed control function (**Pr.128** = "40 or 41").

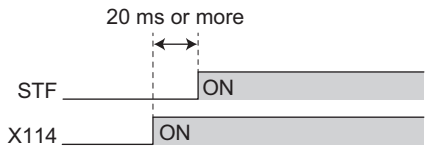
Pr.128 setting	Forward /reverse action setting	Operation status	Set point input	Dancer signal input	Line speed command input
0 (initial value)	—	Dancer feedback speed control invalid	—	—	—
40	Reverse action	When deviation X (set point subtracted by measured value) is a plus value, the manipulated amount is increased, and when the deviation is a minus value, the manipulated amount is decreased.	Set in **Pr.133**.	Set in **Pr.363**.	Set in **Pr.361**.
41	Forward action	When deviation X (set point subtracted by measured value) is a minus value, the manipulated amount is increased, and when the deviation is a plus value, the manipulated amount is decreased.			

NOTE

- The automatic restart after instantaneous power failure function is not activated while dancer feedback speed control is valid (**Pr.128** = "40 or 41").
- To perform dancer feedback speed control, set **Pr.127 PID control automatic switchover frequency** = "9999" (initial value). (If the **Pr.127** setting is other than "9999", a sudden speed change may occur.)

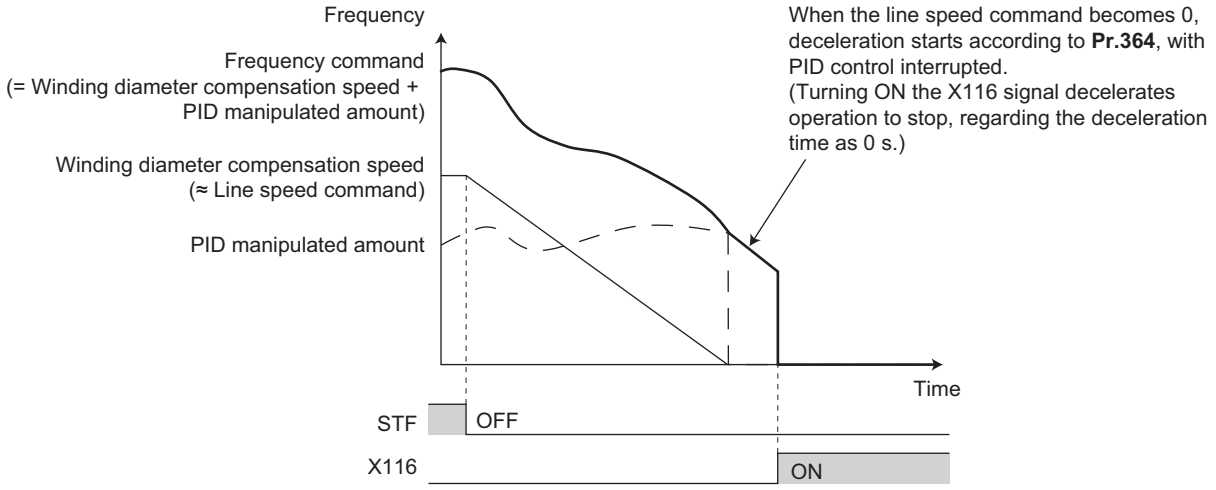
◆Tension control selection signal (X114 signal)

- To enable the dancer feedback speed control, turn ON the Tension control selection (X114) signal and set "40 or 41" in **Pr.128 PID action selection**.
- Ensure the motor has stopped before switching between normal operation and dancer feedback speed control operation.
- To input the X114 signal, set "114" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.
- After turning ON the X114 signal, wait 20 ms or longer to input a start command (STF/STR).

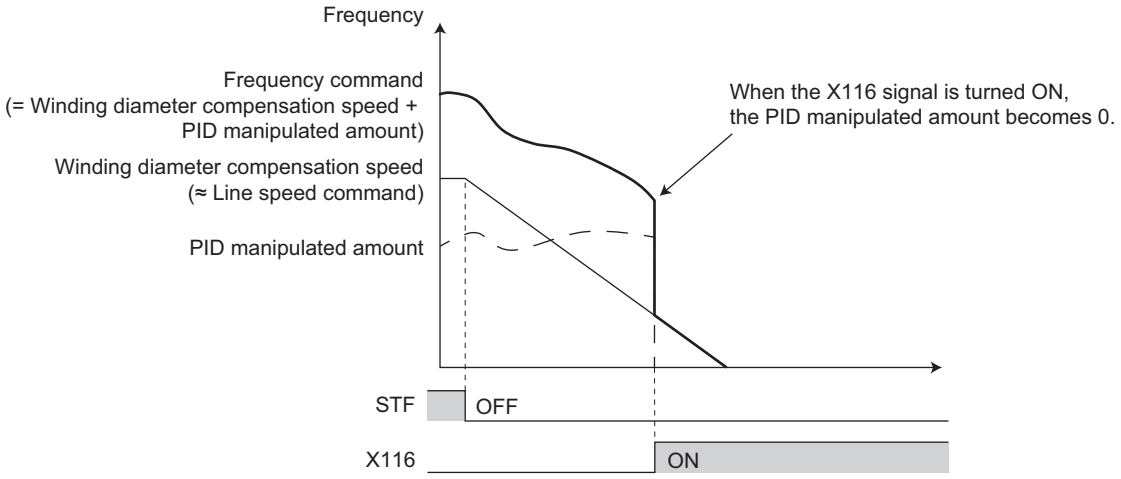


◆PID compensation disabled signal (X116 signal)

- PID compensation can be disabled by turning ON the X116 signal. To input the X18 signal, set "116" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.
- When the line speed command becomes 0 m/min while the output frequency is not 0 Hz, operation is decelerated to stop in the deceleration time set for the line speed command. When the X116 signal is turned ON at this time, the frequency command is regarded as 0 Hz and the deceleration time is regarded as 0 s, and operation is decelerated to stop.



Turning ON the X116 signal after the winding diameter compensation speed becomes 0



Turning ON the X116 signal before the winding diameter compensation speed becomes 0

3.5.2 Winding/unwinding shaft selection

Select whether the target roll is a winding shaft or unwinding shaft.

Pr.	Name	Initial value	Setting range	Description
1230 R002	Winding/unwinding selection	0	0	Winding
			1	Unwinding

◆Winding/unwinding selection (Pr.1230)

- Use **Pr.1230 Winding/unwinding selection** to select whether the target roll is a winding shaft or unwinding shaft.
- The initial diameter of the winding shaft is selected according to whether the operation is winding or unwinding.

Pr.1230 setting	Winding/unwinding selection	Initial roll diameter
0	Winding	Minimum roll diameter
1	Unwinding	Maximum roll diameter

3.5.3 Line speed command input

Set the line speed command input method. The selectable input methods include the following: parameter setting, analog input, multi-speed setting input, and pulse input.

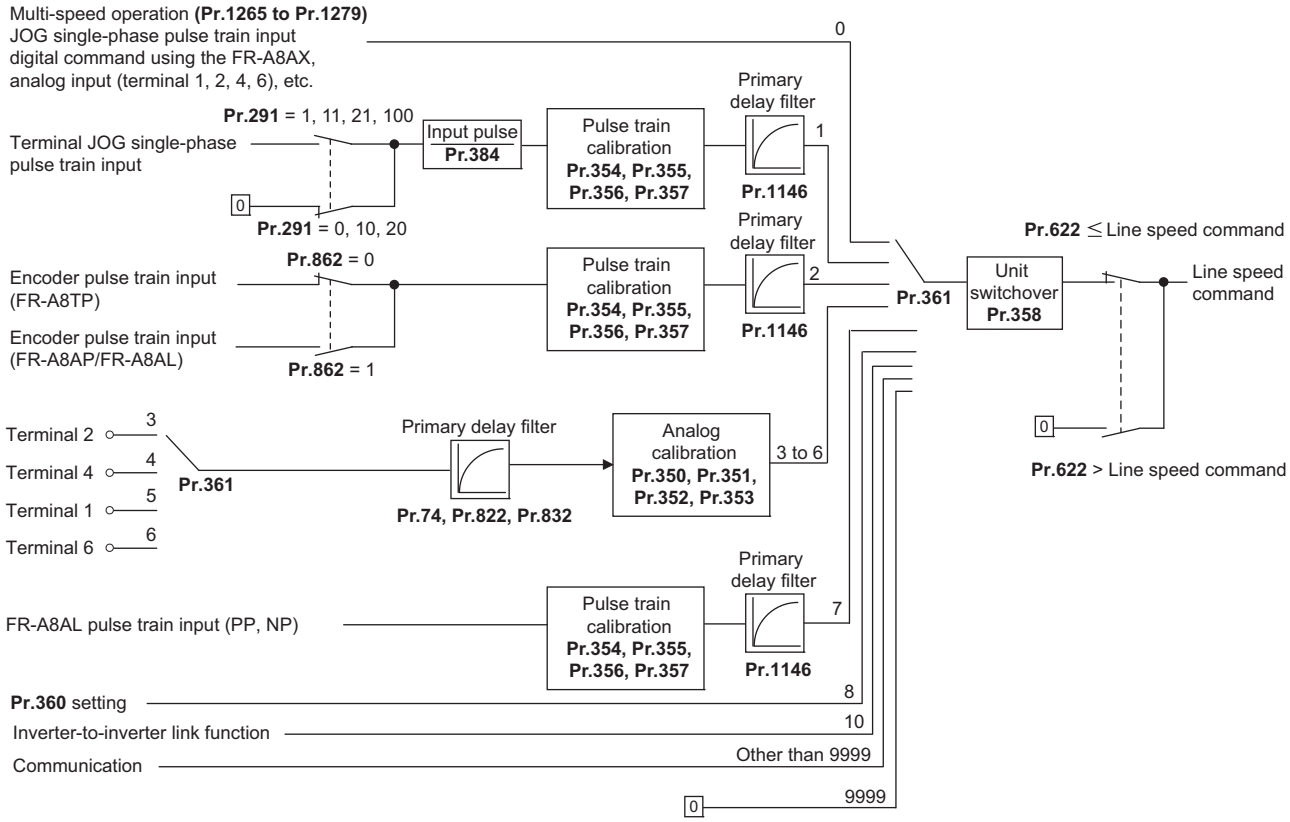
Pr.	Name	Initial value	Setting range	Description
350 R210	Line speed command voltage/current bias	0%	0 to 100%	Set the converted % of the bias voltage (current) for analog input.
351 R211	Line speed command bias	0 m/min*1	0 to 6553.4 m/min*1	Set the bias line speed for analog input.
352 R212	Line speed command voltage/current gain	50%	0 to 100%	Set the converted % of the gain voltage (current) for analog input.
353 R213	Line speed command gain	0 m/min*1	0 to 6553.4 m/min*1, 9999	Set the gain line speed command value for analog input.
354 R220	Line speed command pulse input bias	0 pulses/s	0 to 500k pulses/s	Set the number of bias input pulses for pulse train input.
355 R221	Line speed command pulse input gain	100k pulses/s	0 to 500k pulses/s	Set the bias line speed command value for pulse train input.
356 R222	Line speed command digital input bias	0	0 to 65535	Set the number of gain input pulses for pulse train input.
357 R223	Line speed command digital input gain	65535	0 to 65535	Set the gain line speed command value for pulse train input.
358 R201	Line speed unit	0	0	m/min
			1	m/s
			2	mm/min
			3	mm/s
360 R202	Line speed command value	0 m/min*1	0 to 6553.4 m/min*1	Set the line speed command value.
361 R200	Line speed command input selection	9999	0	According to the priority of the speed command sources.
			1	Terminal JOG single-phase pulse train input
			2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input
			3	Terminal 2 (0 to 100%)
			4	Terminal 4 (20 to 100%)
			5	Terminal 1 (-100 to 100%)
			6	Terminal 6 (FR-A8AZ) (-100 to 100%)
			7	FR-A8AL single-phase pulse train input
			8	Line speed command according to the **Pr.360** setting
			10	Inverter-to-inverter link function (Available only for the FR-A800-E-R2R. For details, refer to the Ethernet Function Manual.)
			9999	No function

Dancer feedback speed control details

Pr.	Name	Initial value	Setting range	Description	
384 D101	**Input pulse division scaling factor**	0	0 to 250	Set the pulse division scaling factor for pulse train input through terminal JOG.	
398 R203	**Draw rate**	100%	0 to 200%	Set a draw rate to be multiplied to the line speed command value or the line speed command acceleration/deceleration reference.	
428 B009	**Command pulse selection**	0	0	Forward/Reverse pulse train	Negative logic
			1	Pulse train + rotation direction sign	
			2	A/B phase pulse train	
			3	Forward/Reverse pulse train	Positive logic
			4	Pulse train + rotation direction sign	
			5	A/B phase pulse train	
622 R204	**Line speed command for starting**	0 m/min*1	0 to 6553.4 m/min*1	Set the line speed command to start operation.	
1146 R224	**Line speed command input filter time constant**	0 s	0 to 5 s	Set the time constant of the primary delay filter relative to the pulse input value.	
1147 R205	**Line speed command maximum value**	6553.4 m/min*1	0 to 6553.4 m/min*1	Set the maximum value for the line speed command.	
1265 R230	**Line multi-speed setting (high-speed)**	0 m/min*1	0 to 6553.4 m/min*1	Set the line speed command value when the RH signal is ON.	
1266 R231	**Line multi-speed setting (middle-speed)**	0 m/min*1	0 to 6553.4 m/min*1	Set the line speed command value when the RM signal is ON.	
1267 R232	**Line multi-speed setting (low-speed)**	0 m/min*1	0 to 6553.4 m/min*1	Set the line speed command value when the RL signal is ON.	
1268 R233	**Line multi-speed setting (speed 4)**	0 m/min*1	0 to 6553.4 m/min*1	The line speed from 4th speed to 15th speed can be set according to the combination of the RH, RM, RL and REX signals.	
1269 R234	**Line multi-speed setting (speed 5)**	0 m/min*1	0 to 6553.4 m/min*1		
1270 R235	**Line multi-speed setting (speed 6)**	0 m/min*1	0 to 6553.4 m/min*1		
1271 R236	**Line multi-speed setting (speed 7)**	0 m/min*1	0 to 6553.4 m/min*1		
1272 R237	**Line multi-speed setting (speed 8)**	0 m/min*1	0 to 6553.4 m/min*1		
1273 R238	**Line multi-speed setting (speed 9)**	0 m/min*1	0 to 6553.4 m/min*1		
1274 R239	**Line multi-speed setting (speed 10)**	0 m/min*1	0 to 6553.4 m/min*1		
1275 R240	**Line multi-speed setting (speed 11)**	0 m/min*1	0 to 6553.4 m/min*1		
1276 R241	**Line multi-speed setting (speed 12)**	0 m/min*1	0 to 6553.4 m/min*1		
1277 R242	**Line multi-speed setting (speed 13)**	0 m/min*1	0 to 6553.4 m/min*1		
1278 R243	**Line multi-speed setting (speed 14)**	0 m/min*1	0 to 6553.4 m/min*1		
1279 R244	**Line multi-speed setting (speed 15)**	0 m/min*1	0 to 6553.4 m/min*1		

*1 The increment varies depending on the **Pr.358** setting.

◆Block diagram



NOTE

- The plug-in option used to input a line speed command or the actual line speed (selected according to the **Pr.862** setting) is not the one used for the motor encoder input (selected by turning ON/OFF of the RT signal). For the details, refer to **page 234**.

◆Line speed command input selection (Pr.361)

- Use **Pr.361 Line speed command input selection** to select the input method for the line speed command value.

Pr.361 setting	Input method for line speed command value
0	According to the priority of the speed command sources. (Refer to **page 70**)
1	Terminal JOG single-phase pulse train input (Refer to **page 71**)
2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases)) (Refer to **page 71**)
3*2*3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*1 (Refer to **page 73**)
4*2*3	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*1 (Refer to **page 73**)
5*2*3	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*1 (Refer to **page 73**)
6*2*3	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*1 (Refer to **page 73**)
7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to **page 71**)
8	Line speed command according to the **Pr.360** setting (Refer to **page 73**)
10	Line speed command according to the inverter-to-inverter link function (Available only for the FR-A800-E-R2R. For details, refer to the Ethernet Function Manual.)
9999 (initial value)	No function

*1 The input specification in the initial setting is indicated.

*2 The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.)
Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command. In this case, the bias and gain parameter settings must be consistent for both command types.
Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918)**
Calibration parameters for line speed command input: **Pr.350 to Pr.353**

*3 To feed paper or wire, turn ON all X114, X115, and X116 signals and disable winding diameter compensation and PID compensation so that the line speed command for tension control (dancer feedback speed control / tension sensor feedback speed control) is used for the feed operation.

◆Line speed unit (Pr.358)

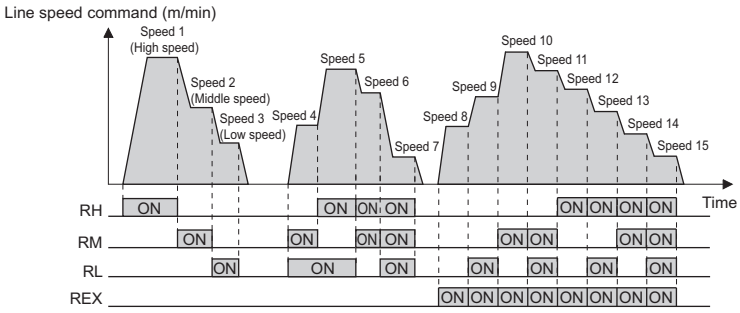
- Use **Pr.358 Line speed unit** to select the unit of the line speed.

Pr.358 setting	Commanded line speed monitoring	Actual line speed monitoring	Line speed setting in parameters
0	m/min	m/min	m/min
1	m/s	m/s	m/s
2	mm/min	mm/min	mm/min
3	mm/s	mm/s	mm/s

◆Line speed command input according to the priority of the speed command sources (Pr.361 = "0")

- The line speed is determined according to the frequency command.
- In the External operation mode, the priorities of the line speed commands are defined as follows:
  Multi-speed setting signal (RL/RM/RH/REX signal) > single-phase pulse train input (terminal JOG) > digital command input (FR-A8AX) > analog input (terminals 1, 2, 4)
- In the Network operation mode, the priorities of the line speed commands are defined as follows:
  Multi-speed setting signal (RL/RM/RH/REX) (communication or external input*1) > single-phase pulse train input (terminal JOG) > digital command input (FR-A8AX) > command input via communication or analog input (terminals 1, 2, 4)*1

  *1 The setting of **Pr.339 Communication speed command source** will be applied to the selection of communication or external input for multi-speed operation, or the selection of command input via communication or analog input.
- When the line speed command is input according to the multi-speed operation, set the line speed command values in **Pr.1265 to Pr.1279**.



- When **Pr.361** = "0", the following calibration parameters are used for calibrating the line speed command according to the input method.

Input method	Calibration parameter
Analog terminal input	**Pr.350 to Pr.353**
Terminal JOG single-phase pulse train input	**Pr.351, Pr.353 to Pr.355**
Digital input through the FR-A8AX	**Pr.351, Pr.353, Pr.356, Pr.357**

NOTE

- For the frequency command input method, refer to the Instruction Manual (Detailed) of the FR-A800 inverter.

◆Line speed command input by pulse train input (Pr.361 = "1, 2, 7")

- The line speed can be commanded using single phase pulse train input through terminal JOG, encoder pulse train input through FR-A8AP/FR-A8AL/FR-A8TP, or pulse train input through FR-A8AL (PP, NP).
- The number of pulses is calculated internally as follows.

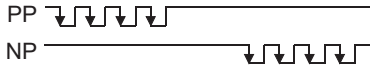
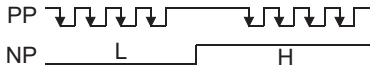
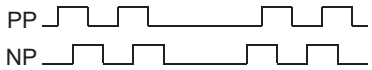
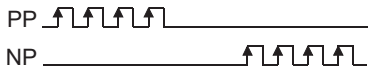
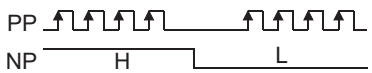
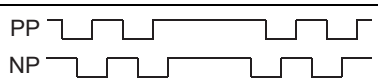
Pr.361 setting	Pulse train input	Number of pulses calculated internally
1	Terminal JOG single-phase pulse train input	Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG. Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse input *1	Time-averaged number of input pulses using **Pr.1245 Sampling time for winding diameter calculation**. (When **Pr.1245** = "9999", the sampling time is fixed to about 5 ms.)
7	Single-phase pulse train input through FR-A8AL (PP, NP)	

*1 To perform Vector control, install the Vector control compatible option.

NOTE

- To input the line speed command by the pulse train input to the plug-in option or control terminal option under vector control, setting of **Pr.862 Encoder option selection** is required. (Refer to page 234.)

- When the single-phase pulse train input using the FR-A8AL is selected, the command pulse train type can be switched by changing the setting of **Pr.428 Command pulse selection** as shown in the following table. The number of pulses is recognized as an absolute value regardless of the sign setting.

Command pulse train type		During forward rotation / During reverse rotation	Setting of Pr.428
Negative logic	Forward pulse train Reverse pulse train		0 (initial value)
	Pulse train + sign		1
	A phase pulse train B phase pulse train		2
Positive logic	Forward pulse train Reverse pulse train		3
	Pulse train + sign		4
	A phase pulse train B phase pulse train		5

- The line speed commanded by pulse train input is calibrated with **Pr.351 Line speed command bias**, **Pr.353 Line speed command gain**, **Pr.354 Line speed command pulse input bias**, and **Pr.355 Line speed command pulse input gain**. The calculation result is applied as the line speed command value (lower limit: 0 m/min, upper limit: 6553.4 m/min). When **Pr.353** = "9999", the calculation result is invalid (line speed command value: 0).

Dancer feedback speed control details

- To calibrate the line speed when **Pr.361** = "2" or when **Pr.361** = "7" and **Pr.428** = "2 or 5", set the number of pulses multiplied by four in **Pr.354** and **Pr.355**. A calculation example is as follows.

System specifications
Roll diameter: 80 mm
Encoder resolution: 1024 Pulse/Rev
Line speed range: 5 to 50 m/min

Theoretical formula

$V\ [m/min] = D\ [m] \times \pi \times n\ [r/min]$

When the line speed is 5 m/min:

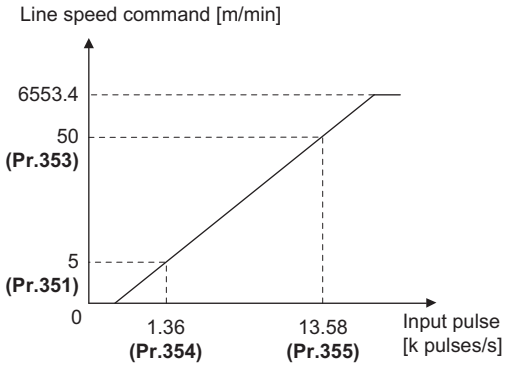
$$n\ [r/min] = \frac{5\ [m/min]}{0.08\ [m] \times \pi} \approx 19.89\ [r/min]$$

$$\text{Input pulse [k pulses/s]} = \frac{19.89\ [r/min] \times 1024\ [Pulse/Rev] \times 4}{60\ [s]} \approx 1.36\ [k\ pulses/s]$$

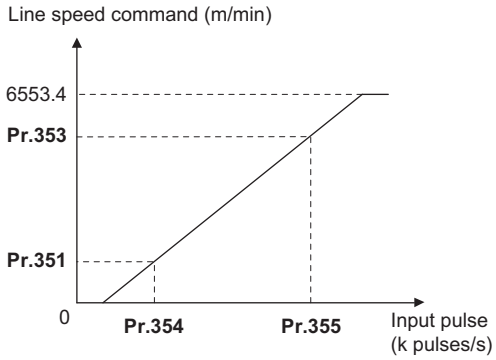
When the line speed is 50 m/min:

$$n\ [r/min] = \frac{50\ [m/min]}{0.08\ [m] \times \pi} \approx 198.9\ [r/min]$$

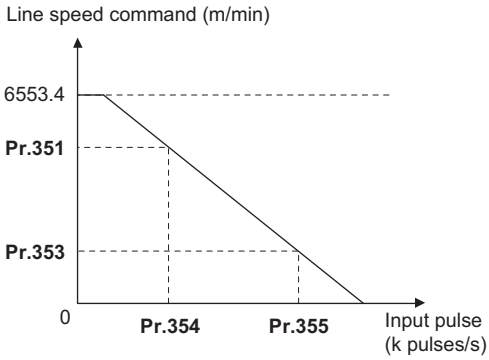
$$\text{Input pulse [k pulses/s]} = \frac{198.9\ [r/min] \times 1024\ [Pulse/Rev] \times 4}{60\ [s]} \approx 13.58\ [k\ pulses/s]$$



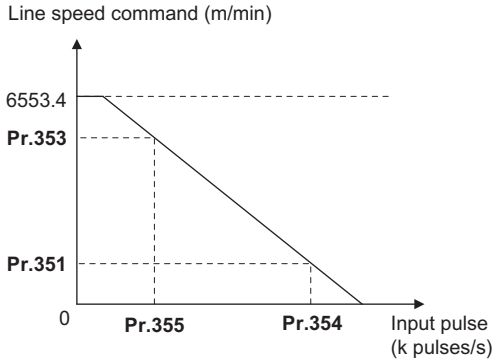
Pr.351 < **Pr.353**, and **Pr.354** < **Pr.355**



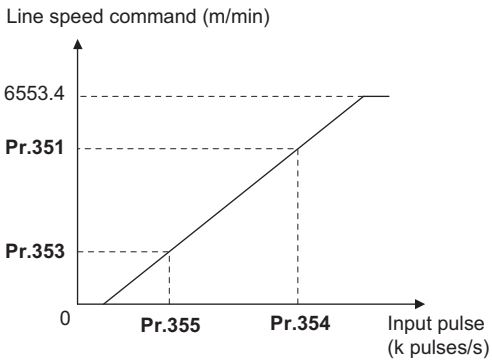
Pr.351 > **Pr.353**, and **Pr.354** < **Pr.355**



Pr.351 < **Pr.353**, and **Pr.354** > **Pr.355**



Pr.351 > **Pr.353**, and **Pr.354** > **Pr.355**

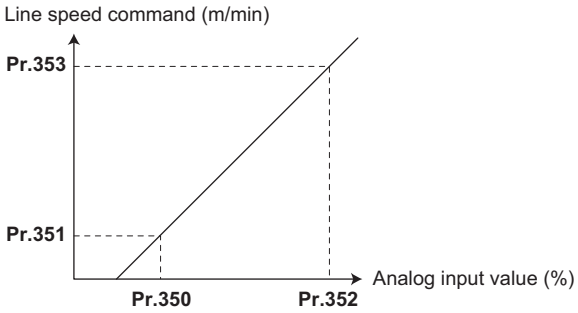


- Use **Pr.1146 Line speed command input filter time constant** to set a filter time for the pulse train input. When **Pr.1146** = "0 (initial value)", the filter time is not set.

Pr.1146 setting	Description
0 (initial value)	None
0.01 to 5 s	Set a filter time constant.

◆Line speed command analog input (Pr.361 = "3 to 6")

- The line speed can be commanded by analog input.
- The line speed commanded by analog input is calibrated with **Pr.350 Line speed command voltage/current bias**, **Pr.351 Line speed command bias**, **Pr.352 Line speed command voltage/current gain**, and **Pr.353 Line speed command gain**. The calculation result is applied as the line speed command value (lower limit: 0 m/min, upper limit: 6553.4 m/min). When **Pr.353** = "9999", the calculation result is invalid (line speed command value: 0).



- When the line speed is commanded by analog input, the input value can be filtered using **Pr.74 Input filter time constant**, **Pr.822 Speed setting filter 1**, and **Pr.832 Speed setting filter 2**.

NOTE

- The difference between the setting values of **Pr.350** and **Pr.352** can be set within 5%. (Even if the difference is 5% or less, Er3 (calibration error) does not occur.)
- The **Pr.350** setting can be larger than the **Pr.352** setting. Also, the **Pr.351** setting can be larger than the **Pr.353** setting.
- Specifications differ depending on the settings of **Pr.73** (terminal 2) or **Pr.267** (terminal 4) and the voltage/current input selection switch. For details, refer to the Instruction Manual (Detailed) of the FR-A800 inverter.
- The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.)
  Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command. In this case, the bias and gain parameter settings must be consistent for both command types.
  Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918)**
  Calibration parameters for line speed command input: **Pr.350 to Pr.353**
- To feed paper or wire, turn ON all X114, X115, and X116 signals and disable winding diameter compensation and PID compensation so that the line speed command for tension control (dancer feedback speed control / tension sensor feedback speed control) is used for the feed operation.
- The range for the PID manipulated amount can be set using the line speed command. (Refer to page 104)

◆Line speed command input by parameter setting (Pr.361 = "8")

- The value set in **Pr.360 Line speed command value** is used for the line speed command. (Setting range: 0 to 6553.4 m/min)

◆Line speed command input through RS-485/Ethernet or using a communication option (except for the FR-A8ND) (Pr.361 ≠ "9999")

- Use the read/write procedure for the set frequency to read/write the line speed command value through RS-485 / Ethernet (CC-Link IE Field Network Basic) or using a communication option (FR-A8NC/FR-A8NCE/FR-A8NP). The frequency set for normal speed control is used as the line speed command value for dancer feedback speed control. (The setting is used as the set frequency when the X114 signal is OFF, and used as the line speed command value when the X114 signal is ON.)
- The setting range is H0000 to HFFFE (0 to 6553.4), and the setting increment is 0.1.

NOTE

- For the details of RS-485 communication, refer to the FR-A800 Instruction Manual (Detailed). For the details of CC-Link IE Field Network Basic, refer to the Ethernet Function Manual. For the details of communication options, refer to the Instruction Manual of each option.

◆Line speed command input using the FR-A8ND (Pr.361 ≠ "9999")

• The line speed command value is read/written as follows.

Read/write	Reading/writing method for line speed command	Setting range	Setting increments
Read	• Read the **Pr.360** setting.	H0000 to HFFFE (0 to 6553.4)	0.1 m/min
Write	• Writing through I/O communication (Output instance 127). • Write through message communication. • Write in **Pr.360**.	H0000 to HFFFE (0 to 6553.4)	0.1 m/min

• The line speed command value is written through I/O communication (output instance 127) as follows.

Byte	Bit	Function	Setting method	Remarks
1	5	Write Attr	0: The values set in bytes 2 and 3 are used as the speed/frequency setting value.	1: The values set in bytes 2 and 3 are used as the writing data to the attributes specified in bytes 6 and 7, respectively.
	6	Hz	1: 0.01 Hz increment	0: An unexpected value is written. (The value written in byte 2 and byte 3 is recognized as a number of rotations. Then, the value is converted into a frequency value and written as the line speed command value.)
	7	32-bit format	0: The format for 16-bit data is being selected. (Bytes 2 and 3 are used.) 1: The format for 32-bit data is being selected. (Bytes 2 to 5 are used.)	
2, 3	—	Speed setting	The line speed command value is written.	According to the setting of bit 7 in byte 1, the format is selected for 16-bit data or 32-bit data.

• The message communication (instance 1 in class 0x2A) related to the line speed command value is defined as follows.

Attribute ID	Access	Data type	Number of data bytes	Range	Description
112	Set	UINT	2	0 to 0xFFFE (0 to 6553.4)	The line speed command value is written in RAM. (0.1 increments)
113	Set	UINT	2	0 to 0xFFFE (0 to 6553.4)	The line speed command value is written in EEPROM. (0.1 increments)

NOTE

• Output instances 20, 21, and 126 and input instances 70, 71, and 176 are not available for the line speed command.

◆Line speed command input signal (X125 signal)

• During speed control, turning ON the Line speed / tension command input (X125) signal enables write and read of the line speed command value through communication regardless of whether the dancer feedback speed control is valid or invalid.

• The signal is useful for inputting the line speed command value while dancer feedback speed control is invalid, or switching validity of the dancer feedback speed control without accidentally changing the frequency command value.

• The following table shows the ON/OFF status of the X125 signal and the validity of the available commands.
(○: Valid through communication, ×: Invalid through communication)

Dancer feedback speed control	X125 signal status	Validity of setting through communication	
		Line speed command	Frequency command
Valid	ON	○	×
	OFF	×	○
	Not assigned to a terminal	○	×
Invalid	ON	○	×
	OFF	×	○
	Not assigned to a terminal	×	○

- The X125 signal affects the input methods as follows.

Input method affected by the X125 signal	Input method not affected by the X125 signal
Operation panel RS-485 communication (Mitsubishi inverter protocol, MODBUS RTU) Communication option (FR-A8NC, FR-A8ND, FR-A8NCE, FR-A8NP) PLC function	Pulse train input Analog input Multi-speed input FR-A8AX Parameter

- To input the X125 signal, set "125" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.

NOTE

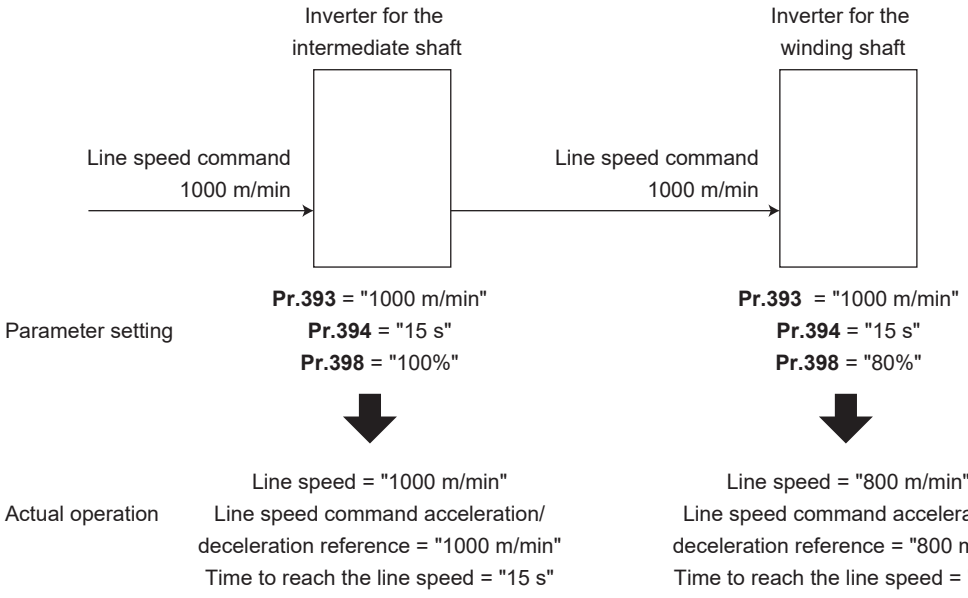
- If the X125 or X114 signal is used to switch the command from frequency to line speed while the Frequency setting screen is displayed on the FR-LU08/FR-PU07, the setting screen remains the same. However, when a frequency value is written, the value is set as a line speed value.
  For example, if 60.00 Hz is entered in the Frequency setting screen of the FR-LU08 while the X125 signal is OFF and then the X125 signal is turned ON before pressing the WRITE key, the Frequency setting screen is still displayed. When the WRITE key is pressed under this condition, "600.0" is written as a line speed command value.

◆Line speed command for starting (Pr.622)

- Use **Pr.622 Line speed command for starting** to set the line speed command for starting operation.
- The line speed command is regarded as zero while the line speed command input value is less than the **Pr.622** setting.
- When the line speed command input value reaches or exceeds the **Pr.622** setting, the commanded line speed is applied for operation.

◆Draw control (Pr.398)

- Use **Pr.398 Draw rate** to set a draw rate to be multiplied to the line speed command value or the line speed command acceleration/deceleration reference.
  Line speed command value after the multiplication = line speed command value × (**Pr.398**) / 100
  Line speed command acceleration/deceleration reference after the multiplication = **Pr.393** × (**Pr.398**) / 100
- As the line speed command acceleration/deceleration reference changes in accordance with the draw rate, the actual acceleration/deceleration time is the same when the same settings are used for the parameters related to acceleration/deceleration.



◆Line speed command maximum value (Pr.1147)

- Use **Pr.1147 Line speed command maximum value** to set the maximum value for the line speed command.

3.5.4 Compensation for line speed command input

Set the following parameters for setting added compensation or override compensation for the line speed command.

Pr.	Name	Initial value	Setting range	Description
252 T050	**Override bias**	50%	0 to 1000%	Set the bias compensation value for the override function.
253 T051	**Override gain**	150%	0 to 1000%	Set the gain compensation value for the override function.
635 R214	**Line speed command added compensation value voltage/ current bias**	9999	0 to 100%, 9999	Set the converted % of the bias voltage (current) for analog input.
636 R215	**Line speed command added compensation value bias**	9999	0 to 6553.4 m/min*1, 9999	Set the bias line speed compensation value for analog input.
637 R216	**Line speed command added compensation value voltage/ current gain**	9999	0 to 100%, 9999	Set the converted % of the gain voltage (current) for analog input.
638 R217	**Line speed command added compensation value gain**	9999	0 to 6553.4 m/min*1, 9999	Set the gain line speed compensation value for analog input.
650 R270	**Terminal 4 input compensation selection**	0	0	The compensation input through terminal 4 is disabled.
			1	The compensation value is input through terminal 4.

*1 The increment varies depending on the **Pr.358** setting. (Refer to page 67.)

◆Added compensation through terminal 1 or 4 (Pr.73, Pr.635 to Pr.638, Pr.650, Pr.868)

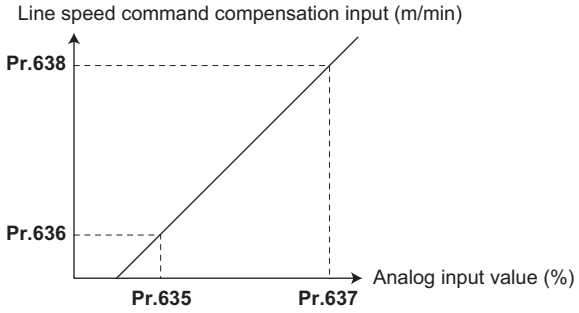
- Use terminal 1 or 4 for adding compensation for the line speed command.
- The terminal used for compensation is determined by the settings of **Pr.73 Analog input selection**, **Pr.650 Terminal 4 input compensation selection**, and **Pr.868 Terminal 1 function assignment**.

Line speed command input method	Add compensation signal input terminal	Add compensation signal input terminal selection		
		Pr.73 setting	Pr.650 setting	Pr.868 setting
Analog input Multi-speed (NET operation (terminal))*1 FR-A8AX*2	Terminal 4	Other than 4, 5, 14, 15	1	—
	Terminal 1		Other than 1	0

*1 Set **Pr.28 Multi-speed input compensation selection** = "1" to enable analog input compensation while the line speed is commanded according to the multi-speed operation.

*2 Set **Pr.304 Digital input and analog input compensation enable/disable selection** = "2, 3, 12, or 13" to enable analog input compensation while the line speed is commanded using the FR-A8AX.

- The analog input value of the line speed compensation value is calibrated with **Pr.635 Line speed command added compensation value voltage/current bias**, **Pr.636 Line speed command added compensation value bias**, **Pr.637 Line speed command added compensation value voltage/current gain**, and **Pr.638 Line speed command added compensation value gain**. The settings are applied to the line speed command compensation value (lower limit: 0 m/min, upper limit: 6553.4 m/min).



- When "9999" is set in any of **Pr.635 to Pr.638**, all the settings in **Pr.635 to Pr.638** are invalid. Instead, the settings in **Pr.350 to Pr.353** are applied for calibrating the compensation value. (Refer to page 73.)

NOTE

- The difference between the setting values of **Pr.635** and **Pr.637** can be set within 5%. (Even if the difference is 5% or less, Er3 (calibration error) does not occur.)
- The **Pr.635** setting can be larger than the **Pr.637** setting. Also, the **Pr.636** setting can be larger than the **Pr.638** setting.
- The compensation is invalid when it is input through the terminal specified for the line speed command input.

◆Override compensation through terminal 2, 4, or 6 (Pr.73, Pr.406, Pr.252, Pr.253, Pr.650)

- Use terminal 2, 4, or 6 (FR-A8AZ) for override compensation of the line speed command value.
- The terminal used for compensation is determined by the settings of **Pr.73 Analog input selection**, **Pr.406 High resolution analog input selection**, and **Pr.650 Terminal 4 input compensation selection**.

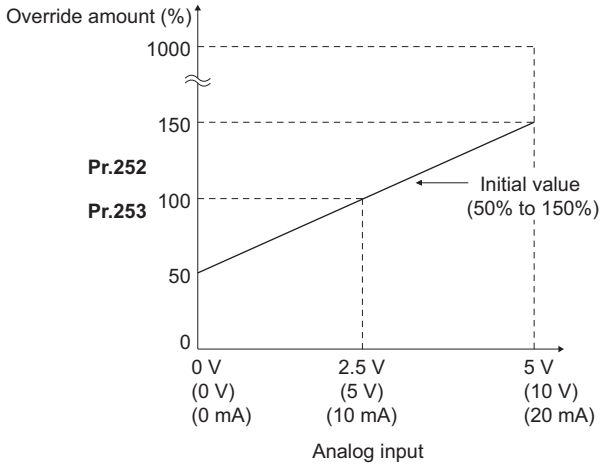
Line speed command input method	Override compensation signal input terminal*1	Parameter setting for selecting the override compensation input terminal		
		Pr.73 setting	Pr.406 setting	Pr.650 setting
Pulse train input Analog input Multi-speed (NET operation (terminal))*2 FR-A8AX*3	Terminal 6 (FR-A8AZ)	4, 5, 14, 15	0	—
	Terminal 4		Other than 0	1
	Terminal 2			0

*1 When any function is assigned to a terminal by setting **Pr.361 to Pr.364**, **Pr.804**, or **Pr.1285**, the terminal cannot be used for the override compensation signal.

*2 Set **Pr.28 Multi-speed input compensation selection** = "1" to enable analog input compensation while the line speed is commanded according to the multi-speed operation.

*3 Set **Pr.304 Digital input and analog input compensation enable/disable selection** = "2, 3, 12, or 13" to enable analog input compensation while the line speed is commanded using the FR-A8AX.

- Use **Pr.252 Override bias** and **Pr.253 Override gain** to set the override compensation amount.



NOTE

- When any function is assigned to terminal 1 using **Pr.361 to Pr.364**, **Pr.804**, or **Pr.1285**, the override compensation is invalid.

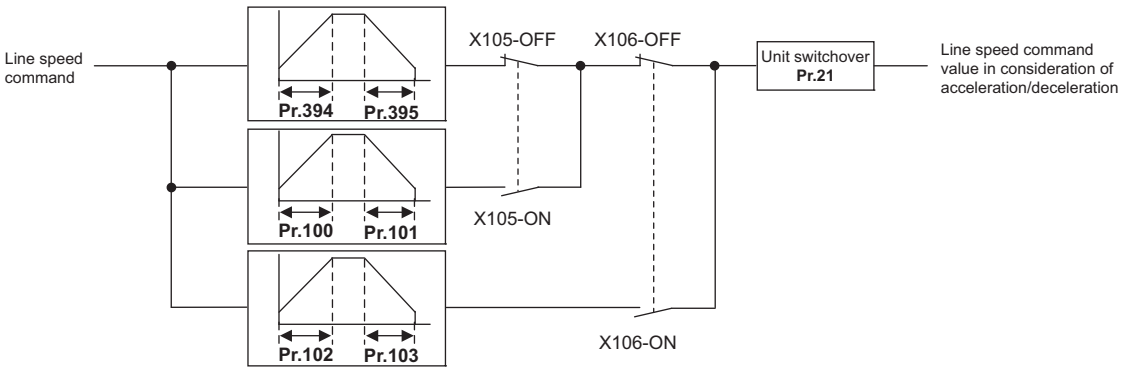
3.5.5 Acceleration/deceleration time setting for line speed command

Set the acceleration/deceleration time for the line speed command.

Pr.	Name	Initial value	Setting range	Description
394 R251	**First acceleration time for line speed command**	15 s	0 to 3600 s	Set the acceleration time (from a stop to **Pr.393**) for the line speed command.
395 R252	**First deceleration time for line speed command**	15 s	0 to 3600 s	Set the deceleration time (from **Pr.393** to a stop) for the line speed command.
100 R253	**Second acceleration time for line speed command**	15 s	0 to 3600 s	Set the second acceleration time for the line speed command.
101 R254	**Second deceleration time for line speed command**	15 s	0 to 3600 s	Set the second deceleration time for the line speed command.
102 R255	**Third acceleration time for line speed command**	15 s	0 to 3600 s	Set the third acceleration time for the line speed command.
103 R256	**Third deceleration time for line speed command**	15 s	0 to 3600 s	Set the third deceleration time for the line speed command.
393 R250	**Line speed command acceleration/deceleration reference**	1000 m/min*1	1 to 6553.4 m/min*1	Set the reference line speed for the acceleration/deceleration time for the line speed.
621 R423	**Allowable deviation from target line speed**	0 m/min*1	0 to 6553.4 m/min*1	The Y237/Y238 signal output range can be set for the target line speed command.

*1 The increment varies depending on the **Pr.358** setting. (Refer to **page 67**.)

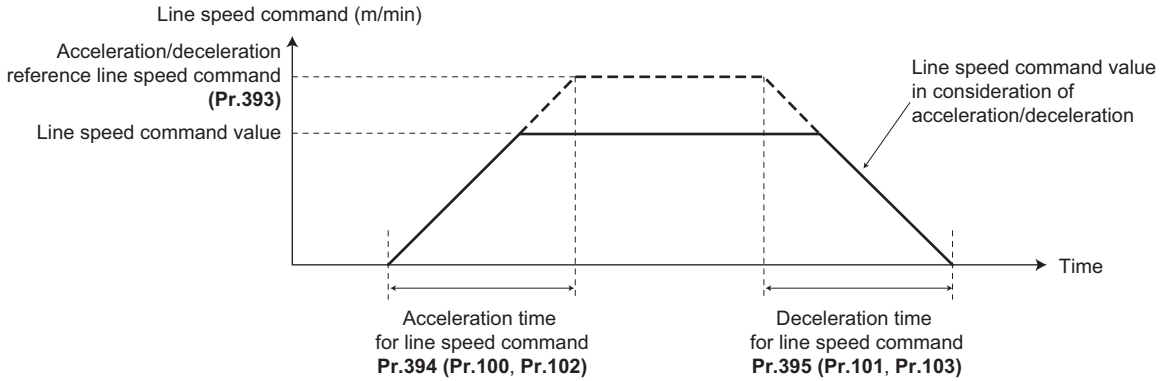
◆Block diagram



◆Acceleration/deceleration time setting (Pr.100 to Pr.103, Pr.393 to Pr.395, X105 signal, X106 signal)

- Settings of acceleration/deceleration time for line speed command are used in the command for accelerating/decelerating the line speed.
- Use **Pr.393 Line speed command acceleration/deceleration reference** for setting time in each parameter.
- Use **Pr.21 Acceleration/deceleration time increments** to set the minimum increment of the acceleration/deceleration time.

Pr.21 setting	Minimum increment
0	0.1 s
1	0.01 s



- The acceleration/deceleration time for the line speed command can be switched using the Acceleration/deceleration time selection signals for line speed command (X105 and X106). For the X105 and X106 signals, assign the function by setting "105 (X105)" or "106 (X106)" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

Signal state		Acceleration/deceleration time	Acceleration/deceleration time setting parameter
X105 signal	X106 signal		
OFF	OFF	First acceleration/deceleration time	**Pr.394**/**Pr.395**
ON	OFF	Second acceleration/deceleration time	**Pr.100**/**Pr.101**
—	ON	Third acceleration/deceleration time	**Pr.102**/**Pr.103**

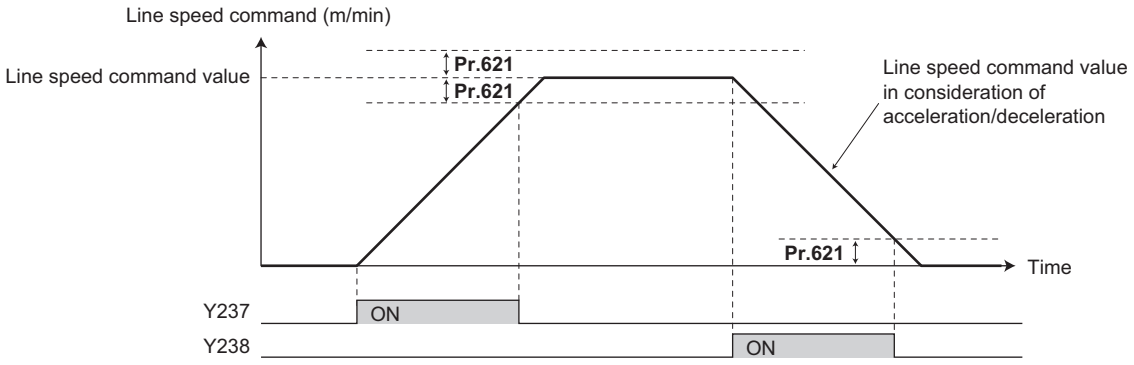
NOTE

- Normally set "0" in **Pr.7 Acceleration time** and **Pr.8 Deceleration time**.

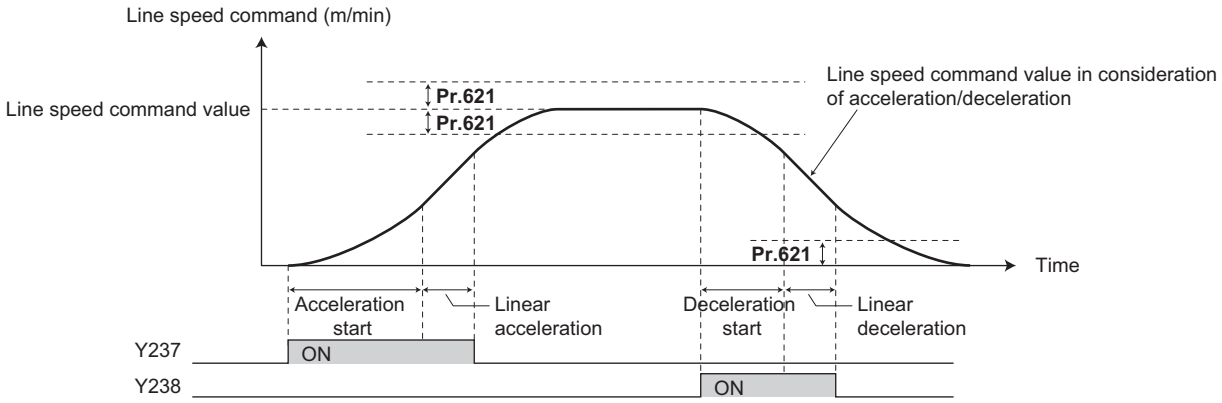
◆Line speed command acceleration/deceleration signal (Pr.621, Y237 signal, Y238 signal)

- The Y237 signal is output while the line speed command value increases. When S-curve acceleration/deceleration is selected for the line speed command (**Pr.1141** = "1"), the signal is output when acceleration is started by the S-curve acceleration/deceleration command or during linear acceleration.
- The Y238 signal is output while the line speed command value decreases. When S-curve acceleration/deceleration is selected for the line speed command (**Pr.1141** = "1"), the signal is output when deceleration is started by the S-curve acceleration/deceleration command or during linear deceleration.
- When using the Y237 and Y238 signals, refer to the following and assign the functions by **Pr.190 to Pr.196 (output terminal function selection)**.

Output signal	Pr.190 to Pr.196 setting	
	Positive logic	Negative logic
Y237	237	337
Y238	238	338



Pr.1141 = "0" (Linear acceleration/deceleration)



Pr.1141 = "1" (S-curve acceleration/deceleration)

NOTE

- When the line speed signal value fluctuates while analog input, etc. is used for the command, the Y237/Y238 signal may repeat ON/OFF. **Pr.621 Allowable deviation from target line speed** can be used to prevent the repetitive ON/OFF operation.
- When the command value for the target line speed and the setting in **Pr.622 Line speed command for starting** are close to each other, the line speed increases and decreases repeatedly and the Y237/Y238 signal may repeat ON/OFF.

3.5.6 Line speed command acceleration/deceleration pattern

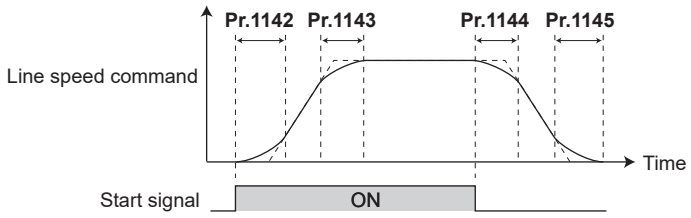
The acceleration/deceleration pattern can be set according to the application.

Pr.	Name	Initial value	Setting range	Description
1141 R290	**Line speed command acceleration/deceleration pattern**	0	0	Linear acceleration/deceleration
			1	S-curve acceleration/deceleration
1142 R291	**Line speed command acceleration start S-curve time**	0.1 s	0.1 to 2.5 s	Set times for S-curve acceleration/deceleration. The settings are also used for the inertia compensation cushion time. The settings are valid for S-curve acceleration/deceleration (**Pr.1141** = "1"). Refer to page 157 for the inertia compensation function.
1143 R292	**Line speed command acceleration completion S-curve time**	0.1 s	0.1 to 2.5 s	
1144 R293	**Line speed command deceleration start S-curve time**	0.1 s	0.1 to 2.5 s	
1145 R294	**Line speed command deceleration completion S-curve time**	0.1 s	0.1 to 2.5 s	

- Use **Pr.1142** to **Pr.1145** to set times for S-curve acceleration/deceleration.
- Set times to start acceleration (**Pr.1142**), complete acceleration (**Pr.1143**), start deceleration (**Pr.1144**), and complete deceleration (**Pr.1145**) for S-curve acceleration/deceleration.
- When the S-curve acceleration/deceleration is set, the acceleration/deceleration time becomes longer, as shown below. The set acceleration/deceleration time T1 indicates the actual time taken for linear acceleration/deceleration as calculated based on **Pr.394**, **Pr.395**, and **Pr.100** to **Pr.103**.

Actual acceleration time T2 = set acceleration time T1 +
(acceleration start S-curve time + acceleration completion S-curve time) / 2

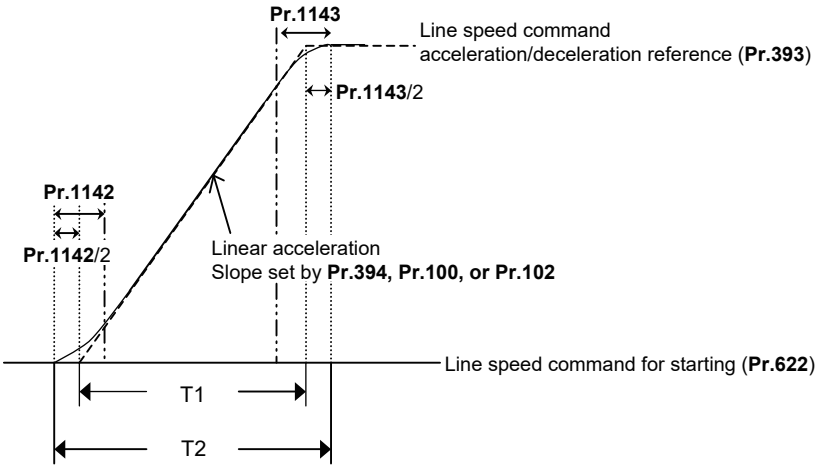
Actual deceleration time T2 = set deceleration time T1 +
(deceleration start S-curve time + deceleration completion S-curve time) / 2



NOTE

- Even if the start signal is turned OFF during acceleration, the inverter does not decelerate immediately to avoid sudden frequency change. (Likewise, the inverter does not immediately accelerate when deceleration is changed to re-acceleration by turning ON the start signal during deceleration, etc.)

- The following section shows the actual acceleration time required to start the inverter by selecting S-curve acceleration/deceleration from a stop to the target line speed command value in the conditions shown in the setting example.



[Setting example]

Target line speed command = 1000 m/min

Pr.1142 = “0.1 s”

Pr.1143 = “0.1 s”

Pr.393 = “1000 m/min”

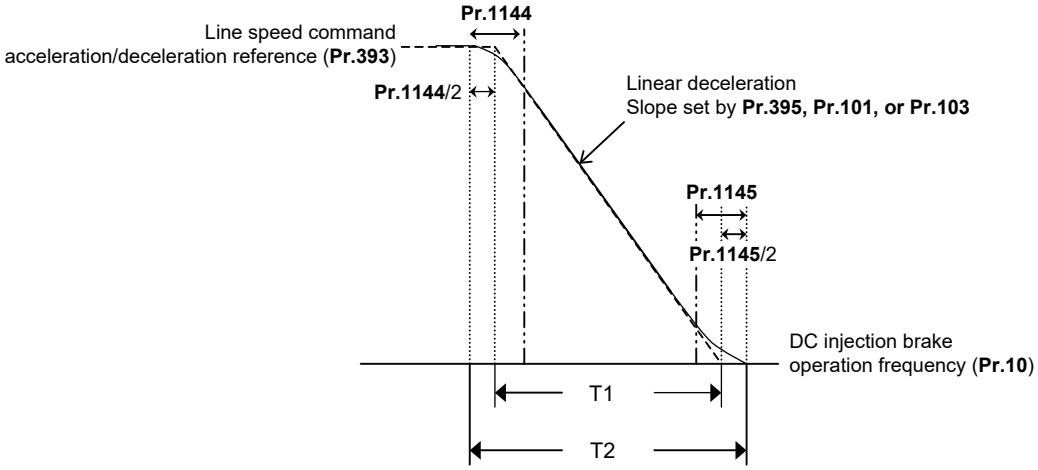
Pr.394 = “15 s”

Pr.622 = “0 m/min”

Set acceleration time T1	= (target line speed command - **Pr.622**) × **Pr.394** / **Pr.393** = (1000 m/min - 0 m/min) × 15 s / 1000 m/min = 15 s (actual acceleration time for linear acceleration)
Actual acceleration time T2	= set acceleration time T1 + (**Pr.1142** + **Pr.1143**) / 2 = 15 s + (0.1 s ＋ 0.1 s) / 2 = 15.1 s (acceleration time for S-curve acceleration)

Dancer feedback speed control details

- The following section shows the actual deceleration time required to stop the inverter by selecting S-curve acceleration/deceleration from the target line speed command value to 0 m/min in the conditions shown in the setting example.



[Setting example]

Target line speed command = 1000 m/min

Pr.1142 = “0.1 s”

Pr.1143 = “0.1 s”

Pr.393 = “1000 m/min”

Pr.394 = “15 s”

Pr.10 = “0 Hz”

Set deceleration time T1 = (target line speed command - **Pr.10**) × **Pr.395** / **Pr.393**
= (1000 m/min - 0 Hz) × 15 s / 1000 m/min
= 15 s (actual deceleration time for linear deceleration)

Actual deceleration time T2 = set deceleration time T1 + (**Pr.1144** + **Pr.1145**) / 2
= 15 s + (0.1 s + 0.1 s) / 2
= 15.1 s (deceleration time for S-curve deceleration)

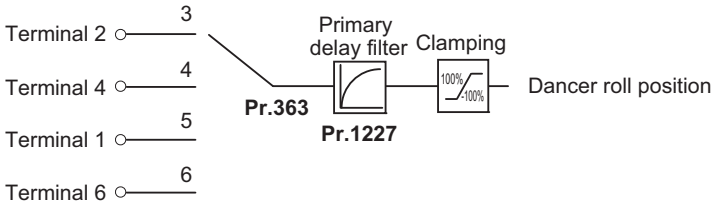
3.5.7 Dancer roll setting

Set the target position for the dancer roll control.

Select the input method to the inverter (analog input terminal) for dancer signal input.

Pr.	Name	Initial value	Setting range	Description
133 R101 (A611)	**PID action set point**	500%	400 to 600%	Set the set point for the dancer roll control.
363 R102	**Dancer / tension sensor feedback input selection**	9999	3	The measured value is input through terminal 2.
			4	The measured value is input through terminal 4.
			5	The measured value is input through terminal 1.
			6	The measured value is input through terminal 6 (FR-A8AZ).
			9	The measured value is input via CC-Link / CC-Link IE Field Network Basic communication.
			9999	No function
1227 R103	**Dancer / tension sensor feedback input filter time constant**	0	0	Without filter
			0.01 to 5 s	Set the primary delay filter for the dancer signal input value.
1382 R150	**PID set point cushion time**	0s	0 to 360s	Set the cushion time required to reach the PID set point.

◆Block diagram



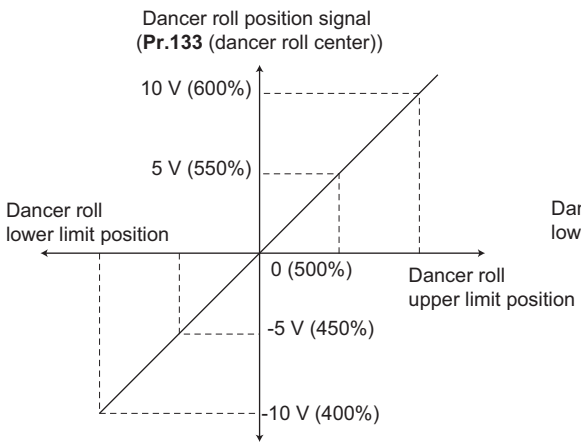
◆PID set point (Pr.133)

- Set the target position (neutral position) of the dancer roll in **Pr.133 PID action set point**.

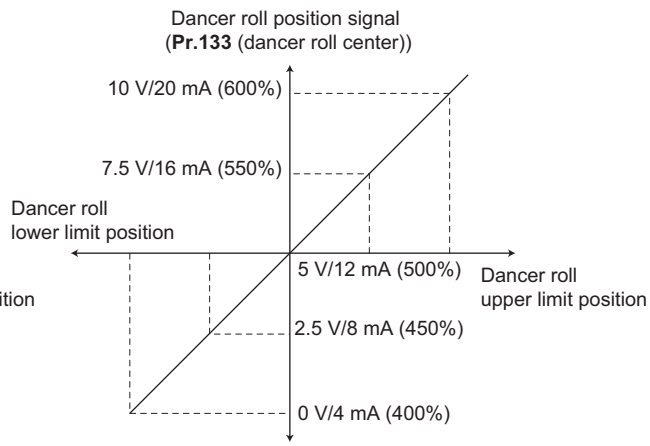
Pr.133 setting	Actual set point
600%	+100%
500% (initial setting)	0%
400%	-100%

- If the position signal input from the dancer roll through terminal 1 is 10 V at the upper limit position, -10 V at the lower limit position, and 0 V at the neutral position (target position), set 500% in **Pr.133**. If the signal is -5 V at the neutral position (target position), set 450% in **Pr.133**. A voltage from -10 V to 10 V can be input through terminal 1.

Dancer signal input through terminal 1, terminal 6



Dancer signal input through terminal 2, terminal 4

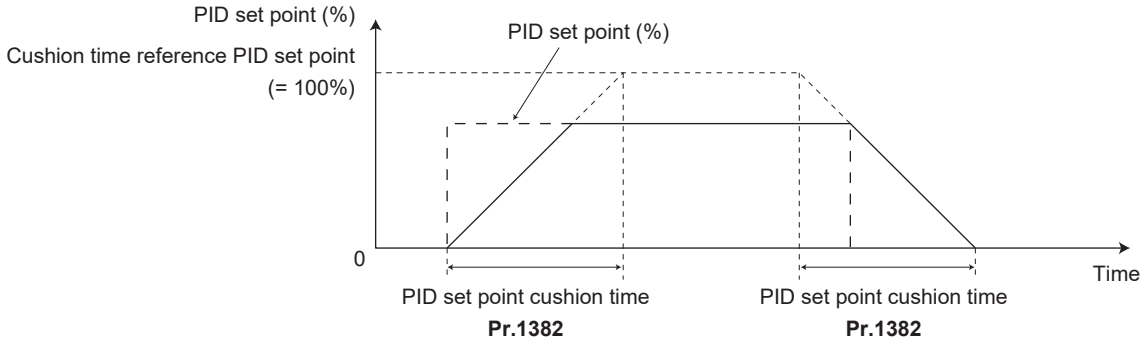


NOTE

- Set "86" in **Pr.52** to monitor the dancer roll position in %. When the negative indication is invalid, the monitored value is indicated as an offset from 1000%.

◆PID set point cushion time (Pr.1382)

- Use **Pr.1382 PID set point cushion time** to set the time required for the PID set point to reach 100% (-100%) from 0%.



◆Taper function for the PID set point

- FTP can be replaced with the PID set point after taper control, and F* with the PID set point after the cushion time. (For details on FTP and F*, refer to **page 151**.)
- The taper ratio is the reduction ratio against 100% (the PID set point set in **Pr.133** is regarded as 100%). When the taper ratio setting is 20% in the example of linear taper control, the PID set point after taper control is 80% of the original value.
- When the taper function is used for the set point, set **Pr.1284 Taper mode selection** ≠ "0", **Pr.364 Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1** = "9999", and **Pr.430 Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2** = "9999".
- When the PID set point after the cushion time is negative, the limit is set at 0%.
- When the taper function is used for the set point, calibrate the settings so that 0% is equivalent to 0 N.

NOTE

- When the analog signal output for dancer tension setting is enabled (**Pr.364** ≠ "9999" or **Pr.430** ≠ "9999"), the taper function is enabled for the analog signal output for dancer tension setting. (Refer to **page 108**.)

◆Dancer signal input selection (Pr.363)

- Use **Pr.363 Dancer / tension sensor feedback input selection** to select the input terminal for the dancer signal (measured value).

Pr.363 setting	Input terminal
3	Terminal 2 (0 to 100%) (0 to 5 V)*1
4	Terminal 4 (20 to 100%) (4 to 20 mA)*1
5 (initial value)	Terminal 1 (-100 to 100%) (-10 to 10 V)*1
6	Terminal 6 (FR-A8AZ) (-100 to 100%) (-10 to 10 V)*1
9	CC-Link or CC-Link IE Field Network Basic (-100 to 100%)

*1 The input specification in the initial setting is indicated.

- When **Pr.363** = "9", dancer / tension sensor feedback can be input via CC-Link or CC-Link IE Field Network Basic communication.
- The 16-bit feedback signal input via communication is recognized as a signed signal. The input data range is from -10000 (-100.00%) to +10000 (+100.00%). When out-of-range values are input, the limit is set at ±10000 (±100.00%).

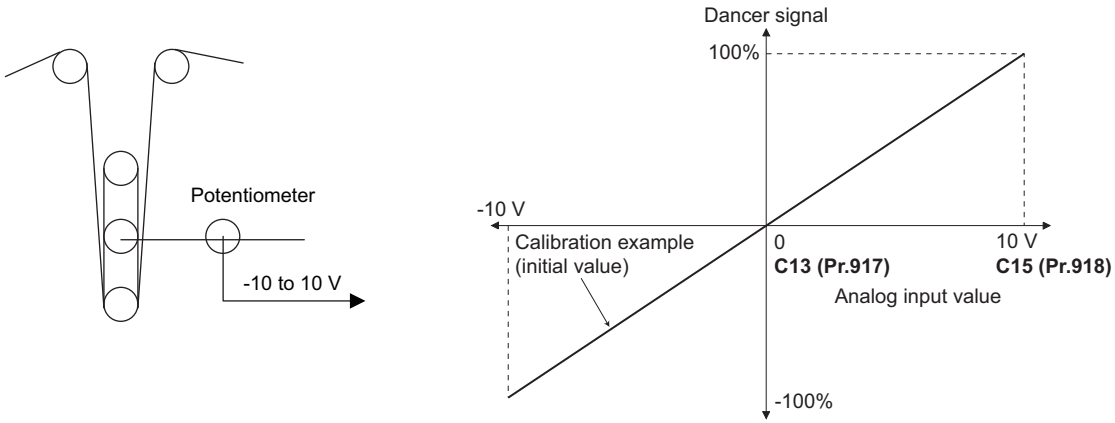
◆Dancer signal calibration example

- The following parameters are used for calibrating the dancer signal according to the input terminal. The dancer signal analog input values at both 0% and 100% can be calibrated.

Input terminal	Calibration parameter
Terminal 2 (0 to 100%)	**C3 (Pr.902)**, **C4 (Pr.903)**
Terminal 4 (0 to 100%)*1	**C6 (Pr.904)**, **C7 (Pr.905)**
Terminal 1 (-100 to 100%)	**C13 (Pr.917)**, **C15 (Pr.918)**
Terminal 6 (FR-A8AZ) (-100 to 100%)	**C31 (Pr.926)**, **C33 (Pr.927)**
CC-Link, CC-Link IE Field Network Basic	—

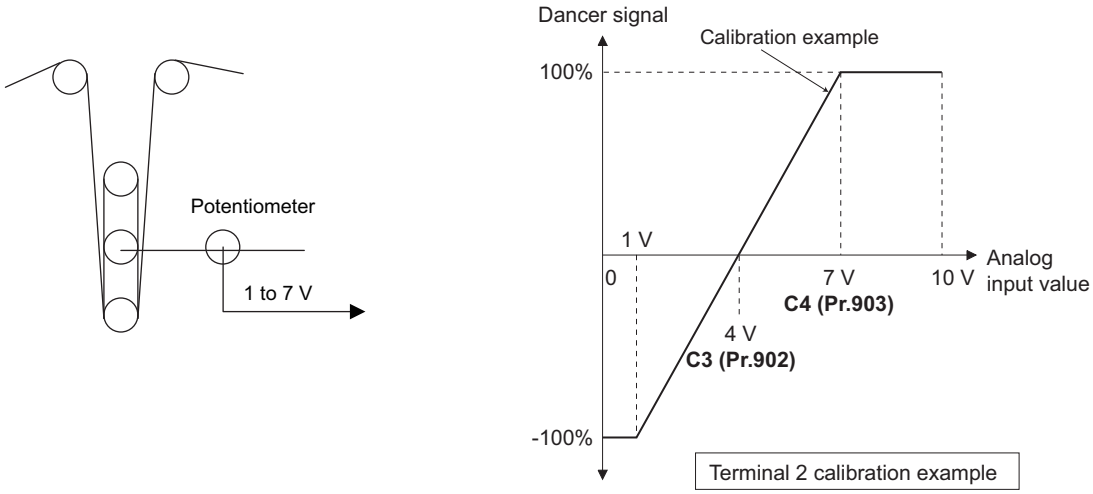
*1 The initial input range is 20 to 100%.

- In the following example, a potentiometer with the output range of -10 to 10 V is used for inputting the dancer signal to terminal 1 (input range: -10 to 10 V). The neutral position is defined as 0% for the calibration. **C13 (Pr.917) Terminal 1 bias (speed)** and **C15 (Pr.918) Terminal 1 gain (speed)** are used for calibration.



Terminal 1 calibration example

- In the following example, a potentiometer with the output range of 1 to 7 V is used for inputting the dancer signal to terminal 2 (input range: 0 to 10 V). The neutral position is defined as 0% for the calibration. **C3 (Pr.902) Terminal 2 frequency setting bias** and **C4 (Pr.903) Terminal 2 frequency setting gain** are used for calibration.



Terminal 2 calibration example

NOTE

- The dancer signal is clamped at ±100%.
- For the details of **C3 (Pr.902)**, **C4 (Pr.903)**, **C6 (Pr.904)**, **C7 (Pr.905)**, **C13 (Pr.917)**, and **C15 (Pr.918)**, refer to the FR-A800 Instruction Manual (Detailed).

◆Dancer signal input filter (Pr.1227)

- Use **Pr.1227 Dancer / tension sensor feedback input filter time constant** to set the primary delay filter for the dancer signal input value. When **Pr.1227** = "0", the filter is not set.

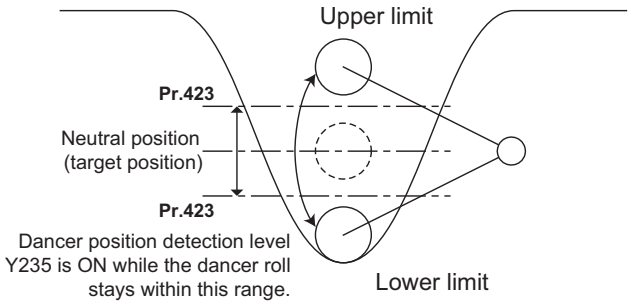
3.5.8 Dancer roll position detection

A signal is output while the dancer roll position value maintains the specified normal level.

Pr.	Name	Initial value	Setting range	Description
423 R422	**Dancer / tension sensor feedback detection level**	10%	0 to 100%	Set the normal position range of the dancer roll. Define the percentage of deviation with respect to the target position.

◆Dancer roll position detection (Pr.423, Y235 signal)

- The Dancer / tension sensor feedback detection level (Y235) signal is output when the dancer roll, which is viewed from the target position, is within the range set in **Pr.423 Dancer position / tension feedback detection**.
- For the Y235 signal, set "235 (positive logic) or 335 (negative logic)" in one of **Pr.190 to Pr.196 (output terminal function selection)** to assign the function to the output terminal.



3.5.9 PID offset displacement

Pr.424 is used to calibrate the reference value of the dancer roll position (PID measured value).

Pr.	Name	Initial value	Setting range	Description
424 R104	**Dancer / tension sensor feedback input offset**	500%	400 to 600%	The offset displacement input value is written.

◆PID offset displacement (Pr.424, X102 signal)

- When the dancer roll is in the user-specified position (set as the reference value), an offset can be added to the PID measured value by turning on the X102 signal. The dancer roll position can also be set to 0% by turning on the X102 signal.
- At the ON edge of the X102 signal, the present input value (-100 to 100%) is written in **Pr.424 Dancer / tension sensor feedback input offset**. A value within the range from 400 to 600% is written in **Pr.424**, considering the measured value of 0% as 500%.
- Measured value (after the offset) = Measured value (before the offset) - **Pr.424** (offset value)

NOTE

- The measured value (after the offset) is limited within the range of ±100%.

3.5.10 Dancer roll malposition detection

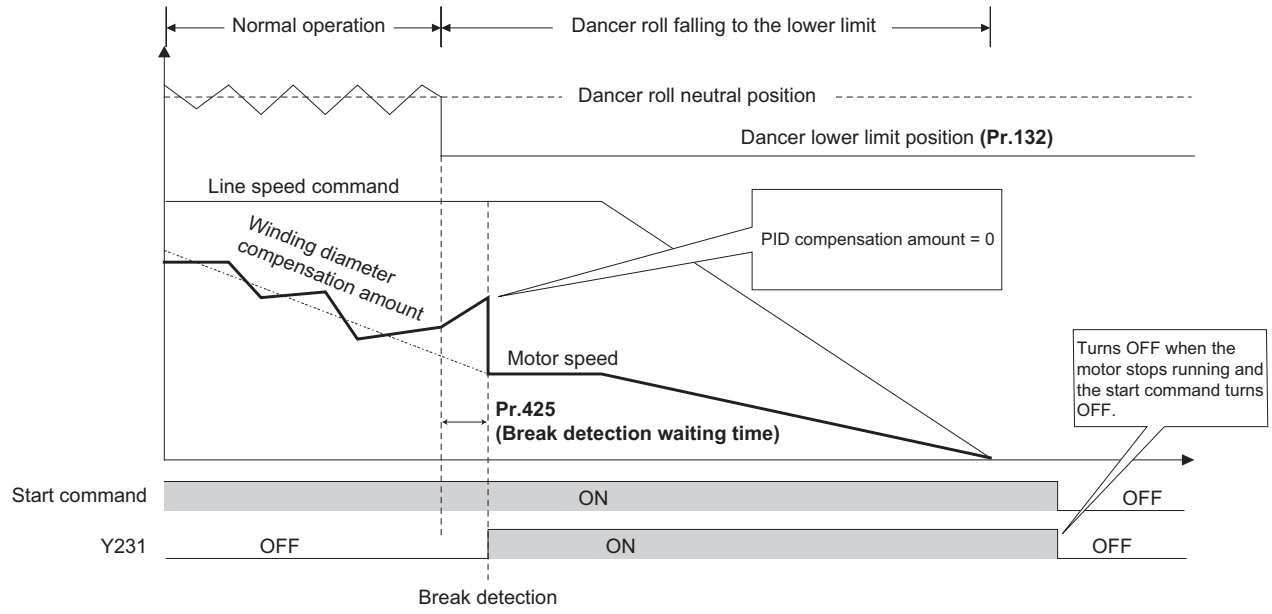
When a break occurs and the dancer roll falls, dancer feedback speed control is used to prevent the motor speed from increasing.

Pr.	Name	Initial value	Setting range	Description
131 A601	PID upper limit	9999	400 to 600%	Set the value for outputting the PID upper limit (FUP) signal.
			9999	No function
132 A602	PID lower limit	9999	400 to 600%	Set the value for outputting the PID lower limit (FDN) signal.
			9999	No function
137 R163	PID upper/lower limit hysteresis width	9999	0 to 100%	Set the hysteresis width for the FUP and FDN signals.
			9999	No function
425 R160	Break detection waiting time	9999	0 to 100 s	Set the time until the dancer roll malposition is determined.
			9999	Break detection disabled
553 A603	PID deviation limit	9999	0 to 100%	The Y48 signal is output when the absolute value of the deviation exceeds the deviation limit value.
			9999	No function
554 A604	PID signal operation selection	0	0 to 3	The action when the upper or lower limit for a measured value input is detected or when a limit for the deviation is detected can be selected.

◆Dancer roll malposition detection (break detection) (Pr.131, Pr.132, Pr.425)

- Set the upper limit of the dancer roll position in **Pr.131 PID upper limit**. Set the lower limit of the dancer roll position in **Pr.132 PID lower limit**.
- When the dancer roll position goes higher than the position set in **Pr.131**, the FUP signal is output. When the position goes lower than the position set in **Pr.132**, the FDN signal is output.
- When the dancer roll position remains higher than the position set in **Pr.131** or lower than the position set in **Pr.132** for the time set in **Pr.425 Break detection waiting time** or longer, the condition is determined as the dancer roll malposition (break), and compensation by PID control becomes 0. The winding diameter at the time of malposition detection is retained.
- When the dancer roll malposition (break) is detected, the Break detection (Y231) signal can be output.
- When the following two conditions are both met, dancer feedback speed control (PID calculation) is resumed.
  - The motor is stopped or output is shutoff.
  - The start signal is OFF.
- For using each signal, use **Pr.190** and **Pr.196 (output terminal function selection)** to assign the function referring to the following table.

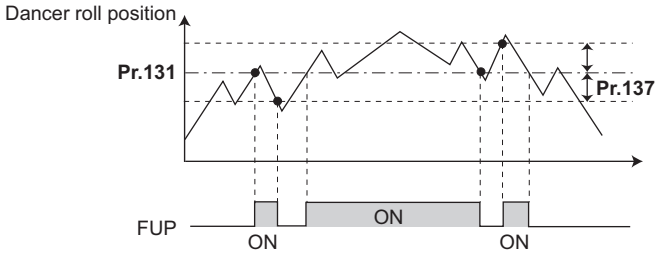
Output signal	Pr.190 to Pr.196 setting	
	Positive logic	Negative logic
FDN	14	114
FUP	15	115
Y231	231	331



◆PID upper/lower limit hysteresis width (Pr.137)

When the dancer roll position fluctuates, the FUP/FDN signal may chatter (turn ON and OFF repeatedly), depending on the position.

To prevent the signal chattering, configure **Pr.137 PID upper/lower limit hysteresis width** to set a hysteresis for the FUP and FDN signals.



Example of the PID upper limit (FUP) signal

NOTE

- **Pr.137** setting does not affect the operation of the Y231 signal. (Refer to page 89 for the details of the Y231 signal.)
- When a value other than "9999" is set in **Pr.137**, depending on fluctuation of the dancer roll position, the FUP/FDN signal may not be turned ON even if the dancer roll position exceeds the **Pr.131** setting or falls below the **Pr.132** setting.

◆Operation selection when a limit is detected (Pr.554, FUP signal, FDN signal, Y48 signal)

- Using **Pr.554 PID signal operation selection**, set the action when the measured value input exceeds the upper limit (**Pr.131 PID upper limit**) or lower limit (**Pr.132 PID lower limit**), or when the deviation input exceeds the permissible value (**Pr.553 PID deviation limit**).
- Choose whether to output the signals (FUP, FDN, Y48) only or to activate the protective function to output the inverter shutoff.

Pr.554 setting	Inverter operation	
	FUP, FDN	Y48
0 (initial value)	Signal output only	Signal output only
1	Signal output + output shutoff (E.PID)	
2	Signal output only	Signal output + output shutoff (E.PID)
3	Signal output + output shutoff (E.PID)	

NOTE

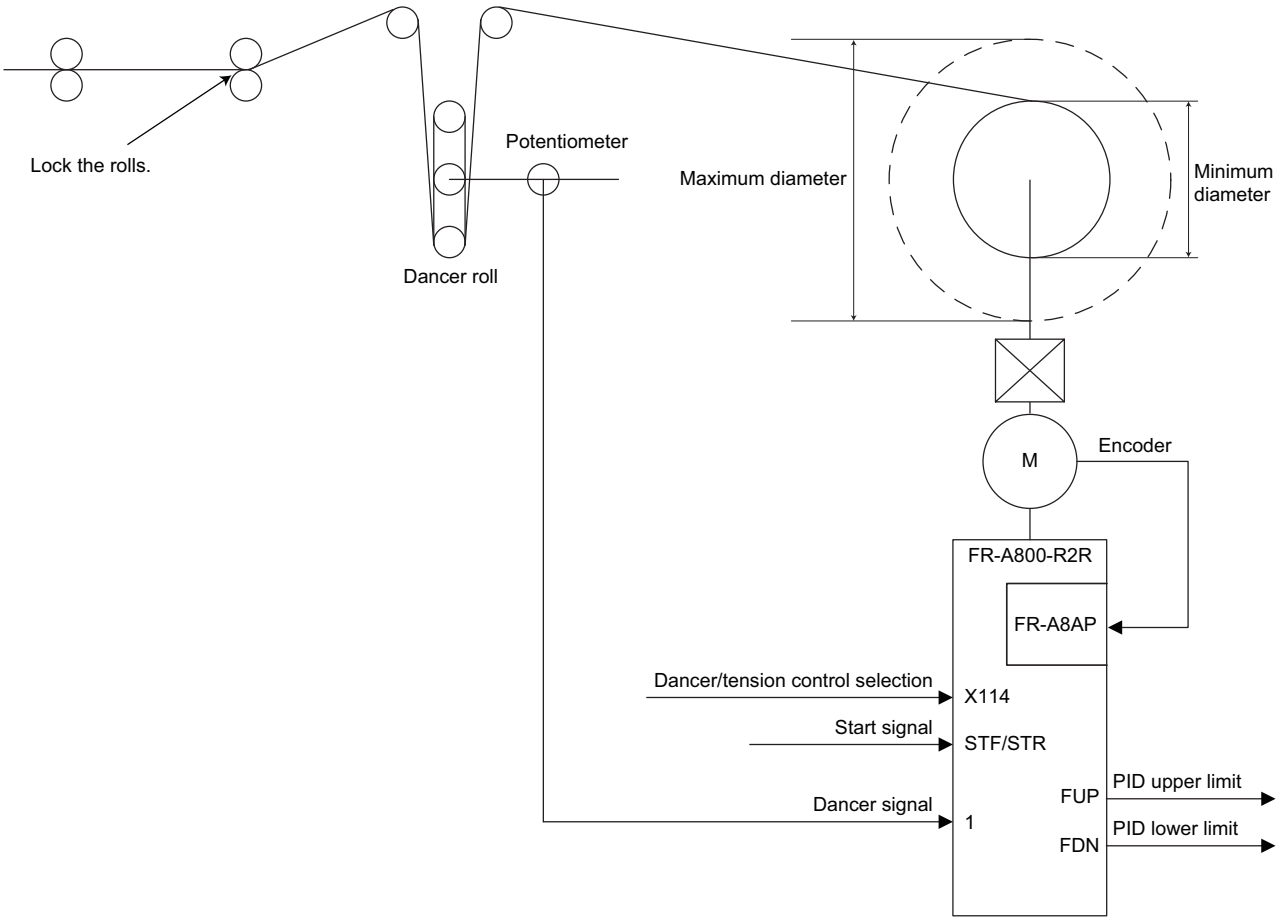
- When each of **Pr.131**, **Pr.132** and **Pr.553** settings corresponding to each of the FUP, FDN and Y48 signals is "9999" (no function), signal output and protective function are not available.

3.5.11 Tension PI gain tuning

During dancer/tension feedback speed control, the PI gain is automatically set by changing the PID manipulated amount and measuring the PID response.
PI gain automatic tuning facilitates setting of PID gain.
The tension PI gain tuning can be performed either while the system is stopped or in operation.

Pr.	Name	Initial value	Setting range	Description
554 A604	**PID signal operation selection**	0	0 to 3	The action when the upper or lower limit for a measured value input is detected or when a limit for the deviation is detected can be selected.
1211 R171	**Tension PI gain tuning timeout time**	50 s	1 to 9999 s	Set the timeout time.
1215 R172	**Limit cycle output upper limit**	0%	0 to 100%	Set the output upper limit for the amount of positive manipulation.
1217 R173	**Limit cycle hysteresis**	1%	0.1 to 10%	Set the hysteresis of the set point.
1219 R170	**Tension PI gain tuning start/ status**	0	0	Tension PI gain tuning is not performed. (Read only)
			1	Tension PI gain tuning starts.
			8	Tension PI gain tuning is forcibly terminated.
			2, 3, 9, 12, 13, 90 to 96	Tuning status is indicated. (Read only)
1222 R175	**Target amplitude**	9999	0 to 100%	Set the target amplitude for the limit cycle.
			9999	Tension PI gain tuning during a stop is disabled.
1223 R174	**Manipulated amount for operation**	1%	0 to 10%	Set the amount for manipulation to fit the value to the set point.
1226 R176	**Tension PI gain tuning response level setting**	2	1 to 7	Set the response level.

◆System configuration example



◆Tension PI gain tuning

- The limit cycle method is used to perform tension PI gain tuning.
- In the limit cycle method, the manipulated amount is output ten times in square waves using the actual system. Gain is calculated from the commanded amplitude (M), vibration amplitude (Xc), and vibration cycle (Tc).
- The PI gain calculation result is automatically applied to the relevant parameter.

◆Before performing tension PI gain tuning

- Tension PI gain tuning can be performed when the system is stopped, or while the system is in operation.
- Tension PI gain tuning while the system is in operation is performed if the response is still slow after the tension PI gain tuning at a system stop is performed.

Tuning method	Purpose
Tension PI gain tuning during stopping	Automatic tuning of the PI gain
Tension PI gain tuning during operation	Tuning for increasing the accuracy, to be performed if the response is still slow after the PI gain tuning during stopping is performed.

NOTE

- Tension PI gain tuning during stopping is not available under Real sensorless vector control. Perform the operation under the control method other than Real sensorless vector control.
- After tension PID gain tuning is completed normally, the settings of the PID constant parameters (**Pr.129** and **Pr.130**) are automatically changed. Before performing tension PI gain tuning, save the PID constant parameter settings as required.
- During tension PI gain tuning, set **Pr.131 PID upper limit**, **Pr.132 PID lower limit**, **Pr.553 PID deviation limit** according to the system.
- The tuning result varies depending on the winding diameter because of the different inertia. If the PID control gain response level is slow when the winding diameter and the inertia values are large, set a large value in **Pr.820 Speed control P gain 1**.
- When offline auto tuning and tension PI gain tuning are attempted at the same time, offline auto tuning is performed. A setting error occurs for tension PI gain tuning.
- When online auto tuning at startup and offline auto tuning are attempted at the same time, online auto tuning at startup is performed first, and then offline auto tuning is performed.

◆Tension PI gain tuning procedure (system stopped)

1 Tuning preparation

Fix the shafts other than the target shaft for tension PI gain tuning so that the workpiece does not move.
Check that forward/reverse operation of the target shaft causes no problem.

2 Parameter setting

Set the following parameters for tension PI gain tuning. Start the setting of **Pr.1222** with a small value (about 1%) and then gradually increase the setting value as required.

Pr.	Name	Setting
73	Analog input selection	10 to 17 (Polarity reversible operation enabled.) (For the details of **Pr.73**, refer to the FR-A800 Instruction Manual (Detailed).)
646	Stored winding diameter	When the initial winding diameter calculation is invalid, set the winding diameter value.
1219	Tension PI gain tuning start/status	1 (Tension PI gain tuning starts.)
1222	Target amplitude	1%

3 Tuning

Enter the start command to start the test operation. Check the behavior of the workpiece and the motor.
The inverter output is shut off after the tuning is complete. If tuning completes normally, "3" will be displayed in **Pr.1219**.
As required, perform tension PI gain tuning while the system is in operation.
Check the accelerating/decelerating operation or the operation with different winding diameters, and adjust the response level as required.

Pr.	Name
1226	Tension PI gain tuning response level setting

4 Finishing tuning

Turn OFF the start command to finish tuning.

When the polarity reversal operation is not required, set **Pr.73** back to the previous value.

NOTE

- To forcibly finish tuning, perform any of the following:
  Set "8" in **Pr.1219**.
  Turn OFF the start signal.
  Inverter reset
  Turn ON the MRS signal.

⚠CAUTION

- **When tension PI gain tuning is started, the motor is automatically started and the dancer roll starts moving. If the value set in Pr.1222 under dancer feedback control is too large, the dancer roll may hit against the system and cause damage.**

◆Tension PI gain tuning procedure (during operation)

POINT

- Perform tension PI gain tuning during stopping first, and then perform tension PI gain tuning during operation as required.

1 Parameter setting

Set the following parameter.

Pr.	Name	Setting
646	Stored winding diameter	When the initial winding diameter calculation is invalid, set the winding diameter value.

2 Operation

Start the inverter normally.

3 Tuning

Set "1" in **Pr.1219 Tension PI gain tuning start/status** or turn ON the Tension PI gain tuning start / forced end (PGT) signal during operation to start tuning. To input the PGT signal, set "81" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.

The inverter returns to normal operation after the tuning is complete. If tuning completes normally, "13" will be displayed in **Pr.1219**.

NOTE

- To finish tuning forcibly, perform any of the following:
  Set "8" in **Pr.1219**.
  Turn OFF the Tension PI gain tuning start / forced end (PGT) signal.
  Turn OFF the start signal.
  Inverter reset
  Turn ON the MRS signal.
- If "1" is already set in **Pr.1219** or the PGT signal is ON when the power is supplied to the inverter, tuning does not start by starting the start command.

⚠CAUTION

- **If the value set in Pr.1222 under dancer feedback control is too large, the dancer roll may hit against the system and cause damage.**

◆Tension PI gain tuning adjustment parameter

• Before performing tension PI gain tuning, adjust the following parameters as required.

Pr.	Name	Necessity of parameter setting		Description
		Tension PI gain tuning at a stop	Tension PI gain tuning during operation	
1211	Tension PI gain tuning timeout time	*1	*1	Set the timeout time for tension PI gain tuning.
1215	Limit cycle output upper limit	—*2	○*3	Set the output upper limit for the amount of positive manipulation for tension PI gain tuning.
1217	Limit cycle hysteresis	—*2	*1	Set the hysteresis of the set point to perform tension PI gain tuning.
1219	Tension PI gain tuning start/ status	○	○*4	Set to indicate the condition of tension PI gain tuning, or start/terminate the tuning.
1222	Target amplitude	○	—	Set the target amplitude for the limit cycle. Start tuning with a small value and gradually increase the value while making sure that tuning causes no problem.
1223	Manipulated amount for operation	*1	—	Set the amount for manipulation to fit the value to the set point.
1226	Tension PI gain tuning response level setting	*1	*1	Set the response level of tension PI gain tuning in the range from "1" (slow) to "7" (fast).

○: Setting required, —: Setting not required

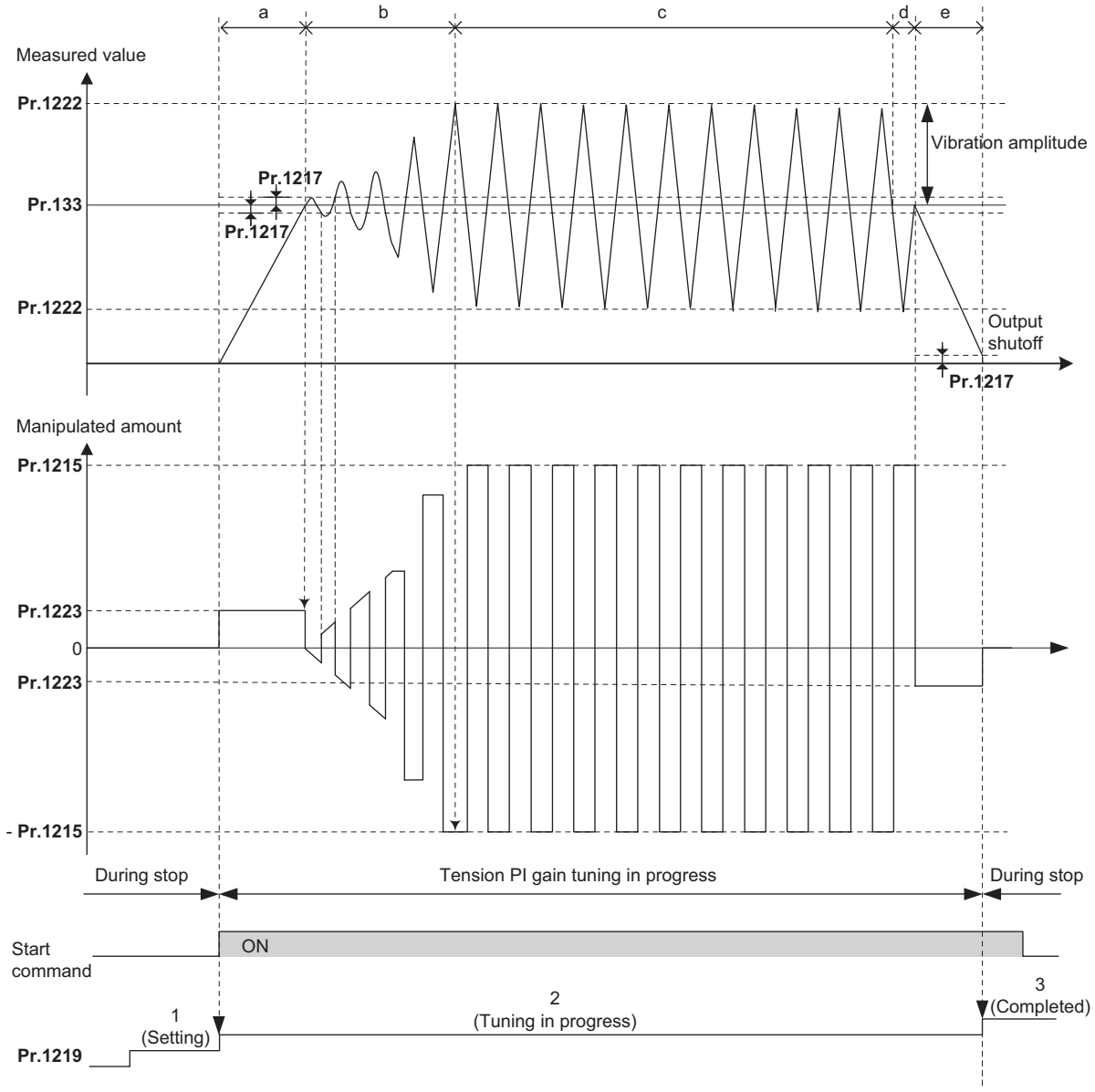
*1 The setting can be adjusted. Adjust the setting as required.

*2 After the tuning, the result is set automatically.

*3 If the approximate setting value is unknown, use the result of the PI gain tuning during stopping.

*4 The PGT signal can be also used for starting or terminating the tuning.

◆Tension PI gain tuning during stopping

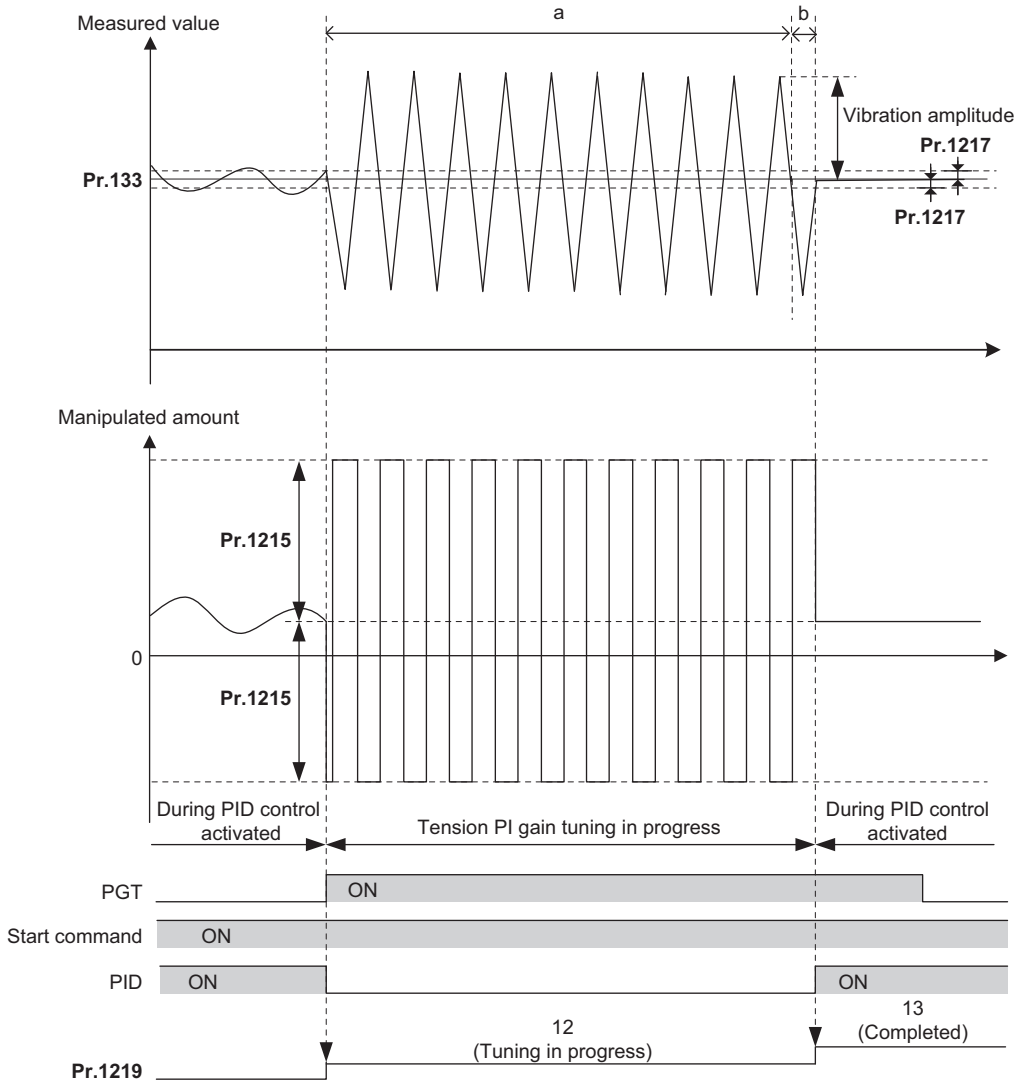


Status	Tuning operation
a	Operate as per the amount set in **Pr.1223 Manipulated amount for operation**, to fit PID value to the setting of **Pr.133 PID action set point**.
b	When the PID value reaches the **Pr.1222** setting, tension PI gain tuning starts.
c	Tension PI gain tuning is in progress.
d	Calculate PI gain. The PI gain response level can be set with **Pr.1226 Tension PI gain tuning response level setting**.
e	Operate as per the amount set in **Pr.1223** to lower the PID measured value.

• The tuning results are applied to the following parameters.

Pr.	Name
129	PID proportional band
130	PID integral time
1215	Limit cycle output upper limit
1217	Limit cycle hysteresis

◆Tension PI gain tuning during operation



Status	Tuning operation
a	Tension PI gain tuning is in progress. Refer to the manipulated amount when the tuning is started, and use the setting in **Pr.1215 Limit cycle output upper limit** to increase/decrease the manipulated amount to adjust the amplitude of the measured value.
b	Calculate PI gain. The PI gain response level can be set with **Pr.1226 Tension PI gain tuning response level setting**.

• The tuning results are applied to the following parameters.

Pr.	Name
129	PID proportional band
130	PID integral time

◆Tension PI gain tuning status indicator

- The tension PI tuning status can be checked by reading the **Pr.1219** setting. Alternatively, check the tension PI gain tuning monitor, which is displayed instead of the output voltage monitor.
- The monitor is displayed on the operation panel as shown below.

Status	Monitor readout of Pr.1219 Tension PI gain tuning status	
	Tuning during stopping	Tuning during operation
Not performed	0	—
Tuning start	1	—
Tuning in progress	2	12
Tuning completed	3	13
Forced end	8	
Tuning error	9, 90 to 96	

NOTE

- When the tuning is forcibly terminated or a tuning error is displayed, tension PI gain tuning has not been properly completed.

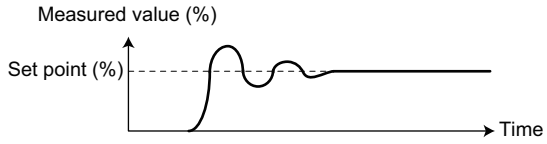
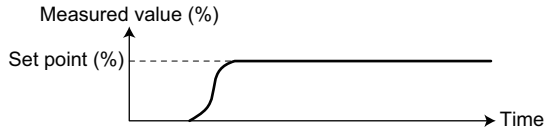
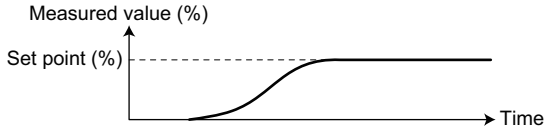
◆Tuning error causes and corrective actions

- If a tuning error occurs, refer to the following for corrective actions.

Error indication	Name	Possible cause	Corrective action
8	Forced end	The start signal has been turned OFF. The PGT signal has been turned OFF. The inverter has been reset. An output shutoff has occurred.	—
9	Protective function activation	An inverter protective function has been activated.	Refer to the FR-A800 Instruction Manual (Detailed) to identify the cause and take corrective actions.
90	Input upper limit error	A value higher than the **Pr.131 PID upper limit** setting is measured while **Pr.554 PID signal operation selection** = "1 or 3".	Check the **Pr.131** and **Pr.554** settings.
91	Input lower limit error	A value lower than the **Pr.132 PID lower limit** setting is measured while **Pr.554 PID signal operation selection** = "1 or 3".	Check the **Pr.132** and **Pr.554** settings.
92	Deviation limit error	The deviation is higher than the **Pr.553 PID deviation limit** setting while **Pr.554 PID signal operation selection** = "2 or 3".	Check the **Pr.553** and **Pr.554** settings.
93	Timeout error	Tension PI gain tuning is not terminated within the time set in **Pr.1211 Tension PI gain tuning timeout time**.	Set a larger value in **Pr.1211**.
94	Calculation error	The tuning calculation is inconsistent. Vibration amplitude Xc is equal to or lower than the amount of hysteresis. **Pr.1222 Target amplitude** is lower than the amount of hysteresis.	• Tuning during stopping The dancer signal may include noise. Set a larger value in **Pr.1222** or take countermeasures against noise to reduce the dancer signal noise. • Tuning during operation Check the settings of **Pr.1222** and **Pr.1217 Limit cycle hysteresis**. The **Pr.1222** setting must be higher than the **Pr.1217** setting.
95	Setting error	PID control is disabled during tension PI gain tuning. The PID control setting has been changed during tension PI gain tuning.	Check that PID control can be performed normally.
96	PID mode error	The switchover frequency is not reached while **Pr.127 PID control automatic switchover frequency** is set. The stall prevention or regeneration avoidance function is activated. Frequency fluctuation occurred because of the frequency jump, maximum frequency, or minimum frequency.	Set "9999" in **Pr.127**. Refer to the FR-A800 Instruction Manual (Detailed) to check the setting.

◆Fine adjustment after tension PI gain tuning

• If fine adjustment is required after completion of tension PI gain tuning, adjust the proportional band (**Pr.129**), integral time (**Pr.130**), and differential time (**Pr.134**).

Status of measurement values	Adjustment method
The response is fast, but vibrations are observed. 	• Increase the proportional band (**Pr.129**). (Smaller proportional effect) • Increase the integral time (**Pr.130**). (Smaller integral effect)
Optimal 	—
Response is slow. 	• Decrease the proportional band (**Pr.129**). (Larger proportional effect) • Decrease the integral time (**Pr.130**). (Larger integral effect)

NOTE

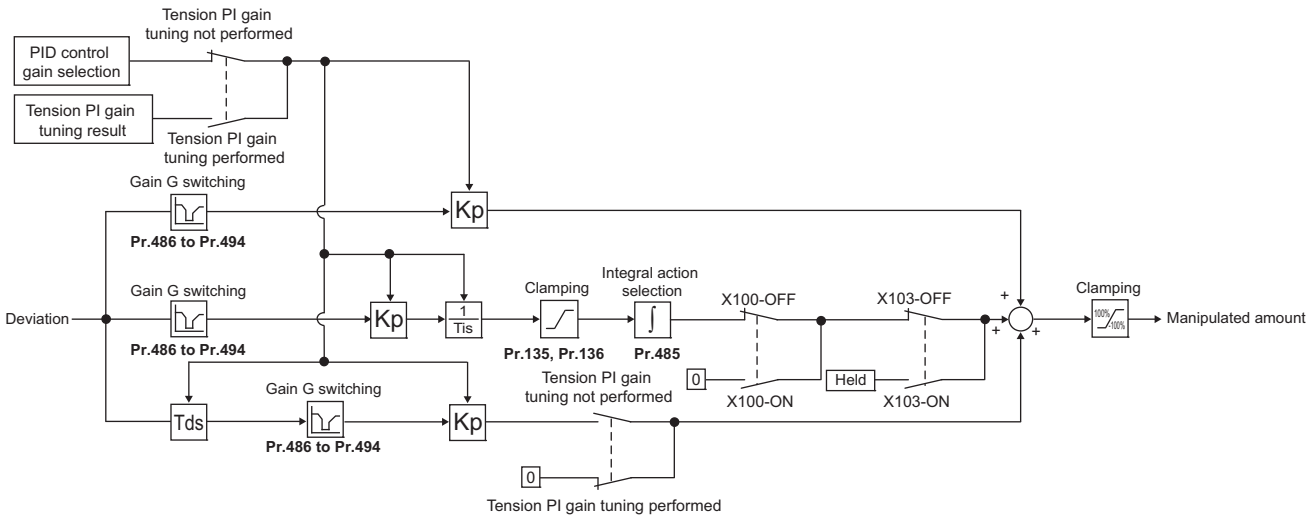
• During the differential operation is used, adjust the differential time (**Pr.134**) while checking the stability and the response level. (Increasing the differential time makes the differential effect larger, and decreasing the differential time makes the differential effect smaller.)

3.5.12 PID control gain setting

Set the proportional band, integral time, and differential time for PID control.

Pr.	Name	Initial value	Setting range	Description
129 R110 (A613)	**PID proportional band**	100%	0.1 to 1000%	If a narrow proportional band is set (small parameter setting value), the manipulated amount changes considerably by slight changes in the measured value. As a result, response improves as the proportional band becomes narrower, though stability worsens as shown by the occurrence of hunting. Gain Kp=1/proportional band
			9999	Without proportional band
130 R111 (A614)	**PID integral time**	1 s	0.1 to 3600 s	With deviation step input, this is the time (Ti) used for obtaining the same manipulated amount as proportional band (P) by only integral (I) action. Arrival to the set point becomes quicker the shorter an integral time is set, though hunting is more likely to occur.
			9999	Without integral control
134 R112 (A615)	**PID differential time**	9999	0.01 to 10 s	With deviation ramp input, this is the time (Td) used for obtaining the manipulated amount only by proportional action (P). Response to changes in deviation increase greatly as the differential time increases.
			9999	Without differential control

◆Block diagram



◆PID control proportional band (Pr.129)

- If a narrow proportional band is set (small parameter setting value), the manipulated amount changes considerably by slight changes in the dancer signal.

PID control formula: $G \cdot Kp \left(1 + \frac{1}{Ti \cdot S} + Td \cdot S\right)$

Gain Kp = 1/proportional band

Ti = Integral time

Td = Differential time

Gain G = PID gain selection function: Refer to page 104.

◆PID control integral time (Pr.130)

- Ti is the time required for integral (I) action alone to provide the same manipulated amount as is the case with proportional (P) action.
- The set point is reached earlier when the integral time setting is shorter.

◆PID control differential time (Pr.134)

- Set the differential time for differential (D) action. Td is the time required to provide the same manipulated amount as is the case with proportional (P) action. Response to changes in deviation increase greatly as the differential time increases.

3.5.13 Integral control action setting

The manipulated amount for PID integral action can be limited by setting parameters.
The integral control action can be enabled or disabled (the integral term is held) according to the PID control deviation.
Integral control can be disabled by the signal input. (The integral term value is cleared.)

Pr.	Name	Initial value	Setting range	Description
135 R161	**Integral clamp (positive polarity)**	9999	0 to 100%	Set the limit level for integral action.
			9999	The limit level is 100%.
136 R162	**Integral clamp (negative polarity)**	9999	0 to 100%	Set the limit level for integral action (negative polarity).
			9999	As set in **Pr.135**.
485 R149	**Integral control activation**	0	0 to 3	Select the action for integral control.
486 R140	**Deviation A**	600%	400.1 to 600%	Set the reference deviation for the integral control action set in **Pr.485**. 9999: Integral control is valid.
487 R141	**Deviation B**	400%	400 to 599.9%	
488 R142	**Deviation C1**	9999	400.1 to 599.9%	
			9999	
489 R143	**Deviation C2**	9999	400.1 to 599.9%	
			9999	
1015 A607	**Integral stop selection at limited manipulated amount**	0	0	The integral stops when the manipulated amount is limited.
			1	The integral does not stop when the manipulated amount is limited.

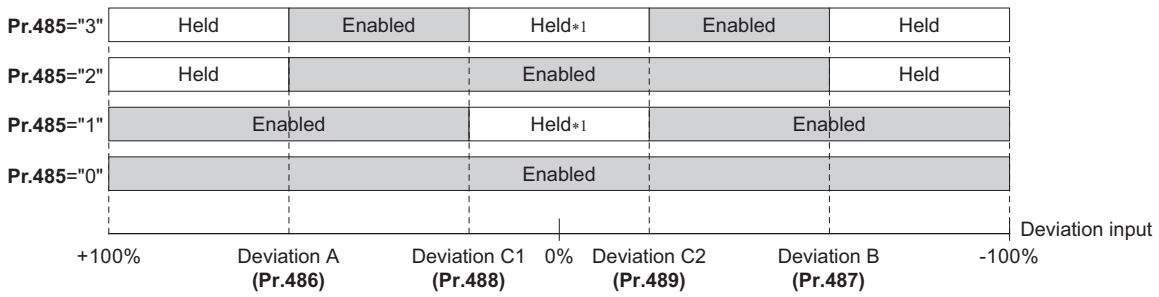
◆Integral action limit (Pr.135, Pr.136)

- Use **Pr.135 Integral clamp (positive polarity)** or **Pr.136 Integral clamp (negative polarity)** to limit the manipulated amount for PID integral action.

Pr.135 setting	Pr.136 setting	Integral action limit level (positive polarity)	Integral action limit level (negative polarity)
9999	9999	100%	100%
9999	0 to 100%	100%	**Pr.136** setting
0 to 100%	9999	**Pr.135** setting	**Pr.135** setting
0 to 100%	0 to 100%	**Pr.135** setting	**Pr.136** setting

◆Integral control action selection (Pr.485)

- The integral control action can be selected according to the PID control deviation.
- Use **Pr.486 to Pr.489** to set the deviation, and use **Pr.485 Integral control activation** to select the action.
- In the holding period, the integral of the deviation is stopped and the integral term is retained as it is. The manipulated amount is calculated using the kept integral term value.



*1 The integral of the deviation is valid when "9999" is set in **Pr.488** or **Pr.489**.

◆Integral stop selection at limited manipulated amount (Pr.1015)

- The operation for the integral term can be selected when the manipulated amount is limited during PID control.

Pr.1015 setting	Operation at limited manipulated amount
0 (initial value)	Integral stops.
1	Integral does not stop.

◆Integral control action selection using input signal (X100 signal, X103 signal)

- Turn ON the PID integral term reset input (X100) signal to disable the integral control. (The integral term value is cleared.)
- To input the X100 signal, set "100" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.
- Turn ON the Integral term activation selection (X103) signal to keep the integral term value. The manipulated amount is calculated using the kept integral term value.
- To input the X103 signal, set "103" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.

NOTE

- Changing the terminal assignment using **Pr.178 to Pr.189 (input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

3.5.14 Differential control action setting

Differential control can be disabled by the signal input. (The differential term value is cleared.)

◆Differential control action selection using input signal (X101 signal)

- Turn ON the PI control switchover (X101) signal to disable the differential control. (The differential term value is cleared.)
- To input the X101 signal, set "101" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.

NOTE

- Changing the terminal assignment using **Pr.178 to Pr.189 (input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

3.5.15 PID control gain selection

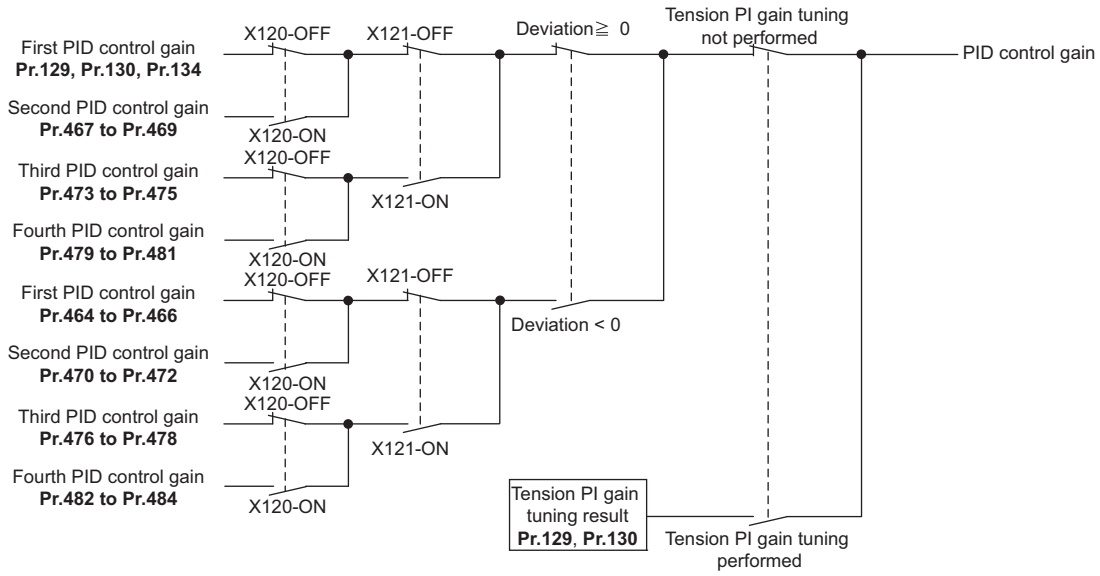
PID gain (proportional band, integral time, differential time) can be set individually according to the polarity of the deviation. First to fourth PID gain (proportional band, integral time, differential time) can be selected by the signal input.

Pr.	Name	Initial value	Setting range	Description
464 R113	**PID proportional band for values below set point**	9999	0.1 to 1000%	Set the proportional band for negative deviations.
			9999	As set in **Pr.129** also for negative deviations.
465 R114	**PID integral time for values below set point**	9999	0.1 to 3600 s	Set the integral time for negative deviations.
			9999	As set in **Pr.130** also for negative deviations.
466 R115	**PID differential time for values below set point**	9999	0.01 to 10 s	Set the differential time for negative deviations.
			9999	As set in **Pr.134** also for negative deviations.
467 R116	**Second PID proportional band**	9999	0.1 to 1000%	Set the second PID proportional band.
			9999	As set in **Pr.129**/**Pr.464**.
468 R117	**Second PID integral time**	9999	0.1 to 3600 s	Set the second PID integral time.
			9999	As set in **Pr.130**/**Pr.465**.
469 R118	**Second PID differential time**	9999	0.01 to 10 s	Set the second PID differential time.
			9999	As set in **Pr.134**/**Pr.466**.
470 R119	**Second PID proportional band for values below set point**	9999	0.1 to 1000%	Set the second PID proportional band for values below set point.
			9999	As set in **Pr.467**.
471 R120	**Second PID integral time for values below set point**	9999	0.1 to 3600 s	Set the second PID integral time for values below set point.
			9999	As set in **Pr.468**.

Dancer feedback speed control details

Pr.	Name	Initial value	Setting range	Description
472 R121	Second PID differential time for values below set point	9999	0.01 to 10 s	Set the second PID differential time for values below set point.
			9999	As set in **Pr.469**.
473 R122	Third PID proportional band	9999	0.1 to 1000%	Set the third PID proportional band.
			9999	As set in **Pr.129**/**Pr.464**.
474 R123	Third PID integral time	9999	0.1 to 3600 s	Set the third PID integral time.
			9999	As set in **Pr.130**/**Pr.465**.
475 R124	Third PID differential time	9999	0.01 to 10 s	Set the third PID differential time.
			9999	As set in **Pr.134**/**Pr.466**.
476 R125	Third PID proportional band for values below set point	9999	0.1 to 1000%	Set the third PID proportional band for values below set point.
			9999	As set in **Pr.473**.
477 R126	Third PID integral time for values below set point	9999	0.1 to 3600 s	Set the third PID integral time for values below set point.
			9999	As set in **Pr.474**.
478 R127	Third PID differential time for values below set point	9999	0.01 to 10 s	Set the third PID differential time for values below set point.
			9999	As set in **Pr.475**.
479 R128	Fourth PID proportional band	9999	0.1 to 1000%	Set the fourth PID proportional band.
			9999	As set in **Pr.129**/**Pr.464**.
480 R129	Fourth PID integral time	9999	0.1 to 3600 s	Set the fourth PID integral time.
			9999	As set in **Pr.130**/**Pr.465**.
481 R130	Fourth PID differential time	9999	0.01 to 10 s	Set the fourth PID differential time.
			9999	As set in **Pr.134**/**Pr.466**.
482 R131	Fourth PID proportional band for values below set point	9999	0.1 to 1000%	Set the fourth PID proportional band for values below set point.
			9999	As set in **Pr.479**.
483 R132	Fourth PID integral time for values below set point	9999	0.1 to 3600 s	Set the fourth PID integral time for values below set point.
			9999	As set in **Pr.480**.
484 R133	Fourth PID differential time for values below set point	9999	0.01 to 10 s	Set the fourth PID differential time for values below set point.
			9999	As set in **Pr.481**.
486 R140	Deviation A	600%	400.1 to 600%	Set the deviation used for selecting PID gain A.
487 R141	Deviation B	400%	400 to 599.9%	Set the deviation used for selecting PID gain B.
488 R142	Deviation C1	9999	400.1 to 599.9%	Set the deviation used for selecting PID gain C1.
			9999	The PID gain is 100%.
489 R143	Deviation C2	9999	400.1 to 599.9%	Set the deviation used for selecting PID gain C2.
			9999	The PID gain is 100%.
490 R144	PID gain A	9999	0.1 to 1000%	Set the gain for the deviation A.
			9999	The PID gain is 100%.
491 R145	PID gain B	9999	0.1 to 1000%	Set the gain for the deviation B.
			9999	The PID gain is 100%.
492 R146	PID gain C1	9999	0.1 to 1000%	Set the gain for the deviation C1.
			9999	The PID gain is 100%.
493 R147	PID gain C2	9999	0.1 to 1000%	Set the gain for the deviation C2.
			9999	The PID gain is 100%.
494 R148	PID gain D	9999	0.1 to 1000%	Set the gain for the deviation in the C1 to C2 range.
			9999	The PID gain is 100%.

◆Block diagram



◆PID gain setting for negative deviations (values below set point) (Pr.464 to Pr.466)

- PID gain can be set individually when the measured value (dancer feedback signal) has a negative deviation from the set point. When the setting is 9999, settings in **Pr.129**, **Pr.130**, and **Pr.134** are applied regardless of the polarity of deviation.

Item	Parameter for PID control gain	
	Positive deviation	Negative deviation
PID proportional band	**Pr.129**	**Pr.464** (**Pr.129** when **Pr.464** = "9999")
PID integral time	**Pr.130**	**Pr.465** (**Pr.130** when **Pr.465** = "9999")
PID differential time	**Pr.134**	**Pr.466** (**Pr.134** when **Pr.466** = "9999")

◆Switchover to the second to fourth PID gain (Pr.464 to Pr.484, X120 signal, X121 signal)

- Use the PID gain switchover (X120/X121) signal to switch the PID gain.
- To assign the X120 signal, set "120" in any of **Pr.178 to Pr.189 (input terminal function selection)**. To assign the X121 signal, set "121" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

Signal		PID control gain	Parameter for PID control gain	
X121	X120		PID proportional band / PID integral time / PID differential time	PID proportional band / PID integral time / PID differential time (negative deviation)
OFF	OFF	(First) PID control gain	**Pr.129**/**Pr.130**/**Pr.134**	**Pr.464**/**Pr.465**/**Pr.466**∗1
	ON	Second PID control gain	**Pr.467**/**Pr.468**/**Pr.469**∗2	**Pr.470**/**Pr.471**/**Pr.472**∗3
ON	OFF	Third PID control gain	**Pr.473**/**Pr.474**/**Pr.475**∗2	**Pr.476**/**Pr.477**/**Pr.478**∗3
	ON	Fourth PID control gain	**Pr.479**/**Pr.480**/**Pr.481**∗2	**Pr.482**/**Pr.483**/**Pr.484**∗3

∗1 As set in **Pr.129**, **Pr.130**, or **Pr.134** respectively when "9999" is set.

∗2 When "9999" is set, the parameter setting for the first PID control gain (or the first PID control gain for values below set point) is applied. For example, when **Pr.468** = "9999", the PID integral time is as set in **Pr.130**, and the PID integral time for values below set point is as set in **Pr.465**.

∗3 When "9999" is set, the PID control gain for positive deviations is applied. For example, when **Pr.478** = "9999" and **Pr.475** ≠ "9999", the **Pr.475** setting is applied to the both.

◆Gain switchover according to the PID deviation (Pr.486 to Pr.494)

- Gain can be switched according to the amount of the deviation from the set point included in the measured value (dancer feedback signal).
- Value G in the PID control formula can be changed according to the deviation of the PID control input.

PID control formula: $G \cdot Kp \left(1 + \frac{1}{Ti \cdot S} + Td \cdot S\right)$

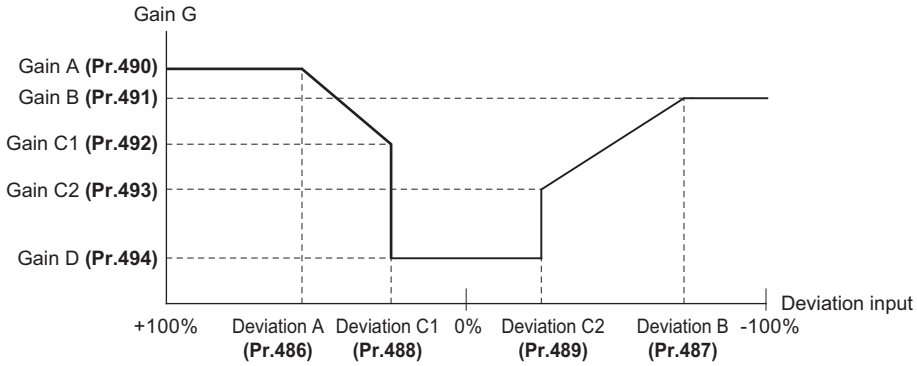
Gain Kp = 1/proportional band

Ti = Integral time

Td = Differential time

Gain G = PID gain selection function

- When "9999" is set in **Pr.490 to Pr.494**, the gain is 100%.
- To use the gain switchover function, set a value other than "9999" in both **Pr.488** and **Pr.489**. If "9999" is set in either or both of the parameters, "9999" is applied to all gains (A to D).
- Set **Pr.486 to Pr.489** so that A>C1≥C2>B is true. Otherwise, a write error occurs. When C1 = C2, larger gain between gain C1 and C2 becomes valid.

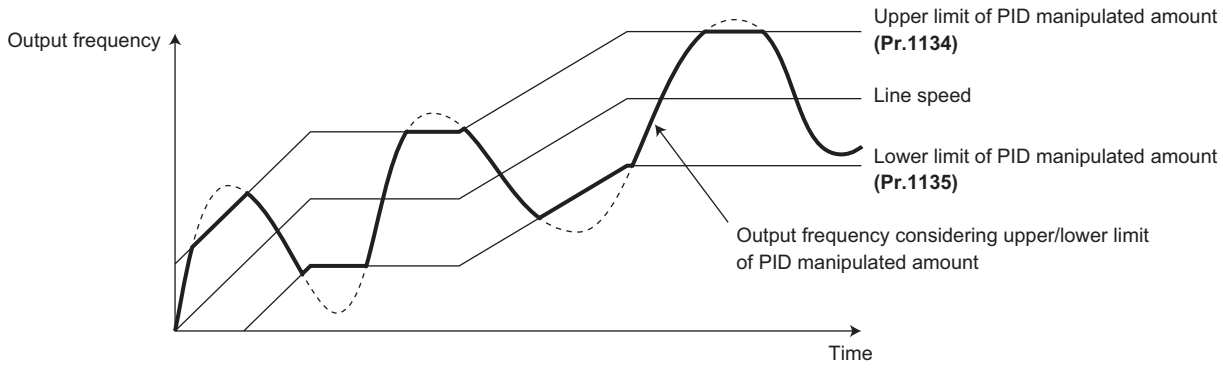


3.5.16 PID manipulated amount

Pr.	Name	Initial value	Setting range	Description
1134 A605	**PID upper limit manipulated value**	100%	0 to 100%	Set the upper limit of PID action.
1135 A606	**PID lower limit manipulated value**	100%	0 to 100%	Set the lower limit of PID action.
1148 R105	**PID manipulated line speed bias**	0 m/min	0 to 6553.4 m/min	Convert the PID manipulated amount to a frequency value (Hz) or a line speed (m/min). 9999: No function
1149 R106	**PID manipulated line speed gain**	9999	0 to 6553.4 m/min, 9999	

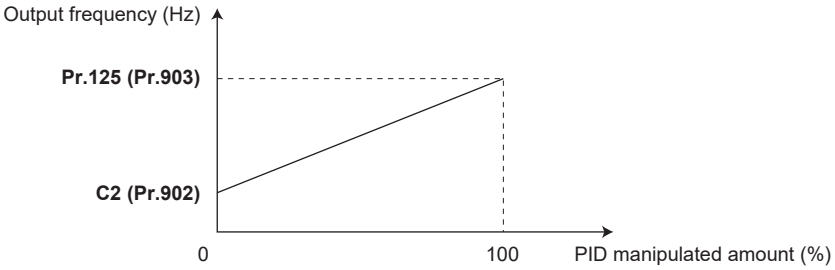
◆Setting the upper and lower limits of the PID manipulated amount

- Set the upper and lower limits of the PID manipulated amount.
- The upper limit of the manipulated amount is the frequency obtained by adding the value resulting from the frequency conversion by **Pr.1134** to the line speed frequency.
  The lower limit of the manipulated amount is the frequency obtained by subtracting the value resulting from the frequency conversion by **Pr.1135** from the line speed frequency.

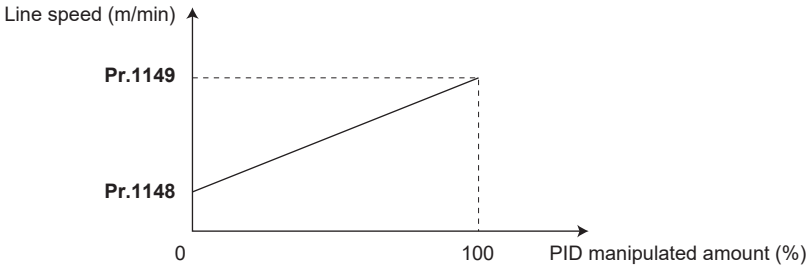


◆Converting the PID manipulated amount to values in different units (Pr.1148, Pr.1149)

- The PID manipulated amount (%) can be converted to values in different units (Hz or m/min).
- When **Pr.1149** = "9999 (initial value)", the amount is converted as shown in the following diagram.



- When **Pr.1149** = "9999", the amount is converted as shown in the following diagram.



3.5.17 Reel change function

Before starting control with a standby shaft, the line speed command can be fit to the target line speed. Also, a speed bias can be set.

Pr.	Name	Initial value	Setting range	Description
620 R570	**Line speed bias for reel change**	1000 m/min*1	0 to 2000 m/min*1	Reel change line speed bias can be set for the target line speed.
621 R423	**Allowable deviation from target line speed**	0 m/min*1	0 to 6553.4 m/min*1	The Y236 signal output range can be set for the target line speed command.

*1 The increment varies depending on the **Pr.358** setting. (Refer to page 67.)

◆Reel change function setting

- The reel change function is activated when the following conditions are satisfied.
  - Dancer feedback speed control valid
  - When **Pr.361 Line speed command input selection** ≠ "9999"
  - The Reel change (X104) signal is ON.
- Turning ON of the Reel change (X104) signal enables the reel change function. To input the X104 signal, set "104" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.

◆Line speed bias for reel change (Pr.620)

- When the reel change function is valid (the X104 signal is ON), a speed bias can be set with **Pr.620 Line speed bias for reel change**.
- The reel change speed bias can be set as an offset from 1000 m/min.

Pr.620 setting	Speed bias for reel change
2000 m/min	1000 m/min
1000 m/min	0 m/min
0 m/min	-1000 m/min

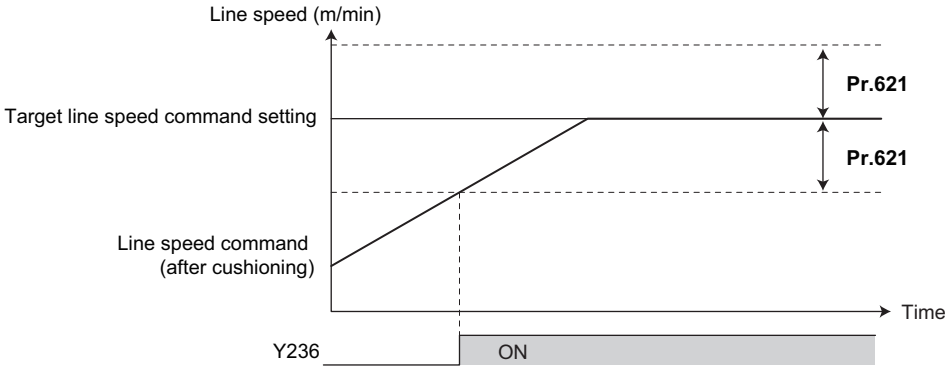
- Use **Pr.358 Line speed unit** to change the unit.
- When the commanded line speed reaches the target line speed after the cushion time while the reel change function is activated, the Reel change ready (Y236) signal is output.
- For the Y236 signal, set "236 (positive logic) or 336 (negative logic)" in one of **Pr.190 to Pr.196 (output terminal function selection)** to assign the function to the output terminal.

NOTE

- The target line speed command is limited in the range of 0 to **Pr.1147** (maximum value for the line speed command) after the reel change line speed bias is added.
- The reel change speed bias is added after the analog input compensation.
- When the reel change function is invalid (the X104 signal is OFF), the target line speed command value (after reel change speed bias is added) and the line speed command value after the cushion time are fit to the target line speed command value before reel change speed bias is added.

◆Allowable deviation from target line speed (Pr.621)

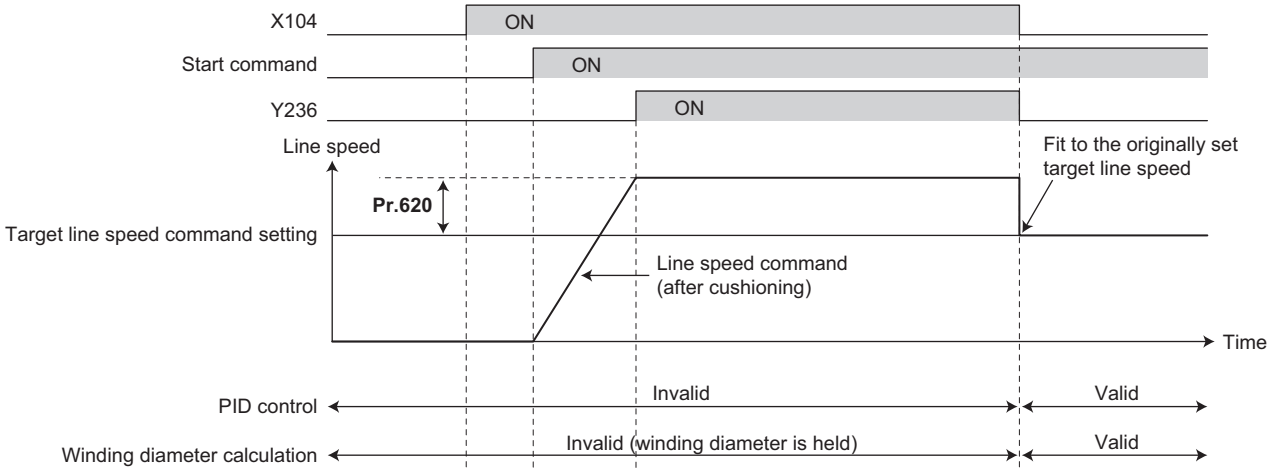
• An allowable deviation range can be set to the Y236 output condition.



NOTE

• The sum of the target line speed command and **Pr.621** values is limited at the value set in **Pr.1147 Line speed command maximum value**.

◆Overview of the reel change operation



• While the reel change function is activated, PID control and winding diameter calculation are disabled.

Function	Condition during reel change
PID control	Disabled (P, I, and D term values are cleared)
Winding diameter calculation	Disabled (winding diameter is held)

3.5.18 Analog output signal function for dancer tension setting

The dancer tension command can be used for controlling the dancer roll using an air cylinder. The dancer tension command can be output through terminal FM/CA or terminal AM.

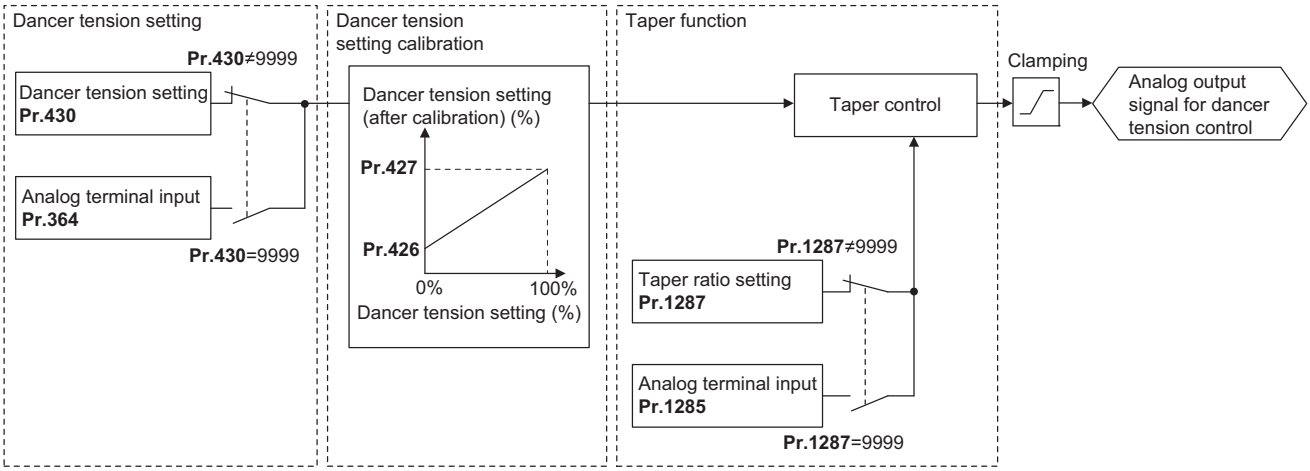
The dancer tension setting can be input by setting parameters or through an analog input terminal.

By setting the dancer tension, taper ratio, and winding diameter at taper start, the analog output signal for dancer tension control can be calculated based on the winding diameter determined by winding diameter calculation.

Pr.	Name	Initial value	Setting range	Description
74 T002	**Input filter time constant**	1	0 to 8	The primary delay filter time constant to the analog input is selectable. A larger setting results in slower response.
364 R411	**Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1**	9999	3	The tension setting is input through terminal 2.
			4	The tension setting is input through terminal 4.
			5	The tension setting is input through terminal 1.
			6	The tension setting is input through terminal 6 (FR-A8AZ).
			9999	No function
426 R412	**Dancer tension setting bias**	0%	0 to 200%	Set the bias tension.
427 R413	**Dancer tension setting gain**	100%	0 to 200%	Set the gain tension.
430 R410	**Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2**	100	1 to 100	Set the maximum value for dancer tension setting.
			9999	Tension setting through analog input terminal
826 T004	**Torque setting filter 1**	9999	0 to 5 s	Set the primary delay filter time constant to the analog input.
			9999	As set in **Pr.74**.
836 T006	**Torque setting filter 2**	9999	0 to 5 s	Second function of **Pr.826** (enabled when the RT signal is ON)
			9999	As set in **Pr.826** or **Pr.74**.
1284 R500	**Taper mode selection**	0	0	No taper
			1	Linear taper profile
			2	Hyperbolic taper profile 1
			3	Hyperbolic taper profile 2
			4	Data table profile
1285 R501	**Taper setting analog input selection**	9999	3	The taper ratio is input through terminal 2.
			4	The taper ratio is input through terminal 4.
			5	The taper ratio is input through terminal 1.
			6	The taper ratio is input through terminal 6 (FR-A8AZ).
			9999	No function
1286 R503	**Winding diameter at taper start**	9999	0 to 6553 mm	Set the winding diameter to start taper control.
			9999	Taper control is started at the minimum winding diameter.
1287 R502	**Taper ratio setting**	0	0 to 100%	Set the taper ratio.
			9999	The taper ratio is set through the analog input terminal.

Pr.	Name	Initial value	Setting range	Description
1288 R510	Data table winding diameter 1	9999	0 to 6553 mm, 9999	Set the data table profile for the taper mode selection.
1289 R511	Data table taper ratio 1	0%	0 to 100%	
1290 R512	Data table winding diameter 2	9999	0 to 6553 mm, 9999	
1291 R513	Data table taper ratio 2	0%	0 to 100%	
1292 R514	Data table winding diameter 3	9999	0 to 6553 mm, 9999	
1293 R515	Data table taper ratio 3	0%	0 to 100%	
1294 R516	Data table winding diameter 4	9999	0 to 6553 mm, 9999	
1295 R517	Data table taper ratio 4	0%	0 to 100%	
1296 R518	Data table winding diameter 5	9999	0 to 6553 mm, 9999	
1297 R519	Data table taper ratio 5	0%	0 to 100%	

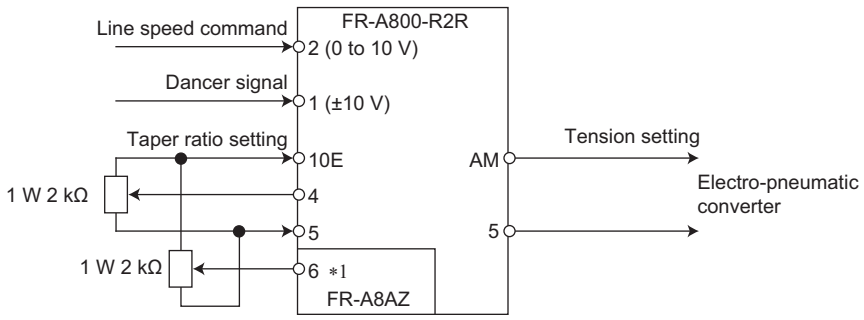
◆Block diagram



◆Connection diagram

Input with the potentiometer

Pr.1285="4"
Pr.1287="9999"
Pr.158="19"



*1 Terminal 6 is equipped to the plug-in option FR-A8AZ.

◆Tension command output setting

• For outputting the tension command, assign the dancer tension command to terminal FM/CA or terminal AM.

Signal type	Minimum increment	Pr.54 (FM/CA) Pr.158 (AM) setting	Terminal FM/CA/AM full-scale value	Remarks
Dancer tension command	1%	19	100%	Output even while dancer feedback speed control is invalid
Dancer tension command 2	1%	30	100%	Zero output while dancer feedback speed control is invalid

• Use **C0 (Pr.900) for terminal FM/CA calibration** and **use C1 (Pr.901**) for terminal AM calibration.

• The dancer tension command is dependent on the winding diameter. Set **Pr.645 Winding diameter storage selection** = "1" to enable the winding diameter storage function.

NOTE

• When the X114 signal is turned OFF while **Pr.645** = "0" (winding diameter storage function disabled), the winding diameter is initialized, which may cause a sudden change in the analog signal output for dancer tension control.

• The dancer tension command and the dancer tension command 2 are clamped at 100%.

◆Dancer tension setting input selection (Pr.364, Pr.430)

• Use **Pr.364 Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1** or **Pr.430 Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2** to set the dancer tension setting input method.

Pr.430 setting	Pr.364 setting	Dancer tension setting method
1 to 100%	—	As set in **Pr.430**
9999	3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*1
	4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*1
	5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*1
	6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*1
	9999	No function*2

*1 The input specification in the initial setting is indicated.

*2 The dancer tension command is 0%.

NOTE

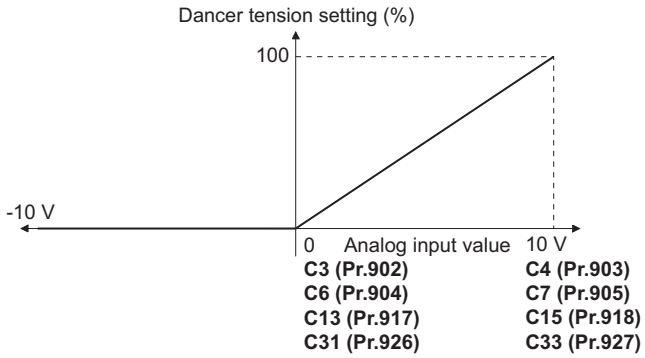
• If two or more functions are assigned to one terminal, the priorities of the functions are defined as follows.
Dancer signal input (**Pr.363**) > Actual line speed input (**Pr.362**) > Tension command input (**Pr.804**) > Line speed command input (**Pr.361**≠0) > Taper setting input (**Pr.1285**) > Dancer tension setting input (**Pr.364**) > Line speed command compensation input > Line speed command input (**Pr.361**=0)

◆Dancer tension setting input adjustment (Pr.74, Pr.822, Pr.833, Pr.902 to Pr.905, Pr.917, Pr.918, Pr.926, Pr.927)

• When analog input is used for setting the dancer tension, use the following parameters to calibrate the input value of each terminal. The tension setting analog input values at both 0% and 100% can be calibrated.

Input terminal	Calibration parameter
Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*1	**C3 (Pr.902)**, **C4 (Pr.903)**
Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*1	**C6 (Pr.904)**, **C7 (Pr.905)**
Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*1	**C13 (Pr.917)**, **C15 (Pr.918)**
Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*1	**C31 (Pr.926)**, **C33 (Pr.927)**

*1 The input specification in the initial setting is indicated.



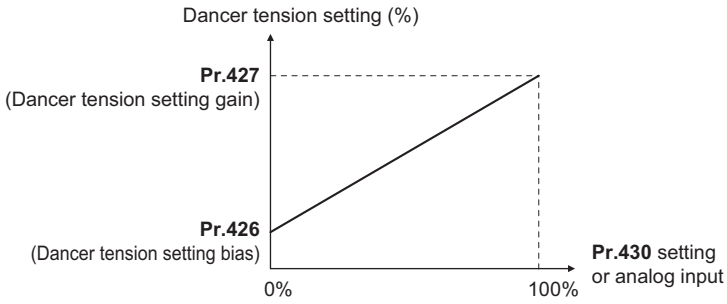
- When the dancer tension setting is input using analog input, the input value can be filtered using **Pr.74 Input filter time constant**, **Pr.826 Torque setting filter 1**, and **Pr.836 Torque setting filter 2**.

NOTE

- The dancer tension setting input is clamped at 100%.

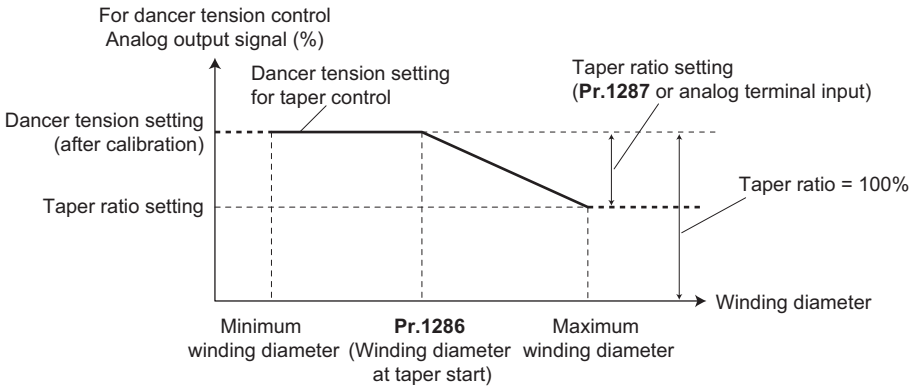
◆Dancer tension setting adjustment (Pr.426, Pr.427)

- Use **Pr.426 Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2** and **Pr.427 Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1** to calibrate the dancer tension setting (**Pr.430 Dancer tension setting bias** setting or input value through terminal set in **Pr.364 Dancer tension setting gain**).
- Use **Pr.426** to set the value when the dancer tension setting is 0%, and use **Pr.427** to set the value when the dancer tension setting is 100%.



◆Taper function (Pr.1284 to Pr.1297)

- By setting the dancer tension, taper ratio, and winding diameter at taper start, the analog output signal for dancer tension control can be calculated based on the winding diameter determined by winding diameter calculation.
- The following example shows the relation between the winding diameter and analog output signal for dancer tension control when **Pr.1284 Taper mode selection** = "1" (taper mode selection: linear taper profile)



- For the details of the operation using taper function, refer to the description of taper function for tension sensorless torque control. (Refer to page 151.)

  The differences from the taper function for tension sensorless torque control are as follows.

Function	Input	Output
Taper function for analog output signal for dancer tension control	Dancer tension setting (**Pr.430**, or analog input according to **Pr.364**)	Analog output signal for dancer tension control
Taper function for tension sensorless torque control / tension sensor feedback torque control	Tension command (Tension command according to **Pr.804**)	Taper control tension command FTP
Taper function for the PID action set point (tension command percentage)	PID action set point (tension command percentage)	PID action set point after taper control (tension command percentage)

◆Dancer tension setting example

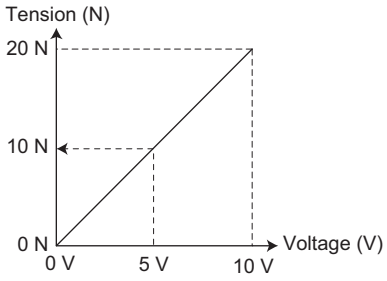
This example assumes an air cylinder for which the dancer tension is 0 N when the input voltage is 0 V, and the dancer tension is 20 N when the input voltage is 10 V. In the example, the setting method is described to input the analog output signal for dancer tension control to the air cylinder so that the dancer tension becomes 10 N when the winding diameter has the minimum value.

1 Checking the air cylinder specifications

Check the air cylinder specifications (relation between the input voltage and the tension).
It is assumed that the dancer tension is 0 N when the input voltage is 0 V, and the dancer tension is 20 N when the input voltage is 10 V for the air cylinder in this example.

2 Finding the voltage based on the target tension setting

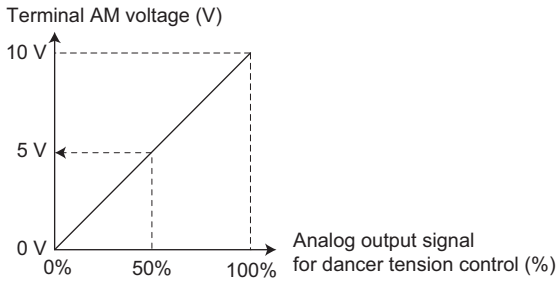
When the target tension value is 10 N, the input voltage is 5 V.



Air cylinder specification

3 Finding the analog output signal value for dancer tension control

In order to output the voltage of 5 V through terminal AM to achieve the target tension, set the analog output signal for dancer tension control to 50%.
Assign the analog output signal for dancer tension control to terminal AM. (**Pr.158**="19")



Analog output signal for dancer tension control

4 Setting the tension

Set the tension so that the value calibrated using **Pr.426 Dancer tension setting bias** and **Pr.427 Dancer tension setting gain** matches the value determined in step 3.
When the **Pr.426** and **Pr.427** settings are initial values, set **Pr.430** or input an analog value through the terminal set in **Pr.364** so that the tension setting becomes 50%.

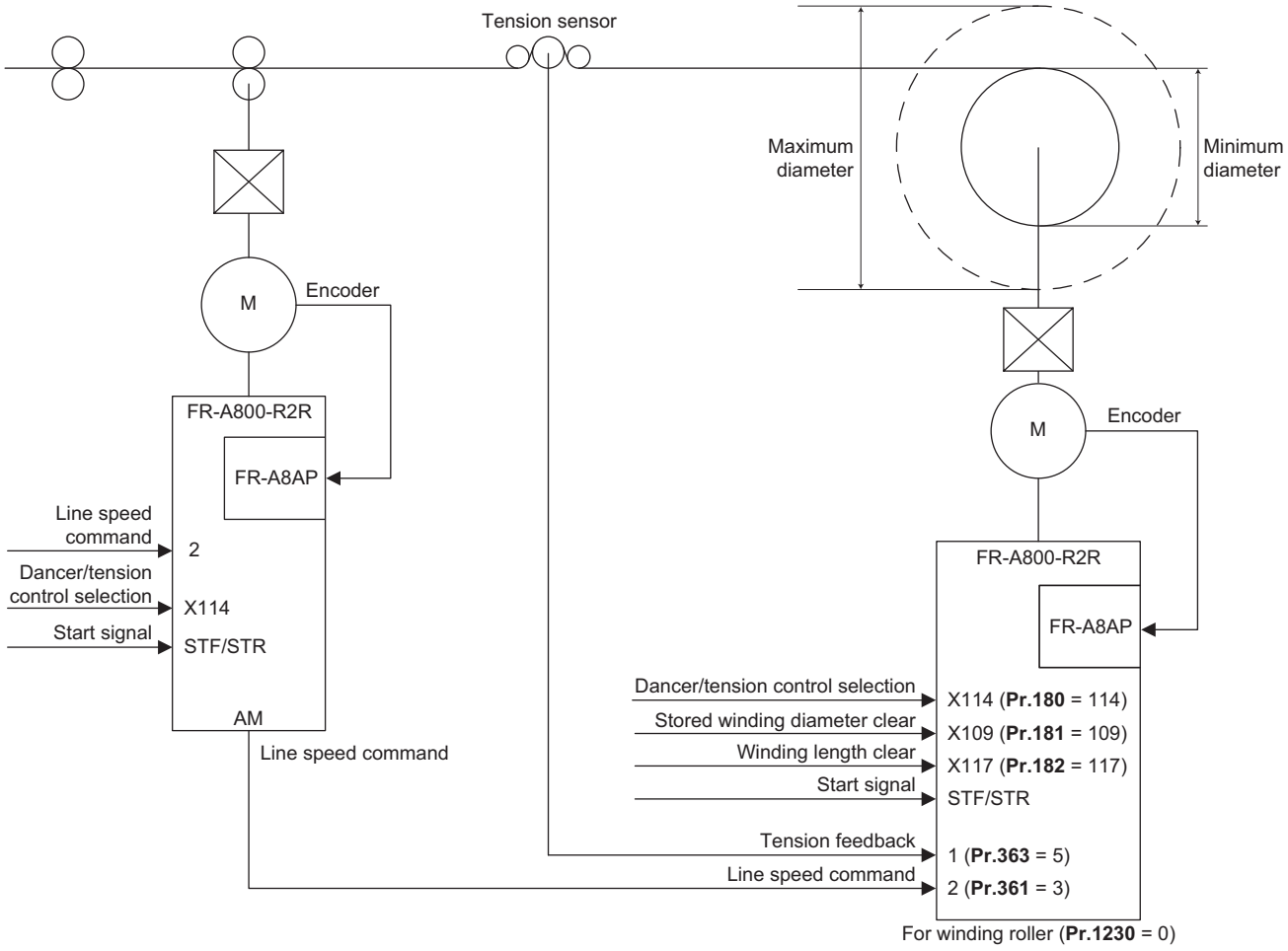
4 TENSION SENSOR FEEDBACK SPEED CONTROL

Tension sensor feedback speed control is a control function to keep the tension constant using feedback from the tension sensor, instead of the dancer roll position.

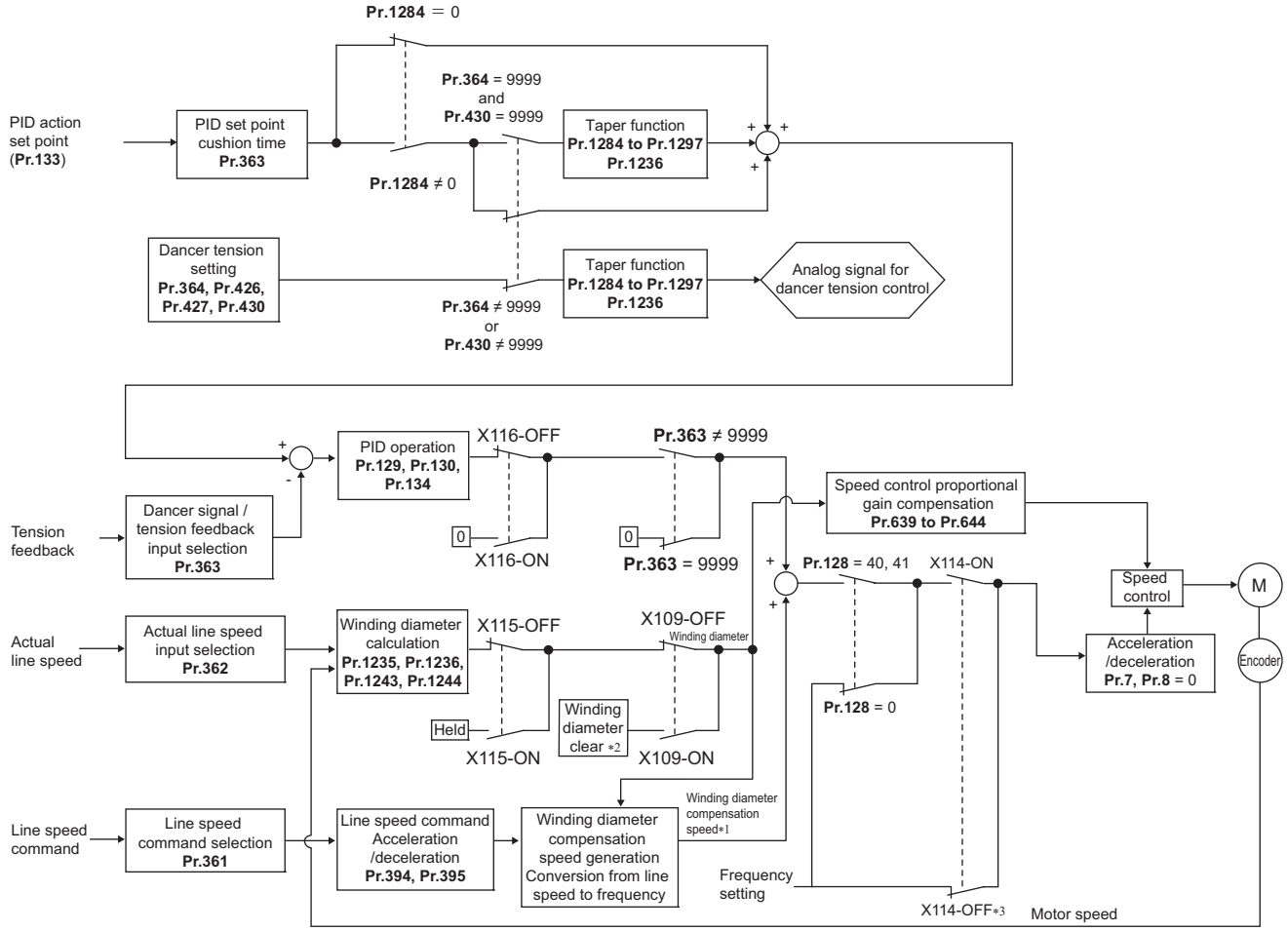
4.1 Dedicated function list

Item		Description
Tension sensor feedback speed control	Control method	PID control, PI control, P control, and PD control can be selected. Gain switchover by tension feedback is available. Gain switchover by external terminal input is available.
	Tension command	Set a point with a parameter.
	Tension detection signal	Use an analog terminal for the signal input. (Terminal 1, 2, 4, or 6 is selectable.)
	Line speed acceleration/deceleration function	Available Three patterns are selectable with external contact signal.
	Additional function	Material break detection function
Winding diameter compensation	Constant line speed control	Available
	Winding diameter calculation	Calculation based on the line speed detection and the motor rotation speed and calculation based on the material thickness and the number of motor rotations are selectable.
	Actual line speed detection	Pulse train input (A/B phase, single phase) and analog input are selectable.
	Reduction ratio setting	Available
	Maximum/minimum winding diameter setting	Available. (Four patterns are selectable with external signal.)
	Speed control proportional gain compensation function	Available. (Straight movement (with three break points) against the winding diameter can be performed.)
	Winding diameter storage	Available
Common	Dedicated input signal	Dancer/tension control selection, Winding diameter compensation selection, PID gain switchover, PID integral term reset (P control selection), Line speed acceleration/deceleration selection, Winding diameter selection, Stored winding diameter clear, Winding/unwinding selection
	Dedicated output signal	Upper limit, Lower limit, Tension feedback detection, Break detection, Initial winding diameter calculation completion, Target winding diameter achieved, Winding/unwinding completion
	Dedicated monitor	Set point, measured value, deviation, line speed command, winding diameter, actual line speed, compensation speed, winding length.

4.2 System configuration example



4.3 Control block diagram



*1 Winding diameter compensation speed = $\frac{\text{Line speed command}}{\pi \times \text{Winding diameter} \times \text{Gear ratio}}$

*2 After clearing, the value becomes the minimum winding diameter when **Pr.1230** = "0" (winding), and the maximum winding diameter when **Pr.1230** = "1" (unwinding).

*3 The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.) Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command. In this case, the bias and gain parameter settings must be consistent for both command types.
Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902)** to **C7 (Pr.905), C12 (Pr.917)** to **C15 (Pr.918)**
Calibration parameters for line speed command input: **Pr.350** to **Pr.353**

4.4 Parameter setting procedure for tension sensor feedback speed control

The following procedure shows the parameter setting example for the tension sensor feedback speed control.

4.4.1 Parameter setting procedure

1 Wiring

Perform secure wiring.

NOTE

- Do not feed the workpiece through the machine.

2 Control method selection

Select the control method according to the application and the motor.

Pr.	Name	Setting range	Minimum setting increments	Initial value
71	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0
9	Electronic thermal O/L relay	0 to 500 A *3	0.01 A*3	Inverter rated current
		0 to 3600 A *4	0.1 A*4	
80	Motor capacity	0.4 to 55 kW, 9999 *3	0.01 kW	9999
		0 to 3600 kW, 9999 *4	0.1 kW	
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999
83	Rated motor voltage	0 to 1000 V	0.1 V	200 V (200 V class)
				400 V (400 V class)
84	Rated motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999
800	Control method selection*1	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20
810	Torque limit input method selection	0 to 2	1	0
359	Encoder rotation direction	0, 1, 100, 101	1	1
369	Number of encoder pulses	0 to 4096	1	1024
707	Motor inertia (integer)*2	10 to 999, 9999	1	9999
724	Motor inertia (exponent)*2	0 to 7, 9999	1	9999
862	Encoder option selection	0, 1	1	0

*1 For the control method, vector control is recommended.

*2 Setting is required for a motor other than a Mitsubishi Electric motor (the SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or SF-V5RU (1500 r/min series) motor).

*3 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*4 For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

NOTE

- Select Vector control for regenerative driving in a low-speed range (about 10 Hz or lower).
- For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

3 Offline auto tuning

Perform offline auto tuning as required. For offline auto tuning, refer to page 55.

Pr.	Name	Setting range	Minimum setting increments	Initial value
96	Auto tuning setting/status	0, 1, 11, 101	1	0

After the offline auto tuning, perform the test run of the motor alone to make sure that no fault is found in the motor's behavior.

4 Speed control gain adjustment

Adjust the speed control gain. Refer to page 59 for the speed control gain adjustment.

5 Mechanical specifications setting

Set the following parameters according to the specifications of the machine used. Refer to 11.6 (Application examples) on page 243.

Pr.	Name	Setting	Intermediate shaft	Winding/ unwinding shaft	Remarks
1235	Maximum winding diameter 1	*1	○	○	For the intermediate shaft, set the roller (reel) diameter in millimeters (1 to 6553 mm) for both **Pr.1235** and **Pr.1236**.
1236	Minimum winding diameter 1	*1	○	○	
178 to 189	Input terminal function selection	114	○	○	Set "114" for the X114 signal.
		109	—	○	Set "109" to use the Stored winding diameter clear (X109) signal.
		117	—	○	Set "117" to use the Winding length clear (X117) signal.
1230	Winding/unwinding selection	*1	—	○	0: Winding shaft 1: Unwinding shaft
645	Winding diameter storage selection	*1	—	○	0: Not stored. 1: The present roll diameter is stored.
1247	Winding diameter change increment amount limit	*1	○	○	Set the maximum change in 0.001 mm increments (0 to 9.998 mm or 9999) per roll diameter calculation.
1243	Gear ratio numerator	*1	○	○	Set a gear ratio in 1 increments (1 to 65534) when the motor shaft has a reduction gear.
1244	Gear ratio denominator	*1	○	○	
7	Acceleration time	0 s	○	○	0 to 3600 seconds, in 0.1 second increments*2
8	Deceleration time	0 s	○	○	
394	First acceleration time for line speed command	*1	○	○	Setting is required in 0.1 second increments*2 (0 to 3600 seconds) when the cushion time is not considered for the line speed command.
395	First deceleration time for line speed command	*1	○	○	
101	Second deceleration time for line speed command	*1	○	○	Set the time in 0.1 second increments*2 (0 to 3600 seconds) as required (for example, for rapid deceleration). Turn ON the X105 signal to enable the setting.
393	Line speed command acceleration/deceleration reference	*1	○	○	Set the reference line speed (travel amount per minute) in 0.1 m/min increments*3 (1 to 6553.4 m/min) for the acceleration/deceleration time for the line speed command.
1141	Line speed command acceleration/deceleration pattern	*1	○	○	Set S-curve acceleration/deceleration to reduce shock during line speed acceleration/deceleration operation. (Refer to page 82.)
1142	Line speed command acceleration start S-curve time	*1	○	○	
1143	Line speed command acceleration completion S-curve time	*1	○	○	
1144	Line speed command deceleration start S-curve time	*1	○	○	
1145	Line speed command deceleration completion S-curve time	*1	○	○	
1231	Material thickness d1	*1	—	○	Setting is required in 0.001 mm increments (0 to 20 mm or 9999) when thickness is used for winding diameter calculation.

*1 Set the parameter according to the specification of the machine used.

*2 The increment applies when **Pr.21** = "0 (initial value)".

*3 The increment applies when **Pr.358** = "0 (initial value)".

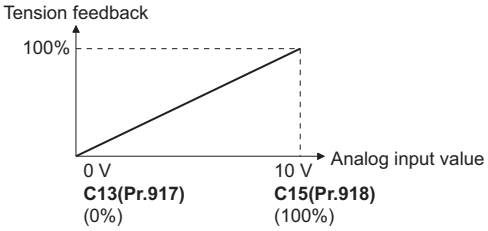
6 Tension feedback setting

Set the following parameters according to the tension feedback input method when the tension sensor is used.

Pr.	Name	Setting	Input method
363	Dancer / tension sensor feedback input selection	3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*1
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*1
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*1
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*1
		9	CC-Link or CC-Link IE Field Network Basic (-100 to 100%)
		9999 (initial value)	No function

*1 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

Item	Setting example
Tension feedback input method	Setting by analog voltage (0 to 10 V) input through terminal 1 (**Pr.363** = "5") 
Parameter setting	**C13 (Pr.917) Terminal 1 bias (speed)** = 0% **C15 (Pr.918) Terminal 1 gain (speed)** = 100%

7 Line speed command input setting

Set **Pr.361** according to the line speed command value input method.

Pr.	Name	Setting	Input method
361	Line speed command input selection	0	According to the priority of the speed command sources. (Refer to page 70)
		1	Terminal JOG single-phase pulse train input (Refer to page 71)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 71)
		3*3*4	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 73)
		4*3*4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 73)
		5*3*4	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73)
		6*3*4	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73)
		7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to page 71)
		8	Line speed command according to the **Pr.360** setting (Refer to page 73)
		10	Inverter-to-inverter link function (Available only for the FR-A800-E-R2R. For details, refer to the Ethernet Function Manual.)
		9999 (initial value)	No function

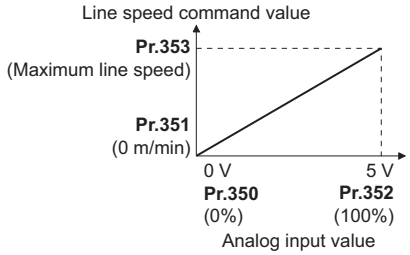
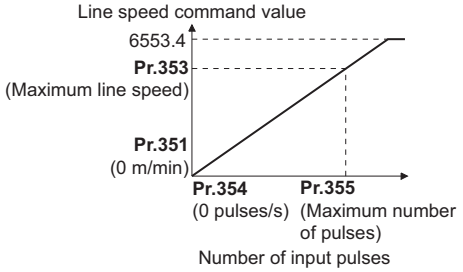
*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

*3 The frequency command cannot be input using the terminal selected as the line speed command input terminal in **Pr.361 Line speed command input selection**. (For example, to input a frequency command while **Pr.361** = "3", input the command from a terminal other than terminal 2.)
Set "0" in **Pr.361** to use the same terminal to input a line speed command and a frequency command. In this case, the bias and gain parameter settings must be consistent for both command types.
Calibration parameters for frequency command input: **Pr.125, Pr.126, C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918)**
Calibration parameters for line speed command input: **Pr.350 to Pr.353**

*4 To feed paper or wire, turn ON all X114, X115, and X116 signals and disable winding diameter compensation and PID compensation so that the line speed command for tension control (dancer feedback speed control / tension sensor feedback speed control) is used for the feed operation.

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Line speed command input method	Setting by analog voltage (0 to 5 V) input through terminal 2 (**Pr.361** = "3") 	Setting by pulse train input through terminal JOG (**Pr.361** = "1") 
Parameter setting	**Pr.350 Line speed command voltage/current bias** = 0% **Pr.351 Line speed command bias** = 0 m/min **Pr.352 Line speed command voltage/current gain** = 100% **Pr.353 Line speed command gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*5 **Pr.351 Line speed command bias** = 0 m/min **Pr.354 Line speed command pulse input bias** = "0" **Pr.353 Line speed command gain** = Maximum line speed **Pr.355 Line speed command pulse input gain** = Maximum number of pulses

*5 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.351** = 0 m/min, **Pr.353** = 100 m/min, **Pr.354** = 0 pulses/s, **Pr.355** = 50k pulses/s, and **Pr.384** = "2", the line speed will be 50 m/min.

8 Actual line speed input setting

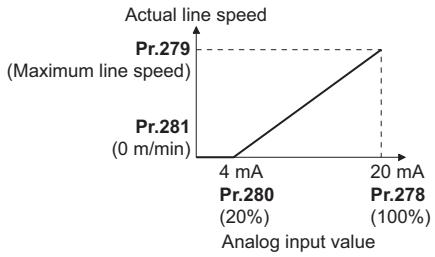
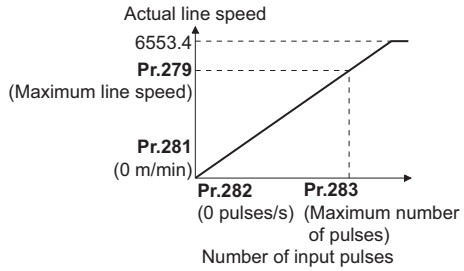
Set **Pr.362** according to the line speed command value input method for calculating the winding diameter (actual line speed method). (Setting is not required for the intermediate shaft.)

Pr.	Name	Setting	Input method
362	Actual line speed input selection	0 (initial value)	V* (line speed command)
		1	Terminal JOG single-phase pulse train input (Refer to page 200)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 200)
		3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 202)
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 202)
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 202)
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 202)
		7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to page 200)
		9	CC-Link or CC-Link IE Field Network Basic (0 to 65534)
		9999	No function

*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Actual line speed input method	Setting by analog current (4 to 20 mA) input through terminal 4 (**Pr.362** = "4") 	Setting by pulse train input through terminal JOG (**Pr.362** = "1") 
Parameter setting	**Pr.280 Actual line speed voltage/current bias** = 20% **Pr.281 Actual line speed bias** = 0 m/min **Pr.278 Actual line speed voltage/current gain** = 100% **Pr.279 Actual line speed gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*3 **Pr.281 Actual line speed bias** = 0 m/min **Pr.282 Actual line speed pulse input bias** = 0 pulses/s **Pr.279 Actual line speed gain** = Maximum line speed **Pr.283 Actual line speed pulse input gain** = Maximum number of pulses

*3 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.281** = 0 m/min, **Pr.279** = 100 m/min, **Pr.282** = 0 pulses/s, **Pr.283** = 50k pulses/s, and **Pr.384** = "2", the actual line speed will be 50 m/min.

9 PID control action setting

Set the following parameters for PID control.

Pr.	Name	Setting	Remarks
128	PID action selection	40 or 41	40: Tension sensor feedback speed control (reverse action) 41: Tension sensor feedback speed control (forward action)
131	PID upper limit	*1	Set the value in 0.1% increments (400 to 600% or 9999) for outputting the PID upper limit (FUP) signal.
132	PID lower limit	*1	Set the value in 0.1% increments (400 to 600% or 9999) for outputting the PID lower limit (FDN) signal.
133	PID action set point	*1	Set the tension command value in 0.01% increments (400 to 600%).
1382	PID set point cushion time	*1	Set the cushion time for the PID set point. (Refer to page 85.)
1284	Taper mode selection	*1	Set the taper function for the PID set point. (Refer to page 124.)

*1 Set the parameter according to the specification of the machine used.

The following table shows a setting example.

Item	Setting example
Tension command setting method	Setting the tension command directly
Parameter setting	Perform calculation to convert the output voltage sent from the tension sensor when an intended tension command is applied. Convert the output voltage of the tension sensor to a percentage. Here 5 V corresponds to 100%. Set the output voltage value (in %) plus 500% in **Pr.133**.

NOTE

- The setting unit for manipulated amount of PID control is initially set to Hz (frequency). To change the unit to m/min (line speed), set the amount using **Pr.1148** and **Pr.1149**. (Refer to page 104.)

10 PID control action check (example)

Apply tension force corresponding to the tension command to the tension sensor.

Input a line speed command of 0 m/min.

Input the X114 signal and start command.

Start the motor without feeding the workpiece.

Change the tension during motor operation, and check that the following motor speed conditions.

If any inconsistency is found, check the **Pr.128** setting.

Winding/unwinding	Tension feedback	Motor speed
Winding	Tension feedback ≥ Tension command	Deceleration
	Tension feedback < Tension command	Acceleration
Unwinding	Tension feedback ≥ Tension command	Acceleration
	Tension feedback < Tension command	Deceleration

11 PID control gain adjustment

Feed the workpiece through the system and adjust the tension PI gain. Refer to page 122 for the tension PI gain adjustment.

12 Test run

Operate the system starting from the maximum-diameter roll to the minimum-diameter roll and vice versa and check that no fault is found in the system behavior.

4.4.2 PID gain adjustment

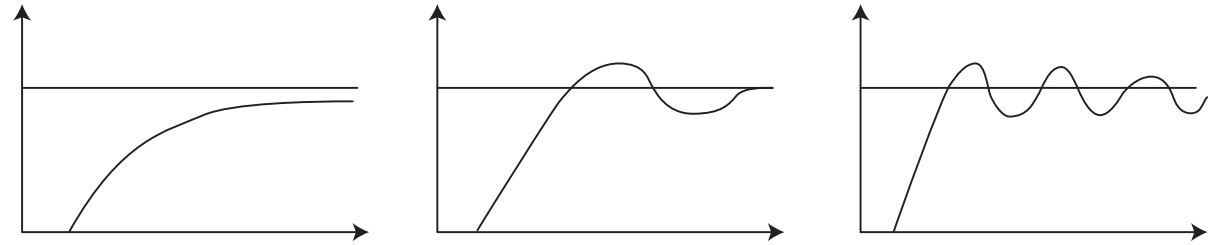
Adjust the PID gain for tension sensor feedback speed control.

◆Adjustment by tension PI gain tuning (recommended)

The PID gain is adjusted by tension PI gain tuning (refer to page 91). Tension PI gain tuning is recommended for PID gain adjustment.

◆Manual adjustment

- Set the minimum-diameter roll for winding and the maximum-diameter roll for unwinding. Connect the material from the beginning to the end of the machine, and increase the line speed gradually while observing the tension feedback value. Adjust the line speed so that appropriate tension feedback value can be obtained.
- Adjust the PID gain so that the dancer roll works without problems at acceleration, constant speed, deceleration, and sudden deceleration.
- It is important to adjust the tension PI gain as high as possible for the minimum-diameter roll.
- Normally, adjust the gain with **Pr.129 PID proportional band** and **Pr.130 PID integral time**.



Slow response
(the tension feedback position is too low)

Proper condition

Fast response
(hunting occurs too frequently)

POINT

- Adjust the gain so that overshooting occurs once or so before the tension feedback value returns to the set point.

- Refer to the following according to the tension feedback condition.

Status	Adjustment method
When the response is slow (the tension feedback value is too low)	• Decrease **Pr.129 PID proportional band** by 10%. • Decrease **Pr.130 PID integral time** by 0.1 s. • Repeat the adjustment procedure in the range from the minimum diameter to the maximum diameter so that the dancer roll moves properly at acceleration, constant speed, deceleration, and sudden deceleration.
When the response is fast (hunting occurs too frequently)	• Increase **Pr.129 PID proportional band** by 10%. • Increase **Pr.130 PID integral time** by 0.1 s. • Repeat the adjustment procedure in the range from the minimum diameter to the maximum diameter so that the dancer roll moves properly at acceleration, constant speed, deceleration, and sudden deceleration.

NOTE

- Set **Pr.134 PID differential time** only when it is necessary as it causes hunting. However, set a small value in **Pr.134** PID differential time to cease fluctuation of the tension feedback value by disturbance and such at an early point. (Set 0.01 s at first and gradually increase the value.)

4.5 Tension sensor feedback speed control details

Purpose	Parameter to set			Refer to page
To select forward/reverse action for PID control	PID action selection	P.R100	Pr.128	65
To select winding or unwinding for a shaft	Winding/unwinding selection	P.R002	Pr.1230	67
To input tension feedback to the inverter	Tension feedback setting	P.R101 to P.R103	Pr.133, Pr.363, Pr.1227	124
To calibrate the zero point of tension feedback	PID offset displacement	P.R104	Pr.424	126
To detect tension feedback malposition	Tension feedback malposition detection	P.R160, P.R163, P.A601, P.A602	Pr.131, Pr.132, Pr.137, Pr.425	127
To allow a signal to be output during normal tension feedback	Tension feedback detection	P.R422	Pr.423	126
To select the line speed command input method	Line speed command input selection	P.R200	Pr.361	67
To select a unit of the line speed	Line speed unit	P.R201	Pr.358	67
To input the line speed command using multi-speed setting	Line multi-speed setting	P.R230 to P.R244	Pr.1265 to Pr.1279	67
To calibrate the line speed command value	Line speed command bias/gain	P.R210 to P.R213, P.R220 to P.R223	Pr.350 to Pr.357	67
To set the line speed command to start operation	Line speed command for starting	P.R204	Pr.622	67
To calibrate the compensation value added to the line speed command value	Line speed command added compensation value bias/gain	P.R214 to P.R217	Pr.635 to Pr.638	76
To set acceleration/deceleration time to increase/decrease the line speed command value	Acceleration/ deceleration time selection for line speed command	P.R253 to P.R256, P.R250 to P.R252	Pr.100 to Pr.103, Pr.393 to Pr.395	79
To enable automatic tuning for complex PI gain calculation	Tension PI gain tuning	P.R170 to P.R176	Pr.1211, Pr.1215, Pr.1217, Pr.1219, Pr.1222, Pr.1223, Pr.1226	91
To enable manual input of gains for PID control	PID control gain setting	P.R110 to P.R112	Pr.129, Pr.130, Pr.134	99

This section explains the details unique to the tension sensor feedback speed control.
Many of the functions are common between dancer feedback speed control and tension sensor feedback speed control. The functions explained in 3.5.1 to 3.5.5 and 3.5.11 to 3.5.15 can be also used during tension sensor feedback speed control.
For tension sensor feedback speed control, set the function by replacing "dancer feedback speed control" with "tension sensor feedback speed control" in the description of the above-mentioned subsections.

4.5.1 Tension feedback setting

Set the target position for tension feedback.

Select the input method to the inverter (analog input terminal) for tension feedback input.

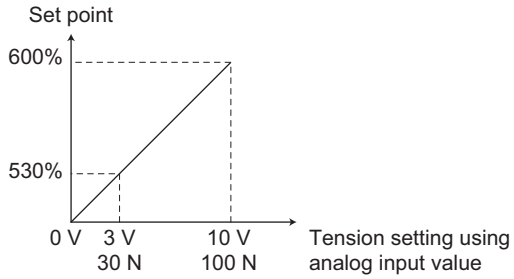
Pr.	Name	Initial value	Setting range	Description
133 R101 (A611)	**PID action set point**	500%	400 to 600%	Set the set point for tension feedback.
363 R102	**Dancer / tension sensor feedback input selection**	9999	3	The measured value is input through terminal 2.
			4	The measured value is input through terminal 4.
			5	The measured value is input through terminal 1.
			6	The measured value is input through terminal 6 (FR-A8AZ).
			9	The measured value is input via CC-Link / CC-Link IE Field Network Basic communication.
			9999	No function
1227 R103	**Dancer / tension sensor feedback input filter time constant**	0	0	Without filter
			0.01 to 5 s	Set the primary delay filter for the tension feedback input value.

◆PID set point (Pr.133)

- Set the set point for tension feedback in **Pr.133 PID action set point**.

Pr.133 setting	Actual set point
600%	+100%
500% (initial setting)	0%
400%	-100%

- Set a value according to the full scale value of the tension detector to be used and the corresponding output voltage. For example, when tension feedback is input through terminal 1 and the tension sensor outputs 10 V for 100 N (full scale value), set 530% in **Pr.133** to set 30 N tension.



NOTE

- Set **Pr.52** = "86" to monitor the tension feedback value on a percentage basis.

◆Taper function for the PID set point

- FTP can be replaced with the PID set point after taper control, and F* with the PID set point after the cushion time. (For details on FTP and F*, refer to page 151.)
- The taper ratio is the reduction ratio against 100% (the PID set point set in **Pr.133** is regarded as 100%). When the taper ratio setting is 20% in the example of linear taper control, the PID set point after taper control is 80% of the original value.
- When the taper function is used for the set point, set **Pr.1284 Taper mode selection** ≠ "0", **Pr.364 Dancer tension setting input selection / taper function enable/disable selection for tension sensor feedback speed control 1** = "9999", and **Pr.430 Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2** = "9999".
- When the PID set point after the cushion time is negative, the limit is set at 0%.
- When the taper function is used for the set point, calibrate the settings so that 0% is equivalent to 0 N.

◆Tension feedback input selection (Pr.363)

- Use **Pr.363 Dancer / tension sensor feedback input selection** to select the input terminal for tension feedback.

Pr.363 setting	Input terminal
3	Terminal 2 (0 to 100%) (0 to 5 VDC)*1
4	Terminal 4 (20 to 100%) (4 to 20 mADC)*1
5 (initial value)	Terminal 1 (-100 to 100%) (0 to ±10 VDC)*1
6	Terminal 6 (FR-A8AZ) (-100 to 100%) (0 to ±10 VDC)*1
9	CC-Link or CC-Link IE Field Network Basic (-100 to 100%)

*1 The input specification in the initial setting is indicated.

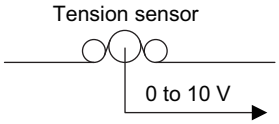
◆Tension feedback calibration example

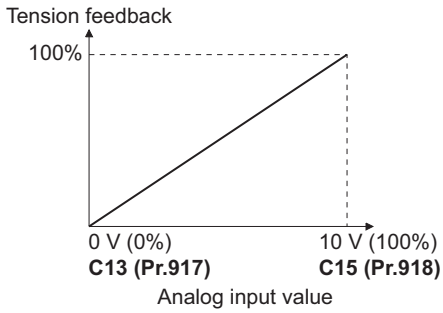
- The following parameters are used for calibrating the terminals which the tension feedback is input via. The tension feedback analog input values at both 0% and 100% can be calibrated.

Input terminal	Calibration parameter
Terminal 2 (0 to 100%)	**C3 (Pr.902)**, **C4 (Pr.903)**
Terminal 4 (0 to 100%)*1	**C6 (Pr.904)**, **C7 (Pr.905)**
Terminal 1 (-100 to 100%)	**C13 (Pr.917)**, **C15 (Pr.918)**
Terminal 6 (FR-A8AZ) (-100 to 100%)	**C31 (Pr.926)**, **C33 (Pr.927)**
CC-Link, CC-Link IE Field Network Basic	—

*1 The initial input range is 20 to 100%.

- In the following example, a tension sensor in capacity from 0 to 10 V output is used for inputting the tension feedback value through terminal 1 (input range: -10 to 10 V). This example defines the minimum tension as 0% and the maximum tension as 100% for calibration. **C13(Pr.917) Terminal 1 bias (speed) and Terminal 1 gain (speed)** are used as calibration parameters.





NOTE

- For the details of **C3 (Pr.902)**, **C4 (Pr.903)**, **C6 (Pr.904)**, **C7 (Pr.905)**, **C13 (Pr.917)**, and **C15 (Pr.918)**, refer to the FR-A800 Instruction Manual (Detailed).

◆Tension feedback input filter (Pr.1227)

- Use **Pr.1227 Dancer / tension sensor feedback input filter time constant** to set the primary filter for the tension feedback input value.

4.5.2 Tension feedback detection

A signal is output while the tension feedback value maintains the specified normal level.

Pr.	Name	Initial value	Setting range	Description
423 **R422**	**Dancer / tension sensor feedback detection level**	10%	0 to 100%	Set the scope of normal value for tension feedback. Define the percentage of deviation with respect to the set point.

◆Tension feedback detection (Pr.423, Y235 signal)

- The Dancer position / tension feedback detection (Y235) signal is output while the tension feedback value is within the range set in **Pr.423 Dancer / tension sensor feedback detection level** around the set point.
- For the Y235 signal, set "235 (positive logic) or 335 (negative logic)" in one of **Pr.190 to Pr.196 (output terminal function selection)** to assign the function to the output terminal.

4.5.3 PID offset displacement

Calibrate the reference value of the tension sensor feedback amount (PID measured value).

Pr.	Name	Initial value	Setting range	Description
424 **R104**	**Dancer / tension sensor feedback input offset**	500%	400 to 600%	The offset displacement input value is written.

◆PID offset displacement (Pr.424, X102 signal)

- When setting the tension sensor feedback amount as a desired reference value, turn ON the Offset displacement storage (X102) signal to add an offset to the PID measured value. The tension sensor feedback amount when the X102 signal turns ON can then be set to 0%.
- At the ON edge of the X102 signal, the present input value (-100 to 100%) is written in **Pr.424 Dancer / tension sensor feedback input offset**. A value within the range from 400 to 600% is written in **Pr.424**, considering the measured value of 0% as 500%.
- Measured value (after the offset) = Measured value (before the offset) - **Pr.424** (offset value)

NOTE

- The measured value (after the offset) is limited within the range of ± 100%.

4.5.4 Tension feedback malposition detection

Set the following parameters to prevent the motor speed from increasing due to a line break (tension feedback = 0 N).

Pr.	Name	Initial value	Setting range	Description
131 A601	PID upper limit	9999	400 to 600%	Set the value for outputting the PID upper limit (FUP) signal .
			9999	No function
132 A602	PID lower limit	9999	400 to 600%	Set the value for outputting the PID lower limit (FDN) signal .
			9999	No function
137 R163	PID upper/lower limit hysteresis width	9999	0 to 100%	Prevent chattering of the FUP/FDN signals.
			9999	No function
425 R160	Break detection waiting time	9999	0 to 100 s	Set the time until tension feedback malposition is determined.
			9999	No break detection
553 A603	PID deviation limit	9999	0 to 100%	The Y48 signal is output when the absolute value of the deviation exceeds the deviation limit value.
			9999	No function
554 A604	PID signal operation selection	0	0 to 3	The action when the upper or lower limit for a measured value input is detected or when a limit for the deviation is detected can be selected.

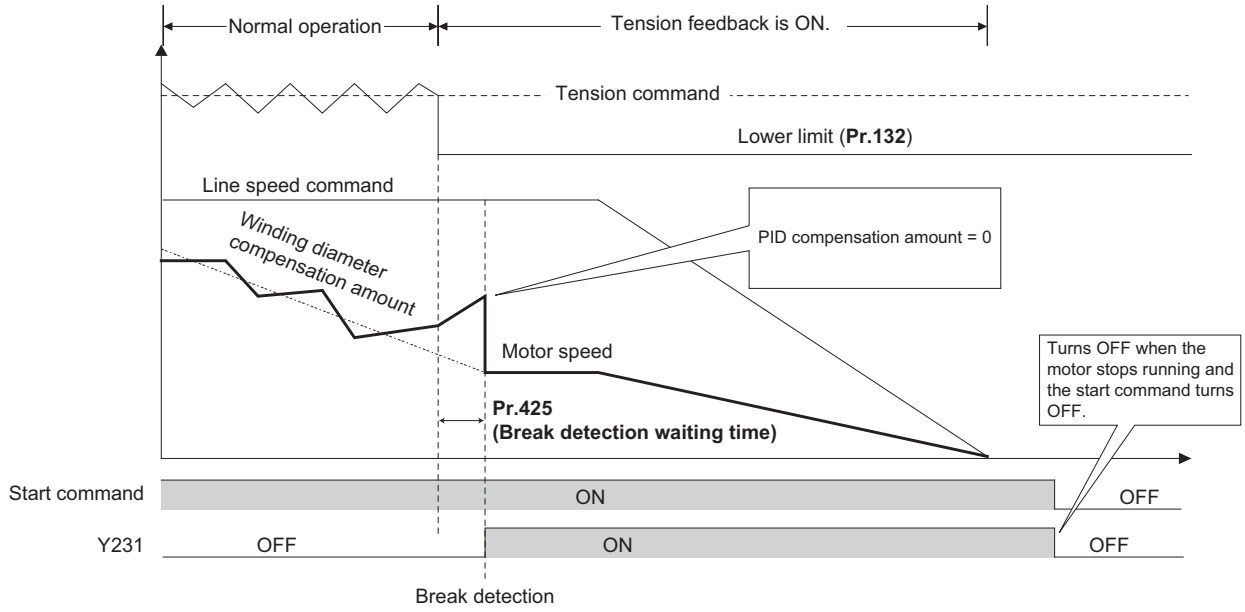
◆Tension feedback malposition detection (break detection) (Pr.131, Pr.132, Pr.425)

- Set the upper limit of tension feedback in **Pr.131 PID upper limit**. Set the lower limit of tension feedback in **Pr.132 PID lower limit**.
- The FUP signal is output when a tension feedback value exceeds the **Pr.131** setting. When a value falls below the **Pr.132** setting, the FDN signal is output.
- When tension feedback remains higher than the **Pr.131** setting or lower than the **Pr.132** setting for the time set in **Pr.425 Break detection waiting time** or longer, the condition is determined as tension feedback malposition (break), and compensation by PID control becomes 0. The winding diameter at the time of malposition detection is retained.
- When tension feedback malposition (break) is detected, the Break detection (Y231) signal can be output.
- When the following two conditions are both met, PID calculation is resumed.
  - The motor is stopped or output is shutoff.
  - The start signal is OFF.

Tension sensor feedback speed control details

- When using each signal, assign the function to **Pr.190 and Pr.196 (output terminal function selection)** referring to the following table.

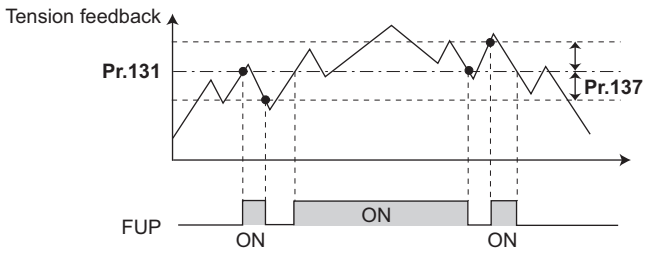
Output signal	Pr.190 to Pr.196 setting	
	Positive logic	Negative logic
FDN	14	114
FUP	15	115
Y231	231	331



◆PID upper/lower limit hysteresis width (Pr.137)

When the tension feedback value fluctuates, the FUP/FDN signal may chatter (turn ON and OFF repeatedly), depending on the position.

To prevent the signal chattering, configure **Pr.137 PID upper/lower limit hysteresis width** to set a hysteresis for the FUP and FDN signals.



Example of the PID upper limit (FUP) signal

NOTE

- **Pr.137** setting does not affect the operation of the Y231 signal. (Refer to page 127 for the details of the Y231 signal.)
- When a value other than "9999" is set in **Pr.137**, depending on the fluctuation of the tension feedback value, the FUP/FDN signal may not turn ON even if the tension feedback value exceeds the **Pr.131** setting or falls below the **Pr.132** setting.

◆Operation selection when a limit is detected (Pr.554, FUP signal, FDN signal, Y48 signal)

- Using **Pr.554 PID signal operation selection**, set the action when the measured value input exceeds the upper limit (**Pr.131 PID upper limit**) or lower limit (**Pr.132 PID lower limit**), or when the deviation input exceeds the permissible value (**Pr.553 PID deviation limit**).
- Choose whether to output the signals (FUP, FDN, Y48) only or to activate the protective function to output the inverter shutoff.

Pr.554 setting	Inverter operation	
	FUP, FDN	Y48
0 (initial value)	Signal output only	Signal output only
1	Signal output + output shutoff (E.PID)	
2	Signal output only	Signal output + output shutoff (E.PID)
3	Signal output + output shutoff (E.PID)	

NOTE

- When each of **Pr.131**, **Pr.132** and **Pr.553** settings corresponding to each of the FUP, FDN and Y48 signals is "9999" (no function), signal output and protective function are not available.

5 TENSION SENSORLESS TORQUE CONTROL

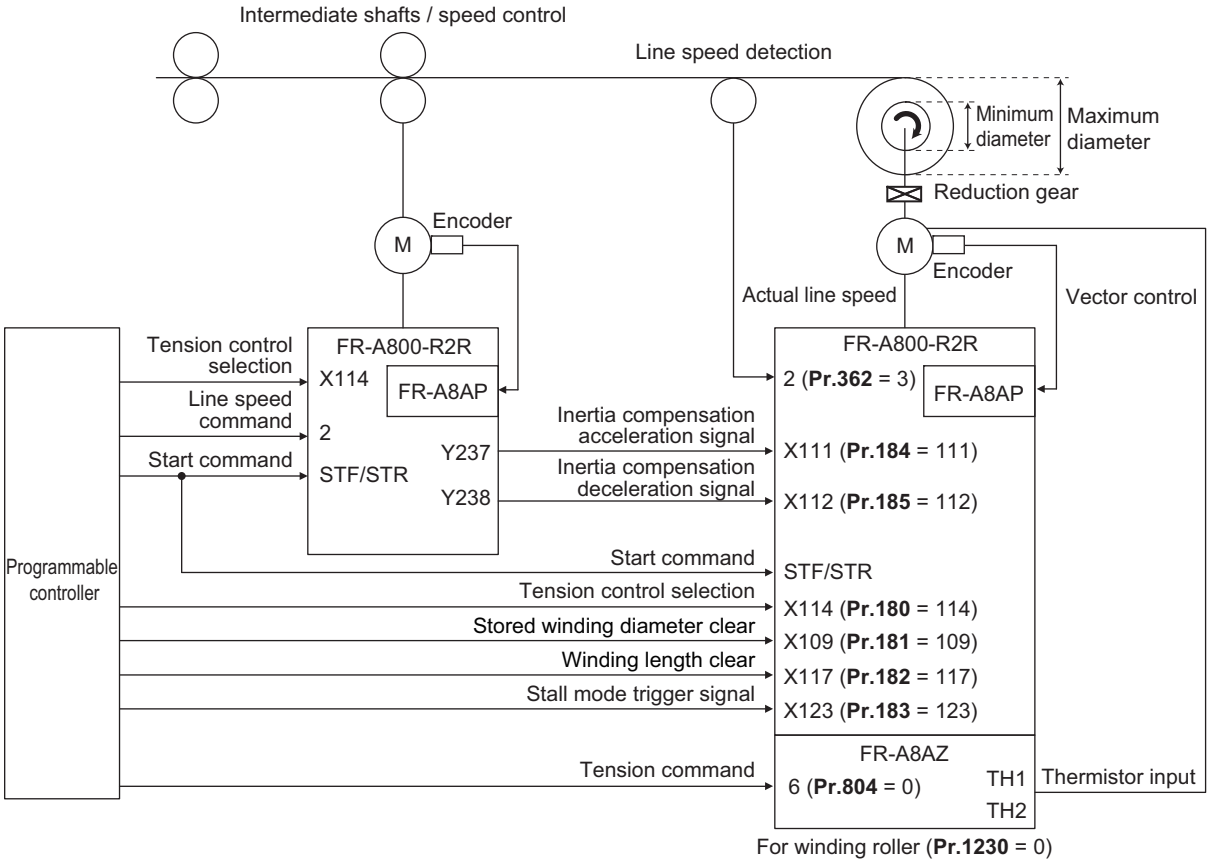
5.1 Dedicated function list

Item		Description
Tension sensorless torque control	Taper function	Set a taper ratio.
	Inertia compensation function	Set the compensation for acceleration and deceleration individually using external signals.
	Mechanical loss compensation function	Straight movement (with five break points) against the speed can be performed.
Common	Dedicated input signal	Dancer/tension control selection, Inertia compensation acceleration, Inertia compensation deceleration, Inertia compensation second acceleration/ deceleration time selection, Winding diameter measurement, Stall mode trigger, Two-way operation.
	Dedicated output signal	Winding diameter calculation completion at start
	Dedicated monitor	Tension command, mechanical loss compensation, inertia compensation

NOTE

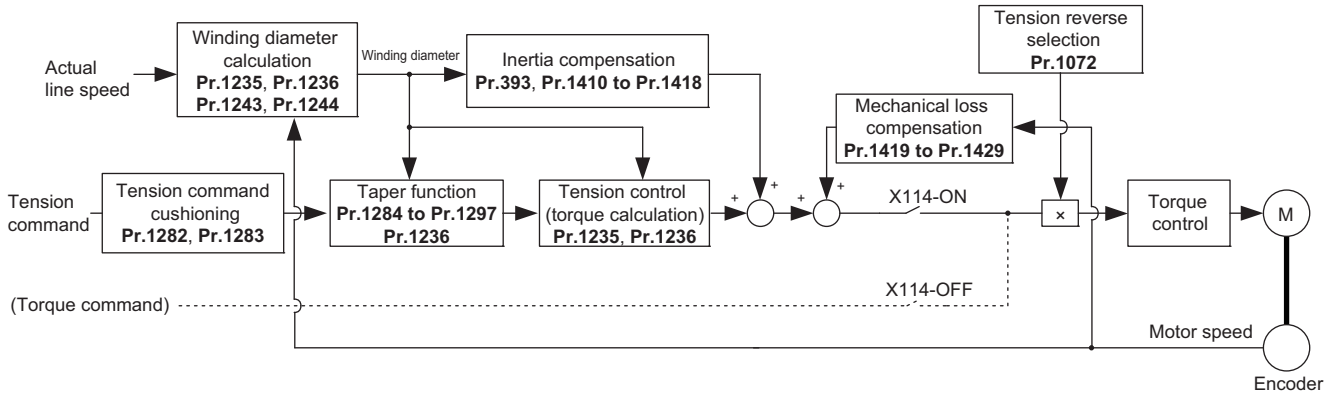
• For the details of the winding diameter compensation function, refer to page 194.

5.2 System configuration example



5.3 Control block diagram

5.3.1 Block diagram of tension sensorless torque control function



5.4 Parameter setting procedure for tension sensorless torque control

The following procedure shows the parameter setting example for the tension sensorless torque control.

5.4.1 Parameter setting procedure

1 Wiring

Perform secure wiring.

NOTE

- Do not feed the workpiece through the machine.

2 Control method selection

Select the control method according to the application and the motor.

Pr.	Name	Setting range	Minimum setting increments	Initial value
71	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0
9	Electronic thermal O/L relay	0 to 500A *3	0.01A*3	Inverter rated current
		0 to 3600A *4	0.1A*4	
80	Motor capacity	0.4 to 55kW, 9999 *3	0.01kW	9999
		0 to 3600kW, 9999 *4	0.1kW	
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999
83	Rated motor voltage	0 to 1000V	0.1V	200 V (200 V class)
				400 V (400 V class)
84	Rated motor frequency	10 to 400Hz, 9999	0.01Hz	9999
800	Control method selection*1	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20
803	Constant output range torque characteristic selection	0 to 2, 10, 11	1	0
807	Speed limit selection	0 to 2	1	0
810	Torque limit input method selection	0 to 2	1	0
359	Encoder rotation direction	0, 1, 100, 101	1	1
369	Number of encoder pulses	0 to 4096	1	1024
707	Motor inertia (integer)*2	10 to 999, 9999	1	9999
724	Motor inertia (exponent)*2	0 to 7, 9999	1	9999
862	Encoder option selection	0, 1	1	0

*1 For the control method, vector control is recommended.

*2 Setting is required for a motor other than a Mitsubishi Electric motor (the SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or SF-V5RU (1500 r/min series) motor).

*3 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*4 For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

NOTE

- Torque control is not available for regenerative driving in a low-speed range (about 10 Hz or lower) or light-load operation in a low-speed range (about 5 Hz or lower and about 20% or lower of the rated torque) under Real sensorless vector control. Select Vector control for regenerative driving or light-load operation in a low-speed range.
- For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

3 Speed limit setting

Set the speed limit as required as follows.

$$\text{Speed limit value} = \frac{\text{Present line speed}}{\pi \times \text{Present diameter} \times \text{Gear ratio}} \times 1.1 \text{ to } 1.2$$

NOTE

- Use **Pr.807 to Pr.809** and **Pr.1113** to set the speed limit. As the speed limit value is overwritten frequently, set "0" in **Pr.342 Communication EEPROM write selection** to enable RAM write. For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

4 Torque characteristic setting

Set "1" in **Pr.803** to make the torque characteristic constant for the tension command in the low-speed range and in the constant output range.

5 Offline auto tuning

Perform offline auto tuning as required. For offline auto tuning, refer to page 55.

Pr.	Name	Setting range	Minimum setting increments	Initial value
96	Auto tuning setting/status	0, 1, 11, 101	1	0

After the offline auto tuning, perform the test run of the motor alone to make sure that no fault is found in the motor's behavior.

6 Mechanical specifications setting

Set the following parameters according to the specifications of the machine used. Refer to 11.6 (Application examples) on page 243.

Pr.	Name	Setting	Remarks
1235	Maximum winding diameter 1	*1	Set the maximum/minimum value in 1 mm increments (1 to 6553 mm) relative to the winding diameter calculation result.
1236	Minimum winding diameter 1	*1	
178 to 189	Input terminal function selection	114	Set "114" for the X114 signal.
		109	Set "109" for using the Stored winding diameter clear (X109) signal.
		117	Set "117" for using the Winding length clear (X117) signal.
1230	Winding/unwinding selection	*1	0: Winding shaft 1: Unwinding shaft
645	Winding diameter storage selection	*1	0: Not stored. 1: The present winding diameter is stored.
1247	Winding diameter change increment amount limit	*1	Set the maximum change in 0.001 mm increments (0 to 9.998 mm or 9999) per roll diameter calculation.
1243	Gear ratio numerator	*1	Set a gear ratio in 1 increments (1 to 65534) when a reduction gear is installed between the driving shaft and motor shaft.
1244	Gear ratio denominator	*1	
7	Acceleration time	0 s	0 to 3600 seconds, in 0.1 second increments*2
8	Deceleration time	0 s	
394	First acceleration time for line speed command	*1	Setting is required in 0.1 second increments*2 (0 to 3600 seconds) when the cushion time is not considered for the line speed command.
395	First deceleration time for line speed command	*1	
101	Second deceleration time for line speed command	*1	Set the time in 0.1 second increments*2 (0 to 3600 seconds) as required (for example, for rapid deceleration). Turn ON the X105 signal to enable the setting.
393	Line speed command acceleration/deceleration reference	*1	Set the reference line speed (travel amount per minute) in 0.1 m/min increments*3 (1 to 6553.4 m/min) for the acceleration/deceleration time for the line speed command.
1231	Material thickness d1	*1	Setting is required in 0.001 mm increments (0 to 20 mm or 9999) when thickness is used for winding diameter calculation.
1072	Tension reverse selection	*1	0: The tension direction is not reversed. 1: The tension direction is reversed.
1114	Torque command reverse selection	*1	0: The torque direction is not reversed. 1: The torque direction is reversed.

Set the torque generation direction in accordance with the machine used.

*1 Set the parameter according to the specification of the machine used.

*2 The increment applies when **Pr.21** = "0 (initial value)".

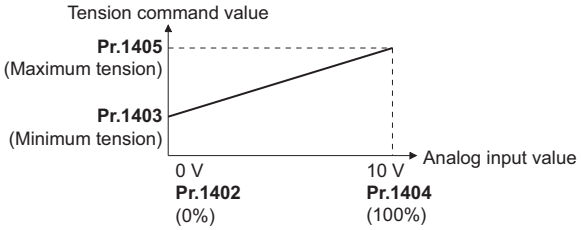
*3 The increment applies when **Pr.358** = "0 (initial value)".

7 Tension command input selection

Set the following parameter according the tension input method.

Pr.	Name	Setting	Input terminal
804	Tension / Torque command source selection	0 (initial value)	Tension command by terminal 1 analog input (-10 to 10 VDC) Tension command by terminal 6 analog input (-10 to 10 VDC) (FR-A8AZ)
		1	Tension command by the parameter setting (**Pr.365** or **Pr.366**)
		2	Tension command by the pulse train command (FR-A8AL)
		3	Tension command via CC-Link communication (FR-A8NC/FR-A8NCE) Tension command via PROFIBUS-DP communication (FR-A8NP)
		4	Tension command by 12/16-bit digital input (FR-A8AX)
		5	Tension command via CC-Link communication (FR-A8NC/FR-A8NCE) Tension command via PROFIBUS-DP communication (FR-A8NP)
		6	

The following table shows a setting example.

Item	Setting example
Tension command input method	Setting by analog voltage (0 to 10 V) input through terminal 1 (**Pr.804** = "0") 
Parameter setting	**Pr.868 Terminal 1 function assignment** = "3 or 4" **Pr.1402 Tension command input voltage bias** = 0% **Pr.1403 Tension command bias** = Minimum tension **Pr.1404 Tension command input voltage gain** = 100% **Pr.1405 Tension command gain** = Maximum tension **Pr.1401 Tension command increment** = "0" (0.01 N increment)

8 Actual line speed input

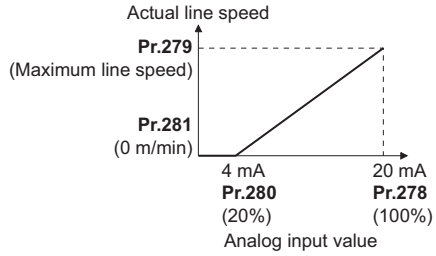
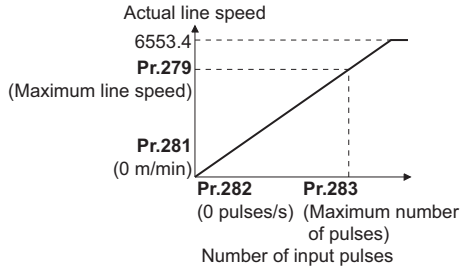
Use **Pr.362** to select the input terminal for actual line speed.

Pr.	Name	Setting	Input terminal
362	Actual line speed input selection	0 (initial value)	V* (line speed command)
		1	Terminal JOG single-phase pulse train input (Refer to page 200)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 200)
		3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 202)
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 202)
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 202)
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 202)
		7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to page 200)
		9	CC-Link or CC-Link IE Field Network Basic (0 to 65534)
		9999	No function

*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Actual line speed input method	Setting by analog current (4 to 20 mA) input through terminal 4 (**Pr.362** = "4") 	Setting by pulse train input through terminal JOG (**Pr.362** = "1") 
Parameter setting	**Pr.280 Actual line speed voltage/current bias** = 20% **Pr.281 Actual line speed bias** = 0 m/min **Pr.278 Actual line speed voltage/current gain** = 100% **Pr.279 Actual line speed gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*3 **Pr.281 Actual line speed bias** = 0 m/min **Pr.282 Actual line speed pulse input bias** = 0 pulses/s **Pr.279 Actual line speed gain** = Maximum line speed **Pr.283 Actual line speed pulse input gain** = Maximum number of pulses

*3 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.281** = 0 m/min, **Pr.279** = 100 m/min, **Pr.282** = 0 pulses/s, **Pr.283** = 50k pulses/s, and **Pr.384** = "2", the actual line speed will be 50 m/min.

9 Taper ratio setting

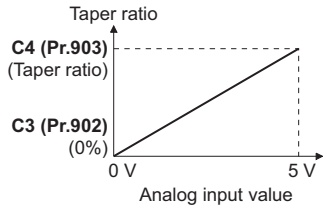
Set the taper ratio input method for using the taper ratio.

Pr.	Name
1285	Taper setting analog input selection
1287	Taper ratio setting

Pr.1287 setting	Pr.1285 setting	Taper ratio setting
0 to 100%	—	As set in **Pr.1287**
9999	3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2
	4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2
	5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2
	6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2
	9999	No function

*1 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

Item	Setting example
Taper ratio setting method	Setting by analog voltage (0 to 5 V) input through terminal 2 (**Pr.1287** = "9999", **Pr.1285** = "3") 
Parameter setting	**C3 (Pr.902) Terminal 2 frequency setting bias** = 0% **C4 (Pr.903) Terminal 2 frequency setting gain** = Taper ratio (%)

For using the taper ratio, set the following parameters according to the taper mode.

Pr.	Name	Setting range	Minimum setting increments	Initial value
1284	Taper mode selection	0 to 4	1	0
1286	Winding diameter at taper start	0 to 6553 mm, 9999	1 mm	9999

NOTE

- For the details of the taper function, refer to page 151.

10 Inertia compensation function setting

Set the following parameters for using the inertia compensation function.

Pr.	Name	Setting	Remarks
393	Line speed command acceleration/deceleration reference	*1	Set the line speed at minimum diameter (the maximum line speed during tension control) in 0.1 m/min increments (1 to 6553.4 m/min).
178 to 189	Input terminal function selection	111	Assign the Inertia compensation acceleration (X111) signal. Input the Line speed acceleration (Y237) signal from the inverter connected to the intermediate shaft.
		112	Assign the Inertia compensation deceleration (X112) signal. Input the Line speed deceleration (Y238) signal from the inverter connected to the intermediate shaft.
		122	Assign the Winding diameter measurement (X122) signal.
1410	Motor inertia	*1	Set the motor inertia in 0.01 kg·m^2 increments (0 to 500 kg·m^2 or 9999). To further improve the accuracy for the inertia compensation function, set a motor inertia value using **Pr.707 and Pr.724**.
1411	Empty reel inertia	*1	Set the empty reel inertia in 0.01 kg·m^2 increments (0 to 500 kg·m^2 or 9999). To further improve the accuracy for the inertia compensation function, set an empty reel inertia value using **Pr.753 and Pr.754**.
1412	Roll width	*1	Set the roll width in 1 mm increments (0 to 5000 mm).
1413	Material specific gravity	*1	Set the specific gravity of the material in 0.001 g/cm^3 increments (0 to 20 g/cm^3).
1141	Line speed command acceleration/deceleration pattern	*1	Set S-curve acceleration/deceleration to reduce shock during inertia compensation operation. (Refer to page 160.)
1142	Line speed command acceleration start S-curve time	*1	
1143	Line speed command acceleration completion S-curve time	*1	
1144	Line speed command deceleration start S-curve time	*1	
1145	Line speed command deceleration completion S-curve time	*1	

*1 Set the parameters according to the specification of the machine used.

NOTE

- For the details of the inertia compensation function, refer to page 157.

11 Mechanical loss compensation function setting

Set the following parameters for using the mechanical loss compensation function.

Pr.	Name	Setting	Remarks
1419	Mechanical loss setting frequency bias	1000	The setting "1000" represents 0%. An offset can be set in 0.1% increment from the setting "1000".
1420	Mechanical loss setting frequency 1	*1	Drive the machine with an empty reel at the frequency of **Pr.1420**, **Pr.1422**, **Pr.1424**, **Pr.1426**, and **Pr.1428** (0 to 400 Hz, 0.01 Hz increments), and set the monitored torque values in **Pr.1421**, **Pr.1423**, **Pr.1425**, **Pr.1427**, and **Pr.1429** respectively. (The setting "1000" in **Pr.1421**, **Pr.1423**, **Pr.1425**, **Pr.1427**, and **Pr.1429** represents 0%. An offset can be set in 0.1% increments (900 to 1100%) from setting "1000".)
1421	Mechanical loss 1	*1	
1422	Mechanical loss setting frequency 2	*1	
1423	Mechanical loss 2	*1	
1424	Mechanical loss setting frequency 3	*1	
1425	Mechanical loss 3	*1	
1426	Mechanical loss setting frequency 4	*1	
1427	Mechanical loss 4	*1	
1428	Mechanical loss setting frequency 5	*1	
1429	Mechanical loss 5	*1	

*1 Set the parameters according to the specification of the machine used.

NOTE

- For the details of the mechanical loss compensation function, refer to page 163.

12 Stall mode function selection

Set the following parameters for using the stall mode function.

Pr.	Name	Setting	Remarks
178 to 189	Input terminal function selection	123	Assign the Stall mode trigger (X123) signal.
270	Acceleration/deceleration time during stall condition	*1	0 to 3600 seconds, in 0.1 second increments
1406	Commanded tension reduction scaling factor during stall condition	*1	0 to 200%, in 0.1% increments
1407	Speed limit during stall condition	*1	0 to 60 Hz, in 0.01 Hz increments

*1 Set the parameters according to the specification of the machine used.

NOTE

- For the details of the stall mode function, refer to page 165.

13 Test run

Operate the system starting from the maximum-diameter roll to the minimum-diameter roll and vice versa and check that no fault is found in the system behavior.

5.5 Tension sensorless torque control details

The tension sensorless torque control is performed to control the output torque of a motor according to the winding diameter of a roll so that the tension applied to a material is constant.
Winding and unwinding of the material is enabled without using dancer rolls or tension controllers.

Purpose	Parameter to set			Refer to page
To perform setting for tension sensorless torque control	Control method selection	P.C100 (P.C200), P.C101 (P.C201), P.C102 (P.C202), P.G200, P.G300	Pr.80 (Pr.453), Pr.81 (Pr.454), Pr.71 (Pr.450), Pr.800, Pr.451	139
To select the tension command input method	Tension command source selection	P.R300	Pr.804	140
To select the tension command setting increment	Tension command increment	P.R301	Pr.1401	140
To select the torque generation direction	Torque generation direction setting	P.R304, P.R305	Pr.1072, Pr.1114	143
To prevent the roll from getting too tight when the winding diameter increases	Taper function	P.R320, P.R321, P.R500 to P.R504, P.R510 to P.R519, P.R600, P.R601	Pr.829, Pr.1243, Pr.1244, Pr.1282 to Pr.1297	151
To keep the tension applied to the material constant also during acceleration/deceleration	Inertia compensation function	P.R530 to P.R540	Pr.271, Pr.272, Pr.753, Pr.754, Pr.1410 to Pr.1415, Pr.1418	157
To prevent tension change due to factors such as mechanical friction	Mechanical loss compensation function	P.R003, P.R550 to P.R560	Pr.1230, Pr.1419 to Pr.1429	163
To prevent sagging of the material before starting winding	Stall mode function	P.R340 to P.R343	Pr.270, Pr.1406, Pr.1407, Pr.1409	165

POINT

- Select torque control under vector control or Real sensorless vector control to perform tension sensorless torque control.
- Turn the X114 signal ON to perform tension sensorless torque control. When the X114 signal is OFF, the tension sensorless torque control is not available.

5.5.1 Tension sensorless torque control setting method

◆Control method selection

- Select torque control under vector control or Real sensorless vector control to perform tension sensorless torque control.
- Use **Pr.800 Control method selection** to select torque control under vector control or Real sensorless vector control.

Pr.80 (Pr.453), Pr.81 (Pr.454)	Pr.800 setting*1	Pr.451 setting*1	Control method	Control mode	Tension sensorless torque control	
					MC-ON	MC-OFF
Motor capacity, number of motor poles	1, 101	—	Vector control*2	Torque control	○	
	2, 102	—		Speed control/torque control switchover	○*3	×*3
	11, 111		Real sensorless vector control	Torque control	○	
	12, 112			Speed control/torque control switchover	○*3	×*3

○: Valid, ×: Invalid

*1 The setting values of 100 and above are used when the fast-response operation is selected. (For the SND rating, the fast-response operation is not available.)

*2 Advanced magnetic flux vector control is applied if a vector control compatible option is not installed.

*3 The control method can be changed using the MC signal while the inverter is stopped.

◆Tension control selection signal (X114 signal)

- Turn ON the Tension control selection (X114) signal to enable the tension sensorless torque control.
- Ensure the motor has stopped before switching between operation with tension sensorless torque control and normal operation.
- To input the X114 signal, set "114" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.

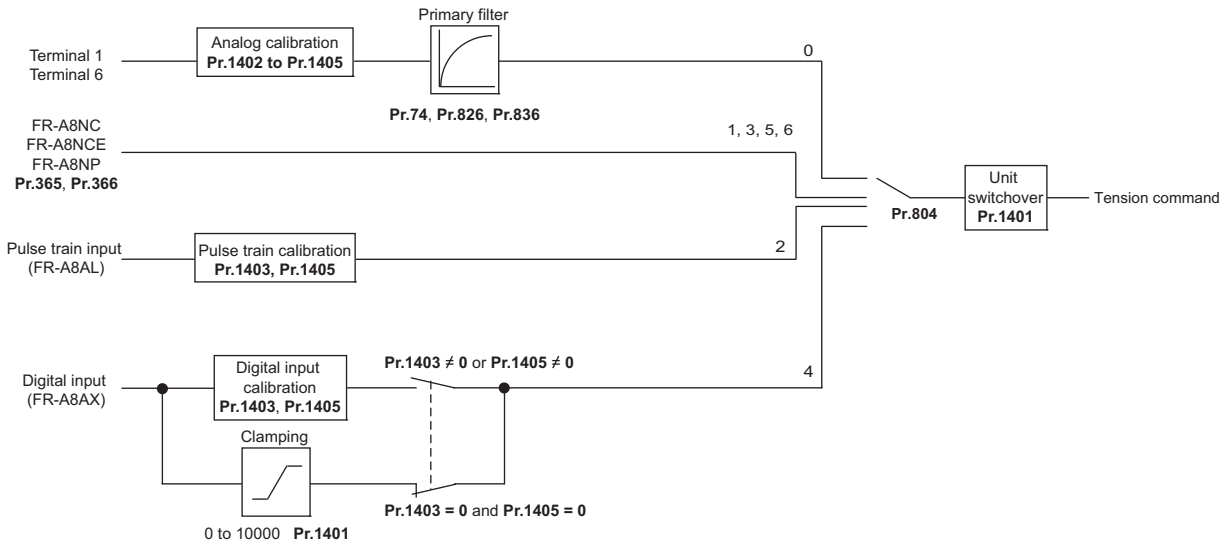
5.5.2 Input method of tension command

The selectable tension command input methods include the following: parameter setting, analog input, multi-speed setting input, pulse input, and input via communication.

Pr.	Name	Initial value	Setting range	Description
365 R302	**Tension command value (RAM)**	0 N	0 to 500 N*1	Writes the tension command value in RAM.
366 R303	**Tension command value (RAM, EEPROM)**	0 N	0 to 500 N*1	Writes the tension command value in RAM and EEPROM
804 R300 (D400)	**Tension / Torque command source selection**	0	0	Tension command by terminal 1 analog input Tension command by terminal 6 analog input (FR-A8AZ)
			1	Tension command by setting the parameter (**Pr.365** or **Pr.366**)
				Tension command via CC-Link communication (FR-A8NC/FR-A8NCE) Tension command via PROFIBUS-DP communication (FR-A8NP)
			2	Tension command by the pulse train command (FR-A8AL)
			3, 5, 6	Tension command via CC-Link communication (FR-A8NC/FR-A8NCE) Tension command via PROFIBUS-DP communication (FR-A8NP)
			4	Tension command by 12/16-bit digital input (FR-A8AX)
1401 R301	**Tension command increment**	0	0	Initial value: 100 N, setting increment: 0.01 N, setting range: 0 to 500 N
			1	Initial value: 1000 N, setting increment: 0.1 N, setting range: 0 to 5000 N
			2	Initial value: 10000 N, setting increment: 1 N, setting range: 0 to 50000 N
1402 R310	**Tension command input voltage bias**	0%	0 to 100%	Set the converted % of the bias voltage for analog input.
1403 R311	**Tension command bias**	0 N	0 to 500 N*1	Set the bias tension command for analog input.
1404 R312	**Tension command input voltage gain**	100%	0 to 100%	Set the converted % of the gain voltage for analog input.
1405 R313	**Tension command gain**	100 N*1	0 to 500 N*1	Set the gain tension command for analog input.

*1 The setting varies with the **Pr.1401** setting.

◆Block diagram

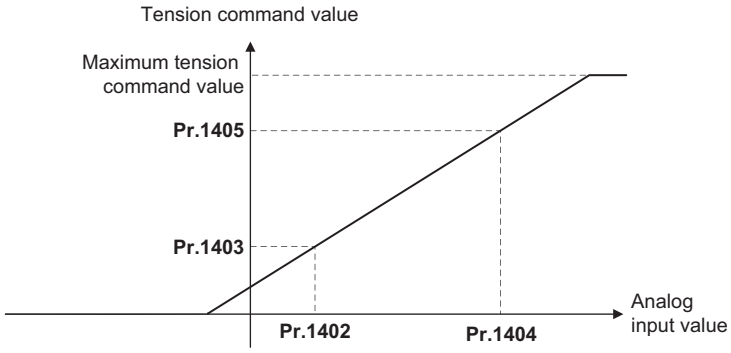


◆Tension command source selection (Pr.804)

- Selects the tension command input method in **Pr.804 Tension / Torque command source selection**.
- The priorities of the input signals are defined as follows. If the input method for a signal is the same as that for the input signal with higher priority, the tension command value is regarded as "0".
  Dancer signal input (**Pr.363**) > Actual line speed input (**Pr.362**) > Tension command input (**Pr.804**) > Line speed command input (**Pr.361** ≠ "0") > Taper setting input (**Pr.1285**) > Dancer tension setting input (**Pr.364**) > Line speed command compensation input > Line speed command input (**Pr.361** = "0")

◆Tension command by analog input (Pr.804 = "0")

- Input the tension command value using analog input to the terminal 1 or the terminal 6 of the FR-A8AZ. To use terminal 1, set **Pr.868 Terminal 1 function assignment** = "3 or 4". To use terminal 6, set **Pr.406 High resolution analog input selection** = "3 or 4".
- The tension command using analog input is calibrated with **Pr.1402 to Pr.1405**. When "0" is set in both **Pr.1403** and **Pr.1405**, the setting is invalid (line speed command value: 0).



NOTE

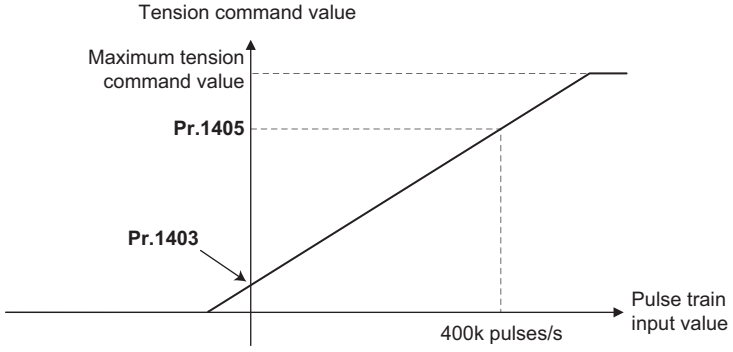
- When the tension command is input using analog input, the input value can be filtered using **Pr.74 Input filter time constant**, **Pr.826 Torque setting filter 1**, and **Pr.836 Torque setting filter 2**.
- The maximum value of the tension command can be changed by the **Pr.1401 Tension command increment** setting.

◆Tension command by parameters (Pr.804 = "1")

- Set **Pr.365 Tension command value (RAM)** or **Pr.366 Tension command value (RAM, EEPROM)** to set the tension command value.
- To change the tension command value frequently, write it in **Pr.365**. If the value is written to **Pr.366** frequently, the life of the EEPROM will be shortened.

◆Tension command by pulse train input (FR-A8AL) (Pr.804 = "2")

- Input the tension command value using pulse train input of the FR-A8AL.
- The tension command using pulse train input (FR-A8AL) is calibrated with **Pr.1403** and **Pr.1405**. When "0" is set in both **Pr.1403** and **Pr.1405**, the setting is invalid (line speed command value: 0).



NOTE

- The maximum value of the tension command can be changed by the **Pr.1401 Tension command increment** setting.

◆Tension command through the CC-Link / CC-Link IE Field Network / PROFIBUS-DP (Pr.804 = "1, 3, 5, 6")

- Set the tension command via the CC-Link communication (FR-A8NC), CC-Link IE Field Network communication (FR-A8NCE), or PROFIBUS-DP communication (FR-A8NP).
- Set the tension command the same way as the torque command. (Refer to the Instruction Manual of each option for details.)

Pr.804 setting	Tension command input			Setting range	Setting increments
	CC-Link	CC-Link IE	PROFIBUS-DP		
1, 6	Tension command by **Pr.365**, **Pr.366**∗1	Tension command by remote register (RWw2)∗2	Tension command by **Pr.365**, **Pr.366**∗1	0 to 500 N∗3∗4	0.01 N∗3
3, 5	Tension command by remote register (RWw1 or RWw2)∗2		Tension command by the buffer memory of PROFIBUS-DP (REF1 to 7)∗2		

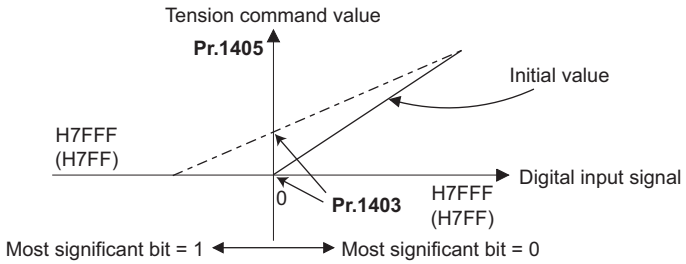
∗1 Can also be set from operation panel or parameter unit.
∗2 The tension command can also be performed by setting a value in **Pr.365** or **Pr.366**.
∗3 The setting varies with the **Pr.1401** setting.
∗4 When **Pr.1401** = "0", enter the setting value multiplied by 100. When **Pr.1401** = "1", enter the setting value multiplied by 10. For example, enter 10000 to set 100.00N when "0" is set in **Pr.1401**.

NOTE

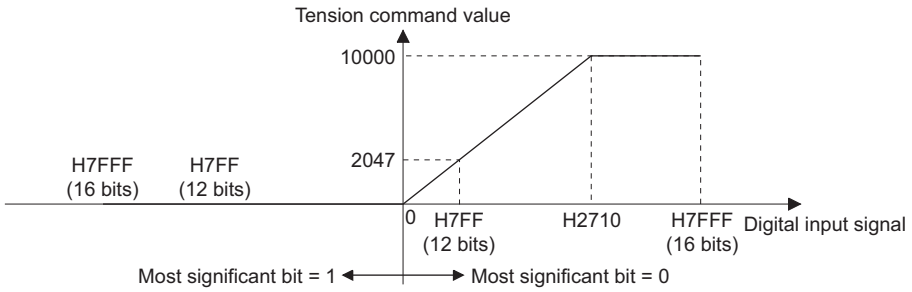
- For the details of FR-A8NC, FR-A8NCE, FR-A8NP setting, refer to the Instruction Manual for the respective communication options.
- For the details of the setting using the PLC function, refer to the PLC Function Programming Manual.

◆Tension command by 16-bit digital input (Pr.804 = "4")

- Execute tension command by 12-bit or 16-bit digital input using FR-A8AX (plug-in option).
- When a value other than "0" is set in **Pr.1403** or **Pr.1405**, use **Pr.1403** or **Pr.1405** to calibrate the tension command value input to the FR-A8AX.



- When "0" is set in both **Pr.1403** and **Pr.1405**, the digital value input to the FR-A8AX is used as it is as the tension command value.
- Use **Pr.1401** to set the maximum tension command value.



NOTE

- For the details of the FR-A8AX setting, refer to the Instruction Manual of the FR-A8AX.

◆The setting range and setting increment of the tension command (Pr.1401)

- The setting increment of the tension command can be changed by the **Pr.1401 Tension command increment** setting. The setting range is also changed according to the increment.

Pr.1401 setting	Initial value	Setting increments	Setting range
0 (initial value)	100 N	0.01 N	0 to 500 N
1	1000 N	0.1 N	0 to 5000 N
2	10000 N	1 N	0 to 50000 N

NOTE

- Changing the **Pr.1401** setting changes the tension command setting **(Pr.365**, **Pr.366**, **Pr.1283**, **Pr.1403**, and **Pr.1405)**. Before changing the **Pr.1401** setting, confirm that changing the tension command setting will not cause any problem.

◆Tension command - torque command switchover (X125 signal)

- When the X125 signal is turned ON during torque control, the commanded tension can be written via communication (CC-Link/CC-Link IE/PROFIBUS-DP) regardless of whether the tension sensorless torque control is valid or invalid.
- Turn ON the X125 signal to input the tension command value before activating the tension sensorless torque control, or to disable the tension sensorless torque control without accidentally changing the torque command value.

Tension sensorless torque control	X125 signal	Command value setting availability through communication			
		Tension command value	Torque command value	Line speed command value*1	Frequency command value*2
Valid	ON	○	×	○	×
	OFF	×	○	×	○
	Not assigned	○	×	○	×
Invalid	ON	○	×	○	×
	OFF	×	○	×	○
	Not assigned	×	○	×	○

○: Available through communication, ×: Not available through communication

*1 Set **Pr.362** ≠ "0" for the actual line speed input selection while tension sensorless torque control is valid. By setting **Pr.362** = "0" (the line speed command value is set as the actual line speed), the line speed command value is used as the actual line speed. However, the line speed command setting is not used as it is. The actual line speed command output value in consideration of acceleration/deceleration is applied.

*2 Set **Pr.807** ≠ "0 (the frequency command value is set as the speed limit)" for setting the speed limit while tension sensorless torque control or tension sensor feedback torque control is valid. While tension sensorless torque control or tension sensor feedback torque control is valid, the tension command value and the frequency command value cannot be set simultaneously.

5

5.5.3 Torque generation direction setting

Set parameters according to the requirement because the torque direction for winding/unwinding differs for each device. Set the torque generation direction in accordance with the machine used.

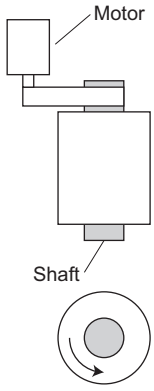
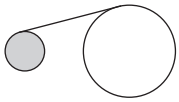
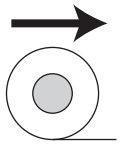
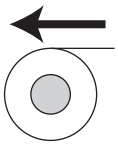
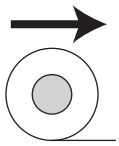
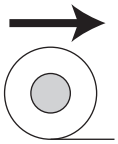
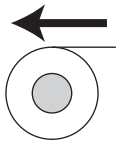
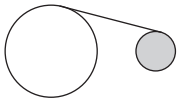
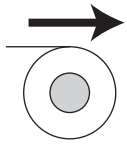
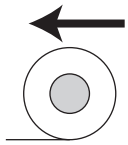
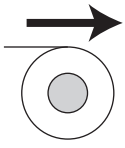
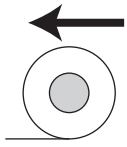
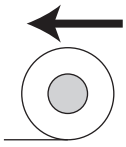
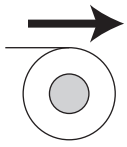
Pr.	Name	Initial value	Setting range	Description
1072 R304	**Tension reverse selection**	0	0	The tension direction is not reversed.
			1	The tension direction is reversed.
1114 R305 (D403)	**Torque command reverse selection**	0	0	The torque direction is not reversed.
			1	The torque direction is reversed.

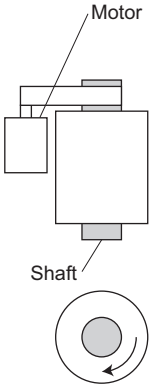
- The direction of torque generation during tension sensorless torque control is determined by a combination of the settings of the start command, **Pr.1072 Tension reverse selection**, and **Pr.1114 Torque command reverse selection**.

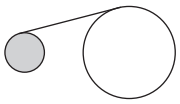
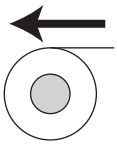
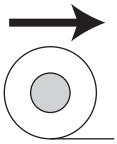
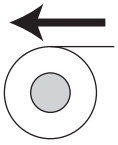
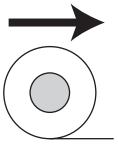
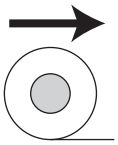
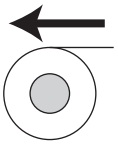
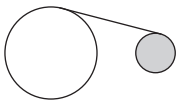
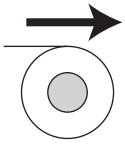
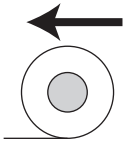
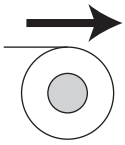
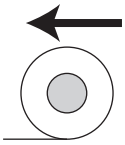
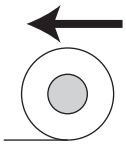
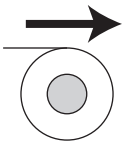
Pr.1114	Pr.1072	Torque generation direction	
		STF signal ON	STR signal ON
0 (The torque direction is not reversed at STR-ON.)	0 (Not reversed)	Forward rotation direction	Forward rotation direction
	1 (Reversed)	Reverse rotation direction	Reverse rotation direction
1 (The torque direction is reversed at STR-ON.)	0 (Not reversed)	Forward rotation direction	Reverse rotation direction
	1 (Reversed)	Reverse rotation direction	Forward rotation direction

Tension sensorless torque control details

- Set parameters according to the requirement because the torque direction for winding/unwinding differs for each device. The setting examples are shown in the following table.
  When switching between the upper winding and lower winding, set **Pr.1114** = "1" to switch between the STF and STR signals. (Even when **Pr.1114** = "0", switching between the upper winding and lower winding is enabled by changing the **Pr.1072** setting.)

<table>
<tr><th colspan="4">System setting</th><th colspan="2">Parameter setting</th></tr>
<tr><th rowspan="2">Motor Installation orientation</th><th rowspan="2">Material position</th><th colspan="2">Winding/unwinding movement when the start command is input</th><th rowspan="2">Pr.1114</th><th rowspan="2">Pr.1072</th></tr>
<tr><th>STF signal ON</th><th>STR signal ON</th></tr>
<tr><td rowspan="8">
Shaft rotation direction during forward motor rotation</td><td rowspan="4">
Right side</td><td colspan="2">
Upper winding/unwinding</td><td rowspan="2">0</td><td>0</td></tr>
<tr><td colspan="2">
Lower winding/unwinding</td><td>1</td></tr>
<tr><td>
Upper winding/unwinding</td><td>
Lower winding/unwinding</td><td rowspan="2">1</td><td>0</td></tr>
<tr><td>
Lower winding/unwinding</td><td>
Upper winding/unwinding</td><td>1</td></tr>
<tr><td rowspan="4">
Left side</td><td colspan="2">
Upper winding/unwinding</td><td rowspan="2">0</td><td>1</td></tr>
<tr><td colspan="2">
Lower winding/unwinding</td><td>0</td></tr>
<tr><td>
Upper winding/unwinding</td><td>
Lower winding/unwinding</td><td rowspan="2">1</td><td>1</td></tr>
<tr><td>
Lower winding/unwinding</td><td>
Upper winding/unwinding</td><td>0</td></tr>
</table>

<table>
<tr><th colspan="4">System setting</th><th colspan="2">Parameter setting</th></tr>
<tr><th rowspan="2">Motor Installation orientation</th><th rowspan="2">Material position</th><th colspan="2">Winding/unwinding movement when the start command is input</th><th rowspan="2">Pr.1114</th><th rowspan="2">Pr.1072</th></tr>
<tr><th>STF signal ON</th><th>STR signal ON</th></tr>
<tr><td rowspan="8">

Shaft rotation direction during forward motor rotation</td><td rowspan="4">
Right side</td><td colspan="2">
Upper winding/unwinding</td><td rowspan="2">0</td><td>1</td></tr>
<tr><td colspan="2">
Lower winding/unwinding</td><td>0</td></tr>
<tr><td>
Upper winding/unwinding</td><td>
Lower winding/unwinding</td><td rowspan="2">1</td><td>1</td></tr>
<tr><td>
Lower winding/unwinding</td><td>
Upper winding/unwinding</td><td>0</td></tr>
<tr><td rowspan="4">
Left side</td><td colspan="2">
Upper winding/unwinding</td><td rowspan="2">0</td><td>0</td></tr>
<tr><td colspan="2">
Lower winding/unwinding</td><td>1</td></tr>
<tr><td>
Upper winding/unwinding</td><td>
Lower winding/unwinding</td><td rowspan="2">1</td><td>0</td></tr>
<tr><td>
Lower winding/unwinding</td><td>
Upper winding/unwinding</td><td>1</td></tr>
</table>

: Required torque direction

The above figures show the shaft as viewed from the opposite side of the motor installation side.

5.5.4 Speed limit

When operating under torque control, motor overspeeding may occur if the load torque drops to a value less than the torque command value, etc. Set the speed limit value to prevent overspeeding.
If the actual speed reaches or exceeds the speed limit value, the control method switches from torque control to speed control, preventing overspeeding.

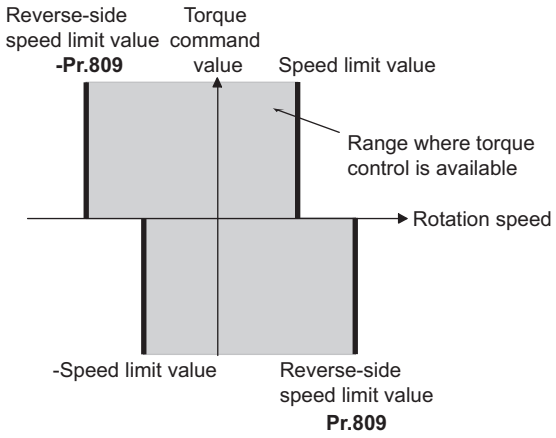
Pr.	Name	Initial value		Setting range	Description
		FM	CA		
807 H410	**Speed limit selection**	0		0	Uses the speed command during speed control as the speed limit.
				1	Sets speed limits for forward and reverse directions individually by using **Pr.808 and Pr.809**.
				2	Forward/reverse rotation speed limit Applies speed limit by analog voltage input to the terminal 1. Speed limit for forward/reverse side is switched by its polarity.
808 H411	**Forward rotation speed limit/ speed limit**	60 Hz	50 Hz	0 to 400 Hz	Sets the forward side speed limit.
809 H412	**Reverse rotation speed limit/ reverse-side speed limit**	9999		0 to 400 Hz	Sets the reverse side speed limit.
				9999	**Pr.808** setting value is effective.
1113 H414	**Speed limit method selection**	0		0	Speed limit mode 2
				1	Speed limit mode 3
				2	Speed limit mode 4
				10	X93 signal OFF: Speed limit mode 3, X93 signal ON: Speed limit mode 4

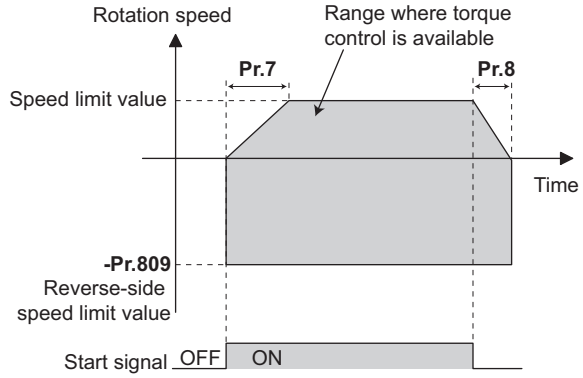
◆Speed limit method selection (Pr.1113)

Pr.1113 setting	Speed limit method	Speed limit value
0 (initial value)	Speed limit mode 2	Speed limit **Pr.807** = "0": Speed command during speed control **Pr.807** = "1": **Pr.808** **Pr.807** = "2": Analog input via terminal 1 Reverse-side speed limit **Pr.809**, or **Pr.808** when **Pr.809** = "9999"
1	Speed limit mode 3	
2	Speed limit mode 4	
10	Switching by external terminals	X93 signal OFF: Speed limit mode 3, X93 signal ON: Speed limit mode 4

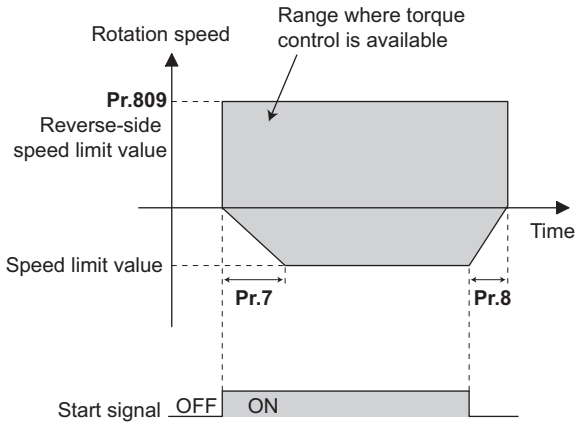
◆Speed limit mode 2 (Pr.1113 = "0" initial value)

- Following the polarity change in the torque command, the polarity of the speed limit value changes. This prevents the speed from increasing in the torque polarity direction. (When the torque command value is 0, the polarity of the speed limit value is positive.)
- When **Pr.807 Speed limit selection** = "0", the setting during speed control is applied for the speed limit. When **Pr.807 Speed limit selection** = "1", **Pr.808 Forward rotation speed limit/speed limit** is applied for the speed limit.
- When **Pr.807** = "2", the speed limit command is given by analog input via terminal 1. Set "5" in **Pr.868 Terminal 1 function assignment**.
- When the load has reversed the rotation opposite to the torque polarity, the setting of **Pr.809 Reverse rotation speed limit/ reverse-side speed limit** is applied for the speed limit. (The speed limit value and reverse-side speed limit value are limited at **Pr.1 Maximum frequency** (maximum 400 Hz under Vector control).)





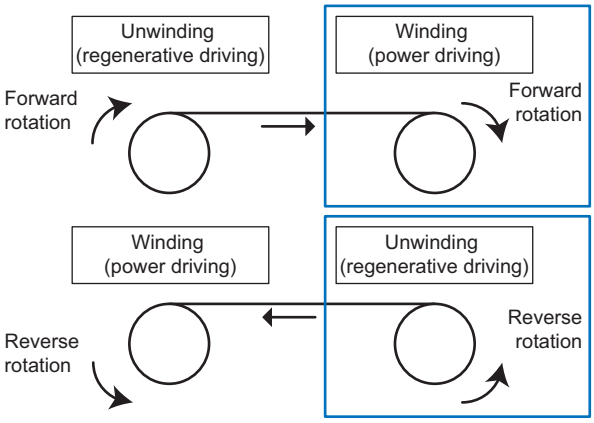
When the torque command value is positive

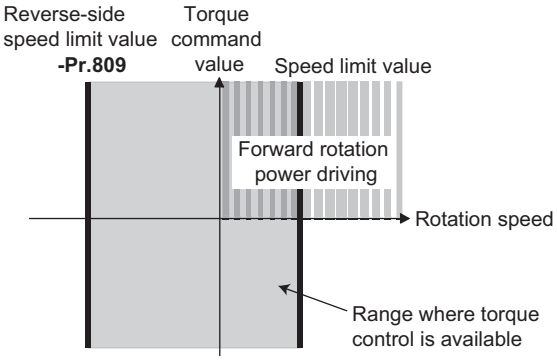


When the torque command value is negative

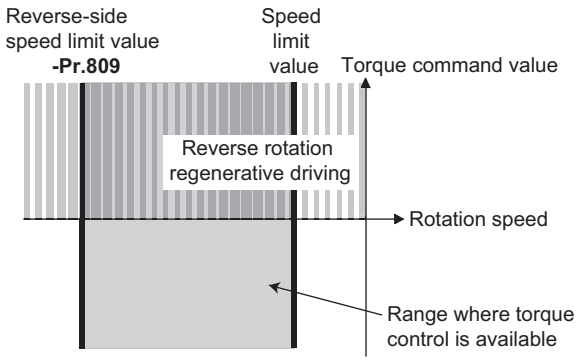
◆Speed limit mode 3 (Pr.1113 = "1")

- Select this mode when the torque command is positive. The forward rotation command is for power driving (such as winding) and the reverse rotation command is for regenerative driving (such as unwinding). (Refer to each following figures.)
- When **Pr.807 Speed limit selection** = "0", the setting during speed control is applied for the speed limit. When **Pr.807 Speed limit selection** = "1", **Pr.808 Forward rotation speed limit/speed limit** is applied for the speed limit.
- When **Pr.807** = "2", the speed limit command is given by an analog signal input via terminal 1. Set "5" in **Pr.868 Terminal 1 function assignment**.
- When the torque command becomes negative, the setting of **Pr.809 Reverse rotation speed limit/reverse-side speed limit** is applied to prevent the speed from increasing in the reverse rotation direction. (The speed limit value and reverse-side speed limit value are limited at **Pr.1 Maximum frequency** (maximum 400 Hz under Vector control).)

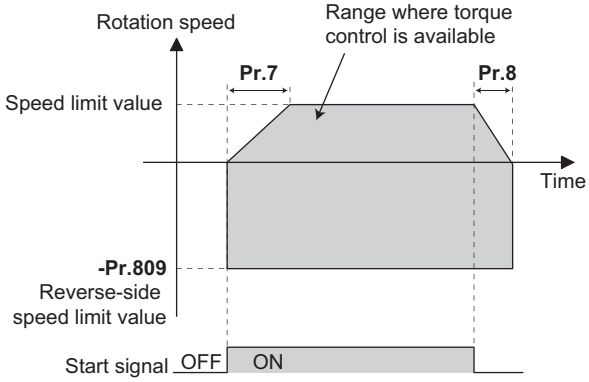




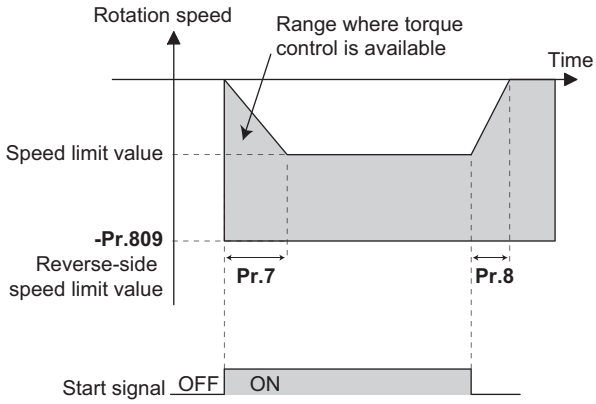
For forward rotation command



For reverse rotation command



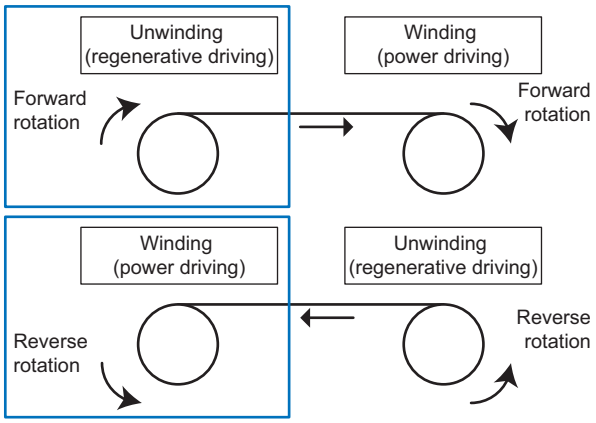
For power driving
by forward rotation command (winding)

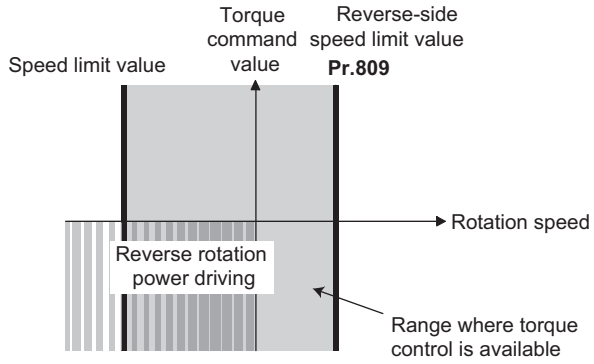


For regenerative driving
by reverse rotation command (unwinding)

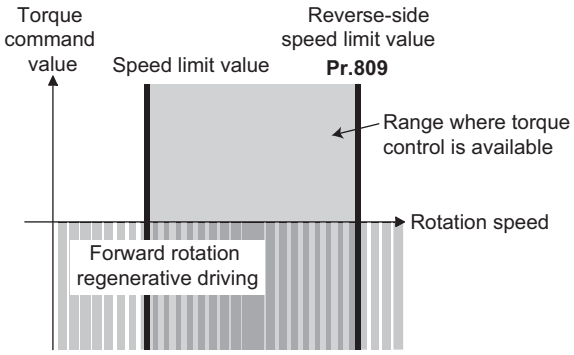
◆Speed limit mode 4 (Pr.1113 = "2")

- Select this mode when the torque command is negative. The forward rotation command is for regenerative driving (such as unwinding) and the reverse rotation command is for power driving (such as winding). (Refer to each following figures.)
- When **Pr.807 Speed limit selection** = "0", the setting during speed control is applied for the speed limit. When **Pr.807 Speed limit selection** = "1", **Pr.808 Forward rotation speed limit/speed limit** is applied for the speed limit.
- When **Pr.807** = "2", the speed limit command is given by an analog signal input via terminal 1. Set "5" in **Pr.868 Terminal 1 function assignment**.
- When the torque command becomes negative, the setting of **Pr.809 Reverse rotation speed limit/reverse-side speed limit** is applied to prevent the speed from increasing in the reverse rotation direction. (The speed limit value and reverse-side speed limit value are limited at **Pr.1 Maximum frequency** (maximum 400 Hz under Vector control).)

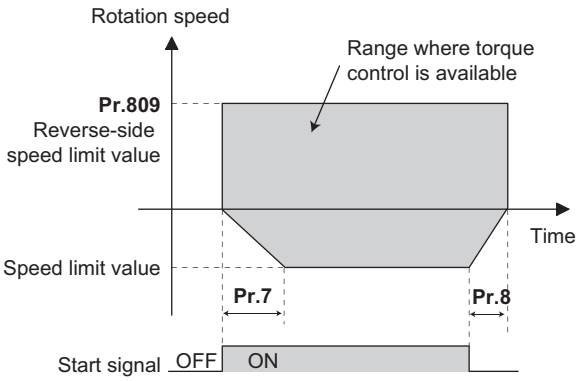




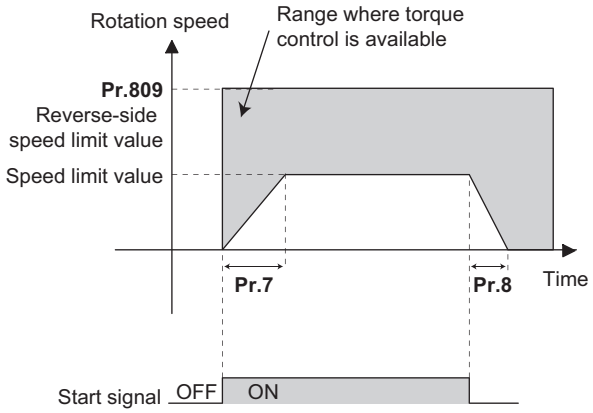
For reverse rotation command



For forward rotation command



For power driving
by reverse rotation command (winding)



For regenerative driving
by forward rotation command (unwinding)

◆Speed limit mode switching via external terminals (Pr.1113 = "10")

- The speed limit mode can be switched between 3 and 4 using the Torque control selection (X93) signal.
- To assign the X93 signal, set "93" in any of **Pr.178 to Pr.189 (Input terminal function selection)**.

X93 signal	Speed limit mode
OFF	Mode 3 (positive torque command, same status as setting **Pr.1113** = "1")
ON	Mode 4 (negative torque command, same status as setting **Pr.1113** = "2")

NOTE

- During the speed limit operation, "SL" (SL) is displayed on the operation panel and the OL signal is output.
- OL signal is assigned to terminal OL in the initial status. Set "3" in one of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the RT signal to another terminal. Changing the terminal assignment using **Pr.190 to Pr.196** may affect the other functions. Set parameters after confirming the function of each terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

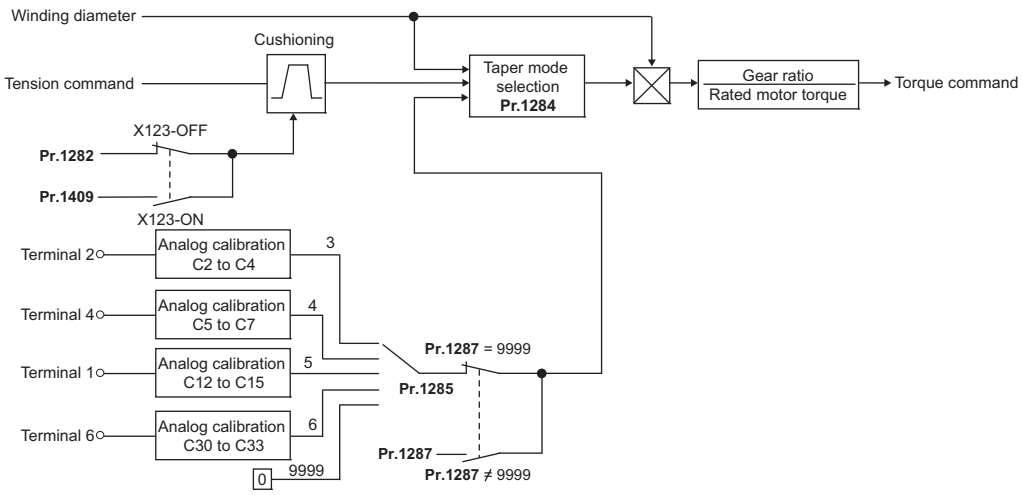
5.5.5 Taper function

The taper function reduces the tension when the winding diameter increases in order to prevent the roll from getting too tight. From a tension value commanded for taper control and the roll diameter determined by the winding diameter calculation, a torque command value required for the tension control is calculated.

Pr.	Name	Initial value	Setting range	Description
829 R504	Taper ratio setting input filter time constant	0.02 s	0 to 5 s	Set the time constant of primary delay filter for analog input at taper ratio setting input using the analog input.
1243 R600	Gear ratio numerator	1	1 to 65534	Set gear ratio when the motor shaft has a reduction gear.
1244 R601	Gear ratio denominator	1	1 to 65534	
1282 R320	Tension command cushion time	0 s	0 to 360 s	Set the time until the tension command value reaches the reference tension command.
1283 R321	Cushion time reference tension	100 N*1	0.01 to 500 N*1	Set the reference tension command value of the tension command cushion time.
1284 R500	Taper mode selection	0	0	No taper
			1	Linear taper profile
			2	Hyperbolic taper profile 1
			3	Hyperbolic taper profile 2
			4	Data table profile
1285 R501	Taper setting analog input selection	9999	3	The taper ratio is input through terminal 2.
			4	The taper ratio is input through terminal 4.
			5	The taper ratio is input through terminal 1.
			6	The taper ratio is input through terminal 6 (FR-A8AZ).
			9999	No function
1286 R503	Winding diameter at taper start	9999	0 to 6553 mm	Set the winding diameter to start taper control.
			9999	Taper control is started at the minimum winding diameter.
1287 R502	Taper ratio setting	0%	0 to 100%	Set the taper ratio.
			9999	The taper ratio is set through the analog input terminal.
1288 R510	Data table winding diameter 1	9999	0 to 6553 mm, 9999	Set the data table profile for the taper mode selection. 9999: The corresponding taper ratio is invalid.
1289 R511	Data table taper ratio 1	0%	0 to 100%	
1290 R512	Data table winding diameter 2	9999	0 to 6553 mm, 9999	
1291 R513	Data table taper ratio 2	0%	0 to 100%	
1292 R514	Data table winding diameter 3	9999	0 to 6553 mm, 9999	
1293 R515	Data table taper ratio 3	0%	0 to 100%	
1294 R516	Data table winding diameter 4	9999	0 to 6553 mm, 9999	
1295 R517	Data table taper ratio 4	0%	0 to 100%	
1296 R518	Data table winding diameter 5	9999	0 to 6553 mm, 9999	
1297 R519	Data table taper ratio 5	0%	0 to 100%	

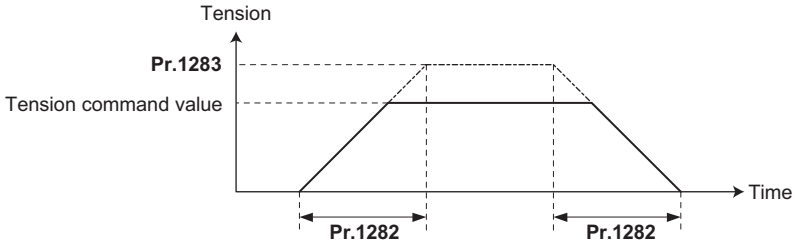
*1 The setting varies with the **Pr.1401** setting. (Refer to page 140.)

◆Block diagram



◆Tension command cushion time (Pr.1282, Pr.1283)

- Set the cushion time for the tension command.
- Set **Pr.1282 Tension command cushion time** for the time to reach **Pr.1283 Cushion time reference tension**.



◆Taper ratio setting (Pr.1285, Pr.1287)

- The tension command after the tension command cushion is 100%. Set how much to loosen the tension as a taper ratio in percent.
- The input method for setting the taper ratio can be set by parameters.

Pr.1287 setting	Pr.1285 setting	Taper ratio setting
0 to 100%	—	As set in **Pr.1287**
9999	3	Terminal 2 input value
	4	Terminal 4 input value
	5	Terminal 1 input value
	6	Terminal 6 (FR-A8AZ) input value
	9999	No function*1

*1 When **Pr.1287** = "9999", the taper ratio is 0%.

NOTE

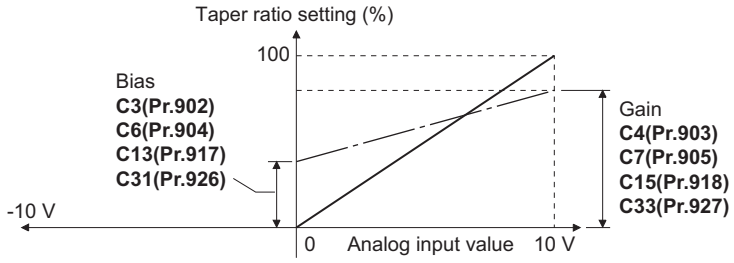
- The priorities of the input signals are defined as follows. If the input method for a signal is the same as that for the input signal with higher priority, the signal with lower priority does not work.
  Dancer signal input (**Pr.363**) > Actual line speed input (**Pr.362**) > Tension command input (**Pr.804**) > Line speed command input (**Pr.361** ≠ "0") > Taper setting input (**Pr.1285**) > Dancer tension setting input (**Pr.364**) > Line speed command compensation input > Line speed command input (**Pr.361** = "0")

◆Taper ratio setting input adjustment (Pr.829, Pr.902 to Pr.905, Pr.917, Pr.918, Pr.926, Pr.927)

- When the taper ratio setting is input using analog input, use the following parameters to calibrate the input value of each terminal. The taper ratios are calibrated for the 0% and 100% analog inputs. (The values for the 0% and 100% analog inputs are fixed.)

Input terminal	Calibration parameter
Terminal 2 (0 to 100%)	**C3 (Pr.902), C4 (Pr.903)**
Terminal 4 (0 to 100%)*1	**C6 (Pr.904), C7 (Pr.905)**
Terminal 1 (-100 to 100%)	**C13 (Pr.917), C15 (Pr.918)**
Terminal 6 (FR-A8AZ) (-100 to 100%)	**C31 (Pr.926), C33 (Pr.927)**

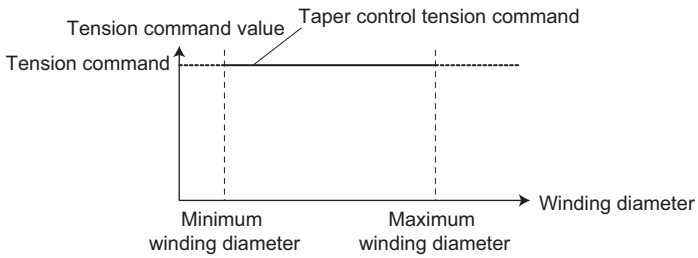
*1 The initial input range is 20 to 100%.



- When the taper ratio setting is input using analog input, the input value can be filtered using **Pr.829 Taper ratio setting input filter time constant**.

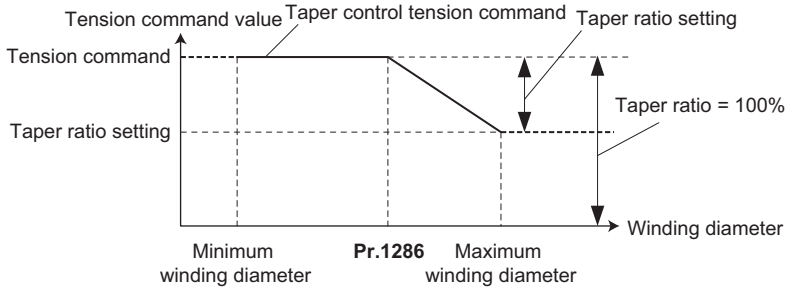
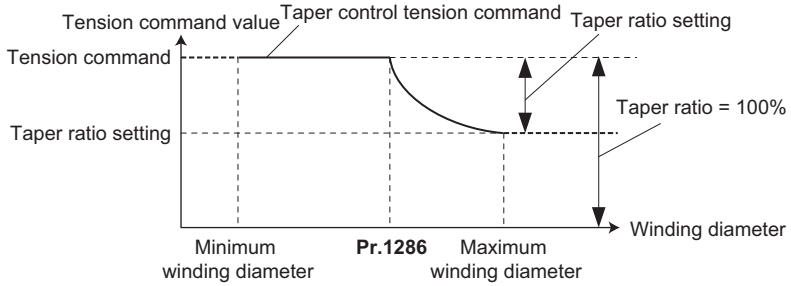
◆Taper mode selection (Pr.1284)

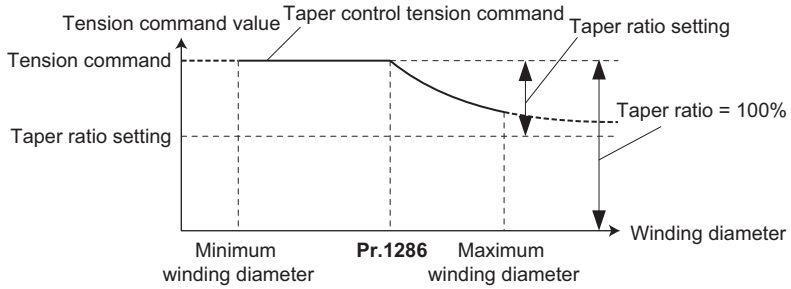
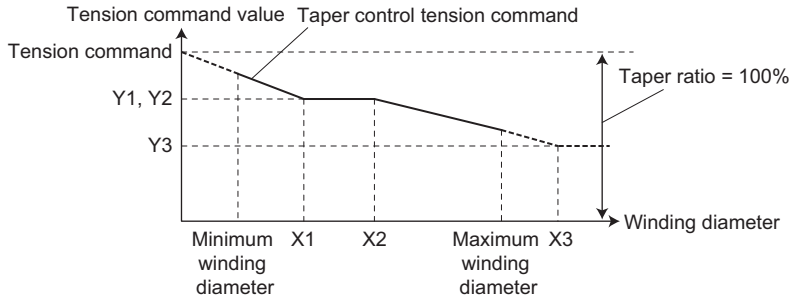
- Use **Pr.1284 Taper mode selection** to select the tension reduction method (taper mode) for the taper function.

Pr.1284 setting	Taper mode
0 No taper	Constant tension command control FTP = F* FTP: Taper control tension command, F*: Tension command 

5

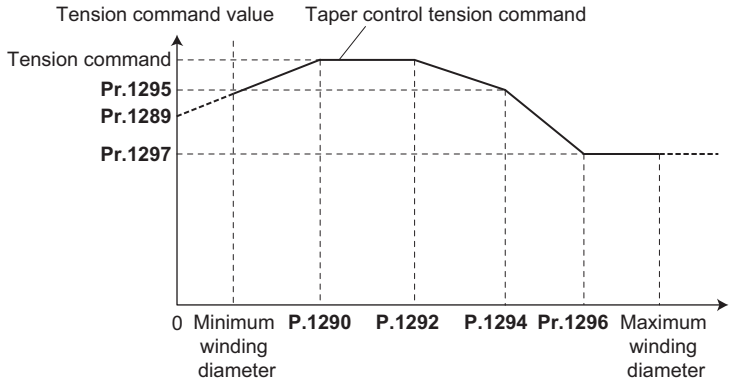
Tension sensorless torque control details

Pr.1284 setting	Taper mode
1 Linear taper profile	Winding diameter ≤ **Pr.1286** $F_{TP} = F^*$ **Pr.1286** < Winding diameter ≤ Maximum winding diameter $F_{TP} = F^* - \frac{F^* \times \text{Taper ratio setting}}{100} \times \frac{D - \textbf{Pr.1286}}{\text{Maximum winding diameter} - \textbf{Pr.1286}}$ F_{TP}: Taper control tension command, F*: Tension command, D: winding diameter  When the **Pr.1286** setting is smaller than the minimum winding diameter and **Pr.1286** = "9999", the winding diameter at taper start is the minimum winding diameter. When the minimum winding diameter is equal to or larger than the maximum winding diameter, the taper function is invalid.
2 Hyperbolic taper profile 1	Winding diameter ≤ **Pr.1286** $F_{TP} = F^*$ **Pr.1286** < Winding diameter ≤ Maximum winding diameter $F_{TP} = F^* - \left(\frac{F^* \times \text{Taper ratio setting}}{100}\right) \times \left(\frac{D - \textbf{Pr.1286}}{D}\right) \times \left(\frac{\text{Maximum winding diameter}}{\text{Maximum winding diameter} - \textbf{Pr.1286}}\right)$ F_{TP}: Taper control tension command, F*: Tension command, D: winding diameter  When the **Pr.1286** setting is smaller than the minimum winding diameter and **Pr.1286** = "9999", the winding diameter at taper start is the minimum winding diameter. When the minimum winding diameter is equal to or larger than the maximum winding diameter, the taper function is invalid.

Pr.1284 setting	Taper mode
3 Hyperbolic taper profile 2	Winding diameter ≤ **Pr.1286** $F_{TP} = F^*$ **Pr.1286** < Winding diameter $F_{TP} = F^* - \left(\frac{F^* \times \text{Taper ratio setting}}{100}\right) \times \left(1 - \frac{\textbf{Pr.1286}}{D}\right)$ F_{TP}: Taper control tension command, F*: Tension command, D: winding diameter  When the **Pr.1286** setting is smaller than the minimum winding diameter and **Pr.1286** = "9999", the winding diameter at taper start is the minimum winding diameter. When the minimum winding diameter is equal to or larger than the maximum winding diameter, the taper function is invalid.
4 Data table profile	Tension commanded for taper control = Data table profile setting X1: Data table winding diameter 1, Y1: Data table taper ratio 1 X2: Data table winding diameter 2, Y2: Data table taper ratio 2 X3: Data table winding diameter 3, Y3: Data table taper ratio 3 X4: Data table winding diameter 4, Y4: Data table taper ratio 4 X5: Data table winding diameter 5, Y5: Data table taper ratio 5 

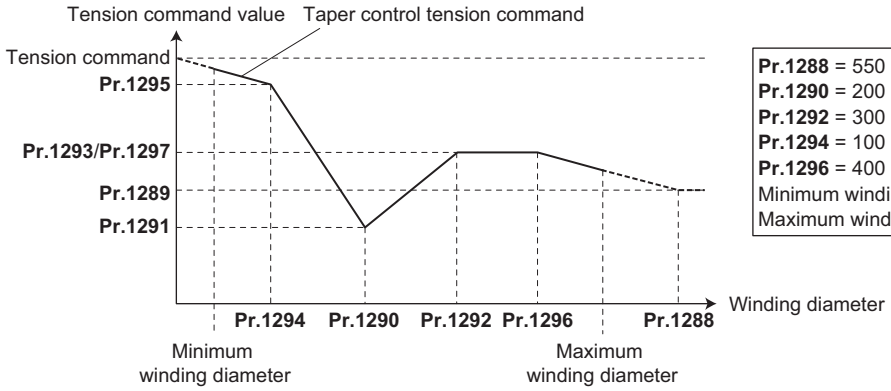
◆Data table profile setting example (Pr.1288 to Pr.1297)

- When the data table winding diameter is 0 mm, the taper ratio when the winding diameter is 0 mm is calculated as the corresponding data table taper ratio.
- When the winding diameter exceeds the maximum data table diameter, the taper ratio is fixed.
- The setting example is as follows.



Pr.1288 = 0 (mm) **Pr.1289** = 20%
Pr.1290 = 150 (mm) **Pr.1291** = 0%
Pr.1292 = 250 (mm) **Pr.1293** = 0%
Pr.1294 = 350 (mm) **Pr.1295** = 10%
Pr.1296 = 420 (mm) **Pr.1297** = 30%
Minimum winding diameter = 50 (mm)
Maximum winding diameter = 500 (mm)

- The pairs of parameters (**Pr.1288**/**Pr.1289**), (**Pr.1290**/**Pr.1291**), (**Pr.1292**/**Pr.1293**), (**Pr.1294**/**Pr.1295**), and (**Pr.1296**/**Pr.1297**) are arranged internally in the inverter from the pair with the smallest winding diameter to the one with the largest to form a data table profile.



Pr.1288 = 550 (mm) **Pr.1289** = 50%
Pr.1290 = 200 (mm) **Pr.1291** = 60%
Pr.1292 = 300 (mm) **Pr.1293** = 40%
Pr.1294 = 100 (mm) **Pr.1295** = 10%
Pr.1296 = 400 (mm) **Pr.1297** = 40%
Minimum winding diameter = 50 (mm)
Maximum winding diameter = 500 (mm)

NOTE

- If the same winding diameter is set in two or more of the **Pr.1288**, **Pr.1290**, **Pr.1292**, **Pr.1294**, and **Pr.1296** settings, the data table set in the parameter with the smallest parameter number is valid.
- When "9999" is set in the data table winding diameter setting, the corresponding taper ratio setting is invalid.

◆Tension sensorless torque control (torque command calculation)

- Calculate the torque command T from the current winding diameter value, motor constant torque, gear ratio for the tension command FTP of the taper control. The torque command value (T) is limited within the range of ±400%.

$$T\,[\%] = \frac{\text{FTP (N)} \times \text{Present winding diameter (m)} \times \text{Gear ratio}}{2 \times \text{Rated motor torque (N·m)}} \times 100 \qquad \text{Gear ratio} = \frac{\textbf{Pr.1243}}{\textbf{Pr.1244}}$$

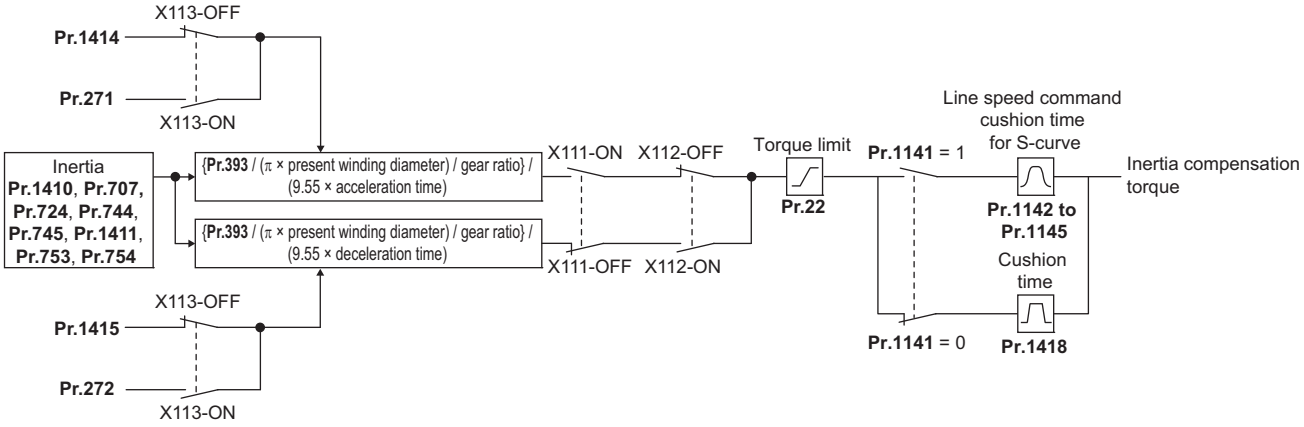
5.5.6 Inertia compensation function

The acceleration/deceleration torque is given to the motor by increasing/decreasing the torque command value to keep the material tension constant even during acceleration/deceleration.

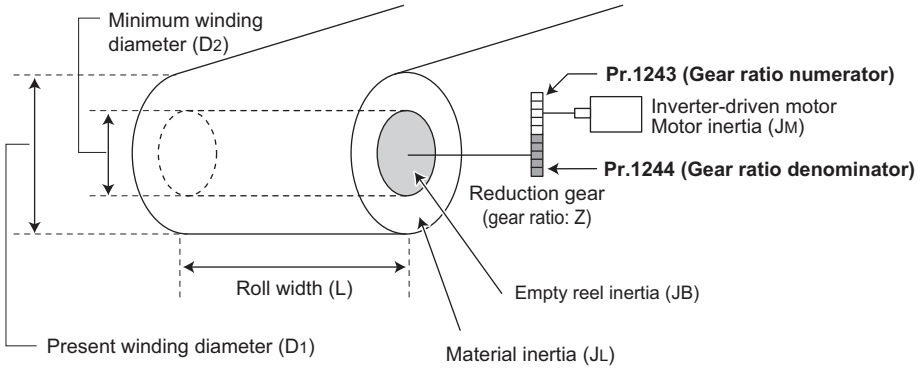
Pr.	Name	Initial value	Setting range	Description
271 R537	**Second acceleration time for inertia compensation**	15 s	0 to 3600 s	Set the acceleration time for inertia compensation when the X113 signal is turned ON.
272 R538	**Second deceleration time for inertia compensation**	15 s	0 to 3600 s	Set the deceleration time for inertia compensation when the X113 signal is turned ON.
393 R250	**Line speed command acceleration/deceleration reference**	1000 m/min*1	1 to 6553.4 m/min*1	Set the reference line speed for the acceleration/deceleration time for the line speed.
753 R539	**Empty reel inertia (integer)**	9999	10 to 999	Set the significand of the floating-point arithmetic to determine the empty reel inertia.
			9999	No function
754 R540	**Empty reel inertia (exponent)**	9999	0 to 7, 101 to 104	Set the exponent of the floating-point arithmetic to determine the empty reel inertia.
			9999	No function
1141 R290	**Line speed command acceleration/deceleration pattern**	0	0	Linear acceleration/deceleration
			1	S-curve acceleration/deceleration
1142 R291	**Line speed command acceleration start S-curve time**	0.1 s	0.1 to 2.5 s	Set times for S-curve acceleration/deceleration. The settings are also used for the inertia compensation cushion time. The settings are valid for S-curve acceleration/deceleration (**Pr.1141** = "1"). For details on S-curve acceleration/deceleration, refer to **page 82**.
1143 R292	**Line speed command acceleration start S-curve time**	0.1 s	0.1 to 2.5 s	
1144 R293	**Line speed command deceleration start S-curve time**	0.1 s	0.1 to 2.5 s	
1145 R294	**Line speed command deceleration completion S-curve time**	0.1 s	0.1 to 2.5 s	
1410 R530	**Motor inertia**	0 kg·m^2	0 to 500 kg·m^2	Set the motor inertia.
			9999	The **Pr.707** and **Pr.724** settings are used to determine a motor inertia for the first motor and the **Pr.744** and **Pr.745** settings for the second motor (refer to **page 56**). When "9999" is set in either **Pr.707** or **Pr.724**, or either **Pr.744** or **Pr.745**, an internal value is used for the first or second motor inertia.
1411 R531	**Empty reel inertia**	0 kg·m^2	0 to 500 kg·m^2	Set the empty reel inertia value.
			9999	The **Pr.753** and **Pr.754** settings are used to determine the empty reel inertia. When "9999" is set in **Pr.753** or **Pr.754**, the inertia is set to 0.
1412 R532	**Roll width**	0 mm	0 to 5000 mm	Set the roll width.
1413 R533	**Material specific gravity**	0 g/cm^3	0 to 20 g/cm^3	Set the specific gravity of the material.
1414 R535	**First acceleration time for inertia compensation**	15 s	0 to 3600 s	Set the acceleration time during inertia compensation operation.
1415 R536	**First deceleration time for inertia compensation**	15 s	0 to 3600 s	Set the deceleration time during inertia compensation operation.
1418 R534	**Inertia compensation cushion time**	0 s	0 to 360 s	Set the time for increasing/decreasing the torque for inertia compensation.

*1 The unit varies depending on the **Pr.358** setting. (Refer to **page 67**.)

◆Block diagram



◆Formula for calculating the torque for inertia compensation



$$\text{Inertia compensation torque T (\%)} = \frac{\text{Ta}}{\text{Rated motor torque } T_M} \times 100\ (\%)$$

$$Ta = [\{J_M + (J_L + J_B) \times Z^2\} \times \{\textbf{Pr.393} / (\pi \times D_1) / Z\}] / (9.55 \times t)$$

$$J_L = \frac{1}{32} \pi \times \rho \times L \times (D_1^4 - D_2^4)$$

Symbol	Description	Remarks
J_M	Motor inertia value J (kg·m^2)	Refer to page 159.
J_L	Material inertia value J (kg·m^2)	—
J_B	Empty reel inertia value J (kg·m^2)	Refer to page 159.
Z	Gear ratio	**Pr.1243**/**Pr.1244**
Pr.393	Line speed command acceleration/deceleration reference	**Pr.393** The parameter setting unit is as set in **Pr.358**.
t	Acceleration time for inertia compensation or deceleration time for inertia compensation (s)	**Pr.1414**, **Pr.1415**, **Pr.271**, **Pr.272**
D_2	Minimum winding diameter (m)	**Pr.1236**, **Pr.1238**, **Pr.1240**, **Pr.1242** The parameter setting unit is mm.
ρ	Material specific gravity (Kg/m^3)	**Pr.1413** The parameter setting unit is g/cm^3.
L	Roll width (m)	**Pr.1412** The parameter setting unit is mm.
D_1	Present winding diameter (m)	—

◆Motor inertia setting and empty reel inertia setting

• Motor inertia setting are determined as follows.

Pr.1410 setting	RT signal	Description	Setting range
Other than 9999	—	**Pr.1410** setting.	0 to 500 kg·m^2
9999	OFF	**Pr.707** × 10^(-**Pr.724**) (When "9999" is set in **Pr.707** or **Pr.724**, an internal value is used.)	10×10^{-7} to 999 kg·m^2
	ON	**Pr.744** × 10^(-**Pr.745**) (When "9999" is set in **Pr.744** or **Pr.745**, an internal value is used.)	

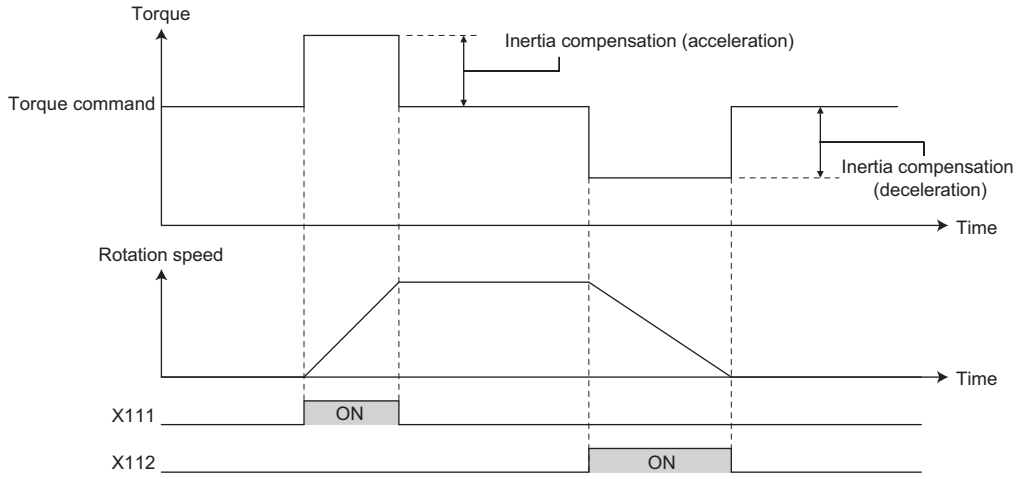
• Empty reel inertia setting are determined as follows.

Pr.1411 setting	Pr.754 setting	Description	Setting range
Other than 9999	—	**Pr.1411** setting.	0 to 500 kg·m^2
9999	0 to 7	**Pr.753** × 10^(-**Pr.754**) (When "9999" is set in **Pr.753** or **Pr.754**, inertia is set to 0.)	10×10^{-7} to 999×10^4 kg·m^2
	101 to 104	**Pr.753** × 10^(**Pr.754**-100) (When "9999" is set in **Pr.753** or **Pr.754**, inertia is set to 0.)	

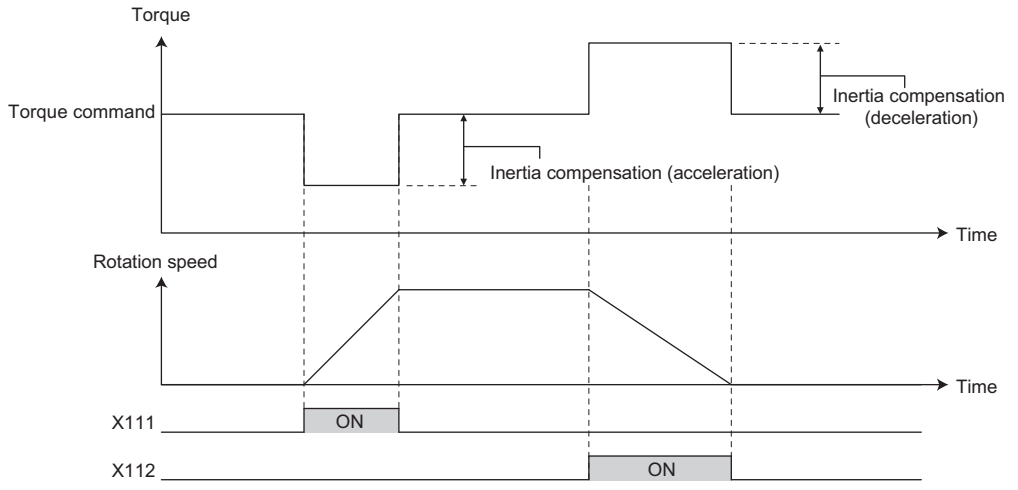
◆Inertia compensation function operation selection (X111 to X113 signals)

Pr.1141 setting	Operation according to the X111 signal status	Operation according to the X112 signal status
0 (Linear acceleration/ deceleration)	When the X111 signal is turned ON, an inertia compensation for the acceleration torque is started. For winding (power driving), the torque command value is increased. For unwinding (regenerative driving), the torque command value is decreased. The variation ratio is determined according to **Pr.1418 Inertia compensation cushion time**. When the X111 signal is turned OFF, the acceleration torque for inertia compensation is decreased according to the **Pr.1418** setting. The Line speed acceleration (Y237) signal of the inverter connected to the intermediate shaft is input to the terminal to which the X111 signal is assigned.	When the X112 signal is turned ON, an inertia compensation for the deceleration torque is started. For winding (power driving), the torque command value is decreased. For unwinding (regenerative driving), the torque command value is increased. The variation ratio is determined according to **Pr.1418 Inertia compensation cushion time**, When the X112 signal is turned OFF, the deceleration torque for inertia compensation is decreased according to the **Pr.1418** setting. The Line speed deceleration (Y238) signal of the inverter connected to the intermediate shaft is input to the terminal to which the X112 signal is assigned.
1 (S-curve acceleration/ deceleration)	When the X111 signal is turned ON, an inertia compensation for the acceleration torque is started. For winding (power driving), the torque command value is increased. For unwinding (regenerative driving), the torque command value is decreased. The variation ratio is determined according to **Pr.1142 Line speed command acceleration start S-curve time**. When the X111 signal is turned OFF, the acceleration torque for inertia compensation is decreased according to the **Pr.1143 Line speed command acceleration completion S-curve time**. The Line speed acceleration (Y237) signal of the inverter connected to the intermediate shaft is input to the terminal to which the X111 signal is assigned.	When the X112 signal is turned ON, an inertia compensation for the deceleration torque is started. For winding (power driving), the torque command value is decreased. For unwinding (regenerative driving), the torque command value is increased. The variation ratio is determined according to **Pr.1144 Line speed command deceleration start S-curve time**. When the X112 signal is turned OFF, the deceleration torque for inertia compensation is decreased according to the **Pr.1145 Line speed command deceleration completion S-curve time**. The Line speed deceleration (Y238) signal of the inverter connected to the intermediate shaft is input to the terminal to which the X112 signal is assigned.

• The diagram shows the operation example when **Pr.1141** = "0" (initial setting).

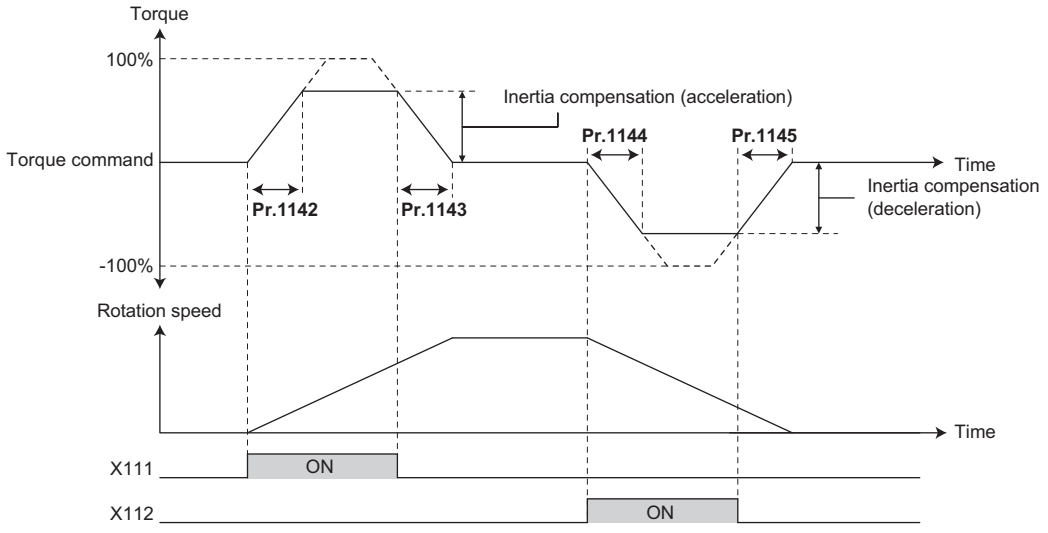


Example of winding (power driving)

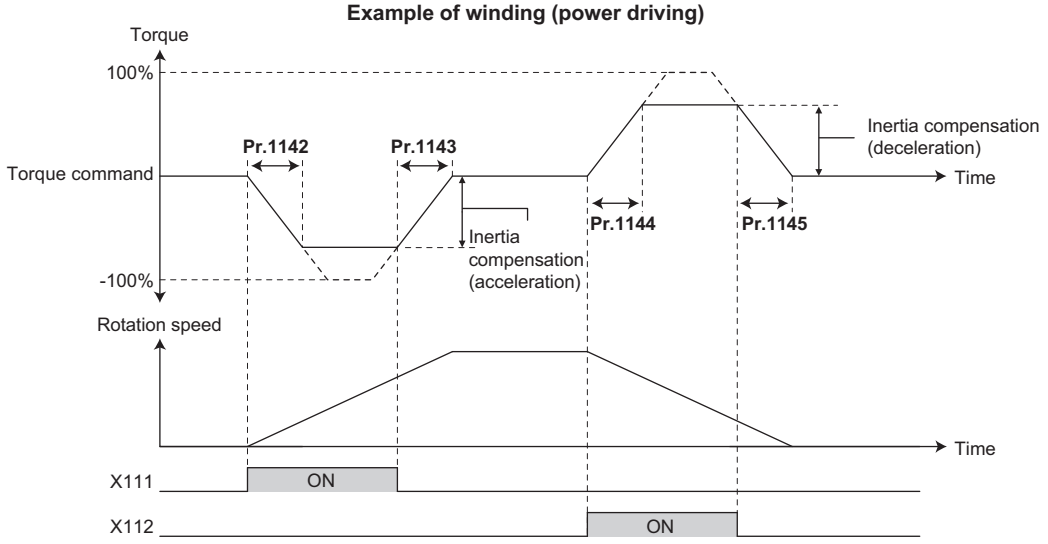


Example of unwinding (regenerative driving)

- The diagram shows the operation example when **Pr.1141** = "1".



Example of winding (power driving)



Example of unwinding (regenerative driving)

- Use the X113 signal to switch the acceleration/deceleration time for inertia compensation.

X113 signal	Acceleration time for inertia compensation	Deceleration time for inertia compensation
OFF	**Pr.1414 First acceleration time for inertia compensation**	**Pr.1415 First deceleration time for inertia compensation**
ON	**Pr.271 Second acceleration time for inertia compensation**	**Pr.272 Second deceleration time for inertia compensation**

- To use the X111 to X113 signals, set **Pr.178 to Pr.189 (input terminal function selection)** to assign the function of each signal to an input terminal.

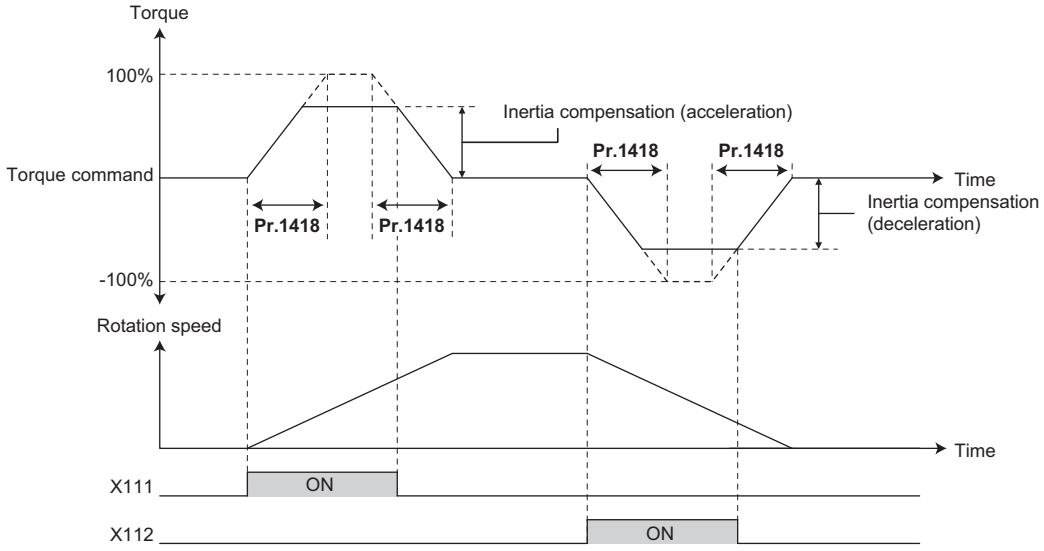
Pr.178 to Pr.189 setting	Signal name	Function
111	X111	Inertia compensation acceleration
112	X112	Inertia compensation deceleration
113	X113	Inertia compensation second acceleration/deceleration time

NOTE

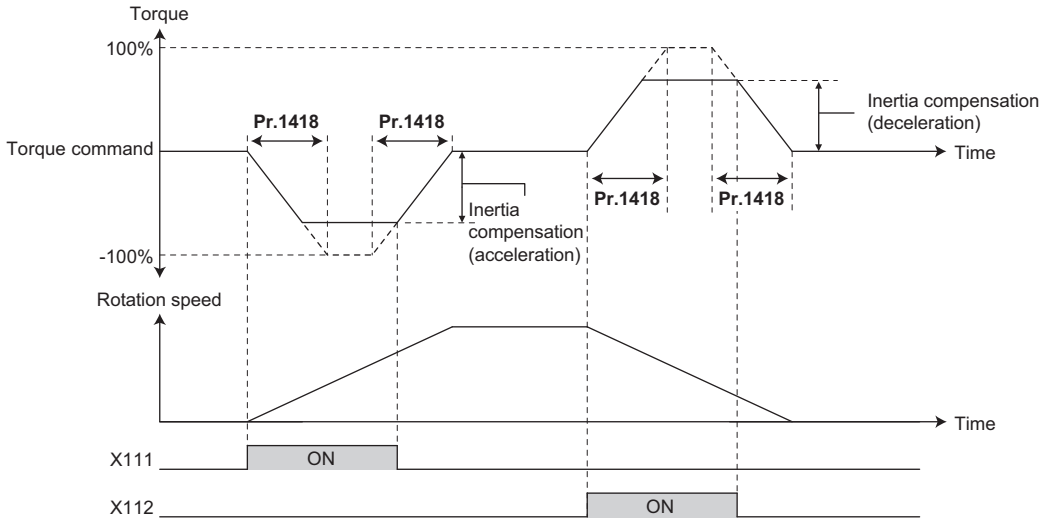
- The function is not activated when the winding diameter is 9 mm or less.
- The inertia compensation function is invalid while the X122 signal is ON.
- If both X111 and X112 signals are ON, the inertia compensation function is not activated.
- When the master's Y237/Y238 signal is used as the slave's X111/X112 signal, do not change the acceleration/deceleration time for the line speed command in the master during S-curve acceleration/deceleration operation, or do not set parameters to reach the line speed command maximum value during S-curve acceleration/deceleration operation. Doing so will cause inconsistency between the required inertia compensation torque and the inertia compensation torque calculated from the parameter setting values.
- For details on changing the line speed command acceleration/deceleration pattern by the Pr.1141 setting value, refer to page 82 .

◆Inertia compensation cushion time (Pr.1418, Pr.1142 to Pr.1145)

- Set the cushion time for the inertia compensation command.
- When **Pr.1141** = "0 (initial value)", the time to reach the 100% torque command is set in **Pr.1418 Inertia compensation cushion time.**

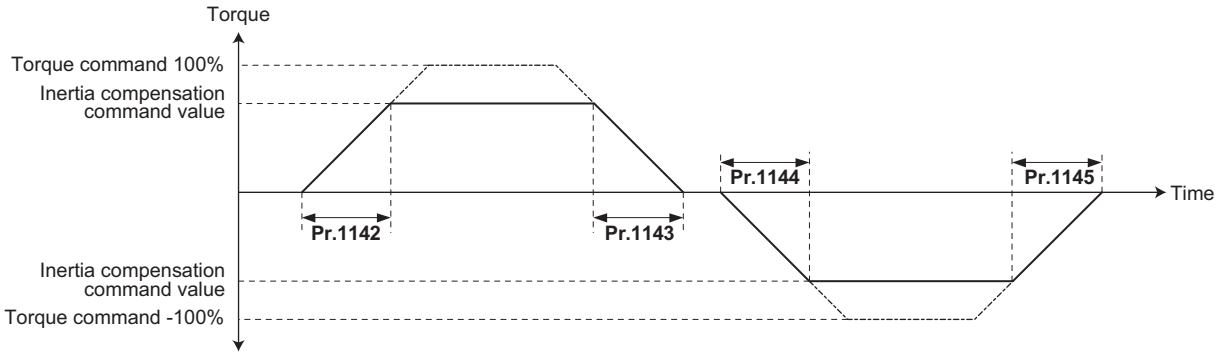


Example of winding (power driving)



Example of unwinding (regenerative driving)

- When **Pr.1141** = "1", times set in **Pr.1142** to **Pr.1145** are used for the inertia compensation cushion time settings.

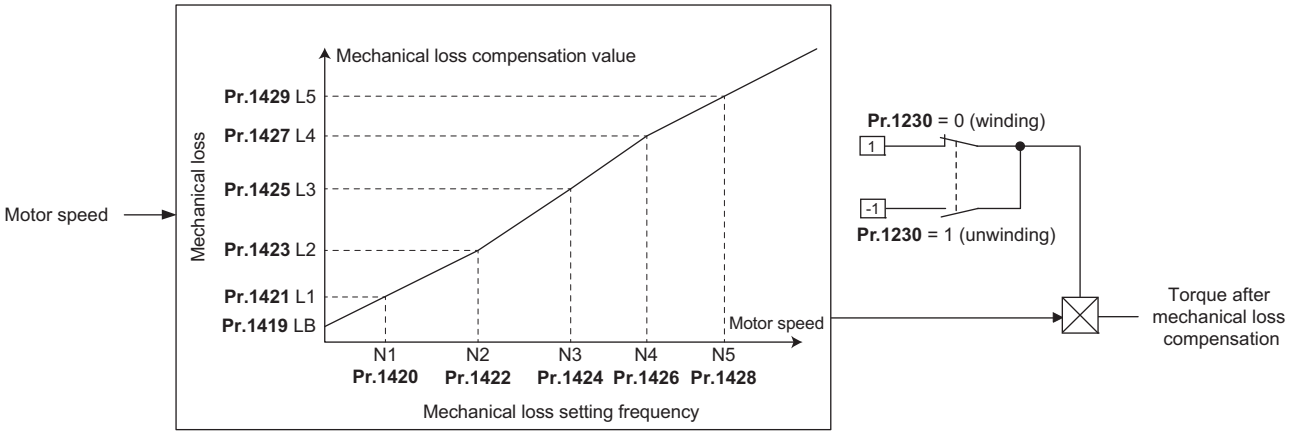


5.5.7 Mechanical loss compensation function

By increasing the torque command value to compensate loss caused by factors such as mechanical friction (mechanical loss), tension change due to mechanical loss can be prevented.

Pr.	Name	Initial value	Setting range	Description
1230 R003	**Winding/unwinding selection**	0	0	Winding
			1	Unwinding
1419 R550	**Mechanical loss setting frequency bias**	1000%	900 to 1100%	Set the bias compensation value for the mechanical loss compensation function.
1420 R551	**Mechanical loss setting frequency 1**	9999	0 to 400 Hz, 9999	Set the frequency for the mechanical loss 1.
1421 R552	**Mechanical loss 1**	1000%	900 to 1100%	Set the compensation value for the mechanical loss 1.
1422 R553	**Mechanical loss setting frequency 2**	9999	0 to 400 Hz, 9999	Set the frequency for the mechanical loss 2.
1423 R554	**Mechanical loss 2**	1000%	900 to 1100%	Set the compensation value for the mechanical loss 2.
1424 R555	**Mechanical loss setting frequency 3**	9999	0 to 400 Hz, 9999	Set the frequency for the mechanical loss 3.
1425 R556	**Mechanical loss 3**	1000%	900 to 1100%	Set the compensation value for the mechanical loss 3.
1426 R557	**Mechanical loss setting frequency 4**	9999	0 to 400 Hz, 9999	Set the frequency for the mechanical loss 4.
1427 R558	**Mechanical loss 4**	1000%	900 to 1100%	Set the compensation value for the mechanical loss 4.
1428 R559	**Mechanical loss setting frequency 5**	9999	0 to 400 Hz, 9999	Set the frequency for the mechanical loss 5.
1429 R560	**Mechanical loss 5**	1000%	900 to 1100%	Set the compensation value for the mechanical loss 5.

◆Block diagram



◆Mechanical loss compensation function selection (Pr.1230, Pr.1419 to Pr.1429)

- The maximum of five approximate break points can be set as mechanical loss points. Set mechanical loss parameters (mechanical loss setting frequency, mechanical loss) and linearly interpolate the values between the set points.
- The mechanical loss compensation value is calculated from the mechanical loss setting and the motor rotation speed (output frequency) and added to the torque command value. The mechanical loss compensation amount is added as follows according to the winding/unwinding setting.

Winding/unwinding	Commanded torque after mechanical loss compensation
Winding shaft (**Pr.1230** = "0")	Torque command value minus mechanical loss compensation value
Unwinding shaft (**Pr.1230** = "1")	Torque command value plus mechanical loss compensation value

- For setting the mechanical loss (**Pr.1419**, **Pr.1421**, **Pr.1423**, **Pr.1425**, **Pr.1427**, **Pr.1429**), regard 1000 as 0% and set an offset from 1000.

Parameter setting	Actual mechanical loss setting
900.0 to 999.9%	-100.0 to -0.1%
1000.0%	0.0%
1000.1 to 1100.0%	0.1 to 100.0%

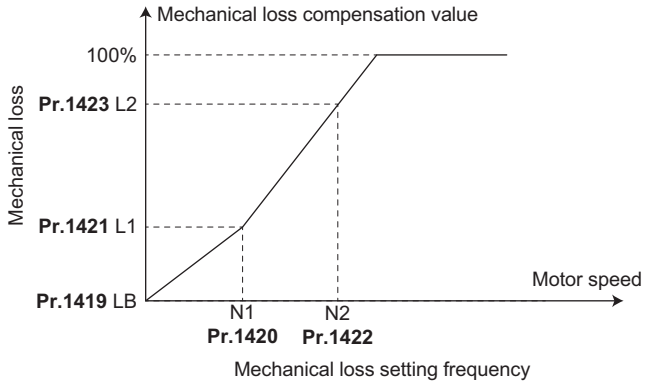
- Operate the line with a load (with a reel inside), and set the motor speed frequency and the monitored torque value in **Pr.1420 to Pr.1429**.

NOTE

- When "9999" is set in the mechanical loss setting frequency, the corresponding mechanical loss setting is invalid.
- If the same frequency is set in two or more of the **Pr.1420**, **Pr.1422**, **Pr.1424**, **Pr.1426**, and **Pr.1428** settings, the mechanical loss set in the parameter with the smallest parameter number is valid.
- When the mechanical loss setting frequency (1 to 5) setting is 0 Hz, the **Pr.1419** setting is invalid.

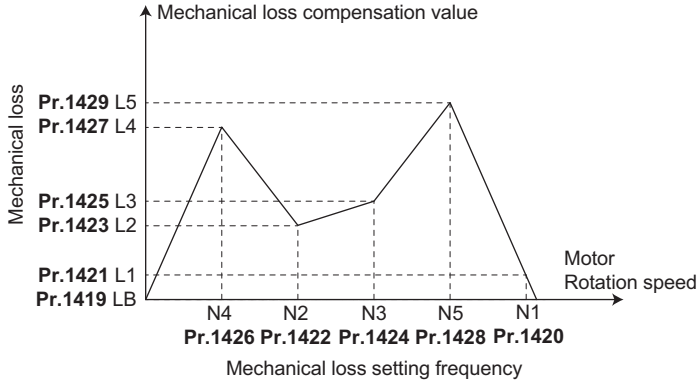
◆Mechanical loss compensation function setting example

- The mechanical loss compensation value after linear interpolation is limited within the range of ±100%.



Pr.1420 = 10 Hz	**Pr.1419** = 1000%
Pr.1422 = 20 Hz	**Pr.1421** = 1030%
Pr.1424 = 9999	**Pr.1423** = 1080%
Pr.1426 = 9999	**Pr.1425** = 1000%
Pr.1428 = 9999	**Pr.1427** = 1000%
	Pr.1429 = 1000%

- The pairs of parameters (**Pr.1420**/**Pr.1421**), (**Pr.1422**/**Pr.1423**), (**Pr.1424**/**Pr.1425**), (**Pr.1426**/**Pr.1427**), and (**Pr.1428**/**Pr.1429**) are arranged internally in the inverter from the pair with the smallest mechanical loss setting frequency to the one with the largest.



Pr.1420 = 50 Hz	**Pr.1419** = 1000%
Pr.1422 = 20 Hz	**Pr.1421** = 1010%
Pr.1424 = 30 Hz	**Pr.1423** = 1030%
Pr.1426 = 10 Hz	**Pr.1425** = 1040%
Pr.1428 = 40 Hz	**Pr.1427** = 1070%
	Pr.1429 = 1080%

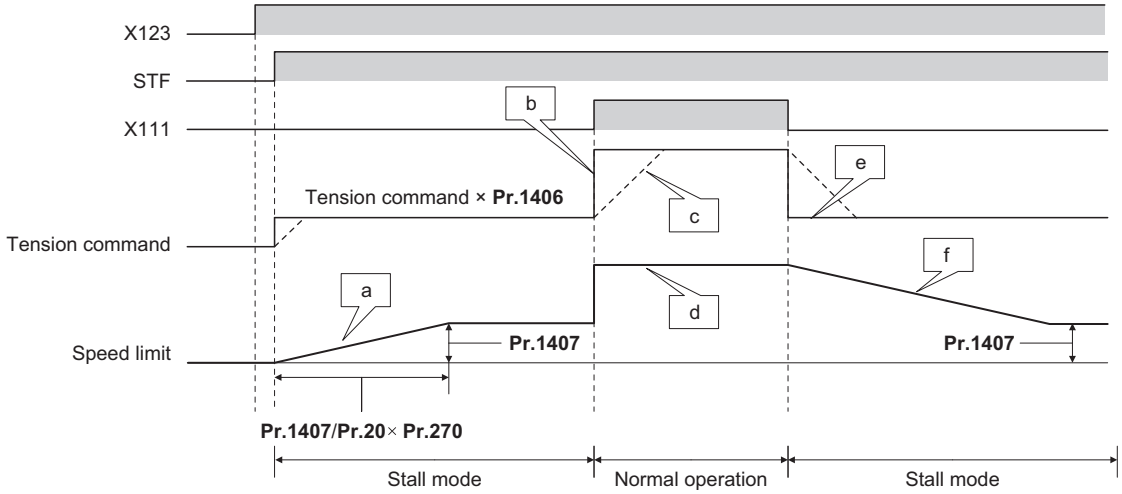
5.5.8 Stall mode function

By turning ON the Stall mode trigger (X123) signal before starting winding, tension is applied to the material and the stall mode is activated.
This function is useful for sagging prevention of the material before it is winded.

Pr.	Name	Initial value	Setting range	Description
270 **R342**	**Acceleration/deceleration time during stall condition**	15 s	0 to 3600 s	Set the acceleration/deceleration time during stall mode.
1406 **R340**	**Commanded tension reduction scaling factor during stall condition**	20%	0 to 200%	Set the value to reduce the commanded tension during stall mode. Commanded tension during stall mode = Tension command value × **Pr.1406**
1407 **R341**	**Speed limit during stall condition**	1 Hz	0 to 60 Hz	Set the speed limit to be used during stall mode.
1409 **R343**	**Tension command cushion time during stall condition**	9999	0 to 360 s	Set the cushion time during stall mode.

◆Stall mode

- While the Stall mode trigger (X123) signal is ON, the tension command value is reduced according to the **Pr.1406 Commanded tension reduction scaling factor during stall condition** setting. The speed limit value is switched to the **Pr.1407 Speed limit during stall condition** setting.



Symbol in the diagram	Description
a	Speed limit during stall condition
b	When the X111 or X112 signal turns ON while the X123 signal is ON, the tension command value is switched back to the normal setting.
c	When **Pr.1409** ≠ 0 (or **Pr.1409** = "9999" and **Pr.1282** ≠ 0), the cushion time is applied.
d	When the X111 or X112 signal turns ON while the X123 signal is ON, the speed limit value is switched back to the normal setting.
e	When the X123 signal is turned ON during operation, the commanded tension is switched to the tension command value multiplied by the **Pr.1406** setting.
f	When the X123 signal is turned ON during operation, the speed limit value is switched to the value set in **Pr.1407** in the time set in **Pr.270**.

NOTE

- The commanded tension after the reduction according to the **Pr.1406** setting is limited by the maximum tension command value.
- While the inertia compensation function is activated (the X111/X112 signal is ON), the stall mode is cancelled. (The tension command and speed limit values are switched back to the normal settings.)

◆Cushion time during stall mode (Pr.1409)

• Use **Pr.1409 Tension command cushion time during stall condition** to set the cushion time during stall mode.

Pr.1282 setting	Pr.1409 setting	X123	
		ON (stall mode)	OFF (normal operation)
0 (initial value)	0	No cushioning	No cushioning
	9999 (initial value)	No cushioning	No cushioning
	0.01 to 360	As set in **Pr.1409**.	As set in **Pr.1282**.
0.01 to 360	0	No cushioning	As set in **Pr.1282**.
	9999 (initial value)	As set in **Pr.1282**.	As set in **Pr.1282**.
	0.01 to 360	As set in **Pr.1409**.	As set in **Pr.1282**.

6 TENSION SENSOR FEEDBACK TORQUE CONTROL

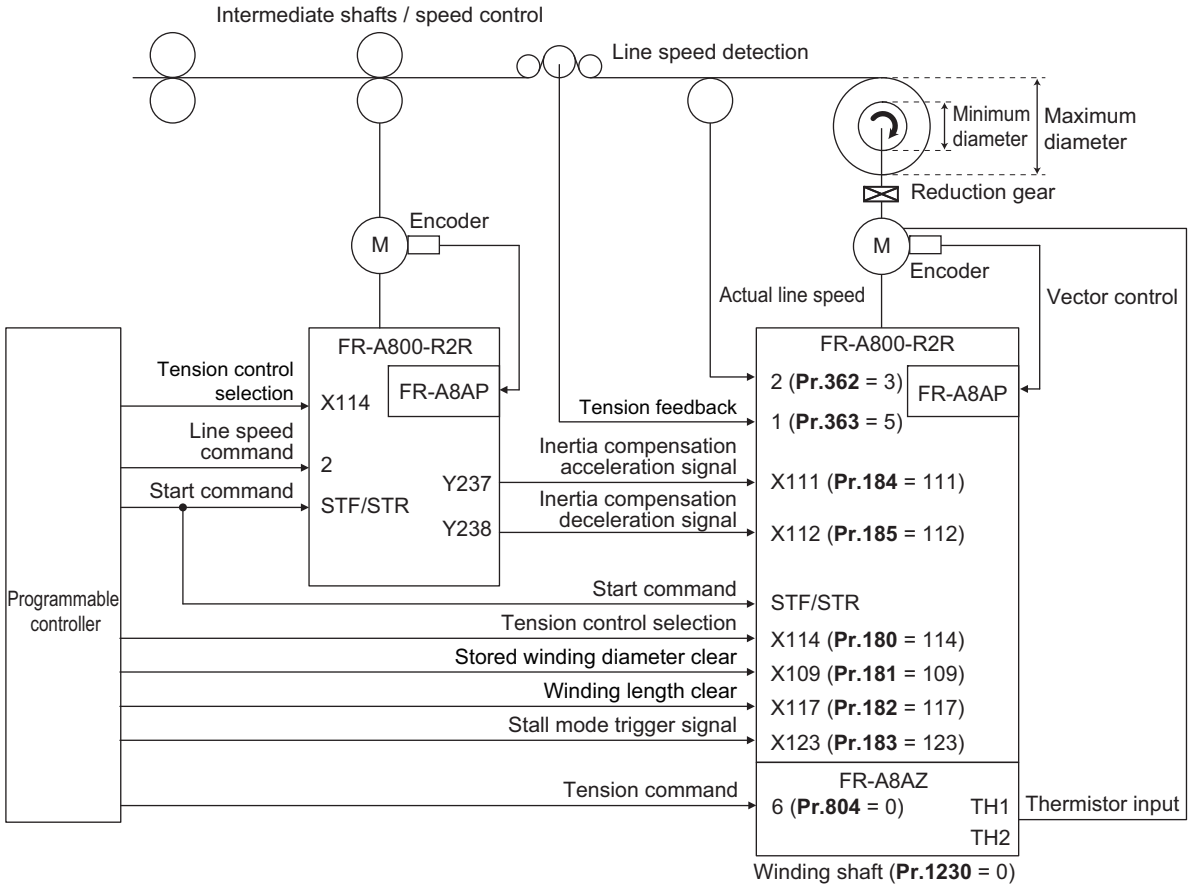
6.1 Dedicated function list

Item		Description
Tension sensor feedback torque control	Control method	PID control, PI control, P control, and PD control can be selected. Gain switchover by tension feedback is available. Gain switchover by external terminal input is available.
	Tension command	Parameter setting / analog terminal input / pulse train input / communication
	Tension detection signal	Use an analog terminal for the signal input. (Terminal 1, 2, 4, or 6 is selectable.)
	Additional function	Material break detection function
	Taper function	Set a taper ratio.
	Inertia compensation function	Set the compensation for acceleration and deceleration individually using external signals.
	Mechanical loss compensation function	Straight movement (with five break points) against the speed can be performed.
Common	Dedicated input signal	Dancer/tension control selection, Inertia compensation acceleration, Inertia compensation deceleration, Inertia compensation second acceleration/ deceleration time selection, Winding diameter measurement, Stall mode trigger, Two-way operation.
	Dedicated output signal	Winding diameter calculation completion at start
	Dedicated monitor	Tension command, mechanical loss compensation, inertia compensation

NOTE

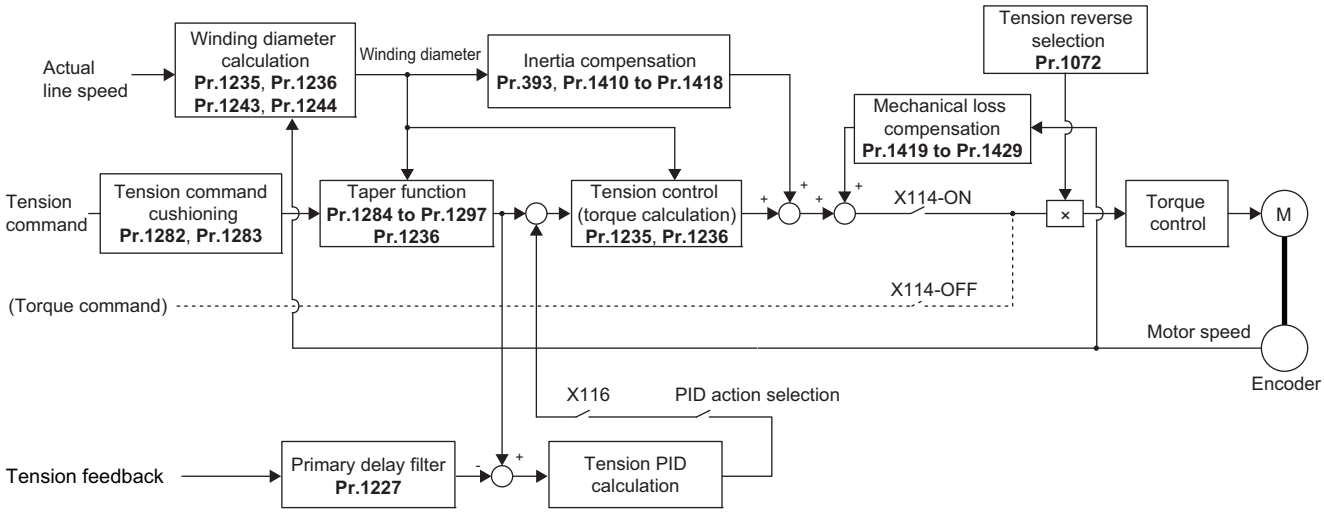
- For the details of the winding diameter compensation function, refer to page 194.

6.2 System configuration example



6.3 Control block diagram

6.3.1 Block diagram of tension sensor feedback torque control function



6.4 Parameter setting procedure for tension sensorless torque control

The following procedure shows the parameter setting example for the tension sensor feedback torque control.

6.4.1 Parameter setting procedure

1 Wiring

Perform secure wiring.

NOTE

- Do not feed the workpiece through the machine.

2 Control method selection

Select the control method according to the application and the motor.

Pr.	Name	Setting range	Minimum setting increments	Initial value
71	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0
9	Electronic thermal O/L relay	0 to 500 A*3	0.01 A*3	Inverter rated current
		0 to 3600 A*4	0.1 A*4	
80	Motor capacity	0.4 to 55 kW, 9999*3	0.01 kW	9999
		0 to 3600 kW, 9999*4	0.1 kW	
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999
83	Rated motor voltage	0 to 1000 V	0.1 V	200 V (200 V class)
				400 V (400 V class)
84	Rated motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999
800	Control method selection*1	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20
803	Constant output range torque characteristic selection	0 to 2, 10, 11	1	0
807	Speed limit selection	0 to 2	1	0
810	Torque limit input method selection	0 to 2	1	0
359	Encoder rotation direction	0, 1, 100, 101	1	1
369	Number of encoder pulses	0 to 4096	1	1024
707	Motor inertia (integer)*2	10 to 999, 9999	1	9999
724	Motor inertia (exponent)*2	0 to 7, 9999	1	9999
862	Encoder option selection	0, 1	1	0

*1 For the control method, vector control is recommended.

*2 Setting is required for a motor other than a Mitsubishi Electric motor (the SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or SF-V5RU (1500 r/min series) motor).

*3 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*4 For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

NOTE

- Torque control is not available in a low-speed (about 10 Hz or lower) regenerative range, or with a low speed and light load (about 5 Hz or lower and rated torque about 20% or lower). Vector control must be selected.
- For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

3 Speed limit setting

Set the speed limit as required as follows.

$$\text{Speed limit value} = \frac{\text{Present line speed}}{\pi \times \text{Present diameter} \times \text{Gear ratio}} \times 1.1 \text{ to } 1.2$$

NOTE

- Use **Pr.807 to Pr.809** and **Pr.1113** to set the speed limit. As the speed limit value is overwritten frequently, set "0" in **Pr.342 Communication EEPROM write selection** to enable RAM write. For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

4 Torque characteristic setting

Set "1" in **Pr.803** to make the torque characteristic constant for the tension command in the low-speed range and in the constant output range.

5 Offline auto tuning

Perform offline auto tuning as required. For offline auto tuning, refer to page 55.

Pr.	Name	Setting range	Minimum setting increments	Initial value
96	Auto tuning setting/status	0, 1, 11, 101	1	0

After the offline auto tuning, perform the test run of the motor alone to make sure that no fault is found in the motor's behavior.

6 Mechanical specifications setting

Set the following parameters according to the specifications of the machine used. Refer to 11.6 (Application examples) on page 243.

Pr.	Name	Setting	Remarks	
1235	Maximum winding diameter 1	*1	Set the maximum/minimum value in 1 mm increments (1 to 6553 mm) relative to the winding diameter calculation result.	
1236	Minimum winding diameter 1	*1		
178 to 189	Input terminal function selection	114	Set "114" for the X114 signal.	
		109	Set "109" for using the Stored winding diameter clear (X109) signal.	
		117	Set "117" for using the Winding length clear (X117) signal.	
1230	Winding/unwinding selection	*1	0: Winding shaft 1: Unwinding shaft	
645	Winding diameter storage selection	*1	0: Not stored. 1: The present winding diameter is stored.	
1247	Winding diameter change increment amount limit	*1	Set the maximum change in 0.001 mm increments (0 to 9.998 mm or 9999) per roll diameter calculation.	
1243	Gear ratio numerator	*1	Set a gear ratio in 1 increments (1 to 65534) when a reduction gear is installed between the driving shaft and motor shaft.	
1244	Gear ratio denominator	*1		
7	Acceleration time	0 s	0 to 3600 seconds, in 0.1 second increments*2	
8	Deceleration time	0 s		
394	First acceleration time for line speed command	*1	Setting is required in 0.1 second increments*2 (0 to 3600 seconds) when the cushion time is not considered for the line speed command.	
395	First deceleration time for line speed command	*1		
101	Second deceleration time for line speed command	*1	Set the time in 0.1 second increments*2 (0 to 3600 seconds) as required (for example, for rapid deceleration). Turn ON the X105 signal to enable the setting.	
393	Line speed command acceleration/deceleration reference	*1	Set the reference line speed (travel amount per minute) in 0.1 m/min increments*3 (1 to 6553.4 m/min) for the acceleration/deceleration time for the line speed command.	
1231	Material thickness d1	*1	Setting is required in 0.001 mm increments (0 to 20 mm or 9999) when thickness is used for winding diameter calculation.	
1072	Tension reverse selection	*1	0: The tension direction is not reversed. 1: The tension direction is reversed.	Set the torque generation direction in accordance with the machine used.
1114	Torque command reverse selection	*1	0: The torque direction is not reversed. 1: The torque direction is reversed.	

*1 Set the parameter according to the specification of the machine used.

*2 The increment applies when **Pr.21** = "0 (initial value)".

*3 The increment applies when **Pr.358** = "0 (initial value)".

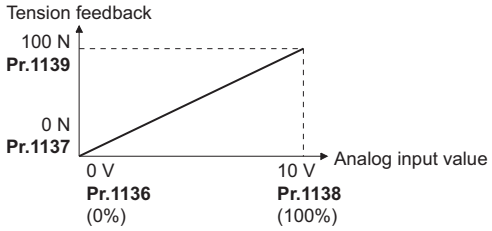
7 Tension feedback setting

Set the following parameters according to the tension feedback input method when the tension sensor is used.

Pr.	Name	Setting	Input method
363	Dancer / tension sensor feedback input selection	3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*1
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*1
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*1
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*1
		9	CC-Link or CC-Link IE Field Network Basic (-100 to 100%)
		9999 (initial value)	No function

*1 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

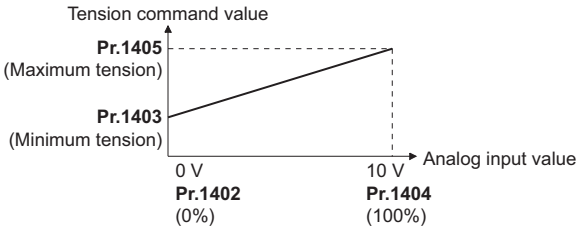
Item	Setting example
Tension feedback input method	Setting by analog voltage (0 to 10 V) input through terminal 1 (**Pr.363** = "5") 
Parameter setting	**Pr.1136 Tension sensor feedback voltage/current bias** = 0% **Pr.1137 Tension sensor feedback bias** = 0 N **Pr.1138 Tension sensor feedback voltage/current gain** = 100% **Pr.1139 Tension sensor feedback gain** = 100 N

8 Tension command input selection

Set the following parameter according the tension input method.

Pr.	Name	Setting	Input terminal
804	Tension / Torque command source selection	0 (initial value)	Tension command by terminal 1 analog input (-10 to 10 VDC) Tension command by terminal 6 analog input (-10 to 10 VDC) (FR-A8AZ)
		1	Tension command by the parameter setting (**Pr.365** or **Pr.366**)
		2	Tension command by the pulse train command (FR-A8AL)
		3	Tension command via CC-Link communication (FR-A8NC/FR-A8NCE) Tension command via PROFIBUS-DP communication (FR-A8NP)
		4	Tension command by 12/16-bit digital input (FR-A8AX)
		5	Tension command via CC-Link communication (FR-A8NC/FR-A8NCE) Tension command via PROFIBUS-DP communication (FR-A8NP)
		6	

The following table shows a setting example.

Item	Setting example
Tension command input method	Setting by analog voltage (0 to 10 V) input through terminal 1 (**Pr.804** = "0") 
Parameter setting	**Pr.868 Terminal 1 function assignment** = "3 or 4" **Pr.1402 Tension command input voltage bias** = 0% **Pr.1403 Tension command bias** = Minimum tension **Pr.1404 Tension command input voltage gain** = 100% **Pr.1405 Tension command gain** = Maximum tension **Pr.1401 Tension command increment** = "0" (0.01 N increment)

9 Actual line speed input

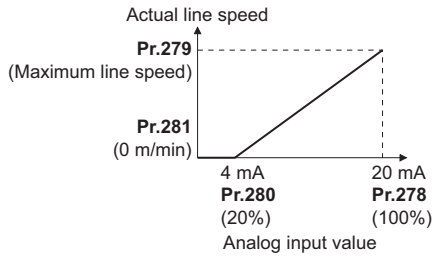
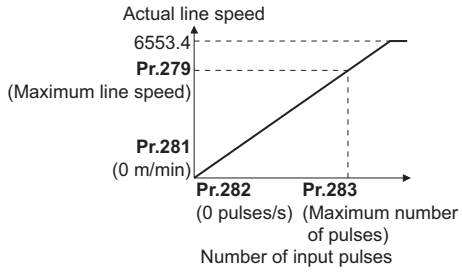
Use **Pr.362** to select the input terminal for actual line speed.

Pr.	Name	Setting	Input terminal
362	Actual line speed input selection	0 (initial value)	V* (line speed command)
		1	Terminal JOG single-phase pulse train input (Refer to page 200)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 200)
		3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 202)
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 202)
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 202)
		6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 202)
		7	FR-A8AL single-phase pulse train input (PP, NP) (Refer to page 200)
		9	CC-Link or CC-Link IE Field Network Basic (0 to 65534)
		9999	No function

*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows setting examples.

Item	Setting example 1	Setting example 2
Actual line speed input method	Setting by analog current (4 to 20 mA) input through terminal 4 (**Pr.362** = "4") 	Setting by pulse train input through terminal JOG (**Pr.362** = "1") 
Parameter setting	**Pr.280 Actual line speed voltage/current bias** = 20% **Pr.281 Actual line speed bias** = 0 m/min **Pr.278 Actual line speed voltage/current gain** = 100% **Pr.279 Actual line speed gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*3 **Pr.281 Actual line speed bias** = 0 m/min **Pr.282 Actual line speed pulse input bias** = 0 pulses/s **Pr.279 Actual line speed gain** = Maximum line speed **Pr.283 Actual line speed pulse input gain** = Maximum number of pulses

*3 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.281** = 0 m/min, **Pr.279** = 100 m/min, **Pr.282** = 0 pulses/s, **Pr.283** = 50k pulses/s, and **Pr.384** = "2", the actual line speed will be 50 m/min.

10 Taper ratio setting

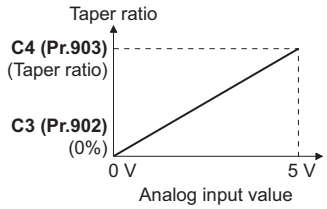
Set the taper ratio input method for using the taper ratio.

Pr.	Name
1285	Taper setting analog input selection
1287	Taper ratio setting

Pr.1287 setting	Pr.1285 setting	Taper ratio setting
0 to 100%	—	As set in **Pr.1287**
9999	3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2
	4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2
	5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2
	6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*2
	9999	No function

*1 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

Item	Setting example
Taper ratio setting method	Setting by analog voltage (0 to 5 V) input through terminal 2 (**Pr.1287** = "9999", **Pr.1285** = "3") 
Parameter setting	**C3 (Pr.902) Terminal 2 frequency setting bias** = 0% **C4 (Pr.903) Terminal 2 frequency setting gain** = Taper ratio (%)

For using the taper ratio, set the following parameters according to the taper mode.

Pr.	Name	Setting range	Minimum setting increments	Initial value
1284	Taper mode selection	0 to 4	1	0
1286	Winding diameter at taper start	0 to 6553 mm, 9999	1 mm	9999

NOTE

- For the details of the taper function, refer to page 151.

11 Inertia compensation function setting

Set the following parameters for using the inertia compensation function.

Pr.	Name	Setting	Remarks
393	Line speed command acceleration/deceleration reference	*1	Set the line speed at minimum diameter (the maximum line speed during tension control) in 0.1 m/min increments (1 to 6553.4 m/min).
1141	Line speed command acceleration/deceleration pattern	*1	Set S-curve acceleration/deceleration to reduce shock during inertia compensation operation. (Refer to page 160.)
1142	Line speed command acceleration start S-curve time	*1	
1143	Line speed command acceleration completion S-curve time	*1	
1144	Line speed command deceleration start S-curve time	*1	
1145	Line speed command deceleration completion S-curve time	*1	
178 to 189	Input terminal function selection	111	Assign the Inertia compensation acceleration (X111) signal. Input the Line speed acceleration (Y237) signal from the inverter connected to the intermediate shaft.
		112	Assign the Inertia compensation deceleration (X112) signal. Input the Line speed deceleration (Y238) signal from the inverter connected to the intermediate shaft.
		122	Assign the Winding diameter measurement (X122) signal.
1410	Motor inertia	*1	Set the motor inertia in 0.01 kg·m^2 increments (0 to 500 kg·m^2 or 9999). To further improve the accuracy for the inertia compensation function, set a motor inertia value using **Pr.707 and Pr.724**.
1411	Empty reel inertia	*1	Set the empty reel inertia in 0.01 kg·m^2 increments (0 to 500 kg·m^2 or 9999). To further improve the accuracy for the inertia compensation function, set an empty reel inertia value using **Pr.753 and Pr.754**.
1412	Roll width	*1	Set the roll width in 1 mm increments (0 to 5000 mm).
1413	Material specific gravity	*1	Set the specific gravity of the material in 0.001 g/cm^3 increments (0 to 20 g/cm^3).

*1 Set the parameters according to the specification of the machine used.

NOTE

- For the details of the inertia compensation function, refer to page 157.

12 Mechanical loss compensation function setting

Set the following parameters for using the mechanical loss compensation function.

Pr.	Name	Setting	Remarks
1419	Mechanical loss setting frequency bias	1000	The setting "1000" represents 0%. An offset can be set in 0.1% increment from the setting "1000".
1420	Mechanical loss setting frequency 1	*1	Drive the machine with an empty reel at the frequency of **Pr.1420**, **Pr.1422**, **Pr.1424**, **Pr.1426**, and **Pr.1428** (0 to 400 Hz, 0.01 Hz increments), and set the monitored torque values in **Pr.1421**, **Pr.1423**, **Pr.1425**, **Pr.1427**, and **Pr.1429** respectively. (The setting "1000" in **Pr.1421**, **Pr.1423**, **Pr.1425**, **Pr.1427**, and **Pr.1429** represents 0%. An offset can be set in 0.1% increments (900 to 1100%) from setting "1000".)
1421	Mechanical loss 1	*1	
1422	Mechanical loss setting frequency 2	*1	
1423	Mechanical loss 2	*1	
1424	Mechanical loss setting frequency 3	*1	
1425	Mechanical loss 3	*1	
1426	Mechanical loss setting frequency 4	*1	
1427	Mechanical loss 4	*1	
1428	Mechanical loss setting frequency 5	*1	
1429	Mechanical loss 5	*1	

*1 Set the parameters according to the specification of the machine used.

NOTE

- For the details of the mechanical loss compensation function, refer to page 163.

13 Stall mode function selection

Set the following parameters for using the stall mode function.

Pr.	Name	Setting	Remarks
178 to 189	Input terminal function selection	123	Assign the Stall mode trigger (X123) signal.
270	Acceleration/deceleration time during stall condition	*1	0 to 3600 seconds, in 0.1 second increments
1406	Commanded tension reduction scaling factor during stall condition	*1	0 to 200%, in 0.1% increments
1407	Speed limit during stall condition	*1	0 to 60 Hz, in 0.01 Hz increments

*1 Set the parameters according to the specification of the machine used.

NOTE

- For the details of the stall mode function, refer to page 165.

14 PID control action setting

Set the following parameters for PID control.

Pr.	Name	Setting	Remarks
128	PID action selection	40 or 41	40: Tension sensor feedback speed control (reverse action) 41: Tension sensor feedback speed control (forward action)
131	PID upper limit	*1	Set the value in 0.1% increments (400 to 600% or 9999) for outputting the PID upper limit (FUP) signal.
132	PID lower limit	*1	Set the value in 0.1% increments (400 to 600% or 9999) for outputting the PID lower limit (FDN) signal.
133	PID action set point	*1	Set the tension command value in 0.01% increments (400 to 600%).
1382	PID set point cushion time	*1	Set the cushion time for the PID set point. (Refer to page 85.)
1284	Taper mode selection	*1	Set the taper function for the PID set point. (Refer to page 124.)

*1 Set the parameter according to the specification of the machine used.

The following table shows a setting example.

Item	Setting example
Tension command setting method	Setting the tension command directly
Parameter setting	Perform calculation to convert the output voltage sent from the tension sensor when an intended tension command is applied. Convert the output voltage of the tension sensor to a percentage. Here 5 V corresponds to 100%. Set the output voltage value (in %) plus 500% in **Pr.133**.

NOTE

- The setting unit for manipulated amount of PID control is initially set to Hz (frequency). To change the unit to N (tension), set the amount using **Pr.1383** and **Pr.1384**. (Refer to page 183.)

15 PID control action check (example)

Apply tension force corresponding to the tension command to the tension sensor.

Give a tension command of 0% (0 N).

Input the X114 signal and start command.

Start the motor without feeding the workpiece.

Change the tension during motor operation, and check that the following motor speed conditions.

If any inconsistency is found, check the **Pr.128** setting.

Winding/unwinding	Tension feedback	Motor speed
Winding	Tension feedback ≥ Tension command	Deceleration
	Tension feedback < Tension command	Acceleration
Unwinding	Tension feedback ≥ Tension command	Acceleration
	Tension feedback < Tension command	Deceleration

16 PID control gain adjustment

Feed the workpiece through the system and adjust the tension PI gain. Refer to page 122 for the tension PI gain adjustment.

17 Test run

Operate the system starting from the maximum-diameter roll to the minimum-diameter roll and vice versa and check that no fault is found in the system behavior.

6.5 Tension sensor feedback torque control details

The tension sensorless torque control is performed to control the output torque of a motor according to the roll diameter so that the tension applied to a material is constant. Using the feedback from tension sensors allows for high-precision winding/unwinding operations.

This section explains the details unique to the tension sensor feedback torque control. Common information among torque control is stated in 5.5 (Tension sensorless torque control details).

Purpose	Parameter to set			Refer to page
To select forward/reverse action for PID control	PID action selection	P.R100	Pr.128	177
To select winding or unwinding for a shaft	Winding/unwinding shaft selection	P.R002	Pr.1230	178
To input tension feedback to the inverter	Tension feedback setting	P.R101 to P.R103, P.R330 to P.R333	Pr.363, Pr.1136 to Pr.1139, Pr.1227	178
To detect tension feedback malposition	Tension feedback malposition detection	P.R160, P.R163, P.A601, P.A602, P.F040	Pr.131, Pr.132, Pr.137, Pr.425, Pr.1103	180
To allow a signal to be output during normal tension feedback	Tension feedback detection	P.R422	Pr.423	126
To enable manual input of gains for PID control	PID control gain setting	P.R110 to P.R112	Pr.129, Pr.130, Pr.134	99
To perform setting for tension sensorless torque control	Control method selection	P.C100 (P.C200), P.C101 (P.C201), P.C102 (P.C202), P.G200, P.G300	Pr.80 (Pr.453), Pr.81 (Pr.454), Pr.71 (Pr.450), Pr.800, Pr.451	139
To select the tension command input method	Tension command source selection	P.R300	Pr.804	140
To select the tension command setting increment	Tension command increment	P.R301	Pr.1401	140
To select the torque generation direction	Torque generation direction setting	P.R304, P.R305	Pr.1072, Pr.1114	143
To prevent the roll from getting too tight when the winding diameter increases	Taper function	P.R320, P.R321, P.R500 to P.R504, P.R510 to P.R519, P.R600, P.R601	Pr.829, Pr.1243, Pr.1244, Pr.1282 to Pr.1297	151
To keep the tension applied to the material constant also during acceleration/deceleration	Inertia compensation function	P.R530 to P.R540	Pr.271, Pr.272, Pr.753, Pr.754, Pr.1410 to Pr.1415, Pr.1418	157
To prevent tension change due to factors such as mechanical friction	Mechanical loss compensation function	P.R003, P.R550 to P.R560	Pr.1230, Pr.1419 to Pr.1429	163
To prevent sagging of the material before starting winding	Stall mode function	P.R340 to P.R343	Pr.270, Pr.1406, Pr.1407, Pr.1409	165

POINT

- Select torque control under Vector control or Real sensorless vector control to perform tension sensor feedback torque control.
- Turn the X114 signal ON to perform tension sensor feedback torque control. When the X114 signal is OFF, the tension sensor feedback torque control is not available.

6.5.1 Tension sensor feedback torque control function selection

Select forward/reverse action for tension sensor feedback torque control.

Pr.	Name	Initial value	Setting range	Description	
128 R100 (A610)	PID action selection	0	0	Tension sensor feedback torque control disabled.	
			40	Tension sensor feedback torque control enabled.	Reverse action
			41		Forward action

◆PID action selection (Pr.128)

- Set forward or reverse action according to the control target.
- The following table shows the input method for the set point, tension feedback signal, and tension command for the tension sensor feedback torque control function (**Pr.128** = 40 or 41).

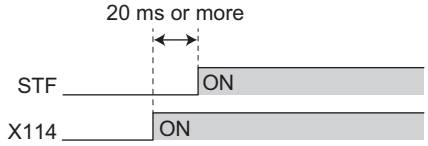
Pr.128 setting value	Forward /reverse action setting	Operation status	Set point input	Tension feedback signal input	Tension command input
0 (initial value)	—	Tension sensor feedback torque control disabled.	—	—	—
40	Reverse action	When deviation X (set point subtracted by measured value) is a plus value, the manipulated amount is increased, and when the deviation is a minus value, the manipulated amount is decreased.	Tension command after taper compensation	Set in **Pr.363**.	Set in **Pr.804**.
41	Forward action	When deviation X (set point subtracted by measured value) is a minus value, the manipulated amount is increased, and when the deviation is a plus value, the manipulated amount is decreased.			

NOTE

- The automatic restart after instantaneous power failure function is not activated while tension sensor feedback torque control is enabled (**Pr.128** = "40 or 41").
- To perform tension sensor feedback torque control, set **Pr.127 PID control automatic switchover frequency** = "9999 (initial value)". (If the **Pr.127** setting is other than "9999", a sudden speed change may occur.)

◆Tension control selection signal (X114 signal)

- To enable the tension sensor feedback torque control, turn ON the Tension control selection (X114) signal and set "40 or 41" in **Pr.128 PID action selection**.
- Ensure the motor has stopped before switching between operation with tension sensor feedback torque control and normal operation.
- To input the X114 signal, set "114" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.
- After turning ON the X114 signal, wait 20 ms or longer to input a start (STF/STR) command.



◆PID compensation disabled signal (X116 signal)

- PID compensation can be disabled by turning ON the X116 signal. To input the X116 signal, set "116" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.

6.5.2 Winding/unwinding shaft selection

Select whether the target roll is a winding shaft or unwinding shaft.

Pr.	Name	Initial value	Setting range	Description
1230 R002	Winding/unwinding selection	0	0	Winding
			1	Unwinding

◆Winding/unwinding selection (Pr.1230)

- Use **Pr.1230 Winding/unwinding selection** to select whether the target roll is a winding shaft or unwinding shaft.
- The initial diameter of the winding shaft is selected according to whether the operation is winding or unwinding.

Pr.1230 setting	Winding/unwinding selection	Initial roll diameter
0	Winding	Minimum roll diameter
1	Unwinding	Maximum roll diameter

6.5.3 Tension feedback setting

Set parameters for tension feedback.

Select the input interface (analog input terminal) used for inputting tension feedback to the inverter.

Pr.	Name	Initial value	Setting range	Description
363 R102	Dancer / tension sensor feedback input selection	9999	3	The measured value is input through terminal 2.
			4	The measured value is input through terminal 4.
			5	The measured value is input through terminal 1.
			6	The measured value is input through terminal 6 on the FR-A8AZ.
			9	The measured value is input via CC-Link / CC-Link IE Field Network Basic communication.
			9999	No function
1136 R330	Tension sensor feedback voltage/current bias	0%	0 to 100%	Set the bias voltage (current) in % for analog input.
1137 R331	Tension sensor feedback bias	0 N	0 to 500 N*1	Set the tension feedback bias value for analog input.
1138 R332	Tension sensor feedback voltage/current gain	100%	0 to 100%	Set the gain voltage (current) in % for analog input.
1139 R333	Tension sensor feedback gain	100 N*1	0 to 500 N*1	Set the tension feedback gain value for analog input.
1227 R103	Dancer / tension sensor feedback input filter time constant	0	0	Without filter
			0.01 to 5 s	Set the primary delay filter for the tension feedback input value.

*1 The setting range varies depending on the **Pr.1401** setting. (Refer to page 140.)

◆PID set point

- Use a commanded tension value after taper compensation to set the set point for tension feedback. Select the tension command input method in **Pr.804 Tension / Torque command source selection**.

NOTE

- Refer to page 140 for **Pr.804** and page 151 for the taper function.

◆Tension feedback input selection (Pr.363)

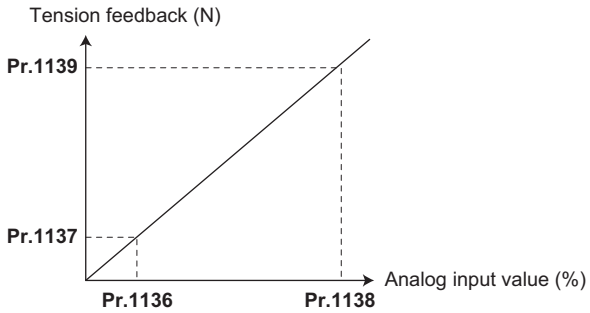
- Use **Pr.363 Dancer / tension sensor feedback input selection** to select the input terminal for tension feedback.

Pr.363 setting	Input terminal
3	Terminal 2 (0 to 100%) (0 to 5 VDC)*1
4	Terminal 4 (20 to 100%) (4 to 20 mA)*1
5 (initial value)	Terminal 1 (-100 to 100%) (0 to ±10 VDC)*1
6	Terminal 6 on the FR-A8AZ (-100 to 100%) (0 to ±10 VDC)*1
9	CC-Link or CC-Link IE Field Network Basic (-100 to 100%)

*1 The input specification in the initial setting is indicated.

◆Tension feedback calibration (Pr.1136 to Pr.1139)

- Set **Pr.1136 to Pr.1139** to calibrate the tension feedback input value.



- When **Pr.363** = "9", dancer / tension sensor feedback can be input via CC-Link or CC-Link IE Field Network Basic communication.
- The 16-bit feedback signal input via communication is recognized as a signed signal. The input data range is from -10000 (-100.00%) to +10000 (+100.00%).

◆Tension feedback input filter (Pr.1227)

- Use **Pr.1227 Dancer / tension sensor feedback input filter time constant** to set the primary filter for the tension feedback input value. When **Pr.1227** = "0", the filter setting is disabled.

6.5.4 Tension feedback malposition detection

Set the following parameters to prevent the motor speed from increasing due to a line break (tension feedback = 0 N).

Pr.	Name	Initial value	Setting range	Description
131 A601	**PID upper limit**	9999	400 to 600%	Set the value for outputting the PID upper limit (FUP) signal .
			9999	No function
132 A602	**PID lower limit**	9999	400 to 600%	Set the value for outputting the PID lower limit (FDN) signal .
			9999	No function
137 R163	**PID upper/lower limit hysteresis width**	9999	0 to 100%	Prevent chattering of the FUP/FDN signals.
			9999	No function
425 R160	**Break detection waiting time**	9999	0 to 100 s	Set the time until tension feedback malposition is determined.
			9999	No break detection
553 A603	**PID deviation limit**	9999	0 to 100%	The Y48 signal is output when the absolute value of the deviation exceeds the deviation limit value.
			9999	No function
554 A604	**PID signal operation selection**	0	0 to 3	The action when the upper or lower limit for a measured value input is detected or when a limit for the deviation is detected can be selected.
1103 F040	**Deceleration time at emergency stop**	5 s	0 to 3600 s	Set the motor deceleration time at a deceleration by turning ON the X92 signal. Set a deceleration time for the deceleration stop at the occurrence of tension feedback malposition.

◆Tension feedback malposition detection (break detection) (Pr.131, Pr.132, Pr.425)

- Set the upper limit of tension feedback in **Pr.131 PID upper limit**. Set the lower limit of tension feedback in **Pr.132 PID lower limit**.
- The FUP signal is output when a tension feedback value exceeds the **Pr.131** setting. When a value falls below the **Pr.132** setting, the FDN signal is output.
- When tension feedback remains higher than the **Pr.131** setting or lower than the **Pr.132** setting for the time set in **Pr.425 Break detection waiting time** or longer, the condition is determined as tension feedback malposition (break), and compensation by PID control becomes 0. The winding diameter at the time of malposition detection is retained.
- When a tension feedback malposition occurs, the torque command value becomes 0. To decelerate the motor to a stop, turn OFF the start signal. The deceleration stop is performed according to the setting in **Pr.1103 Deceleration time at emergency stop**.

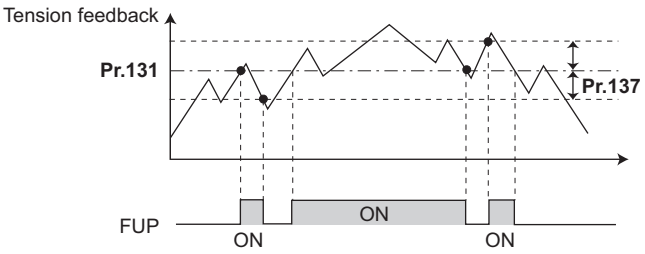
- When tension feedback malposition (break) is detected, the Break detection (Y231) signal can be output.
- When the following two conditions are both met, PID calculation is resumed.
  - The motor is stopped or output is shutoff.
  - The start signal is OFF.
- When using each signal, assign the function to **Pr.190 and Pr.196 (output terminal function selection)** referring to the following table.

Output signal	Pr.190 to Pr.196 setting	
	Positive logic	Negative logic
FDN	14	114
FUP	15	115
Y231	231	331

◆PID upper/lower limit hysteresis width (Pr.137)

When the tension feedback value fluctuates, the FUP/FDN signal may chatter (turn ON and OFF repeatedly), depending on the position.

To prevent the signal chattering, configure **Pr.137 PID upper/lower limit hysteresis width** to set a hysteresis for the FUP and FDN signals.



Example of the PID upper limit (FUP) signal

NOTE

- **Pr.137** setting does not affect the operation of the Y231 signal. (Refer to page 180 for the details of the Y231 signal.)
- When a value other than "9999" is set in **Pr.137**, depending on the fluctuation of the tension feedback value, the FUP/FDN signal may not turn ON even if the tension feedback value exceeds the **Pr.131** setting or falls below the **Pr.132** setting.

◆Operation selection when a limit is detected (Pr.554, FUP signal, FDN signal, Y48 signal)

- Using **Pr.554 PID signal operation selection**, set the action when the measured value input exceeds the upper limit (**Pr.131 PID upper limit**) or lower limit (**Pr.132 PID lower limit**), or when the deviation input exceeds the permissible value (**Pr.553 PID deviation limit**).
- Choose whether to output the signals (FUP, FDN, Y48) only or to activate the protective function to output the inverter shutoff.

Pr.554 setting	Inverter operation	
	FUP, FDN	Y48
0 (initial value)	Signal output only	Signal output only
1	Signal output + output shutoff (E.PID)	
2	Signal output only	Signal output + output shutoff (E.PID)
3	Signal output + output shutoff (E.PID)	

NOTE

- When each of **Pr.131**, **Pr.132** and **Pr.553** settings corresponding to each of the FUP, FDN and Y48 signals is "9999" (no function), signal output and protective function are not available.

6.5.5 Tension feedback detection

A signal is output while the tension feedback value maintains the specified normal level.

NOTE

- For the details, refer to page 126.

6.5.6 PID offset displacement

Calibrate the reference value of the tension sensor feedback amount (PID measured value).

NOTE

- For the details, refer to page 126.

6.5.7 PID control gain setting

Set the proportional band, integral time, and differential time for PID control.

NOTE

- For the details, refer to page 99.

6.5.8 Integral control action setting

The manipulated amount for PID integral action can be limited by setting parameters.
The integral control action can be enabled or disabled (the integral term is held) according to the PID control deviation.
Integral control can be disabled by the signal input. (The integral term value is cleared.)

NOTE

- For the details, refer to page 100.

6.5.9 Differential control action setting

Differential control can be disabled by the signal input. (The differential term value is cleared.)

NOTE

- For the details, refer to page 101.

6.5.10 PID control gain selection

The proportional band, integral time, and differential time required for PID gain setting can be set individually depending on whether deviation is positive or negative.
PID gain settings 1 to 4 (proportional band, integral band, differential time) can be selected by changing the status of two input signals.

NOTE

- For the details, refer to page 101.

6.5.11 Signed winding diameter compensation torque command selection

Set the availability of negative values for the torque command during tension sensor feedback torque control or after PID compensation.

Pr.	Name	Initial value	Setting range	Description
1140 R334	**Signed winding diameter compensation torque command selection**	0	0	Signed
			9999	Unsigned

◆Signed winding diameter compensation torque command selection (Pr.1140)

- When "0 (initial value)" is set in **Pr.1140 Signed winding diameter compensation torque command selection**, and when the calculation result of command torque after PID compensation is a negative value, the value is used as the torque command value.
- When "9999" is set in **Pr.1140**, and when the calculation result of command torque after PID compensation is a negative value, the torque command will be "0".

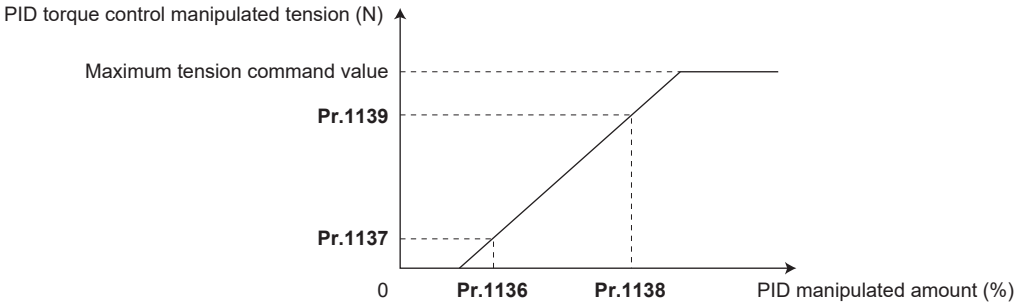
6.5.12 Converting the PID manipulated amount to values in different units

- The PID manipulated amount (%) can be converted to a value in a different unit (N) for tension sensor feedback torque control.

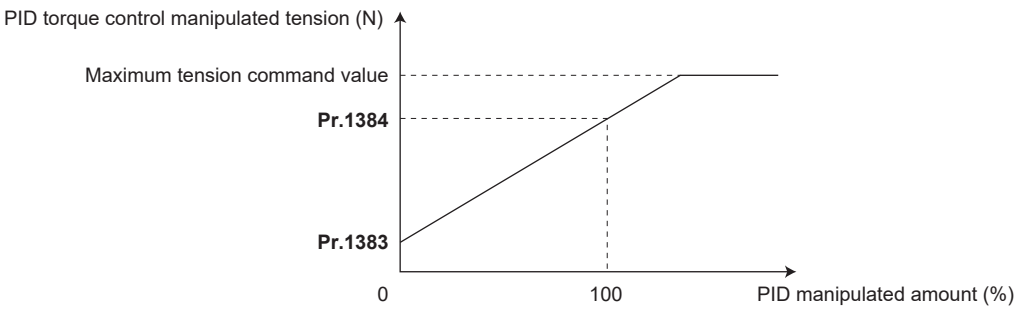
Pr.	Name	Initial value	Setting range	Description
1383 R335	**PID torque control manipulated tension bias [N]**	0 N	0 to 500 N*1	Convert the PID manipulated amount to a tension value (N). 9999: No function
1384 R336	**PID torque control manipulated tension gain [N]**	9999	0 to 500 N*1, 9999	

*1 The increment varies depending on the **Pr.1401** setting. (Refer to page 140.)

- When **Pr.1384** = "9999 (initial value)", the amount is converted as shown in the following diagram.



- When **Pr.1384** ≠ "9999", the amount is converted as shown in the following diagram.

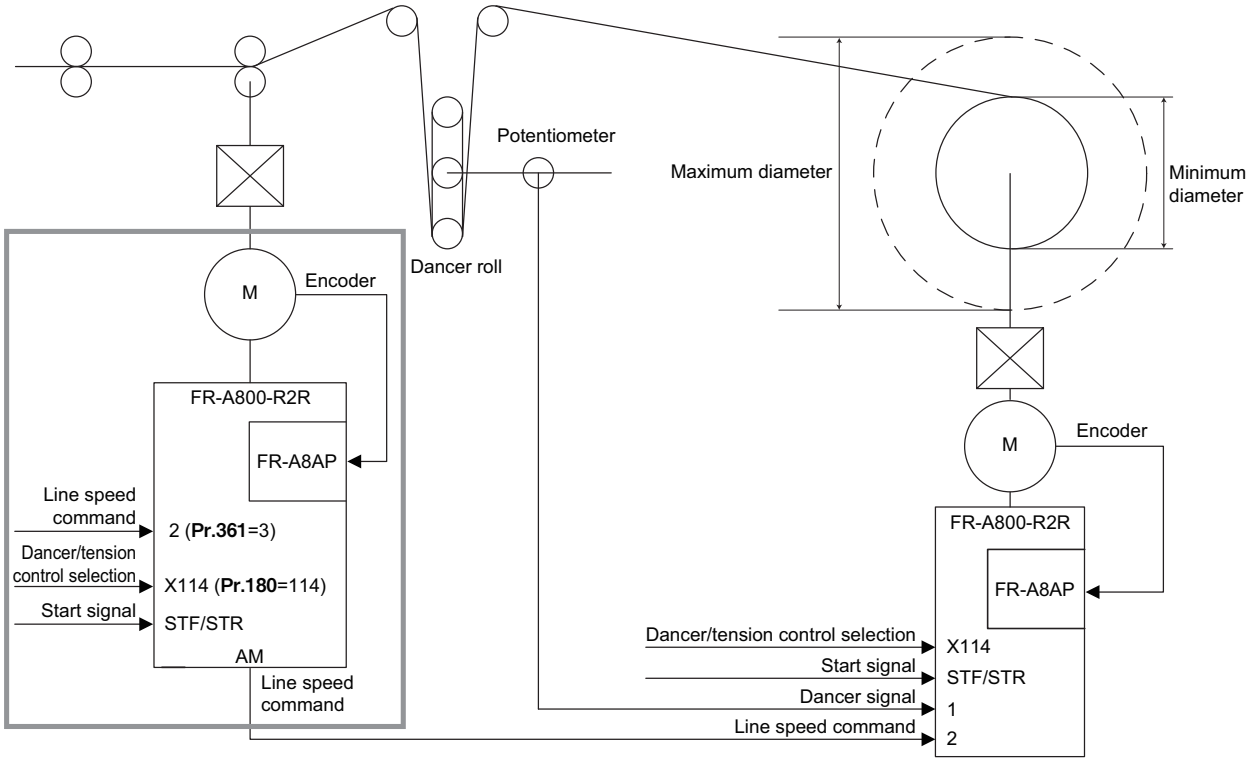


7 SPEED CONTROL OF INTERMEDIATE SHAFTS

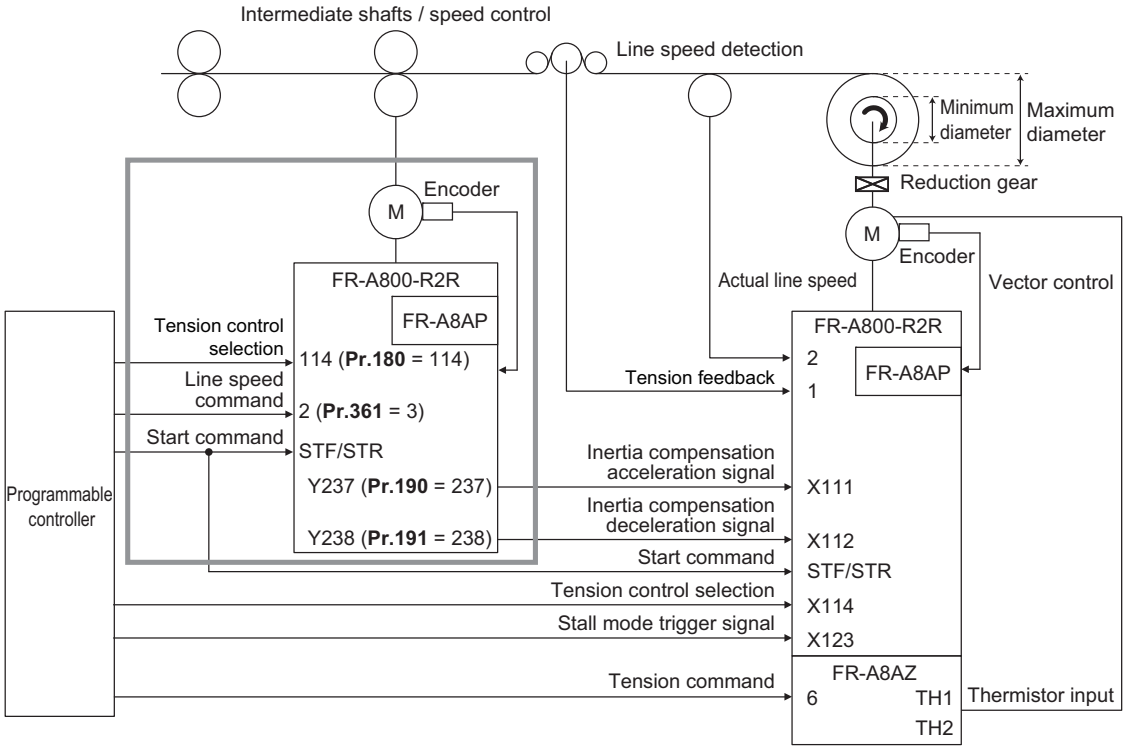
To control intermediate driving shafts (rollers between an unwinding roll and a winding roll), perform speed control by inputting line speed commands.

7.1 System configuration example

◆Dancer feedback speed control



◆Tension sensor feedback torque control



7.2 Parameter setting procedure for speed control of intermediate shafts

The following procedure shows the parameter setting example for the speed control of intermediate shafts.

7.2.1 Parameter setting procedure

1 Wiring

Perform secure wiring.

NOTE

- Do not feed the workpiece through the machine.

2 Control method selection

Select the control method according to the application and the motor.

Pr.	Name	Setting range	Minimum setting increments	Initial value
71	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0
9	Electronic thermal O/L relay	0 to 500 A *3	0.01 A*3	Inverter rated current
		0 to 3600 A *4	0.1 A*4	
80	Motor capacity	0.4 to 55 kW, 9999 *3	0.01 kW	9999
		0 to 3600 kW, 9999 *4	0.1 kW	
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999
83	Rated motor voltage	0 to 1000 V	0.1 V	200 V (200 V class)
				400 V (400 V class)
84	Rated motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999
800	Control method selection*1	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20
810	Torque limit input method selection	0 to 2	1	0
359	Encoder rotation direction	0, 1, 100, 101	1	1
369	Number of encoder pulses	0 to 4096	1	1024
707	Motor inertia (integer)*2	10 to 999, 9999	1	9999
724	Motor inertia (exponent)*2	0 to 7, 9999	1	9999
862	Encoder option selection	0, 1	1	0

*1 For the control method, Vector control is recommended.

*2 Setting is required for a motor other than a Mitsubishi Electric motor (the SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or SF-V5RU (1500 r/min series) motor).

*3 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*4 For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

NOTE

- Select Vector control for regenerative driving in a low-speed range (about 10 Hz or lower), .
- For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

3 Offline auto tuning

Perform offline auto tuning as required. For offline auto tuning, refer to page 55.

Pr.	Name	Setting range	Minimum setting increments	Initial value
96	Auto tuning setting/status	0, 1, 11, 101	1	0

After the offline auto tuning, perform the test run of the motor alone to make sure that no fault is found in the motor's behavior.

4 Speed control gain adjustment

Adjust the speed control gain. Refer to page 59 for the speed control gain adjustment.
Since the diameter is fixed for the intermediate shaft, settings in steps 6 to 8 in the "Adjustment by easy gain tuning (recommended)" section on page 59 are not required.

5 Mechanical specifications setting

Set the following parameters according to the specifications of the machine used.

Pr.	Name	Description
1235	Maximum winding diameter 1	Set the roll diameter of the intermediate shaft in 1 mm increments (1 to 6553 mm)*1 in both **Pr.1235** and **Pr.1236**.
1236	Minimum winding diameter 1	
394	First acceleration time for line speed command	Set the acceleration time in 0.1 second increments*2 (0 to 3600 seconds).
395	First deceleration time for line speed command	Set the deceleration time in 0.1 second increments*2 (0 to 3600 seconds).
1141	Line speed command acceleration/deceleration pattern	Set S-curve acceleration/deceleration to reduce shock during line speed acceleration/deceleration operation. (Refer to page 82.)
1142	Line speed command acceleration start S-curve time	
1143	Line speed command acceleration completion S-curve time	
1144	Line speed command deceleration start S-curve time	
1145	Line speed command deceleration completion S-curve time	
362	Actual line speed input selection	Set "0" (Line speed command).
393	Line speed command acceleration/deceleration reference	Set the reference line speed (travel amount per minute) in 0.1 m/min increments*3 (1 to 6553.4 m/min) for the acceleration/deceleration time for the line speed command.
398	Draw rate	Set a draw rate for the line speed command value or the line speed command acceleration/deceleration reference. (Refer to page 75.)
178 to 189	Input terminal function selection	To assign the Tension control selection (X114) signal, set "114" in any of the parameters.
190 to 196	Output terminal function selection	To assign the Line speed acceleration (Y237) signal and the Line speed deceleration (Y238) signal, set "237" and "238" in any two of the parameters.
7	Acceleration time	Set "0".
8	Deceleration time	Set "0".
1247	Winding diameter change increment amount limit	Set "9999" (Winding diameter calculation disabled).
158	AM terminal function selection	Set "26" (Line speed command value).
276	Line speed monitoring reference	Set the line speed (travel amount per minute) in 0.1 m/min increments*3 (0 to 6553.4 m/min) for maximum (100%) output via terminal AM.
1243	Gear ratio numerator	Set a gear ratio in 1 increments (1 to 65534) when the motor shaft has a reduction gear.
1244	Gear ratio denominator	
363	Dancer / tension sensor feedback input selection	Set "9999" (Function disabled).
128	PID action selection	Set "40".
129	PID proportional band	Set "9999" (Without proportional control).
130	PID integral time	Set "9999" (Without integral control).
134	PID differential time	Set "9999" (Without differential control).
358	Line speed unit	The initial value is "0" (m/min). (0 to 3, in 1 increments) Choose an appropriate value (increment) according to the specifications of the machine used.
621	Allowable deviation from target line speed	The Y237/Y238 signal output range can be set in 0.1 m/min increments*3 (0 to 6553.4 m/min) for the target line speed command. (Refer to page 79.)

*1 Set the parameter according to the specification of the machine used.
*2 The increment applies when **Pr.21** = "0 (initial value)".
*3 The increment applies when **Pr.358** = "0 (initial value)".

6 Line speed command input setting

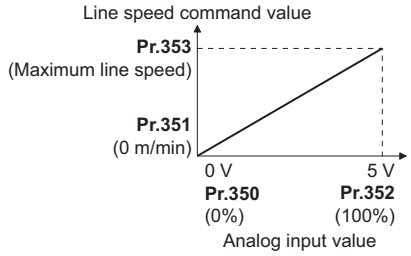
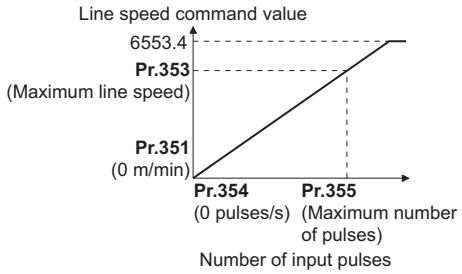
Set **Pr.361** to select an interface for the line speed command value input.

Pr.	Name	Setting	Input method
361	Line speed command input selection	0	According to the priority of the speed command sources. (Refer to page 70.)
		1	Terminal JOG single-phase pulse train input (Refer to page 71.)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 71.)
		3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 73.)
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 73.)
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73.)
		6	Terminal 6 on the FR-A8AZ (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73.)
		7	FR-A8AL single-phase pulse train input (terminal PP/NP) (Refer to page 71.)
		8	Line speed command according to the **Pr.360** setting (Refer to page 73.)
		10	Inverter-to-inverter link function (Available only for the FR-A800-E-R2R. For details, refer to the Ethernet Function Manual.)
		9999 (initial value)	Function disabled.

*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

Item	Setting example 1	Setting example 2
Line speed command input method	Setting by analog voltage (0 to 5 V) input through terminal 2 (**Pr.361** = "3") 	Setting by pulse train input through terminal JOG (**Pr.361** = "1") 
Parameter setting	**Pr.350 Line speed command voltage/current bias** = 0% **Pr.351 Line speed command bias** = 0 m/min **Pr.352 Line speed command voltage/current gain** = 100% **Pr.353 Line speed command gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*3 **Pr.351 Line speed command bias** = 0 m/min **Pr.354 Line speed command pulse input bias** = "0" **Pr.353 Line speed command gain** = Maximum line speed **Pr.355 Line speed command pulse input gain** = Maximum number of pulses

*3 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.351** = 0 m/min, **Pr.353** = 100 m/min, **Pr.354** = 0 pulses/s, **Pr.355** = 50k pulses/s, and **Pr.384** = "2", the line speed will be 50 m/min.

NOTE

- Information on various settings about the line speed is provided in the chapter for the dancer feedback speed control. Refer to page 64.

7.2.2 Offline auto tuning

The offline auto tuning enables the optimal operation of a motor.

NOTE

- For the details, refer to page 55.

7.2.3 Speed control gain adjustment

- The load inertia ratio (load moment of inertia) for the motor is calculated from the torque command and rotation speed during motor driving under Vector control. Because the optimum gain for speed control using dancer feedback / tension sensor feedback is calculated automatically from the load inertia ratio and the response level, the work required for gain adjustment is reduced (easy gain tuning).
- By manually entering the load inertia ratio (if known), the control gain is set automatically.
- Manual gain adjustment is useful for achieving optimum machine performance or improving unfavorable conditions, such as vibration and acoustic noise during operation with high load inertia.

NOTE

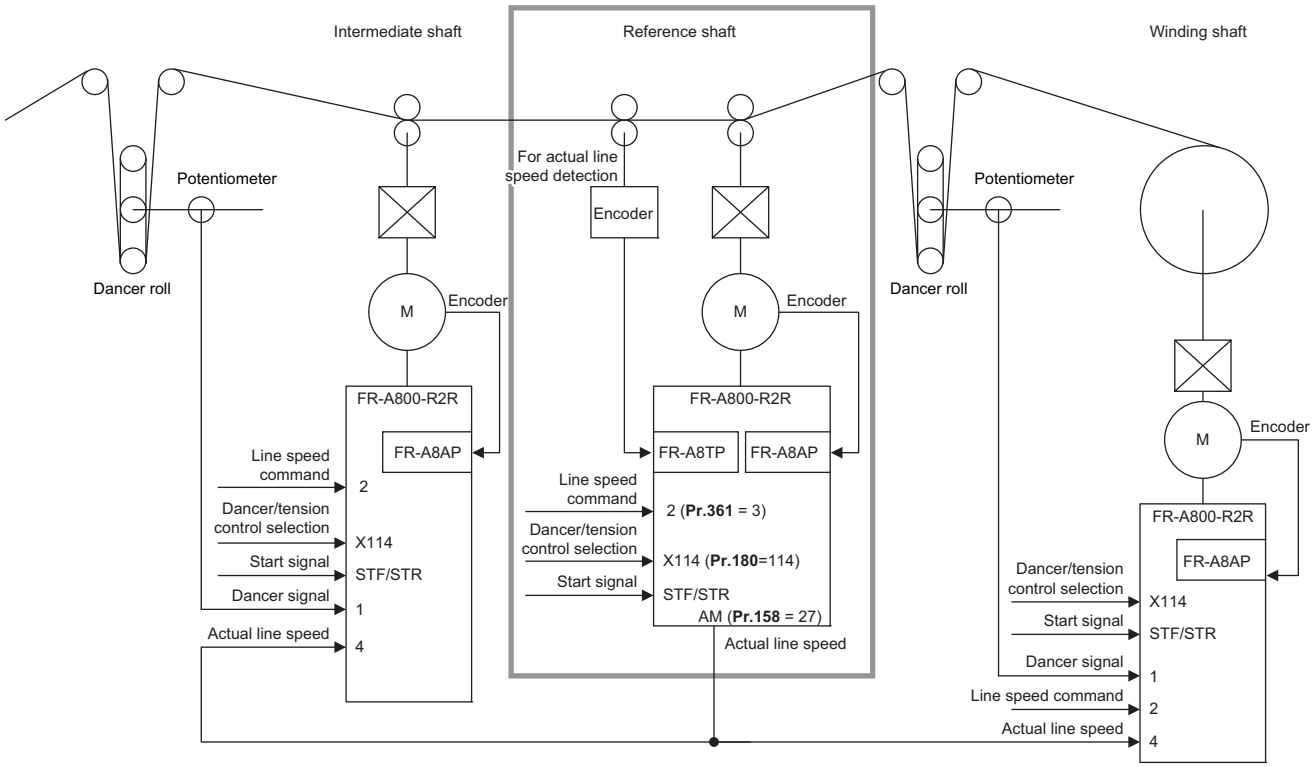
- For the details, refer to page 59.
  Since the diameter is fixed for the intermediate shaft, settings in steps 6 to 8 in the "Adjustment by easy gain tuning (recommended)" section on page 59 are not required.

8 SPEED CONTROL OF REFERENCE SHAFT

To control the reference shaft and other intermediate driving shafts, perform speed control using actual line speed detected at the reference shaft.

8.1 System configuration example

◆Dancer feedback speed control



8.2 Parameter setting procedure for speed control of reference shaft

The following procedure shows the parameter setting example for the speed control of the reference shaft.

8.2.1 Parameter setting procedure

1 Wiring

Perform secure wiring.

NOTE

- Do not feed the workpiece through the machine.

2 Control method selection

Select the control method according to the application and the motor.

Pr.	Name	Setting range	Minimum setting increments	Initial value
71	Applied motor	0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74	1	0
9	Electronic thermal O/L relay	0 to 500 A *3	0.01 A*3	Inverter rated current
		0 to 3600 A *4	0.1 A*4	
80	Motor capacity	0.4 to 55 kW, 9999 *3	0.01 kW	9999
		0 to 3600 kW, 9999 *4	0.1 kW	
81	Number of motor poles	2, 4, 6, 8, 10, 12, 9999	1	9999
83	Rated motor voltage	0 to 1000 V	0.1 V	200 V (200 V class)
				400 V (400 V class)
84	Rated motor frequency	10 to 400 Hz, 9999	0.01 Hz	9999
800	Control method selection*1	0 to 2, 9 to 12, 20, 100 to 102, 109 to 112	1	20
810	Torque limit input method selection	0 to 2	1	0
359	Encoder rotation direction	0, 1, 100, 101	1	1
369	Number of encoder pulses	0 to 4096	1	1024
707	Motor inertia (integer)*2	10 to 999, 9999	1	9999
724	Motor inertia (exponent)*2	0 to 7, 9999	1	9999
862	Encoder option selection	0, 1	1	0

*1 For the control method, Vector control is recommended.

*2 Setting is required for a motor other than a Mitsubishi Electric motor (the SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or SF-V5RU (1500 r/min series) motor).

*3 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.

*4 For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

NOTE

- Select Vector control for regenerative driving in a low-speed range (about 10 Hz or lower), .
- For the parameter details, refer to the FR-A800 Instruction Manual (Detailed).

3 Offline auto tuning

Perform offline auto tuning as required. For offline auto tuning, refer to page 55.

Pr.	Name	Setting range	Minimum setting increments	Initial value
96	Auto tuning setting/status	0, 1, 11, 101	1	0

After the offline auto tuning, perform the test run of the motor alone to make sure that no fault is found in the motor's behavior.

4 Speed control gain adjustment

Adjust the speed control gain. Refer to page 59 for the speed control gain adjustment.

5 Mechanical specifications setting

Set the following parameters according to the specifications of the machine used.

Pr.	Name	Description
1235	Maximum winding diameter 1	Set the roll diameter of the intermediate shaft in 1 mm increments (1 to 6553 mm)*1 in both **Pr.1235** and **Pr.1236**.
1236	Minimum winding diameter 1	
394	First acceleration time for line speed command	Set the acceleration time in 0.1 second increments*2 (0 to 3600 seconds).
395	First deceleration time for line speed command	Set the deceleration time in 0.1 second increments*2 (0 to 3600 seconds).
1141	Line speed command acceleration/deceleration pattern	Set S-curve acceleration/deceleration to reduce shock during line speed acceleration/deceleration operation. (Refer to page 82.)
1142	Line speed command acceleration start S-curve time	
1143	Line speed command acceleration completion S-curve time	
1144	Line speed command deceleration start S-curve time	
1145	Line speed command deceleration completion S-curve time	
362	Actual line speed input selection	Set "2" (FR-A8TP).
393	Line speed command acceleration/deceleration reference	Set the reference line speed (travel amount per minute) in 0.1 m/min increments*3 (1 to 6553.4 m/min) for the acceleration/deceleration time for the line speed command.
398	Draw rate	Set a draw rate for the line speed command value or the line speed command acceleration/deceleration reference. (Refer to page 75.)
178 to 189	Input terminal function selection	To assign the Tension control selection (X114) signal, set "114" in any of the parameters.
190 to 196	Output terminal function selection	To assign the Line speed acceleration (Y237) signal and the Line speed deceleration (Y238) signal, set "237" and "238" in any two of the parameters.
7	Acceleration time	Set "0".
8	Deceleration time	Set "0".
1247	Winding diameter change increment amount limit	Set "9999" (Winding diameter calculation disabled).
158	AM terminal function selection	Set "27" (Actual line speed).
276	Line speed monitoring reference	Set the line speed (travel amount per minute) in 0.1 m/min increments*3 (0 to 6553.4 m/min) for maximum (100%) output via terminal AM.
1243	Gear ratio numerator	Set a gear ratio in 1 increments (1 to 65534) when the motor shaft has a reduction gear.
1244	Gear ratio denominator	
363	Dancer / tension sensor feedback input selection	Set "9999" (Function disabled).
128	PID action selection	Set "40".
129	PID proportional band	Set "9999" (Without proportional control).
130	PID integral time	Set "9999" (Without integral control).
134	PID differential time	Set "9999" (Without differential control).
358	Line speed unit	The initial value is "0" (m/min). (0 to 3, in 1 increments) Choose an appropriate value (increment) according to the specifications of the machine used.
621	Allowable deviation from target line speed	The Y237/Y238 signal output range can be set in 0.1 m/min increments*3 (0 to 6553.4 m/min) for the target line speed command. (Refer to page 79.)

*1 Set the parameter according to the specification of the machine used.

*2 The increment applies when **Pr.21** = "0 (initial value)".

*3 The increment applies when **Pr.358** = "0 (initial value)".

6 Line speed command input setting

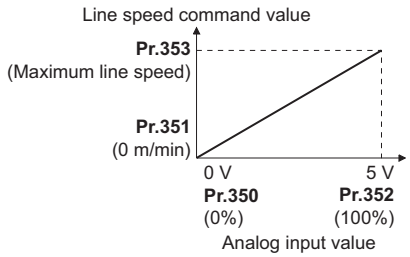
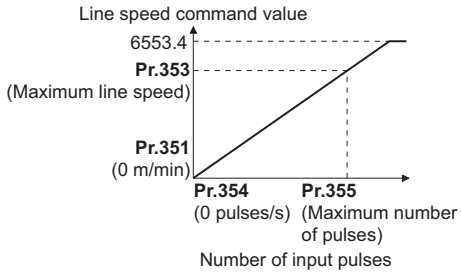
Set **Pr.361** to select an interface for the line speed command value input.

Pr.	Name	Setting	Input method
361	Line speed command input selection	0	According to the priority of the speed command sources. (Refer to page 70.)
		1	Terminal JOG single-phase pulse train input (Refer to page 71.)
		2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input (complementary 12 V / differential 5 V (A-, B-phases))*1 (Refer to page 71.)
		3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*2 (Refer to page 73.)
		4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*2 (Refer to page 73.)
		5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73.)
		6	Terminal 6 on the FR-A8AZ (analog value: -100 to 100%) (0 to ±10 VDC)*2 (Refer to page 73.)
		7	FR-A8AL single-phase pulse train input (terminal PP/NP) (Refer to page 71.)
		8	Line speed command according to the **Pr.360** setting (Refer to page 73.)
		10	Inverter-to-inverter link function (Available only for the FR-A800-E-R2R. For details, refer to the Ethernet Function Manual.)
		9999 (initial value)	Function disabled.

*1 To perform Vector control, install the Vector control compatible option.

*2 The input specification in the initial setting is indicated. (Refer to page 47.)

The following table shows a setting example.

Item	Setting example 1	Setting example 2
Line speed command input method	Setting by analog voltage (0 to 5 V) input through terminal 2 (**Pr.361** = "3")  	Setting by pulse train input through terminal JOG (**Pr.361** = "1") 
Parameter setting	**Pr.350 Line speed command voltage/current bias** = 0% **Pr.351 Line speed command bias** = 0 m/min **Pr.352 Line speed command voltage/current gain** = 100% **Pr.353 Line speed command gain** = Maximum line speed	**Pr.384 Input pulse division scaling factor** = "1"*3 **Pr.351 Line speed command bias** = 0 m/min **Pr.354 Line speed command pulse input bias** = "0" **Pr.353 Line speed command gain** = Maximum line speed **Pr.355 Line speed command pulse input gain** = Maximum number of pulses

*3 Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG.
Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
When inputting 50k pulses/s while **Pr.351** = 0 m/min, **Pr.353** = 100 m/min, **Pr.354** = 0 pulses/s, **Pr.355** = 50k pulses/s, and **Pr.384** = "2", the line speed will be 50 m/min.

NOTE

- Information on various settings about the line speed is provided in the chapter for the dancer feedback speed control. Refer to page 64.

8.2.2 Offline auto tuning

The offline auto tuning enables the optimal operation of a motor.

NOTE

- For the details, refer to page 55.

9 WINDING DIAMETER COMPENSATION FUNCTION

The winding diameter calculation is used to estimate the present winding diameter from the actual line speed or the actual motor speed for the winding/unwinding shaft.
The estimated winding diameter is used to convert the line speed command to the frequency command, or convert the tension command to the torque command.
Using the winding diameter compensation function under dancer feedback speed control, tension sensor feedback speed control, tension sensorless torque control, or tension sensor feedback torque control improves control accuracy.

POINT

- To enable the winding diameter compensation function under dancer feedback speed control, tension sensor feedback speed control, or tension sensor feedback torque control, turn ON the X114 signal and set "40 or 41" in Pr.128 PID action selection. (When the X114 signal is OFF or "0" is set in **Pr.128**, the winding diameter compensation function is disabled under dancer feedback speed control, tension sensor feedback speed control, and tension sensor feedback torque control.)
- Turn ON the X114 signal to enable the sensorless torque control and the winding diameter compensation function. (When the X114 signal is OFF, the tension sensorless torque control and the winding diameter compensation function are not available.)
- To disable dancer feedback speed control and enable only the winding diameter compensation function, turn ON both X114 and X116 signals, or turn ON the X114 signal and set "9999" in **Pr.129, Pr.130**, and **Pr.134**.
- For the X114 and X116 signals, assign the function by setting "114 (X114)" or "116 (X116)" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

9.1 Winding diameter calculation and winding diameter compensation function

◆Winding diameter calculation

- Winding diameter calculation using actual line speed

  Calculate the winding diameter "D" from the actual line speed input value "V" and motor speed.

$$\pi \cdot D \cdot \omega fb \cdot Z = V \qquad D = \frac{V}{\pi \cdot \omega fb \cdot Z}$$

V : Line speed
ωfb : Actual motor speed
Z : Gear ratio

(Example) Calculation when line speed (V) = 409.9 m/min, actual motor speed (ωfb) = 659.0 r/min, and gear ratio (Z) = 0.396

$$D = \frac{V}{\pi \cdot \omega fb \cdot Z} = \frac{409.9\ [m/min] \times 1000}{\pi \times 659.0\ [r/min] \times 0.396} = 499.97\ [mm]$$

- Winding diameter calculation using a sum total of material thickness

  Calculate the winding diameter "D" from the wound (unwound) material thickness "d".

$$D = D1 \pm 2 \cdot d \cdot N \cdot Z$$

D1 : Initial diameter
d : Material thickness
N : Number of roll rotations
Z : Gear ratio

NOTE

- Use the following values as the actual motor speed according to the control method.

Control method	Value used as actual motor speed
Vector control	Actual motor speed
Real sensorless vector control	Estimated value of actual motor speed
V/F control Advanced magnetic flux vector control	Motor rotations per minute (converted from output frequency)

- To use the motor rotations per minute, setting of **Pr.81 Number of motor poles** is required also under V/F control. (When **Pr.81** = "9999", a 4-pole motor is assumed.)

◆Winding diameter compensation speed (dancer)

- Calculate the winding diameter compensation speed from the current diameter "D" obtained from winding diameter calculation (or stored winding diameter) and the line speed command "V^*".

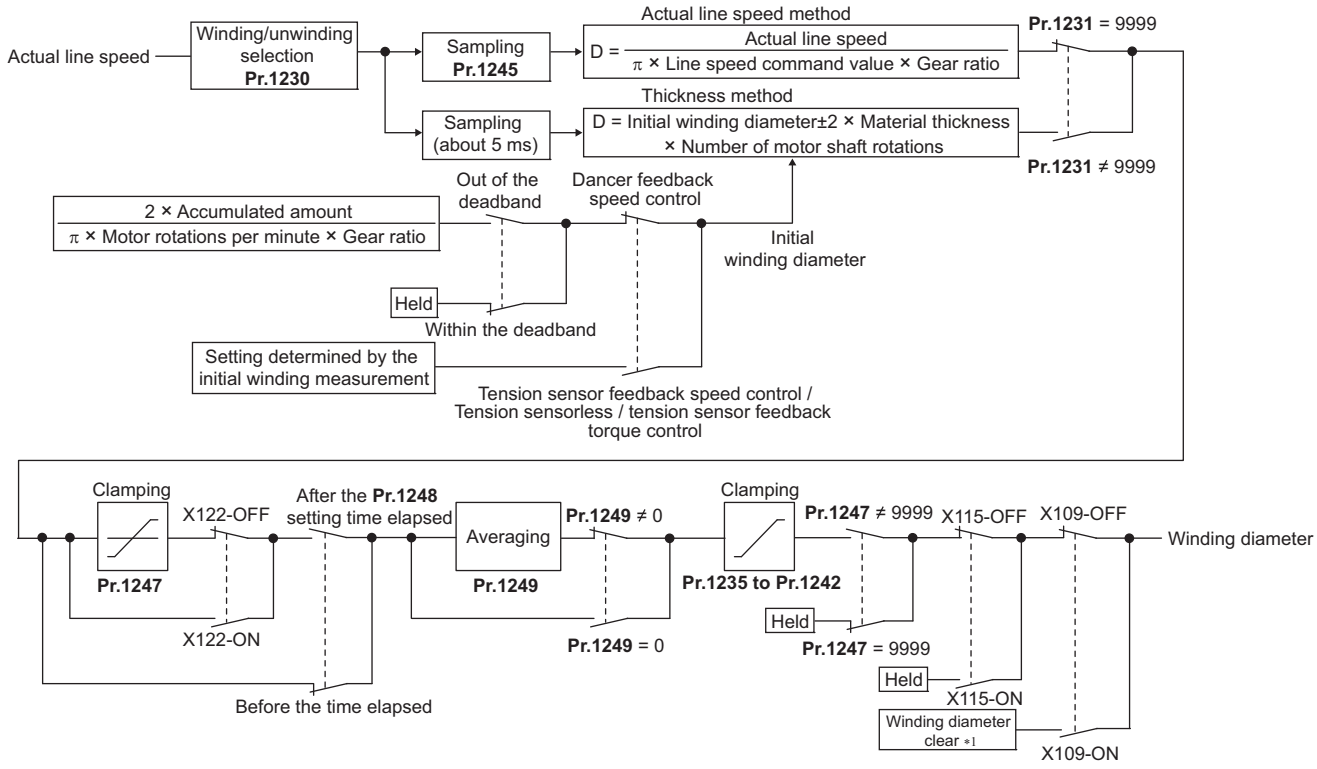
$$\omega = \frac{V^*}{\pi \cdot D \cdot Z}$$

ω : Winding diameter compensation speed
D : Present winding diameter (or stored winding diameter)
V^* : Line speed command
Z : Gear ratio

9.2 Winding diameter calculation setting

Purpose	Parameter to set			Refer to page
To perform setting for winding diameter calculation	Basic setting for winding diameter calculation	P.R000, P.R001, P.R600, P.R601	Pr.1243, Pr.1244, Pr.1247, Pr.1248	197
To calculate the winding diameter from the actual line speed	Winding diameter calculation using actual line speed	P.R041, P.R050 to P.R057, P.R201, P.D101	Pr.278 to Pr.284, Pr.358, Pr.362, Pr.384, Pr.1245	199
To select the actual line speed input method	Actual line speed input selection	P.R050	Pr.362	203
To select the line speed command setting unit	Line speed command unit setting	P.R201	Pr.358	199
To calculate the winding diameter from the material thickness	Winding diameter calculation using material thickness (thickness method)	P.R010 to P.R013	Pr.1231 to Pr.1234	203
To set the line speed command or actual line speed to start winding diameter calculation	Line speed at winding diameter calculated value activation	P.R040	Pr.1246	204
To set a limit to the minimum/ maximum value of the winding diameter calculation result	Minimum/maximum winding diameter	P.R020 to P.R027	Pr.1235 to Pr.1242	206
To output the signal when the predetermined winding diameter is reached	Target winding diameter achieved	P.R420	Pr.648	208
To store the present winding diameter/length value	Winding diameter / winding length storage	P.R003 to P.R008, P.R041, P.R420, P.R421, P.R424	Pr.645 to Pr.648, Pr.1262 to Pr.1264, Pr.1298, Pr.1299, Pr.1346	213

9.2.1 Block diagram

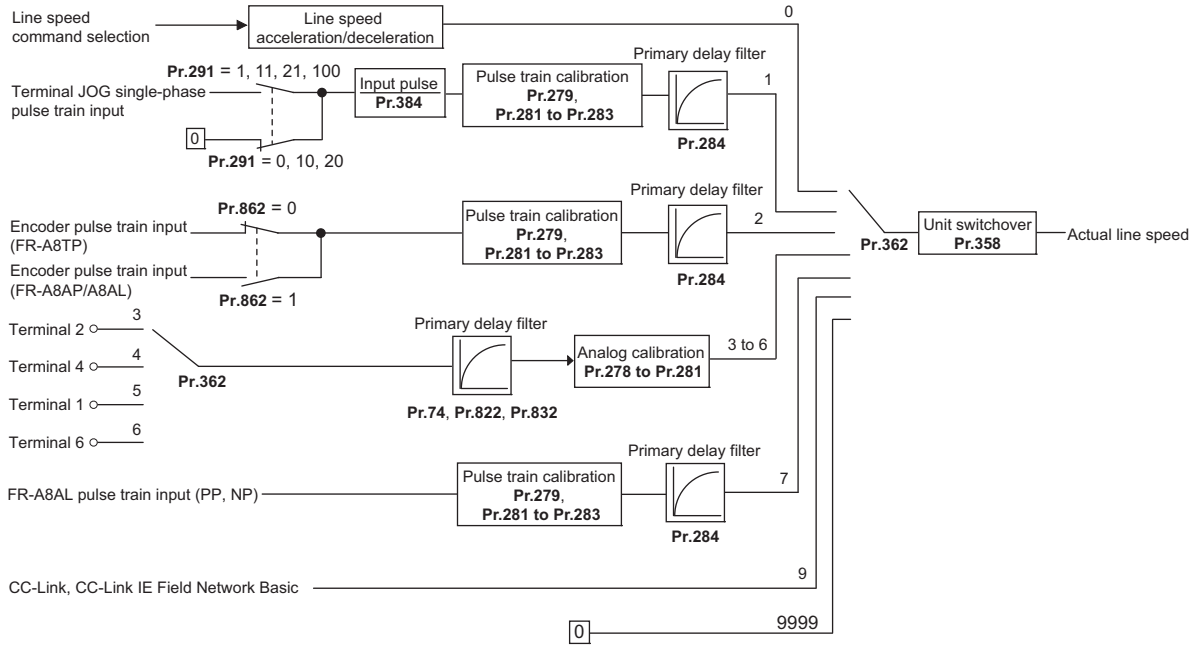


*1 After clearing, the value becomes the minimum winding diameter when **Pr.1230** = "0" (winding), and the maximum winding diameter when **Pr.1230** = "1" (unwinding).

9.2.2 Basic setting for winding diameter calculation

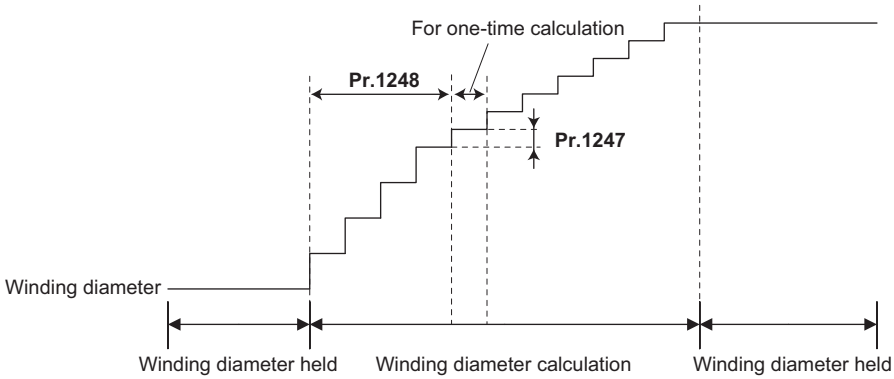
Pr.	Name	Initial value	Setting range	Description
1243 R600	Gear ratio numerator	1	1 to 65534	Set a gear ratio for a reduction-gear-equipped motor.
1244 R601	Gear ratio denominator	1	1 to 65534	
1247 R000	Winding diameter change increment amount limit	9999	0 to 9.998 mm	Set the maximum amount of change in each winding diameter calculation.
			9999	Winding diameter calculation invalid
1248 R001	Winding diameter change limit disable time	0 s	0 to 100 s	Set the waiting time to start limiting the change increment amount after the winding diameter calculation is started.

◆Block diagram



◆Winding diameter calculation function (Pr.1247, Pr.1248, X115 signal)

- The winding diameter calculation function is enabled once all the following conditions are met.
  - Dancer feedback speed control or tension sensorless torque control is valid.
  - **Pr.1247 Winding diameter change increment amount limit** ≠ "9999"
  - The X115 signal is OFF or not assigned.
- Set **Pr.1247** to limit the amount of change in the winding diameter calculation (per winding diameter calculation cycle) to avoid sudden changes of the winding diameter calculation result from the last time. Use **Pr.1247** to set the maximum amount of change in each winding diameter calculation.
- Use **Pr.1248 Winding diameter change limit disable time** to set the waiting time to start limiting the change increment amount after the winding diameter calculation is started.



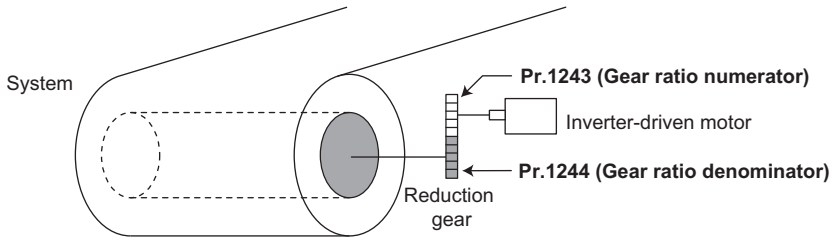
- The present value of winding diameter is retained while the X115 signal is ON. (The winding diameter calculation is stopped, and the winding diameter value is not updated.)
- To assign the X115 signal, set "115" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

NOTE

- The change increment amount limit is invalid in the initial winding measurement mode (while the X122 signal is ON). (The change amount is not limited.)
- While **Pr.1247** = "9999" or the winding diameter calculation is disabled by the X115 signal, the present winding diameter value is retained.

◆Gear ratio setting (Pr.1243, Pr.1244)

- Set a number to determine the gear ratio in **Pr.1243 Gear ratio numerator** and **Pr.1244 Gear ratio denominator** when a reduction gear is installed between the driving shaft and the motor shaft.



- Gear ratio calculation

$$\text{Gear ratio } Z = \frac{\textbf{Pr.1243}}{\textbf{Pr.1244}}$$

- Setting example

  Set the gear ratio as follows when a geared motor with a gear ratio of 1/30 (actual reduction ratio 1/28.51) is used. Set a value as close to the actual reduction ratio as possible.

  Gear ratio Z = 100/2851

NOTE

- Set the gear ratio accurately.

9.2.3 Winding diameter calculation using actual line speed (actual line speed method)

The winding diameter is calculated from the actual line speed and the actual motor speed.

Pr.	Name	Initial value	Setting range	Description
278 R051	**Actual line speed voltage/ current gain**	9999	0 to 100%	Set the converted % of the gain voltage (current) for analog input.
			9999	As set in the line speed command calibration setting.
279 R052	**Actual line speed gain**	9999	0 to 6553.4 m/min*1	Set the actual gain line speed for analog input.
			9999	As set in the line speed command calibration setting.
280 R053	**Actual line speed voltage/ current bias**	9999	0 to 100%	Set the converted % of the bias voltage (current) for analog input.
			9999	As set in the line speed command calibration setting.
281 R054	**Actual line speed bias**	9999	0 to 6553.4 m/min*1	Set the actual bias line speed for analog input.
			9999	As set in the line speed command calibration setting.
282 R055	**Actual line speed pulse input bias**	9999	0 to 500k pulses/s	Set the bias side number of input pulses for pulse train input.
			9999	As set in the line speed command calibration setting.
283 R056	**Actual line speed pulse input gain**	9999	0 to 500k pulses/s	Set the bias line speed for pulse train input.
			9999	As set in the line speed command calibration setting.
284 R057	**Actual line speed input filter time constant**	0.02 s	0 to 5 s	Set the time constant of the primary delay filter relative to the pulse input value.
358 R201	**Line speed unit**	0	0	m/min
			1	m/s
			2	mm/min
			3	mm/s
362 R050	**Actual line speed input selection**	0	0	V* (line speed command)
			1	Terminal JOG single-phase pulse train input
			2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input
			3	Terminal 2 (0 to 100%)
			4	Terminal 4 (20 to 100%)
			5	Terminal 1 (-100 to 100%)
			6	Terminal 6 (FR-A8AZ) (-100 to 100%)
			7	FR-A8AL single-phase pulse train input
			9	CC-Link or CC-Link IE Field Network Basic (0 to 65534)
			9999	No function
384 D101	**Input pulse division scaling factor**	0	0 to 250	Set the pulse division scaling factor for pulse train input through terminal JOG.
1245 R042	**Sampling time for winding diameter calculation**	9999	0.01 to 1 s	Set a sampling time for the winding diameter calculation.
			9999	Sampling time: About 5 ms

*1 The increment varies depending on the **Pr.358** setting. (Refer to page 67.)

◆Actual line speed input selection (Pr.362)

- Use **Pr.362 Actual line speed input selection** to select the input method for actual line speed to perform winding diameter calculation.
- When material thickness is set to **Pr.1231 Material thickness d1** (**Pr.1231** ≠ "9999"), calculate winding diameter not from line speed but from the product of material thickness and number of rotations of a roll. (Refer to **page 203**.)

Pr.362 setting	Actual line speed input method	Input value calibration parameter
0 (initial value)	V* (line speed command)	—
1	Terminal JOG single-phase pulse train input	**Pr.279**, **Pr.281 to Pr.283**
2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse train input*2 (complementary 12 V / differential 5 V (A-, B-phases))	**Pr.279**, **Pr.281 to Pr.283**
3	Terminal 2 (analog value: 0 to 100%) (0 to 5 VDC)*3	**Pr.278 to Pr.281**
4	Terminal 4 (analog value: 20 to 100%) (4 to 20 mADC)*3	**Pr.278 to Pr.281**
5	Terminal 1 (analog value: -100 to 100%) (0 to ±10 VDC)*3	**Pr.278 to Pr.281**
6	Terminal 6 (FR-A8AZ) (analog value: -100 to 100%) (0 to ±10 VDC)*3	**Pr.278 to Pr.281**
7	FR-A8AL single-phase pulse train input (PP, NP)	**Pr.279**, **Pr.281 to Pr.283**
9*4	CC-Link or CC-Link IE Field Network Basic (0 to 65534)	—
9999	No function*1	—

*1 When **Pr.362** = "9999" (no function), the line speed command is regarded as zero.
*2 When **Pr.362** = "2", use **Pr.862** to select the option used for the actual line speed input. (Refer to **page 234**.)
*3 The input specification in the initial setting is indicated.
*4 When the **Pr.362** setting is changed from "9" to a value other than "9", the actual line speed will be input via an interface other than the communication interface immediately after the setting change. When the **Pr.362** setting is changed from a value other than "9" to "9" at an inverter reset, the actual line speed will be input via communication after the reset. The actual line speed input is treated as "0" until the inverter reset is completed.

NOTE

- The priorities of the input signals are defined as follows. If the input method for a signal is the same as that for the input signal with higher priority, the signal with lower priority does not work.
  Dancer signal input (**Pr.363**) > Actual line speed input (**Pr.362**) > Tension command input (**Pr.804**) > Line speed command input (**Pr.361** ≠ "0") > Taper setting input (**Pr.1285**) > Dancer tension setting input (**Pr.364**) > Line speed command compensation input > Line speed command input (**Pr.361** = "0")

◆Actual line speed unit (Pr.358)

- Use **Pr.358 Line speed unit** to select the unit of the line speed.

Pr.358 setting	Commanded line speed monitoring	Actual line speed monitoring	Line speed setting in parameters
0 (initial value)	m/min	m/min	m/min
1	m/s	m/s	m/s
2	mm/min	mm/min	mm/min
3	mm/s	mm/s	mm/s

◆Actual line speed input by pulse train input (Pr.362="1, 2, 7", Pr.279, Pr.281 to Pr.284)

- The actual line speed can be input using single phase pulse train input through terminal JOG, encoder pulse train input through FR-A8AP/FR-A8AL/FR-A8TP, or single phase pulse train input through FR-A8AL (PP, NP).
- The number of pulses is calculated internally as follows.

Pr.362 setting	Pulse train input	Number of pulses calculated internally
1	Terminal JOG single-phase pulse train input	Set the pulse division scaling factor in **Pr.384** for pulse train input through terminal JOG. Number of pulses calculated internally = Number of input pulses / **Pr.384** setting value
2	FR-A8AP/FR-A8AL/FR-A8TP encoder pulse input*2	Time-averaged number of input pulses using **Pr.1245 Sampling time for winding diameter calculation**.
7	Single-phase pulse train input through FR-A8AL (PP, NP)*1	

*1 Use **Pr.428 Command pulse selection** to set the pulse train type. (Refer to **page 67**.)
*2 To perform Vector control, install the Vector control compatible option.

- The actual line speed input by pulse train input is calibrated with **Pr.279 Actual line speed gain**, **Pr.281 Actual line speed bias**, **Pr.282 Actual line speed pulse input bias**, and **Pr.283 Actual line speed pulse input gain**. The calculation result is applied as the actual line speed input value (lower limit: 0 m/min, upper limit: 6553.4 m/min).
- When "9999" is set in any of **Pr.279** or **Pr.281 to Pr.283**, the settings for the corresponding line speed command (**Pr.351**, or **Pr.353 to Pr.355**) are applied for calibration. (Refer to page 67.)
- To calibrate the actual line speed when **Pr.362** = "2" or when **Pr.362** = "7" and **Pr.428** = "2 or 5", set the number of pulses multiplied by four in **Pr.282** and **Pr.283**. A calculation example is as follows.

System specifications
Roll diameter: 80 mm
Encoder resolution: 1024 Pulse/Rev
Line speed range: 5 to 50 m/min

Theoretical formula

$V\ [m/min] = D\ [m] \times \pi \times n\ [r/min]$

When the line speed is 5 m/min:

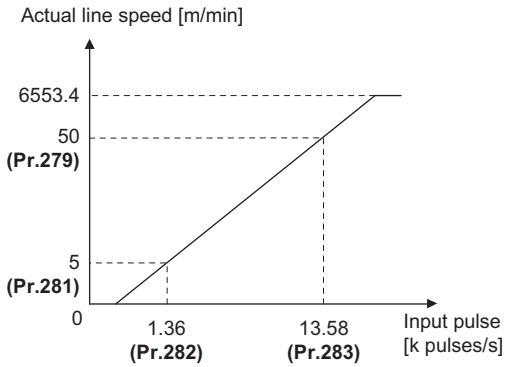
$$n\ [r/min] = \frac{5\ [m/min]}{0.08\ [m] \times \pi} \approx 19.89\ [r/min]$$

$$\text{Input pulse [k pulses/s]} = \frac{19.89\ [r/min] \times 1024\ [Pulse/Rev] \times 4}{60\ [s]} \approx 1.36\ [k\ pulses/s]$$

When the line speed is 50 m/min:

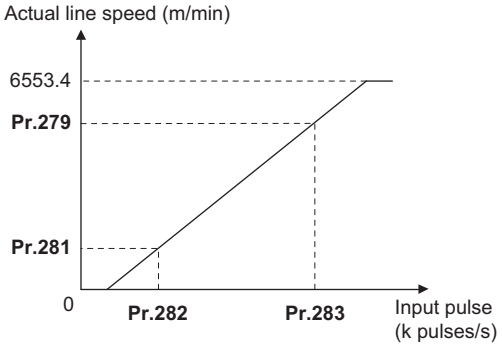
$$n\ [r/min] = \frac{50\ [m/min]}{0.08\ [m] \times \pi} \approx 198.9\ [r/min]$$

$$\text{Input pulse [k pulses/s]} = \frac{198.9\ [r/min] \times 1024\ [Pulse/Rev] \times 4}{60\ [s]} \approx 13.58\ [k\ pulses/s]$$

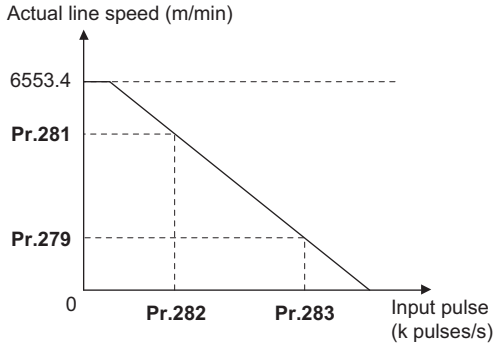


- For the actual line speed input using pulse train, use **Pr.284 Actual line speed input filter time constant** to set the time constant of primary delay filter for pulse train input. When **Pr.284** = 0 s, the filter is not set.

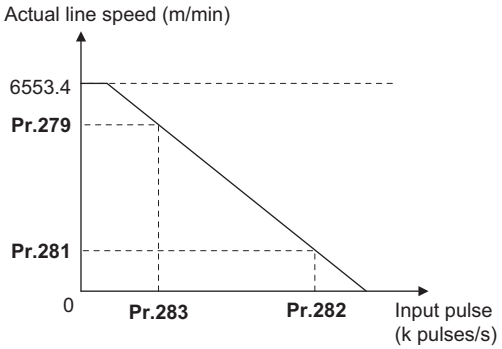
Pr.281 < **Pr.279**, and **Pr.282** < **Pr.283**



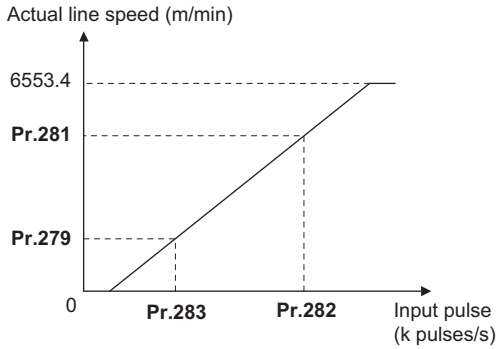
Pr.281 > **Pr.279**, and **Pr.282** < **Pr.283**



Pr.281 < **Pr.279**, and **Pr.282** > **Pr.283**

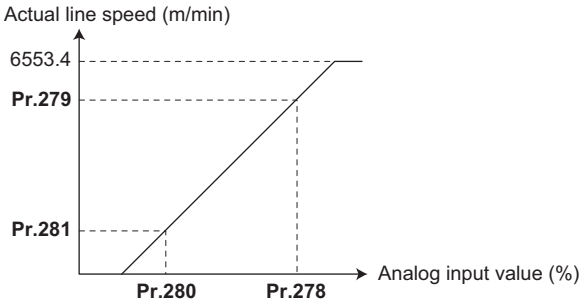


Pr.281 > **Pr.279**, and **Pr.282** > **Pr.283**



◆Actual line speed analog input (Pr.362 = "3 to 6", Pr.278 to Pr.281)

- The actual line speed can be input by analog input.
- The analog input value of the actual line speed is calibrated with **Pr.278 Actual line speed voltage/current gain, Pr.279 Actual line speed gain**, **Pr.280 Actual line speed voltage/current bias**, and **Pr.281 Actual line speed bias**. The calculation result is applied as the line speed command value (lower limit: 0 m/min, upper limit: 6553.4 m/min).
- When "9999" is set in any of **Pr.279 to Pr.281**, the settings for the corresponding line speed command (**Pr.350 to Pr.353**) are applied for calibration. (Refer to page 67.)



NOTE

- The difference between the setting values of **Pr.278** and **Pr.280** can be set within 5%. (Even if the difference is 5% or less, Er3 (calibration error) does not occur.)
- The **Pr.280** setting can be larger than the **Pr.278** setting. Also, the **Pr.281** setting can be larger than the **Pr.279** setting.

◆Actual line speed input via communication (Pr.362 = "9")

- When **Pr.362** = "9", the actual line speed can be input via CC-Link or CC-Link IE Field Network Basic communication.
- The actual line speed input via communication is recognized as 16-bit unsigned data. The input data range is from 0 to 65534 (6553.4). When out-of-range values are input, the limit is set at 0 or 65534 (6553.4).

◆Sampling time for winding diameter calculation (Pr.1245)

- For winding diameter calculation using actual line speed, use **Pr.1245 Sampling time for winding diameter calculation** to set how often the winding diameter calculation result is applied.
- When **Pr.1245** = "9999", a sampling time is about 5 ms for winding diameter calculation.

NOTE

- When the thickness method is selected, the **Pr.1245** setting is invalid and a sampling time is about 5 ms. (Refer to page 203.)
- The sampling time in **Pr.1245** is valid also for pulse train input of the line speed command (when **Pr.361** = "2 or 7"). (Refer to page 67.)

9.2.4 Winding diameter calculation using material thickness (thickness method)

The material thickness is added up for winding diameter calculation.
First to fourth material thickness can be selected by the signal input.

Pr.	Name	Initial value	Setting range	Description
1231 R010	**Material thickness d1**	9999	0 to 20 mm	Set the material thickness for winding diameter calculation.
			9999	Actual line speed method
1232 R011	**Material thickness d2**	1 mm	0 to 20 mm	The material thickness can be selected using the X107 and X108 signals.
1233 R012	**Material thickness d3**	1 mm	0 to 20 mm	
1234 R013	**Material thickness d4**	1 mm	0 to 20 mm	

◆Selection of the thickness method (Pr.1231)

- When a value other than "9999" is set in **Pr.1231**, the winding diameter is calculated not from line speed but from the addition of material thickness and number of roll rotations. (Thickness method)
- When selecting the thickness method, use an option, the FR-A8AP, FR-A8AL, or FR-A8TP, to input the encoder pulse (A/B phase).

NOTE

- When **Pr.1231** = "9999", the winding diameter is calculated from the actual line speed. (Refer to page 199.)
- In the thickness method, the stored values of the initial winding diameter, material thickness, and number of roll rotations are used for calculation. Set correct values for the initial winding diameter and the material thickness. If the setting of the initial winding diameter is incorrect, or the actual material thickness and the material thickness setting (parameter setting) are inconsistent, calculation errors are more likely to occur. If calculation errors occur, select the actual line speed method.

◆Material thickness selection (Pr.1232 to Pr.1234, X107 signal, X108 signal)

- Turn ON/OFF the Minimum/maximum winding diameter selection (X107 and X108) signals to select the material thickness set in **Pr.1232 to Pr.1234**.
- For the X107 and X108 signals, assign the function by setting "107 (X107)" or "108 (X108)" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

Input signal		Material thickness	Maximum winding diameter / minimum winding diameter
X107 signal	X108 signal		
OFF	OFF	Material thickness d1 (**Pr.1231**)	Maximum winding diameter 1 (**Pr.1235**) / Minimum winding diameter 1 (**Pr.1236**)
ON	OFF	Material thickness d2 (**Pr.1232**)	Maximum winding diameter 2 (**Pr.1237**) / Minimum winding diameter 2 (**Pr.1238**)
OFF	ON	Material thickness d3 (**Pr.1233**)	Maximum winding diameter 3 (**Pr.1239**) / Minimum winding diameter 3 (**Pr.1240**)
ON	ON	Material thickness d4 (**Pr.1234**)	Maximum winding diameter 4 (**Pr.1241**) / Minimum winding diameter 4 (**Pr.1242**)

NOTE

- By turning ON/OFF the X107 and X108 signals, the maximum and minimum winding diameters are also selected. (For the details, refer to page 206.)
- When the maximum/minimum diameter is selected using the X107 and X108 signals, or the setting in **Pr.1235 to Pr.1242** is changed, the present winding diameter may be limited and change depending on the maximum/minimum winding diameter setting. When the maximum/minimum winding diameter setting is newly selected or changed, check that the present winding diameter is correct. If the value changes to an unintended value, correct the present diameter by performing one of the following actions.
  - Use **Pr.646 Stored winding diameter** to set the present diameter.
  - Perform initial winding diameter calculation.
  - Turn OFF the X114 signal (restore the initial winding diameter).

9.2.5 Line speed at winding diameter calculated value activation

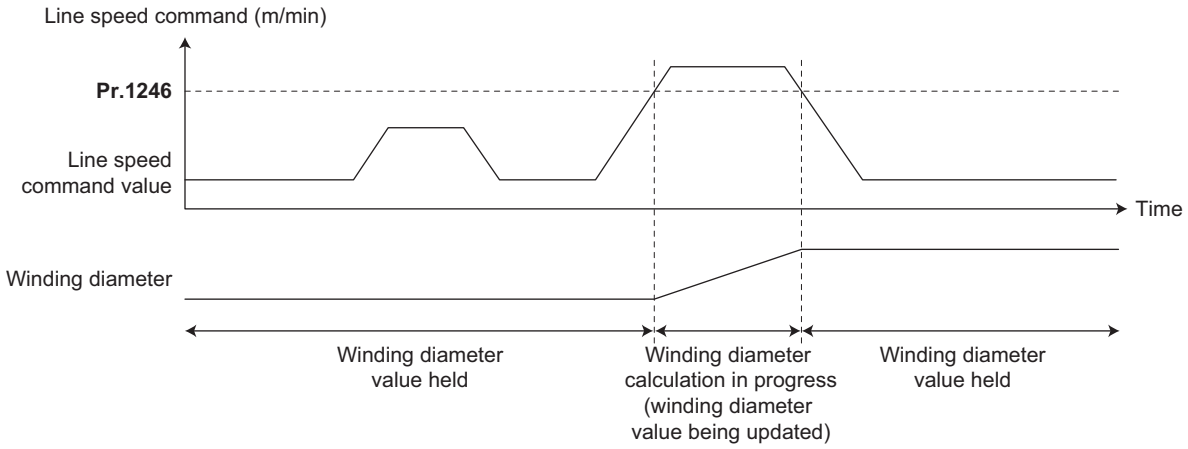
Set the line speed command value or actual line speed to start winding diameter calculation. When the line speed command value or actual line speed is lower than the speed to start winding diameter calculation, winding diameter calculation is not performed and the last winding diameter value is kept.

Pr.	Name	Initial value	Setting range	Description
1246 R040	**Line speed at winding diameter calculated value activation**	1 m/min*1	0 to 6553.4 m/min*1	Set the line speed command value or actual line speed to start winding diameter calculation.

*1 The increment varies depending on the **Pr.358** setting. (Refer to **page 67**.)

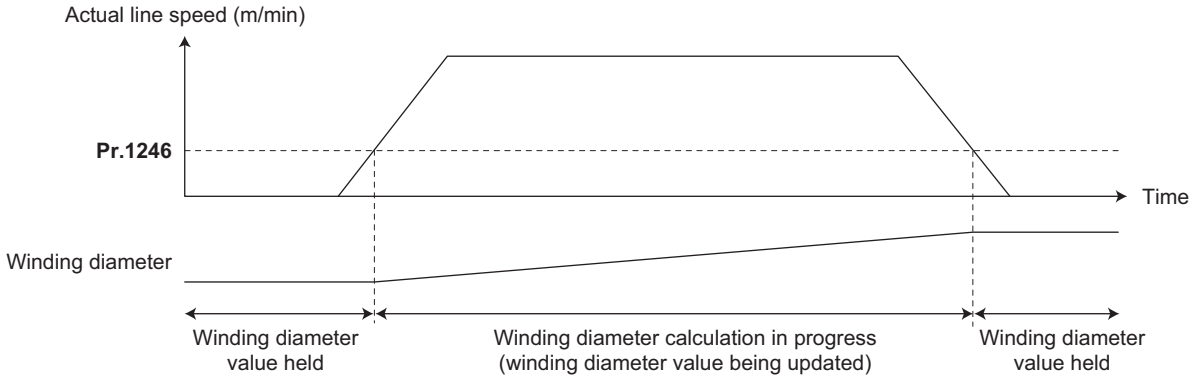
◆Line speed at winding diameter calculated value activation during dancer feedback / tension sensor feedback speed control

- During dancer feedback speed control or tension sensor feedback speed control, when the line speed command value is equal to or higher than **Pr.1246**, winding diameter calculation is performed, and the winding diameter calculation result is updated. When the line speed command value is lower than the **Pr.1246** setting, winding diameter calculation is not performed and the last winding diameter value is kept.
- It is possible to prevent the change in the winding diameter, which may be caused by calculation errors at low-speed operation.



◆Line speed at winding diameter calculated value activation during tension sensorless / tension sensor feedback torque control

- During tension sensorless / tension sensor feedback torque control, when the actual line speed is equal to or higher than **Pr.1246 Line speed at winding diameter calculated value activation**, winding diameter calculation is performed, and the winding diameter calculation result is updated. When the actual line speed is lower than the **Pr.1246** setting, winding diameter calculation is not performed and the last winding diameter value is kept.
- It is possible to prevent the change in the winding diameter, which may be caused by calculation errors at low-speed operation.



NOTE

- In the thickness method, the actual line speed is not used for calculating the winding diameter. However, both in the actual line speed method and the thickness method, the actual line speed is used for determining whether winding diameter calculation is performed.
- If the actual line speed is not input, setting **Pr.362** = "0" (select V* (line speed command) as the actual speed input) enables the use of V* as a reference to determine whether winding diameter calculation is performed.

9.2.6 Averaging process for winding diameter calculation

Set the time constant of the primary delay filter relative to the winding diameter calculation result.

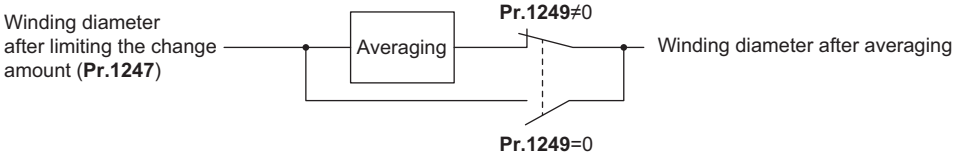
Pr.	Name	Initial value	Setting range	Description
1249 **R043**	**Number of averaging for winding diameter calculation**	4	0 to 10	Set the time constant of the primary delay filter relative to the winding diameter calculation result.

- The filter time constant for the **Pr.1249** setting is as follows.

Pr.1249 setting	Filter time constant
0	Without filter
1	0.02 s
2	0.04 s
3	0.08 s
4 (initial value)	0.16 s
5	0.32 s
6	0.64 s
7	1.28 s
8	2.56 s
9	5.12 s
10	10.24 s

NOTE

- Averaging process for winding diameter calculation is performed after limiting the maximum change for winding diameter calculation (**Pr.1247**).



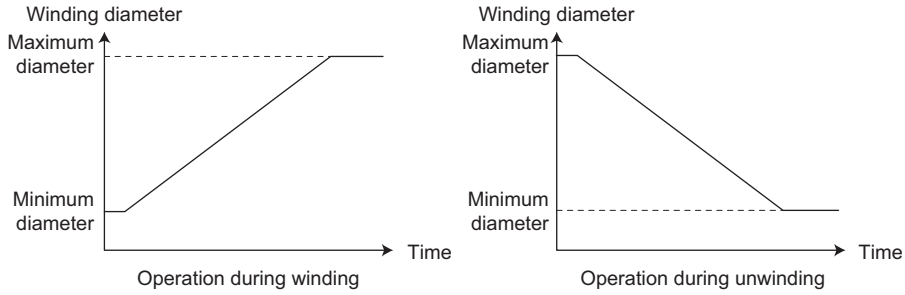
9.2.7 Minimum/maximum winding diameter

Use the following parameters to store a pair of the maximum and minimum roll diameters. Select from the pair 1 to 4 by changing the status of the two input signals.

Pr.	Name	Initial value	Setting range	Description
1235 R020	**Maximum winding diameter 1**	2 mm	1 to 6553 mm	Set the maximum value relative to the roll diameter calculation result.
1236 R021	**Minimum winding diameter 1**	1 mm	1 to 6553 mm	Set the minimum value relative to the roll diameter calculation result.
1237 R022	**Maximum winding diameter 2**	2 mm	1 to 6553 mm	Set the maximum value relative to the roll diameter calculation result. To select this setting, turn ON the X107 signal.
1238 R023	**Minimum winding diameter 2**	1 mm	1 to 6553 mm	Set the minimum value relative to the roll diameter calculation result. To select this setting, turn ON the X107 signal.
1239 R024	**Maximum winding diameter 3**	2 mm	1 to 6553 mm	Set the maximum value relative to the roll diameter calculation result. To select this setting, turn ON the X108 signal.
1240 R025	**Minimum winding diameter 3**	1 mm	1 to 6553 mm	Set the minimum value relative to the roll diameter calculation result. To select this setting, turn ON the X108 signal.
1241 R026	**Maximum winding diameter 4**	2 mm	1 to 6553 mm	Set the maximum value relative to the roll diameter calculation result. To select this setting, turn ON the X107 and X108 signals.
1242 R027	**Minimum winding diameter 4**	1 mm	1 to 6553 mm	Set the minimum value relative to the roll diameter calculation result. To select this setting, turn ON the X107 and X108 signals.

◆Minimum/maximum winding diameter (Pr.1235, Pr.1236)

- Winding diameter calculation values are limited at the maximum diameter set in **Pr.1235 Maximum winding diameter 1**, or the minimum diameter set in **Pr.1236 Minimum winding diameter 1**.
- The winding diameter after the averaging process (**Pr.1249**) is limited at the minimum/maximum diameter.



◆Minimum/maximum winding diameter selection (Pr.1237 to Pr.1242, X107 signal, X108 signal)

- Turn ON/OFF the Minimum/maximum winding diameter selection (X107 and X108) signals to select the maximum and minimum winding diameters set in **Pr.1237 to Pr.1242**.
- For the X107 and X108 signals, assign the function by setting "107 (X107)" or "108 (X108)" in any of **Pr.178 to Pr.189 (input terminal function selection)**.

Input signal		Maximum winding diameter / minimum winding diameter	Material thickness
X107 signal	X108 signal		
OFF	OFF	Maximum winding diameter 1 (**Pr.1235**) / Minimum winding diameter 1 (**Pr.1236**)	Material thickness d1 (**Pr.1231**)
ON	OFF	Maximum winding diameter 2 (**Pr.1237**) / Minimum winding diameter 2 (**Pr.1238**)	Material thickness d2 (**Pr.1232**)
OFF	ON	Maximum winding diameter 3 (**Pr.1239**) / Minimum winding diameter 3 (**Pr.1240**)	Material thickness d3 (**Pr.1233**)
ON	ON	Maximum winding diameter 4 (**Pr.1241**) / Minimum winding diameter 4 (**Pr.1242**)	Material thickness d4 (**Pr.1234**)

NOTE

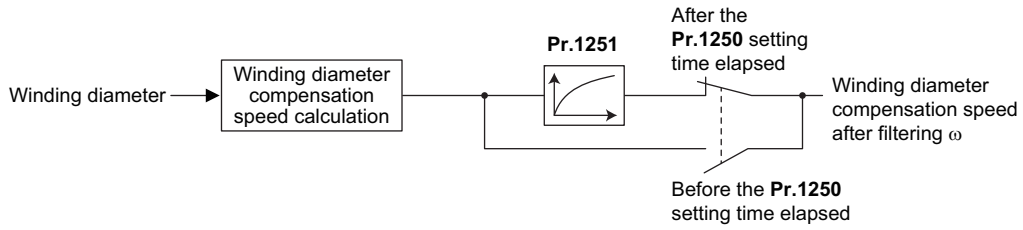
- By turning ON/OFF the X107/X108 signal, the material thickness is also selected. (For the details, refer to page 203.)
- If the minimum winding diameter setting is equal to or larger than the maximum winding diameter setting, the winding diameter is fixed at the maximum diameter (minimum diameter) and therefore, the winding diameter does not change from the maximum diameter (minimum diameter).
- When the maximum/minimum diameter is selected using the X107 and X108 signals, or the setting in **Pr.1235 to Pr.1242** is changed, the present winding diameter may be limited and change depending on the maximum/minimum winding diameter setting. When the maximum/minimum winding diameter setting is newly selected or changed, check that the present winding diameter is correct. If the value changes to an unintended value, correct the present diameter by performing one of the following actions.
  - Use **Pr.646 Stored winding diameter** to set the present diameter.
  - Perform initial winding diameter calculation.
  - Turn OFF the X114 signal (restore the initial winding diameter).

9.2.8 Winding diameter compensation speed filter

Set the time constant of the primary delay filter relative to the winding diameter compensation speed.

Pr.	Name	Initial value	Setting range	Description
1250 R260	**Winding diameter compensation speed filtering waiting time**	0	0 to 100 s	Set a waiting time before applying the primary delay filter.
1251 R261	**Winding diameter compensation speed filter time constant**	0	0 to 100 s	Set the time constant of the primary delay filter relative to the winding diameter compensation speed.

- Use **Pr.1251** to set the time constant of the primary delay filter. When **Pr.1251** = "0", the filter is not set.
- Use **Pr.1250** to set a waiting time before applying the primary delay filter after the initial winding diameter calculation is completed. When the initial winding diameter calculation is not performed, set the waiting time after a start.



9.2.9 Target winding diameter achieved

When the winding diameter calculated in the inverter is equal to or more than the parameter setting, the Target winding diameter achieved (Y233) signal is output.

Pr.	Name	Initial value	Setting range	Description
648 R420	**Target winding diameter**	1	1 to 6553	Set the winding diameter to output the Target winding diameter achieved (Y233) signal.

◆Target winding diameter achieved (Pr.648, Y233 signal)

- When the result of winding diameter calculation in the inverter is equal to or more than the **Pr.648 Target winding diameter** setting, the Target winding diameter achieved (Y233) signal can be output.
- The Y233 output condition depends on whether the operation is winding or unwinding.

Winding/unwinding	Y233 output condition
Winding	Output when the winding diameter reaches or exceeds the **Pr.648** setting.
Unwinding	Output when the winding diameter reaches or falls below the **Pr.648** setting.

9.2.10 Winding diameter calculation at a start (dancer feedback speed control)

When the dancer roll is moved from the upper/lower limit position to the target position at start, the present winding diameter is calculated.

Pr.	Name	Initial value	Setting range	Description
133 R101 (A611)	**PID action set point**	500%	400 to 600%	Set the target position for the dancer roll.
1252 R070	**Dancer lower limit position**	400%	400 to 600%	The initial winding diameter calculation is performed when the dancer roll position is equal to or lower than the setting of this parameter.
1253 R071	**Initial winding diameter calculation deadband**	1%	0 to 50%	Set the deadband on the lower limit position.
1254 R072	**Initial winding diameter calculation deadband 2**	9999	0 to 50%	Set the deadband on the target position.
			9999	The deadband on the target position is as set in **Pr.1253**.
1255 R073	**Accumulated amount**	9999	1 to 5000 mm	Set the accumulated amount.
			8888	The initial winding diameter calculation is invalid. (When the dancer roll position is equal to or lower than the **Pr.1252** setting, the dancer roll is lifted.)
			9999	Initial winding diameter calculation invalid
1256 R074	**Speed control P gain at start**	60%	0 to 1000%	Set the speed control proportional gain during initial winding diameter calculation at start.
1257 R075	**Speed control integral time at start**	2 s	0 to 20 s	Set the speed control integral time during initial winding diameter calculation at start.
1258 R076	**Integral term limit at start**	2.5%	0 to 100%	Set the integral action limit value during initial winding diameter calculation at start.
1259 R077	**PID term limit at start**	2.5%	0 to 100%	Set the PID manipulated amount limit value during initial winding diameter calculation at start.

◆Initial winding diameter calculation at a start (enabled under Vector control only)

- Calculate the initial winding diameter "D" from the dancer travel distance "L" when the dancer roll moves from the lower limit position to the neutral position at a start.

$$D = \frac{2 \cdot L}{\pi \cdot N \cdot Z}$$

L : Dancer travel distance (accumulated amount = 2 · L)

N : Number of motor rotations

Z : Gear ratio

- When **Pr.1255 Accumulated amount** = "8888" and the dancer roll position is equal to or lower than the setting of **Pr.1252 Dancer lower limit position**, dancer roll is lifted with PI gain at a start, but initial winding diameter calculation is not performed. This operation is useful to wind up sagging material slowly.
- When **Pr.1255** = "9999", winding diameter calculation is not performed, and the winding diameter, which has been used, is kept. In such a case like this, PI gain of speed control for normal operation is used instead of gain for winding diameter calculation.

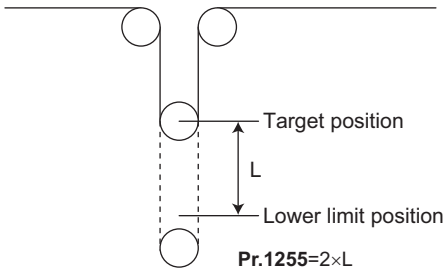
Pr.1255 setting	When the dancer roll position is equal to or lower than the Pr.1252 setting	When the dancer roll position is higher than the Pr.1252 setting
1 to 5000 mm	• Initial winding diameter calculation is performed. • The winding diameter obtained from the initial winding diameter calculation is used. • The dancer roll is lifted with PI gain (**Pr.1256 to Pr.1259**) at a start.	• Initial winding diameter calculation and dancer lifting operation are not performed. • The winding diameter, which has been used, is kept.
8888	• Initial winding diameter calculation is not performed. • The winding diameter is kept. • The dancer roll is lifted with PI gain (**Pr.1256 to Pr.1259**) at a start.	• Initial winding diameter calculation and dancer lifting operation are not performed. • The winding diameter, which has been used, is kept.
9999	• Initial winding diameter calculation and dancer lifting operation are not performed. • The winding diameter, which has been used, is kept.	• Initial winding diameter calculation and dancer lifting operation are not performed. • The winding diameter, which has been used, is kept.

NOTE

- Set a value other than "9999" in **Pr.1247 Winding diameter change increment amount limit** even when lifting the dancer roll without performing the initial winding diameter calculation (**Pr.1255** = "8888").
- Do not use **Pr.78 Reverse rotation prevention selection** when using initial winding diameter calculator function.
- To adjust the overshoot amount at an initial winding diameter calculation, use **Pr.73 Analog input selection** to set the polarity reversible operation.
- To minimize fluctuation of the dancer roll when shifting from initial winding diameter calculation to normal operation, set **Pr.13 Starting frequency** = "0".

◆Dancer lower limit position and accumulated amount setting (Pr.1252, Pr.1255)

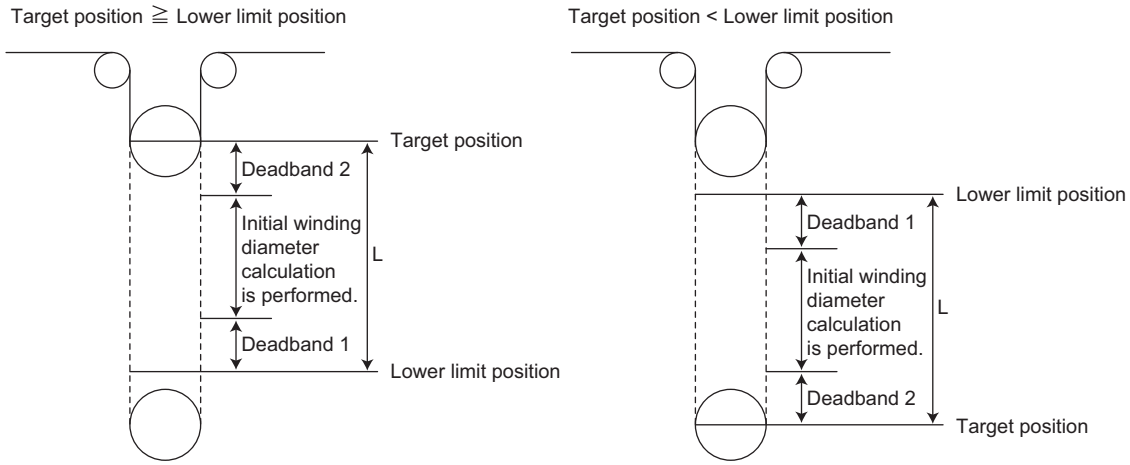
- Set **Pr.1252 Dancer lower limit position** and **Pr.1255 Accumulated amount**. The winding diameter at a start is calculated from the dancer roll travel distance (accumulated amount) and the corresponding number of pulses (number of rotations).



◆Initial winding diameter calculation deadband setting (Pr.1253, Pr.1254)

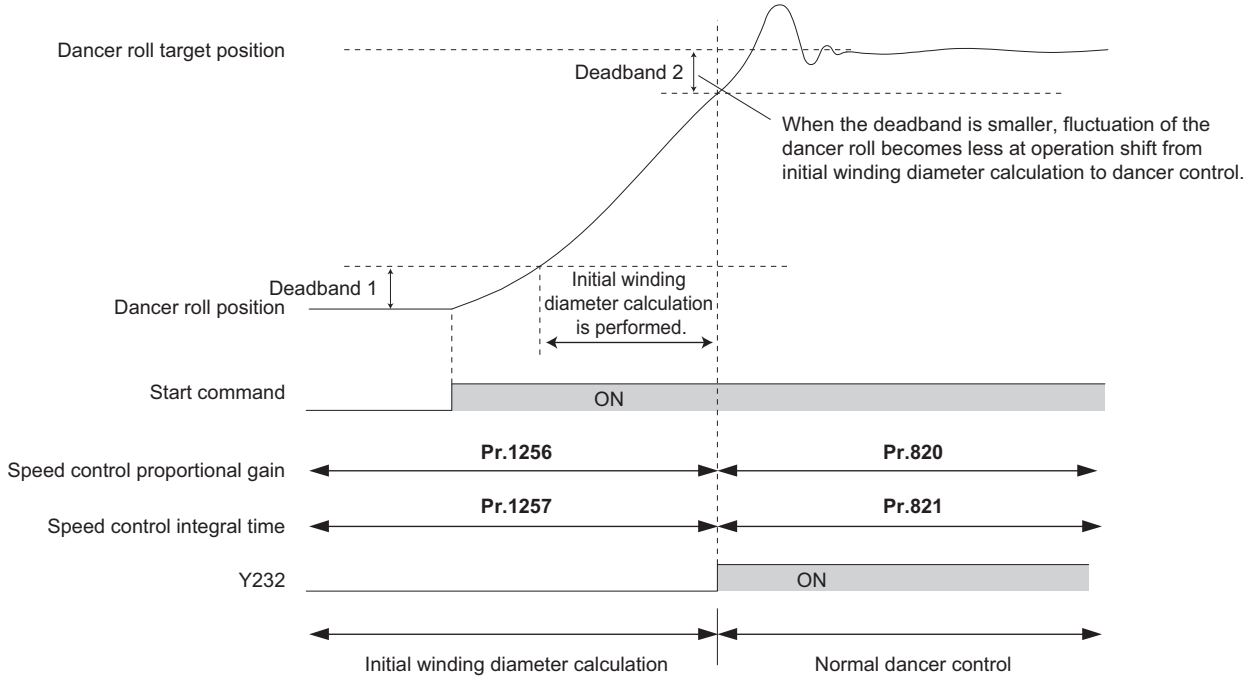
- When performing initial winding diameter calculation, winding diameter calculation deadband can be set for the target position and the lower limit position of the dancer roll.
- Setting a deadband suppresses hunting of dancer control at a start, and reduces the influence of overshooting on the target position.
- Use **Pr.1253 Initial winding diameter calculation deadband** or **Pr.1254 Initial winding diameter calculation deadband 2** to set the ratio of the deadband, assuming that the distance between the target position and the lower limit position is 100%.

Deadband	Calculation formula	Description
Initial winding diameter deadband	| Target position - Lower limit position | × **Pr.1253**/100	Deadband on the lower limit position
Initial winding diameter deadband 2	| Target position - Lower limit position | × **Pr.1254**/100	Deadband on the target position



◆Speed control gain during initial winding diameter calculation at a start (Pr.1256, Pr.1257)

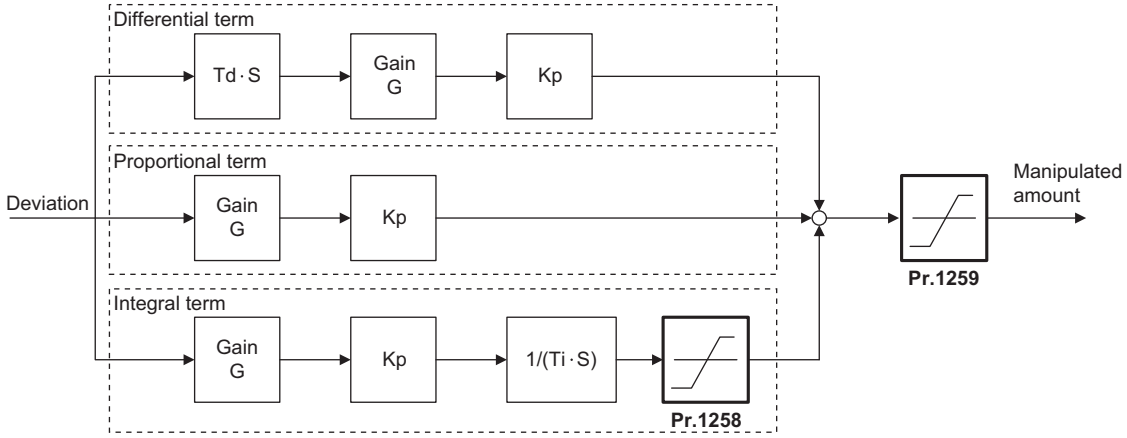
- When performing initial winding diameter calculation, inverter's speed control proportional gain and integral time during winding diameter calculation can be set separately. After initial winding diameter calculation is completed, normal speed control gain is applied.



◆Integral action and PID manipulated amount during initial winding diameter calculation at a start (Pr.1258, Pr.1259)

- The limit for manipulated amount of PID control for dancer roll can be set to prevent a motor from over-speeding during initial winding diameter calculation at a start.
- Set the limit for manipulated amount of integral control action of PID control in **Pr.1258 Integral term limit at start**.
- Set the limit for manipulated amount of PID control in **Pr.1259 PID term limit at start**.

$$\text{PID calculated value} = \text{Gain G} \cdot \text{Kp}\left(1 + \frac{1}{\text{Ti} \cdot \text{S}} + \text{Td} \cdot \text{S}\right)$$



◆Winding diameter calculation completion signal (Y232 signal)

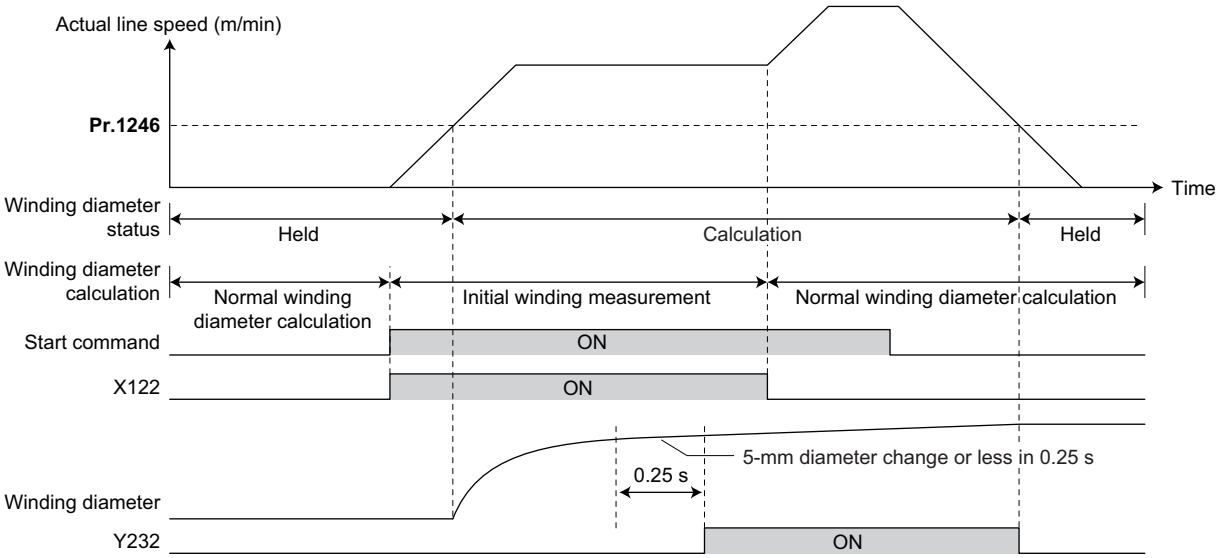
- After initial winding diameter calculation at a start is completed, the Winding diameter calculation completion at start (Y232) signal is output.
- For the Y232 signal, set "232 (positive logic) or 332 (negative logic)" in one of **Pr.190 to Pr.196 (output terminal function selection)** to assign the function to the output terminal.

9.2.11 Initial winding diameter calculation at a start (Tension sensor feedback speed control / tension sensorless torque control / tension sensor feedback torque control)

Turn ON the Winding diameter measurement (X122) signal to select the initial winding measurement mode and calculate the present winding diameter.

◆Initial winding diameter calculation (X122 signal)

- While tension sensorless / tension sensor feedback torque control is valid, the present winding diameter can be measured in the initial winding measurement mode.
- Turn ON the Winding diameter measurement (X122) signal to select the initial winding measurement mode.
- To assign the X122 signal, set "122" in any of **Pr.178 to Pr.189 (input terminal function selection)**.
- When the actual line speed reaches the **Pr.1246 Line speed at winding diameter calculated value activation** in the initial winding diameter measurement mode, calculation for initial winding diameter measurement starts. When the winding diameter difference from the last measurement remains 5 mm or less for 0.25 seconds during measurement, the Y232 signal turns ON.
- Turn OFF the X122 signal to return to the normal winding diameter calculation.



◆Winding diameter calculation completion signal (Y232 signal)

- After initial winding diameter calculation at a start is completed, the Winding diameter calculation completion at start (Y232) signal is output.
- For the Y232 signal, set "232 (positive logic) or 332 (negative logic)" in one of **Pr.190 to Pr.196 (output terminal function selection)** to assign the function to the output terminal.

9.2.12 Winding diameter / winding length storage

The winding diameter/length calculated in the inverter can be stored. The stored diameter and length are kept even if the inverter power is turned OFF.

Pr.	Name	Initial value	Setting range	Description
645 R004	**Winding diameter storage selection**	0	0, 1	Select whether to store the diameter length.
646 R003	**Stored winding diameter**	1 mm	1 to 6553 mm	The stored diameter can be read/written.
647 R041	**Operation time with stored winding diameter**	0 s	0 to 100 s	Set the time to hold the stored diameter after the start signal turns ON.
648 R420	**Target winding diameter**	1 mm	1 to 6553 mm	Set the diameter to output the Target winding diameter achieved (Y233) signal.
1262 R005	**Winding length increment**	3	0	1 km
			1	100 m
			2	10 m
			3	1 m
			4	1 cm
			5	1 mm
1263 R006	**Stored winding length (lower 4 digits)**	0 (m*1)	0 to 9999 (m*1)	The stored winding length (lower 4 digits) can be read/written.
1264 R421	**Winding length detection (lower 4 digits)**	1000 (m*1)	0 to 9999 (m*1)	Set the winding length (lower 4 digits) which triggers the Winding/unwinding completion (Y234) signal output.
1298 R007	**Stored winding length (upper 4 digits)**	0 (m*1)	0 to 9999 (m*1)	The stored winding length (upper 4 digits) can be read/written.
1299 R008	**Stored winding length increment**	0	0	1 m
			1	1 cm
			2	1 mm
1346 R424	**Winding length detection (upper 4 digits)**	0 (m*1)	0 to 9999 (m*1)	Set the winding length (upper 4 digits) which triggers the Winding/unwinding completion (Y234) signal output.

*1 The increment varies depending on the **Pr.1262** setting.

◆Winding length calculation

- While the winding diameter calculation is valid, the winding length can be calculated from the integration of the actual line speed value.
- For the operation in the direction set in winding/unwinding selection (refer to **page 67**), the winding length is increased by 0.1 mm. (When the value exceeds 9999999999.9 mm, the value is reset to 0.0 mm.)
- For the operation opposite to the winding/unwinding setting for the two-way operation function (refer to the "two-way operation function"), the winding length is reduced by 0.1 mm. (When the value falls below 0.0 mm, the value is reset to 9999999999.9 mm.)

◆Winding/unwinding length detection (Pr.1264, Pr.1346, Y234 signal)

- When the material winding (unwinding) length is equal to or more than the length determined by the settings of **Pr.1264 Winding length detection (lower 4 digits)** and **Pr.1346 Winding length detection (upper 4 digits)**, the Winding/unwinding completion (Y234) signal turns ON. Use **Pr.1262 Winding length increment** to set the winding length increment.
- For the Y234 signal, set "234 (positive logic) or 334 (negative logic)" in one of **Pr.190 to Pr.196 (output terminal function selection)** to assign the function to the output terminal.

◆Winding diameter / winding length storage selection (Pr.645)

- Use **Pr.645 Winding diameter storage selection** to select the timing to update the values of winding diameter (**Pr.646**) and winding length (**Pr.1263** and **Pr.1298**).

Pr.645 setting	Winding diameter storage timing (Pr.646 update timing)	Winding length storage timing (update timing for Pr.1263 or Pr.1298)
0	• When a value is set in **Pr.646** • When the Stored winding diameter clear (X109) signal is turned ON	• When a value is set in **Pr.1263 or Pr.1298.** • When the Winding length clear (X117) signal is turned ON
1	In addition to the above-mentioned update timings defined for the setting value of "0", the stored values are also updated at the following timings. • When the enabled winding diameter calculation is disabled. • When the power is turned OFF while the winding diameter calculation is valid (when the power is supplied through the main circuit terminal (**Pr.30** = "0, 1, 20, 21, 100, 101, 120, or 121")) ∗1 • When the X11 signal is turned ON while the winding diameter calculation is valid (when the power is supplied through terminals P/+ and N/- (**Pr.30** = "2, 10, 11, 102, 110, or 111")) ∗2 • At an inverter reset	

∗1 If the power supply is disconnected, the winding diameter may not be stored. To make sure that the winding diameter is stored, turn OFF the X114 signal to store the diameter before turning OFF the power.

∗2 When the FR-HC2/FR-XC/FR-CV is used, the winding diameter is stored using the X11 signal. To make sure that the winding diameter is stored, use the X11 signal.

NOTE

- The winding diameter is kept independently of **Pr.645** setting when start commands (STF, STR) are OFF.
- The winding diameter calculation is used or not used depending on the status of the Tension control selection (X114) signal, **Pr.1247 Winding diameter change increment amount limit** setting, and a prioritized operation such as JOG operation.

◆Stored winding diameter (Pr.646, Pr.647)

- Read **Pr.646 Stored winding diameter** to check the winding diameter presently stored.
- The stored winding diameter can be changed by overwriting the setting value in **Pr.646** with a desired value.
- The present winding diameter is kept for the duration set in **Pr.647 Operation time with stored winding diameter** after the start command is given.

Initial winding diameter calculation	Operation at start
With initial winding diameter calculation	The present winding diameter is kept for the duration set in **Pr.647** after the start command is given and initial winding diameter calculation starts. However, when initial winding diameter calculation is completed before the **Pr.647** setting time elapsed, the result of the calculation is used.
Without initial winding diameter calculation	The present winding diameter is kept for the duration set in **Pr.647** after the start command is given and the winding diameter calculation starts.

◆Stored winding length (Pr.1262, Pr.1263, Pr.1298, Pr.1299)

- While winding diameter calculation is valid, the winding length can be calculated from the integration of the actual line speed value.
- For winding length calculation, the actual line speed is used whichever direction the line goes. When the material is unwound after winding operation, the winding length is not subtracted but added. (When switching between winding and unwinding is performed using the two-way operation function, the winding length is subtracted. (Refer to page 232.))
- The winding length is calculated in the inverter in 0.1 mm increments. When the value exceeds 9999999999.9 mm, the value is reset to 0 mm.
- Use **Pr.1299 Stored winding length increment** to change the increment of the stored winding length.

Pr.1299 setting	Increment	Maximum stored winding length
0 (initial value)	1 m	9999999 m (about 9999 km)
1	1 cm	99999999 cm (about 999 km)
2	1 mm	99999999 mm (about 99 km)

The stored winding length is not changed immediately after changing the **Pr.1299** setting. After changing the **Pr.1299** setting, the stored wiring length is changed at the update timing set in **Pr.645**. (Refer to page 213.)

- Read **Pr.1263 Stored winding length (lower 4 digits)** and **Pr.1298 Stored winding length (upper 4 digits)** to check the stored winding length. The increment is determined by the setting of **Pr.1262 Winding length increment**.

Pr.1262 setting	Increment
0	1 km
1	100 m
2	10 m
3 (initial value)	1 m
4	1 cm
5	1 mm

- The stored winding length can be changed by overwriting the setting value in **Pr.1263** and **Pr.1298** with a desired value. The increment of values to be set in **Pr.1263** and **Pr.1298** can be set in **Pr.1262**.
- The setting values and readouts of **Pr.1263** and **Pr.1298** differ according to the settings of **Pr.1299 Stored winding length increment** and **Pr.1262 Winding length increment**. For example, when "0" (1 m increment) is set in **Pr.1299** and "0" (1 km increment) is set in **Pr.1262**, a value between "0" and "9999" can be set in **Pr.1263**, but a value other than "0" cannot be set in **Pr.1298**. In this case, when "3" (1 m increment) is set in **Pr.1262** after "9999" is set in **Pr.1263**, the readout of **Pr.1263** will be "9000", and the readout of **Pr.1298** will be "999". When "5" (1 mm increment) is set in **Pr.1262**, readout of **Pr.1263** will be "0" and readout of **Pr.1298** will be "9900".

NOTE

- Set **Pr.1299 Stored winding length increment** before setting a value in **Pr.1263** or **Pr.1298**.
- When a value is set in either **Pr.1263** or **Pr.1298**, "0" is automatically set in the other parameter only for the first time after the setting of **Pr.1299 Stored winding length increment** is changed.
- When **Pr.1263** and **Pr.1298** are read in FR Configurator2, the same value calculated from the following formula is displayed for both. The **Pr.1299** setting is added to the ninth digit.
  (**Pr.1298** setting × 10000 + **Pr.1263** × (**Pr.1262** / **Pr.1299**)
  Example 1
  When **Pr.1299** = "2", **Pr.1262** = "3", **Pr.1298** = "1", and **Pr.1263** = "4567"
  14567 × (1 m / 1 mm) = 14567000
  As the **Pr.1299** setting is added to the ninth digit, the **Pr.1263**/**Pr.1298** value displayed in FR Configurator2 is 214567000.
  Example 2
  When **Pr.1299** = "1", **Pr.1262** = "5", **Pr.1298** = "1234", and **Pr.1263** = "5670"
  12345670 × (1 mm / 1 cm) = 1234567
  As the **Pr.1299** setting is added to the ninth digit, the **Pr.1263**/**Pr.1298** value displayed in FR Configurator2 is 101234567.

◆Stored winding diameter/length clear (X109 signal, X117 signal)

- Input the Stored winding diameter clear (X109) signal or Winding length clear (X117) signal to clear the stored winding diameter/length.
- To use the X109 or X117 signal, set **Pr.178 to Pr.189 (input terminal function selection)** to assign the function to an input terminal.

Pr.178 to Pr.189 setting	Signal name	Function
109	X109	Stored winding diameter clear
117	X117	Winding length clear

- When the winding diameter is cleared by the X109 signal, the value after clear is as follows.

Winding/unwinding selection*1	Winding diameter after clear
Winding	Minimum winding diameter*2
Unwinding	Maximum winding diameter*2

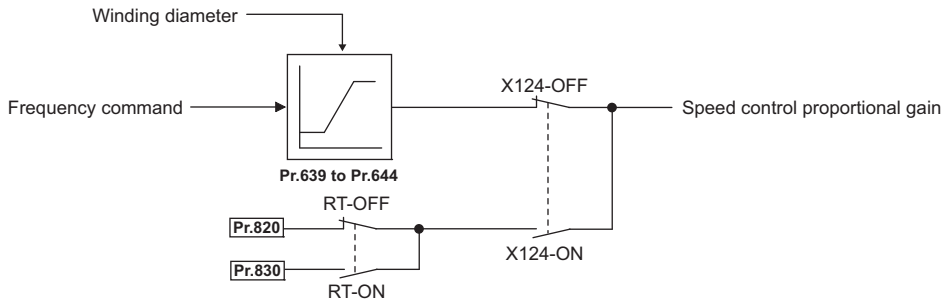
*1 Use **Pr.1230 Winding/unwinding selection** for the selection.
*2 The minimum/maximum winding diameter is as selected by the X107/X108 signal. (Refer to page 206.)

9.2.13 Speed control proportional gain selection according to the winding diameter calculation result

Speed control proportional gain at vector control and Real sensorless vector control can be changed based on the value determined by winding diameter calculation.
First to fourth speed control proportional gain can be selected by the signal input.

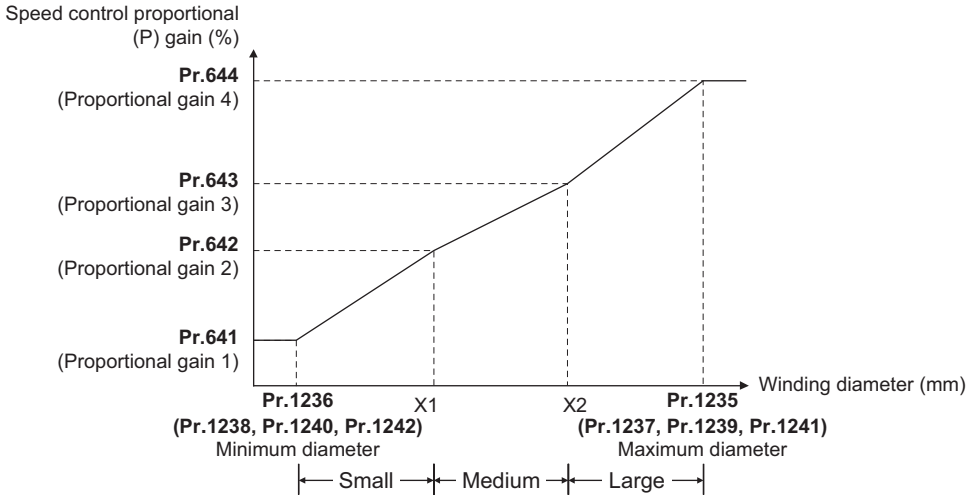
Pr.	Name	Initial value	Setting range	Description
639 R030	**Speed control proportional term applied diameter 1**	9999	1 to 99%	Set the winding diameter (X1) used to select proportional gain.
			9999	Operates as 33%.
640 R031	**Speed control proportional term applied diameter 2**	9999	1 to 99%	Set the winding diameter (X2) used to select proportional gain.
			9999	Operates as 66%.
641 R032	**Speed control proportional gain 1**	9999	0 to 1000%, 9999	The proportional gain settings are switched according to the winding diameter. 9999: Function disabled
642 R033	**Speed control proportional gain 2**	9999	0 to 1000%, 9999	
643 R034	**Speed control proportional gain 3**	9999	0 to 1000%, 9999	
644 R035	**Speed control proportional gain 4**	9999	0 to 1000%, 9999	

◆Block diagram



◆Speed control proportional gain selection (Pr.639 to Pr.644)

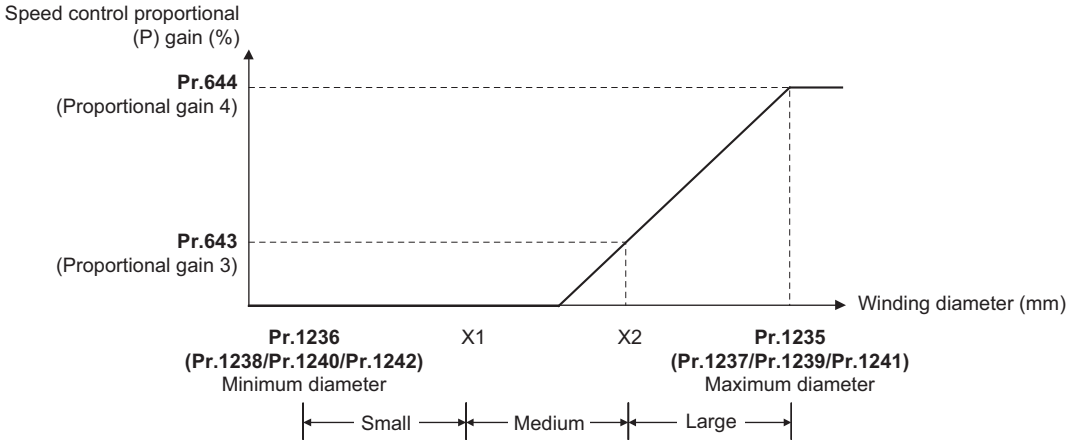
- Speed control proportional gain at vector control and Real sensorless vector control can be changed based on a winding diameter calculation result.



X1 = ((Maximum diameter - Minimum diameter) × **Pr.639**/100) + Minimum diameter

X2 = ((Maximum diameter - Minimum diameter) × **Pr.640**/100) + Minimum diameter

- This function is activated when two or more settings of **Pr.641 to Pr.644 (speed control proportional gain 1 to 4)** are set. If two or more setting are not set, **Pr.820 Speed control P gain 1** (**Pr.830 Speed control P gain 2**) is valid regardless of the winding diameter.
- A machine operates at 33% when **Pr.639** = "9999", at 66% when **Pr.640** = "9999".
- The following graph shows the value of speed control proportional gain when two settings are made.



NOTE

- When **Pr.639** = **Pr.640**, larger gain between proportional gain 2 and proportional gain 3 becomes valid.

◆Speed control proportional gain disabled signal (X124 signal)

- Use the Speed control proportional gain disabled (X124) signal to disable the **Pr.641 to Pr.644** settings.
- To assign the X124 signal, set "124" in any of **Pr.178 to Pr.189 (input terminal function selection).**

Winding diameter calculation	X124	Speed control gain
Disabled	OFF	**Pr.820/Pr.830**
	ON	**Pr.820/Pr.830**
Enabled	OFF	**Pr.641 to Pr.644**
	ON	**Pr.820/Pr.830**

10 ROLL TO ROLL FUNCTION RELATED PARAMETERS

10.1 Monitoring of dedicated functions

Purpose	Parameter to set			Refer to page
To monitor roll to roll dedicated functions	Monitoring of roll to roll dedicated functions (operation panel)	P.M100 to P.M104	Pr.52, Pr.774 to Pr.776, Pr.992	218
	Monitoring of roll to roll dedicated functions (analog output)	P.M300, P.M301	Pr.54, Pr.158	220
To use negative output for monitoring	Negative output selection for monitoring	P.M044	Pr.290	223
To select the polarity (positive or negative) of the signal output through terminal DA1.	Terminal DA1 output polarity selection	P.R450	Pr.159	223
To set reference conditions (display unit, full-scale value, etc.) for monitoring	Monitor reference	P.R005, P.R201, P.R301, P.R400 to P.R402, P.M040, P.M042	Pr.55, Pr.276, Pr.358, Pr.866, Pr.1262, Pr.1280, Pr.1281, Pr.1401	224
To change the unit of the PID measured tension value	PID measured tension monitor increment	P.R430, P.R431	Pr.609, Pr.610	226

10.1.1 Monitoring of roll to roll dedicated functions

The monitor item and the frequency setting displayed on the operation panel can be switched among the winding diameter, line speed command, etc.

◆Monitoring on the operation panel or via communication

Monitor item	Unit	Pr.52, Pr.774 to Pr.776, Pr.992	RS-485 communication dedicated monitor (hexadecimal)	MODBUS RTU real time monitor	Negative indication (-) *1	Description	Refer to page
Frequency / motor speed setting	0.01 Hz	5	H05	40205		Displays the set frequency	—
Load meter	0.1%	17	H11	40217		Displays torque current as a percentage, considering **Pr.56** setting value as 100% (motor rated torque is considered as 100% during Sensorless vector and vector control).	—
Analog output signal for dancer tension control	0.1%	19	H13	40219		Dancer tension command value	108
Winding diameter	0.1 mm	22	H16	40222		Winding diameter calculated in the inverter	213
Line speed command	0.1	26	H1A	40226		Line speed command value in consideration of acceleration/ deceleration	67
Actual line speed	0.1	27	H1B	40227		Actual line speed	199
Dancer compensation speed	0.01 Hz	28	H1C	40228	○	Speed compensation amount (manipulated amount) determined by the PID calculation when dancer feedback speed control is valid	99

Monitor item	Unit	Pr.52, Pr.774 to Pr.776, Pr.992	RS-485 communication dedicated monitor (hexadecimal)	MODBUS RTU real time monitor	Negative indication (-) *1	Description	Refer to page
Winding length (lower 4 digits)	1	29	H1D	40229		Winding length (lower 4 digits) calculated in the inverter	213
Analog output signal 2 for dancer tension control	0.1%	30	H1E	40230		Dancer tension command value	108
Line speed pulse monitor	0.01k pulses/s	31	H1F	40231		Pulse train input value (when the actual line speed is input with pulse signal)	199
PID set point *1	0.1%	52	H34	40252	○	Dancer roll set point	99
PID measured value *1	0.1%	53	H35	40253	○	Dancer roll position	99
PID deviation *1	0.1%	54	H36	40254	○	Dancer roll deviation from set point	99
Winding length (upper 4 digits)	1	63	H3F	40263		Winding length (upper 4 digits) calculated in the inverter	213
PID measured value 2 *1	0.1%	67	H43	40267	○	Dancer roll position. It is displayed even if the dancer feedback speed control operating conditions are not satisfied while the dancer feedback speed control is enabled (**Pr.128** ≠ "0").	99
Tension command after taper compensation	0.01 N / 0.1 N / 1 N	81	H51	40281		Commanded tension after taper compensation	151
Winding diameter compensation torque command*2	0.1%	82	H52	40282	○	Commanded torque after winding diameter compensation	—
Inertia compensation*2	0.1%	83	H53	40283	○	Inertia compensation torque	157
Mechanical loss compensation*2	0.1%	84	H54	40284	○	Mechanical loss compensation value	163
Terminal 1 input voltage*3	0.1 V	85	H55	40285	○	Voltage applied to terminal 1	85
Terminal 1 input after calibration (%) *2	0.1%	86	H56	40286	○	Analog value input through terminal 1 after calibration with **Pr.917** and **Pr.918** settings	85
PID manipulated amount *1	0.1%	91	H5B	40291	○	PID manipulated amount	99
PID measured tension value	0.01 (N)/ 0.1 (N)/ 1 (N)	92	H5C	40292		PID measured tension value	226
PID torque control manipulated amount	0.01 (N)/ 0.1 (N)/ 1 (N)	93	H5D	40293	○	PID torque control manipulated amount Monitoring is only available between -300 N and 300 N (inclusive)*4	—
Dancer compensation line speed	0.1	95	H5F	40295		Line speed compensation amount (manipulated amount) determined by the PID calculation when dancer feedback speed control is valid.	—
Actual line speed 2	0.1	96	H60	40296		Actual line speed calculated inversely from the winding diameter using the gear ratio and the actual motor speed	—
Winding diameter compensation speed	0.01 Hz	97	H61	40297		Frequency (winding diameter compensation speed) calculated from the line speed command, current winding diameter value, and gear ratio when dancer feedback speed control is valid	—

∗1 To enable display with a minus sign, set **Pr.290 Monitor negative output selection**. (Refer to page 223.)

∗2 When the negative indication is invalid, the value is indicated as an offset from 1000%.

∗3 When the negative indication is invalid, a negative value is indicated as an absolute value offset from 100 V. (-10.0 to -0.1 V are indicated as 110.0 to 100.1 V.)

∗4 The range varies with the **Pr.1401** setting.

Pr.1401 setting	Monitor value
0 (initial value)	-300 N to 300 N
1	-3000 N to 3000 N
2	-30000 N to 30000 N

◆Monitoring using analog output (terminals FM/CA and AM)

Monitor item	Unit	Pr.54 (FM/CA) setting	Pr.158 (AM) setting	Full-scale value	Negative indication (-)∗1	Refer to page
Frequency setting value	0.01 Hz	5	5	**Pr.55**		—
Load meter	0.1%	17	17	**Pr.866**		—
Analog output signal for dancer tension control	0.1%	19	19	100%		108
Winding diameter	0.1 mm	22	22	**Pr.1280**		213
Line speed command	0.1 m/min	26	26	**Pr.276**		67
Actual line speed	0.1 m/min	27	27	**Pr.276**		199
Dancer compensation speed	0.01 Hz	28	28	**Pr.55**	○	99
Analog output signal 2 for dancer tension control	0.1%	30	30	100%		108
PID set point	0.1%	—	52	100%	○∗2	99
PID measured value	0.1%	—	53	100%	○∗2	99
PID deviation	0.1%	—	54	100%	○∗2	99
PID measured value 2	0.1%	—	67	100%	○∗2	99
Tension command after taper compensation	0.01 N / 0.1 N / 1 N	81	81	**Pr.1281**		151
Winding diameter compensation torque command	0.1%	—	82	**Pr.866**	○∗2	—
Inertia compensation	0.1%	—	83	**Pr.866**	○∗2	157
Mechanical loss compensation	0.1%	—	84	**Pr.866**	○∗2	163
PID manipulated amount	0.1%	—	91	100%	○∗2	99
PID measured tension value	0.01 (N)/ 0.1 (N)/1 (N)	92	92	**Pr.1281**		226
PID torque control manipulated amount	0.01 (N)/ 0.1 (N)/1 (N)	93	93	**Pr.1281**	○	
Dancer compensation line speed	0.1m/min	95	95	**Pr.276**		—
Actual line speed 2	0.1m/min	96	96	**Pr.276**		—
Winding diameter compensation speed	0.01 Hz	97	97	**Pr.55**		—

∗1 To enable display with a minus sign, set **Pr.290 Monitor negative output selection**. (Refer to page 223.)

∗2 When the negative indication is invalid according to the **Pr.290** setting, "0" is indicated as the terminal AM output.

◆Monitoring using the PLC function / FR Configurator2

Monitor item	PLC function Device number	FR Configurator2 graph function		
		Monitor mode	High speed mode / trace	Trigger level reference
Frequency setting value	SD1152	○	○	*3
Load meter	SD1164	○	○	*3
Analog output signal for dancer tension control	SD1166	○	○	*3
Winding diameter	SD1169	○	○	*3
Line speed command	SD1173	○	○	*3
Actual line speed	SD1174	○	○	*3
Dancer compensation speed	SD1175	○*2	○	*3
Winding length (lower 4 digits)	SD1176	○	○	9999
Analog output signal 2 for dancer tension control	SD1177	○	○	*3
Line speed pulse monitor	SD1178	○	○	500k pulses/s
PID set point	SD1199	○*2	○	*3
PID measured value	SD1200	○*2	○	*3
PID deviation	SD1201	○*2	○	*3
PID measured tension value	SD1202	○	○	*3
PID torque control manipulated amount	SD1203	○*2	○	*3
Winding length (upper 4 digits)	SD1231	○	○	9999
PID measured value 2	SD1213	○*2	○	*3
Tension command after taper compensation	SD1228	○	○	*3
Winding diameter compensation torque command	SD1208	○*2	○	*3
Inertia compensation	SD1209	○*2	○	*3
Mechanical loss compensation	SD1210	○*2	○	*3
Terminal 1 input voltage	—*1	○*2	○	10 V
Terminal 1 input after calibration (%)	—*1	○*2	○	100%
PID manipulated amount	SD1212	○*2	○	*3
Dancer compensation line speed	SD1223	○*2	○	*3
Actual line speed 2	SD1222	○	○	*3
Winding diameter compensation speed	SD1211	○	○	*3

○: Monitoring is available.

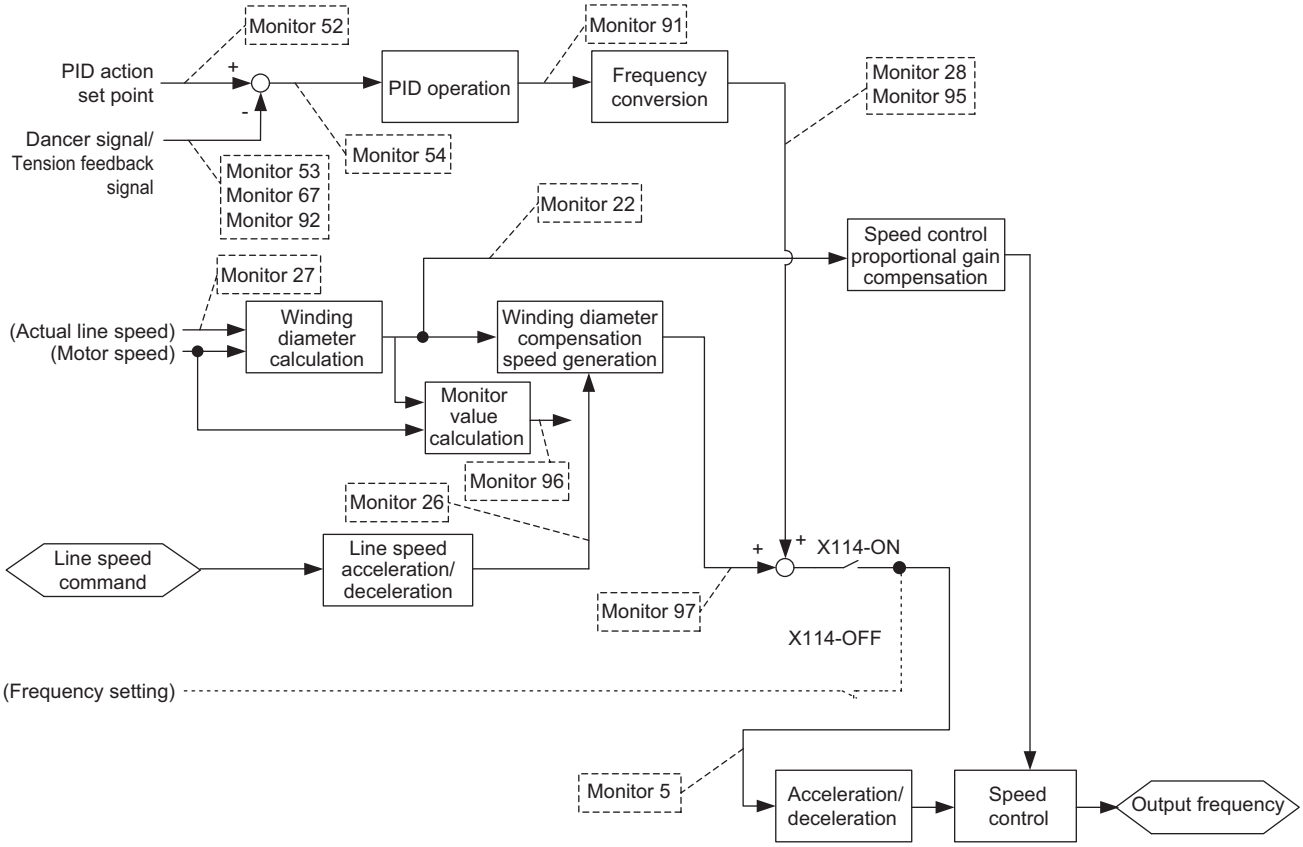
*1 SD1245 (terminal 1 input) can be a substitute.

*2 Negative values can be output. To enable display with a minus sign, set **Pr.290 Monitor negative output selection**. (Refer to page 223.)

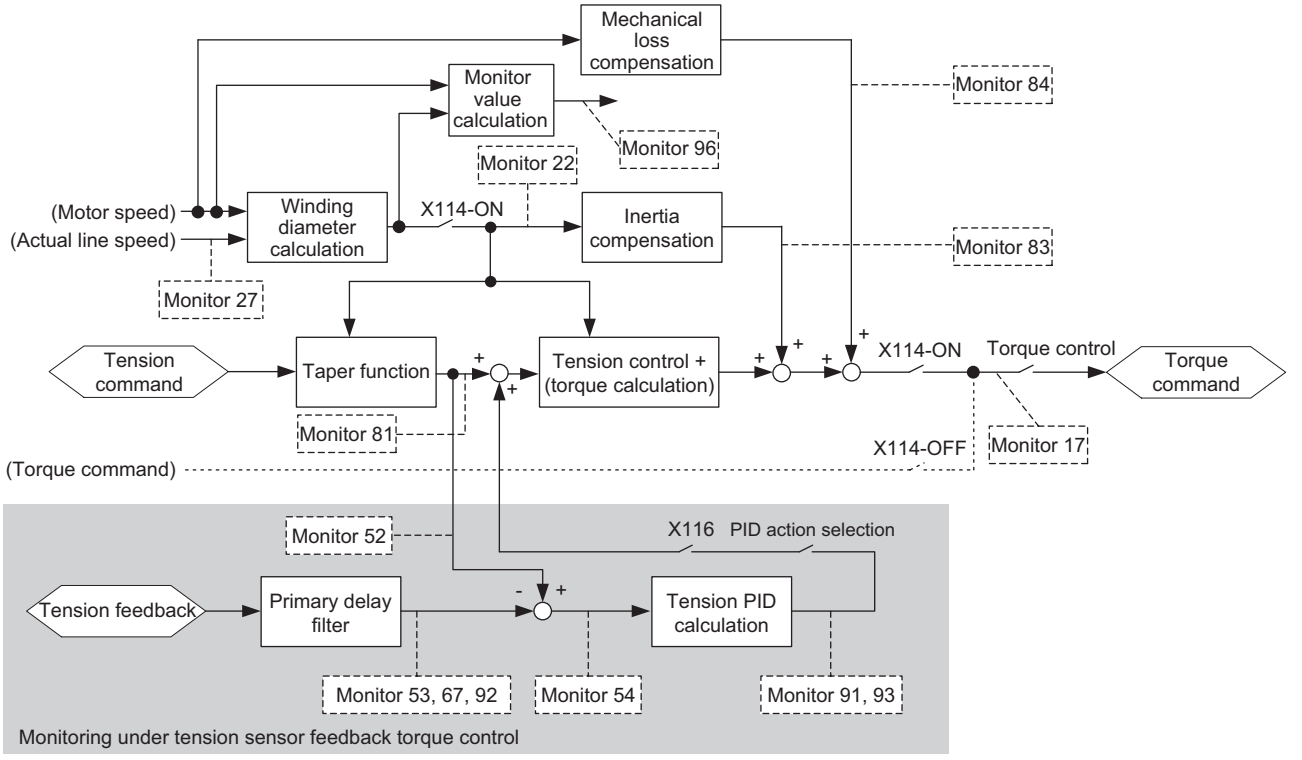
*3 The terminal CA/FM/AM full-scale value is used as the trigger level reference.

◆Schematic diagram of monitoring

• The following diagram shows a monitoring example in a system for dancer/tension feedback speed control.



• The following diagram shows a monitoring example in a system for tension sensorless torque control / tension sensor feedback torque control.



Monitoring under tension sensor feedback torque control

◆Negative output selection for monitoring (Pr.290)

• A negative output can be selected for the monitor display of terminal AM (analog voltage output), the operation panel, and a communication option. For the monitor items for which negative output is possible, refer to the monitor list.

Pr.290 setting	Negative output through terminal AM	Negative indication on operation panel	Negative indication on communication options*1
0 (initial value)	—	—	—
1	Enabled	—	—
2	—	Enabled	—
3	Enabled	Enabled	—
4	—	—	Enabled
5	Enabled	—	Enabled
6	—	Enabled	Enabled
7	Enabled	Enabled	Enabled

—: Disabled (positive only)

*1 RS-485 communication does not support negative indication.

◆Terminal DA1 output polarity selection (Pr.159)

• When the FR-A8AZ is installed, **Pr.159 DA1 output sign selection** can be used to select the polarity of the output through terminal DA1.

Pr.159 setting	Output specification	Actual output sign	
		For positive monitor value	For negative monitor value
0 (initial value)	Standard output	Positive output	Negative output
1	Absolute value output	Positive output	Positive output (absolute value)
2	Reverse output	Negative output	Positive output

10.1.2 Monitor reference

Set the reference value for each item.

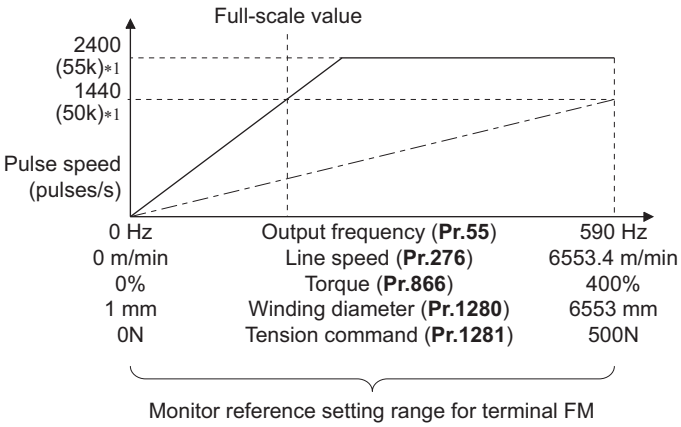
Pr.	Name	Initial value		Setting range	Description
		FM	CA		
55 M040	**Frequency monitoring reference**	60 Hz	50 Hz	0 to 590 Hz	Set the full-scale value when the output frequency monitor value is output through terminal FM, CA, or AM.
276 R400	**Line speed monitoring reference**	1000 m/min*1		0 to 6553.4 m/min*1	Set the full-scale value when the line speed monitor value is output through terminal FM, CA, or AM.
358 R201	**Line speed unit**	0		0	m/min
				1	m/s
				2	mm/min
				3	mm/s
866 M042	**Torque monitoring reference**	150%		0 to 400%	Set the full-scale value when the torque monitor value is output through terminal FM, CA, or AM.
1262 R005	**Winding length increment**	3		0	1 km
				1	100 m
				2	10 m
				3	1 m
				4	1 cm
				5	1 mm
1280 R401	**Winding diameter monitoring reference**	1000 mm		1 to 6553 mm	Set the full-scale value when the diameter monitor value is output through terminal FM, CA, or AM.
1281 R402	**Commanded tension monitoring reference**	100 N*2		0 to 500 N*2	Set the full-scale value of tension monitoring (tension command, PID torque control measured value, and PID torque control manipulated amount) via terminal FM, CA, or AM.
1401 R301	**Tension command increment**	0		0	Initial value: 100 N, setting increment: 0.01 N, setting range: 0 to 500 N
				1	Initial value: 1000 N, setting increment: 0.1 N, setting range: 0 to 5000 N
				2	Initial value: 10000 N, setting increment: 1 N, setting range: 0 to 50000 N

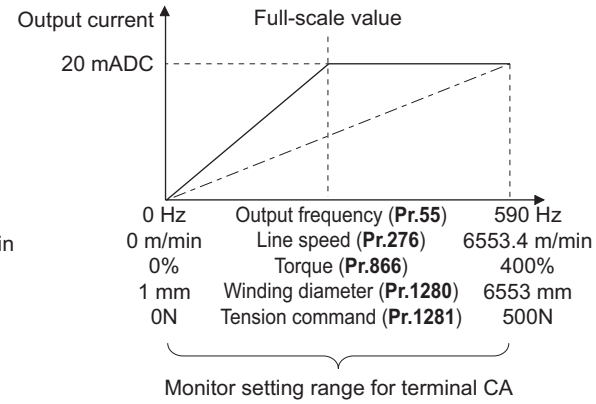
*1 The increment varies depending on the **Pr.358** setting. (Refer to page 67.)

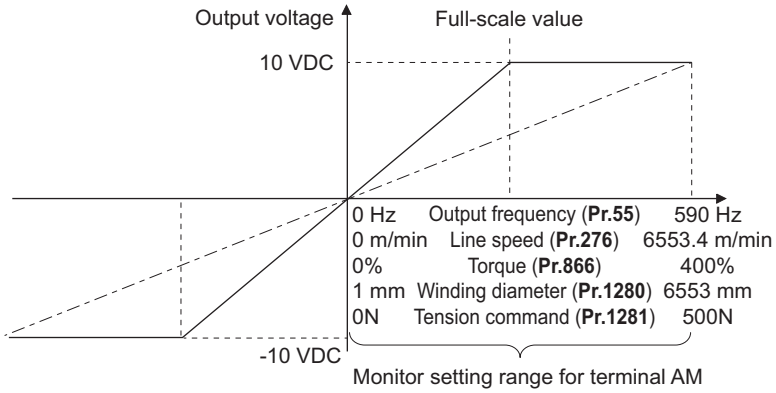
*2 The setting varies with the **Pr.1401** setting. (Refer to page 140.)

◆Setting monitoring reference (Pr.55, Pr.276, Pr.866, Pr.1280, Pr.1281)

Set the full-scale value for outputting the monitor items of output frequency, frequency setting value, and line speed to terminals FM, CA and AM.







*1 The value in parentheses is the number of pulses for the high-speed pulse train output (**Pr.291 Pulse train I/O selection** = "10, 11, 20, 21, or 100").

10.1.3 PID measured tension value

Pr.	Name	Initial value	Setting range	Description
609 R430	**PID measured tension monitor filter**	0	0 to 5s	Set the primary delay filter time constant to the PID measured tension value.
610 R431	**PID measured tension monitor increment**	9999	0	PID measured tension monitored in 0.01 N increments (0 to 500 N)
			1	PID measured tension monitored in 0.1 N increments (0 to 5000 N)
			2	PID measured tension monitored in 1 N increments (0 to 50000 N)
			9999	As set in **Pr.1401**.

- The PID measured tension value is the value after using **Pr.609 PID measured tension monitor filter** , which is displayed with increments set according to **Pr.1401** and **Pr.610**. When **Pr.609** = "0", the filter time is not set.
- The **Pr.610** setting to change the increment is applicable only for monitoring the PID measured tension value. The **Pr.1401** setting is applicable for monitoring values other than the PID measured tension value. When **Pr.610** = "9999", the **Pr.1401** setting is applicable to display the monitor item.

Pr.1401	Pr.610	Increment	Maximum value	Value monitored in the operation example*1
0	9999	0.01 N	500.00 N	500.00 N
	0	0.01 N	500.00 N	500.00 N
	1	0.1 N	5000.0 N	678.9 N
	2	1 N	50000 N	679 N
1	9999	0.1 N	5000.0 N	5000.0 N
	0	0.01 N	5000.0 N*2	5000.0 N*2
	1	0.1 N	5000.0 N	5000.0 N
	2	1 N	50000 N	6789 N
2	9999	1 N	50000 N	50000 N
	0	0.01 N	50000 N*2	50000 N*2
	1	0.1 N	50000 N*2	50000 N*2
	2	1 N	50000 N	50000 N

*1 The conditions of the operation example are as follows:
Input equivalent to 67.89% when **Pr.1136** = 0%, **Pr.1137** = "0", **Pr.1138** = 50%, and **Pr.1139** = maximum value

*2 When the **Pr.1401** setting is larger than the **Pr.610** setting, the value set in **Pr.610** is invalid.

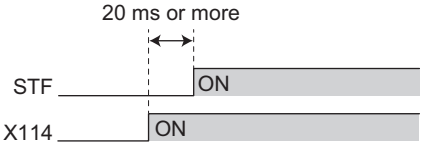
10.2 Roll to roll dedicated I/O signal

10.2.1 Input signal

- To use contact input signals, assign them to **Pr.178 to Pr.189 (input terminal function selection)**.

◆Input signal list

Type	Pr.178 to Pr.189 setting	Signal name		Description	Refer to page
Analog/pulse	—	Dancer roll target position / tension feedback set point		Set the target value with a parameter (**Pr.131**).	85, 124
	—	Dancer roll position detection / tension feedback detection		Dancer roll position / tension sensor feedback input signal	85, 124, 178
	—	Line speed command		Line speed command input signal	67
	—	Actual line speed detection		Actual line speed input signal	199
Contact input	0	Low-speed operation command	RL	Line speed command signals (15 speed settings available). The commanded speed is determined according to the combination of the RH, RM, RL and REX signals.	79
	1	Middle-speed operation command	RM		
	2	High-speed operation command	RH		
	8	15-speed selection	REX		
	81	Tension PI gain tuning start / forced end	PGT	Tension PI gain tuning can be started or forcibly terminated.	91
	100	PID integral term reset input	X100	Turn ON the X100 signal to disable the integral control and clear the integral term. The integral term can be reset by inputting the MRS signal even when no terminal is assigned.	100
	101	PI control switchover	X101	Switches between PID control and PI control. Turn ON the X101 signal to disable the differential control and clear the differential term.	101
	102	Offset displacement storage	X102	Set the present analog value to **Pr.424** as an offset.	88, 126
	103	Integral term activation selection	X103	Turn ON the X103 signal to keep the integral term and calculate the manipulated amount using the integral term in storage.	100
	104	Reel change	X104	Enables the reel change function.	106
	105	Acceleration/ deceleration time selection 1 for line speed command	X105	Switches the acceleration/deceleration time for the line speed command.	79
	106	Acceleration/ deceleration time selection 2 for line speed command	X106		
	107	Minimum/maximum winding diameter selection	X107	Select the minimum/maximum diameter and the material thickness.	203, 206
	108		X108		
	109	Stored winding diameter clear	X109	Clears the stored diameter.	213
	111	Inertia compensation acceleration	X111	Performs inertia compensation during acceleration.	157
	112	Inertia compensation deceleration	X112	Performs inertia compensation during deceleration.	157
	113	Inertia compensation second acceleration/ deceleration time	X113	Switches the acceleration/deceleration time for inertia compensation.	157

Type	Pr.178 to Pr.189 setting	Signal name		Description	Refer to page
Contact input	114	Tension control selection	X114	Turn ON the X114 signal to enable the dancer feedback speed control, tension feedback speed control, tension sensorless torque control, tension sensor feedback torque control, and winding diameter compensation functions. If the signal is OFF, normal speed control is applied. Always set the signal for using the dancer feedback speed control, tension feedback speed control, tension sensorless torque control, tension sensor feedback torque control, and winding diameter compensation functions. (When the X114 signal is not assigned to any input terminal, general speed control or torque control is enabled.) Ensure the motor has stopped before switching between normal operation and an operation with a particular control type. After turning ON the X114 signal, wait 20 ms or longer to input a start command (STF/STR).  When the JOG (JOG operation selection) signal is input while the X114 signal is ON, the JOG operation will be enabled as the JOG signal has higher priority. When JOG operation is prioritized, the frequency and acceleration/deceleration times set in **Pr.15 Jog frequency** and **Pr.16 Jog acceleration/ deceleration time** are used.	64, 139, 177, 194
	115	Winding diameter compensation selection	X115	Turn ON the X115 signal to keep the present winding diameter. (The winding diameter compensation is disabled.)	197
	116	PID compensation disabled	X116	Turning ON the X116 signal interrupts the PID control under dancer feedback speed control, tension sensor feedback speed control, or tension sensor feedback torque control. (The PID compensation amount, integral term, and differential term are cleared.)	65, 177
	117	Winding length clear	X117	Clears the measured winding/unwinding length.	213
	120	PID gain switchover 1	X120	Switches the PID gain.	101
	121	PID gain switchover 2	X121		
	122	Winding diameter measurement	X122	Turning ON the X122 signal enables the initial winding measurement mode.	212
	123	Stall mode trigger	X123	Turning ON the X123 signal triggers the stall mode.	165
	124	Speed control proportional gain disabled	X124	Disables the settings of **Pr.641 to Pr.644 (Speed control proportional gain)**.	216
	125	Line speed / tension command input	X125	Enables write and read of the line speed command value through communication during dancer / tension sensor feedback speed control, regardless of whether the dancer / tension sensor feedback speed control is valid or invalid. Enables write and read of the tension command value through communication during tension sensorless torque control, regardless of whether the tension sensorless torque control is valid or invalid.	67, 140
	126	Two-way operation	X126	Switches between winding and unwinding during operation. The dancer roll position can be held during switching.	232

◆List of input signals with validity status by control mode (function)

Pr.178 to Pr.189 setting	Signal name		Dancer feedback speed control	Tension sensor feedback speed control	Tension sensorless torque control	Tension sensor feedback torque control	Winding diameter calculation
0	Low-speed operation command	RL	○	○	—	—	—
1	Middle-speed operation command	RM	○	○	—	—	—
2	High-speed operation command	RH	○	○	—	—	—
8	15-speed selection	REX	○	○	—	—	—
81	Tension PI gain tuning start / forced end	PGT	○	—	—	—	—
100	PID integral term reset input	X100	○	○	—	○	—
101	PI control switchover	X101	○	○	—	○	—
102	Offset displacement storage	X102	○	○	—	—	—
103	Integral term activation selection	X103	○	○	—	○	—
104	Reel change	X104	○	○	—	—	—
105	Acceleration/deceleration time selection 1 for line speed command	X105	○	○	—	—	—
106	Acceleration/deceleration time selection 2 for line speed command	X106	○	○	—	—	—
107	Minimum/maximum winding diameter selection	X107	—	—	—	—	○
108		X108	—	—	—	—	○
109	Stored winding diameter clear	X109	—	—	—	—	○
111	Inertia compensation acceleration	X111	—	—	○	○	—
112	Inertia compensation deceleration	X112	—	—	○	○	—
113	Inertia compensation second acceleration/deceleration time	X113	—	—	○	○	—
114	Tension control selection	X114	○	○	○	○	○
115	Winding diameter compensation selection	X115	—	—	—	—	○
116	PID compensation disabled	X116	○	○	—	○	—
117	Winding length clear	X117	—	—	—	—	○
120	PID gain switchover 1	X120	○	○	—	○	—
121	PID gain switchover 2	X121	○	○	—	○	—
122	Winding diameter measurement	X122	—	—	—	—	○
123	Stall mode trigger	X123	—	—	○	○	—
124	Speed control proportional gain disabled	X124	○	○	—	—	○
125	Line speed / tension command input	X125	○	○	○	○	—
126	Two-way operation	X126	○	○	○	○	○

○: Valid, —: Invalid

10.2.2 Output signal

• To use output signals, assign them to **Pr.190 to Pr.196 (output terminal function selection)**.

◆Output signal list

Pr.190 to Pr.196 setting		Signal name		Description	Refer to page
Positive logic	Negative logic				
14	114	PID lower limit	FDN	Output when the dancer roll position or the roll tension value falls below the limit determined by the setting of **Pr.132 PID lower limit**.	89
15	115	PID upper limit	FUP	Output when the dancer roll position or the roll tension value exceeds the limit determined by the setting of **Pr.131 PID upper limit**.	89
16	116	PID forward/reverse rotation output	RL	Output during forward rotation under dancer feedback speed control, tension sensor feedback speed control, or tension sensor feedback torque control.	—
47	147	During PID control activated	PID	Output under dancer feedback speed control, tension sensor feedback speed control, or tension sensor feedback torque control.	—
48	148	PID deviation limit	Y48	Output when the absolute deviation value exceeds the limit value.	89, 127, 180
231	331	Break detection	Y231	Output when the dancer roll position or the roll tension becomes abnormal due to a break.	89
232	332	Winding diameter calculation completion at start	Y232	Output when the diameter calculation is completed at an operation start.	208, 212
233	333	Target winding diameter achieved	Y233	Output when the diameter reaches the setting in **Pr.648 Target winding diameter** or longer for winding. Output when the diameter reaches the setting in **Pr.648 Target winding diameter** or shorter for unwinding.	208
234	334	Winding/unwinding completion	Y234	Output when the winding/unwinding length is equal to or more than the value of determined by the settings of **Pr.1264 Winding length detection (lower 4 digits)** and **Pr.1346 Winding length detection (upper 4 digits)**.	213
235	335	Dancer position / tension feedback detection	Y235	Output while the dancer roll position or the roll tension is within a range determined by the setting of **Pr.423 Dancer / tension sensor feedback detection level**. This signal is also output when the inverter is at a stop.	88, 126
236	336	Reel change ready	Y236	Output when the commanded line speed reaches the target line speed while the reel change function is valid.	106
237	337	Line speed acceleration	Y237	Output while the commanded line speed increases. The signal can be input to the terminal to which the Inertia compensation acceleration (X111) signal of the inverter for the driving shaft is assigned.	79, 157
238	338	Line speed deceleration	Y238	Output while the commanded line speed decreases. The signal can be input to the terminal to which the Inertia compensation deceleration (X112) signal of the inverter for the driving shaft is assigned.	79, 157
239	339	Average current load detection	Y239	Output when the output current average value reaches or exceeds 50% of the inverter rated current. (This function is only available for the SND rating.)	8

◆List of output signals with validity status by control mode (function)

Pr.190 to Pr.196 setting		Signal name		Dancer feedback speed control	Tension sensor feedback speed control	Tension sensorless torque control	Tension sensor feedback torque control	Winding diameter calculation
Positive logic	Negative logic							
14	114	PID lower limit	FDN	○	○	—	○	—
15	115	PID upper limit	FUP	○	○	—	○	—
16	116	PID forward/reverse rotation output	RL	○	○	—	○	—
47	147	During PID control activated	PID	○	○	—	○	—
48	148	PID deviation limit	Y48	○	○	—	○	—
231	331	Break detection	Y231	○	○	—	○	—
232	332	Winding diameter calculation completion at start	Y232	—	—	—	—	○
233	333	Target winding diameter achieved	Y233	—	—	—	—	○
234	334	Winding/unwinding completion	Y234	—	—	—	—	○
235	335	Dancer position / tension feedback detection	Y235	○	—	—	○	—
236	336	Reel change ready	Y236	○	○	—	—	—
237	337	Line speed acceleration	Y237	○	○	—	—	—
238	338	Line speed deceleration	Y238	○	○	—	—	—
239	339	Average current load detection	Y239	○	○	○	○	○

10.3 Two-way operation function

◆Description

- In order to switch the operation between winding and unwinding during dancer feedback speed control or tension sensor feedback speed control, it is necessary to change the PID action (forward/reverse), winding/unwinding selection, and start command (STF/STR). When the operation is switched between winding and unwinding and the dancer roll position / tension during operation is held, the dancer roll position / tension fluctuates because the PID manipulated amount suddenly changes along with the changes in the PID action and the start command. Therefore, switch the operation between winding and unwinding while the line is stopped (line speed command: "0").
- By using the two-way operation function, the sudden change in the PID manipulated amount can be prevented, and the operation can be switched between winding and unwinding while maintaining the dancer roll position / tension during operation. Also, no change is required for parameter setting or signal input after switching the operation.
- The function is also enabled during tension sensorless torque control or tension sensor feedback torque control. Only the winding and unwinding settings are changeable during tension sensorless torque control or tension sensor feedback torque control.

◆Switching between winding and unwinding

- The action in winding/unwinding operation can be switched by turning the Two-way operation (X126) signal ON/OFF.
- To input the X126 signal, set "126" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.
- By switching the operation between winding and unwinding, the following action is automatically changed accordingly.

Control	Function	Setting method	Operation status	
			Before switching (X126-OFF)	After switching (X126-ON)
Dancer feedback speed control Tension sensor feedback speed control	PID action	**Pr.128**	Reverse action	Forward action
			Forward action	Reverse action
	Winding/unwinding selection	**Pr.1230**	Winding	Unwinding
			Unwinding	Winding
	Start command*1	Start signal (STF/STR signal) or operation panel key operation	Forward rotation	Reverse rotation
			Reverse rotation	Forward rotation
Tension sensorless torque control Tension sensor feedback torque control	Winding/unwinding selection	**Pr.1230**	Winding	Unwinding
			Unwinding	Winding

*1 The STF/STR indication on the operation panel does not change.

NOTE

- During dancer feedback speed control or tension sensor feedback speed control, switching operation using the X126 signal is available while the commanded line speed is 0 after line speed acceleration/deceleration. (If an analog or other input signal cannot set the line speed to 0, use **Pr.622 Line speed command for starting** to set the line speed to 0. (Refer to page 75.))

10.4 Operation command source and speed command source (Pr.338, Pr.339)

- In the Network operation mode, the commands for the roll to roll function are sent through the external terminals or communication as follows. (The signal assigned to the inverter differs depending on the input terminal function selection setting.)

Pr.	Name	Setting range	Increment	Initial value	Remarks
338	**Communication operation command source**	0, 1	1	0	0: NET command source 1: External command source
339	**Communication speed command source**	0 to 2	1	0	0: NET command source 1: External command source 1 2: External command source 2

Command sources selection			Pr.338 Communication operation command source		0: NET			1: external		
			Pr.339 Communication speed command source		0: NET	1: EXT	2: EXT	0: NET	1: EXT	2: EXT
Fixed function (terminal-equivalent function)			Line speed command sent via communication		NET	—	NET	NET	—	NET
			Line speed command sent through an analog terminal (**Pr.361** = "0")		—	EXT	—	—	EXT	—
			Line speed command sent through an analog terminal (**Pr.361** = "3 to 6")		EXT			EXT		
Selectable function	Pr.178 to Pr.189 setting	0	RL	Low-speed operation command	NET	EXT		NET	EXT	
		1	RM	Middle-speed operation command	NET	EXT		NET	EXT	
		2	RH	High-speed operation command	NET	EXT		NET	EXT	
		5	JOG	Jog operation selection	NET			EXT		
		8	REX	15-speed selection	NET	EXT		NET	EXT	
		81	PGT	Tension PI gain tuning start / forced end	NET			EXT		
		100	X100	PID integral term reset input	NET			EXT		
		101	X101	PI control switchover	NET			EXT		
		102	X102	Offset displacement storage	NET			EXT		
		103	X103	Integral term activation selection	NET			EXT		
		104	X104	Reel change	NET			EXT		
		105	X105	Acceleration/deceleration time selection 1 for line speed command	NET			EXT		
		106	X106	Acceleration/deceleration time selection 2 for line speed command	NET			EXT		
		107	X107	Minimum/maximum winding diameter selection 1	NET			EXT		
		108	X108	Minimum/maximum winding diameter selection 2	NET			EXT		
		109	X109	Stored winding diameter clear	NET			EXT		
		111	X111	Inertia compensation acceleration	Combined			EXT		
		112	X112	Inertia compensation deceleration	Combined			EXT		
		113	X113	Inertia compensation second acceleration/deceleration time	NET			EXT		
		114	X114	Tension control selection	Combined			EXT		
		115	X115	Winding diameter compensation selection	NET			EXT		
		116	X116	PID compensation disabled	NET			EXT		
		117	X117	Winding length clear	NET			EXT		
		120	X120	PID gain switchover 1	NET			EXT		
		121	X121	PID gain switchover 2	NET			EXT		
		122	X122	Winding diameter measurement	NET			EXT		
		123	X123	Stall mode trigger	NET			EXT		
		124	X124	Speed control proportional gain disabled	NET			EXT		
		125	X125	Line speed / tension command input	NET			EXT		
		126	X126	Two-way operation	NET			EXT		

EXT: Commands sent through external terminals are only valid.
NET: Commands sent via network are only valid.
Combined: Any command given via the external terminals or given through communication is valid.
—: Any commands sent through external terminals or via network are invalid.

NOTE

- For other signals, refer to the Instruction Manual (Detailed) of the FR-A800 inverter.

10.5 Encoder input option selection

Select the option (plug-in option / control terminal option) used for the motor (encoder) signal input and the option used for the line speed command / actual line speed input.

Pr.	Name	Initial value	Setting range	Description
862 C242	Encoder option selection	0	0	Signals from the motor (encoder) is input through the plug-in option (FR-A8AP/FR-A8AL/FR-A8APR/FR-A8APS).
			1	Signals from the motor (encoder) is input through the control terminal option (FR-A8TP).

- Select the option used for the motor (encoder) signal input and the option used for the line speed command / actual line speed input. (Plug-in option / control terminal option)
- The options are selected according to the setting in **Pr.862 Encoder option selection**.

Plug-in option*1	Control terminal option	Pr.862 = "0"		Pr.862 = "1"	
		Motor (encoder) signal	Line speed command / actual line speed	Motor (encoder) signal	Line speed command / actual line speed
Installed	Installed	Plug-in option	Control terminal option	Control terminal option	Plug-in option*3
	Not installed*2	Plug-in option	Regarded as "0"	—*4	Plug-in option*3
Not installed*2	Installed	—*4	Control terminal option	Control terminal option	Regarded as "0"
	Not installed*2	—*4	Regarded as "0"	—*4	Regarded as "0"

*1 When two or more options among the FR-A8AP, FR-A8APR, FR-A8AL, and FR-A8APS are installed, the option with highest priority is enabled. FR-A8AL > FR-A8APS > FR-A8APR > FR-A8AP

*2 When the option is not installed, the pulse input value "0" is applied to the operation.

*3 Line speed command / actual line speed input using the FR-A8APR/FR-A8APS is invalid.

*4 The control method is selected under the condition that no Vector control compatible option is used. (For example, Advanced magnetic flux vector control is selected when **Pr.800** = "0".)

NOTE

- When the same option is used for the signal input from the motor (encoder) and the line speed command input (**Pr.361**) or actual line speed input (**Pr.362**), the signal input from the motor (encoder) is enabled.

11 APPENDIX

11.1 Differences in the functions from the standard inverter

- The following functions of the FR-A800 standard inverter are deleted in the FR-A800-R2R inverter. Parameters, I/O signals, and monitors relative to the deleted functions are also deleted or used differently in the FR-A800-R2R inverter.

Function		Parameter	Input signal*1	Output signal*2	Monitor*3
PM motor control		**Pr.373**, **Pr.702**, **Pr.706**, **Pr.711**, **Pr.712**, **Pr.717**, **Pr.721**, **Pr.725**, **Pr.738 to Pr.743**, **Pr.746**, **Pr.747**, **Pr.788**, **Pr.791**, **Pr.792**, **Pr.998**, **Pr.1002**, **Pr.1105, Pr.1412, Pr.1413** **Pr.71** setting range change ("330, 333, 334, 8090, 8093, 8094, 9090, 9093, and 9094" are deleted.) **Pr.450** setting range change ("330, 333, 334, 8090, 8093, 8094, 9090, 9093, and 9094" are deleted.)	—	IPM (57)	—
PID control	Second PID	**Pr.753 to Pr.758**, **Pr.765 to Pr.769**, **Pr.1136 to Pr.1149**	X73 (73) X78 (78) X79 (79) X80 (80)	Y50 (50) Y52 (52) Y54 (54) FDN2 (200) FUP2 (201) RL2 (202) PID2 (203) SLEEP2 (204) Y205 (205)	Second PID set point (92) Second PID measured value (93) Second PID deviation (94) Second PID measured value 2 (95) Second PID manipulated amount (96)
	Set point / deviation / measured value input selection	**Pr.609**, **Pr.610** **Pr.128** setting range change ("10, 11, 20, 21, 42, 43, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011" are deleted.)	X14 (14)		
	PID pre-charge function	**Pr.760 to Pr.764**	X77 (77)	Y49 (49) Y51 (51) Y53 (53)	—
	PID display unit	**Pr.759**, **C42 (Pr.934)**, **C43 (Pr.934)**, **C44 (Pr.935)**, **C45 (Pr.935)**	—	—	—
	SLEEP function	**Pr.575 to Pr.577** **Pr.554** setting range change ("10 to 13" are deleted.) **Pr.1015** setting range change ("2, 10 to 12" are deleted.)	—	SLEEP (70)	—
	Dancer control	—	—	—	Dancer main set speed (97)
Position control		**Pr.419 to Pr.421**, **Pr.423 to Pr.427**, **Pr.429**, **Pr.446**, **Pr.464 to Pr.494**, **Pr.1220 to Pr.1290**, **Pr.1292 to Pr.1298** **Pr.451** setting range change ("3 to 5, 13, 14, 103 to 105, 113, and 114" are deleted.) **Pr.800** setting range change ("3 to 5, 13, 14, 103 to 105, 113, and 114" are deleted.)	CLRN (59) NP (68) CLR (69) X76 (76) X84 (84) X87 (87)	Y36 (36) MEND (38) ZA (56) FP (60) PBSY (61) ZP (63) RDY (84)	Position pulse (19) Position command (lower) (26) Position command (upper) (27) Current position (lower) (28) Current position (upper) (29) Droop pulse (lower) (30) Droop pulse (upper) (31) Multi-revolution counter (75)
Orientation function		**Pr.350 to Pr.358**, **Pr.360 to Pr.366**, **Pr.393 to Pr.399**, **Pr.829**	X22 (22)	ORA (27) ORM (28)	Orientation status (22)
Pulse monitor selection		**Pr.430**	—	—	—
Adjustable 5 points V/F		**Pr.100 to Pr.109** **Pr.71** setting range change ("2" is deleted.)	—	—	—
Remote function		**Pr.59**	—	—	—
Automatic acceleration/ deceleration		**Pr.61 to Pr.64**, **Pr.292**, **Pr.293**	—	—	—

Differences in the functions from the standard inverter

Function	Parameter	Input signal*1	Output signal*2	Monitor*3
Brake sequence control	**Pr.278 to Pr.284**, **Pr.639 to Pr.648**, **Pr.650**, **Pr.651**	BRI (15) BRI2 (45)	BOF (20) BOF2 (22)	—
Electronic bypass sequence	**Pr.135 to Pr.139**, **Pr.159**	X95 (95) X96 (96)	MC1 (17) MC2 (18) MC3 (19)	—
Stop frequency function	**Pr.522**	—	—	—
Stop-on-contact control	**Pr.270**, **Pr.275**, **Pr.276**	—	—	—
Load torque high-speed frequency control	**Pr.271 to Pr.274**	X19 (19)	—	—
Anti-sway control function	**Pr.1072 to Pr.1079**	—	—	—
Traverse function	**Pr.592 to Pr.597**	X37 (37)	—	—
Strengthened excitation deceleration	**Pr.660 to Pr.662**	—	—	—
Self power management	**Pr.248**, **Pr.254**	X94 (94)	—	—
SSCNET III communication (FR-A8NS)	**Pr.379**, **Pr.449**, **Pr.499**	X85 (85) X88 (88) X89 (89)	—	SSCNET III communication status (39)
FL remote communication (FR-A8NF)	—	—	—	—
LONWORKS communication (FR-A8NL)	**Pr.387 to Pr.392**	—	—	—
Torque control by variable-current limiter control	**Pr.451** setting range change ("6 and 106" are deleted.) **Pr.800** setting range change ("6 and 106" are deleted.)	—	—	—
Second motor control method selection	**Pr.451** setting range change ("0 to 2 and 100 to 102" are deleted.)	—	—	—
4 mA input check	**Pr.573** setting range change ("4" is deleted.) **Pr.777** is deleted.	—	—	—
Stop mode at communication error	**Pr.502** setting range change ("3 and 4" are deleted.) **Pr.779** is deleted.	—	—	—
Online auto tuning	**Pr.574** setting range change ("2" is deleted.)	—	—	—
DC injection brake (zero speed control and servo lock)	**Pr.1299**	—	—	—
JOG signal	**Pr.338** (Commands can be sent through communication.)	JOGF (57) JOGR (58)	—	—
Start count monitor	**Pr.1410, Pr.1411**	—	—	—
Changeover between inverter and high power factor converter	**Pr.328**	—	—	—
Parameter information (when the FR-LU08 is installed)	—	—	—	—

*1 The **Pr.178 to Pr.189 (input terminal function selection)** setting is shown in the parentheses.

*2 The **Pr.190 to Pr.196 (output terminal function selection)** setting is shown in the parentheses.

*3 The monitor selection parameter setting is shown in the parentheses.

- The parameters related to cumulative pulse in the FR-A800-R2R are as follows, different from those in the FR-A800 standard inverters. The function of the parameters are the same as those of the FR-A800 standard inverters. (For details, refer to the Instruction Manual (Detailed) of the FR-A800 inverter.)

Parameter name	FR-A800 standard inverter	FR-A800-R2R series inverter
Cumulative pulse clear signal selection	**Pr.635**	**Pr.755**
Cumulative pulse division scaling factor	**Pr.636**	**Pr.756**
Control terminal option-Cumulative pulse division scaling factor	**Pr.637**	**Pr.757**
Cumulative pulse storage	**Pr.638**	**Pr.758**

- The speed command will be given by an analog signal input via terminal 1 when the speed limit mode is set to 2, 3, or 4 and **Pr.807 Speed limit selection** is set to "2". Speed limit mode 1 is disabled. (Refer to page 146 for details.)

Pr.1113 setting	Speed limit method	Speed limit value	
		FR-A800 standard inverter	FR-A800-R2R series inverter
9999	Speed limit mode 1	Enabled	Disabled
0 (initial value)	Speed limit mode 2	Speed limit **Pr.807** = 0 or 2: Speed command under speed control **Pr.807** = 1: **Pr.808** setting Reverse-side speed limit **Pr.809** setting (**Pr.808** setting when **Pr.809** = "9999")	Speed limit **Pr.807** = 0: Speed command under speed control **Pr.807** = 1: **Pr.808** setting **Pr.807** = 2: Analog input via terminal 1 Reverse-side speed limit **Pr.809** setting (**Pr.808** setting when **Pr.809** = "9999")
1	Speed limit mode 3		
2	Speed limit mode 4		

NOTE

- Functions not mentioned above are the same as those of the FR-A800 standard inverter. (The functions added in and after December 2017 are not supported.)
- For the details of general specifications, refer to the catalog or Instruction Manual of the FR-A800 inverter.

11.2 Parameter write selection

Whether to enable the writing to various parameters or not can be selected. Use this function to prevent parameter values from being rewritten by misoperation.

Pr.	Name	Initial value	Setting range	Description
77 **E400**	**Parameter write selection**	0	0	Parameter write is enabled only during stop.
			1	Parameter writing is disabled.
			2	Parameter writing is enabled in any operation mode regardless of the operation status.

- **Pr.77** can be set at any time regardless of the operation mode or operation status. (Setting through communication is unavailable.)

◆Parameter write enabled only during stop (Pr.77 = "0 (initial value)")

- Parameters can be written only during a stop in the PU operation mode.
- The following parameters can always be written regardless of the operation mode or operation status.

Pr.	Name
4 to 6	(Multi-speed setting high-speed, middle-speed, low-speed)
22	Stall prevention operation level
24 to 27	(Multi-speed setting speed 4 to speed 7)
52	Operation panel main monitor selection
54	FM/CA terminal function selection
55	Frequency monitoring reference
56	Current monitoring reference
72*1	PWM frequency selection
75	Reset selection/disconnected PU detection/PU stop selection
77	Parameter write selection
79*2	Operation mode selection
100 to 103	(Acceleration/deceleration time for line speed command)
129	PID proportional band
130	PID integral time
133	PID action set point
134	PID differential time
135, 136	(Integral clamp)
158	AM terminal function selection
160	User group read selection
232 to 239	(Multi-speed setting speed 8 to speed 15)
240*1	Soft-PWM operation selection
241	Analog input display unit switchover

Pr.	Name
268	Monitor decimal digits selection
270	Acceleration/deceleration time during stall condition
271	Second acceleration time for inertia compensation
272	Second deceleration time for inertia compensation
276	Line speed monitoring reference
290	Monitor negative output selection
295	Frequency change increment amount setting
296, 297	(Password setting)
306	Analog output signal selection
310	Analog meter voltage output selection
340*2	Communication startup mode selection
345, 346	(DeviceNet communication)
360	Line speed command value
365	Tension command value (RAM)
366	Tension command value (RAM, EEPROM)
394, 395	(Acceleration/deceleration time for line speed command)
416, 417	(PLC)
423	Dancer / tension sensor feedback detection level
424	Dancer / tension sensor feedback input offset
425	Break detection waiting time
426, 427, 430	(Dancer tension setting)
434, 435	(CC-Link communication)
464 to 494	(PID control)

Pr.	Name
496, 497	(Remote output)
498	PLC function flash memory clear
550*2	NET mode operation command source selection
551*2	PU mode operation command source selection
555 to 557	(Current average value monitoring)
620	Line speed bias for reel change
621	Allowable deviation from target line speed
639 to 644	(Speed control proportional term)
645 to 648	(Winding diameter)
650	Terminal 4 input compensation selection
656 to 659	(Analog remote output)
663	Control circuit temperature signal output level
675	User parameter auto storage function selection
750, 751	(Motor thermistor interface)
759	PID unit selection
774 to 776	(PU/DU monitor selection)
805	Torque command value (RAM)
806	Torque command value (RAM,EEPROM)
838	DA1 terminal function selection
866	Torque monitoring reference
888, 889	(Free parameter)
891 to 899	(Energy saving monitoring)
C0 (900)	FM/CA terminal calibration
C1 (901)	AM terminal calibration
C8 (930)	Current output bias signal
C9 (930)	Current output bias current
C10 (931)	Current output gain signal
C11 (931)	Current output gain current
990	PU buzzer control
991	PU contrast adjustment
992	Operation panel setting dial push monitor selection
997	Fault initiation
999*2	Automatic parameter setting
1000	Direct setting selection
1006	Clock (year)
1007	Clock (month, day)
1008	Clock (hour, minute)
1018	Monitor with sign selection

Pr.	Name
1019	Analog meter voltage negative output selection
1020	Trace operation selection
1048	Display-off waiting time
1073 to 1078	(Ethernet communication)
1124, 1125	(Inverter-to-inverter link function)
1150 to 1199	(PLC function user parameters)
1211, 1215, 1217, 1219, 1222, 1223, 1226	(PID gain tuning)
1246	Line speed at winding diameter calculated value activation
1249	Number of averaging for winding diameter calculation
1252 to 1259	(Initial winding diameter calculation)
1262 to 1264	(Winding length)
1265 to 1279	(Line multi-speed setting)
1280	Winding diameter monitoring reference
1281	Commanded tension monitoring reference
1282	Tension command cushion time
1286 to 1297	(Taper function)
1298, 1299	(Stored winding length)
1346	Winding length detection (upper 4 digits)
1406, 1407, 1409	(Stall function)
1410 to 1415, 1418	(Inertia compensation function)
1419 to 1429	(Mechanical loss function)
1431, 1432, 1434 to 1455	(Ethernet communication)
1480 to 1485	(Load characteristics fault)

*1 Writing during operation is enabled in PU operation mode, but disabled in External operation mode.

*2 Writing during operation is disabled. To change the parameter setting value, stop the operation.

◆Parameter write disabled (Pr.77 = "1")

- Parameter write, Parameter clear, and All parameter clear are disabled. (Parameter read is enabled.)
- The following parameters can be written even if **Pr.77** = "1".

Pr.	Name
22	Stall prevention operation level
75	Reset selection/disconnected PU detection/PU stop selection
77	Parameter write selection
79*1	Operation mode selection
160	User group read selection
296	Password lock level
297	Password lock/unlock
345, 346	(DeviceNet communication)
360	Line speed command value

Pr.	Name
365	Tension command value (RAM)
366	Tension command value (RAM, EEPROM)
496, 497	(Remote output)
620	Line speed bias for reel change
621	Allowable deviation from target line speed
656 to 659	(Analog remote output)
805	Torque command value (RAM)
806	Torque command value (RAM,EEPROM)
997	Fault initiation
1020	Trace operation selection

*1 Writing during operation is disabled. To change the parameter setting value, stop the operation.

◆Parameter write enabled during operation (Pr.77 = "2")

- These parameters can always be written.
- The following parameters cannot be written during operation even if **Pr.77** = "2". To change the parameter setting value, stop the operation.

Pr.	Name
23	Stall prevention operation level compensation factor at double speed
48	Second stall prevention operation level
49	Second stall prevention operation frequency
60	Energy saving control selection
66	Stall prevention operation reduction starting frequency
71	Applied motor
79	Operation mode selection
80	Motor capacity
81	Number of motor poles
82	Motor excitation current
83	Rated motor voltage
84	Rated motor frequency
90 to 94	(Motor constant)
95	Online auto tuning selection
96	Auto tuning setting/status
128	PID action selection
178 to 196	(Input and output terminal function selection)
261	Power failure stop selection
289	Inverter output terminal filter
291	Pulse train I/O selection
298	Frequency search gain
313 to 322	(Extended output terminal function selection)
329	Digital input unit selection
358	Line speed unit
406	High resolution analog input selection
414	PLC function operation selection
415	Inverter operation lock mode setting
418	Extension output terminal filter
450	Second applied motor
451	Second motor control method selection
453	Second motor capacity

Pr.	Name
454	Number of second motor poles
455	Second motor excitation current
456	Rated second motor voltage
457	Rated second motor frequency
458 to 462	(Second motor constant)
463	Second motor auto tuning setting/status
541	Frequency command sign selection
560	Second frequency search gain
561	PTC thermistor protection level
570	Multiple rating setting
574	Second motor online auto tuning
598	Undervoltage level
606	Power failure stop external signal input selection
673	SF-PR slip amount adjustment operation selection
699	Input terminal filter
707, 724, 744, 745	(Motor inertia)
753, 754	(Empty reel inertia)
800	Control method selection
819	Easy gain tuning selection
858	Terminal 4 function assignment
859	Torque current/Rated PM motor current
860	Second motor torque current/Rated PM motor current
862	Encoder option selection
868	Terminal 1 function assignment
977	Input voltage mode selection
999	Automatic parameter setting
1348	P/PI control switchover frequency
1401	Tension command increment

11.3 Compatible options

◆Plug-in option

• The FR-A800-R2R-compatible plug-in options are as follows.

Name	Model
Vector control	FR-A8AP
Vector control / encoder pulse dividing output	FR-A8AL
Vector control / resolver interface	FR-A8APR
Vector control / EnDat interface	FR-A8APS
16-bit digital input	FR-A8AX
Digital output / additional analog output	FR-A8AY
Relay output	FR-A8AR
Bipolar analog output / high-resolution analog input / motor thermistor interface	FR-A8AZ
CC-Link communication	FR-A8NC
Built-in CC-Link IE Field Network communication	FR-A8NCE
DeviceNet communication	FR-A8ND
PROFIBUS-DP communication	FR-A8NP
EtherCAT communication	A8NECT_2P*1
EtherNet/IP communication	A8NEIP_2P*1
PROFINET communication	A8NPRT_2P*1
PROFIBUS-DP communication (DP-V1)	A8NDPV1*1

*1 Manufactured by HMS Industrial Networks AB

◆Control terminal option

• The FR-A800-R2R-compatible control terminal options are as follows.

Name	Model
Vector control	FR-A8TP*1
Screw terminal block	FR-A8TR

*1 The terminal layout is different from the standard control circuit terminal block. Ensure the option is suitable for the system to be used. (For the terminal layout, refer to the FR-A800 inverter catalog or the FR-A8TP Instruction Manual.)

11.4 Registers dedicated to CC-Link

- When the octuple setting is set in CC-Link Ver.2 (**Pr.544** = "18 or 28"), dancer / tension sensor feedback and the actual line speed can be input using the remote registers.

◆CC-Link communication remote registers

- RWwn+1E is used to input dancer / tension sensor feedback, and RWwn+1F is used to input the actual line speed. (**Pr.544** = "18 or 28")

Address*1	Description	
	Upper 8 bits	Lower 8 bits
RWwn+1A	H00 (Free)	
RWwn+1B		
RWwn+1C		
RWwn+1D		
RWwn+1E	Dancer / tension sensor feedback*2	
RWwn+1F	Actual line speed input*3	

*1 "n" indicates a value determined by the station number setting.

*2 Available only when **Pr.363** = "9".

*3 Available only when **Pr.362** = "9".

NOTE

- For other registers, refer to the FR-A8NC Instruction Manual.

◆PLC function remote registers

RWwn+1E (SD1076) is used to input dancer / tension sensor feedback, and RWwn+1F (SD1077) is used to input the actual line speed. (When **Pr.544** = "18 or 28")

PLC function device number	Address*1	Description	
		Upper 8 bits	Lower 8 bits
SD1062	RWwn+10	Registers used to read the data received from the master station	
SD1063	RWwn+11		
SD1064	RWwn+12		
SD1065	RWwn+13		
SD1066	RWwn+14		
SD1067	RWwn+15		
SD1068	RWwn+16		
SD1069	RWwn+17		
SD1070	RWwn+18		
SD1071	RWwn+19		
SD1072	RWwn+1A		
SD1073	RWwn+1B		
SD1074	RWwn+1C		
SD1075	RWwn+1D		
SD1076	RWwn+1E	Dancer / tension sensor feedback (when **Pr.363** = "9")	
		Registers used to read the data received from the master station (when **Pr.363** ≠ "9")	
SD1077	RWwn+1F	Actual line speed input (when **Pr.362** = "9")	
		Registers used to read the data received from the master station (when **Pr.362** ≠ "9")	

*1 "n" indicates a value determined by the station number setting.

NOTE

- For other registers, refer to the PLC Function Programming Manual.

11.5 Common specifications

Control specifications	Control method		Soft-PWM control, high carrier frequency PWM control (selectable among V/F control, Advanced magnetic flux vector control, Real sensorless vector control), Optimum excitation control, and vector control *1
	Output frequency range		0.2 to 590 Hz (The upper-limit frequency is 400 Hz (200 Hz for the SND rating) under Advanced magnetic flux vector control, Real sensorless vector control, and vector control*1.)
	Frequency setting resolution	Analog input	0.015 Hz/60 Hz (0 to 10 V/12 bits for terminals 2 and 4) 0.03 Hz/60 Hz (0 to 5 V/11 bits or 0 to 20 mA/approx. 11 bits for terminals 2 and 4, 0 to ±10 V/12 bits for terminal 1) 0.06 Hz/60 Hz (0 to ±5 V/11 bits for terminal 1)
		Digital input	0.01 Hz
	Frequency accuracy	Analog input	Within ±0.2% of the max. output frequency (25°C ± 10°C)
		Digital input	Within 0.01% of the set output frequency
	Voltage/frequency characteristics		Base frequency can be set from 0 to 590 Hz. Constant-torque/variable-torque pattern can be selected.
	Starting torque		SLD Rating:120% 0.3 Hz, LD Rating:150% 0.3 Hz, SND Rating:150% 0.3 Hz, ND Rating:200% 0.3 Hz*2, HD Rating:250% 0.3 Hz*2 (Real sensorless vector control, vector control*1)
	Torque boost		Manual torque boost
	Acceleration/deceleration time setting		0 to 3600 s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode, backlash countermeasures acceleration/deceleration can be selected.
	DC injection brake (induction motor)		Operation frequency (0 to 120 Hz), operation time (0 to 10 s), operation voltage (0 to 30%) variable
	Stall prevention operation level		Activation range of stall prevention operation (SLD rating: 0 to 120%, LD rating: 0 to 150%, SND rating: 0 to 220%, ND rating: 0 to 220%, HD rating: 0 to 280%). Whether to use the stall prevention or not can be selected. (V/F control, Advanced magnetic flux vector control)
	Torque limit level		Torque limit value can be set (0 to 400% variable). (Real sensorless vector control, vector control *1)
Operation specifications	Frequency setting signal	Analog input	Terminals 2 and 4: 0 to 10 V, 0 to 5 V, 4 to 20 mA (0 to 20 mA) are available. Terminal 1: -10 to +10 V, -5 to +5 V are available.
		Digital input	Input using the setting dial of the operation panel or parameter unit Four-digit BCD or 16-bit binary (when used with option FR-A8AX)
	Start signal		Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected.
	Input signals (twelve terminals)		Low-speed operation command, Middle-speed operation command, High-speed operation command, Second function selection, Terminal 4 input selection, Jog operation selection, Selection of automatic restart after instantaneous power failure, Flying start, Output stop, Start self-holding selection, Forward rotation command, Reverse rotation command, Inverter reset The input signal can be changed using **Pr.178 to Pr.189 (input terminal function selection)**.
		Pulse train input	100k pulses/s
	Operational functions		Dancer feedback speed control, tension sensor feedback speed control, tension sensorless torque control, tension sensor feedback torque control, winding diameter calculation, initial winding diameter calculation, actual line speed detection, reduction ratio setting, maximum/minimum winding diameter setting, winding diameter / winding length storage, line speed acceleration/deceleration function, dancer roll break detection, tension PI gain tuning, speed control proportional gain compensation, reel change function, taper function, inertia compensation function, mechanical loss compensation function, maximum and minimum frequency settings, multi-speed operation, acceleration/deceleration pattern, thermal protection, DC injection brake, starting frequency, JOG operation, output stop (MRS), stall prevention, regeneration avoidance, DC feeding*3, frequency jump, rotation display, automatic restart after instantaneous power failure, retry function, carrier frequency selection, fast-response current limit, forward/reverse rotation prevention, operation mode selection, slip compensation, droop control, speed smoothing control, auto tuning, applied motor selection, gain tuning, RS-485 communication, Ethernet communication*8, dancer control, cooling fan operation selection, stop selection (deceleration stop/coasting), power-failure deceleration stop function, PLC function, life diagnosis, maintenance timer, current average monitor, multiple rating, speed control, torque control, pre-excitation, torque limit, test run, 24 V power supply input for control circuit, safety stop function
	Output signal	Open collector output (five terminals) Relay output (two terminals)	Inverter running, Up to frequency, Instantaneous power failure/undervoltage*3, Overload warning, Output frequency detection, Fault The output signal can be changed using **Pr.190 to Pr.196 (output terminal function selection)**. Fault codes of the inverter can be output (4 bits) from the open collector.
		Pulse train output (FM type)	50k pulses/s
Indication	For meter	Pulse train output (FM type)	Max. 2.4 kHz: one terminal (output frequency) The monitor item can be changed using **Pr.54 FM/CA terminal function selection.**
		Current output (CA type)	Max. 20 mADC: one terminal (output frequency) The monitor item can be changed using **Pr.54 FM/CA terminal function selection.**
		Voltage output	Max. 10 VDC: one terminal (output frequency) The monitor item can be changed using **Pr.158 AM terminal function selection.**
	Operation panel (FR-DU08)	Operating status	Output frequency, Output current, Output voltage, Frequency setting value The monitor item can be changed using **Pr.52 Operation panel main monitor selection**.
		Fault record	A fault record is displayed when a fault occurs. Past 8 fault records and the conditions immediately before the fault (output voltage/current/frequency/cumulative energization time/year/month/date/time) are saved.
Protective/warning function		Protective function	Overcurrent trip during acceleration, Overcurrent trip during constant speed, Overcurrent trip during deceleration or stop, Regenerative overvoltage trip during acceleration, Regenerative overvoltage trip during constant speed, Regenerative overvoltage trip during deceleration or stop, Inverter overload trip (electronic thermal relay function), Motor overload trip (electronic thermal relay function), Heat sink overheat, Instantaneous power failure*3, Undervoltage*3, Input phase loss*3*4, Stall prevention stop, Brake transistor alarm detection*3, Upper limit fault detection*4, Lower limit fault detection*4, Output side earth (ground) fault overcurrent, Output short circuit, Output phase loss, External thermal relay operation*4, PTC thermistor operation*4, Option fault, Communication option fault, Parameter storage device fault, PU disconnection, Retry count excess*4, Parameter storage device fault, CPU fault, Operation panel power supply short circuit/RS-485 terminals power supply short circuit, 24 VDC power fault, Abnormal output current detection*4, Inrush current limit circuit fault*3, Communication fault (inverter), Analog input fault, USB communication fault, Safety circuit fault, Overspeed occurrence*4, Speed deviation excess detection*1*4, Signal loss detection*1*4, Encoder phase fault*1*4, 4 mA input fault*4, PID signal fault*4, Option fault, Opposite rotation deceleration fault*4, Internal circuit fault, Encoder pulse number setting error, Overload trip, Ethernet communication fault*8
		Warning function	Fan alarm, Stall prevention (overcurrent), Stall prevention (overvoltage), Regenerative brake pre-alarm*3*4, Electronic thermal relay function pre-alarm, PU stop, Speed limit indication*4, Parameter copy, Safety stop, Maintenance signal output*4, USB host error, Operation panel lock*4, Password locked*4, Parameter write error, Copy operation error, 24 V external power supply operation, Load fault warning, Ethernet communication fault*8
Environment	Surrounding air temperature		-10°C to +50°C (non-freezing) (LD, SND, ND, HD ratings) -10°C to +40°C (non-freezing) (SLD rating)
	Surrounding air humidity		95% RH or less (non-condensing) (With circuit board coating (conforming to IEC60721-3-3: 1994 3C2/3S2)) 90% RH or less (non-condensing) (Without circuit board coating)
	Storage temperature *5		-20°C to +65°C
	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt, etc.)
	Altitude/vibration		Maximum 2500 m *6, 5.9 m/s^2 *7 or less at 10 to 55 Hz (directions of X, Y, Z axes)

*1 Available only when a vector control compatible option is installed.
*2 In the initial setting of the FR-A820-00340(5.5K) or higher and the FR-A840-00170(5.5K) or higher, it is limited to 150% by the torque limit level.
*3 Enabled only for standard models.
*4 This protective function is not available in the initial status.
*5 Temperature applicable for a short time, e.g. in transit.
*6 For the installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.
*7 2.9m/s^2 or less for the FR-A840-04320(160K) or higher.
*8 Available for the Ethernet models only.

11.6 Application examples

This section shows examples of major applications of the FR-A800-R2R inverters which have the dedicated functions for Roll to Roll applications. Each example provides the overview and the example setting of relevant parameters.

11.6.1 Dancer feedback speed control with roll diameter compensation for printers

This is useful for winding paper rolls for printers.
The roll diameter compensation function and the dancer feedback speed control enhance the speed and quality of winding.

◆Requirements for this application

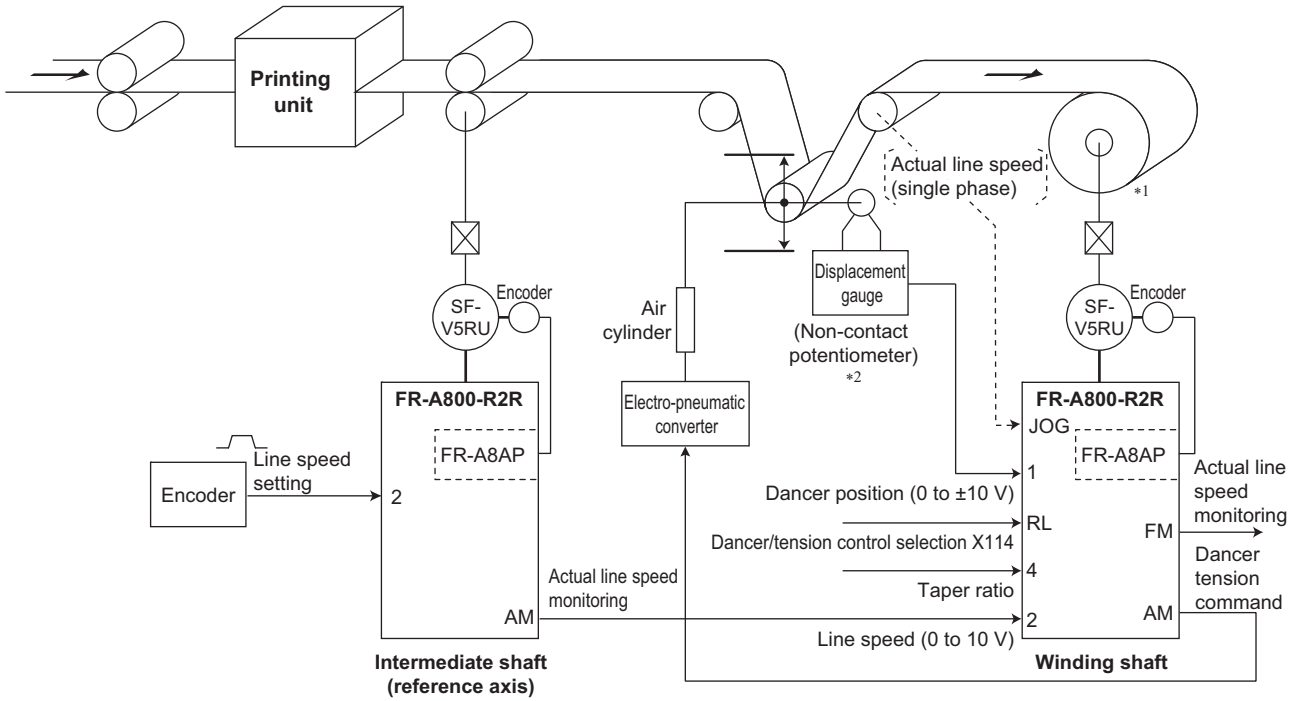
High-speed winding is always required in this application. Furthermore, paper rolls must be wound with less sagging and unevenness. Therefore, fluctuation of dancer rolls must be reduced to a minimum.

Purpose	Inverter features
Prevention of sagging and unevenness	The inverter minimizes speed fluctuation to prevent sagging and unevenness.
Increase speed	Higher responsivity can be expected under Vector control using encoders (internal response: 300 rad/s).
Cost reduction	A dancer roll controller is included in the inverter.

◆Control overview

The FR-A800-R2R inverter for the intermediate roller controls the total line speed of paper rolls. The tension of the paper to be wound is constantly maintained by the dancer roll. Another FR-A800-R2R inverter is used to control the speed of the winding shaft. The inverter keeps the tension of the paper constant for winding by identifying the dancer roll in the same position. The use of the roll diameter compensation function maintains the circumferential speed of the paper roll during winding.
FR-A800-R2R inverters have the following additional functions as compared with the FR-A800 inverter standard models.

Additional function	Description
Dancer feedback speed control function	To keep the position of the dancer roll, PID control is performed for speed control of the winding shaft.
Analog output signal for dancer tension control	Taper function: To change a load applied to the dancer roll, analog signals as tension control commands are output to an electro-pneumatic converter.
Roll diameter compensation function	After the winding roll diameter is calculated, the motor speed is controlled based on data of the diameter so that circumferential speed of the winding roll are kept constant. This function reduces hunting in dancer feedback speed control. Roll diameter calculators and PID calculators do not need to be added externally.
Tension PI gain tuning	By automatically adjusting the tension PI gain for dancer PID control, time required for adjustment is significantly cut down. Anyone can start the system easily.
Speed control proportional gain compensation function	Speed control proportional gain can be changed based on the value determined by roll diameter calculation.



*1 To keep the line speed constant, the winding speed decreases with increasing the roll diameter. The FR-A800-R2R inverter automatically calculates the winding speed by calculating roll diameter.

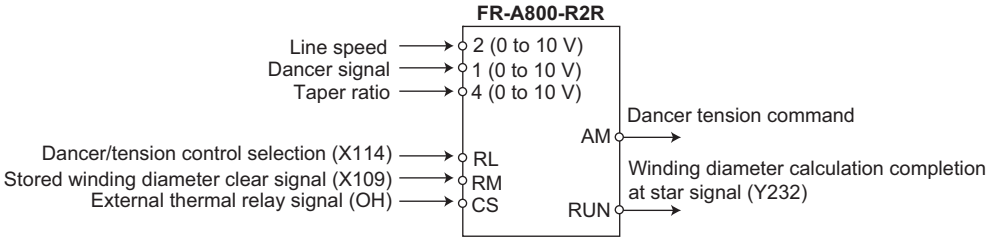
*2 Dancer feedback speed control (PID control) is performed to compensate the frequency so that measurements shown on the displacement gauge (non-contact potentiometer) remains the same.

◆ Example setting of parameters

The following shows mechanical specifications and parameter settings required for configuring the system shown as the application example. The parameter settings are examples for a 15 kW motor and the 18.5 kW inverter used for the winding shaft.

Item	Specification
Minimum roll diameter	100 mm
Maximum roll diameter	1000 mm
Gear ratio	1/3
Maximum speed of the actual line	200 m/min
Dancer signal	0 to 10 V input
Line speed command	Analog signal, 0 to 10 V input (60 seconds cushion time enabled at acceleration/deceleration)
Initial roll diameter calculation	Enabled

Item	Specification
Accumulated amount	300 mm
Roll diameter storage	Enabled
Tension setting output	Required
Taper control	Enabled
Roll diameter at taper start	800 mm
Taper ratio	40%
Taper ratio setting	Analog signal, 0 to 10 V input



Pr.	Parameter name	Initial value	Setting value	Remarks
1	Maximum frequency	120 Hz	70 Hz	Set about 110% of the maximum speed (the maximum speed refers to the motor speed for the minimum-diameter roll at the maximum line speed) (the amount of dancer compensation: about 10%). ω = Maximum line speed / (π × Minimum diameter × Gear ratio) = 200 × 10^3 / (π × 100 × 1/3) / 30 ≒ 63.66 Hz × 1.1 ≒ 70 Hz

Pr.	Parameter name	Initial value	Setting value	Remarks
7	Acceleration time	15 s	0 s	Use these parameters to improve trackability of the dancer feedback speed control.
8	Deceleration time	15 s	0 s	
9	Electronic thermal O/L relay	Inverter rated current	0 A	Setting for a specific motor for Vector control (motor with built-in thermal protector).
10*1	DC injection brake operation frequency	3 Hz	0.5 Hz	
18	High speed maximum frequency	120 Hz	70 Hz	
52	Operation panel main monitor selection	0	22	Set "22" (Roll diameter) for monitoring. Or use any of **Pr.774 to Pr.776** when using the 3-line monitor screen on the PU. Other monitor items related to this application and their setting values are as follows: 26 (Line speed command), 27 (Actual line speed), 28 (Dancer compensation speed), 29 (Winding length), 52 (PID set point), 53 (PID measured value), and 54 (PID deviation).
71	Applied motor	0	30	30: Setting for the Mitsubishi Electric Vector control dedicated motor SF-V5RU.
72	PWM frequency selection	2	15	
73	Analog input selection	1	10	10: Terminal 2 input between 0 to 10 V for the line speed and terminal 1 input between 0 to 10 V for the dancer signal with reversible polarity.
80	Motor capacity	9999	15 kW	Set these parameters according to the motor.
81	Number of motor poles	9999	4 (poles)	
83	Rated motor voltage	200 V	164 V	
84	Rated motor frequency	9999	51	
128	PID action selection	0	40	40: Dancer control enabled (reverse action)
129*1	PID proportional band	100%	100%	Performing tension PI gain tuning allows setting these parameters.
130*1	PID integral time	1 s	10 s	
133*1	PID action set point	500%	550%	Set **Pr.52** = "86" (Terminal 1 input after calibration in %) to check the upper and lower limit of the dancer roll position. Set the target position (neutral position) in this parameter according to the check result.
134*1	PID differential time	9999	9999	To improve trackability of a mechanical extraneous disturbance (variation), set 0.01 seconds at first, and change the setting to a slightly larger value as required. (Set the minimum possible value because setting a too large value causes hunting.)
158	AM terminal function selection	1	19	19: Analog output signal for dancer tension control
180	RL terminal function selection	0	114	114: Tension control selection (X114) signal ON (Setting "114" is required for tension control.)
181	RM terminal function selection	1	109	109: Stored winding diameter clear (X109) signal ON (Setting "109" clears the stored roll diameter.)
186	CS terminal function selection	6	7	7: External thermal relay input (OH) signal (Setting "7" is required for signals input from the SF-V5RU thermal protector.)
190	RUN terminal function selection	0	232	232: Winding diameter calculation completion at start (Y232) signal (positive logic)
267	Terminal 4 input selection	0	2	2: Terminal 4 input between 0 to 10 V for the taper ratio setting
350	Line speed command voltage/ current bias	0%	0%	
351	Line speed command bias	0 m/min	0 m/min	Use **Pr.358** to set the increment.
352	Line speed command voltage/ current gain	50%	100%	
353	Line speed command gain	0 m/min	200 m/min	Use **Pr.358** to set the increment. Max. line speed: 200 m/min
358	Line speed unit	0	0	0: m/min (increment of the maximum line speed)
360	Line speed command value	0 m/min	0 m/min	If setting **Pr.361** to "8", set a line speed command value in this parameter.
361	Line speed command input selection	9999	0	
362	Actual line speed input selection	0	0	0: Signals for the actual line speed are not input (the actual line speed is determined by calculating from the line speed setting).
363	Dancer / tension sensor feedback input selection	9999	5	5: Dancer signals input via terminal 1.
369	Number of encoder pulses	1024	2048	

Pr.	Parameter name	Initial value	Setting value	Remarks
393	Line speed command acceleration/deceleration reference	1000 m/min	100 m/min	
394	First acceleration time for line speed command	15 s	0 s	Setting must be lower than the acceleration/deceleration rate of the line speed command (input via terminals 2 and 5). (In this example, setting these parameters are not required as the cushion time is considered for the line speed command.)
395	First deceleration time for line speed command	15 s	0 s	
430	Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2	100%	100%	
622*1	Line speed command for starting	0 m/min	0 m/min	Setting this parameter avoids intermittent operation after the initial roll diameter calculation is completed.
641*1	Speed control proportional gain 1	9999	60%	By adjusting the speed control proportional gain, response improvement is achievable according to the roll diameter. **Pr.644** (proportional gain for the maximum roll diameter) and **Pr.641** (proportional gain for the minimum roll diameter) are used for determination of the setting of **Pr.642** and **Pr.643**. **Pr.642** = α/5 + **Pr.641** **Pr.643** = 8 × α/15 + **Pr.641** (α = **Pr.644** - **Pr.641**)
642*1	Speed control proportional gain 2	9999	80%	
643*1	Speed control proportional gain 3	9999	120%	
644*1	Speed control proportional gain 4	9999	200%	
645	Winding diameter storage selection	0	1	When "1" (storing roll diameters enabled) is set, the input of the Stored winding diameter clear (X109) signal is required. The storing of roll diameters (writing in EEPROM) is conducted when the inverter power or the X114 signal turns OFF. Note that storing is not conducted when the RES signal is input. Therefore, avoid inputting the RES signal frequently without storing the roll diameters. For the input of the RES signal by necessity such as a reset of the inverter fault, it is recommended to configure the sequence that the RES signal will be input after the X114 signal turns OFF and before the X114 signal turns ON again.
647	Operation time with stored winding diameter	0 s	0.01 s	Be sure to set this parameter when storing roll diameters is set to enabled (the value of the stored roll diameter is not applied to any setting if this parameter is not set).
800	Control method selection	20	0	0: Vector control (speed control)
821	Speed control integral time 1	0.333 s	0 s	Set 0 seconds to disable the integral so that the inverter acts as a proportional amplifier.
868	Terminal 1 function assignment	0	9999	9999: Function disabled. (Setting "9999" is required to prevent compensation for the dancer signal voltage input from being added when the X114 signal is OFF.)
C2 (902)*1*2	Terminal 2 frequency setting bias frequency	0 Hz	0 Hz	Use these parameters to correct the offset of the line speed commands.
C3 (902)*1*2	Terminal 2 frequency setting bias	0%	3%	
C6 (904)*1*2	Terminal 4 frequency setting bias	20%	0%	Use this parameter to correct the taper ratio setting.
C7 (905)*1*2	Terminal 4 frequency setting gain	100%	40%	
1003*1	Notch filter frequency	0	100 Hz	Use this parameter to decrease whining sound of a motor when stopped.
1004*1	Notch filter depth	0	2	
1219	Tension PI gain tuning start/ status	0	1	1: Tension PI gain tuning starts.
1222*1	Target amplitude	9999	1%	Set the target amplitude for the limit cycle. Start tuning with a small value and gradually increase the value while making sure that tuning causes no problem.
1230	Winding/unwinding selection	0	0	0:Winding, 1: Unwinding
1235	Maximum winding diameter 1	2 mm	1000 mm	
1236	Minimum winding diameter 1	1 mm	100 mm	
1243	Gear ratio numerator	1	1	Set the gear ratio of the unwinding shaft as a accurately as possible.
1244	Gear ratio denominator	1	3	
1245*1	Sampling time for winding diameter calculation	9999	0.1 s	Setting is recommended when the results of the roll diameter calculation change significantly.

Pr.	Parameter name	Initial value	Setting value	Remarks
1246*1	Line speed at winding diameter calculated value activation	1 m/min	1 m/min	
1247*1	Winding diameter change increment amount limit	9999	0.2 mm	Setting **Pr.1247** = "9999 (initial value)" disables the roll diameter calculation. Be sure to change the setting from the initial value for the roll diameter calculation.
1249*1	Number of averaging for winding diameter calculation	4	4	Use this parameter to enable the primary delay filter relative to the result of the roll diameter calculation.
1251*1	Winding diameter compensation speed filter time constant	0 s	0.1 s	
1252*1	Dancer lower limit position	400%	500%	
1253*1	Initial winding diameter calculation deadband	1.0%	10%	
1254*1	Initial winding diameter calculation deadband 2	9999	0%	Use this parameter to prevent the dancer roll from moving too much when the normal operation starts after the initial roll diameter calculation is completed.
1255*1	Accumulated amount	9999	270 mm	The setting value can be calculated from the setting of **Pr.1253 Initial winding diameter calculation deadband** (10%) and the accumulated amount (300 mm) as follows: 300 mm × 0.9 = 270 mm
1258*1	Integral term limit at start	2.5%	1.5%	Use these parameters to adjust winding speed for the initial roll diameter calculation.
1259*1	PID term limit at start	2.5%	1.5%	
1285	Taper setting analog input selection	9999	4	4: The taper ratio is input through terminal 4.
1286	Winding diameter at taper start	9999	800 mm	
1287	Taper ratio setting	0%	9999	9999: The taper ratio is set through the analog input terminal.

*1 Adjustment parameter.

*2 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

11.6.2 Dancer feedback speed control with roll diameter compensation for wire drawing machines

This is useful for winding wire using a wire drawing machine.
The dancer feedback speed control with roll diameter compensation function in the inverter enable high-speed winding for high-inertia loads.

◆Requirements for this application

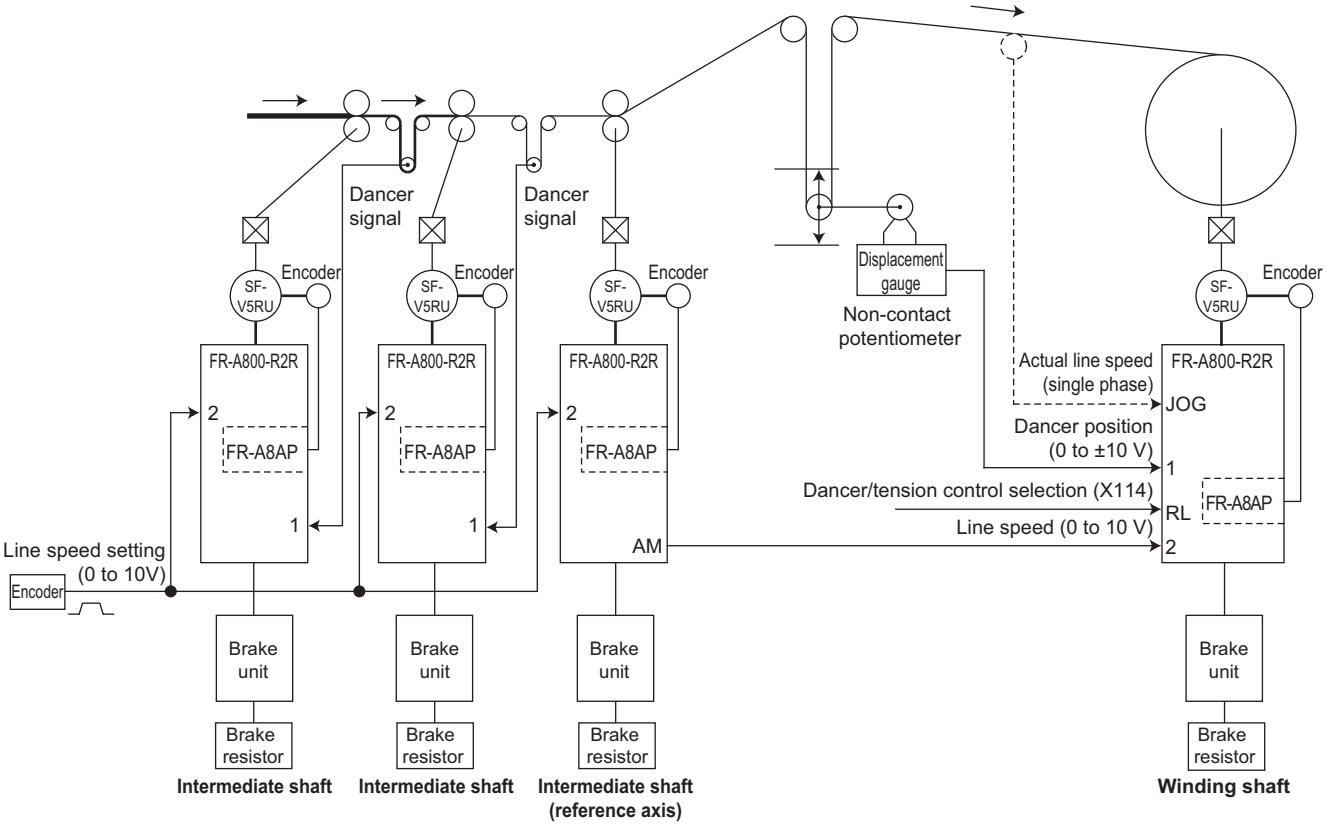
High-speed winding for high-inertia loads and the stability of a dancer roll are required in this application.

Purpose	Inverter features
Stability of dancer roll	The inverter minimizes speed fluctuation to prevent sagging and unevenness.
Winding for high-inertia loads	Higher responsivity can be expected under Vector control using encoders (internal response: 300 rad/s).
Cost reduction	A dancer roll controller is included in the inverter.

◆Control overview

The wire drawing section pulls the wire at a constant speed to make the wire thinner. Tension of wire to be wound is maintained constant by the dancer roll. For the winding shaft, the inverter provides dancer feedback speed control to keep the dancer roll position, achieving constant tension winding. In addition, using the roll diameter compensation function, the circumferential speed of the winding bobbin is kept constant.
FR-A800-R2R inverters have the following additional functions as compared with the FR-A800 inverter standard models.

Additional function	Description
Dancer feedback speed control function	The winding shaft rotation speed is controlled to keep the dancer roll position constant.
Roll diameter compensation function	After the winding roll diameter is calculated, the motor speed is controlled based on data of the diameter so that circumferential speed of the winding roll are kept constant. This function reduces hunting in dancer feedback speed control. Roll diameter calculators and PID calculators do not need to be added externally.
Tension PI gain tuning	By automatically adjusting the tension PI gain for dancer PID control, time required for adjustment is significantly cut down. Anyone can start the system easily.
Speed control proportional gain compensation function	Speed control proportional gain can be changed based on the value determined by roll diameter calculation.



◆Example setting of parameters

The following shows mechanical specifications and parameter settings required for configuring the system shown as the application example. The parameter settings are examples for a 7.5 kW motor and the 11 kW inverter used for the winding shaft.

Item	Specification
Minimum roll diameter	280 mm
Maximum roll diameter	400 mm
Gear ratio	1/1.2
Maximum speed of the actual line	2000 m/min
Dancer signal	0 to 10 V input

Item	Specification
Line speed command	Analog signal, 0 to 10 V input (90 seconds cushion time enabled at acceleration/deceleration)
Initial roll diameter calculation	Disabled
Roll diameter storage	Enabled
Tension setting output	Required

Pr.	Parameter name	Initial value	Setting value	Remarks
7	Acceleration time	15 s	0.1 s	Use these parameters to improve trackability of the dancer feedback speed control. (In this example, 0.1 seconds is applied to avoid the influence of external noises. Setting a larger value worsen the trackability.)
8	Deceleration time	15 s	0.1 s	
9	Electronic thermal O/L relay	Inverter rated current	0 A	Setting for a specific motor for Vector control (motor with built-in thermal protector).
10	DC injection brake operation frequency	3 Hz	0 Hz	
52	Operation panel main monitor selection	0	22	Set "22" (Roll diameter) for monitoring. Or use any of **Pr.774 to Pr.776** when using the 3-line monitor screen on the PU. Other monitor items related to this application and their setting values are as follows: 26 (Line speed command), 27 (Actual line speed), 28 (Dancer compensation speed), 29 (Winding length), 52 (PID set point), 53 (PID measured value), and 54 (PID deviation).
71	Applied motor	0	30	30: Setting for the Mitsubishi Electric Vector control dedicated motor SF-V5RU.
73	Analog input selection	1	10	10: Terminal 2 input between 0 to 10 V for the line speed and terminal 1 input between 0 to 10 V for the dancer signal with reversible polarity.
79	Operation mode selection	0	2	2: External operation mode only.
80	Motor capacity	9999	7.5 kW	Set these parameters according to the motor.
81	Number of motor poles	9999	4 (poles)	
83	Rated motor voltage	200 V	164 V	
84	Rated motor frequency	9999	51 Hz	
128	PID action selection	0	41	41: Dancer control enabled (forward action) (Compensation direction of the dancer signal is reversed since the lower limit of the dancer signal output is 8 V and the upper limit is 2 V.)
129*1	PID proportional band	100%	250%	Performing tension PI gain tuning allows setting these parameters.
130*1	PID integral time	1 s	5 s	
133*1	PID action set point	500%	550%	Set **Pr.52** = "86" (Terminal 1 input after calibration in %) to check the upper and lower limit of the dancer roll position. Set the target position (neutral position) in this parameter according to the check result.
134*1	PID differential time	9999	0.05 s	To improve trackability of a mechanical extraneous disturbance (variation), set 0.01 seconds at first, and change the setting to a slightly larger value as required. (Set the minimum possible value because setting a too large value causes hunting.)
180	RL terminal function selection	0	114	114: Tension control selection (X114) signal ON (Setting "114" is required for tension control.)
181	RM terminal function selection	1	109	109: Stored winding diameter clear (X109) signal ON (Setting "109" clears the stored roll diameter.)

Pr.	Parameter name	Initial value	Setting value	Remarks
186	CS terminal function selection	6	7	7: External thermal relay input (OH) signal (Setting "7" is required for signals input from the SF-V5RU thermal protector.)
242	Terminal 1 added compensation amount (terminal 2)	100%	0%	Setting 0% is required to disable additional input to the dancer signal (compensation for addition via terminal 1) while the X114 signal is OFF and the normal operation is carried out.
350	Line speed command voltage/ current bias	0%	0%	
351	Line speed command bias	0 m/min	0 m/min	Use **Pr.358** to set the increment.
352	Line speed command voltage/ current gain	50%	100%	
353	Line speed command gain	0 m/min	2000 m/min	Use **Pr.358** to set the increment. Max. line speed: 2000 m/ min
358	Line speed unit	0	0	0: m/min (increment of the maximum line speed)
360	Line speed command value	0 m/min	0 m/min	If setting **Pr.361** to "8", set a line speed command value in this parameter.
361	Line speed command input selection	9999	0	
362	Actual line speed input selection	0	0	0: Signals for the actual line speed are not input (the actual line speed is determined by calculating from the line speed setting).
363	Dancer / tension sensor feedback input selection	9999	5	5: Dancer signals input via terminal 1.
369	Number of encoder pulses	1024	2048	
393	Line speed command acceleration/deceleration reference	1000 m/min	100 m/min	
394	First acceleration time for line speed command	15 s	0.5 s	Setting must be lower than the acceleration/deceleration rate of the line speed command (input via terminals 2 and 5). (In this example, setting these parameters are not required as the cushion time is considered for the line speed command. However, 0.5 seconds is set as a precaution against noise.)
395	First deceleration time for line speed command	15 s	0.5 s	
622*1	Line speed command for starting	0 m/min	0 m/min	Setting this parameter avoids intermittent operation after the initial roll diameter calculation is completed.
641*1	Speed control proportional gain 1	9999	100%	By adjusting the speed control proportional gain, response improvement is achievable according to the roll diameter. **Pr.644** (proportional gain for the maximum roll diameter) and **Pr.641** (proportional gain for the minimum roll diameter) are used for determination of the setting of **Pr.642** and **Pr.643**. **Pr.642** = α/5 + **Pr.641** **Pr.643** = 8 × α/15 + **Pr.641** (α = **Pr.644** - **Pr.641**)
642*1	Speed control proportional gain 2	9999	140%	
643*1	Speed control proportional gain 3	9999	200%	
644*1	Speed control proportional gain 4	9999	300%	
645	Winding diameter storage selection	0	1	When "1" (storing roll diameters enabled) is set, the input of the Stored winding diameter clear (X109) signal is required. The storing of roll diameters (writing in EEPROM) is conducted when the inverter power or the X114 signal turns OFF. Note that storing is not conducted when the RES signal is input. Therefore, avoid inputting the RES signal frequently without storing the roll diameters. For the input of the RES signal by necessity such as a reset of the inverter fault, it is recommended to configure the sequence that the RES signal will be input after the X114 signal turns OFF and before the X114 signal turns ON again.
647	Operation time with stored winding diameter	0 s	0.01 s	Be sure to set this parameter when storing roll diameters is set to enabled (the value of the stored roll diameter is not applied to any setting if this parameter is not set).
800	Control method selection	20	0	0: Vector control (speed control)
821	Speed control integral time 1	0.333 s	0 s	Set 0 seconds to disable the integral so that the inverter acts as a proportional amplifier.
822*1	Speed setting filter 1	9999	0.5 s	Set this parameter when noise is superimposed on the input analog signals.
1003*1	Notch filter frequency	0	50 Hz	Use this parameter to decrease whining sound of a motor when stopped.
1004*1	Notch filter depth	0	2	

Pr.	Parameter name	Initial value	Setting value	Remarks
1219	Tension PI gain tuning start/ status	0	1	1: Tension PI gain tuning starts.
1222*1	Target amplitude	9999	1%	Set the target amplitude for the limit cycle. Start tuning with a small value and gradually increase the value while making sure that tuning causes no problem.
1230	Winding/unwinding selection	0	0	0:Winding, 1: Unwinding
1235	Maximum winding diameter 1	2 mm	400 mm	Set the initial roll diameter as accurately as possible. (Unwinding roll: maximum diameter / Winding roll: minimum diameter).
1236	Minimum winding diameter 1	1 mm	280 mm	
1243	Gear ratio numerator	1	10	Set the gear ratio of the unwinding shaft as accurately as possible.
1244	Gear ratio denominator	1	12	
1245*1	Sampling time for winding diameter calculation	9999	0.1 s	Setting is recommended when the results of the roll diameter calculation change significantly.
1247*1	Winding diameter change increment amount limit	9999	0.1 mm	Setting **Pr.1247** = "9999 (initial value)" disables the roll diameter calculation. Be sure to change the setting from the initial value for the roll diameter calculation.
1249*1	Number of averaging for winding diameter calculation	4	4	Use this parameter to enable the primary delay filter relative to the result of the roll diameter calculation.
1251*1	Winding diameter compensation speed filter time constant	0 s	0.1 s	
1255	Accumulated amount	9999	9999	9999: Initial roll diameter calculation disabled.

*1 Adjustment parameter.

11.6.3 Tension sensorless torque control with roll diameter compensation for printers

This is useful for winding paper rolls for printers.
Torque control by the inverter with tension control, inertia compensation, and mechanical loss compensation enables the winding of paper rolls without dancer rolls and tension controllers.

◆Requirements for this application

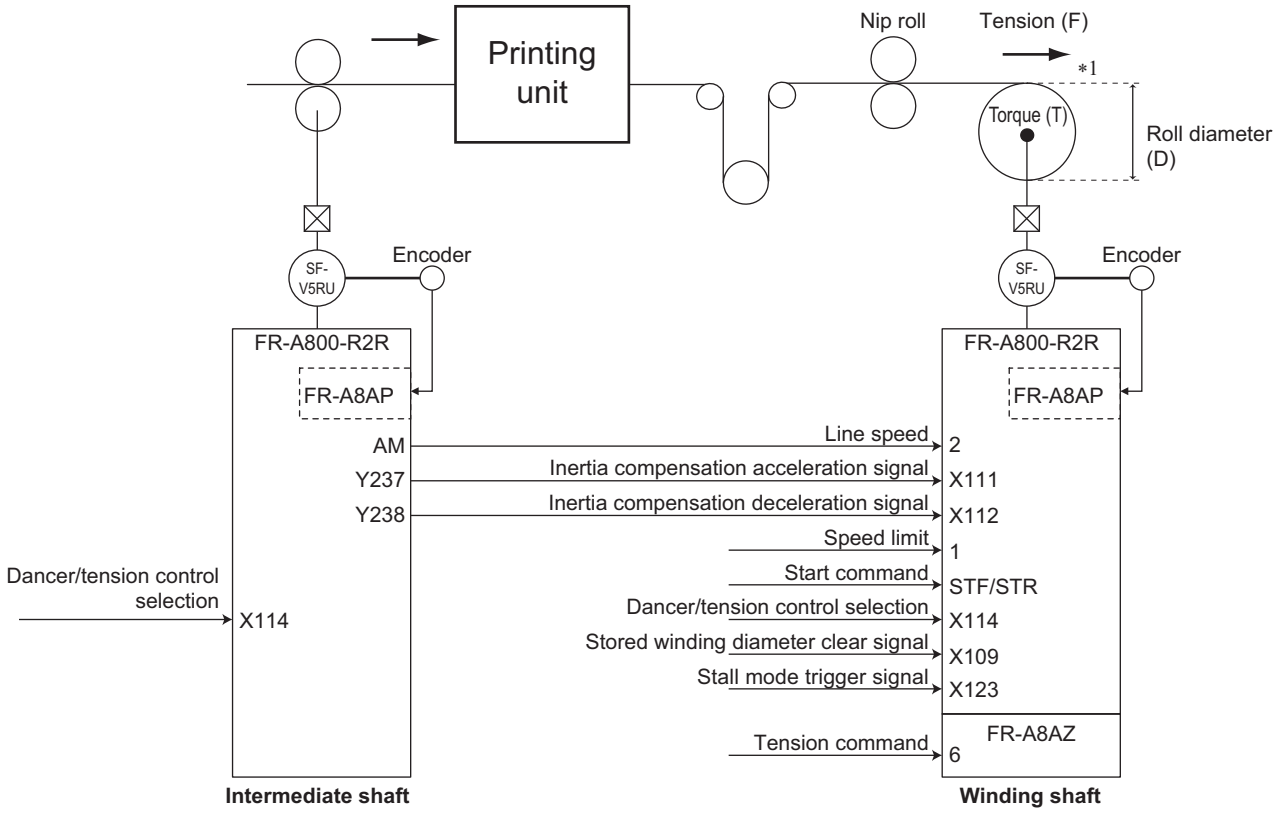
This control method is suitable for a winding application where a reasonable finish is required in about half the dancer-roll-winding machine speed.

Purpose	Inverter features
Cost reduction	Dancer rolls and tension controllers are not required for the winding system (tension control).
Constant tension	Tension is kept steady during operation including acceleration/deceleration (by inertia compensation and mechanical loss compensation).

◆Control overview

The FR-A800-R2R inverter is used for roll winding machines.
The inverter controls the motor output torque according to the calculated diameter of a paper roll to make paper tension constant.
When the paper feed speed of the printer is increased (or decreased), the inverter changes the torque command value according to the inertia of the paper roll to give the acceleration (or deceleration) torque to keep a constant tension. A taper ratio can be also set to prevent the roll from getting too tight.
FR-A800-R2R inverters have the following additional functions as compared with the FR-A800 inverter standard models.

Additional function	Description
Roll diameter calculation function, tension control	The inverter controls the motor output torque according to the changing diameter of a paper roll to make paper tension constant.
Taper function	Tension is reduced when the roll diameter increases in order to prevent the roll from getting too tight. Various taper ratio settings are enabled using parameters.
Inertia compensation function	Paper tension is kept constant by adding the acceleration/deceleration torque even when the paper feeding speed increases/decreases.
Mechanical loss compensation function	The torque command, which is calculated in consideration of the mechanical loss amount, is given to avoid tension changes due to mechanical losses.



*1 To make the tension constant, the torque is controlled according to the changing roll diameter.
Motor torque (T) = Tension (F) × Roll diameter (D) / 2

◆Example setting of parameters

The following shows mechanical specifications and parameter settings required for configuring the system shown as the application example. The parameter settings are examples for a 7.5 kW motor and the 11 kW inverter used for the winding shaft.

Item	Specification
Minimum roll diameter	100 mm
Maximum roll diameter	300 mm
Gear ratio	1/1.2
Maximum speed of the actual line	400 m/min

Item	Specification
Initial roll diameter calculation	Disabled
Roll diameter storage	Enabled
Tension command	0 to 300 N
Tension setting output	Required

Pr.	Parameter name	Initial value	Setting value		Remarks
			Intermediate shaft	Winding shaft	
7	Acceleration time	15 s	0 s		
8	Deceleration time	15 s	0 s		
9	Electronic thermal O/L relay	Inverter rated current	0		
10	DC injection brake operation frequency	3 Hz	0.5 Hz	0 Hz	
12	DC injection brake operation voltage	4%	2.5%		
52	Operation panel main monitor selection	0	27	22	Set "22" (Roll diameter) or "27" (Actual line speed) for monitoring. Or use any of **Pr.774 to Pr.776** when using the 3-line monitor screen on the PU. Other monitor items related to this application and their setting values are as follows: 26 (Line speed command), 81 (Tension command after taper compensation), 82 (Winding diameter compensation torque command), 83 (Inertia compensation), and 84 (Mechanical loss compensation).
71	Applied motor	0	30		30: Setting for the Mitsubishi Electric Vector control dedicated motor SF-V5RU.
73	Analog input selection	1	1	10	10: Terminal 2 input between 0 to 10 V for the line speed with reversible polarity.
80	Motor capacity	9999	7.5 kW		Set these parameters according to the motor.
81	Number of motor poles	9999	4 (poles)		
83	Rated motor voltage	200 V	164 V		
84	Rated motor frequency	9999	51 Hz		
95	Online auto tuning selection	0	0	2	2: Magnetic flux observer (continuous tuning)
128	PID action selection	0	40	0	
129	PID proportional band	100%	9999	100%	
130	PID integral time	1 s	9999	1 s	
134	PID differential time	9999	9999	9999	
158	AM terminal function selection	1	26	1	26 (for intermediate shaft): Line speed command value
180	RL terminal function selection	0	114		114: Tension control selection (X114) signal ON (Setting "114" is required for tension control.)
181	RM terminal function selection	1	1	109	109: Stored winding diameter clear (X109) signal ON (Setting "109" clears the stored roll diameter.)
182	RH terminal function selection	2	2	123	123: Stall mode trigger signal (X123) signal ON (Setting "123" triggers the stall mode.)
184	AU terminal function selection	4	4	111	To use the inertia compensation function, assign the Inertia compensation acceleration (X111) signal and the Inertia compensation deceleration (X112) signal.
189	RES terminal function selection	62	62	112	
193	OL terminal function selection	3	237	3	To use the inertia compensation function, assign the Line speed acceleration (Y237) signal and the Line speed deceleration (Y238) signal to affected output terminals on the inverter for the intermediate roller to output these signal to the inverter for the winding shaft.
194	FU terminal function selection	4	238	4	

Application examples

Pr.	Parameter name	Initial value	Setting value		Remarks
			Intermediate shaft	Winding shaft	
270*1	Acceleration/deceleration time during stall condition	15 s	15 s		Set the acceleration/deceleration time during stall mode.
350	Line speed command voltage/ current bias	0%	0%		
351	Line speed command bias	0 m/min	0 m/min		Use **Pr.358** to set the increment.
352	Line speed command voltage/ current gain	50%	50%	100%	
353	Line speed command gain	0 m/min	400 m/min		Use **Pr.358** to set the increment. Max. line speed: 400 m/min
358	Line speed unit	0	0		0: m/min (increment of the maximum line speed)
360	Line speed command value	0 m/min	0 m/min		If setting **Pr.361** to "8", set a line speed command value in this parameter.
361	Line speed command input selection	9999	3		3: Input via terminal 2
362	Actual line speed input selection	0	0		0: Signals for the actual line speed are not input (the actual line speed is determined by calculating from the line speed setting).
363	Dancer / tension sensor feedback input selection	9999	9999		Leave the setting "9999 (initial value)" (No function) since tension feedback is not required.
369	Number of encoder pulses	1024	2048		
393	Line speed command acceleration/deceleration reference	1000 m/min	250 m/min		The line accelerates to 250 m/min in 5 seconds.
394	First acceleration time for line speed command	15 s	5 s		Setting must be lower than the acceleration/ deceleration rate of the line speed command (input via terminals 2 and 5).
395	First deceleration time for line speed command	15 s	5 s		
645	Winding diameter storage selection	0	0	1	When "1" (storing roll diameters enabled) is set, the input of the Stored winding diameter clear (X109) signal is required. The storing of roll diameters (writing in EEPROM) is conducted when the inverter power or the X114 signal turns OFF. Note that storing is not conducted when the RES signal is input. Therefore, avoid inputting the RES signal frequently without storing the roll diameters. For the input of the RES signal by necessity such as a reset of the inverter fault, it is recommended to configure the sequence that the RES signal will be input after the X114 signal turns OFF and before the X114 signal turns ON again.
647	Operation time with stored winding diameter	0 s	0.01 s		Be sure to set this parameter when storing roll diameters is set to enabled (the value of the stored roll diameter is not applied to any setting if this parameter is not set).
800	Control method selection	20	0	2	0: Vector control (speed control) 2: Vector control (switchover between speed control and torque control)
803	Constant output range torque characteristic selection	0	0		To limit output torque in the constant power range, set "1" (constant torque).
804	Tension / Torque command source selection	0	0		Tension command given by analog input via terminal 1 on the inverter (0 to ±10 VDC) or terminal 6 on the FR-A8AZ (0 to ±10 VDC)
807	Speed limit selection	0	0	2	2: Speed limit command given by analog voltage input via terminal 1
821	Speed control integral time 1	0.333 s	0.333 s	0.333 s	
868	Terminal 1 function assignment	0	0	5	5: Forward/reverse rotation speed limit (**Pr.807**=2)
1230	Winding/unwinding selection	0	1	0	0:Winding, 1: Unwinding
1235	Maximum winding diameter 1	2 mm	80 mm	300 mm	Set the initial roll diameter as accurately as possible. (Unwinding roll: maximum diameter / Winding roll: minimum diameter).
1236	Minimum winding diameter 1	1 mm	80 mm	100 mm	
1243	Gear ratio numerator	1	10		Set the gear ratio of the unwinding shaft as accurately as possible.
1244	Gear ratio denominator	1	12		
1245*1	Sampling time for winding diameter calculation	9999	0.1		Set a sampling time for the roll diameter calculation.
1246*1	Line speed at winding diameter calculated value activation	1 m/min	1 m/min		Set the line speed command value to start the roll diameter calculation.

Pr.	Parameter name	Initial value	Setting value		Remarks
			Intermediate shaft	Winding shaft	
1247*1	Winding diameter change increment amount limit	9999	9999	1 mm	Setting **Pr.1247** = "9999 (initial value)" disables the roll diameter calculation. Be sure to change the setting from the initial value for the roll diameter calculation.
1249*1	Number of averaging for winding diameter calculation	4	4		Use this parameter to enable the primary delay filter relative to the result of the roll diameter calculation.
1255	Accumulated amount	9999	9999		9999: Initial roll diameter calculation disabled.
1284	Taper mode selection	0	0	1	1 (for winding shaft): Linear taper profile
1286	Winding diameter at taper start	9999	9999	240 mm	Set the roll diameter to start taper control.
1287	Taper ratio setting	0%	0%	20%	Set the taper ratio.
1401	Tension command increment	0	1		1: Setting increment: 0.1 N, setting range: 0 to 1000 N
1402	Tension command input voltage bias	0%	0%		Set the tension command in the range of 0 to 300 N.
1403	Tension command bias	0 N	0 N		
1404	Tension command input voltage gain	100%	100%		
1405	Tension command gain	1000 N	300 N		
1406	Commanded tension reduction scaling factor during stall condition	20%	20%		Commanded tension during stall mode = Tension command value × **Pr.1406**
1407	Speed limit during stall condition	1 Hz	1 Hz		Set the speed limit to be used during stall mode.
1410	Motor inertia	0	0	0.01	Set the motor inertia for the inertia compensation function.
1411	Empty reel inertia	0	0	0.01	Set the empty reel inertia for the inertia compensation function.
1412	Roll width	0	0	50 mm	Set the roll width for the inertia compensation function.
1413	Material specific gravity	0	0	1.4	Set the specific gravity of the material for the inertia compensation function.
1414	First acceleration time for inertia compensation	15 s	15 s	5 s	Set the acceleration time for the inertia compensation function.
1415	First deceleration time for inertia compensation	15 s	15 s	5 s	Set the deceleration time for the inertia compensation function.
1419*1	Mechanical loss setting frequency bias	1000%	1001.5%		Set the frequency and the compensation value for each setting of mechanical loss. For setting, start measuring mechanical loss with an empty reel attached at low speeds, and gradually increase the set speed to find the speed requiring mechanical loss compensation.
1420*1	Mechanical loss setting frequency 1	9999	9999	1.33 Hz	
1421*1	Mechanical loss 1	1000%	1000%	1001.5%	
1422*1	Mechanical loss setting frequency 2	9999	9999	2 Hz	
1423*1	Mechanical loss 2	1000%	1000%	1002%	
1424*1	Mechanical loss setting frequency 3	9999	9999	4.67 Hz	
1425*1	Mechanical loss 3	1000%	1000%	1002.5%	
1426*1	Mechanical loss setting frequency 4	9999	9999	23.33 Hz	
1427*1	Mechanical loss 4	1000%	1000%	1003%	
1428*1	Mechanical loss setting frequency 5	9999	9999	50 Hz	
1429*1	Mechanical loss 5	1000%	1000%	1004%	

*1 Adjustment parameter.

11.6.4 Tension sensor feedback torque control with roll diameter compensation for fabric inspection machines

This is useful for a small winding system formed by the small number of shafts (rollers) and no controllers, for example, a fabric inspection machine.
As tension of material rolls can be controlled by the R2R inverters only, winding/unwinding of materials is possible without programmable controllers.

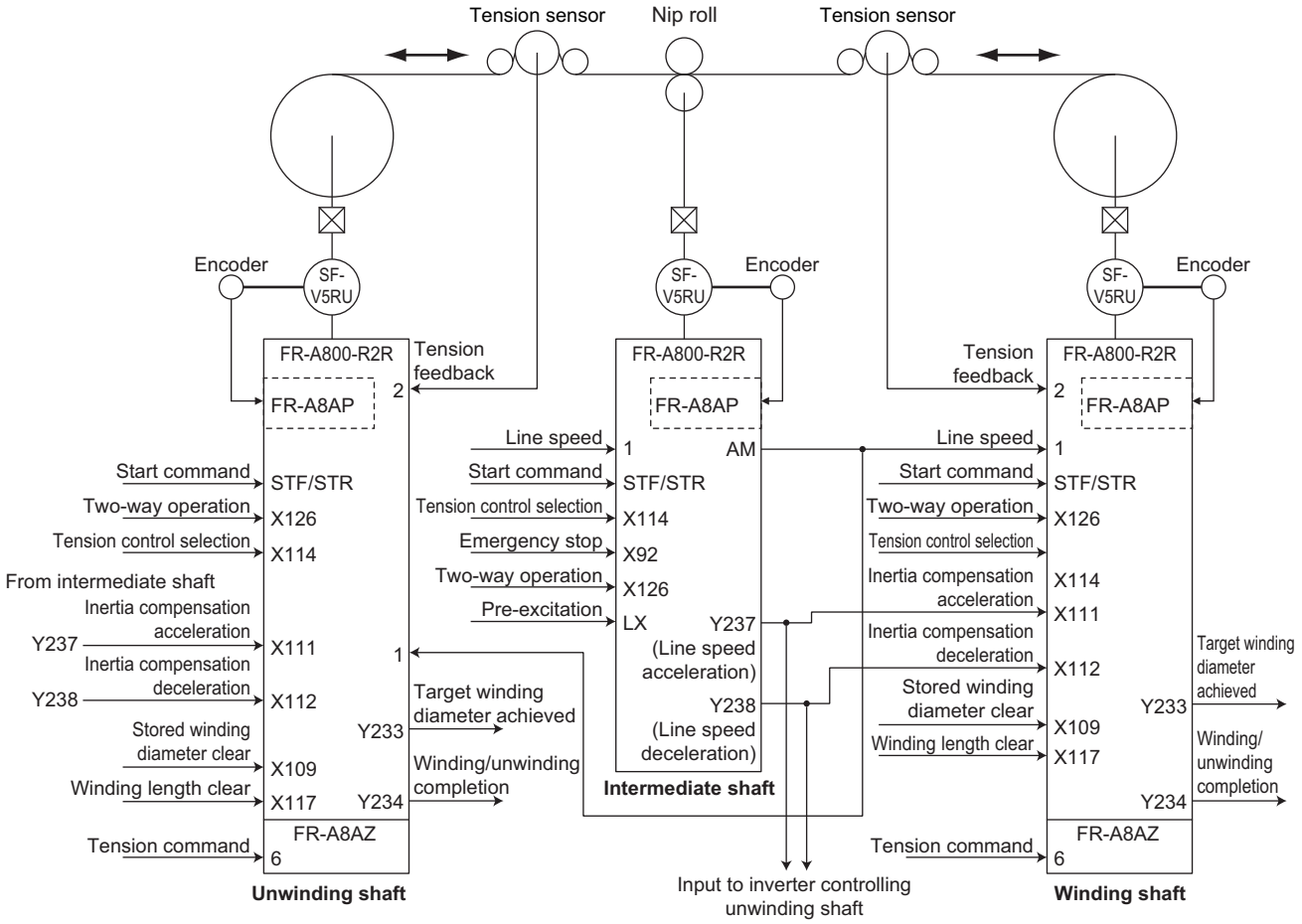
◆Requirements for this application

Highly responsive tension control using feedback from tension sensors is required for the above-mentioned winding system.

Purpose	Inverter features
Cost reduction	Tension control with no programmable controllers improves the maintainability of the winding system and reduces to the total man-hour count to develop the system.
Responsivity enhancement	The responsivity of the R2R inverter performing tension control is high as tension data is fed back to the inverter directly from a tension sensor.

Control overview
The FR-A800-R2R inverter is used for every driving roller in the winding system.
The inverter controls the motor output torque based on tension data fed back from a tension sensor to make fabric tension constant.
FR-A800-R2R inverters have the following additional functions as compared with the FR-A800 inverter standard models.

Additional function	Description
Tension control	The inverter controls the motor output torque according to the changing diameter of a fabric roll to make fabric tension constant.
Inertia compensation function	Fabric tension is kept constant by adding the acceleration/deceleration torque even when the fabric feeding speed increases/decreases.
Mechanical loss compensation function	The torque command, which is calculated in consideration of the mechanical loss amount, is given to avoid tension changes due to mechanical losses.
Two-way operation	The operation can be switched automatically between winding and unwinding.



◆Example setting of parameters

The following shows mechanical specifications and parameter settings required for configuring the system shown as the application example. The parameter settings are examples for a 7.5 kW motor and the 11 kW inverter used for each roller.

Item	Specification
Minimum roll diameter	100 mm
Maximum roll diameter	800 mm
Gear ratio	1/3
Maximum speed of the actual line	300 m/min
Minimum tension	100 N
Maximum tension	300 N

Item	Specification
Tension feedback signal	0 to 10 V / 0 to 300 N input
Tension setting output	Required
Initial roll diameter calculation	Disabled
Roll diameter storage	Enabled
Intermediate shaft (Nip roll) diameter	200 mm

Pr.	Parameter name	Initial value	Setting value			Remarks
			Unwinding shaft	Intermediate shaft	Winding shaft	
7	Acceleration time	15 s	0.1 s	15 s	0.1 s	
8	Deceleration time	15 s	0.1 s	15 s	0.1 s	
9	Electronic thermal O/L relay	Inverter rated current	0			Setting for a Vector control dedicated motor (with built-in thermal protectors).
10	DC injection brake operation frequency	3 Hz	0 Hz			
11	DC injection brake operation time	0.5 s	0 s	0.5 s	0 s	
30	Regenerative function selection	0	1			Set "1" when using the FR-ABR.

Pr.	Parameter name	Initial value	Setting value			Remarks
			Unwinding shaft	Intermediate shaft	Winding shaft	
52	Operation panel main monitor selection	0	22	0		Set "22" (Roll diameter) for monitoring. Or use any of **Pr.774 to Pr.776** when using the 3-line monitor screen on the PU. Other monitor items related to this application and their setting values are as follows: 26 (Line speed command), 27 (Actual line speed), 81 (Tension command after taper compensation), 82 (Winding diameter compensation torque command), 83 (Inertia compensation), and 84 (Mechanical loss compensation).
70	Special regenerative brake duty	0%	6%			Setting is required when the FR-ABR is used (setting value: 10% for the 7.5K inverter or lower, 6% for the 11K inverter or higher). (When the SF-V5RU motor is used, the inverter of the next larger capacity is supposed to be used.)
71	Applied motor	0	30			30: Setting for the Mitsubishi Electric Vector control dedicated motor SF-V5RU.
73	Analog input selection	1	0			0: Terminal 2 input between 0 to 10 V and terminal 1 input between 0 to ±10 V
79	Operation mode selection	0	0	3	0	3 (for intermediate roller): External/PU combined operation mode 1
80	Motor capacity	9999 kW	7.5 kW			Set these parameters according to the motor.
81	Number of motor poles	9999	4 (poles)			
83	Rated motor voltage	200 V	164 V			
84	Rated motor frequency	9999	51 Hz			
95	Online auto tuning selection	0	2	0	2	2: Magnetic flux observer (continuous tuning)
129*1	PID proportional band	100%	50%	0%	50%	Setting increment: 0.1%
130*1	PID integral time	1 s	2 s	300 s	2 s	Setting increment: 0.1 second
158	AM terminal function selection	1	1	26	1	26 (for intermediate roller): Line speed command value
180	RL terminal function selection	0	92			92: Emergency stop (X92) signal
181	RM terminal function selection	1	117			117: Winding length clear (X117) signal (Turning the signal ON clears the winding length.)
182	RH terminal function selection	2	109			109: Stored winding diameter clear (X109) signal (Turning the signal ON clears the stored roll diameter.)
183	RT terminal function selection	3	114			114: Tension control selection (X114) signal (Turning the signal ON is required for tension control.)
184	AU terminal function selection	4	23			23: Pre-excitation (LX) signal
187	MRS terminal function selection	24	126			126: Two-way operation (X126) signal
188	STOP terminal function selection	25	111			To use the inertia compensation function, assign the Inertia compensation acceleration (X111) signal and the Inertia compensation deceleration (X112) signal.
189	RES terminal function selection	62	112			
350	Line speed command voltage/current bias	0	0			
351	Line speed command bias	0	0			Use **Pr.358** to set the increment.
352*1	Line speed command voltage/current gain	50%	92%	100%	92%	Line speed commands are input to the inverter for the intermediate shaft (roller) via terminal 1 and output to the inverters for the winding roll and the unwinding roll via terminal AM. The setting value for the winding roll and the unwinding roll is smaller than the one for the intermediate shaft because it has been calibrated considering a voltage drop.

Pr.	Parameter name	Initial value	Setting value			Remarks
			Unwinding shaft	Intermediate shaft	Winding shaft	
353	Line speed command gain	0 m/min	300 m/min			Use **Pr.358** to set the increment. Max. line speed: 300 m/min
358	Line speed unit	0	0			0: m/min (increment of the maximum line speed)
360	Line speed command value	0	0			If setting **Pr.361** to "8", set a line speed command value in this parameter.
361	Line speed command input selection	9999	5			5: Input via terminal 1
362	Actual line speed input selection	0	0			0: Signals for the actual line speed are not input (the actual line speed is determined by calculating from the line speed setting).
369	Number of encoder pulses	1024	2048			
393	Line speed command acceleration/deceleration reference	1000 m/min	300 m/min			Acceleration/deceleration speed and time: 300 m/min for 30 seconds (same as the setting of the intermediate shaft)
394	First acceleration time for line speed command	15 s	10 s	30 s	10 s	
395	First deceleration time for line speed command	15 s	10 s	30 s	10 s	
645	Winding diameter storage selection	0	1	0	1	When "1" (storing roll diameters enabled) is set, the input of the Stored winding diameter clear (X109) signal is required.
800	Control method selection	20	1	0	1	0: Speed control, 1: Torque control
802	Pre-excitation selection	0	1			1: Servo lock
803	Constant output range torque characteristic selection	0	1	0	1	To limit output torque in the constant power range, set "1" (constant torque).
804	Tension / Torque command source selection	0	0	0	0	0: Tension command given by analog input via terminal 6 on the FR-A8AZ
807	Speed limit selection	0	1			1: Speed limited by the setting of **Pr.808** or **Pr.809**
808	Forward rotation speed limit/ speed limit	60 Hz	120 Hz			Set the forward rotation speed limit.
823*1	Speed detection filter 1	0.001 s	0.001 s	0.01 s	0.001 s	The setting of 0.01 seconds for the intermediate shaft is for noise precautions.
868	Terminal 1 function assignment	0	0			
1072	Tension reverse selection	0	1	0	0	Set the intermediate shaft to "1" (tension direction reversed) for back tension.
1136*1	Tension sensor feedback voltage/current bias	0%	0%			0.0% (0 V) corresponds to 0 N and 100.0% (10 V) corresponds to 300.0 N when **Pr.1401** is set to "1" (0.1 N).
1137*1	Tension sensor feedback bias	0 N	0 N			
1138*1	Tension sensor feedback voltage/current gain	100%	100%	0%	100%	
1139*1	Tension sensor feedback gain	100 N	300 N	0 N	300 N	
1230	Winding/unwinding selection	0	1	0	0	0: Winding, 1: Unwinding
1231	Material thickness d1	9999	0.3 mm			Set this parameter for the roll diameter calculation from the material thickness.
1235	Maximum winding diameter 1	2 mm	800 mm	200 mm	800 mm	Set the initial roll diameter as accurately as possible. (Unwinding roll: maximum diameter / Winding roll: minimum diameter).
1236	Minimum winding diameter 1	1 mm	100 mm	200 mm	100 mm	
1243	Gear ratio numerator	1	1			Set the gear ratio of the unwinding/winding shaft as accurately as possible.
1244	Gear ratio denominator	1	3			
1245*1	Sampling time for winding diameter calculation	9999	0.1 s	9999	0.1 s	Setting is recommended when the results of the roll diameter calculation change significantly.
1246*1	Line speed at winding diameter calculated value activation	1	0			Set the line speed command value to start the roll diameter calculation.
1247*1	Winding diameter change increment amount limit	9999	2 mm	9999	2 mm	Setting **Pr.1247** = "9999 (initial value)" disables the roll diameter calculation. Be sure to change the setting from the initial value for the roll diameter calculation.

Application examples

Pr.	Parameter name	Initial value	Setting value			Remarks
			Unwinding shaft	Intermediate shaft	Winding shaft	
1249*1	Number of averaging for winding diameter calculation	4	5			Use this parameter to enable the primary delay filter relative to the result of the roll diameter calculation.
1401	Tension command increment	0	1	0	1	1: Setting increment: 0.1 N, setting range: 0 to 1000 N
1405	Tension command gain	100 N	300 N	100 N	300 N	0 V corresponds to 0 N and 10 V corresponds to 300 N.
1410	Motor inertia	0 $kg \cdot m^2$	0 $kg \cdot m^2$			Set these parameters to control tension changes due to inertia torque during acceleration/deceleration.
1411	Empty reel inertia	0 $kg \cdot m^2$	0.01 $kg \cdot m^2$			
1412	Roll width	0 mm	50 mm			
1413	Material specific gravity	0 g/cm^3	1.7 g/cm^3			
1414	First acceleration time for inertia compensation	15 s	5 s			
1415	First deceleration time for inertia compensation	15 s	5 s			
1418	Inertia compensation cushion time	0 s	0 s			
1419*1	Mechanical loss setting frequency bias	1000%	1001.5%			Set the frequency and the compensation value for each setting of mechanical loss. Use these parameters when mechanical losses are large or variable due to hard acceleration/deceleration.
1420*1	Mechanical loss setting frequency 1	9999	1 Hz			
1421*1	Mechanical loss 1	1000%	1001.5%			
1422*1	Mechanical loss setting frequency 2	9999	6.67 Hz			
1423*1	Mechanical loss 2	1000%	1002%			
1424*1	Mechanical loss setting frequency 3	9999	16.67 Hz			
1425*1	Mechanical loss 3	1000%	1002.5%			
1426*1	Mechanical loss setting frequency 4	9999	50 Hz			
1427*1	Mechanical loss 4	1000%	1003.5%			
1428*1	Mechanical loss setting frequency 5	9999	93.33 Hz			
1429*1	Mechanical loss 5	1000%	1004.5%			

*1 Adjustment parameter.

11.7 Parameters (functions) and instruction codes under different control methods

The following parameters and instruction codes are changed or added in the FR-A800-R2R inverter as compared to the FR-A800 series standard inverter. The availability of the parameters and instruction codes is shown by control method.
For information on the availability of other parameters by control method and instruction codes, refer to the Instruction Manual (Detailed) of the FR-A800 inverter.

*1 Instruction codes are used to read and write parameters by using the Mitsubishi inverter protocol via RS-485 communication. (For the details of the RS-485 communication, refer to the Instruction Manual (Detailed) of the FR-A800 inverter.)

*2 Function availability under each control method is as follows:
○: Available
×: Not available
Δ: Available with some restrictions

*3 For "parameter copy", "parameter clear", and "all parameter clear", "○" indicates the function is available, and "×" indicates the function is not available.

*4 Communication parameters that are not cleared by parameter clear or all clear (H5A5A or H55AA) via communication.

*5 When a communication option is installed, parameter clear (lock release) during password lock (**Pr.297 Password lock/unlock** ≠ "9999") can be performed only from the communication option.

*6 Reading and writing via the PU connector are available.

*7 The parameter is used for gain adjustment during servo lock.

*8 Available under tension sensor feedback torque control.

The function of the parameter with the following mark is available when the option is connected.
AP FR-A8AP, AL FR-A8AL, TP FR-A8TP, APR FR-A8APR, APS FR-A8APS, AR FR-A8AR, AX FR-A8AX, AY FR-A8AY, AZ FR-A8AZ, NC FR-A8NC, NCE FR-A8NCE, ND FR-A8ND, NP FR-A8NP

Pr.	Name	Instruction code*1			Control method*2						Parameter		
							Vector		Sensorless				
		Read	Write	Extended	V/F	Magnetic flux	Speed control	Torque control	Speed control	Torque control	Copy*3	Clear*3	All clear*3
0	Torque boost	00	80	0	○	×	×	×	×	×	○	○	○
1	Maximum frequency	01	81	0	○	○	○	○	○	○	○	○	○
2	Minimum frequency	02	82	0	○	○	○	○	○	○	○	○	○
3	Base frequency	03	83	0	○	×	×	×	×	×	○	○	○
4	Multi-speed setting (high speed)	04	84	0	○	○	○	○	○	○	○	○	○
5	Multi-speed setting (middle speed)	05	85	0	○	○	○	○	○	○	○	○	○
6	Multi-speed setting (low speed)	06	86	0	○	○	○	○	○	○	○	○	○
7	Acceleration time	07	87	0	○	○	○	○	○	○	○	○	○
8	Deceleration time	08	88	0	○	○	○	○	○	○	○	○	○
9	Electronic thermal O/L relay	09	89	0	○	○	○	○	○	○	○	○	○
10	DC injection brake operation frequency	0A	8A	0	○	○	○	○	○	○	○	○	○
11	DC injection brake operation time	0B	8B	0	○	○	○	○	○	○	○	○	○
12	DC injection brake operation voltage	0C	8C	0	○	○	×	×	×	×	○	○	○
13	Starting frequency	0D	8D	0	○	○	○	○	○	○	○	○	○
14	Load pattern selection	0E	8E	0	○	×	×	×	×	×	○	○	○
15	Jog frequency	0F	8F	0	○	○	○	○	○	○	○	○	○
16	Jog acceleration/deceleration time	10	90	0	○	○	○	○	○	○	○	○	○
17	MRS input selection	11	91	0	○	○	○	○	○	○	○	○	○
18	High speed maximum frequency	12	92	0	○	○	○	○	○	○	○	○	○
19	Base frequency voltage	13	93	0	○	×	×	×	×	×	○	○	○
20	Acceleration/deceleration reference frequency	14	94	0	○	○	○	○	○	○	○	○	○
21	Acceleration/deceleration time increments	15	95	0	○	○	○	○	○	○	○	○	○
22	Stall prevention operation level (Torque limit level)	16	96	0	○	○	○	○	○	○	○	○	○
23	Stall prevention operation level compensation factor at double speed	17	97	0	○	○	×	×	×	×	○	○	○
24	Multi-speed setting (speed 4)	18	98	0	○	○	○	○	○	○	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector: Speed control	Vector: Torque control	Sensorless: Speed control	Sensorless: Torque control	Copy*3	Clear*3	All clear*3
25	Multi-speed setting (speed 5)	19	99	0	○	○	○	○	○	○	○	○	○
26	Multi-speed setting (speed 6)	1A	9A	0	○	○	○	○	○	○	○	○	○
27	Multi-speed setting (speed 7)	1B	9B	0	○	○	○	○	○	○	○	○	○
28	Multi-speed input compensation selection	1C	9C	0	○	○	○	○	○	○	○	○	○
29	Acceleration/deceleration pattern selection	1D	9D	0	○	○	○	○	○	○	○	○	○
30	Regenerative function selection	1E	9E	0	○	○	○	○	○	○	○	○	○
31	Frequency jump 1A	1F	9F	0	○	○	○	○	○	○	○	○	○
32	Frequency jump 1B	20	A0	0	○	○	○	○	○	○	○	○	○
33	Frequency jump 2A	21	A1	0	○	○	○	○	○	○	○	○	○
34	Frequency jump 2B	22	A2	0	○	○	○	○	○	○	○	○	○
35	Frequency jump 3A	23	A3	0	○	○	○	○	○	○	○	○	○
36	Frequency jump 3B	24	A4	0	○	○	○	○	○	○	○	○	○
37	Speed display	25	A5	0	○	○	○	○	○	○	○	○	○
41	Up-to-frequency sensitivity	29	A9	0	○	○	○	×	○	×	○	○	○
42	Output frequency detection	2A	AA	0	○	○	○	Δ	○	Δ	○	○	○
43	Output frequency detection for reverse rotation	2B	AB	0	○	○	○	Δ	○	Δ	○	○	○
44	Second acceleration/deceleration time	2C	AC	0	○	○	○	○	○	○	○	○	○
45	Second deceleration time	2D	AD	0	○	○	○	○	○	○	○	○	○
46	Second torque boost	2E	AE	0	○	×	×	×	×	×	○	○	○
47	Second V/F (base frequency)	2F	AF	0	○	×	×	×	×	×	○	○	○
48	Second stall prevention operation level	30	B0	0	○	○	×	×	×	×	○	○	○
49	Second stall prevention operation frequency	31	B1	0	○	○	×	×	×	×	○	○	○
50	Second output frequency detection	32	B2	0	○	○	○	Δ	○	Δ	○	○	○
51	Second electronic thermal O/L relay	33	B3	0	○	○	○	○	○	○	○	○	○
52	Operation panel main monitor selection	34	B4	0	○	○	○	○	○	○	○	○	○
54	FM/CA terminal function selection	36	B6	0	○	○	○	○	○	○	○	○	○
55	Frequency monitoring reference	37	B7	0	○	○	○	○	○	○	○	○	○
56	Current monitoring reference	38	B8	0	○	○	○	○	○	○	○	○	○
57	Restart coasting time	39	B9	0	○	○	○	○	○	○	○	○	○
58	Restart cushion time	3A	BA	0	○	○	×	×	×	×	○	○	○
60	Energy saving control selection	3C	BC	0	○	○	×	×	×	×	○	○	○
65	Retry selection	41	C1	0	○	○	○	○	○	○	○	○	○
66	Stall prevention operation reduction starting frequency	42	C2	0	○	○	×	×	×	×	○	○	○
67	Number of retries at fault occurrence	43	C3	0	○	○	○	○	○	○	○	○	○
68	Retry waiting time	44	C4	0	○	○	○	○	○	○	○	○	○
69	Retry count display erase	45	C5	0	○	○	○	○	○	○	○	○	○
70	Special regenerative brake duty	46	C6	0	○	○	○	○	○	○	○	○	○
71	Applied motor	47	C7	0	○	○	○	○	○	○	○	○	○
72	PWM frequency selection	48	C8	0	○	○	○	○	○	○	○	○	○
73	Analog input selection	49	C9	0	○	○	○	○	○	○	○	×	○
74	Input filter time constant	4A	CA	0	○	○	○	○	○	○	○	○	○
75	Reset selection/disconnected PU detection/PU stop selection	4B	CB	0	○	○	○	○	○	○	○	×	×
76	Fault code output selection	4C	CC	0	○	○	○	○	○	○	○	○	○
77*6	Parameter write selection	4D	CD	0	○	○	○	○	○	○	○	○	○
78	Reverse rotation prevention selection	4E	CE	0	○	○	○	○	○	○	○	○	○
79*6	Operation mode selection	4F	CF	0	○	○	○	○	○	○	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
80	Motor capacity	50	D0	0	×	○	○	○	○	○	○	○	○
81	Number of motor poles	51	D1	0	×	○	○	○	○	○	○	○	○
82	Motor excitation current	52	D2	0	×	○	○	○	○	○	○	×	○
83	Rated motor voltage	53	D3	0	×	○	○	○	○	○	○	○	○
84	Rated motor frequency	54	D4	0	×	○	○	○	○	○	○	○	○
85	Excitation current break point	55	D5	0	×	○	×	×	○	○	○	×	○
86	Excitation current low-speed scaling factor	56	D6	0	×	○	×	×	○	○	○	×	○
89	Speed control gain (Advanced magnetic flux vector)	59	D9	0	×	○	×	×	×	×	○	×	○
90	Motor constant (R1)	5A	DA	0	×	○	○	○	○	○	○	×	○
91	Motor constant (R2)	5B	DB	0	×	○	○	○	○	○	○	×	○
92	Motor constant (L1)	5C	DC	0	×	○	○	○	○	○	○	×	○
93	Motor constant (L2)	5D	DD	0	×	○	○	○	○	○	○	×	○
94	Motor constant (X)	5E	DE	0	×	○	○	○	○	○	○	×	○
95	Online auto tuning selection	5F	DF	0	×	○	○	○	○	○	○	○	○
96	Auto tuning setting/status	60	E0	0	×	○	○	○	○	○	○	×	○
100	Second acceleration time for line speed command	00	80	1	○	○	○	○	○	○	○	○	○
101	Second deceleration time for line speed command	01	81	1	○	○	○	○	○	○	○	○	○
102	Third acceleration time for line speed command	02	82	1	○	○	○	○	○	○	○	○	○
103	Third deceleration time for line speed command	03	83	1	○	○	○	○	○	○	○	○	○
110	Third acceleration/deceleration time	0A	8A	1	○	○	○	○	○	○	○	○	○
111	Third deceleration time	0B	8B	1	○	○	○	○	○	○	○	○	○
112	Third torque boost	0C	8C	1	○	×	×	×	×	×	○	○	○
113	Third V/F (base frequency)	0D	8D	1	○	×	×	Δ	×	Δ	○	○	○
114	Third stall prevention operation level	0E	8E	1	○	○	×	×	×	×	○	○	○
115	Third stall prevention operation frequency	0F	8F	1	○	○	×	×	×	×	○	○	○
116	Third output frequency detection	10	90	1	○	○	○	Δ	○	Δ	○	○	○
117	PU communication station number	11	91	1	○	○	○	○	○	○	○	○*4	○*4
118	PU communication speed	12	92	1	○	○	○	○	○	○	○	○*4	○*4
119	PU communication stop bit length / data length	13	93	1	○	○	○	○	○	○	○	○*4	○*4
120	PU communication parity check	14	94	1	○	○	○	○	○	○	○	○*4	○*4
121	Number of PU communication retries	15	95	1	○	○	○	○	○	○	○	○*4	○*4
122	PU communication check time interval	16	96	1	○	○	○	○	○	○	○	○*4	○*4
123	PU communication waiting time setting	17	97	1	○	○	○	○	○	○	○	○*4	○*4
124	PU communication CR/LF selection	18	98	1	○	○	○	○	○	○	○	○*4	○*4
125	Terminal 2 frequency setting gain frequency	19	99	1	○	○	○	○	○	○	○	×	○
126	Terminal 4 frequency setting gain frequency	1A	9A	1	○	○	○	○	○	○	○	×	○
127	PID control automatic switchover frequency	1B	9B	1	○	○	○	×	○	×	○	○	○
128	PID action selection	1C	9C	1	○	○	○	×*8	○	×*8	○	○	○
129	PID proportional band	1D	9D	1	○	○	○	×*8	○	×*8	○	○	○
130	PID integral time	1E	9E	1	○	○	○	×*8	○	×*8	○	○	○
131	PID upper limit	1F	9F	1	○	○	○	×*8	○	×*8	○	○	○
132	PID lower limit	20	A0	1	○	○	○	×*8	○	×*8	○	○	○
133	PID action set point	21	A1	1	○	○	○	×*8	○	×*8	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
134	PID differential time	22	A2	1	○	○	○	×*8	○	×*8	○	○	○
135	Integral clamp (positive polarity)	23	A3	1	○	○	○	×*8	○	×*8	○	○	○
136	Integral clamp (negative polarity)	24	A4	1	○	○	○	×*8	○	×*8	○	○	○
137	PID upper/lower limit hysteresis width	25	A5	1	○	○	○	×*8	○	×*8	○	○	○
140	Backlash acceleration stopping frequency	28	A8	1	○	○	○	○	○	○	○	○	○
141	Backlash acceleration stopping time	29	A9	1	○	○	○	○	○	○	○	○	○
142	Backlash deceleration stopping frequency	2A	AA	1	○	○	○	○	○	○	○	○	○
143	Backlash deceleration stopping time	2B	AB	1	○	○	○	○	○	○	○	○	○
144	Speed setting switchover	2C	AC	1	○	○	○	○	○	○	○	○	○
145	PU display language selection	2D	AD	1	○	○	○	○	○	○	○	×	×
147	Acceleration/deceleration time switching frequency	2F	AF	1	○	○	○	○	○	○	○	○	○
148	Stall prevention level at 0 V input	30	B0	1	○	○	×	×	×	×	○	○	○
149	Stall prevention level at 10 V input	31	B1	1	○	○	×	×	×	×	○	○	○
150	Output current detection level	32	B2	1	○	○	○	○	○	○	○	○	○
151	Output current detection signal delay time	33	B3	1	○	○	○	○	○	○	○	○	○
152	Zero current detection level	34	B4	1	○	○	○	○	○	○	○	○	○
153	Zero current detection time	35	B5	1	○	○	○	○	○	○	○	○	○
154	Voltage reduction selection during stall prevention operation	36	B6	1	○	○	×	×	×	×	○	○	○
155	RT signal function validity condition selection	37	B7	1	○	○	○	×	○	×	○	○	○
156	Stall prevention operation selection	38	B8	1	○	○	○	×	○	×	○	○	○
157	OL signal output timer	39	B9	1	○	○	○	○	○	○	○	○	○
158	AM terminal function selection	3A	BA	1	○	○	○	○	○	○	○	○	○
159	DA1 output sign selection AZ	3B	BB	1	○	○	○	○	○	○	○	○	○
160	User group read selection	00	80	2	○	○	○	○	○	○	○	○	○
161	Frequency setting/key lock operation selection	01	81	2	○	○	○	○	○	○	○	×	○
162	Automatic restart after instantaneous power failure selection	02	82	2	○	○	○	○	○	○	○	○	○
163	First cushion time for restart	03	83	2	○	○	×	×	×	×	○	○	○
164	First cushion voltage for restart	04	84	2	○	○	×	×	×	×	○	○	○
165	Stall prevention operation level for restart	05	85	2	○	○	×	×	×	×	○	○	○
166	Output current detection signal retention time	06	86	2	○	○	○	○	○	○	○	○	○
167	Output current detection operation selection	07	87	2	○	○	○	○	○	○	○	○	○
168	Parameter for manufacturer setting. Do not set.												
169													
170	Watt-hour meter clear	0A	8A	2	○	○	○	○	○	○	○	×	○
171	Operation hour meter clear	0B	8B	2	○	○	○	○	○	○	×	×	×
172	User group registered display/batch clear	0C	8C	2	○	○	○	○	○	○	×	×	×
173	User group registration	0D	8D	2	○	○	○	○	○	○	×	×	×
174	User group clear	0E	8E	2	○	○	○	○	○	○	×	×	×
178	STF terminal function selection	12	92	2	○	○	○	○	○	○	○	×	○
179	STR terminal function selection	13	93	2	○	○	○	○	○	○	○	×	○
180	RL terminal function selection	14	94	2	○	○	○	○	○	○	○	×	○
181	RM terminal function selection	15	95	2	○	○	○	○	○	○	○	×	○
182	RH terminal function selection	16	96	2	○	○	○	○	○	○	○	×	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
183	RT terminal function selection	17	97	2	○	○	○	○	○	○	○	×	○
184	AU terminal function selection	18	98	2	○	○	○	○	○	○	○	×	○
185	JOG terminal function selection	19	99	2	○	○	○	○	○	○	○	×	○
186	CS terminal function selection	1A	9A	2	○	○	○	○	○	○	○	×	○
187	MRS terminal function selection	1B	9B	2	○	○	○	○	○	○	○	×	○
188	STOP terminal function selection	1C	9C	2	○	○	○	○	○	○	○	×	○
189	RES terminal function selection	1D	9D	2	○	○	○	○	○	○	○	×	○
190	RUN terminal function selection	1E	9E	2	○	○	○	○	○	○	○	×	○
191	SU terminal function selection	1F	9F	2	○	○	○	○	○	○	○	×	○
192	IPF terminal function selection	20	A0	2	○	○	○	○	○	○	○	×	○
193	OL terminal function selection	21	A1	2	○	○	○	○	○	○	○	×	○
194	FU terminal function selection	22	A2	2	○	○	○	○	○	○	○	×	○
195	ABC1 terminal function selection	23	A3	2	○	○	○	○	○	○	○	×	○
196	ABC2 terminal function selection	24	A4	2	○	○	○	○	○	○	○	×	○
232	Multi-speed setting (speed 8)	28	A8	2	○	○	○	○	○	○	○	○	○
233	Multi-speed setting (speed 9)	29	A9	2	○	○	○	○	○	○	○	○	○
234	Multi-speed setting (speed 10)	2A	AA	2	○	○	○	○	○	○	○	○	○
235	Multi-speed setting (speed 11)	2B	AB	2	○	○	○	○	○	○	○	○	○
236	Multi-speed setting (speed 12)	2C	AC	2	○	○	○	○	○	○	○	○	○
237	Multi-speed setting (speed 13)	2D	AD	2	○	○	○	○	○	○	○	○	○
238	Multi-speed setting (speed 14)	2E	AE	2	○	○	○	○	○	○	○	○	○
239	Multi-speed setting (speed 15)	2F	AF	2	○	○	○	○	○	○	○	○	○
240	Soft-PWM operation selection	30	B0	2	○	○	○	○	○	○	○	○	○
241	Analog input display unit switchover	31	B1	2	○	○	○	○	○	○	○	○	○
242	Terminal 1 added compensation amount (terminal 2)	32	B2	2	○	○	○	○	○	○	○	○	○
243	Terminal 1 added compensation amount (terminal 4)	33	B3	2	○	○	○	○	○	○	○	○	○
244	Cooling fan operation selection	34	B4	2	○	○	○	○	○	○	○	○	○
245	Rated slip	35	B5	2	○	×	×	×	×	×	○	○	○
246	Slip compensation time constant	36	B6	2	○	×	×	×	×	×	○	○	○
247	Constant-power range slip compensation selection	37	B7	2	○	×	×	×	×	×	○	○	○
249	Earth (ground) fault detection at start	39	B9	2	○	○	×	×	×	×	○	○	○
250	Stop selection	3A	BA	2	○	○	○	○	○	○	○	○	○
251	Output phase loss protection selection	3B	BB	2	○	○	○	○	○	○	○	○	○
252	Override bias	3C	BC	2	○	○	○	○	○	○	○	○	○
253	Override gain	3D	BD	2	○	○	○	○	○	○	○	○	○
255	Life alarm status display	3F	BF	2	○	○	○	○	○	○	×	×	×
256	Inrush current limit circuit life display	40	C0	2	○	○	○	○	○	○	×	×	×
257	Control circuit capacitor life display	41	C1	2	○	○	○	○	○	○	×	×	×
258	Main circuit capacitor life display	42	C2	2	○	○	○	○	○	○	×	×	×
259	Main circuit capacitor life measuring	43	C3	2	○	○	○	○	○	○	○	○	○
260	PWM frequency automatic switchover	44	C4	2	○	○	○	○	○	○	○	○	○
261	Power failure stop selection	45	C5	2	○	○	○	○	○	○	○	○	○
262	Subtracted frequency at deceleration start	46	C6	2	○	○	○	○	○	○	○	○	○
263	Subtraction starting frequency	47	C7	2	○	○	○	○	○	○	○	○	○
264	Power-failure deceleration time 1	48	C8	2	○	○	○	○	○	○	○	○	○
265	Power-failure deceleration time 2	49	C9	2	○	○	○	○	○	○	○	○	○
266	Power failure deceleration time switchover frequency	4A	CA	2	○	○	○	○	○	○	○	○	○
267	Terminal 4 input selection	4B	CB	2	○	○	○	○	○	○	○	×	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux Vector	Vector Speed control	Vector Torque control	Sensorless Speed control	Sensorless Torque control	Copy*3	Clear*3	All clear*3
268	Monitor decimal digits selection	4C	CC	2	○	○	○	○	○	○	○	○	○
269	Parameter for manufacturer setting. Do not set.												
270	Acceleration/deceleration time during stall condition	4E	CE	2	×	×	×	○	×	○	○	○	○
271	Second acceleration time for inertia compensation	4F	CF	2	×	×	×	○	×	○	○	○	○
272	Second deceleration time for inertia compensation	50	D0	2	×	×	×	○	×	○	○	○	○
276	Line speed monitoring reference	54	D4	2	○	○	○	○	○	○	○	○	○
278	Actual line speed voltage/current gain	56	D6	2	○	○	○	○	○	○	○	○	○
279	Actual line speed gain	57	D7	2	○	○	○	○	○	○	○	○	○
280	Actual line speed voltage/current bias	58	D8	2	○	○	○	○	○	○	○	○	○
281	Actual line speed bias	59	D9	2	○	○	○	○	○	○	○	○	○
282	Actual line speed pulse input bias	5A	DA	2	○	○	○	○	○	○	○	○	○
283	Actual line speed pulse input gain	5B	DB	2	○	○	○	○	○	○	○	○	○
284	Actual line speed input filter time constant	5C	DC	2	○	○	○	○	○	○	○	○	○
285	Overspeed detection frequency (Speed deviation excess detection frequency)	5D	DD	2	×	Δ	○	×	×	×	○	○	○
286	Droop gain	5E	DE	2	×	○	○	×	○	×	○	○	○
287	Droop filter time constant	5F	DF	2	×	×	○	×	○	×	○	○	○
288	Droop function activation selection	60	E0	2	×	○	○	×	○	×	○	○	○
289	Inverter output terminal filter	61	E1	2	○	○	○	○	○	○	○	×	○
290	Monitor negative output selection	62	E2	2	○	○	○	○	○	○	○	○	○
291	Pulse train I/O selection	63	E3	2	○	○	○	○	○	○	○	×	○
294	UV avoidance voltage gain	66	E6	2	○	○	○	○	○	○	○	○	○
295	Frequency change increment amount setting	67	E7	2	○	○	○	○	○	○	○	○	○
296	Password lock level	68	E8	2	○	○	○	○	○	○	○	×	○
297	Password lock/unlock	69	E9	2	○	○	○	○	○	○	○	○*5	○
298	Frequency search gain	6A	EA	2	○	○	×	×	○	○	○	×	○
299	Rotation direction detection selection at restarting	6B	EB	2	○	○	×	×	○	×	○	○	○
300	BCD input bias AX	00	80	3	○	○	○	○	○	○	○	○	○
301	BCD input gain AX	01	81	3	○	○	○	○	○	○	○	○	○
302	BIN input bias AX	02	82	3	○	○	○	○	○	○	○	○	○
303	BIN input gain AX	03	83	3	○	○	○	○	○	○	○	○	○
304	Digital input and analog input compensation enable/disable selection AX	04	84	3	○	○	○	○	○	○	○	○	○
305	Read timing operation selection AX	05	85	3	○	○	○	○	○	○	○	○	○
306	Analog output signal selection AY	06	86	3	○	○	○	○	○	○	○	○	○
307	Setting for zero analog output AY	07	87	3	○	○	○	○	○	○	○	○	○
308	Setting for maximum analog output AY	08	88	3	○	○	○	○	○	○	○	○	○
309	Analog output signal voltage/current switchover AY	09	89	3	○	○	○	○	○	○	○	○	○
310	Analog meter voltage output selection AY	0A	8A	3	○	○	○	○	○	○	○	○	○
311	Setting for zero analog meter voltage output AY	0B	8B	3	○	○	○	○	○	○	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
312	Setting for maximum analog meter voltage output AY	0C	8C	3	○	○	○	○	○	○	○	○	○
313	DO0 output selection AY NC NCE	0D	8D	3	○	○	○	○	○	○	○	×	○
314	DO1 output selection AY NC NCE	0E	8E	3	○	○	○	○	○	○	○	×	○
315	DO2 output selection AY NC NCE	0F	8F	3	○	○	○	○	○	○	○	×	○
316	DO3 output selection AY	10	90	3	○	○	○	○	○	○	○	×	○
317	DO4 output selection AY	11	91	3	○	○	○	○	○	○	○	×	○
318	DO5 output selection AY	12	92	3	○	○	○	○	○	○	○	×	○
319	DO6 output selection AY	13	93	3	○	○	○	○	○	○	○	×	○
320	RA1 output selection AR	14	94	3	○	○	○	○	○	○	○	×	○
321	RA2 output selection AR	15	95	3	○	○	○	○	○	○	○	×	○
322	RA3 output selection AR	16	96	3	○	○	○	○	○	○	○	×	○
323	AM0 0V adjustment AY	17	97	3	○	○	○	○	○	○	○	×	○
324	AM1 0mA adjustment AY	18	98	3	○	○	○	○	○	○	○	×	○
326	Motor temperature feedback reference AZ	1A	9A	3	×	×	○	○	×	×	○	×	○
329	Digital input unit selection AX	1D	9D	3	○	○	○	○	○	○	○	×	○
331	RS-485 communication station number	1F	9F	3	○	○	○	○	○	○	○	○*4	○*4
332	RS-485 communication speed	20	A0	3	○	○	○	○	○	○	○	○*4	○*4
333	RS-485 communication stop bit length / data length	21	A1	3	○	○	○	○	○	○	○	○*4	○*4
334	RS-485 communication parity check selection	22	A2	3	○	○	○	○	○	○	○	○*4	○*4
335	RS-485 communication retry count	23	A3	3	○	○	○	○	○	○	○	○*4	○*4
336	RS-485 communication check time interval	24	A4	3	○	○	○	○	○	○	○	○*4	○*4
337	RS-485 communication waiting time setting	25	A5	3	○	○	○	○	○	○	○	○*4	○*4
338	Communication operation command source	26	A6	3	○	○	○	○	○	○	○	○*4	○*4
339	Communication speed command source	27	A7	3	○	○	○	○	○	○	○	○*4	○*4
340	Communication startup mode selection	28	A8	3	○	○	○	○	○	○	○	○*4	○*4
341	RS-485 communication CR/LF selection	29	A9	3	○	○	○	○	○	○	○	○*4	○*4
342	Communication EEPROM write selection	2A	AA	3	○	○	○	○	○	○	○	○	○
343	Communication error count	2B	AB	3	○	○	○	○	○	○	×	×	×
345	DeviceNet address ND	2D	AD	3	○	○	○	○	○	○	○	○*4	○*4
346	DeviceNet baud rate ND	2E	AE	3	○	○	○	○	○	○	○	○*4	○*4
349	Communication reset selection NC NCE ND NP	31	B1	3	○	○	○	○	○	○	○	○*4	○*4
350	Line speed command voltage/current bias	32	B2	3	○	○	○	○	○	○	○	○	○
351	Line speed command bias	33	B3	3	○	○	○	○	○	○	○	○	○
352	Line speed command voltage/current gain	34	B4	3	○	○	○	○	○	○	○	○	○
353	Line speed command voltage/current gain	35	B5	3	○	○	○	○	○	○	○	○	○
354	Line speed command pulse input bias	36	B6	3	○	○	○	○	○	○	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
355	Line speed command pulse input gain	37	B7	3	○	○	○	○	○	○	○	○	○
356	Line speed command digital input bias	38	B8	3	○	○	○	○	○	○	○	○	○
357	Line speed command digital input gain	39	B9	3	○	○	○	○	○	○	○	○	○
358	Line speed unit	3A	BA	3	○	○	○	○	○	○	○	○	○
359	Encoder rotation direction AP AL APR APS	3B	BB	3	○	○	○	○	×	×	○	○	○
360	Line speed command value	3C	BC	3	○	○	○	○	○	○	○	○	○
361	Line speed command input selection	3D	BD	3	○	○	○	○	○	○	○	○	○
362	Actual line speed input selection	3E	BE	3	○	○	○	○	○	○	○	○	○
363	Dancer / tension sensor feedback input selection	3F	BF	3	○	○	○	×*8	○	×*8	○	○	○
364	Dancer tension setting input selection / taper function enable/ disable selection for tension sensor feedback speed control 1	40	C0	3	○	○	○	×	○	×	○	○	○
365	Tension command value (RAM)	41	C1	3	×	×	×	○	×	○	○	○	○
366	Tension command value (RAM, EEPROM)	42	C2	3	×	×	×	○	×	○	○	○	○
367	Speed feedback range AP AL TP APR APS	43	C3	3	○	○	×	×	×	×	○	○	○
368	Feedback gain AP AL TP APR APS	44	C4	3	○	○	×	×	×	×	○	○	○
369	Number of encoder pulses AP AL	45	C5	3	○	○	○	○	×	×	○	○	○
374	Overspeed detection level	4A	CA	3	×	×	○	○	○	○	○	○	○
376	Encoder signal loss detection enable/disable selection AP AL APR APS	4C	CC	3	×	×	○	○	×	×	○	○	○
380	Acceleration S-pattern 1	50	D0	3	○	○	○	○	○	○	○	○	○
381	Deceleration S-pattern 1	51	D1	3	○	○	○	○	○	○	○	○	○
382	Acceleration S-pattern 2	52	D2	3	○	○	○	○	○	○	○	○	○
383	Deceleration S-pattern 2	53	D3	3	○	○	○	○	○	○	○	○	○
384	Input pulse division scaling factor	54	D4	3	○	○	○	○	○	○	○	○	○
385	Frequency for zero input pulse	55	D5	3	○	○	○	○	○	○	○	○	○
386	Frequency for maximum input pulse	56	D6	3	○	○	○	○	○	○	○	○	○
393	Line speed command acceleration/ deceleration reference	5D	DD	3	○	○	○	○	○	○	○	○	○
394	First acceleration time for line speed command	5E	DE	3	○	○	○	○	○	○	○	○	○
395	First deceleration time for line speed command	5F	DF	3	○	○	○	○	○	○	○	○	○
398	Draw rate	62	E2	3	○	○	○	○	○	○	○	○	○
406	High resolution analog input selection AZ	06	86	○	○	○	○	○	○	○	○	×	○
407	Motor temperature detection filter AZ	07	87	○	○	○	○	○	○	○	○	○	○
408	Motor thermistor selection AZ	08	88	○	○	○	○	○	○	○	○	○	○
413	Encoder pulse division ratio AL	0D	8D	4	○	○	○	○	○	○	○	○	○
414	PLC function operation selection	0E	8E	4	○	○	○	○	○	○	○	×	×
415	Inverter operation lock mode setting	0F	8F	4	○	○	○	○	○	○	○	○	○
416	Pre-scale function selection	10	90	4	○	○	○	○	○	○	○	○	○
417	Pre-scale setting value	11	91	4	○	○	○	○	○	○	○	○	○
418	Extension output terminal filter AY AR	12	92	4	○	○	○	○	○	○	○	×	○
422	Position control gain	16	96	4	×	×	×*7	×	×	×	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
423	Dancer / tension sensor feedback detection level	17	97	4	○	○	○	×*8	○	×*8	○	○	○
424	Dancer / tension sensor feedback input offset	18	98	4	○	○	○	×	○	×	○	○	○
425	Break detection waiting time	19	99	4	○	○	○	×*8	○	×*8	○	○	○
426	Dancer tension setting bias	1A	9A	4	○	○	○	×	○	×	○	○	○
427	Dancer tension setting gain	1B	9B	4	○	○	○	×	○	×	○	○	○
428	Command pulse selection	1C	9C	4	○	○	○	○	○	○	○	○	○
430	Dancer tension setting / taper function enable/disable selection for tension sensor feedback speed control 2	1E	9E	4	○	○	○	×	○	×	○	○	○
432	Pulse train torque command bias AL	20	A0	4	×	×	×	○	×	○	○	○	○
433	Pulse train torque command gain AL	21	A1	4	×	×	×	○	×	○	○	○	○
434	IP address 1 NCE	22	A2	4	○	○	○	○	○	○	○	○*4	○*4
435	IP address 2 NCE	23	A3	4	○	○	○	○	○	○	○	○*4	○*4
447	Digital torque command bias AX	2F	AF	4	×	×	×	○	×	○	○	○	○
448	Digital torque command gain AX	30	B0	4	×	×	×	○	×	○	○	○	○
450	Second applied motor	32	B2	4	○	○	○	○	○	○	○	○	○
451	Second motor control method selection	33	B3	4	○	○	○	○	○	○	○	○	○
453	Second motor capacity	35	B5	4	×	○	○	○	○	○	○	○	○
454	Number of second motor poles	36	B6	4	×	○	○	○	○	○	○	○	○
455	Second motor excitation current	37	B7	4	×	○	○	○	○	○	○	×	○
456	Rated second motor voltage	38	B8	4	×	○	○	○	○	○	○	○	○
457	Rated second motor frequency	39	B9	4	×	○	○	○	○	○	○	○	○
458	Second motor constant (R1)	3A	BA	4	×	○	○	○	○	○	○	×	○
459	Second motor constant (R2)	3B	BB	4	×	○	○	○	○	○	○	×	○
460	Second motor constant (L1)	3C	BC	4	×	○	○	○	○	○	○	×	○
461	Second motor constant (L2)	3D	BD	4	×	○	○	○	○	○	○	×	○
462	Second motor constant (X)	3E	BE	4	×	○	○	○	○	○	○	×	○
463	Second motor auto tuning setting/ status	3F	BF	4	×	○	○	○	○	○	○	×	○
464	PID proportional band for values below set point	40	C0	4	○	○	○	×*8	○	×*8	○	○	○
465	PID integral time for values below set point	41	C1	4	○	○	○	×*8	○	×*8	○	○	○
466	PID differential time for values below set point	42	C2	4	○	○	○	×*8	○	×*8	○	○	○
467	Second PID proportional band	43	C3	4	○	○	○	×*8	○	×*8	○	○	○
468	Second PID integral time	44	C4	4	○	○	○	×*8	○	×*8	○	○	○
469	Second PID differential time	45	C5	4	○	○	○	×*8	○	×*8	○	○	○
470	Second PID proportional band for values below set point	46	C6	4	○	○	○	×*8	○	×*8	○	○	○
471	Second PID integral time for values below set point	47	C7	4	○	○	○	×*8	○	×*8	○	○	○
472	Second PID differential time for values below set point	48	C8	4	○	○	○	×*8	○	×*8	○	○	○
473	Third PID proportional band	49	C9	4	○	○	○	×*8	○	×*8	○	○	○
474	Third PID integral time	4A	CA	4	○	○	○	×*8	○	×*8	○	○	○
475	Third PID differential time	4B	CB	4	○	○	○	×*8	○	×*8	○	○	○
476	Third PID proportional band for values below set point	4C	CC	4	○	○	○	×*8	○	×*8	○	○	○
477	Third PID integral time for values below set point	4D	CD	4	○	○	○	×*8	○	×*8	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
478	Third PID differential time for values below set point	4E	CE	4	○	○	○	×*8	○	×*8	○	○	○
479	Fourth PID proportional band	4F	CF	4	○	○	○	×*8	○	×*8	○	○	○
480	Fourth PID integral time	50	D0	4	○	○	○	×*8	○	×*8	○	○	○
481	Fourth PID differential time	51	D1	4	○	○	○	×*8	○	×*8	○	○	○
482	Fourth PID proportional band for values below set point	52	D2	4	○	○	○	×*8	○	×*8	○	○	○
483	Fourth PID integral time for values below set point	53	D3	4	○	○	○	×*8	○	×*8	○	○	○
484	Fourth PID differential time for values below set point	54	D4	4	○	○	○	×*8	○	×*8	○	○	○
485	Integral control activation	55	D5	4	○	○	○	×*8	○	×*8	○	○	○
486	Deviation A	56	D6	4	○	○	○	×*8	○	×*8	○	○	○
487	Deviation B	57	D7	4	○	○	○	×*8	○	×*8	○	○	○
488	Deviation C1	58	D8	4	○	○	○	×*8	○	×*8	○	○	○
489	Deviation C2	59	D9	4	○	○	○	×*8	○	×*8	○	○	○
490	PID gain A	5A	DA	4	○	○	○	×*8	○	×*8	○	○	○
491	PID gain B	5B	DB	4	○	○	○	×*8	○	×*8	○	○	○
492	PID gain C1	5C	DC	4	○	○	○	×*8	○	×*8	○	○	○
493	PID gain C2	5D	DD	4	○	○	○	×*8	○	×*8	○	○	○
494	PID gain D	5E	DE	4	○	○	○	×*8	○	×*8	○	○	○
495	Remote output selection	5F	DF	4	○	○	○	○	○	○	○	○	○
496	Remote output data 1	60	E0	4	○	○	○	○	○	○	×	×	×
497	Remote output data 2	61	E1	4	○	○	○	○	○	○	×	×	×
498	PLC function flash memory clear	62	E2	4	○	○	○	○	○	○	×	×	×
500	Communication error execution waiting time NC NCE ND NP	00	80	5	○	○	○	○	○	○	○	○	○
501	Communication error occurrence count display NC NCE ND NP	01	81	5	○	○	○	○	○	○	×	○	○
502	Stop mode selection at communication error	02	82	5	○	○	○	○	○	○	○	○	○
503	Maintenance timer 1	03	83	5	○	○	○	○	○	○	×	×	×
504	Maintenance timer 1 warning output set time	04	84	5	○	○	○	○	○	○	○	×	○
505	Speed setting reference	05	85	5	○	○	○	○	○	○	○	○	○
516	S-pattern time at a start of acceleration	10	90	5	○	○	○	○	○	○	○	○	○
517	S-pattern time at a completion of acceleration	11	91	5	○	○	○	○	○	○	○	○	○
518	S-pattern time at a start of deceleration	12	92	5	○	○	○	○	○	○	○	○	○
519	S-pattern time at a completion of deceleration	13	93	5	○	○	○	○	○	○	○	○	○
539	MODBUS RTU communication check time interval	27	A7	5	○	○	○	○	○	○	○	○*4	○*4
541	Frequency command sign selection NC NCE NP	29	A9	5	○	○	○	×	○	×	○	○*4	○*4
542	Communication station number (CC-Link) NC	2A	AA	5	○	○	○	○	○	○	○	○*4	○*4
543	Baud rate selection (CC-Link) NC	2B	AB	5	○	○	○	○	○	○	○	○*4	○*4
544	CC-Link extended setting NC	2C	AC	5	○	○	○	○	○	○	○	○*4	○*4
547	USB communication station number	2F	AF	5	○	○	○	○	○	○	○	○*4	○*4
548	USB communication check time interval	30	B0	5	○	○	○	○	○	○	○	○*4	○*4
549	Protocol selection	31	B1	5	○	○	○	○	○	○	○	○*4	○*4

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
550	NET mode operation command source selection	32	B2	5	○	○	○	○	○	○	○	○*4	○*4
551	PU mode operation command source selection	33	B3	5	○	○	○	○	○	○	○	○*4	○*4
552	Frequency jump range	34	B4	5	○	○	○	○	○	○	○	○	○
553	PID deviation limit	35	B5	5	○	○	○	×	○	×	○	○	○
554	PID signal operation selection	36	B6	5	○	○	○	×	○	×	○	○	○
555	Current average time	37	B7	5	○	○	○	○	○	○	○	○	○
556	Data output mask time	38	B8	5	○	○	○	○	○	○	○	○	○
557	Current average value monitor signal output reference current	39	B9	5	○	○	○	○	○	○	○	○	○
560	Second frequency search gain	3C	BC	5	○	○	×	×	○	○	○	×	○
561	PTC thermistor protection level	3D	BD	5	○	○	○	○	○	○	○	×	○
563	Energization time carrying-over times	3F	BF	5	○	○	○	○	○	○	×	×	×
564	Operating time carrying-over times	40	C0	5	○	○	○	○	○	○	×	×	×
565	Second motor excitation current break point	41	C1	5	×	○	×	×	○	○	○	×	○
566	Second motor excitation current low-speed scaling factor	42	C2	5	×	○	×	×	○	○	○	×	○
569	Second motor speed control gain	45	C5	5	×	○	×	×	×	×	○	×	○
570	Multiple rating setting	46	C6	5	○	○	○	○	○	○	○	×	×
571	Holding time at a start	47	C7	5	○	○	○	○	○	○	○	○	○
573	4 mA input check selection	49	C9	5	○	○	○	○	○	○	○	○	○
574	Second motor online auto tuning	4A	CA	5	×	○	○	○	○	○	○	○	○
598	Undervoltage level	62	E2	5	○	○	○	○	○	○	○	○	○
599	X10 terminal input selection	63	E3	5	○	○	○	○	○	○	○	○	○
600	First free thermal reduction frequency 1	00	80	6	○	○	○	○	○	○	○	○	○
601	First free thermal reduction ratio 1	01	81	6	○	○	○	○	○	○	○	○	○
602	First free thermal reduction frequency 2	02	82	6	○	○	○	○	○	○	○	○	○
603	First free thermal reduction ratio 2	03	83	6	○	○	○	○	○	○	○	○	○
604	First free thermal reduction frequency 3	04	84	6	○	○	○	○	○	○	○	○	○
606	Power failure stop external signal input selection	06	86	6	○	○	○	○	○	○	○	○	○
607	Motor permissible load level	07	87	6	○	○	○	○	○	○	○	○	○
608	Second motor permissible load level	08	88	6	○	○	○	○	○	○	○	○	○
609	PID measured tension monitor filter	09	89	6	○	○	○	○	○	○	○	○	○
610	PID measured tension monitor increment	0A	8A	6	○	○	○	○	○	○	○	○	○
611	Acceleration time at a restart	0B	8B	6	○	○	○	×	○	×	○	○	○
617	Reverse rotation excitation current low-speed scaling factor	11	91	6	×	○	×	×	○	○	○	×	○
620	Line speed bias for reel change	14	94	6	○	○	○	×	○	×	○	○	○
621	Allowable deviation from target line speed	15	95	6	○	○	○	×	○	×	○	○	○
622	Line speed command for starting	16	96	6	○	○	○	○	○	○	○	○	○
635	Line speed command added compensation value voltage/current bias	23	A3	6	○	○	○	○	○	○	○	○	○
636	Line speed command added compensation value bias	24	A4	6	○	○	○	○	○	○	○	○	○
637	Line speed command added compensation value voltage/current gain	25	A5	6	○	○	○	○	○	○	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
638	Line speed command added compensation value gain	26	A6	6	○	○	○	○	○	○	○	○	○
639	Speed control proportional term applied diameter 1	27	A7	6	○	○	○	×	○	×	○	○	○
640	Speed control proportional term applied diameter 2	28	A8	6	○	○	○	×	○	×	○	○	○
641	Speed control proportional gain 1	29	A9	6	○	○	○	×	○	×	○	○	○
642	Speed control proportional gain 2	2A	AA	6	○	○	○	×	○	×	○	○	○
643	Speed control proportional gain 3	2B	AB	6	○	○	○	×	○	×	○	○	○
644	Speed control proportional gain 4	2C	AC	6	○	○	○	×	○	×	○	○	○
645	Winding diameter storage selection	2D	AD	6	○	○	○	○	○	○	○	○	○
646	Stored winding diameter	2E	AE	6	○	○	○	○	○	○	○	○	○
647	Operation time with stored winding diameter	2F	AF	6	○	○	○	○	○	○	○	○	○
648	Target winding diameter	30	B0	6	○	○	○	○	○	○	○	○	○
650	Terminal 4 input compensation selection	32	B2	6	○	○	○	○	○	○	○	○	○
653	Speed smoothing control	35	B5	6	○	×	×	×	×	×	○	○	○
654	Speed smoothing cutoff frequency	36	B6	6	○	×	×	×	×	×	○	○	○
655	Analog remote output selection	37	B7	6	○	○	○	○	○	○	○	○	○
656	Analog remote output 1	38	B8	6	○	○	○	○	○	○	×	×	×
657	Analog remote output 2	39	B9	6	○	○	○	○	○	○	×	×	×
658	Analog remote output 3	3A	BA	6	○	○	○	○	○	○	×	×	×
659	Analog remote output 4	3B	BB	6	○	○	○	○	○	○	×	×	×
663	Control circuit temperature signal output level	3F	BF	6	○	○	○	○	○	○	○	○	○
665	Regeneration avoidance frequency gain	41	C1	6	○	○	○	×	○	×	○	○	○
668	Power failure stop frequency gain	44	C4	6	○	○	○	○	○	○	○	○	○
673	SF-PR slip amount adjustment operation selection	49	C9	6	○	×	×	×	×	×	○	○	○
674	SF-PR slip amount adjustment gain	4A	CA	6	○	×	×	×	×	×	○	○	○
675	User parameter auto storage function selection	4B	CB	6	○	○	○	○	○	○	○	○	○
679	Second droop gain	4F	CF	6	×	○	○	×	○	×	○	○	○
680	Second droop filter time constant	50	D0	6	×	○	○	×	○	×	○	○	○
681	Second droop function activation selection	51	D1	6	×	○	○	×	○	×	○	○	○
682	Second droop break point gain	52	D2	6	×	○	○	×	○	×	○	○	○
683	Second droop break point torque	53	D3	6	×	○	○	×	○	×	○	○	○
684	Tuning data unit switchover	54	D4	6	×	○	○	○	○	○	○	○	○
686	Maintenance timer 2	56	D6	6	○	○	○	○	○	○	×	×	×
687	Maintenance timer 2 warning output set time	57	D7	6	○	○	○	○	○	○	○	×	○
688	Maintenance timer 3	58	D8	6	○	○	○	○	○	○	×	×	×
689	Maintenance timer 3 warning output set time	59	D9	6	○	○	○	○	○	○	○	×	○
690	Deceleration check time	5A	DA	6	×	×	○	×	×	×	○	○	○
692	Second free thermal reduction frequency 1	5C	DC	6	○	○	○	○	○	○	○	○	○
693	Second free thermal reduction ratio 1	5D	DD	6	○	○	○	○	○	○	○	○	○
694	Second free thermal reduction frequency 2	5E	DE	6	○	○	○	○	○	○	○	○	○
695	Second free thermal reduction ratio 2	5F	DF	6	○	○	○	○	○	○	○	○	○
696	Second free thermal reduction frequency 3	60	E0	6	○	○	○	○	○	○	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
699	Input terminal filter	63	E3	6	○	○	○	○	○	○	○	×	○
707	Motor inertia (integer)	07	87	7	×	×	○	×	○	×	○	○	○
724	Motor inertia (exponent)	18	98	7	×	×	○	×	○	×	○	○	○
744	Second motor inertia (integer)	2C	AC	7	×	×	○	×	○	×	○	○	○
745	Second motor inertia (exponent)	2D	AD	7	×	×	○	×	○	×	○	○	○
750	Motor temperature detection level AZ	32	B2	7	○	○	○	○	○	○	○	○	○
751	Reference motor temperature AZ	33	B3	7	○	○	○	○	○	○	○	○	○
753	Empty reel inertia (integer)	35	B5	7	×	×	×	○	×	○	○	○	○
754	Empty reel inertia (exponent)	36	B6	7	×	×	×	○	×	○	○	○	○
755	Cumulative pulse clear signal selection AP AL TP APR	37	B7	7	○	○	○	○	○	○	○	○	○
756	Cumulative pulse division scaling factor AP AL TP APR	38	B8	7	○	○	○	○	○	○	○	○	○
757	Control terminal option-Cumulative pulse division scaling factor AP AL TP APR	39	B9	7	○	○	○	○	○	○	○	○	○
758	Cumulative pulse storage AP AL TP APR	3A	BA	7	○	○	○	○	○	○	○	○	○
774	Operation panel monitor selection 1	4A	CA	7	○	○	○	○	○	○	○	○	○
775	Operation panel monitor selection 2	4B	CB	7	○	○	○	○	○	○	○	○	○
776	Operation panel monitor selection 3	4C	CC	7	○	○	○	○	○	○	○	○	○
778	4 mA input check filter	4E	CE	7	○	○	○	○	○	○	○	○	○
799	Pulse increment setting for output power	63	E3	7	○	○	○	○	○	○	○	○	○
800	Control method selection	00	80	8	○	○	○	○	○	○	○	○	○
801	Output limit level	01	81	8	○	○	○	○	○	○	○	○	○
802	Pre-excitation selection	02	82	8	×	×	○	×	×	×	○	○	○
803	Constant output range torque characteristic selection	03	83	8	×	×	○	○	○	○	○	○	○
804	Tension / Torque command source selection	04	84	8	×	×	×	○	×	○	○	○	○
805	Torque command value (RAM)	05	85	8	×	×	×	○	×	○	×	○	○
806	Torque command value (RAM,EEPROM)	06	86	8	×	×	×	○	×	○	○	○	○
807	Speed limit selection	07	87	8	×	×	×	○	×	○	○	○	○
808	Forward rotation speed limit/speed limit	08	88	8	×	×	×	○	×	○	○	○	○
809	Reverse rotation speed limit/reverse-side speed limit	09	89	8	×	×	×	○	×	○	○	○	○
810	Torque limit input method selection	0A	8A	8	×	×	○	○	○	○	○	○	○
811	Set resolution switchover	0B	8B	8	○	○	○	○	○	○	○	○	○
812	Torque limit level (regeneration)	0C	8C	8	×	×	○	○	○	○	○	○	○
813	Torque limit level (3rd quadrant)	0D	8D	8	×	×	○	○	○	○	○	○	○
814	Torque limit level (4th quadrant)	0E	8E	8	×	×	○	○	○	○	○	○	○
815	Torque limit level 2	0F	8F	8	×	×	○	○	○	○	○	○	○
816	Torque limit level during acceleration	10	90	8	×	×	○	○	○	○	○	○	○
817	Torque limit level during deceleration	11	91	8	×	×	○	○	○	○	○	○	○
818	Easy gain tuning response level setting	12	92	8	×	×	○	×	○	×	○	○	○
819	Easy gain tuning selection	13	93	8	×	×	○	×	○	×	○	×	○
820	Speed control P gain 1	14	94	8	×	×	○	×	○	×	○	○	○
821	Speed control integral time 1	15	95	8	×	×	○	×	○	×	○	○	○
822	Speed setting filter 1	16	96	8	×	×	○	○	○	○	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
823	Speed detection filter 1 AP AL TP APR APS	17	97	8	×	×	○	○	×	×	○	○	○
824	Torque control P gain 1 (current loop proportional gain)	18	98	8	×	×	○	○	○	○	○	○	○
825	Torque control integral time 1 (current loop integral time)	19	99	8	×	×	○	○	○	○	○	○	○
826	Torque setting filter 1	1A	9A	8	×	×	○	○	○	○	○	○	○
827	Torque detection filter 1	1B	9B	8	×	×	○	○	○	○	○	○	○
828	Model speed control gain	1C	9C	8	×	×	○	×	○	×	○	○	○
829	Taper ratio setting input filter time constant	1D	9D	8	○	○	○	○	○	○	○	○	○
830	Speed control P gain 2	1E	9E	8	×	×	○	×	○	×	○	○	○
831	Speed control integral time 2	1F	9F	8	×	×	○	×	○	×	○	○	○
832	Speed setting filter 2	20	A0	8	×	×	○	○	○	○	○	○	○
833	Speed detection filter 2 AP AL TP APR APS	21	A1	8	×	×	○	×	×	×	○	○	○
834	Torque control P gain 2	22	A2	8	×	×	○	○	○	○	○	○	○
835	Torque control integral time 2	23	A3	8	×	×	○	○	○	○	○	○	○
836	Torque setting filter 2	24	A4	8	×	×	○	○	○	○	○	○	○
837	Torque detection filter 2	25	A5	8	×	×	○	○	○	○	○	○	○
838	DA1 terminal function selection AZ	26	A6	8	○	○	○	○	○	○	○	○	○
839	DA1 output filter AZ	27	A7	8	○	○	○	○	○	○	○	○	○
840	Torque bias selection	28	A8	8	×	×	○	×	○	×	○	○	○
841	Torque bias 1	29	A9	8	×	×	○	×	○	×	○	○	○
842	Torque bias 2	2A	AA	8	×	×	○	×	○	×	○	○	○
843	Torque bias 3	2B	AB	8	×	×	○	×	○	×	○	○	○
844	Torque bias filter	2C	AC	8	×	×	○	×	○	×	○	○	○
845	Torque bias operation time	2D	AD	8	×	×	○	×	○	×	○	○	○
846	Torque bias balance compensation	2E	AE	8	×	×	○	×	○	×	○	○	○
847	Fall-time torque bias terminal 1 bias	2F	AF	8	×	×	○	×	○	×	○	○	○
848	Fall-time torque bias terminal 1 gain	30	B0	8	×	×	○	×	○	×	○	○	○
849	Analog input offset adjustment	31	B1	8	○	○	○	○	○	○	○	○	○
850	Brake operation selection	32	B2	8	×	×	×	×	○	○	○	○	○
851	Control terminal option-Number of encoder pulses TP	33	B3	8	○	○	○	○	×	×	○	○	○
852	Control terminal option-Encoder rotation direction TP	34	B4	8	○	○	○	○	×	×	○	○	○
853	Speed deviation time AP AL TP APR APS	35	B5	8	×	×	○	×	×	×	○	○	○
854	Excitation ratio	36	B6	8	×	×	○	○	○	○	○	○	○
855	Control terminal option-Signal loss detection enable/disable selection TP	37	B7	8	×	×	○	○	×	×	○	○	○
857	DA1-0V adjustment AZ	39	B9	8	○	○	○	○	○	○	○	×	○
858	Terminal 4 function assignment	3A	BA	8	○	○	○	○	○	○	○	×	○
859	Torque current/Rated PM motor current	3B	BB	8	×	○	○	○	○	○	○	×	○
860	Second motor torque current/Rated PM motor current	3C	BC	8	×	○	○	○	○	○	○	×	○
862	Encoder option selection AP AL TP APR APS	3E	BE	8	○	○	○	○	×	×	○	○	○
863	Control terminal option-Encoder pulse division ratio TP	3F	BF	8	○	○	○	○	○	○	○	○	○
864	Torque detection	40	C0	8	×	×	○	○	○	○	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
865	Low speed detection	41	C1	8	○	○	○	○	○	○	○	○	○
866	Torque monitoring reference	42	C2	8	×	○	○	○	○	○	○	○	○
867	AM output filter	43	C3	8	○	○	○	○	○	○	○	○	○
868	Terminal 1 function assignment	44	C4	8	○	○	○	○	○	○	○	×	○
869	Current output filter	45	C5	8	○	○	○	○	○	○	○	○	○
870	Speed detection hysteresis	46	C6	8	○	○	○	○	○	○	○	○	○
872	Input phase loss protection selection	48	C8	8	○	○	○	○	○	○	○	○	○
873	Speed limit AP AL TP APR APS	49	C9	8	×	×	○	×	×	×	○	○	○
874	OLT level setting	4A	CA	8	×	×	○	×	○	×	○	○	○
875	Fault definition	4B	CB	8	○	○	○	○	○	○	○	○	○
876	Thermal protector input TP	4C	CC	8	○	○	○	○	○	○	○	○	○
877	Speed feed forward control/model adaptive speed control selection	4D	CD	8	×	×	○	×	○	×	○	○	○
878	Speed feed forward filter	4E	CE	8	×	×	○	×	○	×	○	○	○
879	Speed feed forward torque limit	4F	CF	8	×	×	○	×	○	×	○	○	○
880	Load inertia ratio	50	D0	8	×	×	○	×	○	×	○	×	○
881	Speed feed forward gain	51	D1	8	×	×	○	×	○	×	○	○	○
882	Regeneration avoidance operation selection	52	D2	8	○	○	○	×	○	×	○	○	○
883	Regeneration avoidance operation level	53	D3	8	○	○	○	×	○	×	○	○	○
884	Regeneration avoidance at deceleration detection sensitivity	54	D4	8	○	○	○	×	○	×	○	○	○
885	Regeneration avoidance compensation frequency limit value	55	D5	8	○	○	○	×	○	×	○	○	○
886	Regeneration avoidance voltage gain	56	D6	8	○	○	○	×	○	×	○	○	○
888	Free parameter 1	58	D8	8	○	○	○	○	○	○	○	×	×
889	Free parameter 2	59	D9	8	○	○	○	○	○	○	○	×	×
891	Cumulative power monitor digit shifted times	5B	DB	8	○	○	○	○	○	○	○	○	○
892	Load factor	5C	DC	8	○	○	○	○	○	○	○	○	○
893	Energy saving monitor reference (motor capacity)	5D	DD	8	○	○	○	○	○	○	○	○	○
894	Control selection during commercial power-supply operation	5E	DE	8	○	○	○	○	○	○	○	○	○
895	Power saving rate reference value	5F	DF	8	○	○	○	○	○	○	○	○	○
896	Power unit cost	60	E0	8	○	○	○	○	○	○	○	○	○
897	Power saving monitor average time	61	E1	8	○	○	○	○	○	○	○	○	○
898	Power saving cumulative monitor clear	62	E2	8	○	○	○	○	○	○	○	×	○
899	Operation time rate (estimated value)	63	E3	8	○	○	○	○	○	○	○	○	○
C0 (900)	FM/CA terminal calibration	5C	DC	1	○	○	○	○	○	○	○	×	○
C1 (901)	AM terminal calibration	5D	DD	1	○	○	○	○	○	○	○	×	○
C2 (902)	Terminal 2 frequency setting bias frequency	5E	DE	1	○	○	○	○	○	○	○	×	○
C3 (902)	Terminal 2 frequency setting bias	5E	DE	1	○	○	○	○	○	○	○	×	○
125 (903)	Terminal 2 frequency setting gain frequency	5F	DF	1	○	○	○	○	○	○	○	×	○
C4 (903)	Terminal 2 frequency setting gain	5F	DF	1	○	○	○	○	○	○	○	×	○
C5 (904)	Terminal 4 frequency setting bias frequency	60	E0	1	○	○	○	○	○	○	○	×	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
C6 (904)	Terminal 4 frequency setting bias	60	E0	1	○	○	○	○	○	○	○	×	○
126 (905)	Terminal 4 frequency setting gain frequency	61	E1	1	○	○	○	○	○	○	○	×	○
C7 (905)	Terminal 4 frequency setting gain	61	E1	1	○	○	○	○	○	○	○	×	○
C12 (917)	Terminal 1 bias frequency (speed)	11	91	9	×	×	○	○	○	○	○	×	○
C13 (917)	Terminal 1 bias (speed)	11	91	9	×	×	○	○	○	○	○	×	○
C14 (918)	Terminal 1 gain frequency (speed)	12	92	9	×	×	○	○	○	○	○	×	○
C15 (918)	Terminal 1 gain (speed)	12	92	9	×	×	○	○	○	○	○	×	○
C16 (919)	Terminal 1 bias command (torque/ magnetic flux)	13	93	9	×	×	○	○	○	○	○	×	○
C17 (919)	Terminal 1 bias (torque/magnetic flux)	13	93	9	×	×	○	○	○	○	○	×	○
C18 (920)	Terminal 1 gain command (torque/ magnetic flux)	14	94	9	×	×	○	○	○	○	○	×	○
C19 (920)	Terminal 1 gain (torque/magnetic flux)	14	94	9	×	×	○	○	○	○	○	×	○
C29 (925)	Motor temperature detection calibration (analog input) AZ	19	99	9	○	○	○	○	○	○	○	×	○
C30 (926)	Terminal 6 bias frequency (speed) AZ	1A	9A	9	○	○	○	○	○	○	○	×	○
C31 (926)	Terminal 6 bias (speed) AZ	1A	9A	9	○	○	○	○	○	○	○	×	○
C32 (927)	Terminal 6 gain frequency (speed) AZ	1B	9B	9	○	○	○	○	○	○	○	×	○
C33 (927)	Terminal 6 gain (speed) AZ	1B	9B	9	○	○	○	○	○	○	○	×	○
C34 (928)	Terminal 6 bias command (torque) AZ	1C	9C	9	×	×	○	○	○	○	○	×	○
C35 (928)	Terminal 6 bias (torque) AZ	1C	9C	9	×	×	○	○	○	○	○	×	○
C36 (929)	Terminal 6 gain command (torque) AZ	1D	9D	9	×	×	○	○	○	○	○	×	○
C37 (929)	Terminal 6 gain (torque) AZ	1D	9D	9	×	×	○	○	○	○	○	×	○
C8 (930)	Current output bias signal	1E	9E	9	○	○	○	○	○	○	○	○	○
C9 (930)	Current output bias current	1E	9E	9	○	○	○	○	○	○	○	○	○
C10 (931)	Current output gain signal	1F	9F	9	○	○	○	○	○	○	○	○	○
C11 (931)	Current output gain current	1F	9F	9	○	○	○	○	○	○	○	○	○
C38 (932)	Terminal 4 bias command (torque/ magnetic flux)	20	A0	9	×	×	○	○	○	○	○	×	○
C39 (932)	Terminal 4 bias (torque/magnetic flux)	20	A0	9	×	×	○	○	○	○	○	×	○
C40 (933)	Terminal 4 gain command (torque/ magnetic flux)	21	A1	9	×	×	○	○	○	○	○	×	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
C41 (933)	Terminal 4 gain (torque/magnetic flux)	21	A1	9	×	×	○	○	○	○	○	×	○
977	Input voltage mode selection	4D	CD	9	○	○	○	○	○	○	○	×	×
989	Parameter copy alarm release	59	D9	9	○	○	○	○	○	○	○	×	○
990	PU buzzer control	5A	DA	9	○	○	○	○	○	○	○	○	○
991	PU contrast adjustment	5B	DB	9	○	○	○	○	○	○	○	×	○
992	Operation panel setting dial push monitor selection	5C	DC	9	○	○	○	○	○	○	○	○	○
994	Droop break point gain	5E	DE	9	×	○	○	×	○	×	○	○	○
995	Droop break point torque	5F	DF	9	×	○	○	×	○	×	○	○	○
997	Fault initiation	61	E1	9	○	○	○	○	○	○	×	○	○
999	Automatic parameter setting	63	E3	9	○	○	○	○	○	○	×	×	○
1000	Direct setting selection	00	80	A	○	○	○	○	○	○	○	○	○
1003	Notch filter frequency	03	83	A	×	×	○	×	○	×	○	○	○
1004	Notch filter depth	04	84	A	×	×	○	×	○	×	○	○	○
1005	Notch filter width	05	85	A	×	×	○	×	○	×	○	○	○
1006	Clock (year)	06	86	A	○	○	○	○	○	○	×	×	×
1007	Clock (month, day)	07	87	A	○	○	○	○	○	○	×	×	×
1008	Clock (hour, minute)	08	88	A	○	○	○	○	○	○	×	×	×
1015	Integral stop selection at limited manipulated amount	0F	8F	A	○	○	○	×*8	○	×*8	○	○	○
1016	PTC thermistor protection detection time	10	90	A	○	○	○	○	○	○	○	×	○
1018	Monitor with sign selection	12	92	A	○	○	○	○	○	○	○	○	○
1019	Analog meter voltage negative output selection AY	13	93	A	○	○	○	○	○	○	○	○	○
1020	Trace operation selection	14	94	A	○	○	○	○	○	○	○	○	○
1021	Trace mode selection	15	95	A	○	○	○	○	○	○	○	○	○
1022	Sampling cycle	16	96	A	○	○	○	○	○	○	○	○	○
1023	Number of analog channels	17	97	A	○	○	○	○	○	○	○	○	○
1024	Sampling auto start	18	98	A	○	○	○	○	○	○	○	○	○
1025	Trigger mode selection	19	99	A	○	○	○	○	○	○	○	○	○
1026	Number of sampling before trigger	1A	9A	A	○	○	○	○	○	○	○	○	○
1027	Analog source selection (1ch)	1B	9B	A	○	○	○	○	○	○	○	○	○
1028	Analog source selection (2ch)	1C	9C	A	○	○	○	○	○	○	○	○	○
1029	Analog source selection (3ch)	1D	9D	A	○	○	○	○	○	○	○	○	○
1030	Analog source selection (4ch)	1E	9E	A	○	○	○	○	○	○	○	○	○
1031	Analog source selection (5ch)	1F	9F	A	○	○	○	○	○	○	○	○	○
1032	Analog source selection (6ch)	20	A0	A	○	○	○	○	○	○	○	○	○
1033	Analog source selection (7ch)	21	A1	A	○	○	○	○	○	○	○	○	○
1034	Analog source selection (8ch)	22	A2	A	○	○	○	○	○	○	○	○	○
1035	Analog trigger channel	23	A3	A	○	○	○	○	○	○	○	○	○
1036	Analog trigger operation selection	24	A4	A	○	○	○	○	○	○	○	○	○
1037	Analog trigger level	25	A5	A	○	○	○	○	○	○	○	○	○
1038	Digital source selection (1ch)	26	A6	A	○	○	○	○	○	○	○	○	○
1039	Digital source selection (2ch)	27	A7	A	○	○	○	○	○	○	○	○	○
1040	Digital source selection (3ch)	28	A8	A	○	○	○	○	○	○	○	○	○
1041	Digital source selection (4ch)	29	A9	A	○	○	○	○	○	○	○	○	○
1042	Digital source selection (5ch)	2A	AA	A	○	○	○	○	○	○	○	○	○
1043	Digital source selection (6ch)	2B	AB	A	○	○	○	○	○	○	○	○	○
1044	Digital source selection (7ch)	2C	AC	A	○	○	○	○	○	○	○	○	○
1045	Digital source selection (8ch)	2D	AD	A	○	○	○	○	○	○	○	○	○
1046	Digital trigger channel	2E	AE	A	○	○	○	○	○	○	○	○	○
1047	Digital trigger operation selection	2F	AF	A	○	○	○	○	○	○	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
1048	Display-off waiting time	30	B0	A	○	○	○	○	○	○	○	○	○
1049	USB host reset	31	B1	A	○	○	○	○	○	○	×	○	○
1072	Tension reverse selection	48	C8	A	×	×	×	○	×	○	○	○	○
1103	Deceleration time at emergency stop	03	83	B	○	○	○	○	○	○	○	○	○
1106	Torque monitor filter	06	86	B	○	○	○	○	○	○	○	○	○
1107	Running speed monitor filter	07	87	B	○	○	○	○	○	○	○	○	○
1108	Excitation current monitor filter	08	88	B	○	○	○	○	○	○	○	○	○
1109	PROFIBUS communication command source selection NP	09	89	B	×	○	○	○	○	○	○	○*4	○*4
1110	PROFIBUS format selection NP	0A	8A	B	○	○	○	○	○	○	○	○*4	○*4
1113	Speed limit method selection	0D	8D	B	×	×	×	○	×	○	○	○	○
1114	Torque command reverse selection	0E	8E	B	×	×	×	○	×	○	○	○	○
1115	Speed control integral term clear time	0F	8F	B	×	×	○	×	○	×	○	○	○
1116	Constant output range speed control P gain compensation	10	90	B	×	×	○	×	○	×	○	○	○
1117	Speed control P gain 1 (per-unit system)	11	91	B	×	×	○	×	○	×	○	○	○
1118	Speed control P gain 2 (per-unit system)	12	92	B	×	×	○	×	○	×	○	○	○
1119	Model speed control gain (per-unit system)	13	93	B	×	×	○	×	○	×	○	○	○
1121	Per-unit speed control reference frequency	15	95	B	×	×	○	×	○	×	○	○	○
1134	PID upper limit manipulated value	22	A2	B	○	○	○	×	○	×	○	○	○
1135	PID lower limit manipulated value	23	A3	B	○	○	○	×	○	×	○	○	○
1136	Tension sensor feedback voltage/ current bias	24	A4	B	×	×	×	×*8	×	×*8	○	○	○
1137	Tension sensor feedback bias	25	A5	B	×	×	×	×*8	×	×*8	○	○	○
1138	Tension sensor feedback voltage/ current gain	26	A6	B	×	×	×	×*8	×	×*8	○	○	○
1139	Tension sensor feedback gain	27	A7	B	×	×	×	×*8	×	×*8	○	○	○
1140	Signed winding diameter compensation torque command selection	28	A8	B	×	×	×	○	×	○	○	○	○
1141	Line speed command acceleration/ deceleration pattern	29	A9	B	○	○	○	○	○	○	○	○	○
1142	Line speed command acceleration start S-curve time	2A	AA	B	○	○	○	○	○	○	○	○	○
1143	Line speed command acceleration completion S-curve time	2B	AB	B	○	○	○	○	○	○	○	○	○
1144	Line speed command deceleration start S-curve time	2C	AC	B	○	○	○	○	○	○	○	○	○
1145	Line speed command deceleration completion S-curve time	2D	AD	B	○	○	○	○	○	○	○	○	○
1146	Line speed command input filter time constant	2E	AE	B	○	○	○	○	○	○	○	○	○
1147	Line speed command maximum value	2F	AF	B	○	○	○	○	○	○	○	○	○
1148	PID manipulated line speed bias	30	B0	B	○	○	○	○	○	○	○	○	○
1149	PID manipulated line speed gain	31	B1	B	○	○	○	○	○	○	○	○	○
1150	User parameters 1	32	B2	B	○	○	○	○	○	○	○	○	○
1151	User parameters 2	33	B3	B	○	○	○	○	○	○	○	○	○
1152	User parameters 3	34	B4	B	○	○	○	○	○	○	○	○	○
1153	User parameters 4	35	B5	B	○	○	○	○	○	○	○	○	○
1154	User parameters 5	36	B6	B	○	○	○	○	○	○	○	○	○
1155	User parameters 6	37	B7	B	○	○	○	○	○	○	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
1156	User parameters 7	38	B8	B	○	○	○	○	○	○	○	○	○
1157	User parameters 8	39	B9	B	○	○	○	○	○	○	○	○	○
1158	User parameters 9	3A	BA	B	○	○	○	○	○	○	○	○	○
1159	User parameters 10	3B	BB	B	○	○	○	○	○	○	○	○	○
1160	User parameters 11	3C	BC	B	○	○	○	○	○	○	○	○	○
1161	User parameters 12	3D	BD	B	○	○	○	○	○	○	○	○	○
1162	User parameters 13	3E	BE	B	○	○	○	○	○	○	○	○	○
1163	User parameters 14	3F	BF	B	○	○	○	○	○	○	○	○	○
1164	User parameters 15	40	C0	B	○	○	○	○	○	○	○	○	○
1165	User parameters 16	41	C1	B	○	○	○	○	○	○	○	○	○
1166	User parameters 17	42	C2	B	○	○	○	○	○	○	○	○	○
1167	User parameters 18	43	C3	B	○	○	○	○	○	○	○	○	○
1168	User parameters 19	44	C4	B	○	○	○	○	○	○	○	○	○
1169	User parameters 20	45	C5	B	○	○	○	○	○	○	○	○	○
1170	User parameters 21	46	C6	B	○	○	○	○	○	○	○	○	○
1171	User parameters 22	47	C7	B	○	○	○	○	○	○	○	○	○
1172	User parameters 23	48	C8	B	○	○	○	○	○	○	○	○	○
1173	User parameters 24	49	C9	B	○	○	○	○	○	○	○	○	○
1174	User parameters 25	4A	CA	B	○	○	○	○	○	○	○	○	○
1175	User parameters 26	4B	CB	B	○	○	○	○	○	○	○	○	○
1176	User parameters 27	4C	CC	B	○	○	○	○	○	○	○	○	○
1177	User parameters 28	4D	CD	B	○	○	○	○	○	○	○	○	○
1178	User parameters 29	4E	CE	B	○	○	○	○	○	○	○	○	○
1179	User parameters 30	4F	CF	B	○	○	○	○	○	○	○	○	○
1180	User parameters 31	50	D0	B	○	○	○	○	○	○	○	○	○
1181	User parameters 32	51	D1	B	○	○	○	○	○	○	○	○	○
1182	User parameters 33	52	D2	B	○	○	○	○	○	○	○	○	○
1183	User parameters 34	53	D3	B	○	○	○	○	○	○	○	○	○
1184	User parameters 35	54	D4	B	○	○	○	○	○	○	○	○	○
1185	User parameters 36	55	D5	B	○	○	○	○	○	○	○	○	○
1186	User parameters 37	56	D6	B	○	○	○	○	○	○	○	○	○
1187	User parameters 38	57	D7	B	○	○	○	○	○	○	○	○	○
1188	User parameters 39	58	D8	B	○	○	○	○	○	○	○	○	○
1189	User parameters 40	59	D9	B	○	○	○	○	○	○	○	○	○
1190	User parameters 41	5A	DA	B	○	○	○	○	○	○	○	○	○
1191	User parameters 42	5B	DB	B	○	○	○	○	○	○	○	○	○
1192	User parameters 43	5C	DC	B	○	○	○	○	○	○	○	○	○
1193	User parameters 44	5D	DD	B	○	○	○	○	○	○	○	○	○
1194	User parameters 45	5E	DE	B	○	○	○	○	○	○	○	○	○
1195	User parameters 46	5F	DF	B	○	○	○	○	○	○	○	○	○
1196	User parameters 47	60	E0	B	○	○	○	○	○	○	○	○	○
1197	User parameters 48	61	E1	B	○	○	○	○	○	○	○	○	○
1198	User parameters 49	62	E2	B	○	○	○	○	○	○	○	○	○
1199	User parameters 50	63	E3	B	○	○	○	○	○	○	○	○	○
1211	Tension PI gain tuning timeout time	0B	8B	C	○	○	○	×	○	×	○	○	○
1215	Limit cycle output upper limit	0F	8F	C	○	○	○	×	○	×	○	○	○
1217	Limit cycle hysteresis	11	91	C	○	○	○	×	○	×	○	○	○
1219	Tension PI gain tuning start/status	13	93	C	○	○	○	×	○	×	×	×	×
1222	Target amplitude	16	96	C	○	○	○	×	○	×	○	○	○
1223	Manipulated amount for operation	17	97	C	○	○	○	×	○	×	○	○	○
1226	Tension PI gain tuning response level setting	1A	9A	C	○	○	○	×	○	×	○	○	○
1227	Dancer / tension sensor feedback input filter time constant	1B	9B	C	○	○	○	×*8	○	×*8	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
1230	Winding/unwinding selection	1E	9E	C	○	○	○	○	○	○	○	○	○
1231	Material thickness d1	1F	9F	C	○	○	○	○	○	○	○	○	○
1232	Material thickness d2	20	A0	C	○	○	○	○	○	○	○	○	○
1233	Material thickness d3	21	A1	C	○	○	○	○	○	○	○	○	○
1234	Material thickness d4	22	A2	C	○	○	○	○	○	○	○	○	○
1235	Maximum winding diameter 1	23	A3	C	○	○	○	○	○	○	○	○	○
1236	Minimum winding diameter 1	24	A4	C	○	○	○	○	○	○	○	○	○
1237	Maximum winding diameter 2	25	A5	C	○	○	○	○	○	○	○	○	○
1238	Minimum winding diameter 2	26	A6	C	○	○	○	○	○	○	○	○	○
1239	Maximum winding diameter 3	27	A7	C	○	○	○	○	○	○	○	○	○
1240	Minimum winding diameter 3	28	A8	C	○	○	○	○	○	○	○	○	○
1241	Maximum winding diameter 4	29	A9	C	○	○	○	○	○	○	○	○	○
1242	Minimum winding diameter 4	2A	AA	C	○	○	○	○	○	○	○	○	○
1243	Gear ratio numerator	2B	AB	C	○	○	○	○	○	○	○	○	○
1244	Gear ratio denominator	2C	AC	C	○	○	○	○	○	○	○	○	○
1245	Sampling time for winding diameter calculation	2D	AD	C	○	○	○	○	○	○	○	○	○
1246	Line speed at winding diameter calculated value activation	2E	AE	C	○	○	○	○	○	○	○	○	○
1247	Winding diameter change increment amount limit	2F	AF	C	○	○	○	○	○	○	○	○	○
1248	Winding diameter change limit disable time	30	B0	C	○	○	○	○	○	○	○	○	○
1249	Number of averaging for winding diameter calculation	31	B1	C	○	○	○	○	○	○	○	○	○
1250	Winding diameter compensation speed filtering waiting time	32	B2	C	○	○	○	×	○	×	○	○	○
1251	Winding diameter compensation speed filter time constant	33	B3	C	○	○	○	×	○	×	○	○	○
1252	Dancer lower limit position	34	B4	C	○	○	○	×	○	×	○	○	○
1253	Initial winding diameter calculation deadband	35	B5	C	○	○	○	×	○	×	○	○	○
1254	Initial winding diameter calculation deadband 2	36	B6	C	○	○	○	×	○	×	○	○	○
1255	Accumulated amount	37	B7	C	○	○	○	×	○	×	○	○	○
1256	Speed control P gain at start	38	B8	C	○	○	○	×	○	×	○	○	○
1257	Speed control integral time at start	39	B9	C	○	○	○	×	○	×	○	○	○
1258	Integral term limit at start	3A	BA	C	○	○	○	×	○	×	○	○	○
1259	PID term limit at start	3B	BB	C	○	○	○	×	○	×	○	○	○
1262	Winding length increment	3E	BE	C	○	○	○	○	○	○	○	○	○
1263	Stored winding length (lower 4 digits)	3F	BF	C	○	○	○	○	○	○	○	○	○
1264	Winding length detection (lower 4 digits)	40	C0	C	○	○	○	○	○	○	○	○	○
1265	Line multi-speed setting (high-speed)	41	C1	C	○	○	○	○	○	○	○	○	○
1266	Line multi-speed setting (middle-speed)	42	C2	C	○	○	○	○	○	○	○	○	○
1267	Line multi-speed setting (low-speed)	43	C3	C	○	○	○	○	○	○	○	○	○
1268	Line multi-speed setting (speed 4)	44	C4	C	○	○	○	○	○	○	○	○	○
1269	Line multi-speed setting (speed 5)	45	C5	C	○	○	○	○	○	○	○	○	○
1270	Line multi-speed setting (speed 6)	46	C6	C	○	○	○	○	○	○	○	○	○
1271	Line multi-speed setting (speed 7)	47	C7	C	○	○	○	○	○	○	○	○	○
1272	Line multi-speed setting (speed 8)	48	C8	C	○	○	○	○	○	○	○	○	○
1273	Line multi-speed setting (speed 9)	49	C9	C	○	○	○	○	○	○	○	○	○
1274	Line multi-speed setting (speed 10)	4A	CA	C	○	○	○	○	○	○	○	○	○
1275	Line multi-speed setting (speed 11)	4B	CB	C	○	○	○	○	○	○	○	○	○
1276	Line multi-speed setting (speed 12)	4C	CC	C	○	○	○	○	○	○	○	○	○

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
1277	Line multi-speed setting (speed 13)	4D	CD	C	○	○	○	○	○	○	○	○	○
1278	Line multi-speed setting (speed 14)	4E	CE	C	○	○	○	○	○	○	○	○	○
1279	Line multi-speed setting (speed 15)	4F	CF	C	○	○	○	○	○	○	○	○	○
1280	Winding diameter monitoring reference	50	D0	C	○	○	○	○	○	○	○	○	○
1281	Commanded tension monitoring reference	51	D1	C	×	×	×	○	×	○	○	○	○
1282	Tension command cushion time	52	D2	C	×	×	×	○	×	○	○	○	○
1283	Cushion time reference tension	53	D3	C	×	×	×	○	×	○	○	○	○
1284	Taper mode selection	54	D4	C	○	○	○	○	○	○	○	○	○
1285	Taper setting analog input selection	55	D5	C	○	○	○	○	○	○	○	○	○
1286	Winding diameter at taper start	56	D6	C	○	○	○	○	○	○	○	○	○
1287	Taper ratio setting	57	D7	C	○	○	○	○	○	○	○	○	○
1288	Data table winding diameter 1	58	D8	C	○	○	○	○	○	○	○	○	○
1289	Data table taper ratio 1	59	D9	C	○	○	○	○	○	○	○	○	○
1290	Data table winding diameter 2	5A	DA	C	○	○	○	○	○	○	○	○	○
1291	Data table taper ratio 2	5B	DB	C	○	○	○	○	○	○	○	○	○
1292	Data table winding diameter 3	5C	DC	C	○	○	○	○	○	○	○	○	○
1293	Data table taper ratio 3	5D	DD	C	○	○	○	○	○	○	○	○	○
1294	Data table winding diameter 4	5E	DE	C	○	○	○	○	○	○	○	○	○
1295	Data table taper ratio 4	5F	DF	C	○	○	○	○	○	○	○	○	○
1296	Data table winding diameter 5	60	E0	C	○	○	○	○	○	○	○	○	○
1297	Data table taper ratio 5	61	E1	C	○	○	○	○	○	○	○	○	○
1298	Stored winding length (upper 4 digits)	62	E2	C	○	○	○	○	○	○	○	○	○
1299	Stored winding length increment	63	E3	C	○	○	○	○	○	○	○	○	○
1346	Winding length detection (upper 4 digits)	2E	AE	D	○	○	○	○	○	○	○	○	○
1348	P/PI control switchover frequency	30	B0	D	×	×	○	×	○	×	○	○	○
1349	Emergency stop operation selection	31	B1	D	○	○	○	○	○	○	○	○	○
1382	PID set point cushion time	52	D2	D	×	×	×	○	×	○	○	○	○
1383	PID torque control manipulated tension bias [N]	53	D3	D	×	×	×	○	×	○	○	○	○
1384	PID torque control manipulated tension gain [N]	54	D4	D	×	×	×	○	×	○	○	○	○
1401	Tension command increment	01	81	E	×	×	×	○	×	○	○	○	○
1402	Tension command input voltage bias	02	82	E	×	×	×	○	×	○	○	○	○
1403	Tension command bias	03	83	E	×	×	×	○	×	○	○	○	○
1404	Tension command input voltage gain	04	84	E	×	×	×	○	×	○	○	○	○
1405	Tension command gain	05	85	E	×	×	×	○	×	○	○	○	○
1406	Commanded tension reduction scaling factor during stall condition	06	86	E	×	×	×	○	×	○	○	○	○
1407	Speed limit during stall condition	07	87	E	×	×	×	○	×	○	○	○	○
1409	Tension command cushion time during stall condition	09	89	E	×	×	×	○	×	○	○	○	○
1410	Motor inertia	0A	8A	E	×	×	×	○	×	○	○	○	○
1411	Empty reel inertia	0B	8B	E	×	×	×	○	×	○	○	○	○
1412	Roll width	0C	8C	E	×	×	×	○	×	○	○	○	○
1413	Material specific gravity	0D	8D	E	×	×	×	○	×	○	○	○	○
1414	First acceleration time for inertia compensation	0E	8E	E	×	×	×	○	×	○	○	○	○
1415	First deceleration time for inertia compensation	0F	8F	E	×	×	×	○	×	○	○	○	○
1418	Inertia compensation cushion time	12	92	E	×	×	×	○	×	○	○	○	○
1419	Mechanical loss setting frequency bias	13	93	E	×	×	×	○	×	○	○	○	○
1420	Mechanical loss setting frequency 1	14	94	E	×	×	×	○	×	○	○	○	○

Parameters (functions) and instruction codes under different control methods

Pr.	Name	Instruction code*1			Control method*2						Parameter		
		Read	Write	Extended	V/F	Magnetic flux	Vector		Sensorless		Copy*3	Clear*3	All clear*3
							Speed control	Torque control	Speed control	Torque control			
1421	Mechanical loss 1	15	95	E	×	×	×	○	×	○	○	○	○
1422	Mechanical loss setting frequency 2	16	96	E	×	×	×	○	×	○	○	○	○
1423	Mechanical loss 2	17	97	E	×	×	×	○	×	○	○	○	○
1424	Mechanical loss setting frequency 3	18	98	E	×	×	×	○	×	○	○	○	○
1425	Mechanical loss 3	19	99	E	×	×	×	○	×	○	○	○	○
1426	Mechanical loss setting frequency 4	1A	9A	E	×	×	×	○	×	○	○	○	○
1427	Mechanical loss 4	1B	9B	E	×	×	×	○	×	○	○	○	○
1428	Mechanical loss setting frequency 5	1C	9C	E	×	×	×	○	×	○	○	○	○
1429	Mechanical loss 5	1D	9D	E	×	×	×	○	×	○	○	○	○
1480	Load characteristics measurement mode	50	D0	E	○	○	○	○	○	○	○	○	○
1481	Load characteristics load reference 1	51	D1	E	○	○	○	○	○	○	○	○	○
1482	Load characteristics load reference 2	52	D2	E	○	○	○	○	○	○	○	○	○
1483	Load characteristics load reference 3	53	D3	E	○	○	○	○	○	○	○	○	○
1484	Load characteristics load reference 4	54	D4	E	○	○	○	○	○	○	○	○	○
1485	Load characteristics load reference 5	55	D5	E	○	○	○	○	○	○	○	○	○
1486	Load characteristics maximum frequency	56	D6	E	○	○	○	○	○	○	○	○	○
1487	Load characteristics minimum frequency	57	D7	E	○	○	○	○	○	○	○	○	○
1488	Upper limit warning detection width	58	D8	E	○	○	○	○	○	○	○	○	○
1489	Lower limit warning detection width	59	D9	E	○	○	○	○	○	○	○	○	○
1490	Upper limit fault detection width	5A	DA	E	○	○	○	○	○	○	○	○	○
1491	Lower limit fault detection width	5B	DB	E	○	○	○	○	○	○	○	○	○
1492	Load status detection signal delay time / load reference measurement waiting time	5C	DC	E	○	○	○	○	○	○	○	○	○
1499	Parameter for manufacturer setting. Do not set.												

11.8 Index

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REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Revision
Jan. 2016	IB(NA)-0600622ENG-A	First edition
Jun. 2016	IB(NA)-0600622ENG-B	Added • Calibration parameters for the compensation value added to the line speed command **(Pr.635 to Pr.638)**
Oct. 2017	IB(NA)-0600622ENG-C	Added • PID upper/lower limit hysteresis width (**Pr.137**) • Empty reel inertia (integer/exponent) (**Pr.753**, **Pr.754**) • Parameters related to cumulative pulse (**Pr.755 to Pr.758**) • Winding length increment selection (cm/mm) (**Pr.1262** = "4, 5") • Parameters related to stored winding length (**Pr.1298**, **Pr.1299**) • Winding length detection (upper 4 digits) (**Pr.1346**)
Aug. 2018	IB(NA)-0600622ENG-D	Added • Parameters (**Pr.85, Pr.86, Pr.565, Pr.566, Pr.617, Pr.675, Pr.801, Pr.1348, Pr.1349, Pr.1480 to Pr.1492**) • Parameter setting range (**Pr.14, Pr.52, Pr.75, Pr.178 to Pr.189, Pr.190 to Pr.196, Pr.288, Pr.414, Pr.502, Pr.681, Pr.774 to Pr.776, Pr.803, Pr.992**) • Tension sensor feedback torque control • Speed control of intermediate shafts • Application examples
Jun. 2019	IB(NA)-0600622ENG-E	Added • Parameters (**Pr.1134**, **Pr.1135**, **Pr.1140**) • Monitoring of the wiring length (upper 4 digits) supported by FR Configurator2. • Functions available during tension sensor feedback torque control (**Pr.424**, **Pr.553**, **Pr.554**, RL signal, PID signal, Y48 signal) Edited • Parameter initial setting (**Pr.353**) • Parameter setting range (**Pr.54**, **Pr.365**, **Pr.366**, **Pr.1137**, **Pr.1139**, **Pr.1281**, **Pr.1283**, **Pr.1403**, **Pr.1405**)
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