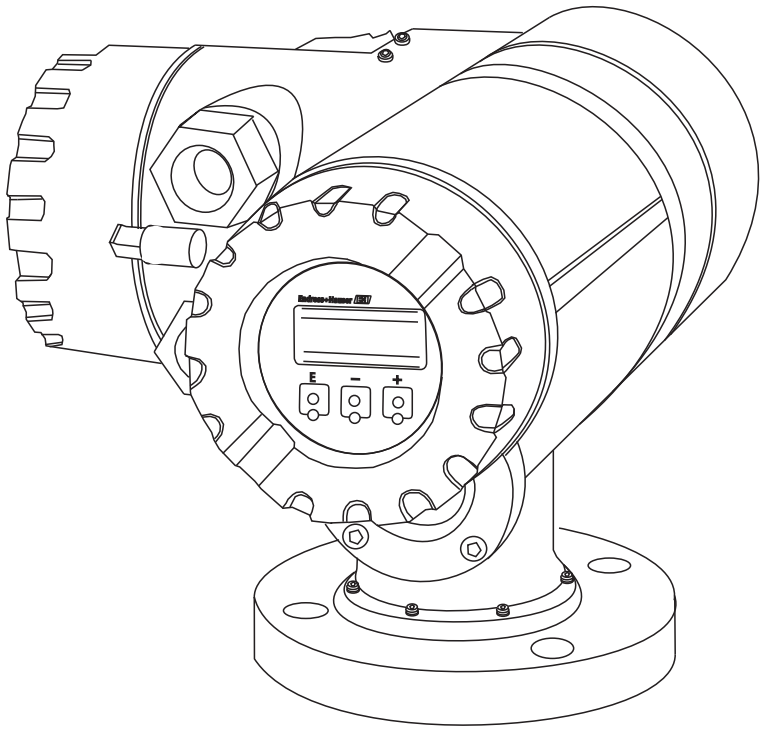
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Operating Instruction Proservo NMS5

Intelligent Tank Gauge



Endress+Hauser
People for Process Automation

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1 Safety Instructions

1.1 Designated Use

Proservo NMS5 of intelligent tank gauge is designed for high-accuracy liquid level measurement in storage and process applications.
NMS5 performs the tank inventory management, loss control, total cost saving, and safe operation.
NMS5 is designed for the purpose of single or multi-task installations, converting a wide range of measurement functions.

1.2 Installation, Commissioning, and Operation

- Mounting, electrical installation, start-up, and maintenance of the instrument may only be performed by trained personnel authorized by the operator of the facility.
- Personnel must read and understand these installation instructions before performing the procedures.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual must be observed.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system must be grounded.
- Observe all law and regulations applicable and valid for your country and pertaining to the opening and repairing of electrical devices.

1.3 Product Requirements

Power Source
Check the voltage of the power supply before connecting it to the product. It should be the exact voltage required for proper operation of the product.

Connection to Other Devices
It is possible to connect to other devices explained in this instruction. Refer to each operation instruction when connecting to devices.

Ground
Do not remove earth terminal or earth wire when the power is on.

Power Cable
Use a power cable specified by our company. The product should be protectively grounded before it is connected to a measurement object or an external control circuit.

1.4 Operational Safety

Hazardous Area

- Use the explosion proof type for measurement in areas where explosion hazards are present.
- Devices installed in areas having explosion hazards must not be opened when the power is on.
- Strict compliance with installation instructions and - ratings, as directed in this supplementary documentation, is mandatory.
- Device maintenance and repair is restricted to meet explosion proof regulations.
- Tighten the cable gland firmly.
- Devices employed in areas having explosion hazards should be installed and wired in keeping with explosion proof regulations.
- Ensure that all personnel are properly qualified.
- Observe the certification requirements as well as national and local regulations.

⚠ WARNING

Changes or modifications other than those expressly approved by Endress+Hauser are strictly prohibited. Unauthorized modifications can cause malfunction or damage, resulting in serious injury or death.

1.5 Electrostatic Charge

Mounting with a stilling well is recommended for use in a tank which contains flammable liquid with conductivity at 10^{-8} S/m or less.
In case of installation without a stilling well, allow enough stilling time according to the table below before lowering the level gauge down to the liquid surface. When a stilling well is used, the stilling time is shown as in column "<10" in the table below.

conductivity **(S/cm)**	**Reference: Stilling Time (min.)**			
	Liquid Volume in Tank (m^3)			
	≤10	**10~50**	**50~100**	**≥5000**
$\geq 10^{-8}$	≥1	≥1	≥1	≥2
$10^{-12} \sim 10^{-8}$	≥2	≥3	≥10	≥30
$10^{-14} \sim 10^{-12}$	≥4	≥5	≥60	≥120
$\leq 10^{-14}$	≥10	≥10	≥120	≥240

(Japan National Institute of Occupational Safety and Health)

1.6 Notes on Safety Conventions and Symbols

To highlight safety-relevant or alternative operating procedures in this manual, the following conventions have been used, each indicated by a corresponding symbol on the left.

Symbol	Meaning
 A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.7 Symbols for Certain Types of Information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Recommendation** Indicates procedures, processes or actions that are recommended.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.

2 Identification

2.1 Device Designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:

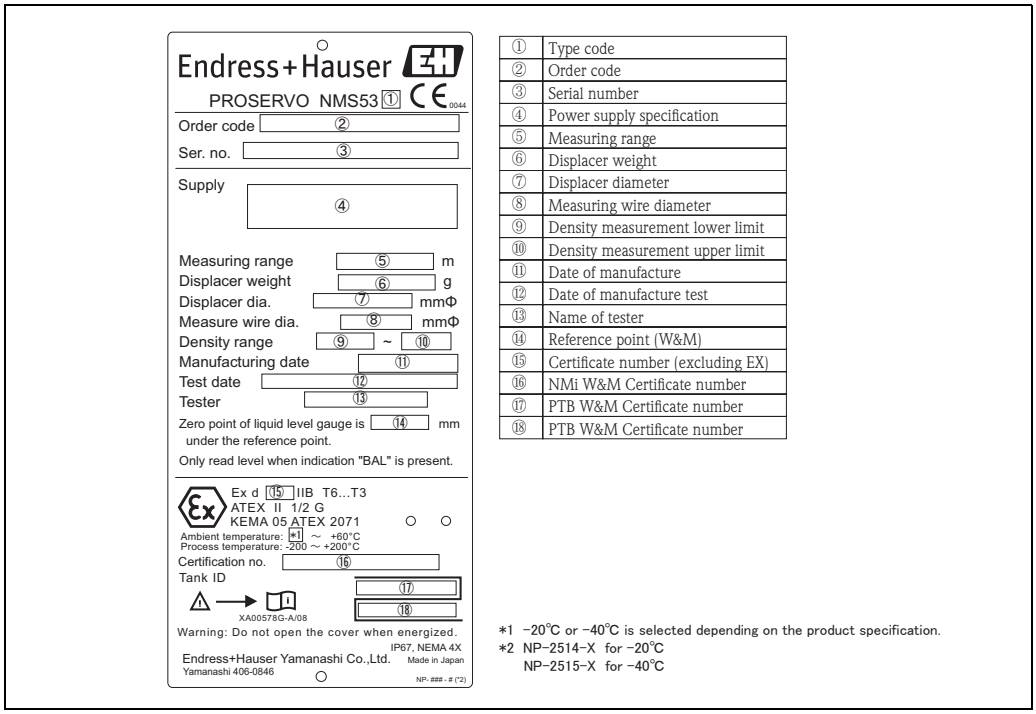


Figure 1: ATEX Approval Type Ex d/Ex d [ia]

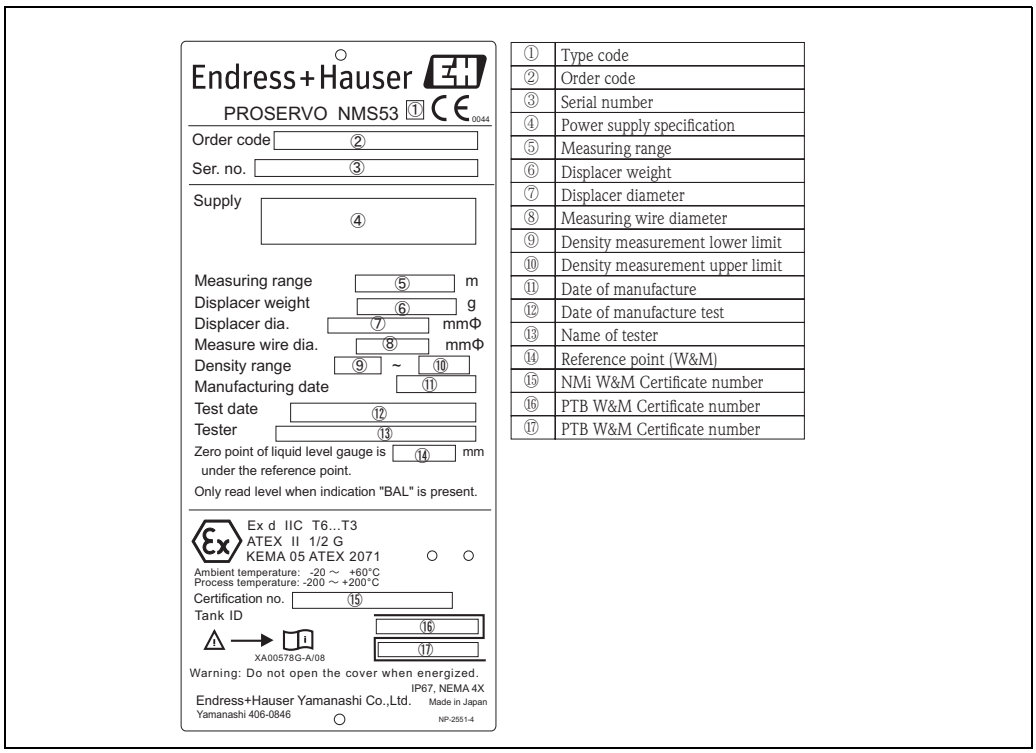
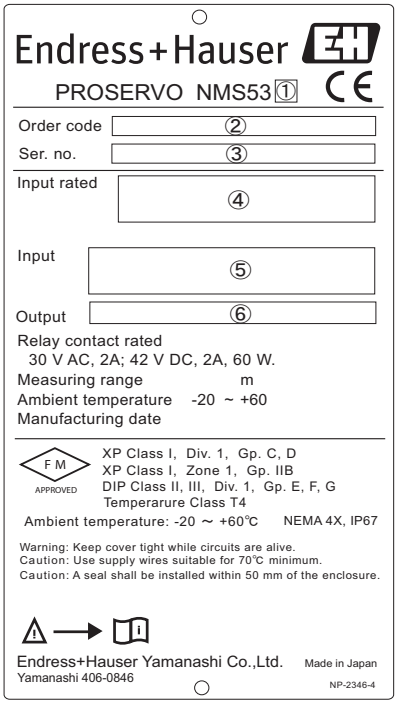
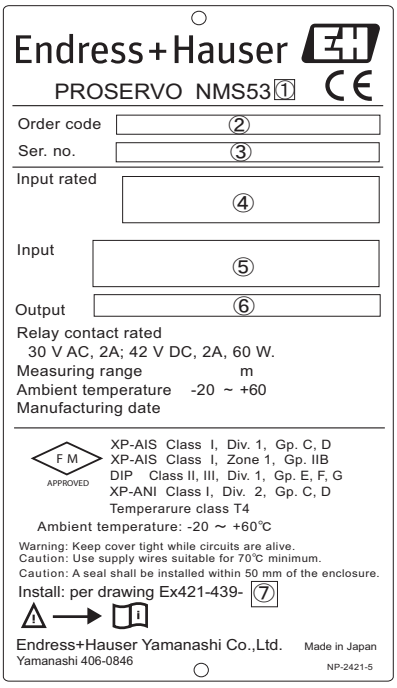


Figure 2: ATEX Approval Type Ex d



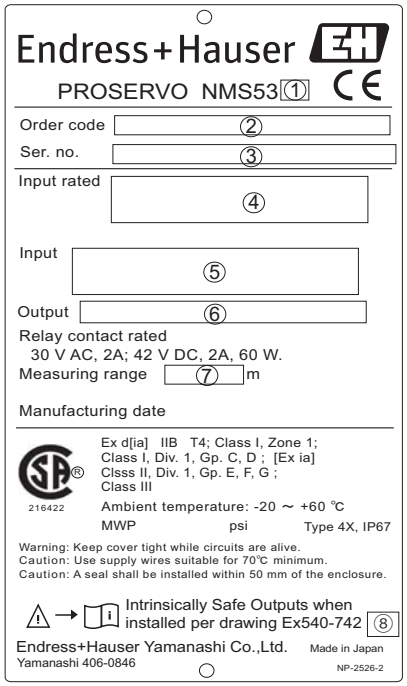
①	Type code
②	Order code
③	Serial number
④	Power supply specificaiton
⑤	Signal input specification
⑥	Signal output specification

Figure 3: FM Approval Type XP



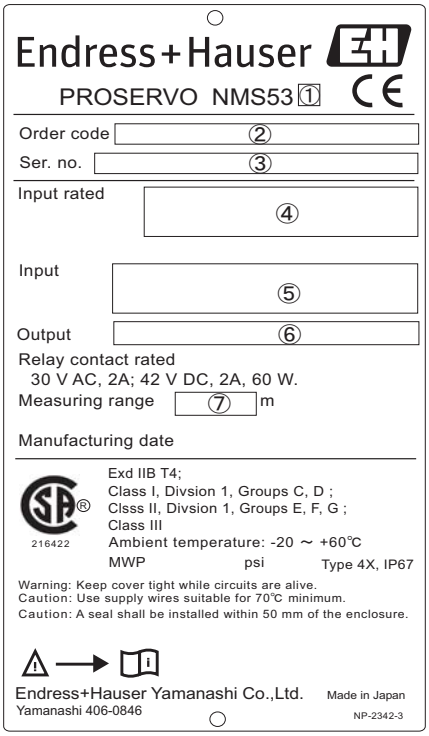
①	Type code
②	Order code
③	Serial number
④	Power supply specification
⑤	Signal input specification
⑥	Signal output specification
⑦	XA version number

Figure 4: FM Approval Type XP-AIS



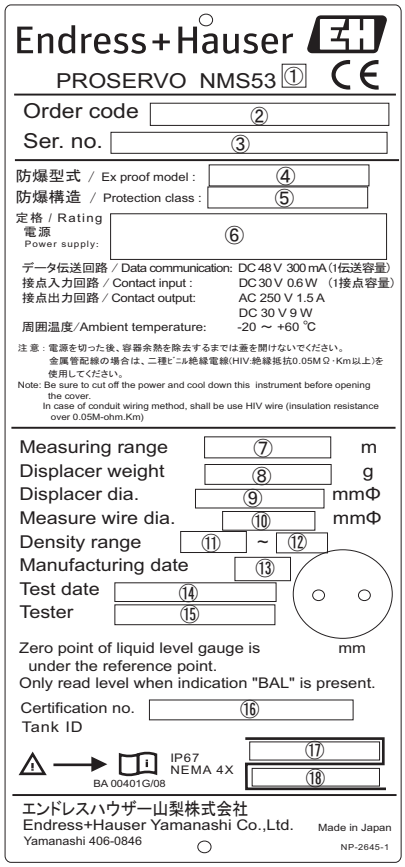
①	Type code
②	Order code
③	Serial number
④	Input rating
⑤	Signal input specification
⑥	Signal output specification
⑦	Measuring ragne
⑧	XA version number

Figure 5: CSA Approval Type Ex d[ia]



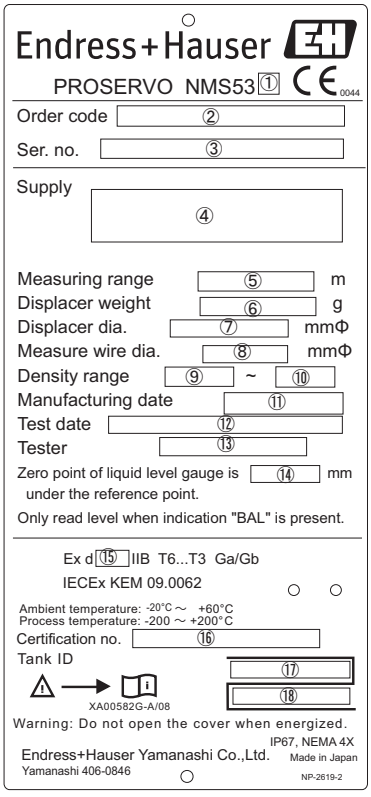
①	Type code
②	Order code
③	Serial number
④	Input rating
⑤	Signal input specification
⑥	Signal output specification
⑦	Measuring range

Figure 6: CSA Approval Type Ex d



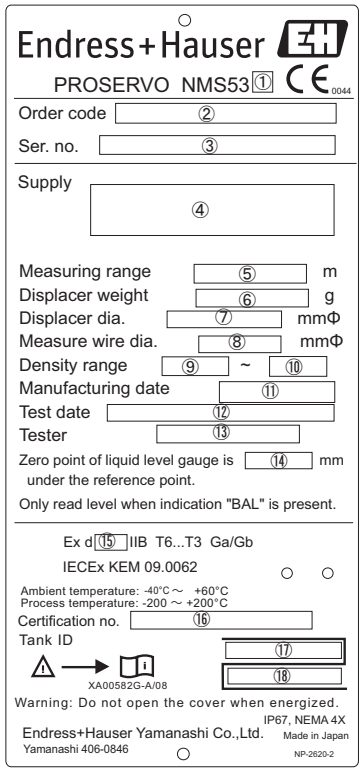
①	Type code
②	Order code
③	Serial number
④	Ex-proof model
⑤	Protection class
⑥	Power supply specification
⑦	Measuring range
⑧	Displacer weight
⑨	Displacer diameter
⑩	Measuring wire diameter
⑪	Density measurement lower limit
⑫	Density measurement upper limit
⑬	Date of manufacture
⑭	Date of manufacture test
⑮	Name of tester
⑯	NMi W&M Certificate number
⑰	PTB W&M Certificate number
⑱	PTB W&M Certificate number

Figure 7: TIIS Approval Type Ex d



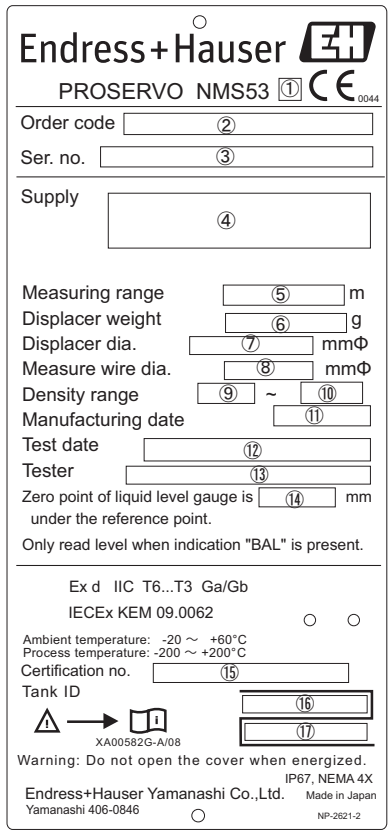
①	Type code
②	Order code
③	Serial number
④	Power supply specification
⑤	Measuring range
⑥	Displacer weight
⑦	Displacer diameter
⑧	Measuring wire diameter
⑨	Density measurement lower limit
⑩	Density measurement upper limit
⑪	Date of manufacture
⑫	Date of manufacture test
⑬	Name of tester
⑭	Reference point (W&M)
⑮	Protection class
⑯	NMi W&M Certificate number
⑰	PTB W&M Certificate number
⑱	PTB W&M Certificate number

Figure 8: IEC Approval Type Ex d -20°C



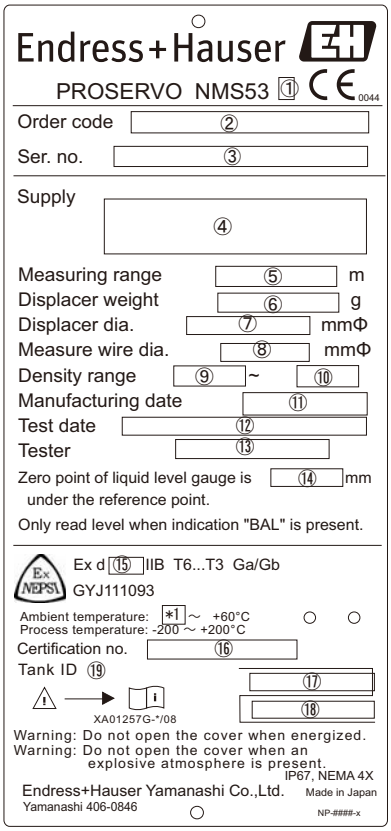
①	Type code
②	Order code
③	Serial number
④	Power supply specification
⑤	Measuring range
⑥	Displacer weight
⑦	Displacer diameter
⑧	Measuring wire diameter
⑨	Density measurement lower limit
⑩	Density measurement upper limit
⑪	Date of manufacture
⑫	Date of manufacture test
⑬	Name of tester
⑭	Reference point (W&M)
⑮	Protection class
⑯	NMi W&M Certificate number
⑰	PTB W&M Certificate number
⑱	PTB W&M Certificate number

Figure 9: IEC Approval Type Ex d -40°C



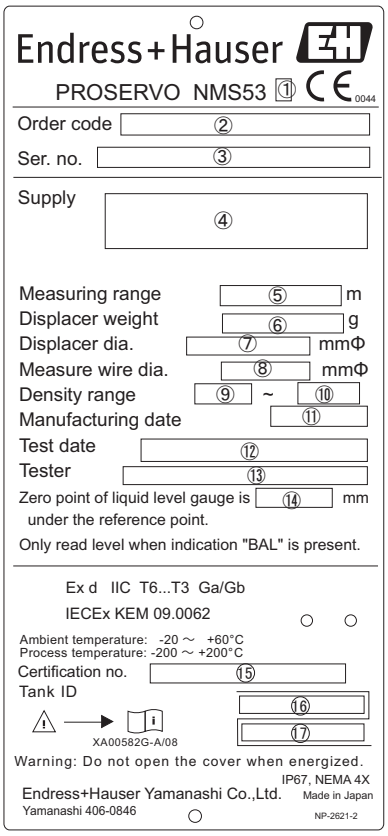
①	Type code
②	Order code
③	Serial number
④	Power supply specification
⑤	Measuring range
⑥	Displacer weight
⑦	Displacer diameter
⑧	Measuring wire diameter
⑨	Density measurement lower limit
⑩	Density measurement upper limit
⑪	Date of manufacture
⑫	Date of manufacture test
⑬	Name of tester
⑭	Reference point (W&M)
⑮	NMi W&M Certificate number
⑯	PTB W&M Certificate number
⑰	PTB W&M Certificate number

Figure 10: IEC Approval Type Ex d IIC



①	Type code
②	Order code
③	Serial number
④	Power supply specification
⑤	Measuring range
⑥	Displacer weight
⑦	Displacer diameter
⑧	Measuring wire diameter
⑨	Density measurement lower limit
⑩	Density measurement upper limit
⑪	Date of manufacture
⑫	Date of manufacture test
⑬	Name of tester
⑭	Reference point (W&M)
⑮	Protection class
⑯	NMi W&M Certificate number
⑰	PTB W&M Certificate number
⑱	PTB W&M Certificate number

Figure 11: NEPSI Approval Type IIB



①	Type code
②	Order code
③	Serial number
④	Power supply specification
⑤	Measuring range
⑥	Displacer weight
⑦	Displacer diameter
⑧	Measuring wire diameter
⑨	Density measurement lower limit
⑩	Density measurement upper limit
⑪	Date of manufacture
⑫	Date of manufacture test
⑬	Name of tester
⑭	Reference point (W&M)
⑮	Protection class
⑯	NMi W&M Certificate number
⑰	PTB W&M Certificate number
⑱	PTB W&M Certificate number

Figure 12: NEPSI Approval Type IIC

2.2 Order Information

010		**Drum Housing Pressure Rating; Material:**
	1	0··· 200mbar/20kPa/2.9psi; Alu
	2	0··· 200mbar/20kPa/2.9psi; stainless ste>
	4	0··· 5.88bar/588kPa/85.28psi; Alu
	5	0··· 5.88bar/588kPa/85.28psi; stainless steel
	6	0··· 24.5bar/2.45MPa/355.34psi; stainless steel
	9	Special version, TSP-no. to be spec.

020		**Approval:**
	0	Weather proof, IP 67 NEMA 4X
	1	TIIS Ex d IIB T4
	5	FM XP Cl. I Div. 1 Gr. C-D
	N	FM XP-AIS Cl. I Div.1 Gr. C-D
	6	CSA Cl. I Div. 1 Gr. C-D
	O	CSA Ex d|ia| Cl. I Div. 1 Gr. C-D
	G	ATEX II 1/2G Ex d IIB T6...T3
	Q	ATEX II 1/2G Ex d IIC T6...T3
	S	ATEX II 1/2G Ex d IIB T6...T3, -40°C
	J	ATEX II 1/2G Ex d (ia) IIB T6...T3
	U	ATEX II 1/2G Ex d (ia) IIB T6...T3, -40°C
	A	IEC Ex d ia IIB T6...T3 Ga/Gb
	B	IEC Ex d IIB T6...T3 Ga/Gb
	C	IEC Ex d IIC T6...T3 Ga/Gb
	D	IEC Ex d ia IIB T6...T3 Ga/Gb, -40°C
	E	IEC Ex d IIB T6...T3 Ga/Gb, -40°C
	T	NEPSI Ex d ia IIB T6...T3
	V	NEPSI Ex d IIB T6...T3
	W	NEPSI Ex d IIC T6...T3
	X	NEPSI Ex d ia IIB T6...T3, -40°C
	4	NEPSI Ex d IIB T6...T3, -40°C
	9	Special version, TSP-no. to be spec.

030		**Application:**
	A	Liquid Level
	B	PTB (<1mm) type approval, liquid level
	C	NMi (<1mm) type approval, liquid level
	D	Multi measurement, liquid level, I/F level, bottom, density
	E	PTB (<1mm) type approval, liquid level, I/F level, bottom, density
	F	NMi (<1mm) type approval, liquid level, I/F level, bottom, density
	G	Density profile multi measurement, liquid level, I/F level, bottom, density
	H	PTB (<1mm)type approval, density profile, liquid level, I/F level, bottom, density
	J	NMi (<1mm) type approval, density profile, liquid level, I/F level, bottom, density
	Y	Special version, TSP-no. to be spec.

040		**Output 1:**
	F	Not selected
	A	2-way 2-wire (V1 protocol)
	J	2-way 2-wire (MDP protocol)
	B	2-way 2-wire (BBB protocol)
	C	2-way 2-wire (MIC, RS232C protocol)
	D	2-way 2-wire (MIC protocol)
	G	HART active
	H	HART passive
	L	Whessmatic 550, overvoltage protection
	M	Mark Space
	N	Enraf BPM
	P	Modbus RS 485
	Y	Special version, TSP-no. to be spec.

NMS5-	**Product designation (Continued on next page)**

050	Output 2:
0	Not selected
1	4 x relay SPST
2	2 x 4-20mA
3	4 x relay SPST, 2 x 4 - 20mA
4	2 x relay SPST, Overspill prevention TÜV
5	4 x relay SPST, 1 x 4 - 20mA
9	Special version, TSP-no. to be spec.

060	Input:
0	HART (NMT5xx, NRF560, pressure transmitter)
1	1 x spot temperature Pt100, HART (NRF560, pressure transmitter)
2	2 x operation contact, HART (NMT5xx, NRF560, pressure transmitter)
3	1 x spot temperature Pt100, 2 x operation contact, HART (NMT5xx, NRF560, pressure transmitter)
4	1 x status, HART (NMT5xx, NRF560, pressure transmitter)
5	1 x spot temperature Pt100, 1 x status, HART (NMT5xx, NRF560, pressure transmitter)
6	1 x spot temperature Pt100, 1 x status, 2 x operation contact, HART (NMT5xx, NRF560, pressure transmitter)
9	Special version, TSP-no. to be spec.

070	Measuring Range; wire:
C	0 - 28m; SUS316L, 0.15mm
L	0 - 36m; SUS316L, 0.15mm
N	0 - 47m; SUS316L, 0.15mm
H	0 - 16m; PFA>SUS316, 0.4mm
K	0 - 16m; Alloy C, 0.2mm
M	0 - 22m; Alloy C, 0.2mm
Y	Special version, TSP-no. to be spec.

080	Cable Entry:
E	4 x thread G1/2
F	4 x thread G3/4
G	4 x thread NPT1/2
H	4 x thread NPT3/4
L	4 x thread M20
M	4 x thread M25
Y	Special version, TSP-no. to be spec.

090	Process Connection:
A	10K 80A RF, flange JIS B2220
C	10K 80A FF, flange JIS B2220
U	10K 150A RF, flange JIS B2220
E	20K 80A RF, flange JIS B2220
G	NPS 3" Cl.150 RF, flange ASME B16.5
J	NPS 3" Cl.300 RF, flange ASME B16.5
W	NPS 4" Cl.300 RF, flange ASME B16.5
T	NPS 6" Cl.150 RF, flange ASME B16.5
L	DN80 PN10 B1, flange EN1092-1 (DIN2527 B)
N	DN80 PN25 B1, flange EN1092-1 (DIN2527 B)
Q	80A 150lbs RF, flange JPI 7S-15
S	80A 300lbs RF (apply for NMS5-6), flange JPI 7S-15
Y	Special version, TSP-no. to be spec.

100	Power supply:
3	85 - 264 VAC, 50/60 Hz
4	20 - 62 VDC, 20 - 55 VAC, 50/60 Hz
Y	Special version, TSP-no. to be spec.

NMS5-	Product designation (Continued on next page)

110	**Displacer:**	
	N	Cylindrical 30 mm, SUS316
	K	Cylindrical 40 mm, SUS316
	D	Cylindrical 50 mm, SUS316
	W	Cylindrical 30 mm, PTFE
	V	Cylindrical 40 mm, PTFE
	U	Cylindrical 50 mm, PTFE
	T	Cylindrical 50 mm, Alloy C
	B	Conical 50 mm, PTFE
	R	Conical 70 mm, SUS316
	S	Conical 110 mm, SUS316
	Y	Special version, TSP-no. to be spec.

120	**O-ring; chamber finishing:**	
	0	NBR; not selected
	1	Silicon rubber; not selected
	5	Silicone rubber; FEP coated
	3	PTFE (wire drum FKM); not selected
	4	PTFE (Wire drum FKM); FEP coated
	6	CR; not selected
	2	FKM; not selected
	7	FKM; FEP coated
	8	FFKM; not selected
	A	FFKM; FEP coated
	9	Special version, TSP-no. to be spec.

130	**Options:**	
	A	not selected
	C	Rc3/8 cleaning nozzle
	D	Rc3/8 gas purging nozzle
	E	Guide wire installation
	G	Relief valve
	H	Relief valve, pressure gauge
	J	Sunshade
	L	Rc3/8 gas purging nozzle, sunshade
	M	Rc3/8 cleaning nozzle, sunshade
	N	Rc3/8 gas purging nozzle, guide wire installation
	P	Rc3/8 cleaning nozzle, guide wire installation
	Q	Guide wire installation, sunshade
	R	Relief valve, guide wire installation
	S	Relief valve, pressure gauge, guide wire installation
	T	Relief valve, sunshade
	U	Relief valve, pressure gauge, sunshade
	Y	Special version, TSP-no. to be spec.

NMS5-	**Complete product designation**

2.3 Scope of Delivery

⚠ WARNING

It is extremely important to follow the instructions concerning the unpacking, transportation and storage of measuring instruments provided in the chapter “Incoming Acceptance, Transportation, Storage”.

The scope of delivery consists of:

- Assembled Instrument

Accompanying documentation:

- Installation Instructions (this manual)
- Safety Instructions (XA)
- Functional Safety Manual (SD), Supplied with 4-20mA and Overspill Prevention Relay Output

2.4 Certificates and Approvals

CE Mark, Declaration of Conformity
The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.5 Registered Trademarks

HART®
Registered trademark of HART Communication Foundation, Austin, USA

FieldCare®
Registered trademark of the company Endress+Hauser Flowtec AG, Rheinach, CH

3 Installation

3.1 Incoming Acceptance, Transport, and Storage

3.1.1 Incoming Acceptance

Check the packing and contents for any signs of damage.
Check the shipment, and make sure that nothing is missing and that the items match your order.

3.1.2 Transport

WARNING

- Follow the safety instructions and conditions of transportation for instruments in excess of 18kg (40 lbs.).
- Do not lift the measuring instrument by its housing during transportation.

3.1.3 Storage

Pack the measuring instrument so that it is protected against impacts during storage and transportation.
The original packing material provides the optimum protection for this.
The allowed storage temperature is -40 to +85°C (-40 to +185°F)

3.2 Terms Related to Tank Measurements

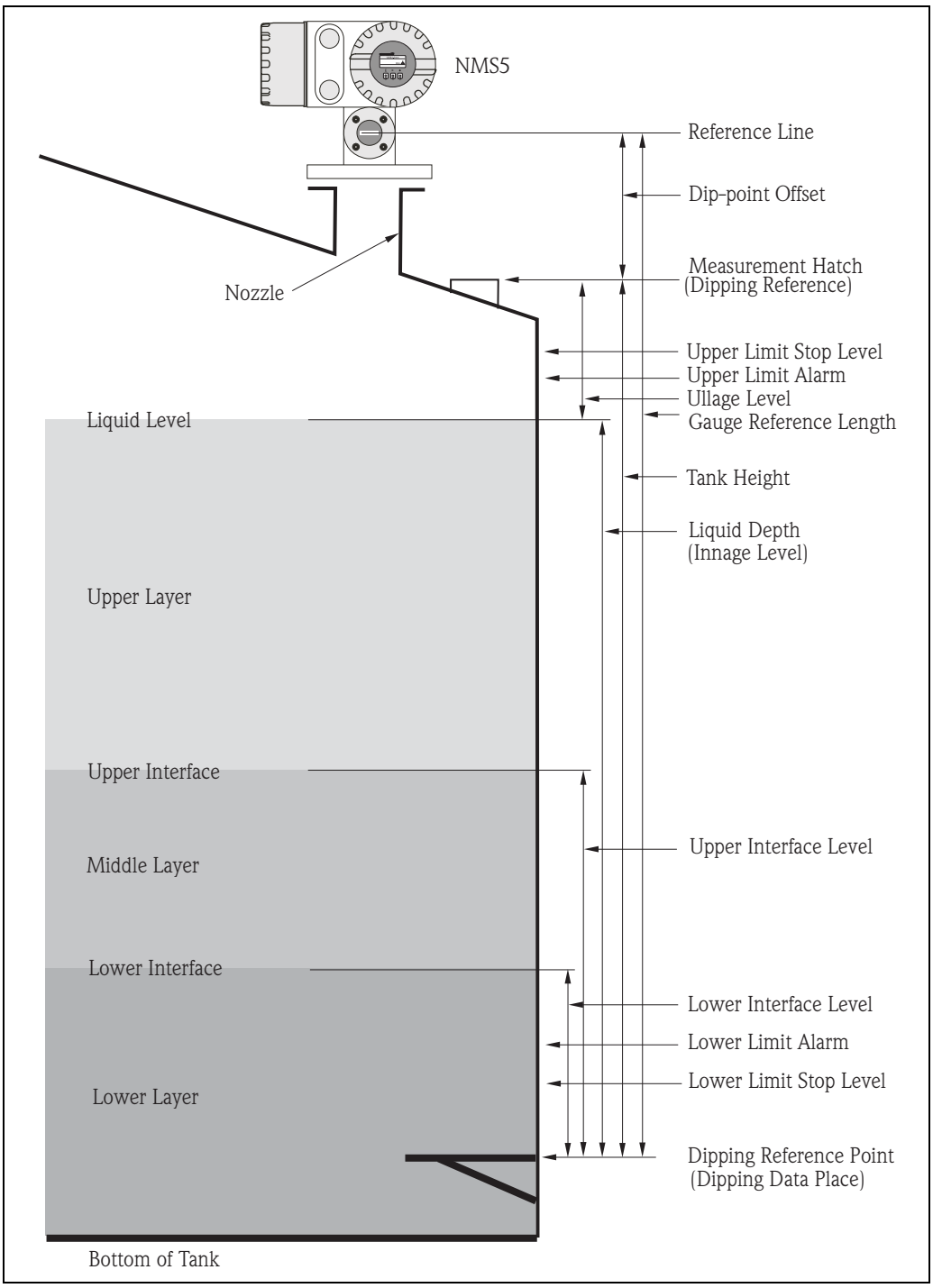
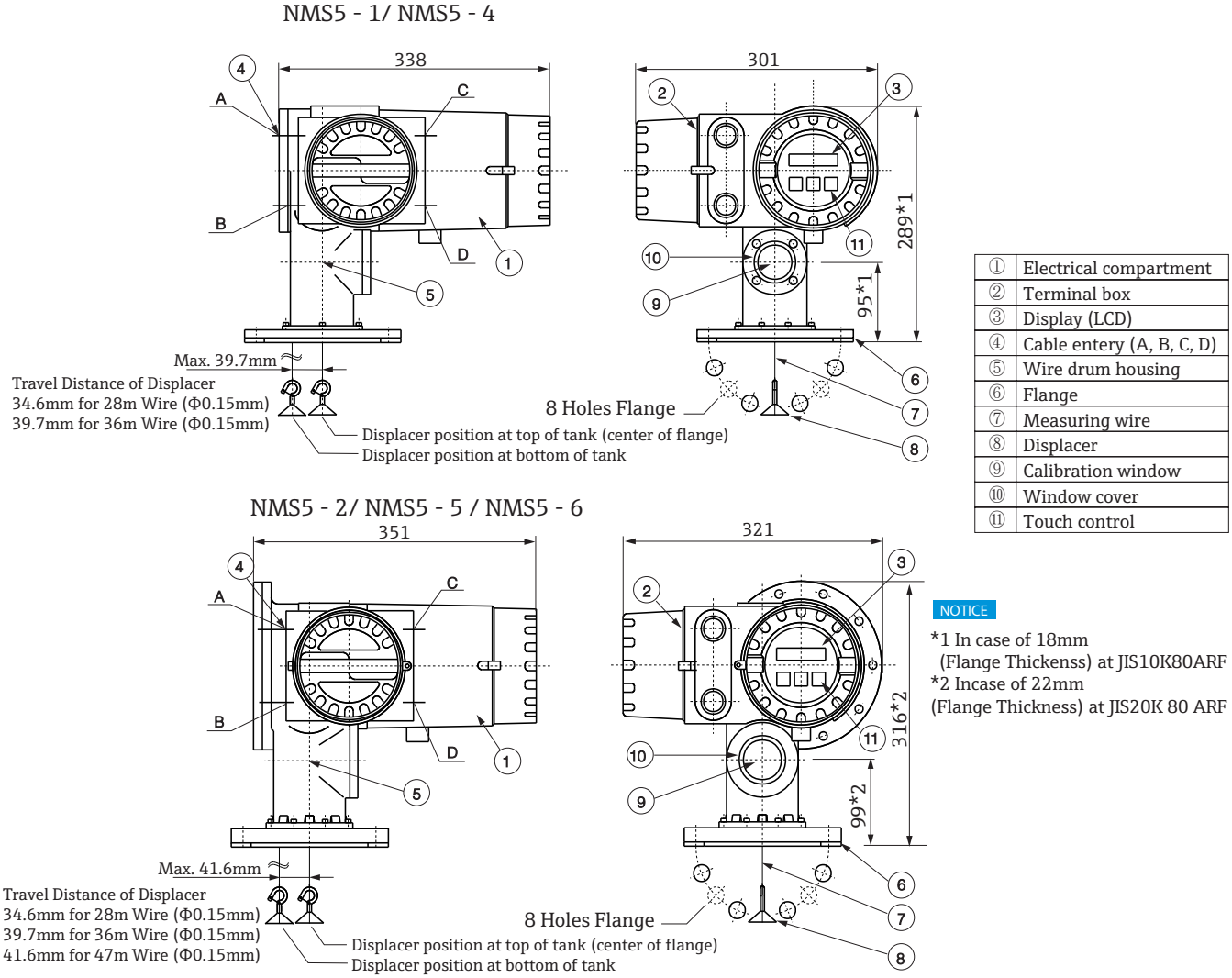


Figure 13: Terms Related to Tank Measurements

3.3 Design and Dimensions



①	Electrical compartment
②	Terminal box
③	Display (LCD)
④	Cable entery (A, B, C, D)
⑤	Wire drum housing
⑥	Flange
⑦	Measuring wire
⑧	Displacer
⑨	Calibration window
⑩	Window cover
⑪	Touch control

NOTICE

*1 In case of 18mm
(Flange Thickenss) at JIS10K80ARF
*2 Incase of 22mm
(Flange Thickness) at JIS20K 80 ARF

Figure 14: NMS5 Dimension

3.4 Necessary Tools for Installation

The following tools are required when installing NMS5.

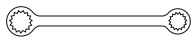
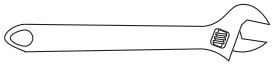
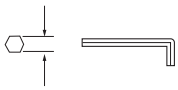
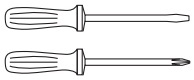
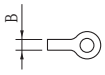
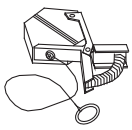
Box End Wrench	 24,26,30,32
Crescent Wrench	 350mm
Allen Wrench (Hex Key)	 3mm and 5mm
Screw Driver ■ Flat Head ■ Phillips	
Wire Cutters or Terminal Pliers	
Wire Terminal	 3 mm 1.25 sq, 2.0 sq
Water Pump Pliers	
Density Calibration Test Weight	

Figure 15: Tools to Be Prepared

4 Mounting of NMS5

The following installation procedures are available for NMS5.

- Mounting without guide system.
- Mounting with stilling well
- Mounting with guide wire

4.1 Application Drawing for Tank

Mounting with stilling well or guide wire is required for the following applications:

- Floating Roof Tank
- Covered Floating Roof Tank
- Tank with Strong Agitator or Heavy Turbulence

Mounting without any guide system covers all cases that are not listed above.
Refer to Figure 14 of applications (with and without mounting stilling well, with mounting guide wire)

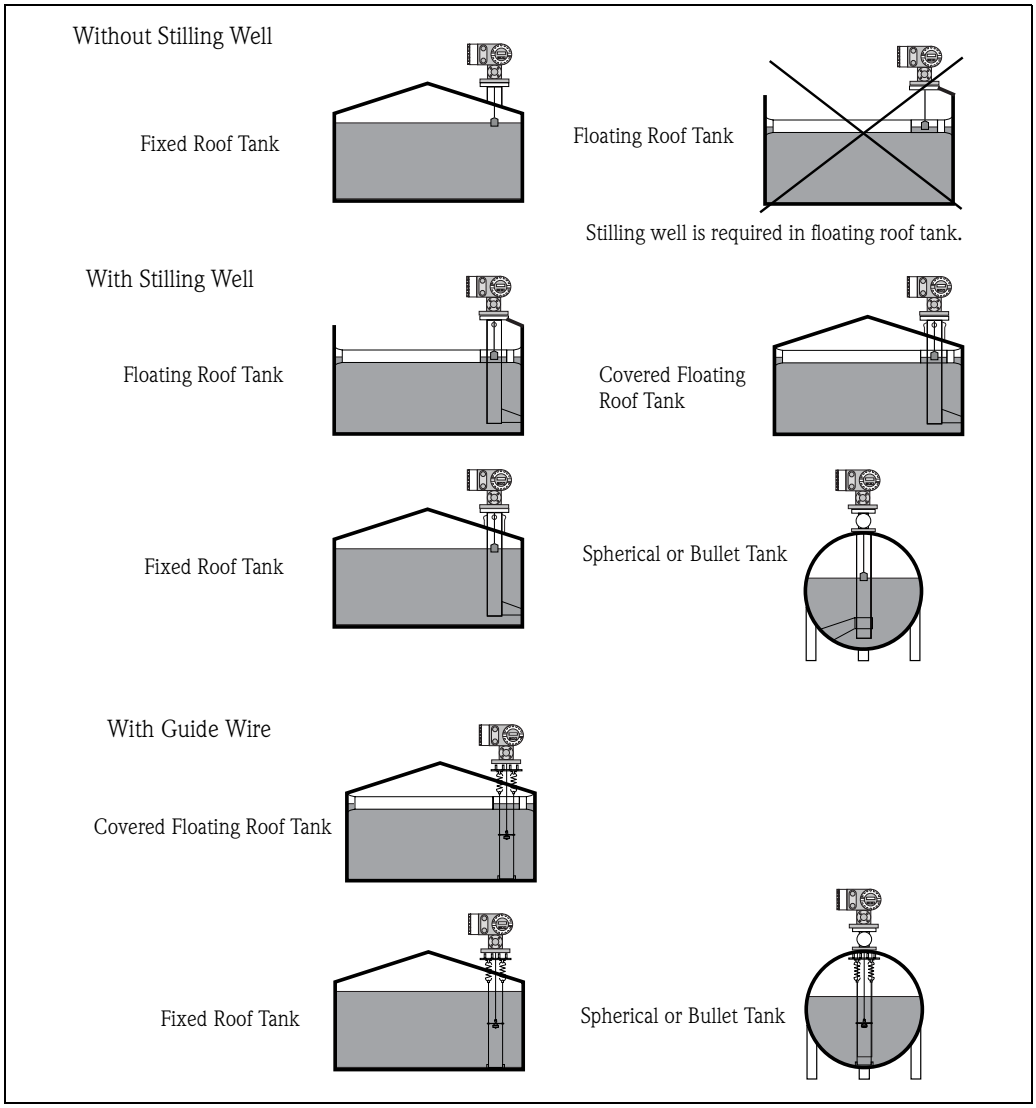


Figure 16: Application for Each Tank

4.2 Mounting without Guide System

NMS5 is mounted on a nozzle of the tank roof without any guide system (Refer to Figure. 14: Application for Each Tank). The mounting preparations require the observance of some recommendations for setting the nozzle and the minimum measuring level.

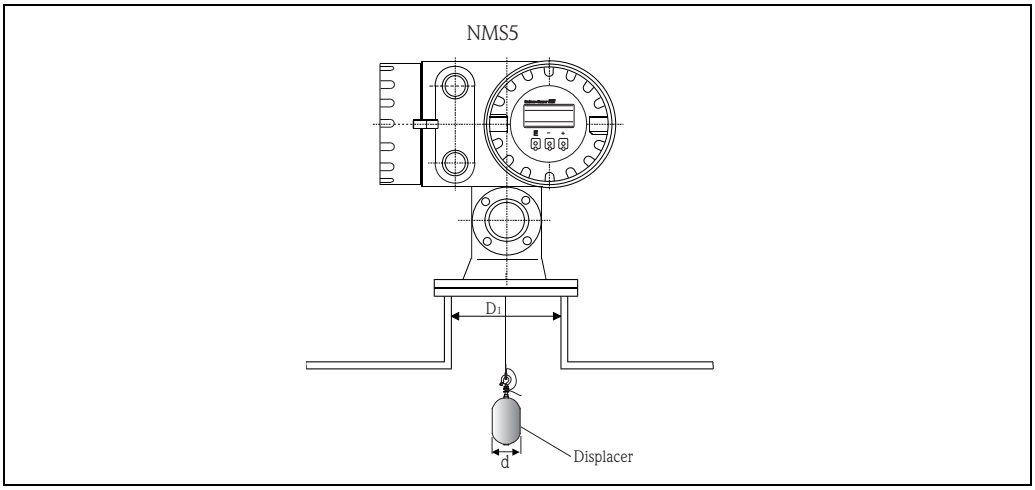


Figure 17: Mounting without Guide System

4.3 Mounting with Stilling Well

Stilling Well Diameter

The stiling well diameter that is required to protect the measuring wire without disturbing its operation varies depending on the tank height. The stiling well could either be constant diameter, or thinner at its upper part and thicker at its lower part. The figure 16 shows two examples of the latter case, namely an asymmetric pipe and a concentric pipe.

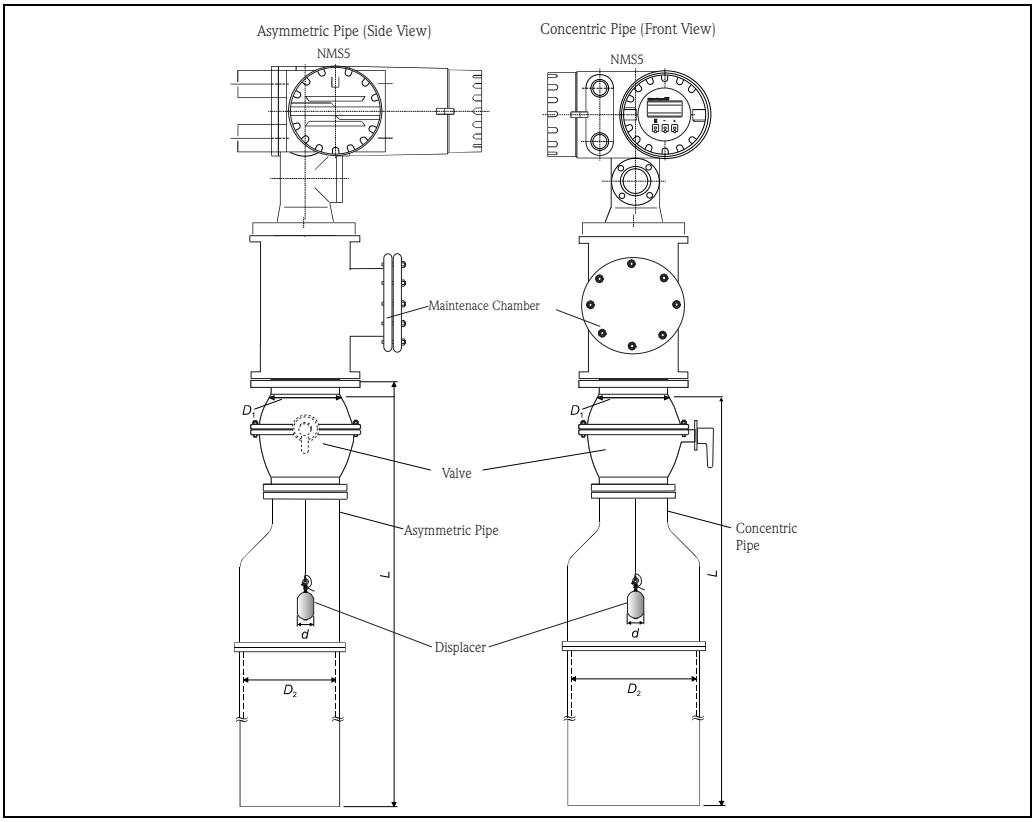


Figure 18: Mounting with Stilling Well, Asymmetric Pipe, and Connection Pipe

⚠ CAUTION

The valve is required when mounting NMS5 on pressurized liquid tanks.
NMS5 must be mounted on the asymmetric pipe in the direction shown on Figure 16.
To calculate the required pipe diameters, the formula below should be used.
The variables and constants have the following meanings.

D1: Inner diameter of the upper part of the pipe
D2: Inner diameter of the lower part of the pipe
L: Length of the pipe (from the flange of NMS5 to bottom of the stilling well) meters
v: Deviation of the pipe from the vertical per length (mm/m)
d: Diameter of the displacer
e: Lateral shift of the displacer per length due to the groove of the wire drum

Feature: 070	Measuring Range/Material/Diameter of Wire	e = Lateral Shift (mm)
C	0-28m: SUS316L, 0.15mm	0.37
H	0-16m: PFA>SUS316, 0.4mm	0.40
K	0-16m: Alloy C, 0.2mm	0.47
L	0-36m: SUS316L, 0.15mm	0.33
M	0-22m: Alloy C, 0.2mm	0.47
N	0-47m: SUS316L, 0.15mm	0.30

- Upper Diameter of Stilling Well

$D_1 > d + 10$ mm

D1 should be 3" or more.

- Lower Diameter of Stilling Well

  – Asymmetric Pipe

$D_2 > d + eL + 2vL + 10$mm

  – Concentric Pipe

$D_2 > d + 2eL + 2vL + 10$mm

Recommendations for Mounting Stilling Well

⚠ CAUTION

Follow the recommendations for mounting NMS5 with stilling well:

- Keep the pipe connection welds smooth.
- While drilling holes into the pipe, keep the interior surface of the holes clear of metal chips and burrs.
- Coat or paint the interior surface of the pipe to avoid rust.
- Keep the pipe as perfectly vertical as possible. Check this by a plumb.
- Install the asymmetric pipe under the valve and fit the centers of the NMS5 and the valve.
- Set the center of the lower part of the asymmetric pipe to the direction of the displacer motion.
- Observe recommendations as per API MPMS chapter 3.1B.
- Confirm grounding between NMS NMS5 and tank nozzle.

4.4 Mounting NMS5 with Guide Wire

It is also possible to guide the displacer by a guide wire to prevent lateral motion.

Guide Wire Installation Procedure

1. Secure the guide wire [4] to the wire hook.
2. Secure the springs [3] to the reducer plate [2] (see Figure 17).
3. Fix NMS5 [1] temporarily so that springs are located at the outside the reducer plate.
4. Perform weight calibration.
5. Fix NMS5 to the reducer plate.
6. Put displacer ring [7] through guide wire and set the displacer [5] so that marking ring [6] is located on the reference position.

This completes the guide wire installation procedure.

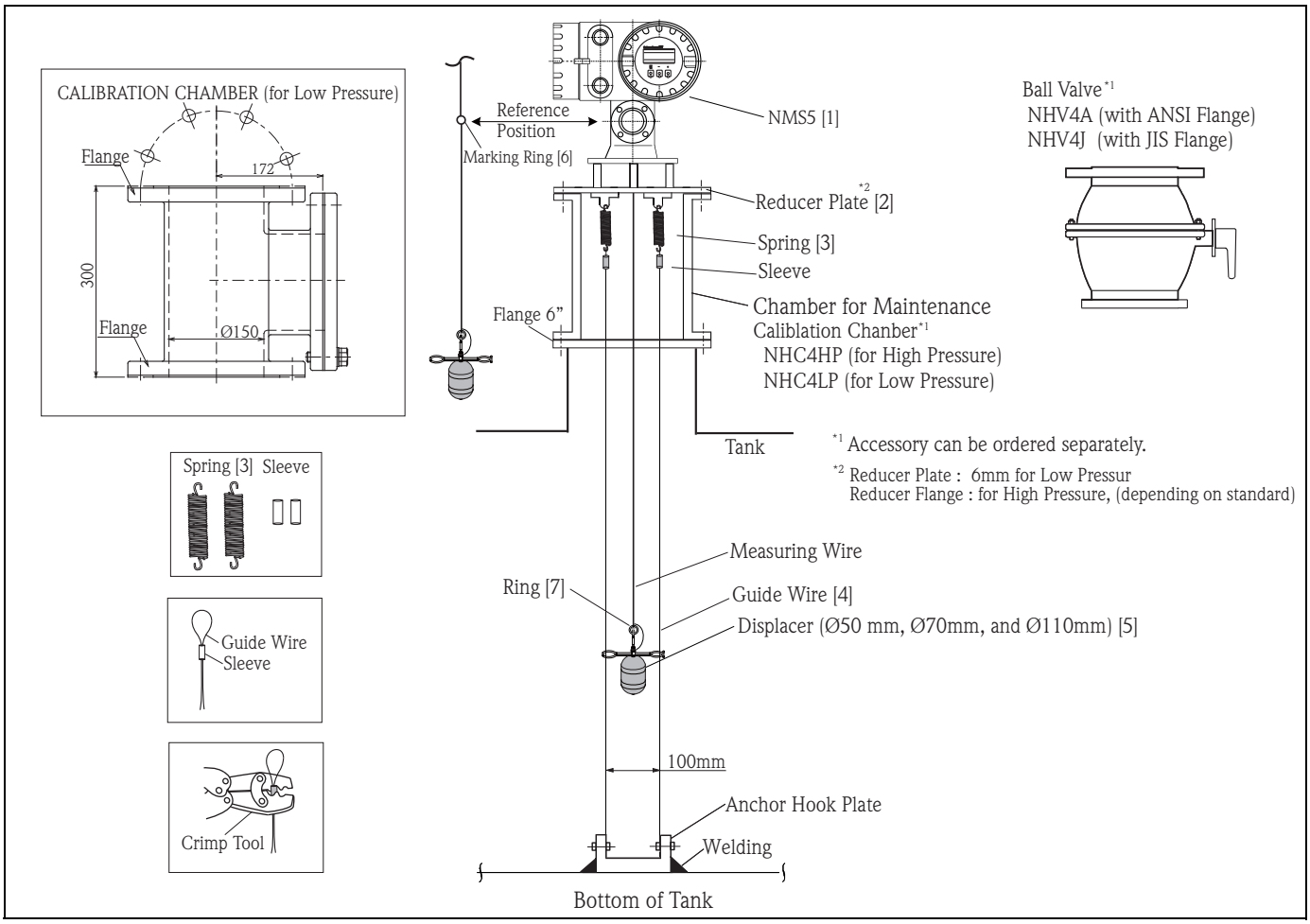


Figure 19: Mounting with Guide Wire

Weight Calibration Method for Guide Wire Installation

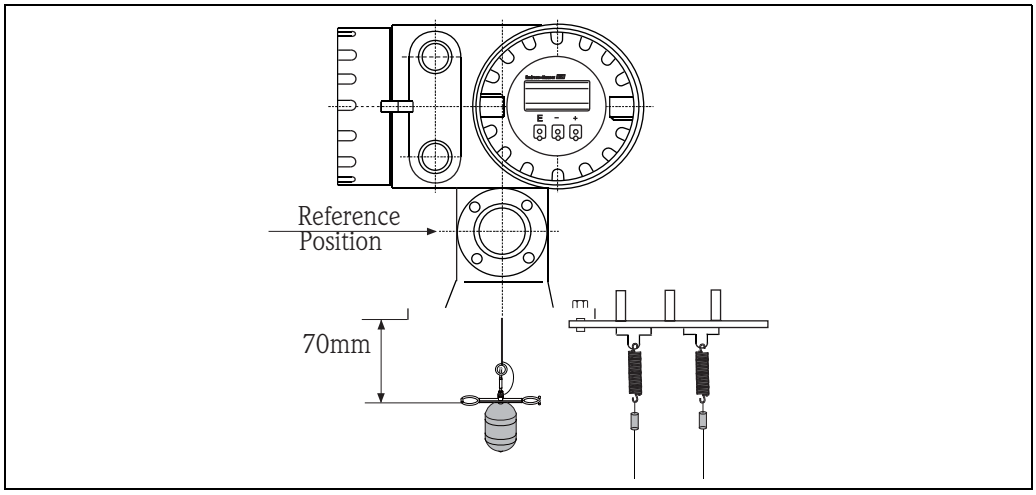


Figure 20: Weight Calibration for NMS with Guide Wire

Weight Calibration Procedure

1. Fix NMS5 temporarily so that NMS5 is located at the outside the reducer plate to perform weight calibration.
2. Replace the measuring wire to an appropriate length.
   - During standard weight calibration, the displacer moves up until it touches the mechanical stop in the housing.
   - After weight calibration is finished, the displacer stops 70mm (the value set in the matrix (configurable, GVH378)) below the mechanical stop. This is the Reference Position.
3. During this special weight calibration, the guide rings of the displacer touches the bottom face of the flange.
4. The displacer goes down 70mm and stops. NMS5 remembers the distance of 70mm as Reference Position, and weight table calibration resumes.
5. When weight calibration is complete, return NMS5 back to its original mounting position on the tank nozzle.

This completes the weight calibration procedure.

4.4.1 Type of Tanks

Fixed Roof Tank with Stilling Well

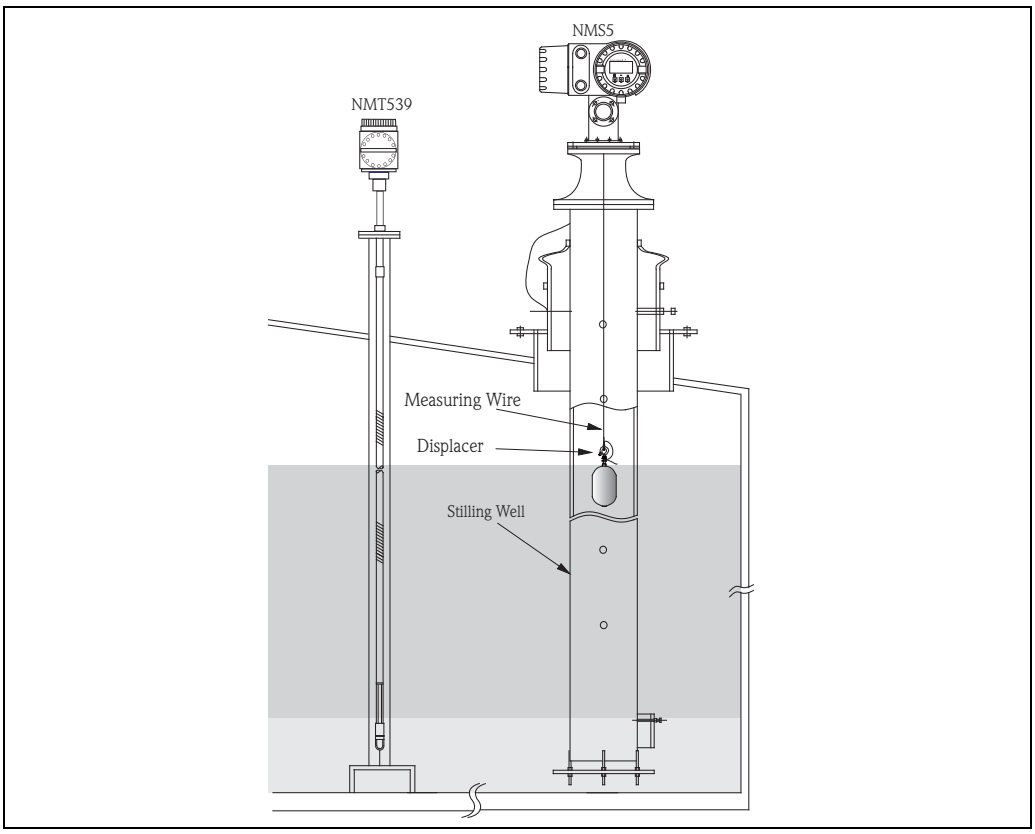


Figure 21: Stilling Well in Fixed Roof Tank

Pressurized Tank with Stilling Well and Ball Valve

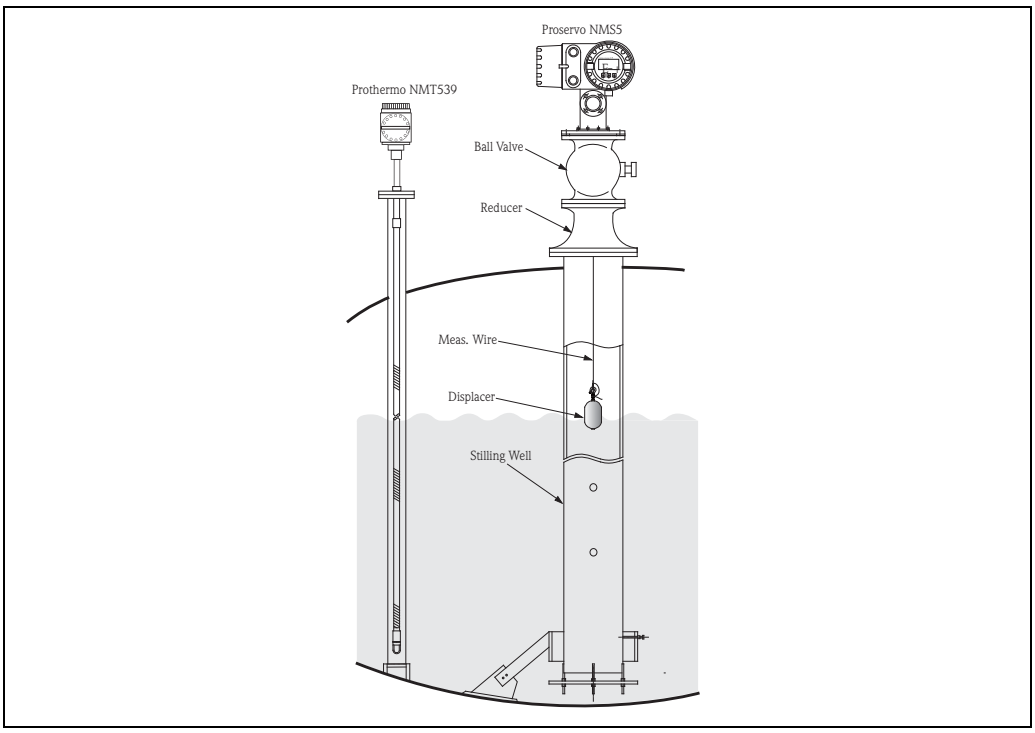


Figure 22: Stilling Well in Pressurized Tank

Floating Roof Tank and /or Covered Floating Roof Tank

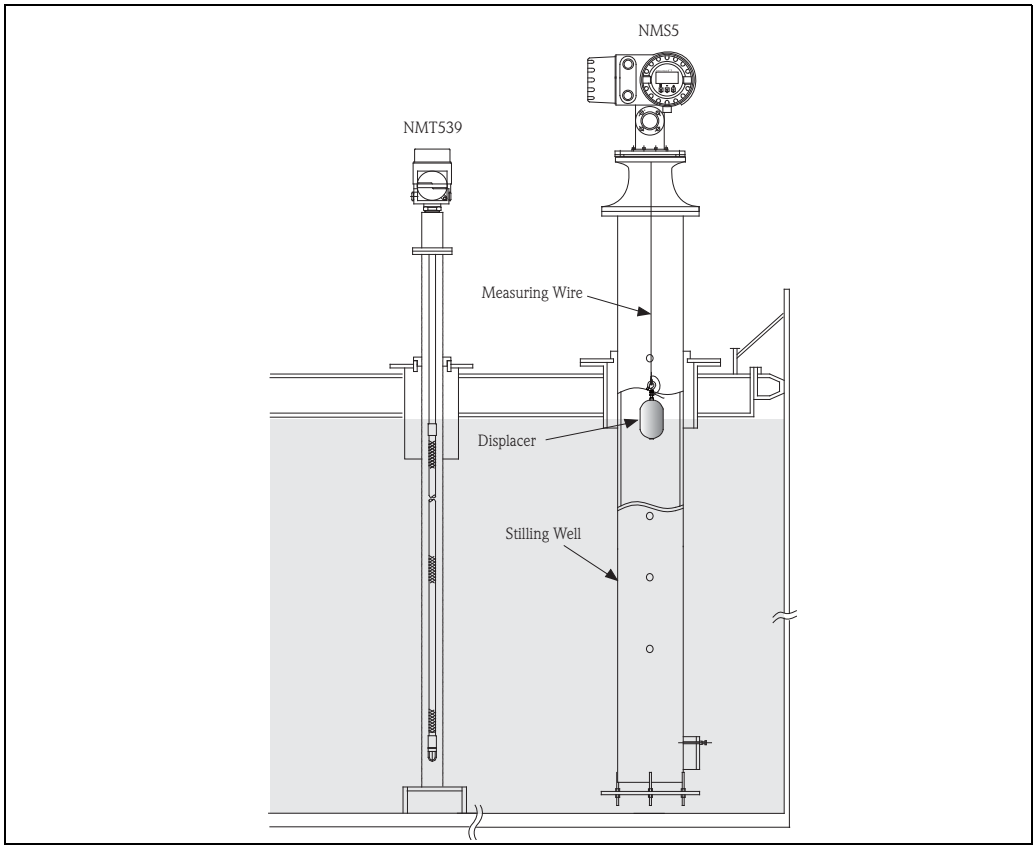


Figure 23: Stilling Well in Floating Roof Tank/Covered Floating Roof Tank

⚠ CAUTION

When NMS5 is installed in a floating roof tank, ensure to use a stilling well.

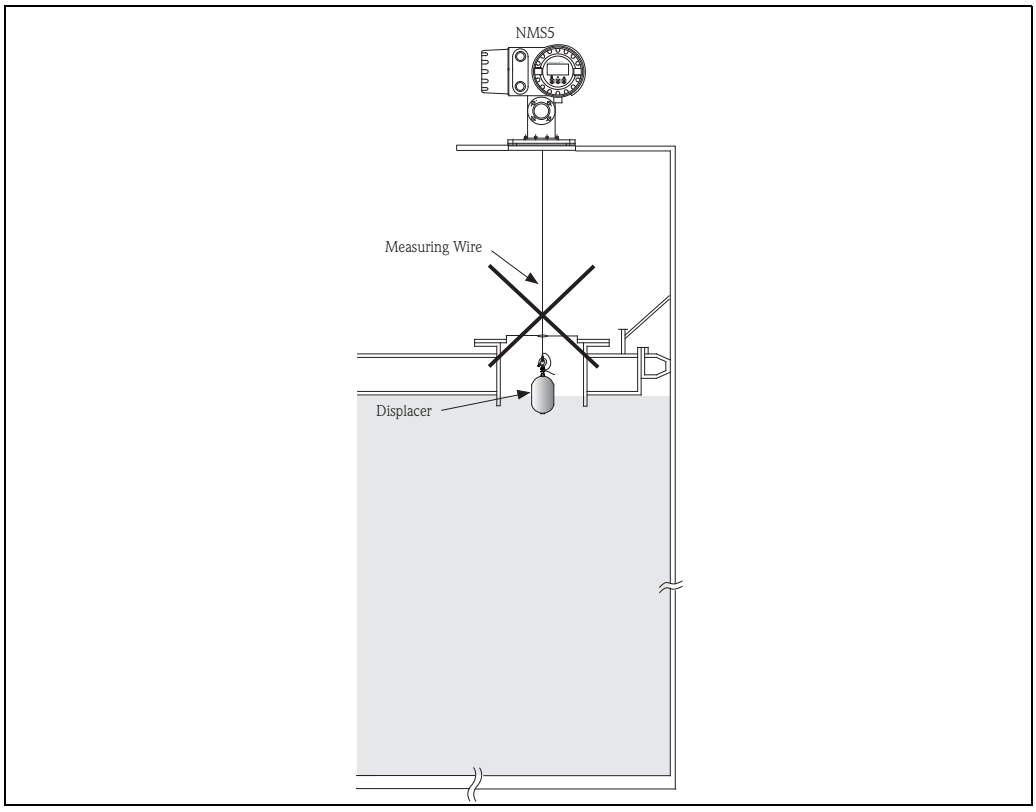


Figure 24: Stilling Well in Floating Roof Tank

4.5 Preparation for Mounting of NMS5

4.5.1 Flange

A nozzle and a flange should be prepared prior to mounting NMS5 on the tank. The flange size and the rating of NMS5 vary depending on the customer's specifications.

⚠ CAUTION

- Check the flange size of NMS5.
- Mount the flange on the top of the tank. The deviation of the flange from the horizontal plane should not exceed +/- 1 degree.
- When mounting NMS5 on a long nozzle, ensure that the displacer does not touch the inner side of the nozzle when the nozzle is in the vertical position.

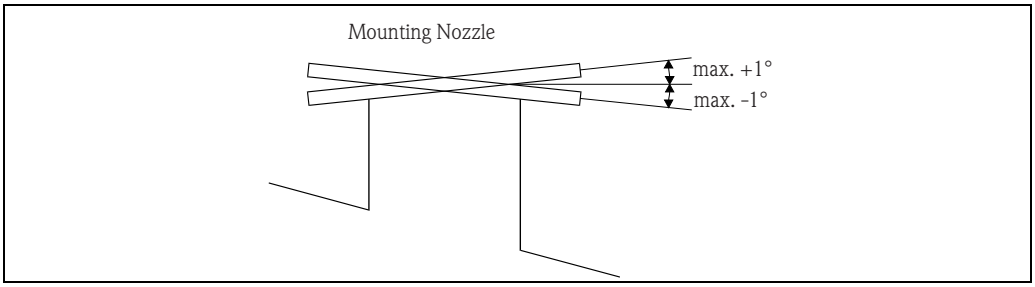


Figure 25: Allowable Inclination of Mounting Flange

⚠ CAUTION

When NMS5 is installed without a guide system, follow the recommendations below:

- Set the mounting nozzle in the sector between 45 and 90 deg (or -45 and -90 deg.) apart from the inlet pipe of the tank. This prevents heavy swing of the displacer caused by wave or turbulence of the inlet liquid.
- Set the mounting nozzle at 500mm or more away from the tank wall. Ensure that the measurement is not influenced by changes of the ambient temperature.
- Set the minimum measuring level at 500mm or more above the top of the inlet pipe. This protects the displacer from direct flow of the inlet liquid.
- If the stilling well can not be mounted in the tank due to the shape or condition of a tank, attaching a guide system is recommended. Consult E+H services for further information.

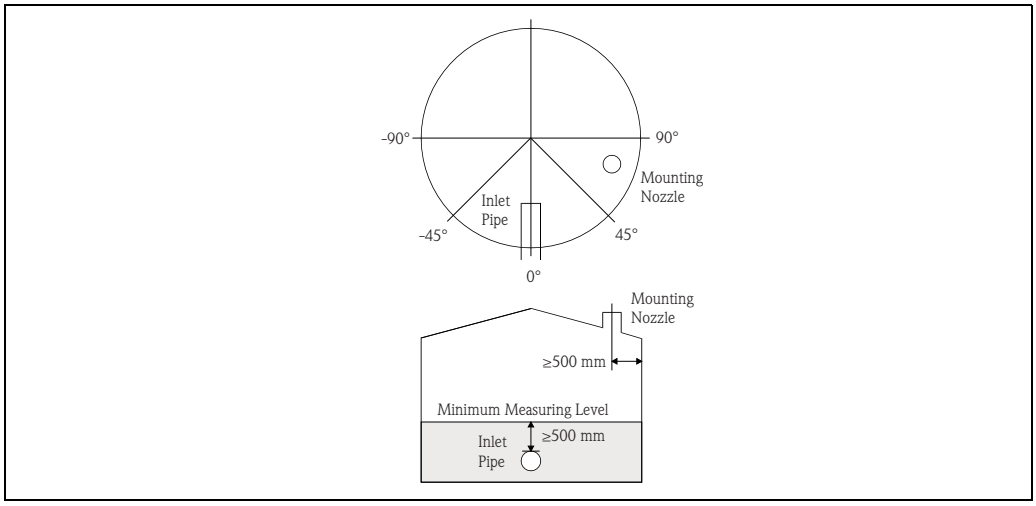


Figure 26: Recommended Setting of Mounting Nozzle and Minimum Measuring Level

⚠ CAUTION

- Before pouring liquid into the tank, confirm that liquid flowing through the inlet of the pipe does not touch the displacer directly.
- When discharging liquid of the tank, ensure that the displacer does not get caught in the liquid current and sucked into the outlet pipe.

4.6 Electrostatic Charge

⚠ CAUTION

When liquid measured by NMS5 has a conductivity at 10^{-8} s/cm or less, it is quasi-nonconductive. In this case, using a stilling well or guide wire is recommended. This releases the electrostatic charge on liquid surface. (refer to "1.5 Electrostatic Charge" details on a stiling time for a volume of a charged object).

4.7 Installation for Wire Drum and Displacer

When NMS5 is delivered, there are 2 ways of packing procedures depending on mounting methods of a displacer.

1. For All-in-one method, the displacer is mounted on the measuring wire of NMS5. Follow the instructions to remove the packing attached to NMS5.
2. Displacer shipped separately. It is necessary to install the displacer in the measuring wire inside NMS5. Follow the instructions below.

4.7.1 All-in-one

As NMS5 is protected by some packaging materials, remove them as follows prior to mounting NMS5 (refer to Figure 25: Removing Procedure for All-in-one).

Packaging Material Removing Procedure

Step	Procedure	Notes
1	1. Hold the gauge so that it stays horizontal against the flange. 2. Cut the fixing bands. 3. Remove the displacer holder.	▪ Do not tilt the gauge after removing the displacer holder.
2	4. Mount NMS5 on the nozzle .	▪ Be sure that the measuring wire hangs vertically. ▪ Confirm that there are no kinks or other malfunctions in the calibration window.
3	5. Remove the drum housing cover from NMS5 unit. 6. Loosen two screws on the wire drum holder and remove the holder and the bracket.	▪ Be sure not to lose O-ring and fixed bolts for the cover for the drum housing.
4	7. Remove the tape from the wire drum carefully.	▪ Remove the tape by hands to avoid damage to wire drum. ▪ Make sure that the measuring wire is wrapped so that it fits correctly in grooves. ▪ If not, rewrap the wire so it fits correctly in grooves.
5	8. Attach the drum housing cover.	▪ Confirm that O-ring is in groove.
6	9. Turn on the main power and confirm that NMS5 shows "STOP" and that level shows "16050 ~16060 mm". 10. Set "LEVEL" command, then set "STOP" where the displacer stops 16000 mm or less near the 15950 mm level. 11. Set "UP" command and the displacer will automatically stop at 16000 mm. 12. Set "STOP" command.	

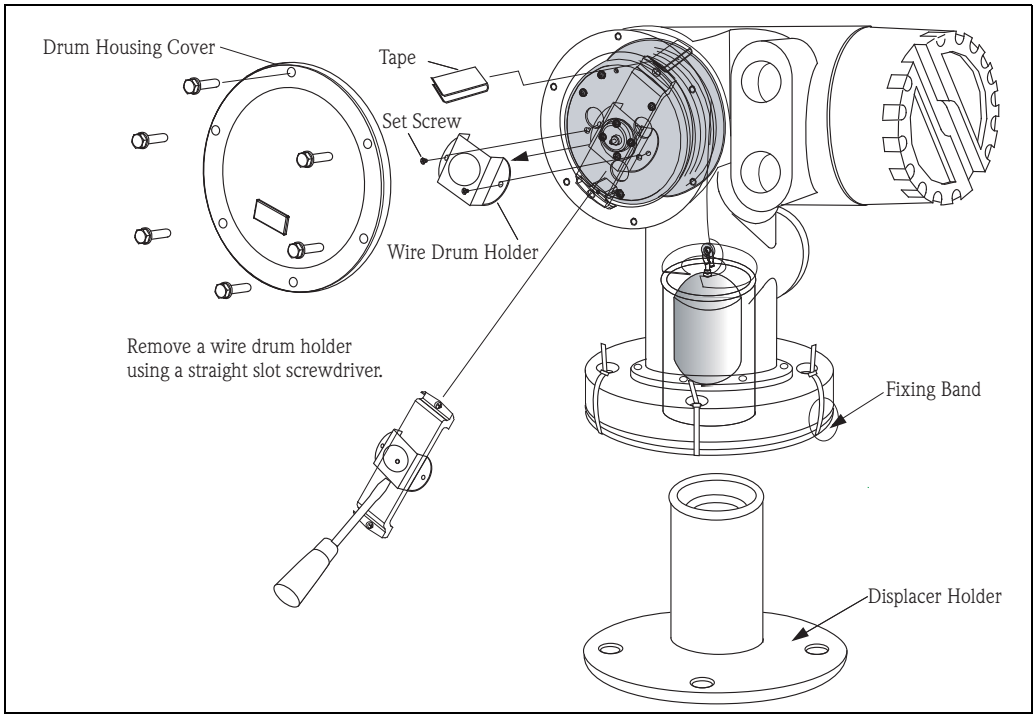
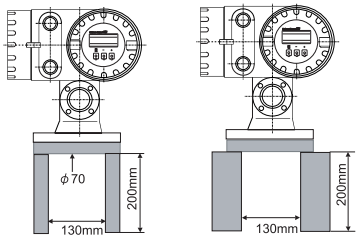
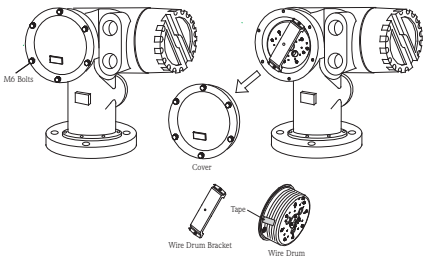
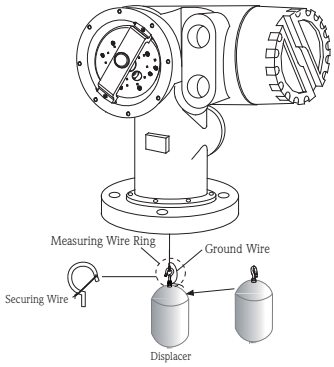
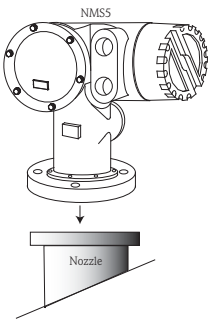


Figure 27: Removing Packing Materials for All-in-one

4.7.2 Displacer Shipped Separately

It is necessary to install the displacer on the measuring wire inside NMS5.

Procedure A: Install Displacer prior to Installing NMS5 on Tank

Figures	Procedure	Notes
 Figure 28: Displacer Installation - 1A	1. Put NMS5 on the blocks or a pedestal. 2. Confirm that there is enough space under NMS5.	▪ Be careful not to drop NMS.
 Figure 29: Displacer Installation - 2A	3. Remove M6 bolts. 4. Remove the wire drum cover and bracket. 5. Remove the cover, the wire drum bracket, and the wire drum. 6. Remove the tape. 7. Mount the wire drum, the wire drum bracket, and the cover again.	▪ Handle the measuring wire with care.
 Figure 30: Displacer Installation - 3A	8. Rotate the wire drum clockwise until the measuring wire ring appears out side the flange. 9. Hook the displacer on the ring of the measuring wire. 10. Secure the displacer to the measuring wire by using the securing wire. 11. Install the ground wire of the displacer (refer to Appendix "14.3.1 Displacer Installation"). 12. Rotate the wire drum counterclockwise until measuring wire ring appears in the calibration window.	▪ Wire drum rotates every one-fifth revolution. ▪ Displacer moves 300mm each one revolution.
 Figure 31: Displacer Installation - 4A	13. Mount NMS5 on the nozzle of the tank top. 14. Confirm that the displacer does not touch inside the nozzle inside. 15. Replace the drum housing cover.	▪ Confirm that the measuring wire is wrapped appropriately in the grooves. ▪ If not, rewind the wire correctly in the grooves.

4.7.3 Displacer Shipped Separately (Diameter 50mm Displacer)

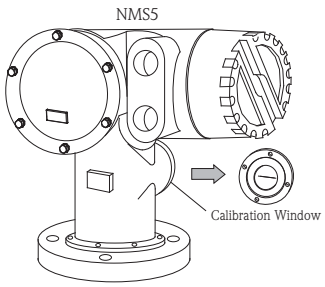
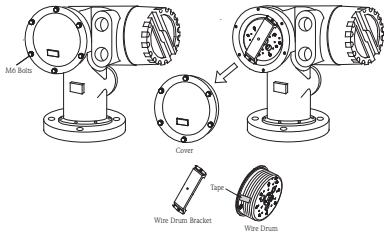
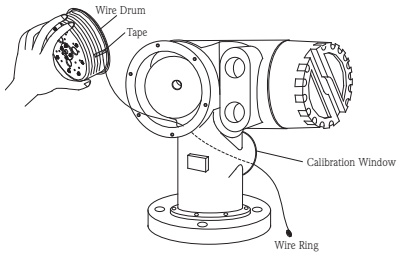
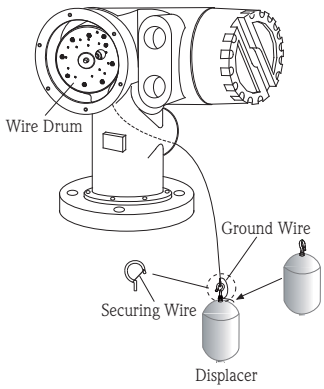
In the case of the diameter 50mm displacer, the displacer can be installed from the calibration window.

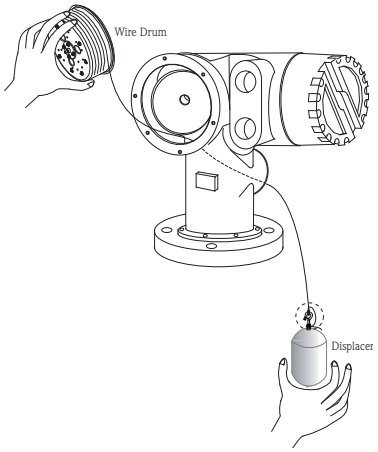
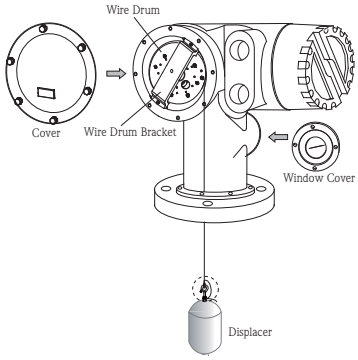
⚠ CAUTION

It is not possible to install the displacer from the calibration window in the following cases.

- Except Ø50mm, SUS and alloy C, cylindrical displacer
- Except 0.15mm, SUS measuring wire

Procedure B: Install Displacer after Installing NMS5 on Tank

Figures	Procedures	Notes
 Figure 32: Displacer Installation - 1B	1. Remove the calibration window cover.	▪ Ensure not to kink and damage the measuring wire.
 Figure 33: Displacer Installation - 2B	2. Remove M6 bolts. 3. Remove the cover and bracket. 4. Remove the wire drum from the drum housing. 5. Remove the tape that is securing the wire.	▪ Handle the measuring wire with care.
 Figure 34: Displacer Installation - 3B	6. Hold the wire drum by using single hand and drop the measuring wire down at approximately 50cm. 7. Secure the wire temporarily with the tape. 8. Insert the wire ring into the drum housing. 9. Pull the wire ring so that the ring comes out from the calibration window.	▪ Handle the measuring wire with care.
 Figure 35: Displacer Installation - 4B	10. Insert the wire drum temporarily into the drum housing. 11. Hook the displacer on the wire ring. 12. Secure the displacer to the measuring wire by using the securing wire. 13. Install the ground wire for the displacer (refer to "14.3.1 Displacer Installation" for details).	▪ Handle the measuring wire with care. It may cause damage by kink.

Figures	Procedures	Notes
 Figure 36: Displacer Installation - 5B	14. Hold the wire drum and the displacer by hands. 15. Remove the wire drum from the drum housing and drop the measuring wire down approximately 50 cm. 16. Hold the wire drum up and place the displacer into the calibration window. 17. Hold the displacer at center of calibration window. 18. Hold other hand (wire drum) up and add tension to measuring wire not to drop displacer down rapidly.	▪ Wire drum rotates every one-fifth revolution. ▪ Displacer move over 300mm each one revolution.
 Figure 37: Displacer Installation - 6B	19. Release the hand from the displacer. 20. Remove the tape from the wire drum. 21. Insert the wire drum into the drum housing. 22. Set the wire drum bracket. 23. Rotate the wire drum with the hand a couple of times and check that the displacer does not touch inside the nozzle. 24. Pull the ring of the measuring wire up so that it can be seen from the calibration window. 25. Replace the covers of the wire drum and the calibration window.	▪ Confirm that the measuring wire is wrapped correctly in grooves before turning on the power. ▪ If not, rewind the wire correctly in grooves.

5 Wiring

5.1 Wiring Connection

The electrical connections of NMS5 are shown in Figures 36-39.

⚠ CAUTION

The power supply cable should have the following specifications:

- PVC, PE, or equivalently isolated
- 600 V insulation voltage or equivalent.
- Temperature rating 80 or high

The size of the core is defined by the core resistance, voltage drop, and required power consumption. The maximum power consumption of NMS5 is 50 VA.

⚠ WARNING

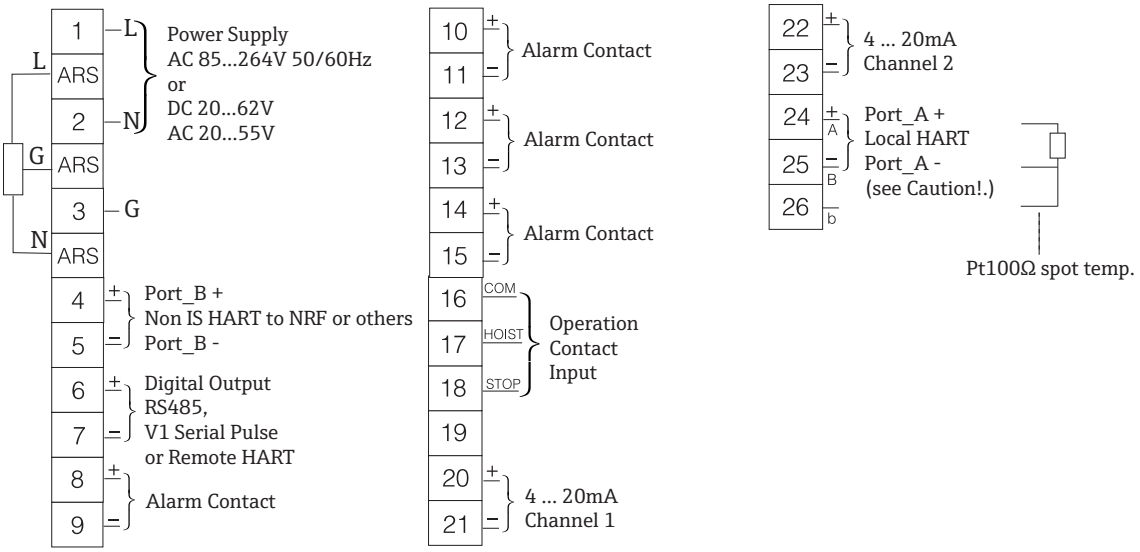
- Connect the ground terminal to the ground line inside or outside the terminal box.
- Use a wire 4mm^2 or more for ground.
- Use cables and wires of sufficient and appropriate size and length to make a solid connection at each terminal required.

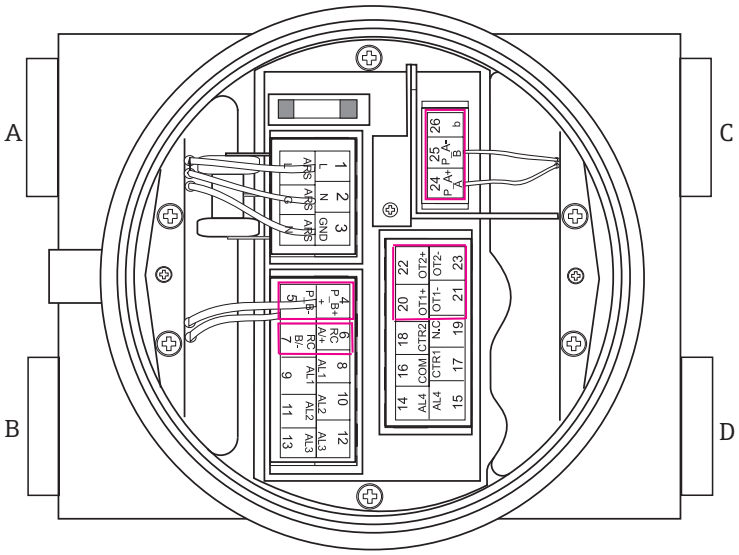
⚠ DANGER

- Do not stretch cable and wires. This may lead to failure, loss of function, and/or damage to the device and facility.
- Cut the trim cables and wires for appropriate length. Do not leave the extra cables and wires in the electrical compartment. This may lead to failure, loss of function, and /or damage to the device and facility.

5.2 Terminal Assignment

5.2.1 V1 Serial Signal, Modbus RS485, HART, Enraf BPM





NOTICE

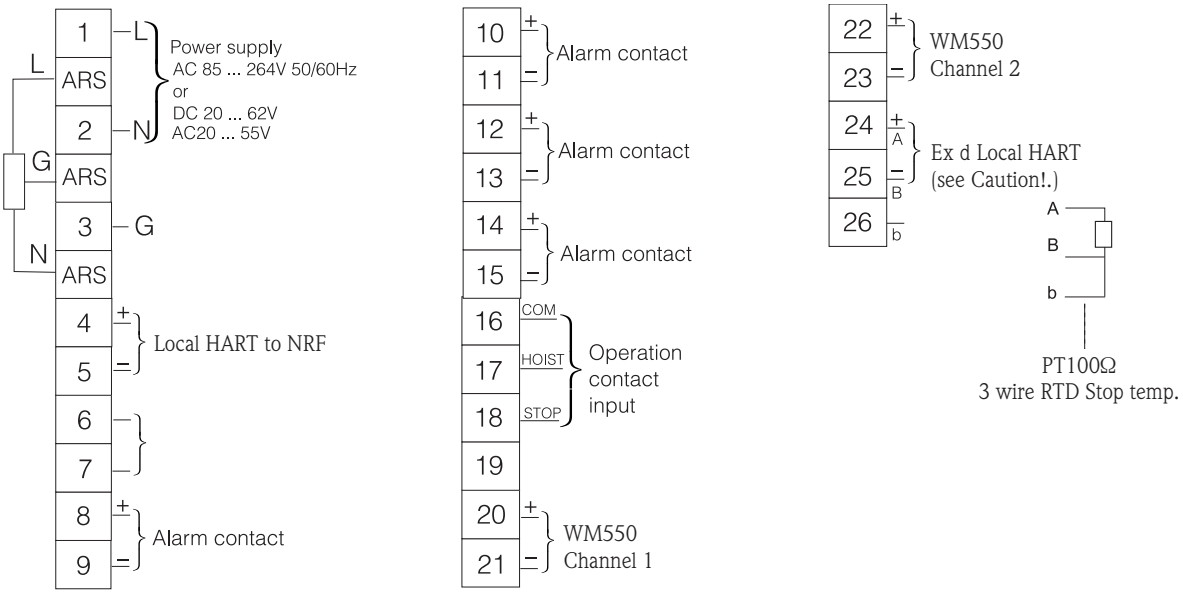
Cable Entry Descriptions	
A	Power Supply
B	Ex d local (slave) HART Terminals: 4 &5 Digital Output: Terminals 6 & 7 V1 Serial Pulse, Modbus (RS485) HART, Enraf BPM
C	Ex ia local (slave) HART, or Pt100 3 wire spot RTD (see Caution!.) Terminals: 24 & 25
D	4 to 20mA Output: Terminals 20 & 21, 22 & 23 ⚠ CAUTION Terminals 22 & 23 will be used as “Status 1 Input” when signal input from field unit (Order code position 60) is: Order Information: 060 4: HART and Status 1 input 5: HART, Pt100 Spot and Status 1 input 6: HART, Pt100 Spot temp., Operation cntact, and Status 1 input

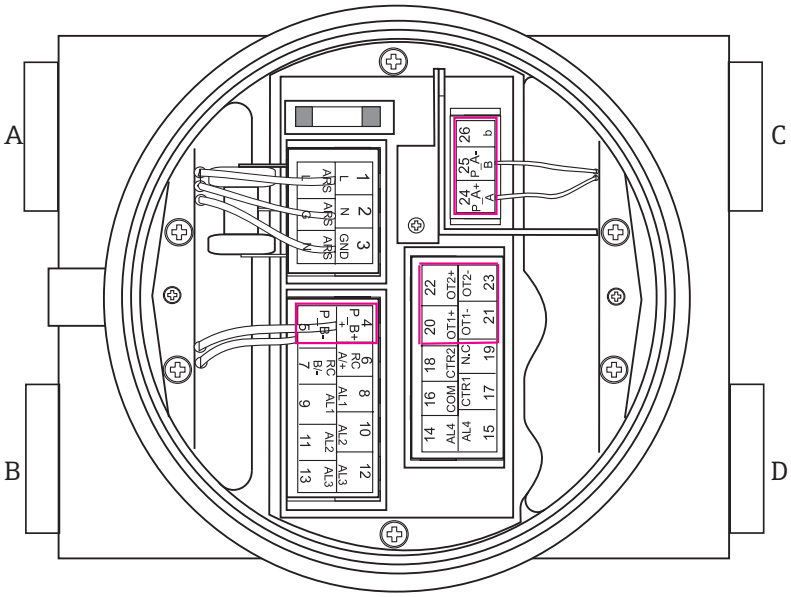
⚠ WARNING

- Terminal connection for Whessoe Matic 550 (WM550) and Mark Space, refer to the next few pages.
- Terminals 4 & 5 and 24 & 25 for HART devices are inter - connected on Explosion proof (Ex d) certified version.
- Terminals 24 & 25 (and 24, 25 & 26 for spot temp.) will be intrinsically safe (i.s.) device connection only when intrinsically safe certified version is selected.

Figure 38: Wiring Sample 1

5.2.2 Whessoe Matic 550





NOTICE

Cable Entry Descriptions	
A	Power Supply
B	Ex d local (slave) HART Terminals: 4 &5
C	Ex d local (slave) HART, or Pt100 3 wire spot RTD (see Caution!.) Terminals: 24 & 25
D	Whessoe Matic (WM)Output: Terminals 20 & 21, 22 & 23 WM550 is the current loop redundant data transmission protocol. Since these 4 terminals are occupied by WM550 terminal connection, 4 - 20mA output and status 1 input function are no longer available.

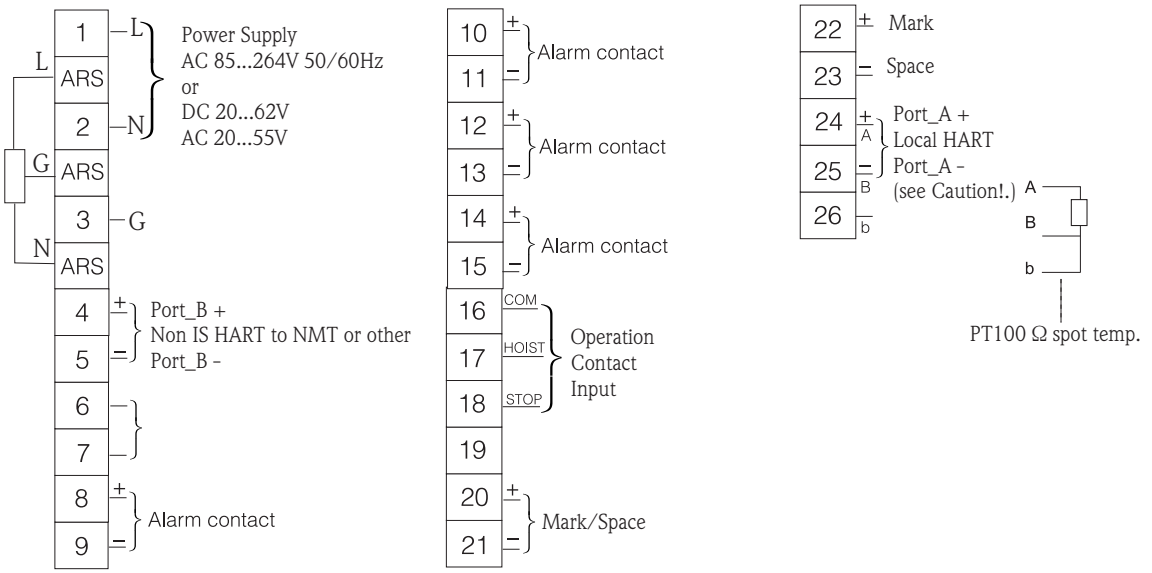
Normally the combination of WM550 and analog 4 to 20mA is prohibited.
Contact Endress+Hauser representatives if nedded.

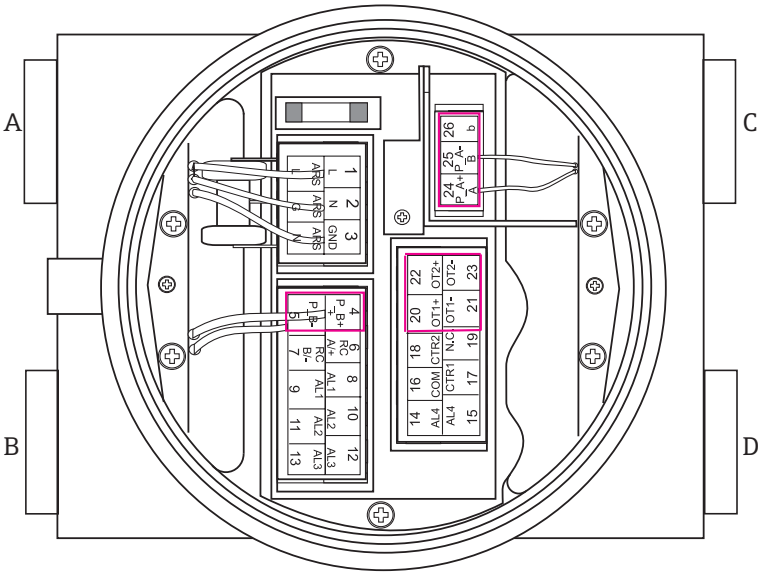
WARNING

- Terminals 4 & 5 and 24 & 25 for HART devices are inter - connected on Explosion proof (Ex d) certified version.
- Terminals 24 & 25 (and 24, 25 & 26 for spot temp.) will be intrinsically safe (i.s.) device connection only when intrinsically safe certified version is selected.

Figure 39: Wiring Sample 2

5.2.3 Mark/Space





NOTICE

Cable Entry Descriptions	
A	Power Supply
B	Ex d local (slave) HART Terminals: 4 &5
C	Ex d local (slave) HART, or Pt100 3 wire spot RTD (see Caution!.) Terminals: 24 & 25
D	M/S output: Terminals 20 &21, 22 & 23 M/S is the serial pulse digital data transmission along with separate power supply circuit. Since these 4 terminals are occupied by M/S terminal connection, 4 - 20mA output and status 1 input function are no longer available.

Normally the combination of M/S and analog 4 to 20mA is prohibited.
Contact Endress+Hauser representatives if nedded.

⚠ WARNING

- Terminals 4 & 5 and 24 & 25 for HART devices are inter - connected on Explosion proof (Ex d) certified version.
- Terminals 24 & 25 (and 24, 25 & 26 for spot temp.) will be intrinsically safe (i.s.) device connection only when intrinsically safe certified version is selected.

Figure 40: Wiring Sample 3

Using the external operation switch, ensure that the settings of the system are the same as shown in the following logic setting table. This will allow user to input operation signals.

(Hoist-CTR1) (Stop-CTR2)

CTR 1	CTR 2	OPERATION
OFF	OFF	LEVEL
ON	OFF	HOIST
OFF	ON	STOP
ON	ON	INTERFACE

5.2.4 Input and Output

Input

- Contact Switch
- HART
- Pt 100

Output

- V1
- WM550
- M/S
- ENRAF BPM
- MODBUS
- HART
- ANALOG 4-20mA
- Overspill Prevention (OSP)

DANGER

- The cable used for input and/or output must be 24 AWG or more and must be screened or steel armored. A twisted pair is required for HART and/or RS 485 signal.
- Two or three cores for mains, two cores for digital output and two cores for HART input are normally used for the cabling of NMS5. The instrument has max. four cable entries.
- Check the cable size and the number of cables prior to ordering NMS5.

5.2.5 Cable Gland

When there are extra cable entries not be used, mount threaded plugs for waterproof.
Refer to "Safety Instruction XA00578G-A".

WARNING

When ordering TIIS Ex d specification, cable glands are attached with NMS5. Ensure to use the cable glands.

5.3 Temperature Input System

There are two types of temperature input method and two types of Ex protection system as Ex d or Ex [ia] in NMS5.

5.3.1 Ex d NMT Input + HART Input

Ex d HART sensor and NMT53x Ex d are connected in this system.

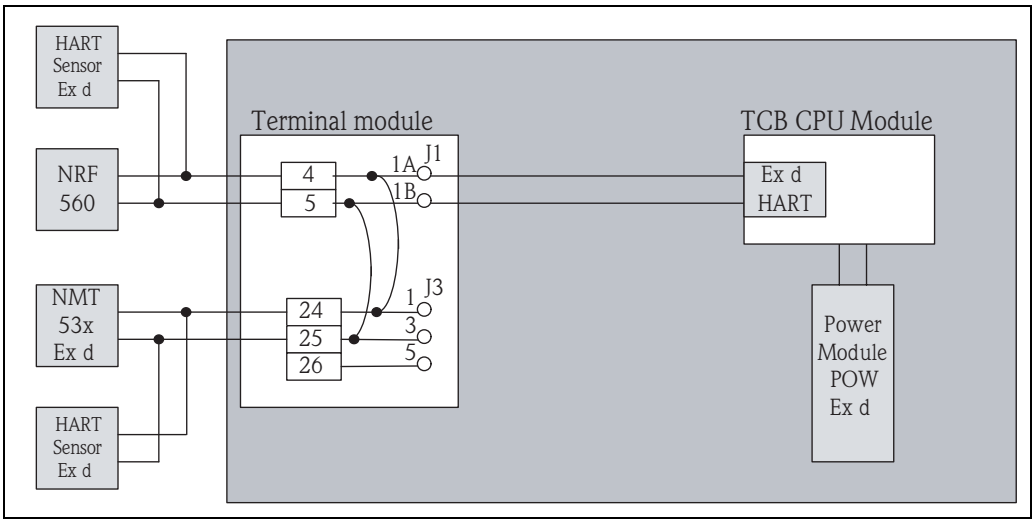


Figure 41: Ex d NMT Input and HART Input

5.3.2 Ex d Pt100 Spot Temperature Input +HART Input

Ex d HART sensor and Ex d Pt100 sensor are connected in this system.

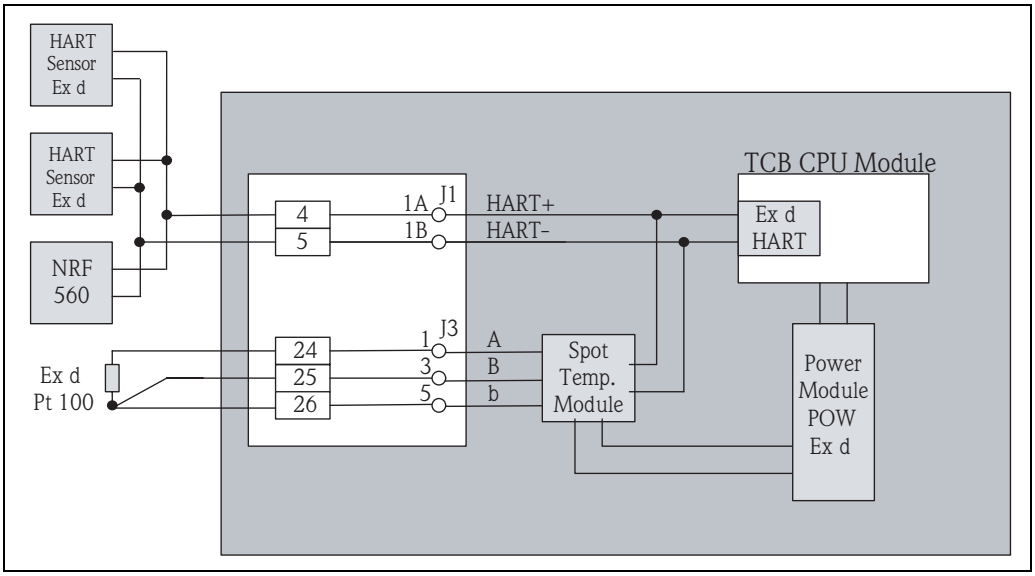


Figure 42: Ex d Pt100 Spot Temperature Input and HART Input

5.3.3 Ex ia NMT Input + HART Input

Ex d HART sensor and NMT53x Ex ia are connected in this system.

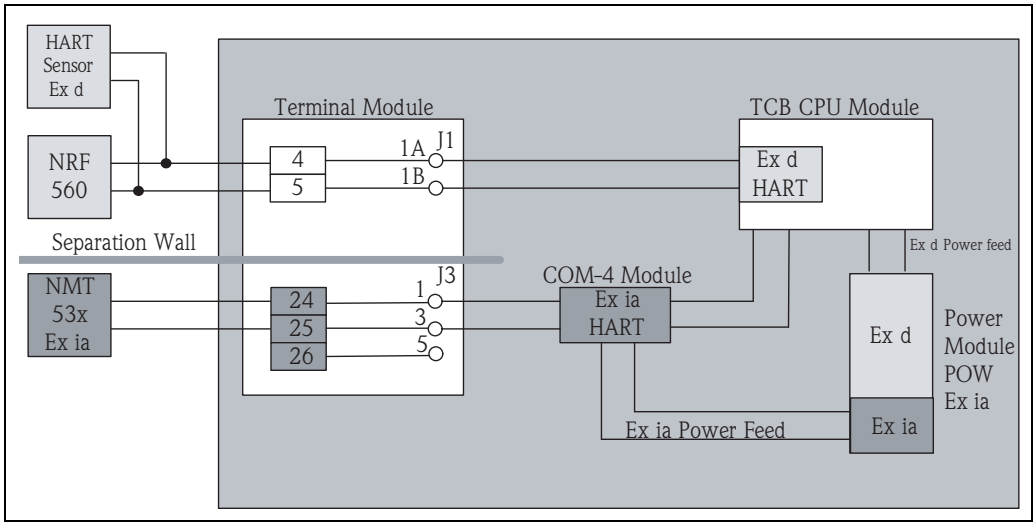


Figure 43: Ex ia NMT Input and HART Input

5.3.4 Ex ia Pt100 Spot Temperature Input + HART Input

Ex d HART sensor and Ex ia Pt100 sensor are connected in this system.

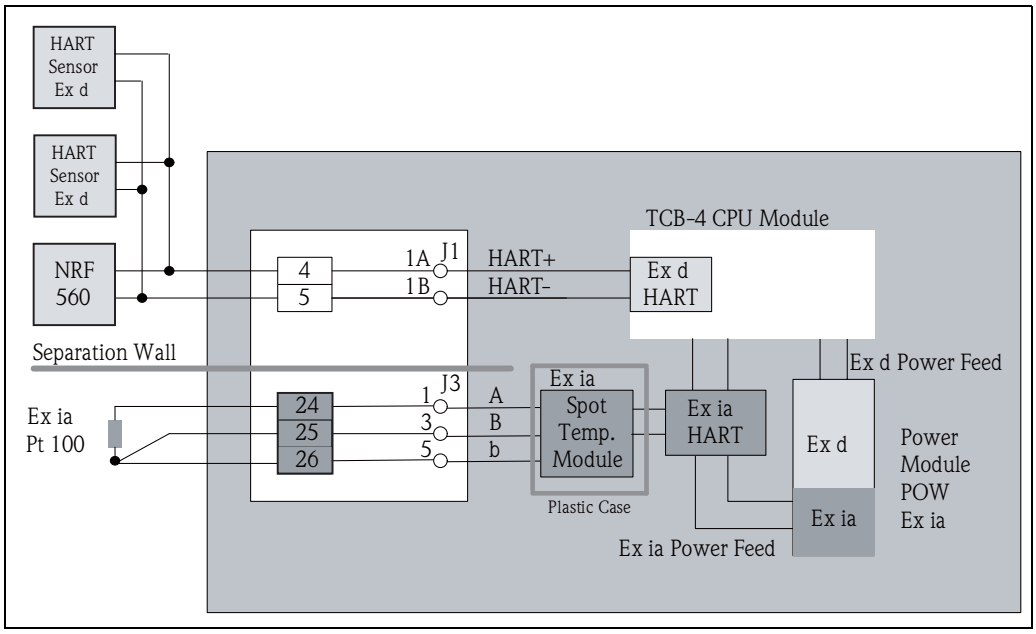


Figure 44: Ex ia Pt100 Spot Temperature Input and HART Input

6 Operation

6.1 Touch Control and Programming Matrix

6.1.1 Display and Operating Elements

Display
During normal operation, NMS5 has an illuminated LCD that shows the level, the temperature, and the status of the device at "HOME" position.
For the display of the other data and the programming of the parameters for operation, NMS5 uses a convenient programming matrix.

Operating Elements
NMS5 is operated by three visual operating elements, namely the keys "E", "+", and "-" . They are actuated when the appropriate field on the protective glass of the front is touched with the finger ("touch control"). The corresponding transmitting and receiving diodes are not affected by external influences, e.g. direct sunlight. The software and hardware installed in NMS5 rule out any malfunction that may be caused in this way. Even in explosive hazardous areas, the explosion-proof housing of the touch control ensures a safe access to the data.

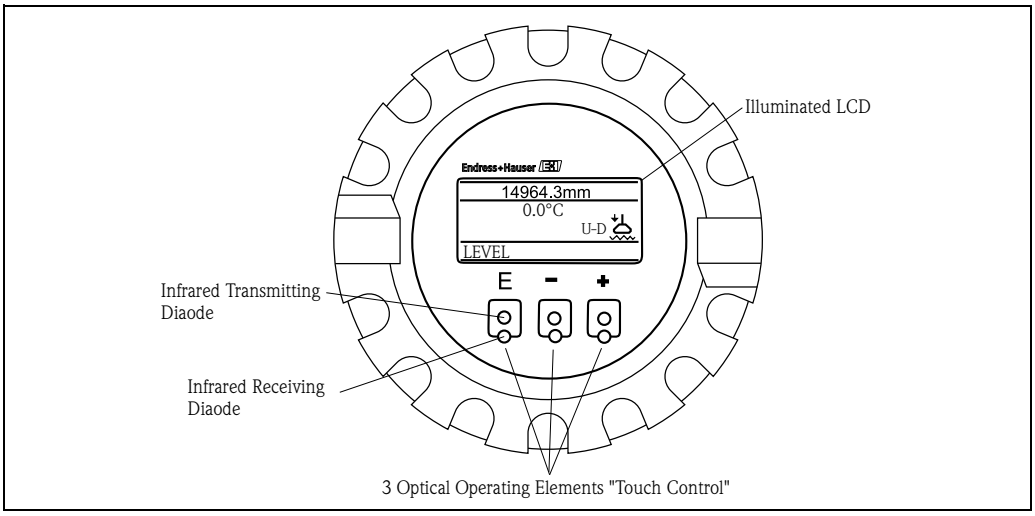


Figure 45: Display

6.1.2 Functions of Operating Elements

The programming matrix consists of matrix groups, namely one "static" matrix and additional "dynamic" matrices. They are described in detail in Section "13 Matrix". The individual matrix groups, function groups, and functions within the programming matrix can be selected by alternately touching the operating elements.

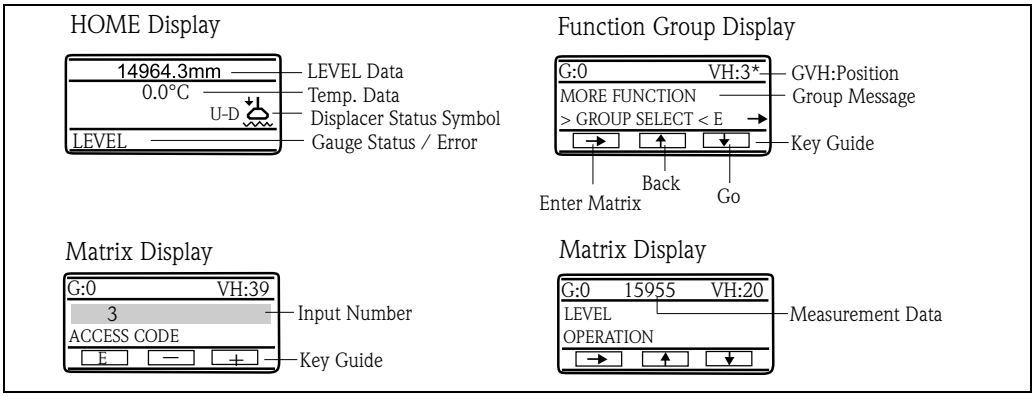


Figure 46: Displays

Matrix Construction

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Calibration									
Level Data	4										
Calibration	5										
Adjustment	6										
Auto Wire Calib.	7										
Auto Calib. Displ.	8										
Display	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Device Data									
Contact Output	4										
Analog Out	5										
parts Data	6										
Input Signal	7										
Communication	8										
Status	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Service									
Meas. Wire & Drum	4										
Gauge data	5										
System Data	6										
Service	7										
Sensor Value	8										
Sensor Data	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Temperature									
Temperature Data	4										
Element Temp.	5										
Element Position	6										
NMT Adjustment	7										
Set Data NMT	8										
Device Data	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	HART Dev (1)									
Measured Value	4										
P.V. Setting	5										
Sensor Specific	6										
Alarm	7										
Self Diagnostic	8										
Device Data	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	HART Dev (2)									
Measured Value	4										
P.V. Setting	5										
Sensor Specific	6										
Alarm	7										
Self Diagnostic	8										
Device Data	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Adjust Sensor									
Adjust Sensor	4										
HART Error Rate	5										
Unit	6										
HART Line	7										
Interface Adjust	8										
	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Tank Profile									
Profile Operation	4										
Status/Data	5										
Density 1-10	6										
Density 11-16	7										
Position 1-10	8										
Position 11-16	9										

		0	1	2	3	4	5	6	7	8	9
Measured Value 1	0										
Measured Value 2	1										
Operation	2										
More Function	3	Interface Profile									
	4										
Status/Data	5										
Density 1-10	6										
Density 11-16	7										
Position 1-10	8										
Position 11-16	9										

Static Matrix

Dynamic Matrix

Figure 47: Matrix Construction

Key	Functions
E	▪ Access to the programming matrix (touch the key for 3 seconds or more). ▪ Return to HOME position (touch the key for 3 seconds or more). ▪ Move the status horizontally in the function group to select functions. ▪ Save parameters or access codes.
+ −	▪ Move the status vertically to select function groups. ▪ Selec or set parameters. ▪ Set access codes.

NOTICE

LCD returns to HOME position when no key is touched for 10 minutes or more. Digits are incremented or decremented using by + or - key. When touching + or - key continuously, then the minimum digit changes first. After one cycle of the minimum, the second minimum changes. After one cycle of the second follows the third minimum, and so on. When releasing a finger from the touch control, then the procedure starts again from the minimum digit (Analogy of mechanical counter).

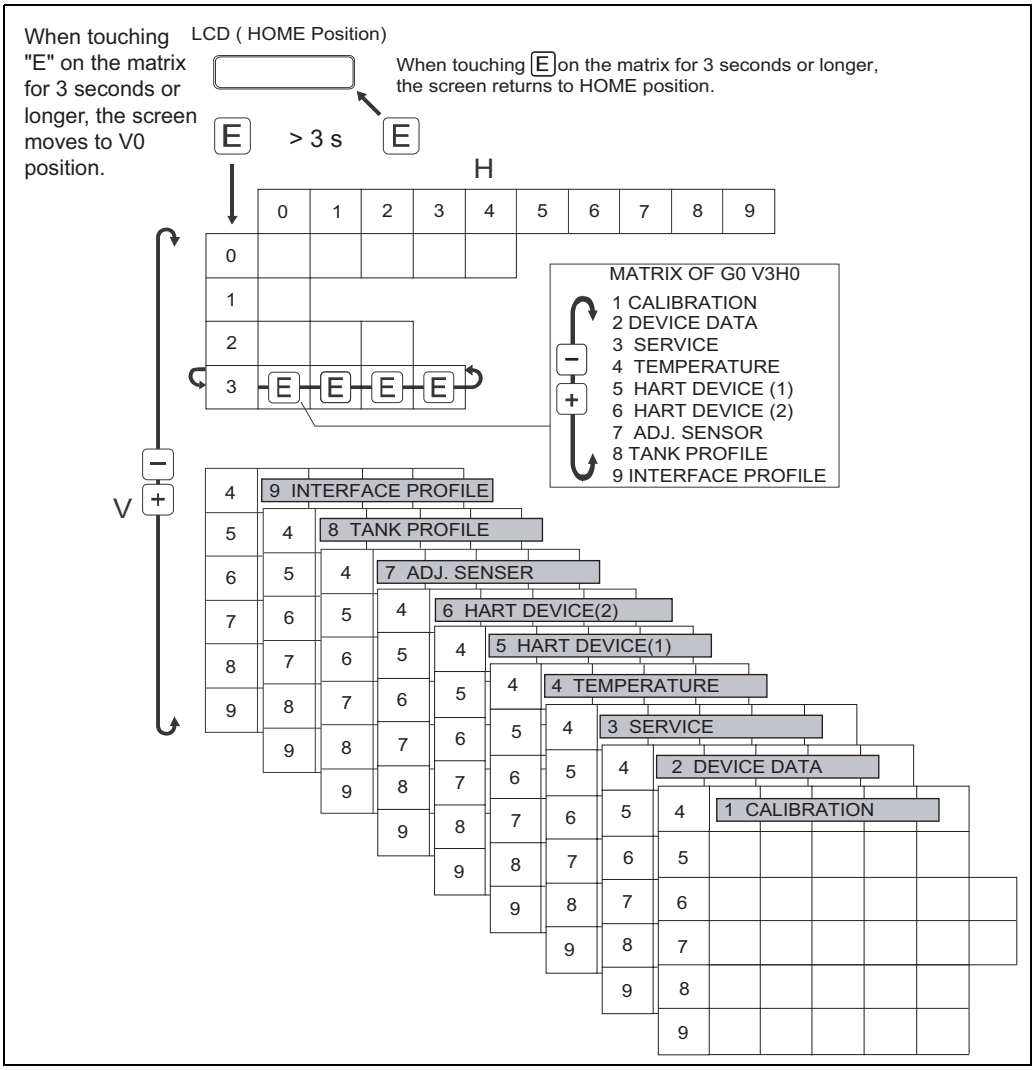


Figure 48: Selection Matrix Groups, Function Groups, and Functions with Programming Matrix

6.2 HOME Position

After turning on the power, LCD shows the current data on HOME position.

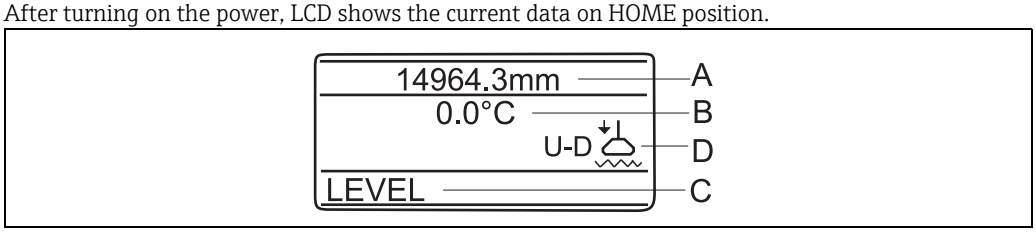


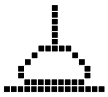
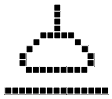
Figure 49: HOME Position

The letters A, B, C and D stand for the areas where information on measured values and status of the device are displayed:

Area	Information
A	Current Level
B	Current Temperature
C	Gauge Status
D	Displacer Status

The meanings of message appearing on LCD (display) is explained in the following table.

Gauge Status	Description
G - RE	Reference position for measuring
UP	The measuring wire is hoisted.
STOP	The measuring wire stops.
LIQU	The liquid is being measured.
U - IF	The upper interface level is being measured.
LIF	The lower interface level is being measured.
BOTM	The tank bottom level is being measured.
U - DE	The upper liquid density is being measured.
M - DE	The middle liquid density is being measured.
B - DE	The bottom liquid density is being measured.
CAN	Resetting RELE.OVER TENS (over tension error).
TEAC	Calibration is being measured.
blank	Measuring is not possible.

Displacer Status	Symbol	Meaning
BAL		**Balance** The displacer is resting on the liquid surface or interface and in balanced status.
T - B		**Temporary Balance** Automatic weight calibration is being carried out.
U - U		**Unbalance Up** The displacer is being hoisted and in unbalanced status.
U - D		**Unbalance Down** The displacer is being lowered and in unbalanced status.
R - U		**Balance Up** The displacer is being hoisted and in correction of balance.
R - D		**Balance down** The displacer is being lowered and in correction of balance.
LOW		The displacer is resting at the lower stop.

NOTICE

If no LCD operation, NMS5 will turn off the backlight of LCD 12 hour later. Touching LCD again after this time will turn on the backlight.

6.3 Access Code

The access code is to ensure the confidentiality of the setup data. Three security levels are available along with access codes.

Security Level		Access Code
0		None
1	For Operator	50
2	For Engineer	51/530/777

NOTICE

The higher levels include the lower ones. e.g. If access code 50 is specified for a function, then code 51 also enables editing. A function that requires access code 51, on the contrary, cannot be edited by code 50. However, 777 is only used to change I.S. terminal configuration.

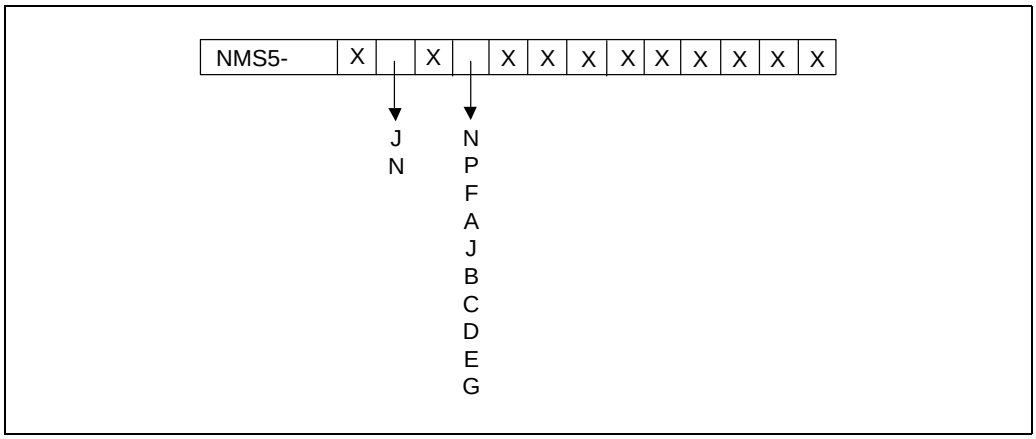
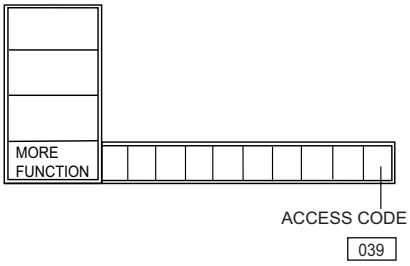


Figure 50: Order code which require Access Code 777

Setting Access Code

Item	Procedure	Remarks
Static Matrix  Figure 51: Access Code	1. At the static matrix "MORE FUNCTION", select GVH=039 "ACCESS CODE" 2. The default value is "0". Touch the "+" key. 3. The first digit increases to 9, then the second digit increases. Stop touching "+" once you reach "50". 4. "50" is blinking. Gently touch "+" key again to change the first digit from 0 to 1. Now you have "51". 5. Here touch "E"; "EDITING ENABLE" will be displayed.	▪ When touching "E" while displaying an access code except 0, 50, or 51 "EDITING LOCKED" will appear. ▪ If an access code has not been selected before performing any settings, the screen will automatically change to show "ACCESS CODE" ▪ Operation Commands can be sent, and displayed data read, by remote systems, depending on your NMS5 specification.

6.4 Operation Command and New Operation Status

6.4.1 Operation Commands

Operation Commands can be sent the NMS5 from a host system. The following table explain the command codes.

Code	Command	Remarks
0	LEVEL	
1	UP	
2	STOP	After weight calibration, STOP is set as a default operation command.
3	BOTTOM LEVEL	
4	UPPER INTERF. LEVEL	
5	MIDD.INTERF.LEVEL	
6	UPPER DENSITY	
7	MIDDLE DENSITY	
8	DENSITY BOTTOM	
9	REPEATABILITY	
10	WATER DIP	

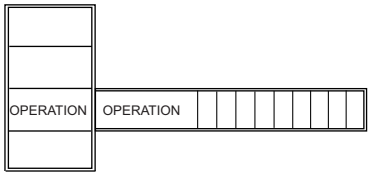
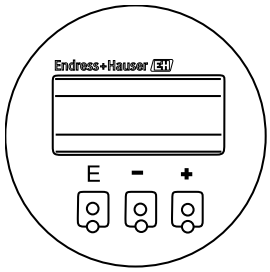
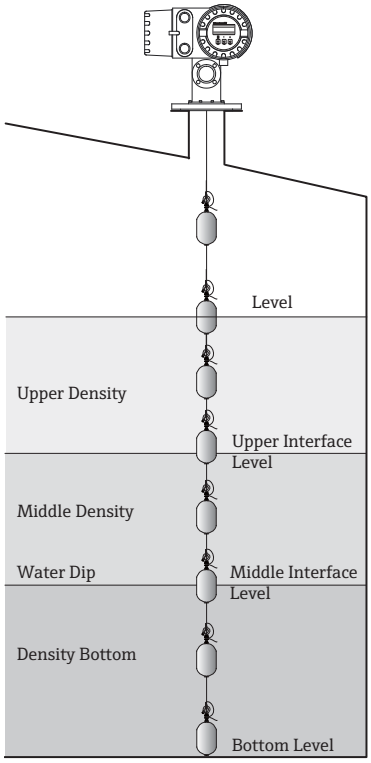
6.4.2 New Operation Status

The following table shows the new operation status, which is available when "NEW NMS STATUS", matrix position GVH=272, is selected to "ENABLED".

Code	Meaning	NMS Display
0	No definition	-
1	Displacer at reference position	REFERENCE
2	Displacer hoisting up	UP
3	Displacer going down	DOWN
4	Displacer stop	STOP
5	Level measurement, balanced	LEVEL
6	Upper I/F level, balanced	UPPER INTERF. LEV.
7	Middle I/F level, balanced	MIDD. INTERF. LEV.
8	Bottom meas. Balanced	BOTTOM LEVEL
9	Upper density finished	UPPER DENSITY
10	Middle density finished	MIDDLE DENSITY
11	Bottom density finished	DENSITY BOTTOM
12	Release over tension	RELE. OVER TENS.
13	Calibration activated	CAL. ACTIVE
14	Seeking level	LEVEL SEEKING
15	Following level	LEVEL FOLLOWING
16	Seeking upper density	UPP.DEN.SEEKING
17	Seeking middle density	MID.DEN.SEEKING
18	Seeking bottom density	BOT. DEN. SEEKING
19	Seeking upper I/F level	UPP. INT. SEEKING
20	Following upper I/F level	UPP. INT. FOLLOWING
21	Seeking middle I/F level	MID.INT.SEEKING
22	Following middle I/F level	MID.INT.FOLLOWING
23	Seeking bottom level	BOTTOM SEEKING
24	Not initialized	NO INITIALIZE
25	Stopped at upper pos.	UPPER STOP
26	Stopped at lower pos.	LOWER STOP
27	Repeatability testing	REPEATABILITY
28	Seeking water level	WATER SEEKING
29	Water level, balanced	WATER LEVEL
30	Following water level	WATER FOLLOWING
31	Over-/under tension, Z-phase, ADC error	EMERGENCY ERROR
32	GVH157 SERVICE MODE = ON	MAINTENACE

6.5 Operation of Displacer

The operation of the displacer for level, bottom level, interface level, and density measurement is possible by touch control.

Item	Procedure	Remarks
 Figure 52: Static Matrix  Figure 53: Touch Control	1. Select function groupGVH=020 OPERATION 2. Select item OPERATION. The LCD shows the command given to NMS5and the displacer position.	▪ Set access code to 50. ▪ If editing has previously been enabled by a valid access code, then the request for the code will not appear.
 Figure 54: Operation of Displacer	3. The following commands are available at this position: ▪ LEVEL ▪ UP ▪ STOP ▪ BOTTOM LEVEL ▪ UPPER INTERF. LEV* ▪ MIDD.INTERF.LEV* ▪ UPPER DENSITY* ▪ MIDDLE DENSITY* ▪ DENSITY BOTTOM* ▪ WATER DIP* ▪ REPEATABILITY TEST ▪ Interface and density measurements are not available unless specifically requested. ▪ Density profile measurement is explained in section "7 Commissioning".	▪ The optional operation commands are available when such options are set.

6.6 Calculation of Level and Densities

The section specifies the formula used by NMS5 to calculate levels and densities.

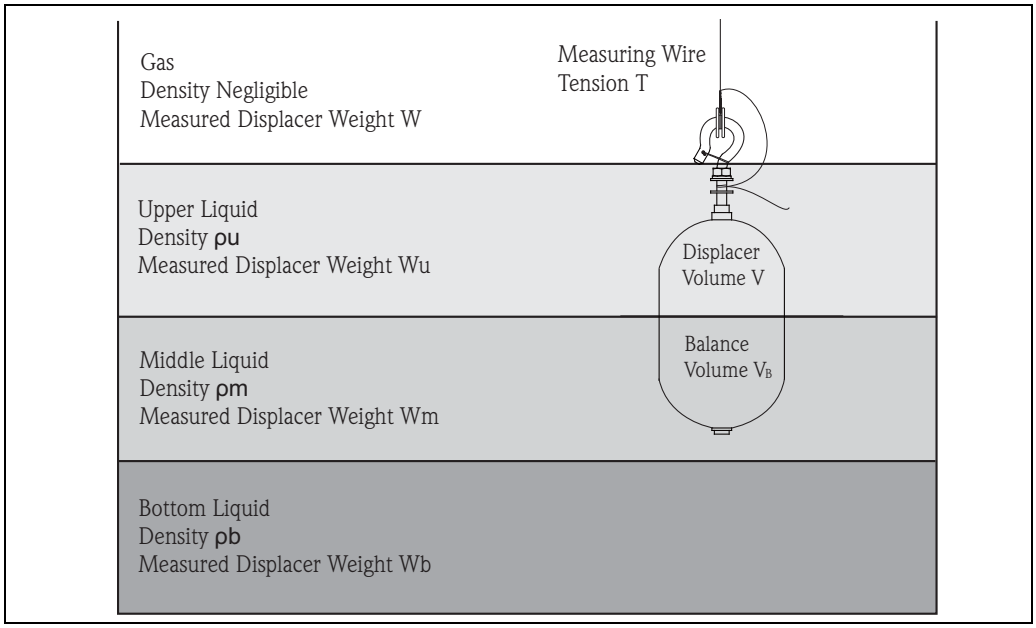


Figure 55: Calculation of Levels and Densities

Surface and Interface Levels
While the measured surface or interface level is constant, the displacer rests at the balancing position. The tension on the measuring wire is proportional to the displacer weight diminished by the buoyancy forces in both layers:

Level	Formula
Liquid Level	T = W - Vвρu
Upper Surface	T = W - Vвρm - (V - Vв) ρu
Middle Surface	T = W - Vвρb - (V - Vв) ρm

A rise or fall of the level will increase or decrease the submerged volume. If this change exceeds the volume tolerance set at matrix position GVH=345 "VOLUME TOLERANCE", then the corresponding change will actuate the motor of the NMS5 till the balancing condition is fulfilled again.

Tank Bottom Level
For bottom level measurement, the balancing condition is defined as

$$T = W - (V + V_B)\rho_b$$

Densities

The upper, middle, and bottom densities are calculated by the following formulas.

- Upper density (Pu) and Density profile

$$\rho u = \frac{W - Wu}{V}$$

- Middle density (Pm)

$$\rho m = \frac{Wu - Wm}{V} + \rho u$$

- Bottom density (Pb)

$$\rho b = \frac{Wm - Wb}{V} + \rho m$$

Draft (distance from liquid surface to the bottom of displacer)

The draft varies depending on the shape of the displacer. For cylindrical shape, the draft is

$$D = (V_2 - V_1) / A \times 10 + h$$

where the variables and constants have the following meanings.

$$= (V_1 - V_2 - V_3) / A \times 10 + h + h_1$$

V_1 Displacer Balance Volume (69cm^3)
V_2 Displacer Lower Hemisphere Volume
V_3 Displacer Bottom Stub Volume
A Cross-section of Displacer
h Height of Lower Cone
h_1 Height of End of Cone

For example: standard displacer Ø50.8 mm Cylindrical shape

V_1 Balance Volume (69 cm^3)
V_2 Volume of Lower Cone (24.46 cm^3)
V_3 Volume of End of Cone (0.12 cm^3)
A Cross-section of Displacer (20.26 cm^2)
h_1 Displacer Bottom Stub Height (20 mm)

D = (69 - 24.46 - 0.12) / 20.26 x 10 + 20 + 3
= 44.92

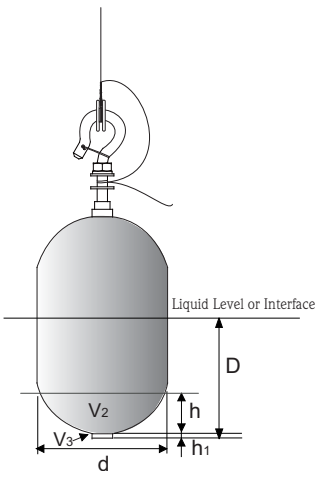


Figure 56: Variables and Constants for Displacer

The surface or interface level should be within the cylindrical part of the displacer and approximately in the middle of its total height.

7 Commissioning

7.1 Initial Settings

All of the initial settings are required for NMS5 in most case. However, depending on NMS5 specification, some settings may not be required. Set Access code 51 at GVH039 before applying the initial settings.

7.1.1 System Calendar/Clock (GVH193 to 197)

Calendar/Clock values are set at factory (Japan Standard Time) prior to delivery. Change the data to reflect local time.

7.1.2 Density Values (GVH005 to 007)

⚠ CAUTION
Always set GVH=005 Upper Density for actual density data, in LPG and any application where the actual density is 0.7000 g/ml or less. failure to set this data may result in level gauge malfunction. Density values for 3 liquid phases are set to 1.000 g/ml prior to delivery. Change the data to reflect actual density values. For tanks with only one liquid phase, set Upper Density. For tanks with 2 or 3 clear phases, set Middle and Bottom densities too.

NOTICE
Minimum difference between phase settings should be at least 0.100 g/ml.
*GVH005£GVH006£GVH007
Example:

- GVH005 Upper Density: 0.758
- GVH006 Middle Density: 0.880
- GVH007 Density Bottom: 1.000

7.1.3 Tank Height (GVH140)

Tank height value is set to default value at factory prior to delivery. Tank height is the reference height, usually a gauging hatch on the tank that is used during manual level measurements. Change GVH140 to equal the reference height.

NOTICE
GVH141 "Dip Point Offset" will *automatically* change to reflect the difference in height between the reference height and the NMS5 reference position.

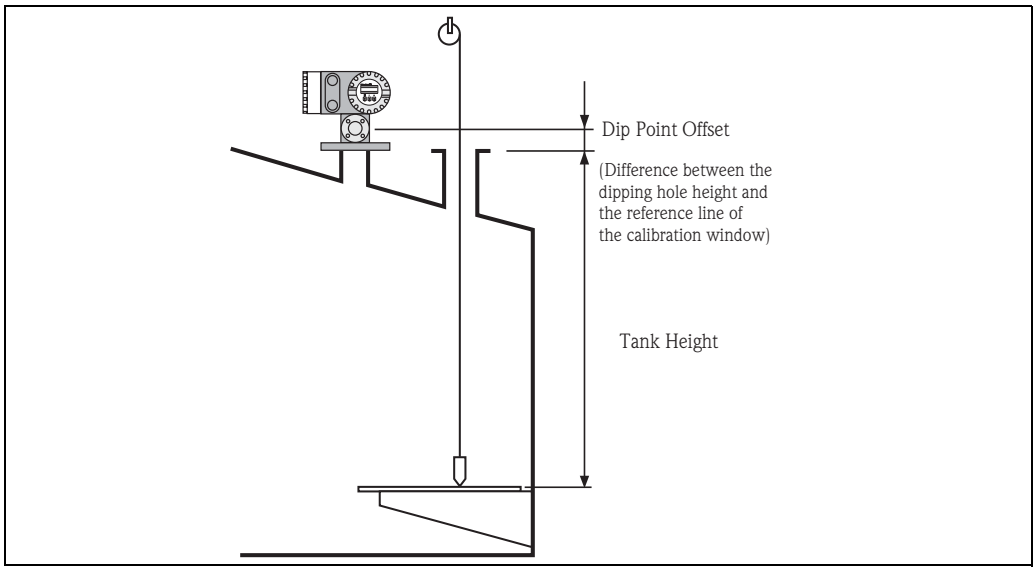


Figure 57: Tank Height

7.1.4 Upper/Lower Stop (GVH161/162)

Upper and Lower Stop determine the highest and lowest point of displacer movement. These data are set to 16000mm and 0mm respectively at factory prior to delivery. Change these data to the desired actual Upper and Lower limit values.

7.1.5 Communications Address (GVH285)

Several types of digital output communication protocols are available when ordered from Endress + Hauser. NMS5 is delivered with communications hardware and/or software installed. Only minimal matrix parameter setting, Access code 51, is required.
Communications protocol is displayed and selected at G2V8H6 Protocol. NMS5 has been preset at factory, it is not necessary to change the setting.
At GVH285 select the desired device address for NMS5. Address range: 0 to 9, 00 to FF, or 1 to 247 for Modbus.

NOTICE
FF is fixed for MIC protocol. WM550 and M/S address setting is done via dip switches on the communications module inside NMS5. For Rackbus, termination resistors should be set on NMS5 at end of loop. Enraf BPM address range is 00 to 99.
Refer to Sect. 7.5 for Address Setting details.

7.1.6 Proactive Safety Function (GVH157/158/159)

Matrix	Setting
G1V5H7	Service Mode: default = OFF. Select OFF if GVH158 Prosafety = ON. Select ON only when performing maintenance on NMS5. ⚠ WARNING Selecting ON disables the Proactive Safety function! Access code 530
G1V5H8	Prosafety: default = ON. Select OFF only if the Proactive Safety function will not be used. ⚠ WARNING Failure to confirm ON disables the Proactive Safety function! Access code 530
G1V5H9	Safety Level: default = 65000.0mm (WM550.), or = 99999.0 mm (other protocols) Possible data values depend on receiver specification (see table below) Access code 530

Safety Level Default by Output Protocol

Protocol	Data Range	Data Format
Modbus	0.0 to 99999.0mm	Float
V1	0 to 99999.9mm	ASCII / 6 digit
MDP	0 to 99999mm	BCD / 5digit
WM550	0 to 65000mm	16bit
Mark/Space	19.999m/32.699m	20bit BCD / 5 digit
Enraf BPM	0 to 99999.9mm	6 or 7 byte
Rackbus	0 to 99999.9mm	Float
HART	0 to 99999.9mm	Float

7.1.7 Analogue Output (GVH250 to 256)

When specified and ordered from Endress+Hauser, NMS5 is equipped with analogue output hardware installed. Function settings may be changed as follows:

Function	Setting
Assign Output 1	Assign level or temperature to channel 1 output.
Adjust 4mA	Set desired value at which level or temperature outputs 4 mA.
Adjust 20mA	Set desired value at which level or temperature outputs 20 mA
Assign Output 2	Assign level or temperature to channel 2 output.
Adjust 4mA	Set desired value at which level or temperature outputs 4 mA
Adjust 20mA	Set desired value at which level or temperature outputs 20 mA.
Device at Alarm	Select type of output for alarm

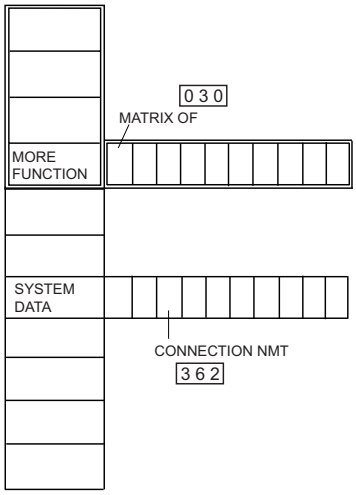
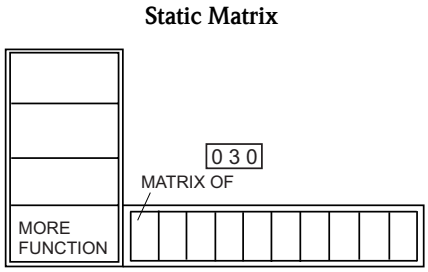
7.1.8 Contact Relay Alarm Output (GVH240 to 247)

When specified and ordered from Endress+Hauser, NMS5 is equipped with contact relay alarm output hardware installed. Function settings may be changed as follows:

Function	Setting
Select Relay	Select relay number from 1, 2, 3 or 4.
Assign Relay	Select output definition from range of choices: None, Level, Liquid Temperature, Caution, Warning, Emergency Error, Balance Signal.
Relay Function	Select High or Low.
Switching Point	Set value at which relay is activated.
Hysteresis	Set hysteresis value for selected relay.
Relay on Alarm	Select relay of Normal Open or Normal Closed.
On Delay Time	Set time delay value for alarm output start.
Off Delay Time	Set delay value for alarm output stop.

7.2 Settings for NMT 53x Connections

The following settings are required to display NMT 539 data on NMS5 screens.

Item	Procedure	Remarks
 Figure 58: Matrix Group: Service  Figure 59: Static Matrix	1. In Static Matrix "MORE FUNCTION", invoke GVH=030 "MATRIX OF" and select "SERVICE". 2. Invoke the Dynamic Matrix GVH=362 "CONNECTION NMT" screen. 3. Use the "+" and "-" keys to display "AVERAGE" and press "E" to set data. 4. Press "E" to return to "SYSTEM DATA" and press the "-" key to return to "MORE FUNCTION". 5. Invoke Static Matrix "GVH=030 MATRIX OF". NMS5 matrix is divided into matrix groups. Select "TEMPERATURE" from these groups. 6. "EDITING ENABLED" is displayed on the LCD. 7. The average liquid temperature is displayed on Dynamic Matrix screen GVH=440. 8. The temperature of each contact is displayed on Dynamic Matrix screens GVH=450 to GVH=459.	

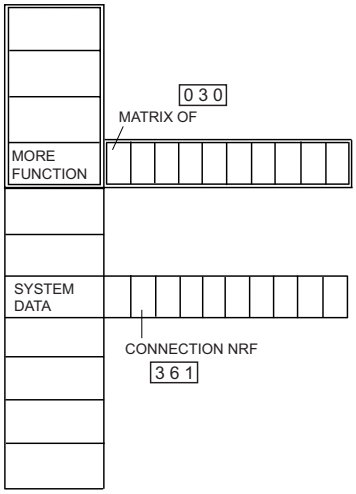
NOTICE

For NMT535/539/532 connections, refer to the appropriate operating manual for the device.

7.3 Settings for Connection to NRF560

To connect NRF560, NMS5 requires the following settings.

⚠ CAUTION
Turn on the power to NMS5 first.

Item	Procedure	Remarks
 Figure 60: Matrix Group: Service	1. In Static Matrix "MORE FUNCTION", invoke GVH=030 "MATRIX OF" and select "SERVICE". 2. Invoke the Dynamic Matrix GVH=361 "CONNECTION NRF" screen. 3. Use the "+" and "-" keys to select either "CONTACT 1" or "CONTACT 2".	▪ Set access code 51. ▪ CONTACT 1... NRF 560 software version 1.6x and earlier (those NRF 560 that indicate no software version correspond to connection type 1). ▪ CONTACT 2... NRF 560 software version 1.8x and later.

7.4 Liquid Level Calibration

7.4.1 Opened Tank

Preparation
Select LEVEL at GVH020 Operation. The displacer will descend to the liquid surface and balance.
When "BAL" is displayed, the displacer stopped moving.
When measuring the liquid level manually, use an approved method.

Set Level (GVH150) for Opening Tank
Input the value at GVH150 after measuring the dipping level.

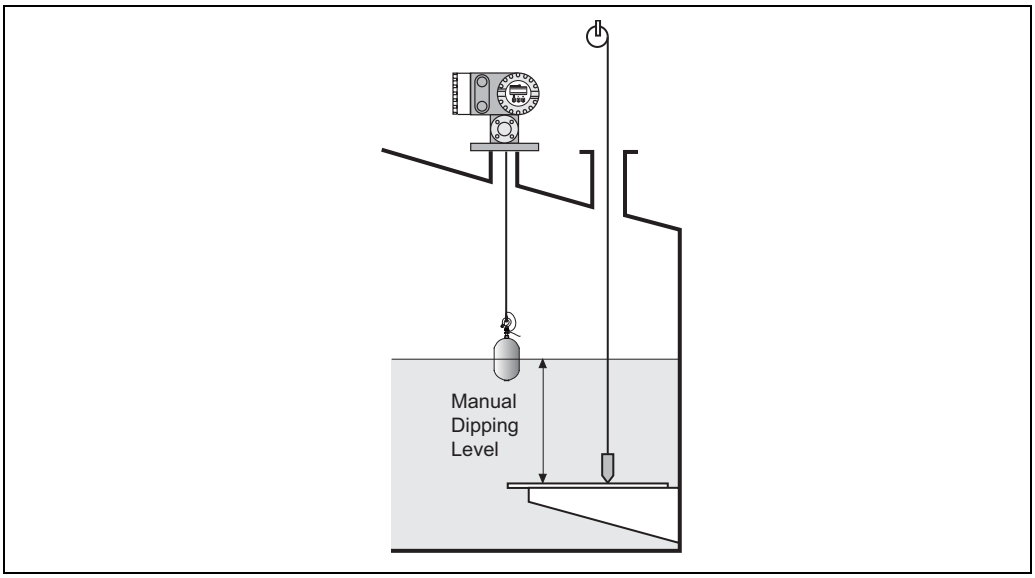


Figure 61: Calibration Level (Manual Dipping Level)

When there is not liquid in the tank;

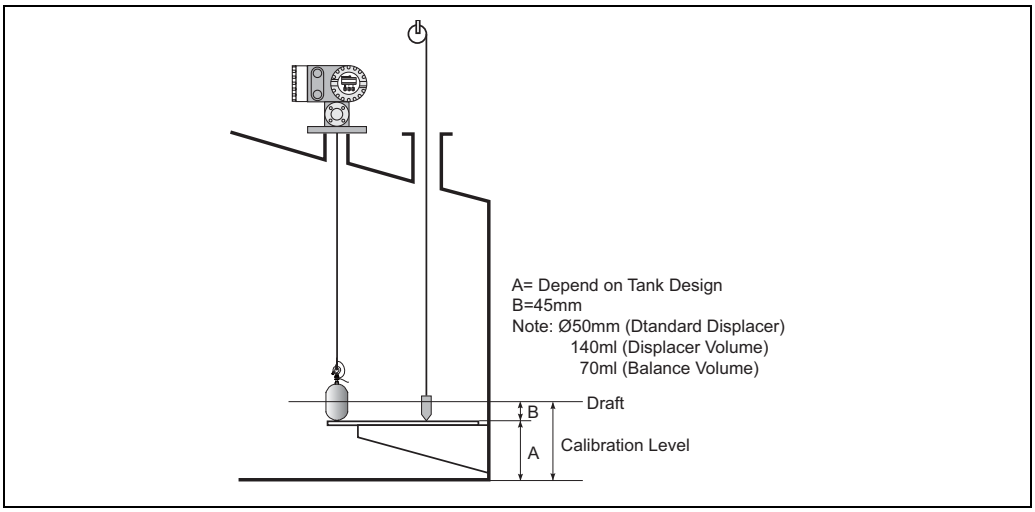


Figure 62: Calibration Level (Empty Tank)

⚠ CAUTION
When there is no liquid in the tank, level calibration is not 0mm on the measurement principle.
When 0mm level calibration is needed, refer to GVH004(BOTTOM LEVEL) or GVH142(DISPLAC. DRAFT).

7.4.2 Closed Tank

Level Calibration Procedure for Closed Tank

⚠ CAUTION
Closed tanks (e.g. LPG) cannot be hand-dipped. Follow the procedure shown below.

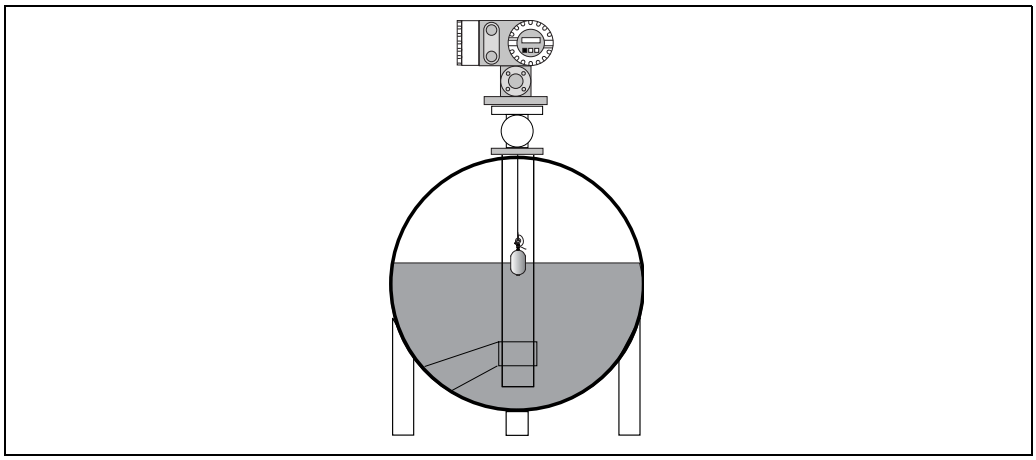


Figure 63: Level Calibration 1

1. Check the NMS parameter

GVH	ITEM
005	UPPER DENSITY
340	WIRE DRUM CIRC.
342	DISPLACER WEIGHT
343	DISPLACER VOLUME
344	BALANCE VOLUME

2. Set the Level gauge at GVH020(BOTTOM)

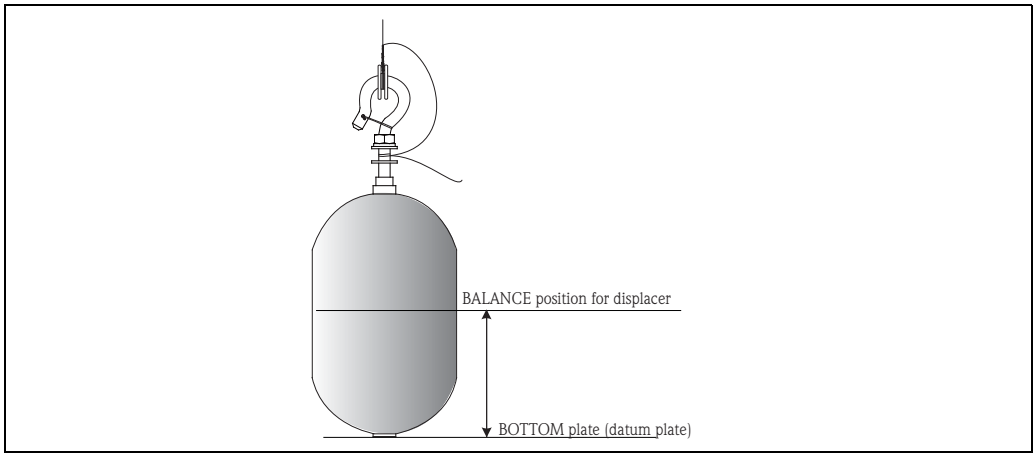


Figure 64: Draft Level of Displacer

3. Check that the displacer is balance and LCD (display) shows Balance.
4. Calculate the displacer balance position.
   - In case of Ø50 standard displacer, balance volume(GVH343) is reference value (a half of displace volume)
   - The balance point is 45mm from the bottom of the tank.

NOTICE
Refer to Appendix "14.3 Displacer".

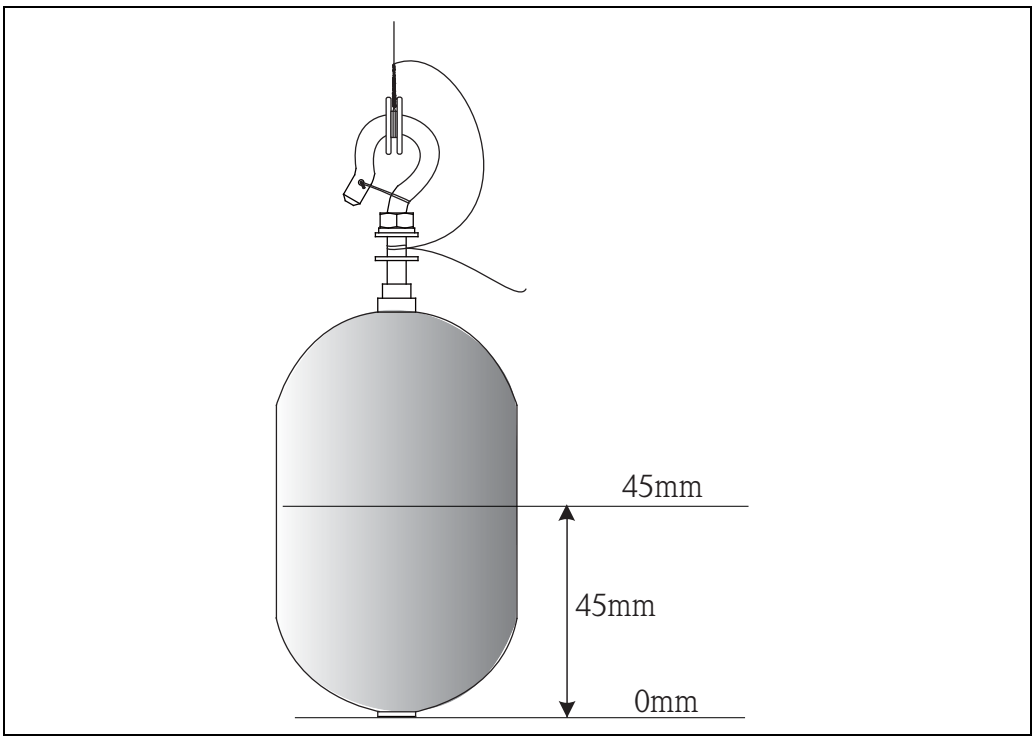


Figure 65: Level Calibration 2

5. Set Level Calibration to 45mm at GVH150 (SET LEVEL) in G1 MATRIX (Calibration).The bottom is ZERO.
   - If the bottom plate is not Zero (ex; X mm), adjust the level value by adding to the value.

   LEVEL = X + 45(mm)

This completes the level calibration procedure.

7.5 Remote Communications

7.5.1 Digital Output

The desired loop address for most digital protocols can be set at G2V8H5 (Address). The allowable range for setting varies depending on the protocol installed in NMS5. The range has 0-9, 00-FF (FF is fixed for MIC protocol), or 1-247 for Modbus.

- WM550 and Mark Space protocols addresses must be set by switches on the communications module inside NMS5.
- Enraf BPM: Address range is 00-99. A-F is not available.

7.5.2 Whessoe Matic 550 (WM550) Communication Board Setting

Jumper Setting

Jumper settings for WM550 communication board

Jumper	Function	Default Condition
J3 (Mode)	Use EPROM [IC4]->short	Short
J4 (Test)	Software testing	Short
J6 (Reset)	Reset	Open
J7 (Watch dog)	Watch dog setting	Short

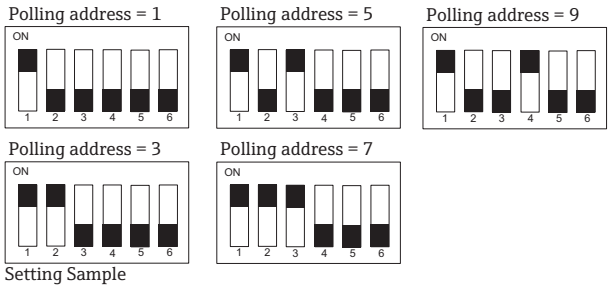
If software reset is required; J6 has to be short.

Polling Address Setting

WARNING

Polling addresses are set by mechanically at SW1 on WM550 communication board (not by acccessing NMS programming matrix). Check all polling addresses before setting.
The following table shows about address setting.

Switch Position	Value
1	1
2	2
3	4
4	8
5	16
6	COMPATIBILITY MODE



Setting Sample

NOTICE

For current loop setting, refer a operating manual for Whessoe 1098 or RTU 8130 operating manual.

7.5.3 Mark/Space(M/S) Communication Board Setting

Jumper Setting

Jumper settings for M/S communication board

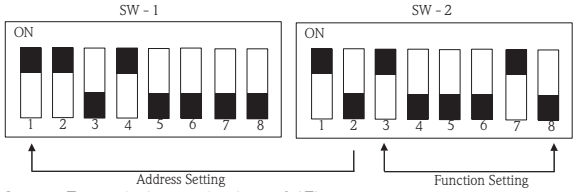
Jumper	Function	Default condition
J3 (Mode)	Use EPROM [IC4]->short	Short
J3 (Reset)	Reset	Open
J3 (WD)	Watch dog setting	Short

Polling Address Setting

WARNING

Polling addresses are set by mechanically at SW1 (1-8) and SW2(1-2) on Mark Space communication board (not by accessing NMS programming matrix). Check all polling addresses before setting. The following table shows address setting.

Switch Position	Value
SW1-1	1
SW1-2	2
SW1-3	4
SW1-4	8
SW1-5	16
SW1-6	32
SW1-7	64
SW1-8	128
SW2-1	256
SW2-2	512



Setting Example (example above:267)

Function Setting

Each function is set at SW2-* shown as follows.

Switch	Function	Default Condition
SW2-3	ON: Data transmission under unbalanced condition	ON
SW2-4	ON: low baud rate setting	OFF
SW2-5	ON: Feet data OR 0-20m, OFF: 0-30m	OFF
SW2-6	ON: Measured data converted to feet	OFF
SW2-7	ON: Temperature data (57 bits)	ON
SW2-8	ON: Deg. F measured temperature unit, OFF: Deg. C	OFF

7.5.4 ENRAF Bi Phase Communication Board (COM-3) Setting

COM-3 Jumper Setting

Jumper	Function	Default Condition
JP1 (Mode)	ROM type setting 1-2 short: 27C4096 2-3 short: 27C1024	2-3 short
JP2 (Reset)	CPU mode setting (Fixed)	1-2 open 3-4 short 5-6 short
J3 (WD)	Baud rate setting 1-2 short: 1200 bps 1-2 open: 2400 bps	1-2 open

Communication Setting
Select "V1/ENRAF BPM" at the matrix position GVH=286.

Communication Setting
Polling address is set at GVH=285 "ADDRESS" of NMS5 matrix. The allowable range is from 00 to 99.

WARNING
A to F for polling address can not use.

Communication Setting

- Switch S1: Reset switch
- Connector J3: Communication port for debugging

7.5.5 Analog Output

Setting of analog output 4-20mA is available when ordered from Endress+Hauser. NMS5 is delivered with analog output hardware installed. For the following matrix parameter settings, Access code 51, is required.

Matrix	Item	Setting
G2V5H0	Assign Output	Assign analog output (Level or Temperature) for channel 1.
G2V5H1	Adjust 4mA	Set level or temperature value for 4mA output on channel 1. Available only when G2V5H0= "Level" or "Liquid Temp" Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
G2V5H2	Adjust 20mA	Set level or temperature value for 20mA output on channel 1. Available only when G2V5H0 = "Level" or "Liquid Temp." Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
G2V5H3	Assign Output 2	Assign analog output (Level or Temperature) for channel 2.
G2V5H4	Adjust 4mA	Set level or temperature value for 4mA output on channel 2. Available only when G2V5H3 = "Level" or "Liquid Temp." Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
G2V5H5	Adjust 20mA	Set level or temperature value for 20mA output on channel 2. Available only when G2V5H3 = "Level" or "Liquid Temp." Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
G2V5H6	Device at Alarm	Select type of output for alarm. Select from OFF, HOLD current output, Maximum value or Minimum value. Default : OFF

⚠ CAUTION
If "LEVEL", confirm GVH158 (Prosafety) is "NO".

7.5.6 Contact Relay Alarm Output

The specification of alarm for output contact relay is delivered as a part of NMS5. This specification allows a maximum of 4 output contact relay settings. Set access code 51 in case of the following matrix parameters.

Matrix	Item	Setting
G2V4H0	Select Relay	Use +/- and E keys to select to activate Contact Output Relays 1 to 4. Default value = 1.
G2V4H1	Assign Relay	Select output definition from range of choices: None, Level, Liquid Temp, Caution, Warning, Emergency Error, and Balance Signal. Default value = NONE.
G2V4H2	Relay Function	Select High or Low function, available only when G2V4H1 = "Level" or "Liquid Temp." Default value = HIGH.
G2V4H3	Switching Point	Set level (0-99999 mm) at which relay is activated, available only when G2V4H1 = "Level" or "Liquid Temp." Default value = 0 mm.
G2V4H4	Hysterisis	Set hysterisis value (0-99999 mm) for selected relay, available only when G2V4H1 = "Level" or "Liquid Temp." Default value = 0 mm.
G2V4H5	Relay on Alarm	Select from Normal Open or Normal Closed, available only when G2V4H1 = "Level" or "Liquid Temp." Default value = NORMAL OPENED.
G2V4H6	On Delay time	Set delay time (0-999 seconds) for alarm output start, available only when G2V4H1 = "Level" or "Liquid Temp." Default value = 0 seconds.
G2V4H7	Off Delay Time	Set delay time (0-999 seconds) for alarm stop, available only when G2V4H1 = "Level" or "Liquid Temp." Default value = 0 seconds.

Description of Error Message

Error Type	Descriptions
LEVEL	Liquid level exceeded the designated upper or lower limit.
LIQUID TEMPERATURE	Liquid temperature exceeded upper or lower limit.
CAUTION	Auto wire calibration error; Auto displacer calibration error
WARNING	Weight value exceeded the designated alarm sending limit (upper limit: GVH=162 or lower limit: GVH=163). (e.g. local communication error, LCD error, communication error, EEROM data error)
EMERGENCY ERROR	Z-phase no input error, ADC sensor error, communication IC error, A-phase no input error, Driver error, power failure

7.5.7 Relay Logic

Module name	I/O - 3		
Alarm output, Standard (Order Code position 050= 1,2,3 or 5)	4 relays with potential-free change-over contacts, freely assignable to measured value		
Hysteresis, Alarm output	Switch points and switching hysteresis freely adjustable, residual current fail-safe mode: minimum or maximum, selectable		
Operation output logic		Relay Condition	
	Initial Configuration (Normal Status)	Open	Closed
	On alarm	Closed	Open
	On device error	Closed	Open
	On abnormal power supply (5% lower than, higher than specified power supply	Custody Transfer Closed	Custody Transfer Open
	Power outage	Hold last condition	
Switching capacity, Alarm output	▪ Max. 250VAC, 2A/62.5W ▪ Max. 220VDC, 2A/60W ▪ FM/CSA: 30VAC, 2A/42VDC, 2A, 60W ▪ TIIS: 250VAC, 1.5A/30VDC, 9W		

Alarm output, Overspill prevention (Order Code position 050=4)	2 relays with potential- free changeover contacts, assignable to Level	
Hysteresis, Alarm output	Switch points and switching hysteresis freely adjustable, residual current fail-safe mode: minimum or maximum, selectable	
Operation output logic		Relay Condition
	Initial Configuration (Normal Status)	Closed
	On alarm	Open
	On device error	Open
	On abnormal power supply (5% lower than, higher than specified power supply	Open
	Power outage	Open
Switching capacity	▪ Umax. 200VDC/200VppAC ▪ Imax. 0.5AC, DC or peak AC ▪ Pmax. 15W	

Operation Input	2 photocouplers, for external input from controller (tumbler switch, DCS, etc.)		
Operation output logic	Gauge Status	CTR1	CTR2
	Level	0 (OFF)	0 (OFF)
	UP	1 (ON)	0 (OFF)
	STOP	0 (OFF)	1 (ON)
	Interface Level	1 (ON)	1 (ON)
Input voltage	15VDC, active circuit (supplied by NMS5)		
Input current	Approximately 5mA		

7.6 Density and Density Profile Measurements

Two different types of density measurement are available when ordered from Endress+Hauser.

- Spot density measurement for up to 3 liquid phases
- Density profile measurement
  1. Tank profile for up to 16 points for total liquid height.
  2. Tank profile for upper phase liquid only.
  3. Tank profile based on a manually entered profile parameter.

7.6.1 Spot Density Measurement

Spot measurement for up to 3 liquid phases is an option that is available when ordered from Endress+Hauser.
The following preconditions are required in order to assure safe and accurate operation.

- NMS5 must be configured for Spot density measurement as ordered from Endress+Hauser. For information regarding upgrading your NMS5, contact Endress+Hauser representatives.

- Density values:

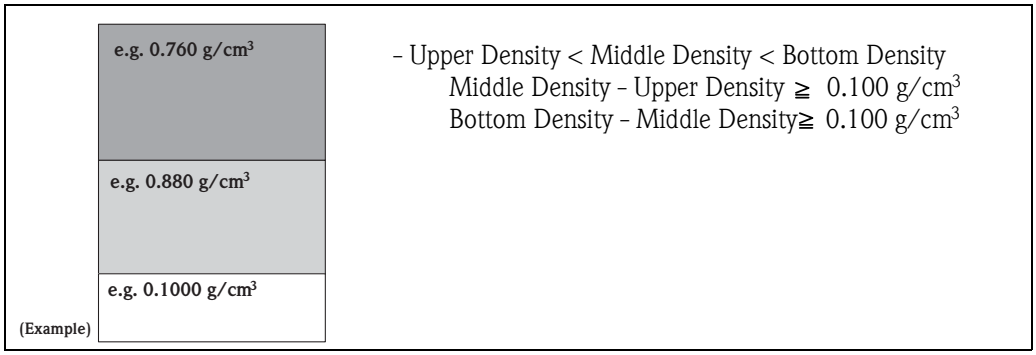


Figure 66: Density Measurement

- Density values can be viewed and changed at the following matrix positions:
  G0V0H5 Upper Density
  G0V0H6 Middle Density
  G0V0H7 Density Bottom

- The displacer is balanced at liquid level and the liquid surface is not moving.

For spot density measurement, the following parameters can be set or selected. However the factory default settings also can be used.

Matrix	Item	Setting
G1V4H3	Displacer Raise Density	Set distance (0-300mm) for displacer to rise the level position above during measuring density. Default setting = 150 mm. Observe the rule: G1V4H3 + G1V4H4 = 300 n, where n = integer.
G1V4H4	Displacer Sub-merge Density	Set distance (0-300mm) for displacer to submerge the level position above during measuring density. Default setting = 150 mm. Observe the rule: G1V4H3 + G1V4H4 = 300 n, where n = integer.

Operation
Select the measurement of the density desired from UPPER DENSITY, MIDDLE DENSITY, or DENSITY BOTTOM at G0V2H0 "OPERATION". NMS5 raises the displacer up out of the liquid, measures its weight, and sends the displacer down to measure the density. After density is measured, the displacer remains at that position until UP or LEVEL command are selected at G0V2H0.

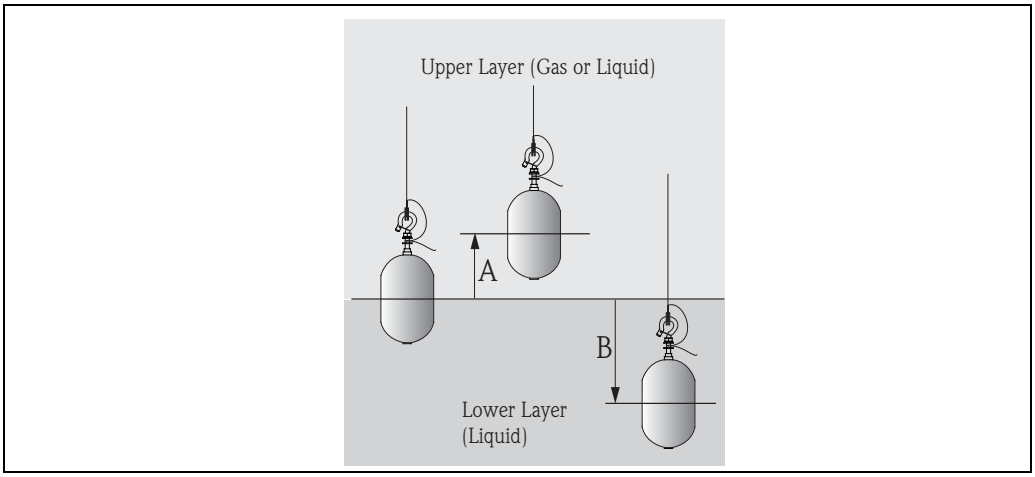


Figure 67: Density Profile Measurement

7.6.2 Density Profile Measurement

Tank Profile Density Measurement
In addition to the preconditions, the following additional preconditions are required in order to assure safe and accurate operation for the density measurement of the tank profile.
Access Code 51 is required to edit parameters.

- NMS5 must be configured for Spot & Profile density measurement as ordered from Endress+Hauser. Contact Endress+Hauser for the information regarding upgrading NMS5.
- The standard tank bottom level (GVH004) is zero. If not, the formula used for calculating the interval between profiles is GVH000 / GVH841. The displacer touches the bottom of the tank before measuring a lower level (e.g. 884mm).
- If Bottom Level is not 0 mm, select Manual I/F Profile at GVH840. Set GVH843 I/F Manual Level = actual bottom level e.g. 884mm. In this case, the intervals will be calculated based on GVH000 - GVH843/GVH841.
- The density profile can be operated when the liquid is still in the tank. However, depending on the height of liquid level, it may take 1 hour or more to operate the density profile.

Matrix	Item	Setting
G1V5H4	Safe Density	Select the desired resultant condition when density profile measurement fails due to displacer reaching the low-limit for density profile operation (set in G1V5H5). Selecting "ON" will result in STOP operation. Selecting "IGNOR" will result in "LEVEL" operation, displacer will return to liquid level. Selecting "OFF" will leave the displacer at the position where density profile measurement failed, and in "DENSITY" operation.
G1V5H5	Den Ope Level	Set the lower limit for displacer movement during density profile operation Default setting = 300 mm.

NOTICE
Additional matrix parameter settings are required for remote communications via WM550 communications protocol.
Refer to Section "13. Matrix, (Dynamic Matrix, Device Data : G2), WM550 DENS. SEL.".

- A. Tank profile for up to 16 points for total liquid height

G8V4H0 Ope Select: Select 1: Tank Profile.

- B. Tank profile for upper phase liquid only

G8V4H0 Ope Select: Select 2: I/F Profile.

- C. Tank profile for based on a manually entered profile parameter.

G8V4H0 Ope Select: Select 3: MANU.I/F Profile.

When choosing A, B, and C above, the following parameters can be set or select. The factory default settings also can be used.

Matrix	Item	Setting
G8V4H1	Ope Point	Set the number of measurement points (2-16) for Tank Profile measurement. Default setting = 2.
G8V4H3	I/F Manu. Level	Manually set the water interface level (0-99999.9mm) to be referenced during the tank profile measurement. Default setting = 0 mm. Only used with C, tank profile for based on a manually entered profile parameter.
G8V4H4	Bal. Level	Set the allowance for level movement (1.0 -99.9 mm) prior to Tank Profile operation. If the level movement exceeds this value, profile operation is canceled. Setting 99.9mm allows Profile measurement to proceed, regardless of level movement. Default setting = 2.0 mm.
G8V4H5	Up Wait Time	Set waiting time (1-31 minutes) for displacer weight to be measured in air, when making the weight table at start of profile operation. Default setting = 1 minute.
G8V4H6	Liq Wait Time	Set the time (1-31 minutes) for displacer to stop at each measurement position during profile operation. Default setting = 1 minute.
G8V4H7	Ope Wait Time	Set maximum waiting time (1-31 minutes) for conditions in G8V4H4 (Bal Level) to be satisfied before profile operation begins. E.g. if the level movement exceeds setting at G8V4H4, NMS5 is in "standby" for the time set in this matrix. After the maximum time elapses, profile operation is canceled. Default setting = 1 minute.

Initial Setting of Tank Profile (Density Profile) Measurement

All of necessary set up can be done at "G8 Tank Profile" matrix. There are six factors to configured prior to the actual operation.

G8V4H0 OPE. SELECT

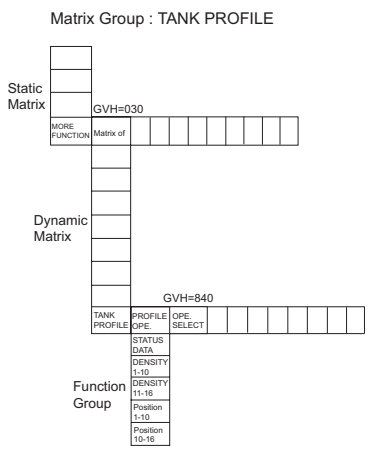
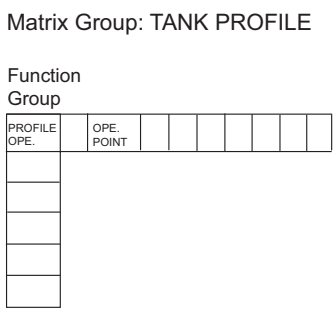
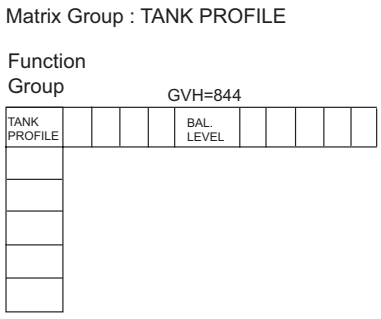
Item	Procedure	Remarks
	1. Select G0V3H0 "MATRIX OF" in the row "MORE FUNCTION" on Static Matrix, then select "Tank profile".	▪ Set access code to 50.
	2. Select function group "PROFILE OPE" and G8V4H0 "OPE SELECT".	▪ The row of PROFILE OPE is the only function group that needs configuration for the density profile operation.
	3. Select 1: "TANK PROFILE" by pressing + or - key. 4. Press E to configure.	▪ Selection of "0: SPOT" enables Upper Density measurement instead of Density Profile measurment.

Figure 68: G8V4H0

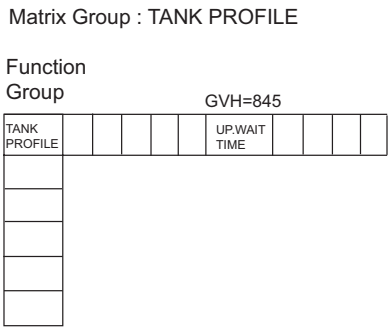
G8V4H1 OPE. POINT

Item	Procedure	Remarks
 Figure 69: G8V4H1	1. Select G8V4H1 "OPE POINT " to determine number of density measuring points. 2. Enter required number by pressing + or - key, and select E to enter.	▪ Set access code to 51. Default value is 2 points and selectable up to 16 points. ▪ Whatever the number of measuring point is selected, the measuring interval & point between each point are automatically calculated within the liquid level.

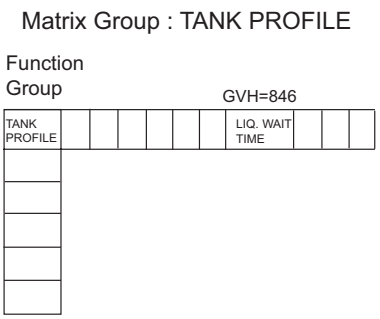
G8V4H4 BAL. LEVEL

Item	Procedure	Remarks
 Figure 70: G8V4H4	1. Select G8V4H4 "BAL LEVEL" to determine the liquid stability range in order to start the operation. 2. Enter desired value by pressing + or - key and select E to enter. Input value of 99.9mm represents that the measuring procedure starts regardless of level condition.	▪ Set access code to 51. NMS software has a function to scan & record the liquid level every 5 minutes. ▪ NMS5 only starts the actual measurement when the liquid level is within the entered value compared to the recorded level data 5 minutes ago. This function ensures the safe operating condition to avoid filling or draining liquid from the tank.

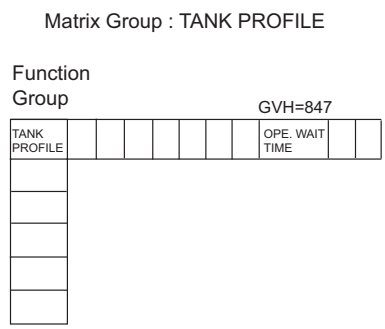
G8V4H5 UP WAIT TIME

Item	Procedure	Remarks
 Figure 71: G8V4H5	1. Select G8V4H4 "UP WAIT TIME" to determine the displacer weight calibration interval in air. 2. Enter desired waiting time by pressing + or - key, and select E to enter.	▪ Set access code to 51. The displacer raises approximately 500mm above liquid surface after confirming the stability of liquid level within "BAL LEVEL" function. ▪ The displacer weight is calibrated at 8 different positions in air and the interval between those positions are adjustable within this function to allow excess liquid to drip off the displacer to achieve higher accuracy.

G8V4H6 LIQ. WAIT TIME

Item	Procedure	Remarks
 Figure 72: G8V4H6	1. Select G8V4H6 "LIQ. WAIT TIME" to determine the displacer weight calibration interval between each measuring point in the liquid.	▪ Set access code to 51. A small turbulence made by the movement of displacer itself may cause the liquid surrounding displacer to be unstable for the accurate measurement.
	2. Enter desired waiting time by pressing + or - key, and select E to enter.	▪ This function allows displacer to hold in each calculated position before actual measurement is proceeded based on the entered value.

G8V4H7 OPE. WAIT TIME

Item	Procedure	Remarks
 Figure 73: G8V4H7	1. Select G8V4H7 "OPE. WAIT TIME" to determine the operation holding time limit to accept "BAL. LEVEL" before the actual operation starts.	▪ Set access code to 51. Entire operation begins only when the condition described in "BAL. LEVEL" is achieved.
	2. Enter desired waiting time by pressing + or - key, and select E to enter.	▪ This function determines how long for the NMS to wait if "BAL. LEVEL" can not be established before quitting entire operation.

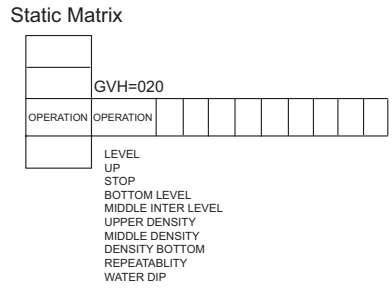
Operation of Tank Profile (Density Profile) Measurement
After all the initial settings are completed, the actual operation can be proceeded by one simple command. The operation status regarding this function is displayed at G8V5H0 and the liquid level condition is also displayed at G8V5H1. Terms of status display and descriptions are listed below.

Operations Status (G8V5H0, OPE. STATUS)

Status	Contents
0: Accepting	Accepting density profile command
1: Standby	Ready to execute density profile command
2: In operation	Executing density profile command
3: OPR. END	Density profile operation completed successfully
4: UN_BALANCE ERR	Fail: Required conditions for density profile operation not satisfied
5: IPR. ERR. STOP	Fail: Abnormal conditions occurred during density profile operation

Level Condition Status (G8V5H1, LEVEL CONDITION)

Status	Contents
0: Off Level Meas.	Active operation is not LEVEL (Profile cannot start).
1: Stable	Liquid level/surface is stable (Profile can start).
2: Unstable	Liquid level/surface is unstable (Profile cannot start).
3: Ignore condition	Ignores liquid level/surface condition (profile cannot start).

Item	Procedure	Remarks
 Figure 74: Static Matrix	1. Select G0V2H0 "OPERATION" in the Static Matrix and select "UPPER DENSITY".	▪ Set access code to 50. ▪ The operation command "UPPER DENSITY" is shared between spot and Tank Profile density measurement depends on G8V4H0 configuration.
	2. Press E to start the operation.	▪ The operation must start when the NMS is in Level measuring mode.
	3. Unless there is any incompatible circumstances during the displacer automatically returns to the level measurement after the last measuring point.	▪ To minimize the risk of safe operation, the displacer immediately returns to the Level measurement regardless of completing various data process.

Density Profile Operation Diagram

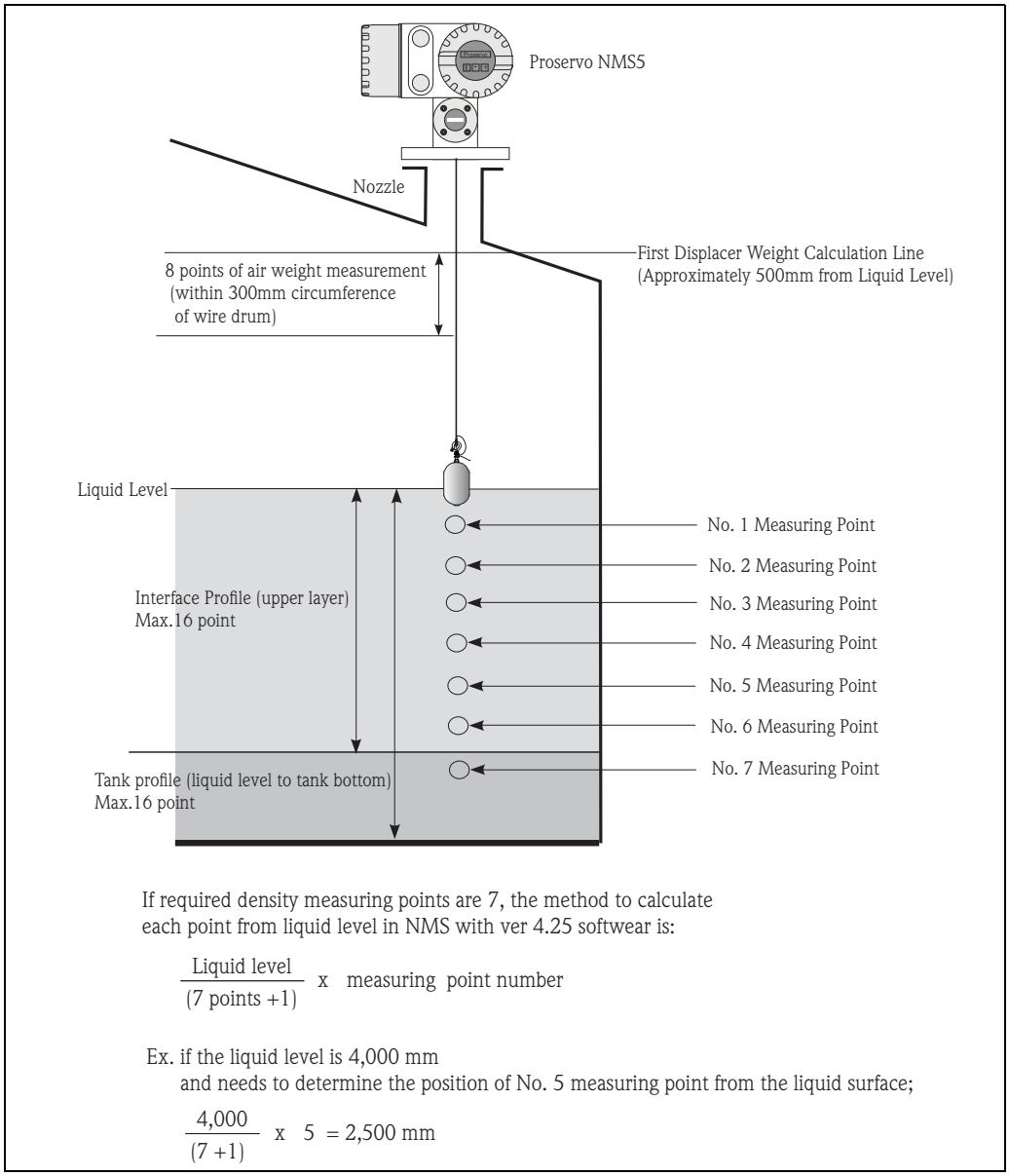


Figure 75: Density Profile

Operation Procedure

1. Set NMS5 so that it can measures the liquid level.
2. Raises the displacer and measure each weight of 8 measuring points in the air.
3. Measure the density at the setting position in the liquid level.
4. Return to level measurement.
5. Save the data in G8 matrix accordingly.

This completes the operation procedure.

WARNING

The average density and temperature data regarding density profile function (G8 Matrix) are completely different from the data on G0 static matrix which displays the conventional upper density (spot) and temperature (continuously scanned) data.

7.7 Interface Measurement

NMS5 can measure interface levels via the following operations.

- Upper Interface Level: returns the level data for the interface between top 2 liquid phases. Displacer remains at interface level in UPPER INTERFACE operation.
- Middle Interface Level: returns the level data for the interface between bottom 2 liquid phases. Displacer remains at interface level in MIDDLE INTERFACE operation.
- Water Dip: returns the level data for the interface between top 2 liquid phases. Displacer returns to liquid level in LEVEL operation.

The following preconditions are required in order to assure safe and accurate operation.

- Density values:

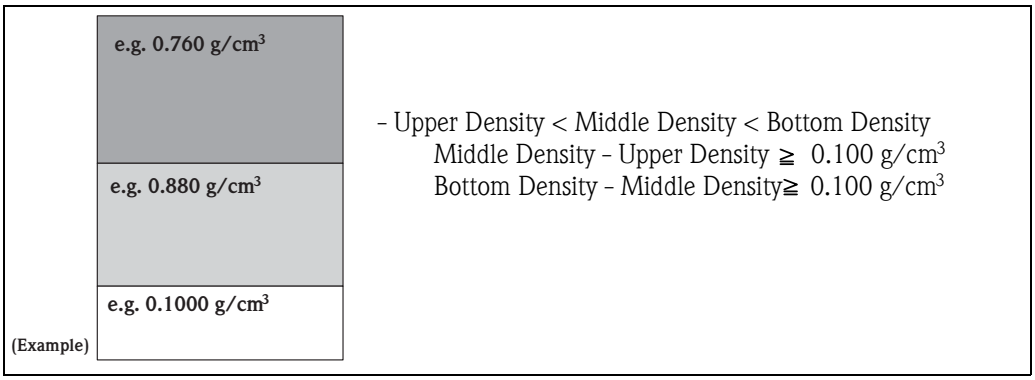


Figure 76: Interface Measurement

Density values can be viewed and changed at the following matrix positions:

- G0V0H5 Upper Density
- G0V0H6 Middle Density
- G0V0H7 Density Bottom

NOTICE

Additional matrix parameter settings are required for remote communications via WM550 communications protocol.
Refer to Section "13. Matrix, (Dynamic Matrix, Device Data : G2), WM550 ALM. SELECT.".

Operation:

After confirming the above pre-conditions, use the "+" or "-" keys to select the desired operation at matrix position G0V2H0 OPERATION. When the desired operation is displayed, press the "E" key.

7.8 Sealing of NMS5

NMS5 can be sealed, and data can be made unchangeable for custody transfer purposes as follows.

Sealing of NMS5 Procedure

1. Set OPE. DENSITY at GVH=278 as the liquid density (if the density is expected to change during operation, set the average value.).
2. Turn off the power supply, open NMS5.
3. Turn the micro switch to the "on position" on the printed circuit board TCB (see figure below). NMS5 will then enter "write-protect" mode and not accept any further level, weight, or density data changes.

This completes the sealing of NMS5 procedure.

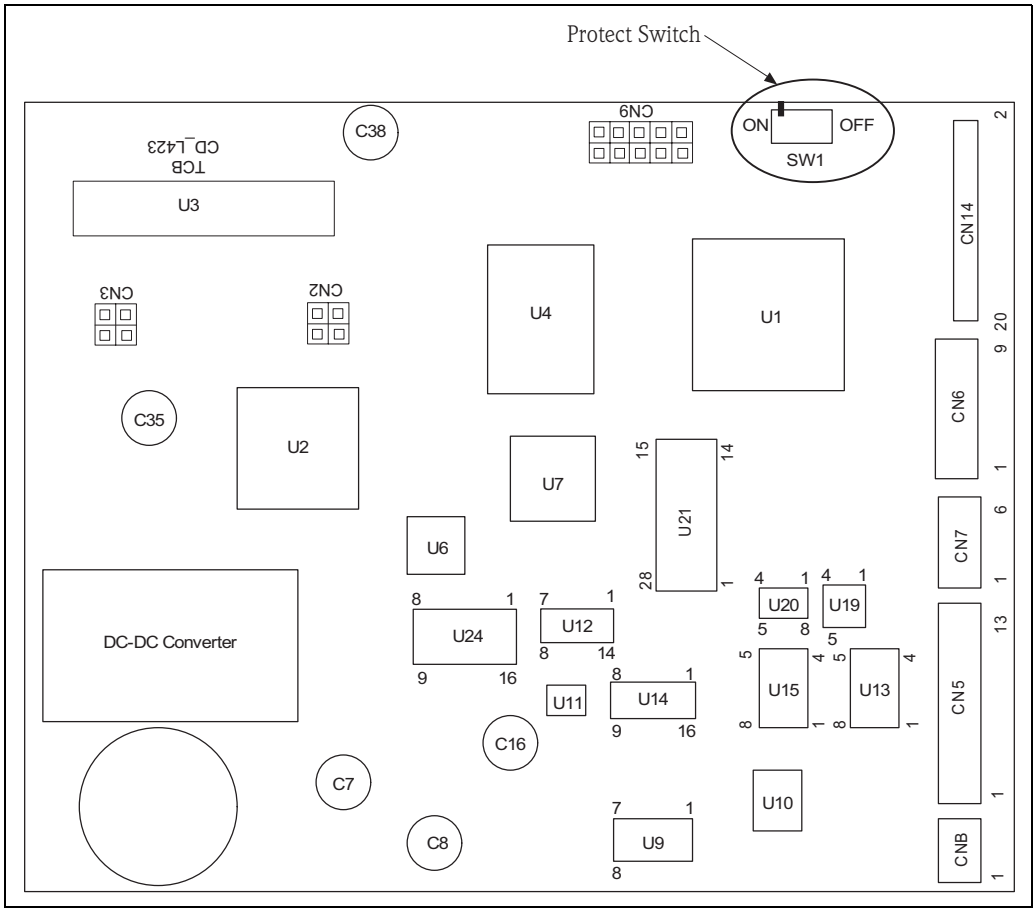


Figure 77: The printed circuit board TCB

8 Maintenance

NMS5 measuring instrument requires no special maintenance.

8.1 Exterior Cleaning

When cleaning the exterior of measuring devices, always use cleaning agents which will not cause corrosion or other damage to the housing surface seals.

8.2 Seals Replacement

NMS5 O-rings may need to be replaced periodically, and more frequently in extreme climates. The period between changes will depend on climate severity, ambient temperatures and process.

8.3 Repairs

The Endress+Hauser repair policy is based on the fact that the measuring devices have a modular design and that customers are able to undertake repairs themselves. Spare parts are contained in corresponding kits along with their related replacement instructions. Endress+Hauser provides spare parts for repairs of NMS5, which are located with their order numbers on later pages (refer to "10.6 Spare Parts"). Contact Endress+Hauser service representatives for further assistance regarding service and spare parts.

8.4 Repairs to Ex-approved Devices

When performing repairs on Ex-approved devices, note the following:

- Repairs of Ex-approved devices may only be performed by trained personnel or by Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and other relevant rules.
- Only use original spare parts provided by Endress+Hauser.
- When ordering spare parts, note the device information on the nameplate. Replace parts only with parts that have the same device information.
- Perform repairs according to the instructions. When completing repairs, perform the specified routine test on the device.
- Only Endress+Hauser service representatives may convert a certified device into a different certified variant.
- Document all repair work and conversions.

8.5 Replacement

After replacing NMS5 or electronic module, the adjustment of a new sensor is required.

9 Accessories

9.1 Calibration Chamber

Refer to the separate "Technical Information for NMS5".
NHC4HP: high pressure version
NHC4LP: low pressure version

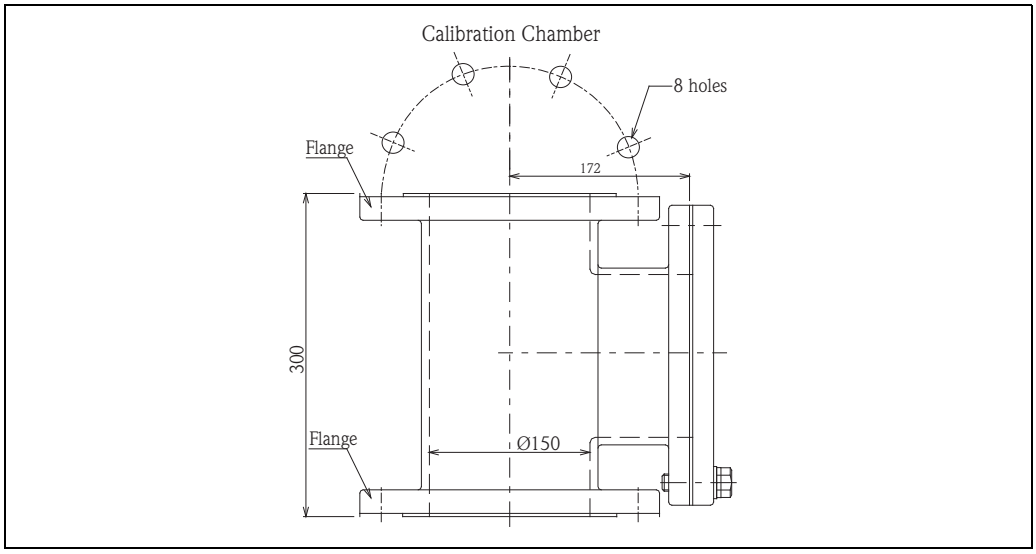


Figure 78: Calibration Chamber

9.2 Power and Control Switch

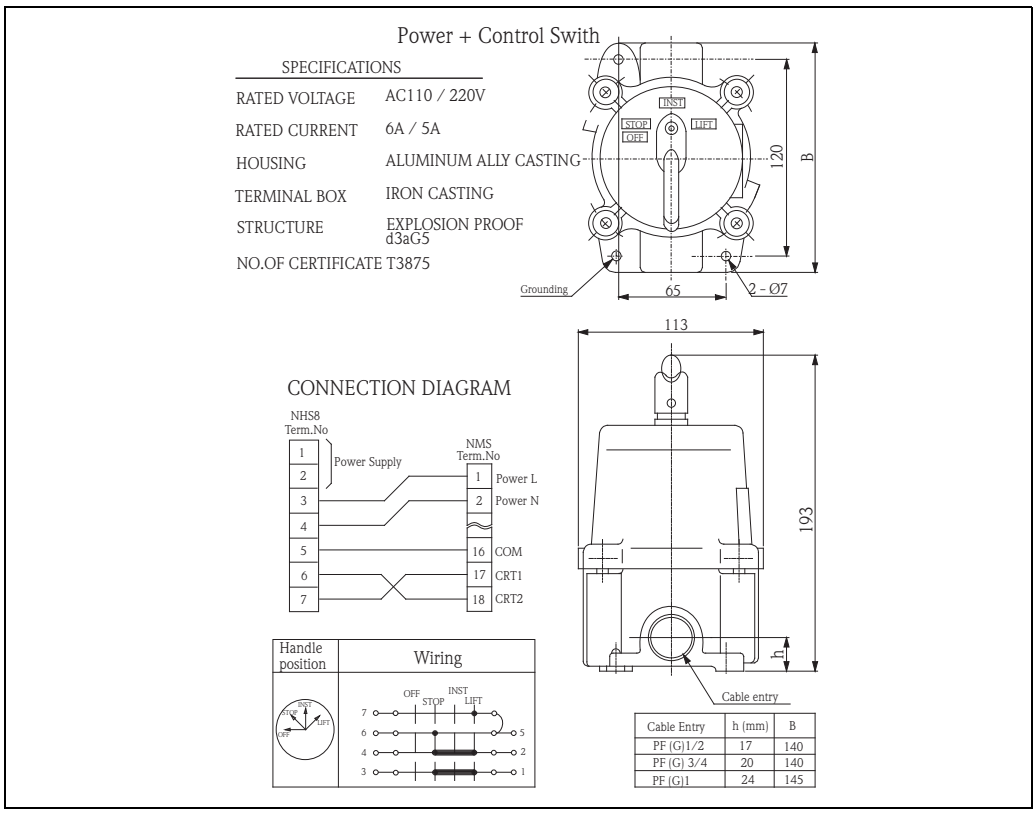


Figure 79: Power and Control Switch NHS8

9.3 Ball Valve NHV4A

NHV4A: Standard ball valve with ASME flanges
NHV4J: Standard ball valve with JIS flanges

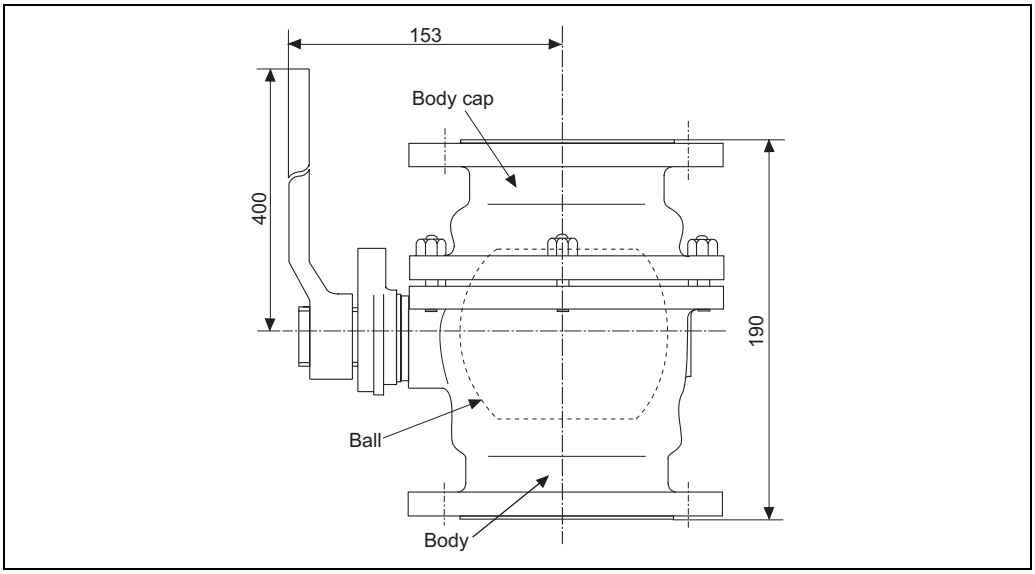


Figure 80: Ball Valve

9.4 Reducing Flange NHF4

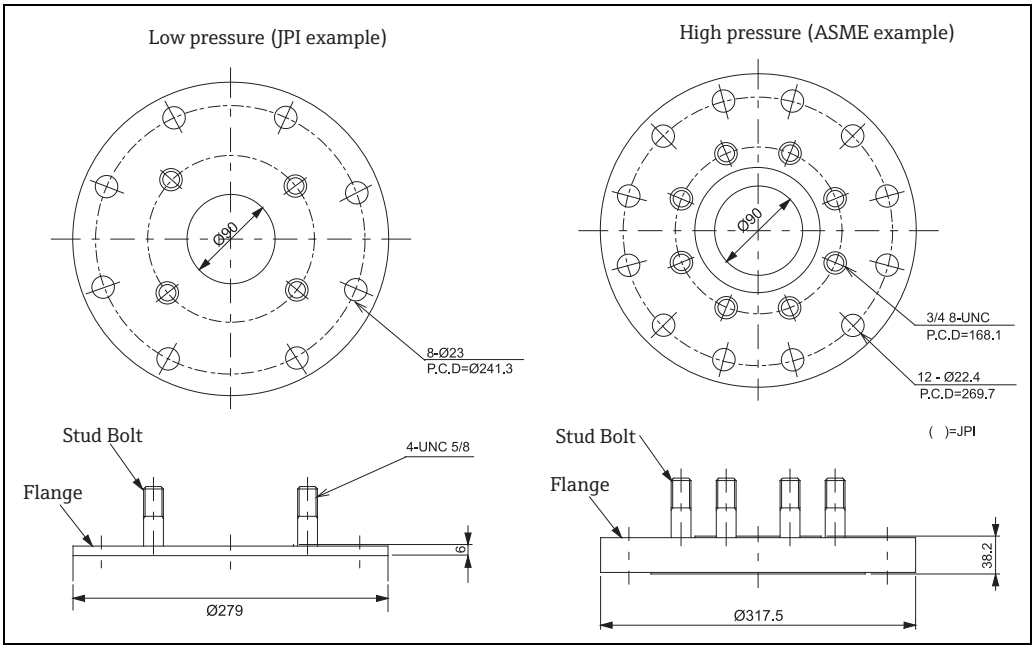
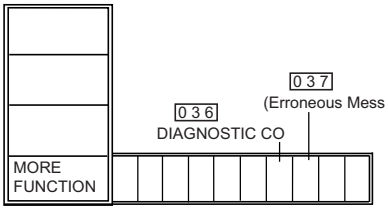
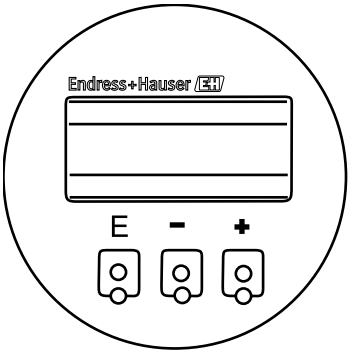


Figure 81: Reducing Flange

10 Diagnosis and Troubleshooting

NMS5 has a superb self-diagnosis function which monitors its operation. If an error is occurred, the corresponding message is displayed on the LCD. The selected matrix position and the error message are displayed every few seconds alternatively. Data can be accessed while the selected matrix position is displayed. The error messages are stored in the memory of NMS5. Matrix position GVH=037 provides the diagnostic history.

10.1 Selection of Diagnostic Code and History

Item	Procedure	Remarks
Static Matrix : G0  Figure 82: Static Matrix **Touch Control**  Figure 83: Touch Control	1. On "MORE FUNCTION" , select item GVH=036 "DIAGNOSTIC CO." 2. Previous static matrix records are sequentially displayed in Static Matrix screen GVH=037, starting with the latest record. Up to 100 alarm records can be saved. If the number of records exceeds 100, it is sequentially overwritten starting with the oldest record. For example, 973192238 2402 means that an error occurred at 22:38 on March 19, 1997, when the instrument temperature was 24 °C and this is the second error since NMS5 was installed. Display includes the year, month, day, hour, minute, instrument temperature, and an error sequential number, in this order.	▪ Item GVH=037 only shows error message, calendar, and pointer, but no label on the LCD.

10.2 Error and Status Messages

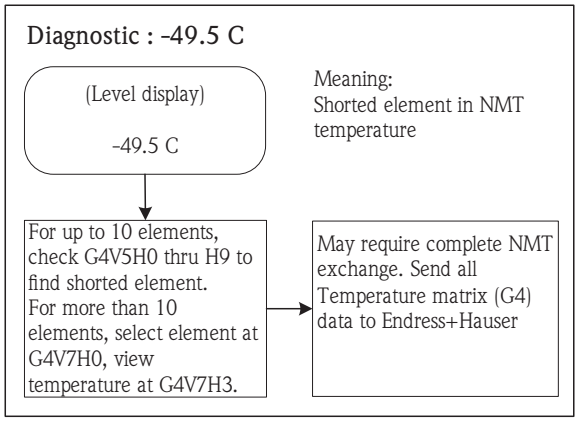
Message	Cause	Remedy	Error Code
-49.5 °C	Indication of shorted element in NMT temperature sensor	Check GVH=450 thru GVH=459 to see element.	
358.0 °C	Element is not enabled, or not installed in NMT temperature sensor .	Check GVH=482 Total number of elements	
359.0 °C	Indication of open element in NMT temperature sensor	Check GVH=450 thru GVH=459 to see element.	
ADC/SENSOR ERROR	The signal from the A/D converter is out of range.	Consult E+H Service.	107
ADJ. XXXCOUNTER (X=A, I, Z or combination)	Error of level data check by A, I, and/or Z phase encoder.	If the message appears frequently, then consult E+H Service.	
A PHASE NO INPUT	The input of the A phase signal from the encoder is not available.	Replace the detector unit. Consult E+H Service.	122
BELOWBOT. POINT	Indicates NMS displacer position is below lowest of NMT temperature sensor.		
DEVICE ERROR: DEV 1 (or 2)	The HART device 1 (or 2) gives an error signal.	Check the HART device 1 (or 2) .	130, 131
DEVICE ERROR: NMT	NMT 53x gives an error signal.	Check the connection of NMT 53x. Check the register of the temeperature sensor at position GVH=362 "CONNECTION NMT."	250
DEVICE ERROR: NMT	NMT 53x temperature sensor is not available.	Check NMT 53x. Error messages are available in NMT 53x manual.	233
DEVICE ERROR: NRF	NRF 560 gives an error signal.	Check NRF 560. Error messages are available in NRF 560 manual.	240
DISPL CALIB ERROR	The deviation of automatic weight calibration exceeds its set limit.	Check build-up or deposit on the displacer.	120
ELEM 0 RANGE OVER	Indicates the reference resistance element (°C) on NMT electronics is out-of- tolerance.		
IMPOSSIBILITY	Operation is impossible because there is no weight table.		
LOCAL ERROR: DEV1 (or 2)	NMS5 cannot access the local HART device 1 (or 2).	Check the connection of the HART device to NMS5. Check the registration of the device(s) in matrix group G5/6.	232
LOCAL ERROR: NMT	The signal from NMT 53x temperature sensor is not available.	Check the connection of NMT 53x. Check the register of the temperature sensor at position GVH=362 "CONNECTION NMT."	111
LOCAL ERROR: NRF	NMS5 cannot access NRF 560.	Check the connection of NRF 560 and register of the tank side monitor at position GVH=361 "CONNECTION NRF."	113
MINTENANCE	GVH157 Service Mode = ON	Set GVH157 = OFF	199
MEM. ERROR	Defect in the memory that is specially used for custody transfer sealing.	Replace the CPU board. Consult E+H Service.	201
MPU RESET	Power to the CPU module fell below minimum value.		
MPU: START ACT*	Power to NMS5 was turned OFF/ON.	If the message occurs frequently, then consult E+H Service.	
OVERTENSION	The tension on the measuring wire exceeds the upper limit set at position GVH=162 "OVER TENS. SET."	Check if the displacer motion is blocked by clogging or sticking. To release overtensioning, access position GVH=371 "RELE. OVER TENS."	101
POWER FAILURE	The supply voltage falls below the allowed value.	Check the power source.	124

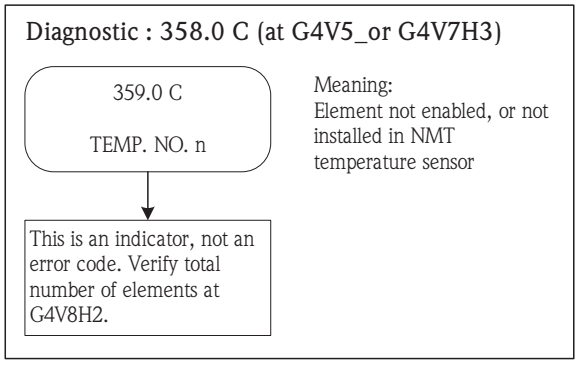
Message	Cause	Remedy	Error Code
RAM FAILURE	CPU RAM failure		
ROM ERROR	EEPROM	Consult E+H Service.	132
SIFA ERROR	Error between communication board and CPU board for digital output.	Replace the CPU board. Consult E+H service.	114
TEMP BELOW RANGE	Indicates the measured temperature data is below the fixed range of the NMT temperature sensor.		
TEMP COM OPEN	Indicates an open common line in the NMT temperature sensor		
TEMP COM SHORT	Indicates a shorted common line in the NMT temperature sensor		
TEMP OVER RANGE	Indicates the measured temperature data is highter than the fixed range of the NMT temperature sensor.		
UNDERTENSION	The tension on the measuring wire falls below the lower limit set at position GVH=163 "UNDER TENS. SET."	Check if the measuring wire is cut or the displacer is lost. In this case, check the installation of the NMS5.	102
WIRE CALIB ERROR	The deviation of automatic wire calibration exceeds its set limit.	Check wire and wire drum.	115
Z PHASE NO INPUT	The input of the Z phase signal from the encoder is not available.	Replace the detector unit. Consult E+H Service.	106, 112
MPU:XXXX* (XXXX=text)	CPU error	The error might happen occasionally and might be registered in GVH=037 (Erroneous Message). However, it is normally negligible. If it occurs frequently, then consult E+H Service.	
OPE.CODE ERROR	An illegal operation command is accessed.	If the message occurs frequently, then consult E+H Service.	
LCD CHECK	Error between LCD (touch control) unit and CPU boaed for digital output.	Replace the touch control.	121
GAUGE TEMP.	The temperature inside the gauge exceeds the limit.	Check if the ambient temperature stays within the limit. If the application is a high temperature tank, then take meadures to avoid heat tranfer from the tank to NMS5.	
DRIVER ERROR	A motor driver error has occurred	Consult E+H Service	

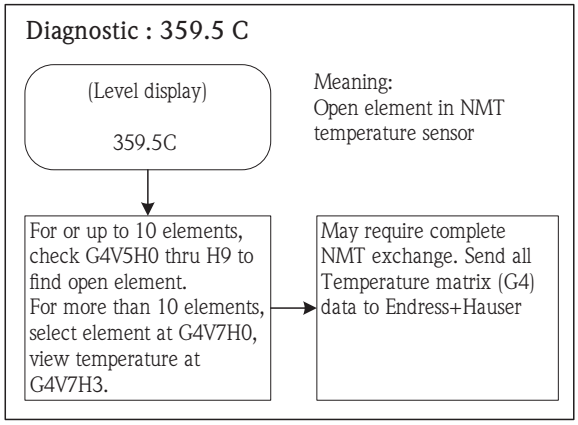
NOTICE

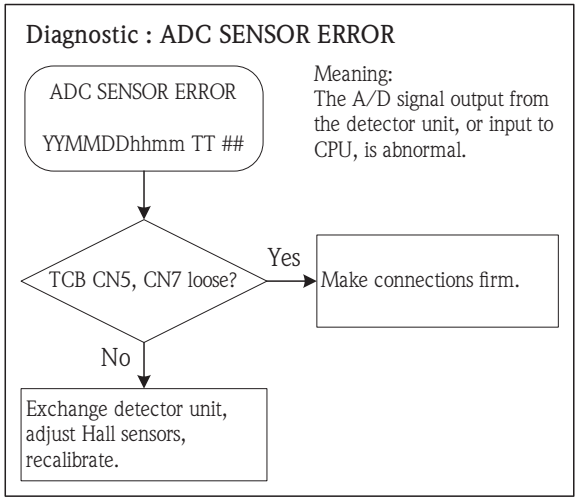
These error histories are available (Erroneous Message) at position GVH=037.

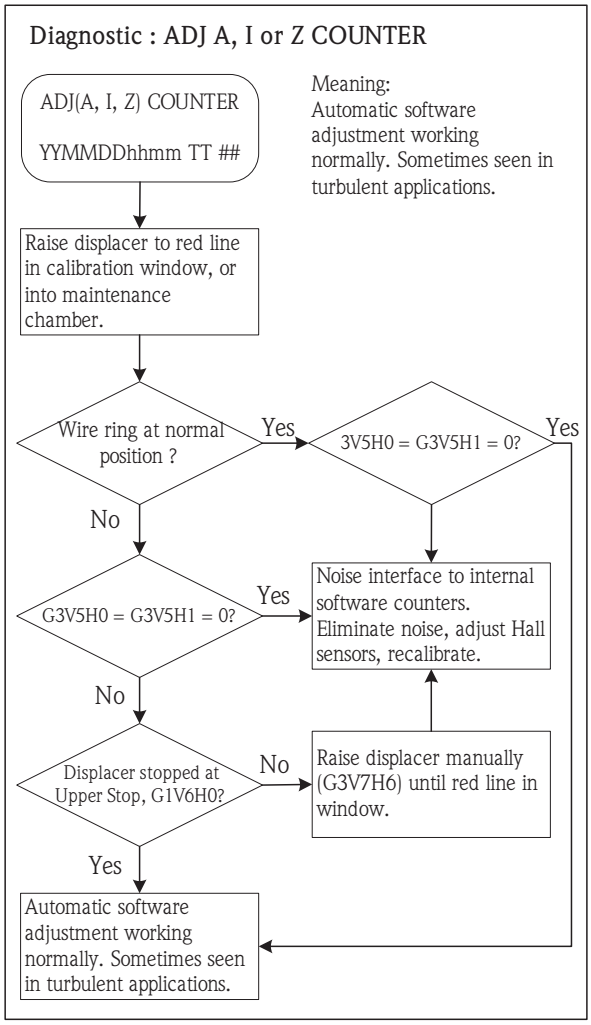
10.3 Flowcharts for Diagnostics and Troubleshooting

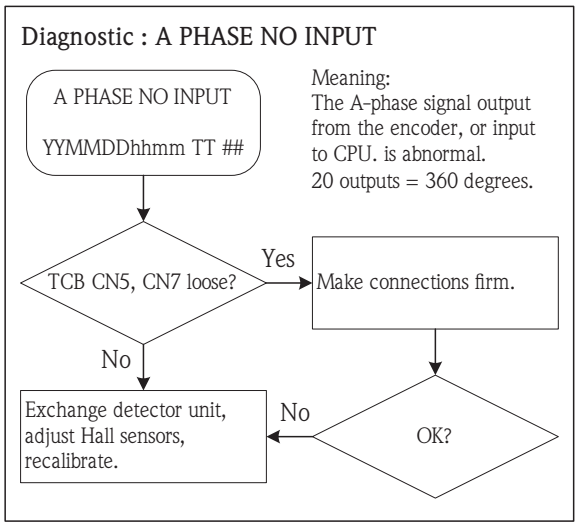




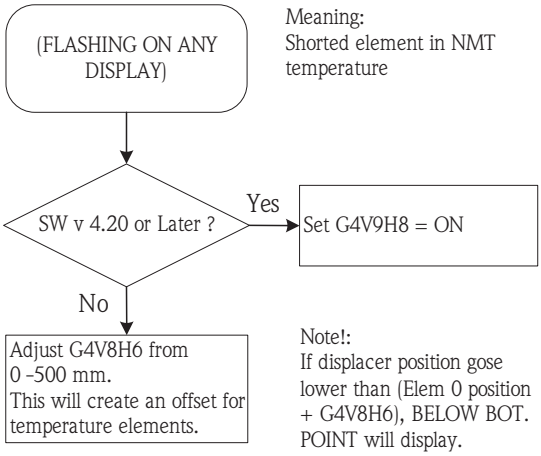




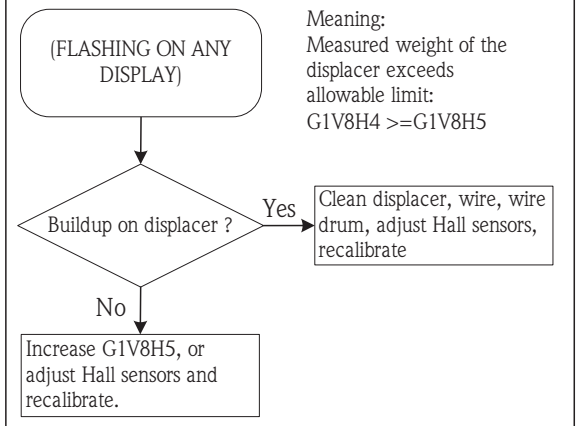




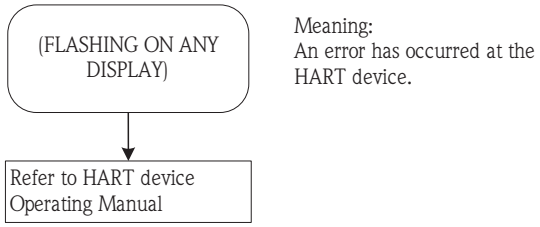
Diagnostic : BELOW BOT. POINT



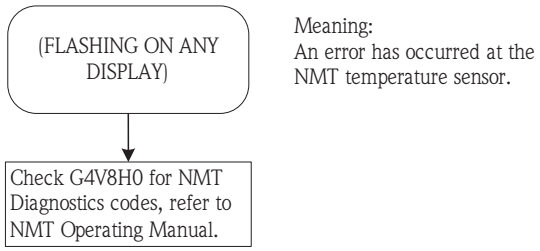
Diagnostic : DISPL CALIB ERROR



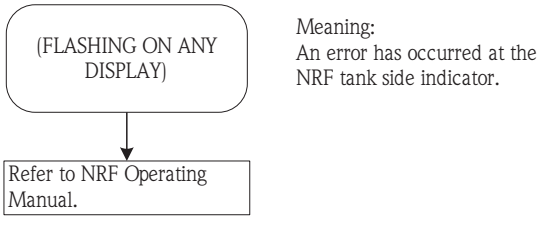
Diagnostic : DEVICE ERROR: DEV1 (2)



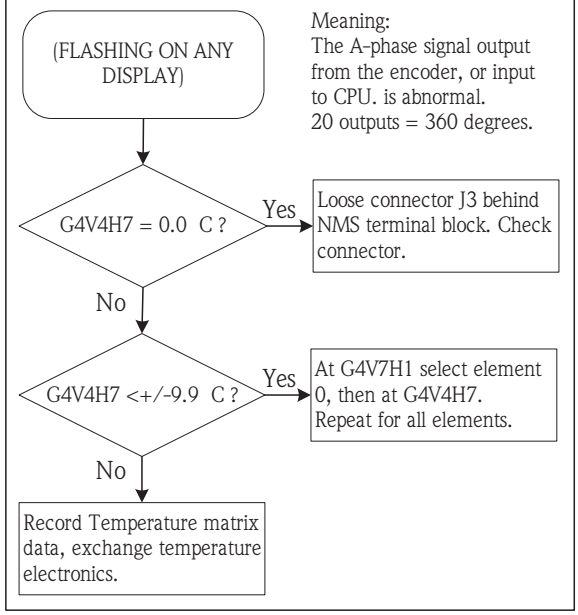
Diagnostic : DEVICE ERROR: NMT



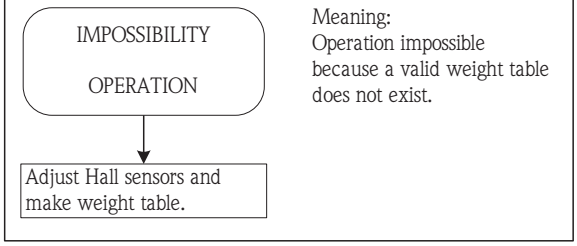
Diagnostic : DEVICE ERROR : NRF



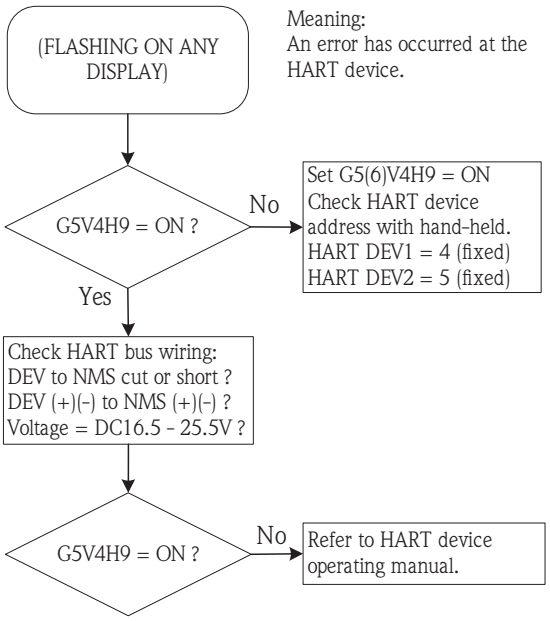
Diagnostic : ELEM 0 RANGE OVER



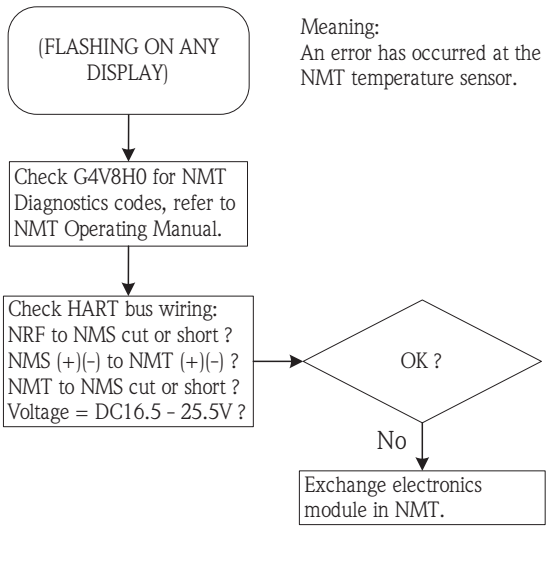
Diagnostic : IMPOSSIBILITY



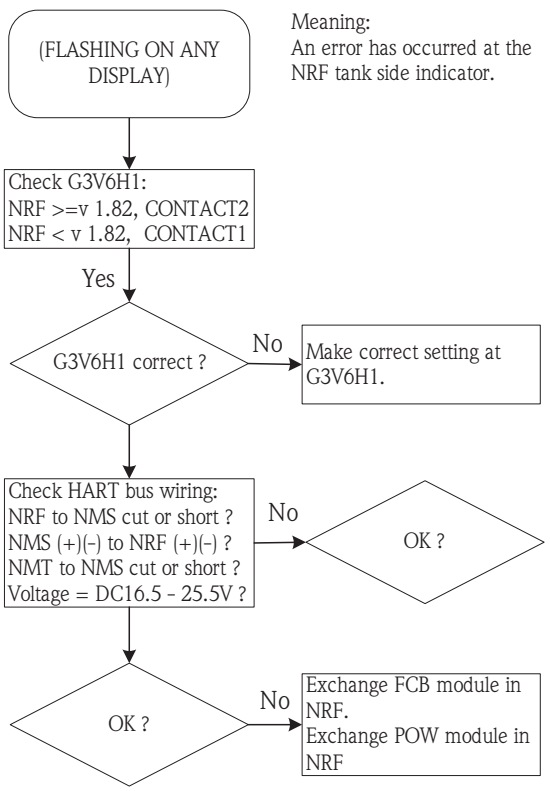
Diagnostic : LOCAL ERROR DEV1(2)



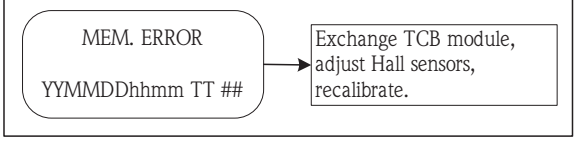
Diagnostic : LOCAL Error NMT



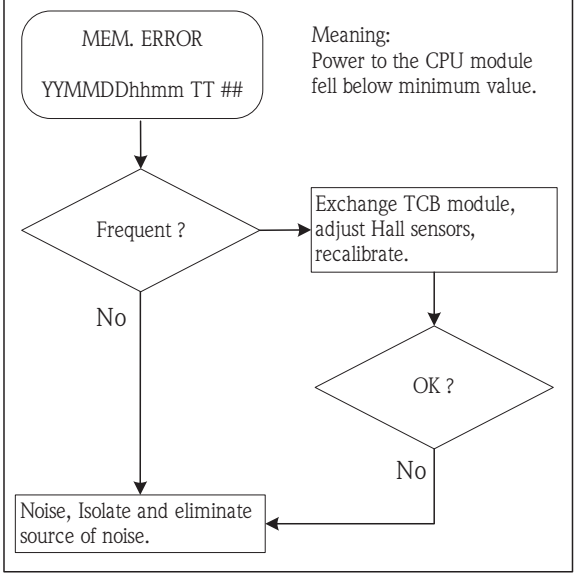
Diagnostic : LOCAL ERROR NRF



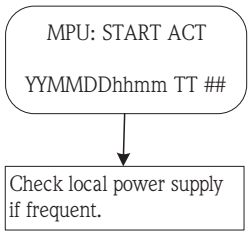
Diagnostic : MEM ERROR



Diagnostic : MPU : RESET



Diagnostic : MPU: START ACT



Meaning:
Power supply has been turned (off and) on.
Indicates normal operation.

Check local power supply if frequent.

Diagnostic : OVERTENSION



Meaning:
Tension on measuring wire is more than value in G1V6H3.

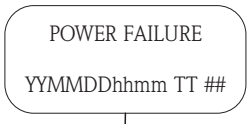
Set Operation = STOP
Set G3V7H1 = ON

Measuring wire cut ?

Yes → Find and fix cause of cut wire. Replace displacer, adjust Hall sensor, recalibrate.

No → Check measuring wire, displacer, stilling pipe for cause of overtension.

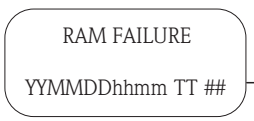
Diagnostic : POWER FAILURE



Meaning:
Supply voltage has fallen below about AC95V.

Check local power supply.

Diagnostic : RAM FAILURE



Meaning:
CPU RAM failure.

Exchange TCB module, adjust Hall sensors, recalibrate.

Diagnostic : ROM ERROR



Meaning:
CPU ROM failure.

Exchange TCB module, adjust Hall sensor, recalibrate

Diagnostic : SIFA ERROR



Meaning:
CPU SIFA failure.

Exchange TCB module, adjust Hall sensor, recalibrate

Diagnostic : TEMP. BELOW RAMGE



Meaning:
Measured temperature data for one or more elements is below fixed range of NMT specification.

Check NMT specification.
Check G4V5H0 thru H9.
Check temperature in tank.

Data below range ?

Yes → Normal operation. Error will clear when actual temperature is within specification.

No → Record Temperature matrix data, exchange temperature electronics.

Diagnostic : TEMP. COM. OPEN



Meaning:
Open element in NMT temperature sensor.

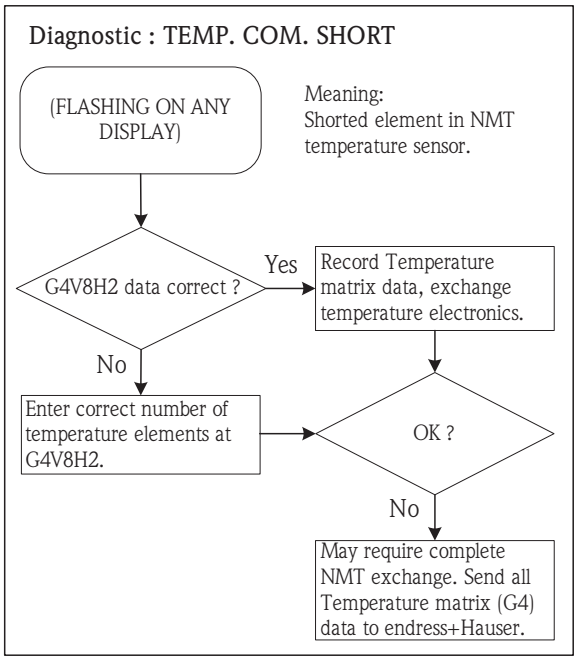
G4V8H2 data correct ?

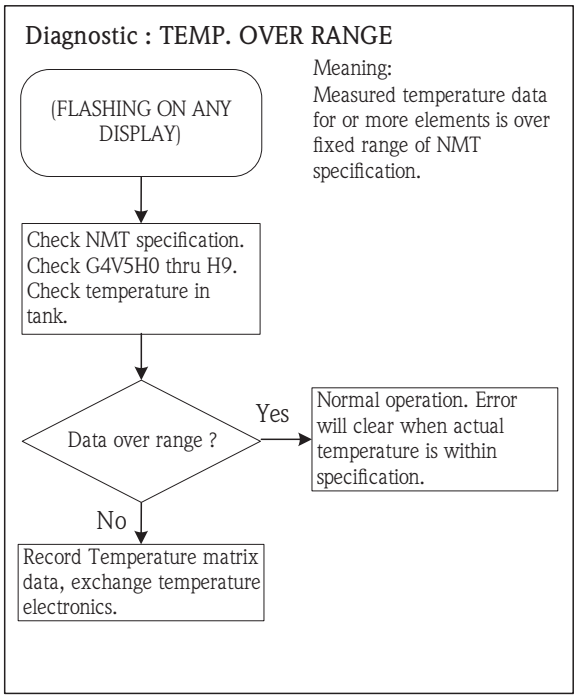
Yes → Record Temperature matrix data, exchange temperature electronics.

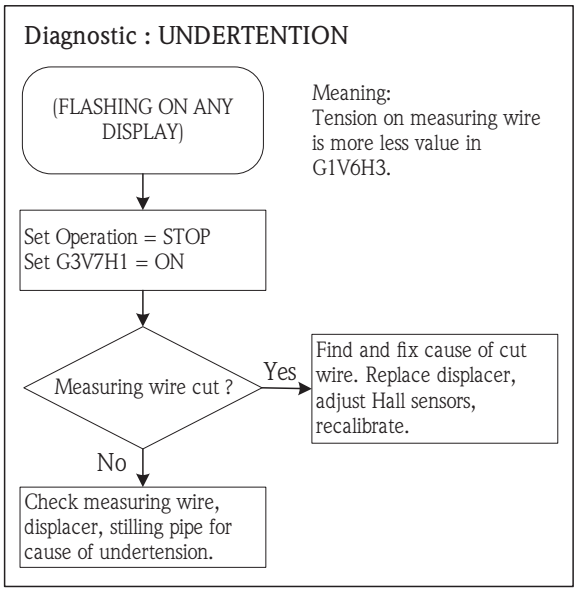
No → Enter correct number of temperature elements at G4V8H2.

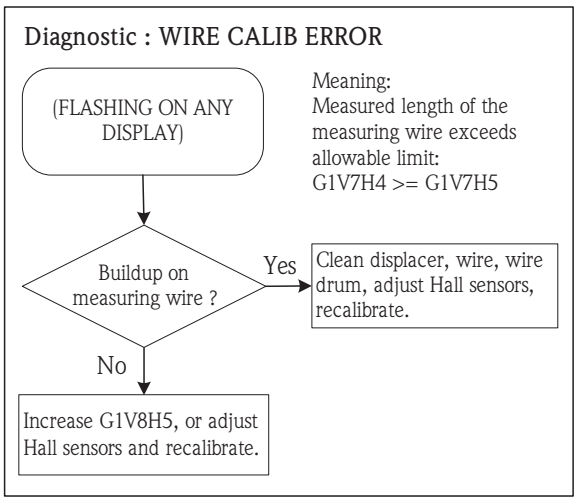
OK ?

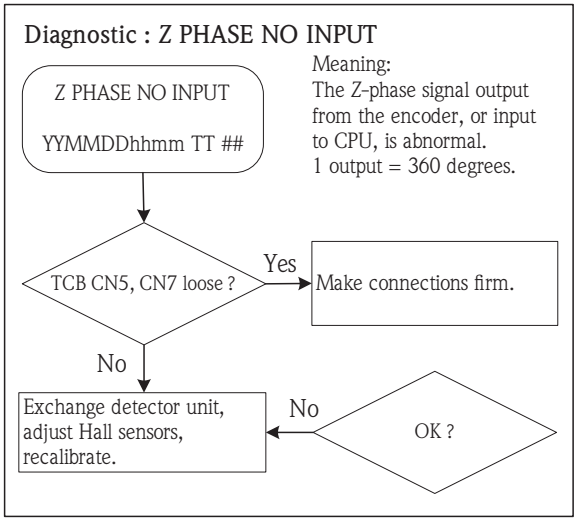
No → May require complete NMT exchange. Send all Temperature matrix (G4) data to Endress+Hauser.

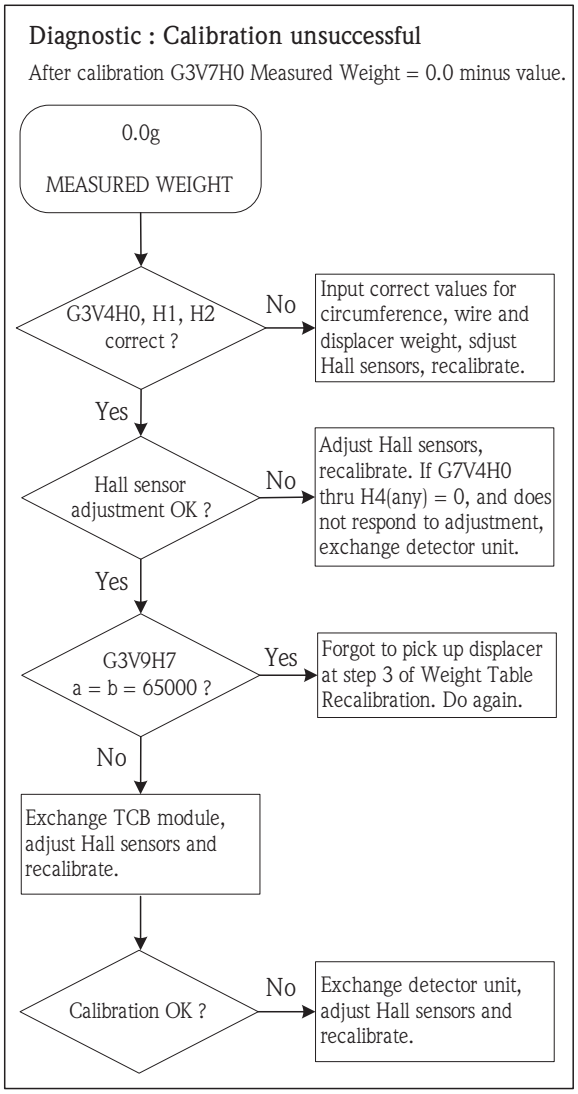

Diagnostic : TEMP. COM. SHORT
(FLASHING ON ANY DISPLAY)
Meaning:
Shorted element in NMT temperature sensor.
G4V8H2 data correct ?
Yes
Record Temperature matrix data, exchange temperature electronics.
No
Enter correct number of temperature elements at G4V8H2.
OK ?
No
May require complete NMT exchange. Send all Temperature matrix (G4) data to endress+Hauser.

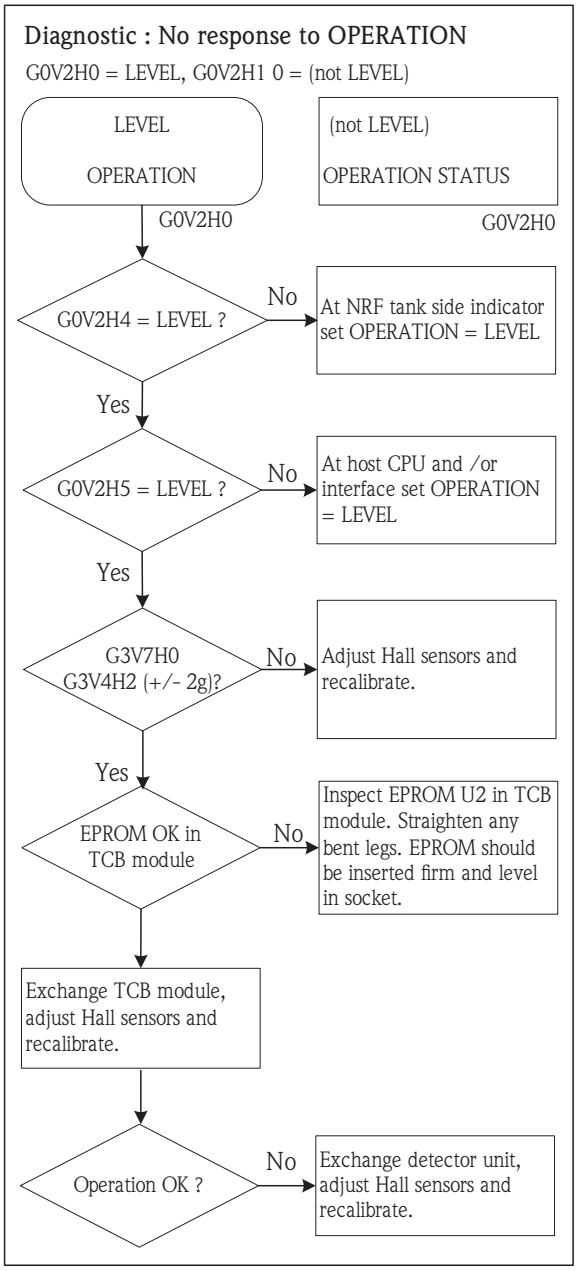

Diagnostic : TEMP. OVER RANGE
(FLASHING ON ANY DISPLAY)
Meaning:
Measured temperature data for or more elements is over fixed range of NMT specification.
Check NMT specification.
Check G4V5H0 thru H9.
Check temperature in tank.
Data over range ?
Yes
Normal operation. Error will clear when actual temperature is within specification.
No
Record Temperature matrix data, exchange temperature electronics.


Diagnostic : UNDERTENTION
(FLASHING ON ANY DISPLAY)
Meaning:
Tension on measuring wire is more less value in G1V6H3.
Set Operation = STOP
Set G3V7H1 = ON
Measuring wire cut ?
Yes
Find and fix cause of cut wire. Replace displacer, adjust Hall sensors, recalibrate.
No
Check measuring wire, displacer, stilling pipe for cause of undertension.


Diagnostic : WIRE CALIB ERROR
(FLASHING ON ANY DISPLAY)
Meaning:
Measured length of the measuring wire exceeds allowable limit:
G1V7H4 >= G1V7H5
Buildup on measuring wire ?
Yes
Clean displacer, wire, wire drum, adjust Hall sensors, recalibrate.
No
Increase G1V8H5, or adjust Hall sensors and recalibrate.


Diagnostic : Z PHASE NO INPUT
Z PHASE NO INPUT
YYMMDDhhmm TT ##
Meaning:
The Z-phase signal output from the encoder, or input to CPU, is abnormal.
1 output = 360 degrees.
TCB CN5, CN7 loose ?
Yes
Make connections firm.
No
Exchange detector unit, adjust Hall sensors, recalibrate.
No
OK ?

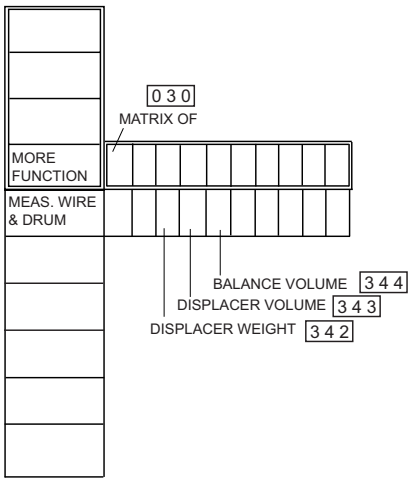
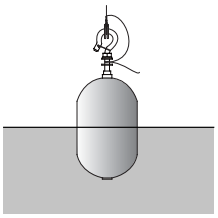

Diagnostic : Calibration unsuccessful
After calibration G3V7H0 Measured Weight = 0.0 minus value.
0.0g
MEASURED WEIGHT
G3V4H0, H1, H2 correct ?
No
Input correct values for circumference, wire and displacer weight, sdjust Hall sensors, recalibrate.
Yes
Hall sensor adjustment OK ?
No
Adjust Hall sensors, recalibrate. If G7V4H0 thru H4(any) = 0, and does not respond to adjustment, exchange detector unit.
Yes
G3V9H7 a = b = 65000 ?
Yes
Forgot to pick up displacer at step 3 of Weight Table Recalibration. Do again.
No
Exchange TCB module, adjust Hall sensors and recalibrate.
Calibration OK ?
No
Exchange detector unit, adjust Hall sensors and recalibrate.


Diagnostic : No response to OPERATION
G0V2H0 = LEVEL, G0V2H1 0 = (not LEVEL)
LEVEL
OPERATION
G0V2H0
(not LEVEL)
OPERATION STATUS
G0V2H0
G0V2H4 = LEVEL ?
No
At NRF tank side indicator set OPERATION = LEVEL
Yes
G0V2H5 = LEVEL ?
No
At host CPU and /or interface set OPERATION = LEVEL
Yes
G3V7H0 G3V4H2 (+/- 2g)?
No
Adjust Hall sensors and recalibrate.
Yes
EPROM OK in TCB module
No
Inspect EPROM U2 in TCB module. Straighten any bent legs. EPROM should be inserted firm and level in socket.
Exchange TCB module, adjust Hall sensors and recalibrate.
Operation OK ?
No
Exchange detector unit, adjust Hall sensors and recalibrate.

10.4 Setting after Parts Replacement

After any part of NMS5 is replaced, and before starting NMS5 calibration, specify the data on the following equipment.

- Circumferential length of wire drum (indicated on face of wire drum)
- Weight of displacer (indicated on the body of the displacer)
- Volume of displacer (indicated on the body of the displacer)
- Balance volume (indicated on the body of the displacer or 50% of volume)
- Density of measured liquid (up to three phases)
- Height of tank with NMS5 mounted on it (refer to Section "7 Commissioning").

Item	Procedure	Remarks
Matrix Group: SERVICE	3. In Static Matrix "MORE FUNCTION" bring up GVH=030 "MATRIX OF" and select "SERVICE." 1. Select Dynamic Matrix GVH=340 "WIRE DRUM CIRC." Check whether the displayed value is equal to the value marked on the wire drum. ▪ If not, adjust the displayed value.	▪ Set the access code at 51.
 Figure 84: Dynamic Matrix.  Figure 85: Displacer	2. Select the Dynamic Matrix screen GVH=341. 3. Set Dynamic Matrix GVH=342 "DISPLACER WEIGHT" at the value marked on the displacer. 4. Set Dynamic Matrix GVH=343 "DISPLACER VOLUME" to the value marked on the displacer. 5. Set Dynamic Matrix GVH=344 "BALANCE VOLUME" at half the value set in "DISPLACER VALUME." "This setting is provided to the approximate position of the displacer when it becomes 6. stationary in the liquid. NOTICE ▪ The weight and volume of the displacer are marked on its bottom ▪ The balance volume is the volume of that part of the displacer that is immersed in the liquid when the displacer is balanced in the liquid.	▪ For calculation methods of the draft position.

10.5 Intelligent Function

10.5.1 Maintenance Prediction Function

The history of maintenance is displayed at matrix screen GVH=265 "(Parts Overused Date)." LCD screen displays the following contents.

- Total operation time for parts managed according to this value
- Total number of rotations of the wire drum for parts managed according to this value

	Reference Part Management Value	
Display	Part	Reference (conducting time/ number of rotations)
1) POWER UNIT	Power supply unit	43,800 hours (about 5 years)
2) DISPLAY UNIT	LCD indicator	61,300 hours (about 7 years)
3) MOTOR UNIT	Motor/driver unit	43,800 hours (about 5 years)
4) WIRE UNIT	Measuring wire	240,000 rotations
5) BEARINGS UNIT	Drum bearing metal	145,000 rotations
6) SHAFT UNIT	Drum shaft	240,000 rotations

10.6 Spare Parts

Spare parts are contained in kits. Spare parts for NMS5 which can be ordered from Endress+Hauser are shown with their order numbers in the diagram below. Contact Endress+Hauser service representatives for further assistance.

10.6.1 NMS5

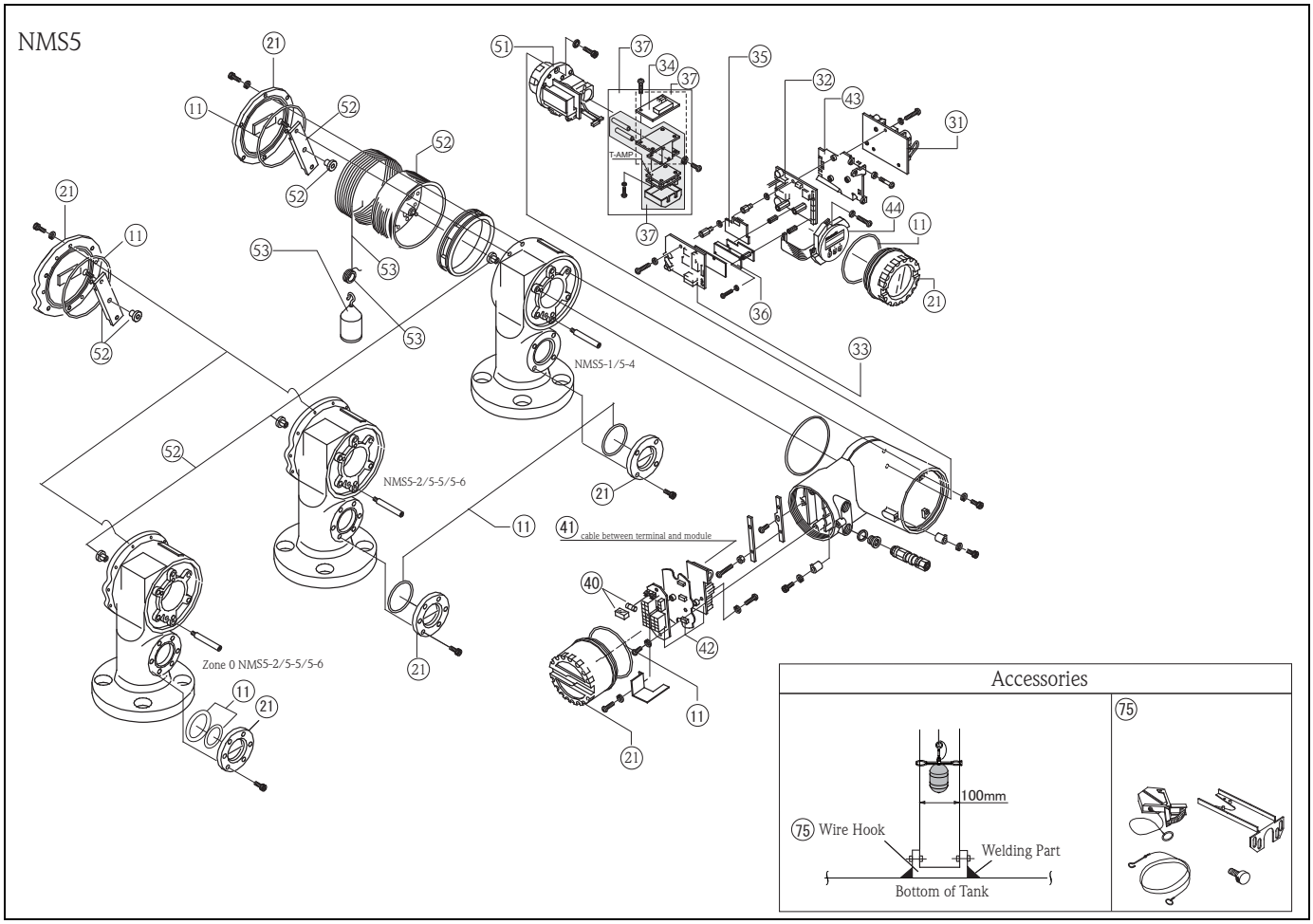


Figure. 86: Spare parts

No.	Parts No.	Parts Name	No.	Parts No.	Parts Name
11	017803-0034	O-ring, cover drum housing Alu, NBR	33	70106039	Upgrade kit HART active output
	70106019	O-ring, cover drum housing Alu, CR		56004534	Communication module WM550, arrestor
	70106020	O-ring, cover drum housing Alu, FKM		52013662	Upgrade kit WM550
	70106021	O-ring, cover drum housing Alu, Silicon		56004409	Communication module Mark Space
	56004345	O-ring, cover drum housing Alu, PTFE		52013658	Upgrade kit Mark Space
	017803-0066	O-ring, cover drum housing SS, FKM		56004355	Communication module ENRAF BPM, COM-3
	017803-0035	O-ring, cover drum housing SS, Silicon		52013649	Upgrade kit ENRAF BPM
	70109105	O-ring, cover drum housing SS, NBR	34	017800-0007	Alarm output, 2x contact, I/O3
	70109106	O-ring, cover drum housing, D158-d3.5, CR		70109108	Alarm output, 2x contact, I/O3, TUV OSP
	70109107	O-ring, cover drum housing, D158-d3.5, PFA		52013654	Upgrade kit I/O-3
	017803-0033	O-ring, calibration window, NBR	35	017800-0017	Output 4-20mA, I/O-5, TCB4
	70106018	O-ring, calibration window, CR		52013656	Upgrade kit I/O-5
	017803-0041	O-ring, calibration window, silicon	36	56004356	Communication module Ex i HART, COM-4
	017803-0036	O-ring, calibration window, FKM	37	56004442	Oper. I/C. O., spot temperature
	56004518	O-ring, calibration window, PTFE		70106035	Upgrade kit oper. I./C. O., Ex d temp.
	017803-0030	O-ring display cover, NBA		70106032	Upgrade kit oper. input/contact out
	017803-0040	O-ring, terminal cover, NBA		56004441	Operation input/contact out, carrier
	71070894	PTFE packing + ring, calibration window, Zone 0		56004491	Spot temp. with Chassis
21	017800-0111	Cover, display module, Aluminum		56004490	Spot temp. input T-AMP Upgrade kit
	017800-0112	Cover, terminal box, Aluminum, NMS		70106027	Spot temp. Ex ia, carrier
	017800-0113	Cover, drum housing Alu, NMS531/NMS534	40	70106498	Fuse 250VAC T2A50, NMS, 10 pcs.
	56004307	Cover, drum housing SS, NMS535/NMS536		70106499	Fuse 20-62VDC T3A15, NMS, 10 pcs.
	56004308	Cover, drum housing SS, NMS532		70106500	Fuse cover 10set, NMS
	56004295	Calibration window, Alu, NMS531/NMS534	41	52013660	Wiring harness, Terminal-COM-1/RS485/BPM module
	56004296	Calibration window, SS, NMS532/NMS535		52013650	Wiring harness, Terminal-HART passive module
	56004297	Calibration window, SS, NMS536		70106037	Wiring harness, Terminal-HART active module
	71070909	Calibration window, SS, Zone 0, NMS532/535/536		52013657	Wiring harness, Terminal-Mark Space module
31	70103940	POW-6, HV, non Ex i		52013648	Wiring harness, Terminal-ENRAF BPM module
	70103942	POW-6, HV, Ex i		52013653	Wiring harness, Terminal-I/O-3 module
	70103941	POW-6, LV, non Ex i		52013652	Wiring harness, I/O-3 TCB
	70103943	POW-6, LV, Ex i		52013655	Wiring harness, Terminal-I/O-5 module
32	70103937	TCB-6, CPU module, upgrade of TCB-4		70106036	Wiring harness, Terminal-COM-4 module
33	017800-0005	COM-1, Communication module, V1		70106033	CPU, T-AMP Ex d module cable
	52013661	Upgrade kit V1		70106034	Wiring harness, Terminal-T-AMP Ex d module
	71086763	Modbus module RS485, COM-5		70105996	Wiring harness, Terminal-T-AMP Ex ia module
	70106270	Upgrade kit Modbus RS485		70105995	CPU, T-AMP Ex ia module cable
	56004484	COM-6 HART, passive remote communication, module	42	56004508	Terminal, noise filter, Exd
	52013651	Upgrade kit, HART, passive		56004509	Terminal, noise filter, Exd (ia)
	56004485	COM-6 HART, active remote communication, module			

No.	Parts No.	Parts Name	No.	Parts No.	Parts Name
43	017800-0015	PCB CPU Carrier set complete, spacer	53	56004257	5x measuring wire, 28m, d=0.15mm, 316L
44	017800-0021	Display module 2 line, 3 key optical		71114403	Measuring wire 0.15mm 28m SUS316L, ring SUS316
	70103938	Display module 4 line, 3 key optical		56004255	5x measuring wire, 16m, d=0.2mm, Alloy C
51	017800-0043	Detector unit NMS, TCC-3		56004914	Measuring wire, 0.2mm, Alloy C, 16m
	70103944	Detector unit NMS, TCC-3, V1		56004256	5x measuring wire, 16m, d=0.4mm, PTFE 5 set
52	56004523	Wire drum + wire measuring, 28m		56004912	5x measuring wire, 16m, d=0.4mm, PTFE coated
	56004524	Wire drum + teflon wire, 10/16m		017800-0241	Wire ring, 316
	56004520	Wire drum, wire Alloy, 16m		017800-0242	Wire ring, PTFE coated
	71114404	Wire drum, 28m wire, CR		017800-0243	Wire ring, Alloy C
	71114405	Wire drum, 28m wire, silicon		017800-0252	Displacer, 50mm, cylindrical, SUS316
	71114406	Wire drum, 10/16m PFA wire, CR		56004339	Displacer, 50mm, cylindrical guide ring
	71114407	Wire drum, 10/16m PFA wire, silicon		017800-0253	Displacer, 50mm, conical PTFE solid
	71114408	Wire drum 16m Alloy C wire, CR		70105994	Displacer, 50mm, cylindrical PTFE solid
	71114409	Wire drum 16m Alloy C wire, silicon		017800-0271	Displacer, 50mm, cylindrical Alloy C
	71133077	Wire drum + 36m wire, SUS316L		017800-0263	Displacer, 70mm, conical, SUS316, NMi
	71133079	Wire drum + 36m wire, SUS316L, CR		017800-0267	Displacer, 110mm, conical, SUS316, low
	71133078	Wire drum + 36m wire, SUS316L, silicon		70104684	Displacer, 110mm, conical, SUS316, high
	71134099	Wire drum + 47m wire		71083820	Displacer, 50mm, cylindrical, SUS316, Zone 0
	71134100	Wire drum + 47m wire, CR		71084149	Displacer, 70mm, cylindrical, SUS316, Zone 0
	71134101	Wire drum + 47m wire, silicon		71084150	Displacer, 110mm, cylindrical, SUS316, Zone 0
	56004525	Wire drum + 47m wire, Alu		71134069	Displacer, 30mm, cylindrical, SUS316, Zone 0
	56004527	Wire drum + 47m wire, SS		71134070	Displacer, 40mm, cylindrical, SUS316, Zone 0
	56004526	Wire drum bracket SS, teflon coated		71134071	Displacer, 50mm, cylindrical, SUS316, Zone 0 with ring
	017800-0221	Bearing, wire drum bracket, PTFE		71134067	Displacer, 70mm, cylindrical, SUS316, Zone 0 with ring
	71136789	Wire drum 0.15mm, 28m wire, FFKM		71134068	Displacer, 110mm, cylindrical, SUS316, Zone 0 with ring
	71136790	Wire drum 0.15mm 36m wire, FFKM		71134072	Displacer, 50mm, cylindrical, Alloy C, Zone 0
			75	71067825	Calibration weight 50g, NMS5
				71134095	Wire hook, SUS316, L=100
				71134096	Wire hook, SS400, L=100

10.7 Return

1. The following procedure must be performed before returning NMS5 to Endress+Hauser e.g. for repair or calibration.
   - Remove all residue. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is corrosive, poisonous, carcinogenic, radioactive, or otherwise hazardous.
   - Always enclose a duly completed "Declaration of Hazardous Material and De-contamination" form. Only then can Endress+Hauser transport, examine, and repair a returned device.
   - Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.
2. Additionally specify:
   - An exact description of the application
   - The chemical and physical characteristics of the instrument
   - A short description of the error that occurred (specify the error code where possible)
   - Operating time of the device

A copy of the “Declaration of Contamination” is included at the end of this operating manual.

WARNING

- Hazardous materials may be attached to damaged parts of NMS5 or its plastic material. Unless hazardous materials are completely removed from NMS5, no repair request is accepted.
- Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the operator of the instrument.

10.8 Disposal

In case of disposal, separate the various components according to their materials.

10.9 Software History

Software version / Date	Software changes	Documentation changes
V2.13, from 9.96	Original Release	BA001N/08/en/09.98
V2.20, from 10.97	T2:TCB-2, Modified V1: R&S command	BA001N/08/en/11.97
V4.06, from 04.98	HART master, T4:TCB-4	
V4.06, from 04.98	HART master T&W, T4:TCB-4	
V4.08X, from 08.98	upper stop speed reduction 3-step	
V4.20, from 08.98	WM550, Commuwin II display, elem. Error fix	BA001N/08/en/12.99
V4.20, from 09.98	T&W	BA001N/08/en/12.99
V4.22, from 05.00	HART line selection add to static matrix: gas temp. minus data remote communication level 6 digit data processing memory clear volume calculation matrix deleted	
V4.23B, from 09.00	standard release, alarm output modify, NMT level selection	
V4.24, from 04.01	standard release	BA001N/08/en/03.01
V4.24 OSP, from 06.01	Over Spill protection	
V4.24T&W, from 07.01	T&W spec.	
V4.24 T2, from 02.02	TCB-2 CPU, NMT, V1 level measurement	
V4.25, from 09.02	Density profile function	BA001N/08/en/02.02
V4.27, from 09.04	Level hold matrix, Error display on Home screen only	BA001N/08/en/11.04
V4.27 T6/T&O, from11.05	W&M and Overspill prevention	BA001N/08/en/03.06
V4.27 A, from 05.07	standard release	
V4.27 B, from 09.08	standard release	BA1001N/08/en/12.08
V4.27 C, from 04.09	Proactive Safety function	BA1001N/08/en/04.09
V4.27 E, from 03.10	DTM support	BA00401G/08/en/ 01.11
V4.27 F, from 05.11	SIL	BA00401G/08/en/ 02.11
V4.27 G, from 05.12	4-20mA long range support	BA00401G/08/en/ 03.13

11 Displacer and Measuring Wire

11.1 Shape, Diameter, and Material

11.1.1 Displacer

There are several types of displacer available for NMS5.

- The standard type has cylindrical shape and a diameter of 50 mm. Diameters from 30 to 50 mm are optional.
- Cylindrical shape is used for viscous liquids. It is also effective if the stilling well is not smooth on its interior surface.

Displacer weight and volume depend on the application. Thin displacers are suited for level measurement, thicker ones for bottom level, interface level, and density measurement.
A counterweight is optional for heavy turbulence (inquire).
Displacers of three different materials are provided.

- The standard material is stainless steel SUS316.
- Alloy C and PFA are optional for corrosive liquids.
- Solid PFA, however, is not applied for flammable liquids.

The following size of displacer will be supplied, when you order custody transfer approval.

NOTICE
NMi (Netherlands).....∅70mm
PTB (Germany).....∅110mm

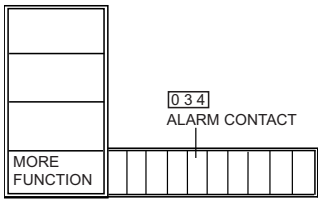
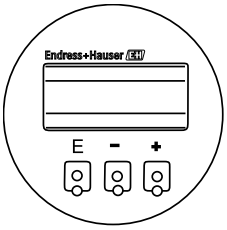
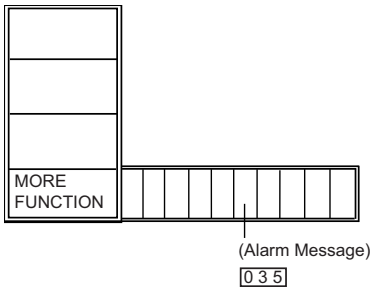
11.1.2 Measuring Wire

- The standard material of the measuring wire is stainless steel SUS316L.
- Alloy C and PFA coated stainless steel SUS316 are for corrosive liquids.

The following specification of measuring will be supplied when ordering the custody transfer approval.

NOTICE
- Select SUS316L (0.15mm) for NMi and PTB specifications.
- Refer to the separate "Techenical Information TI00452G" for displacer selection information and Appendix "14.3 Displacer" in this chapter.

11.2 Alarm History Display

Item	Procedure	Remarks
Matrix Group: DEVICE DATA  Figure 87: Device Data **Touch Control**  Figure 88: LCD (Display)	1. Bring up Static Matrix GVH=034 *ALARM CONTACT."	
Static Matrix  Figure 89: Static Matrix	2. Previous static matrix records are sequentially displayed in Static Matrix screen GVH=035, starting with the latest record. ▪ Up to 100 alarm records can be saved. If the number of records exceeds 100, it is sequentially overwritten starting with the oldest record. ▪ The display includes the year, month, day, hour, minute, instrument temperature, and an error sequential number, in this order. For example, 97 3192238 2402 means that an error occurred at 22:38 on March 19, 1997, when the instrument temperature was 24 °C and this is the second error since NMS5 was installed.	

11.3 List of Alarm Messages

MESSAGE	Cause of Alarm
UPPER LIMIT LEVEL	The level has risen above the set alarm operation value.
LOWER LIMIT LEVEL	The level has fallen below the set alarm operation value.
UPPER LIMIT TEMP.	The temperature has risen above the set alarm operation value.
LOWER LIMIT TEMP.	The temperature has fallen below the set alarm operation value.

11.4 Hall Sensors

After exchanging CPU module, detector unit, wire drum, measuring wire (all or part), it is necessary to adjust the hall sensors and make new weight table calibration.

1. Move the displacer to the side of calibration window or the maintenance chamber window (top of the tank) or put the displacer on a work bench so that the displacer can be touched.

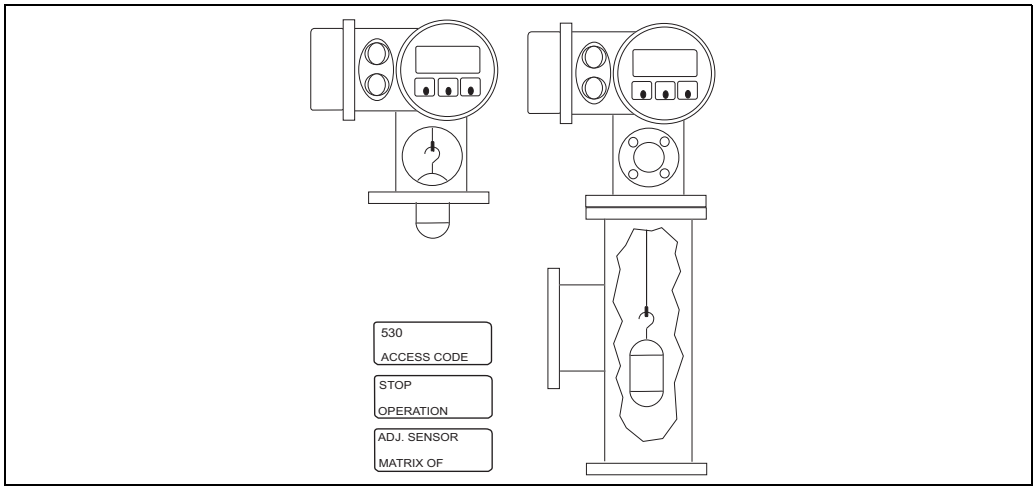


Figure 90: Hall Sensor Adjustment 1

2. Confirm that NMS5 is level and no vibration or other disturbance occurred.
   - Access Code 530
   - Set Operation = STOP
   - Set GVH030 = Adj. Sensor

3. Set A Span and Record Sensor Count (Wa2) at GVH74.

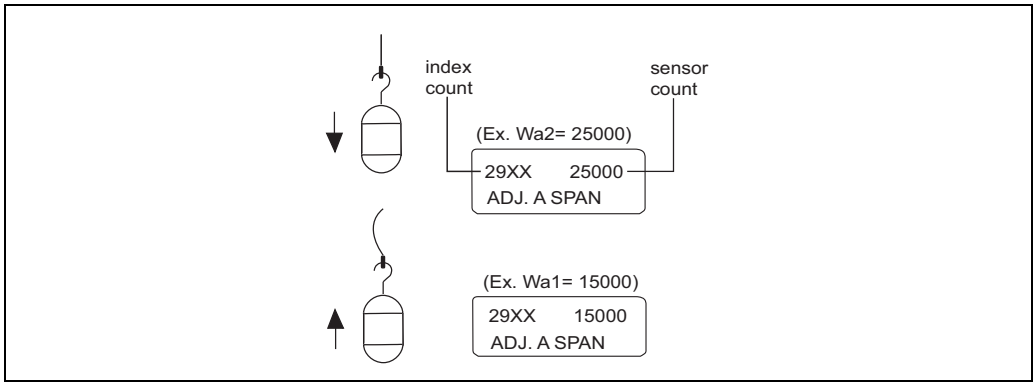


Figure 91: Hall Sensor 2

WARNING
Do not let wire fall off the wire drum.

4. Lift the displacer until Sensor Count is stable and record the value of Sensor Count (Wa1).
   - |Wa2 - Wa1| = 10000 (+/-100)?
5. If Yes, go to step 7 "GVH740 A Zero".
6. If No, return the displacer to the original position at GVH741
   - If |Wa2 - Wa1|<10,000, increase Index Count.
   - If |Wa2 - Wa1|>10,000, decrease Index Count.
   - Repeat until |Wa2 - Wa1| = 10000 (+/-100).

7. Adjust A Zero Sensor Count = 21000 (+/-100) at GVH740.

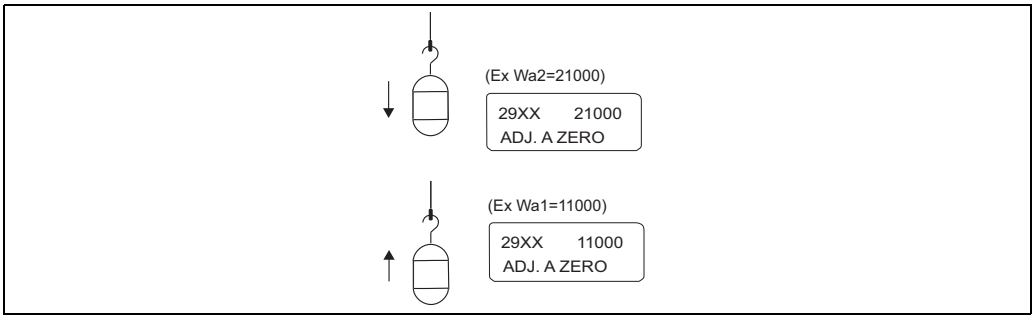


Figure 92: Hall Sensor Adjustment 3

8. Record the value of Sensor Counter (Wa2)
9. Lift the displacer until Sensor Count is stable and record the value of Sensor Count (Wa2).
   - |Wa1 - Wa2 | = 10000 (+/-100)?
10. If yes, go to step 12. "GVH743 B Span".
11. If not, repeat Steps 3and 7.
12. Set B Span to |Wa2 - Wa1|=10000 (+/-100) at GVH743.

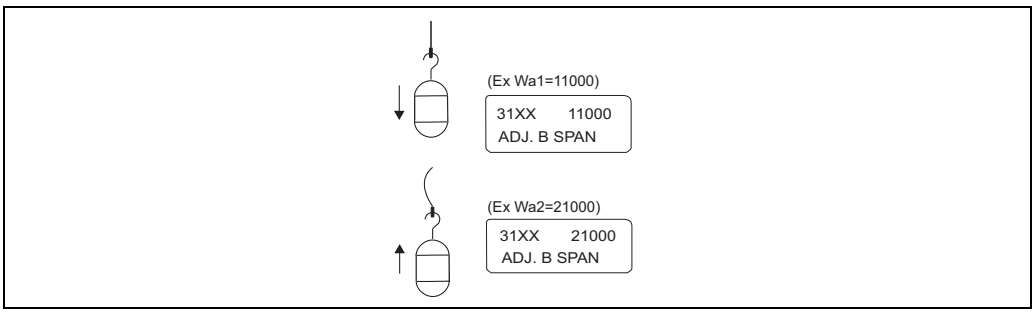


Figure 93: Hall Sensor Adjustment 4

13. Adjust B Zero Sensor Count = 11000 (+/- 100) at GVH742.

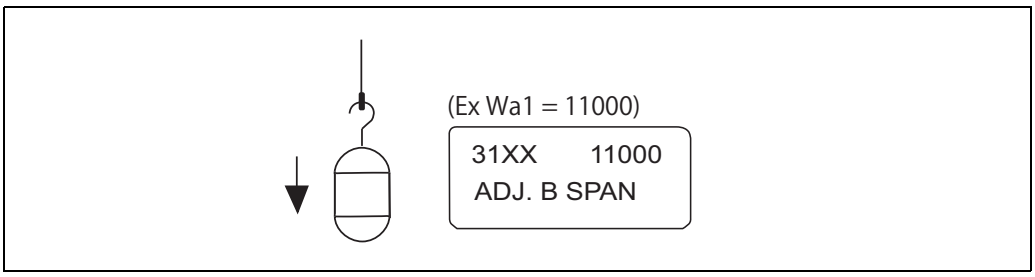
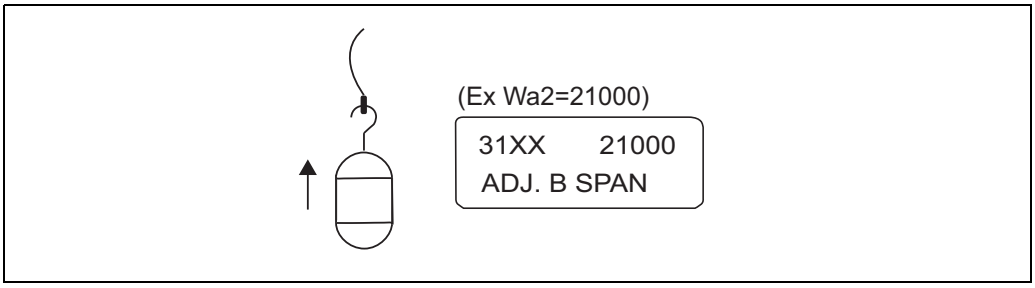


Figure 94: Hall Sensor Adjustment 5

14. Adjust to |Wa2 - Wa1| = 10000 (+/-100) at GVH42.



This completes the hall sensor adjustment.

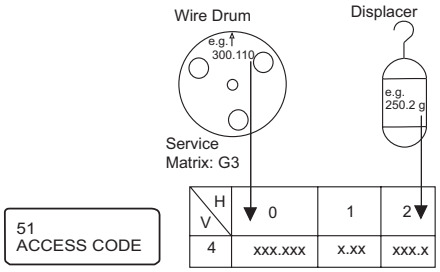
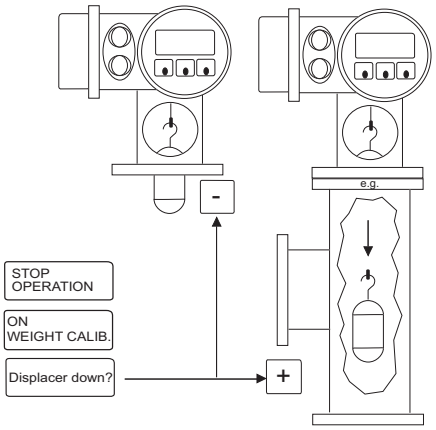
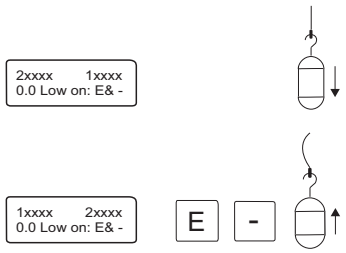
11.5 Initial Weight Calibration

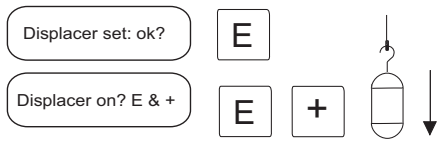
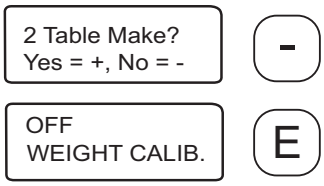
11.5.1 Displacer Weight Calibration

Weight table calibration must be done after completing hall sensor adjustment. The calibration procedures will vary depending on the measurement specifications. Use this procedure ONLY for NMS5 with level measurement function.

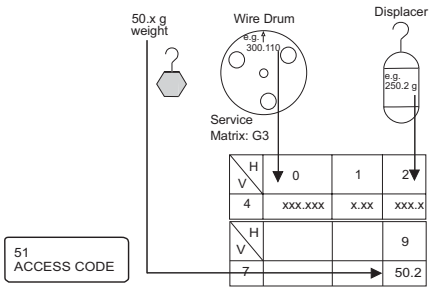
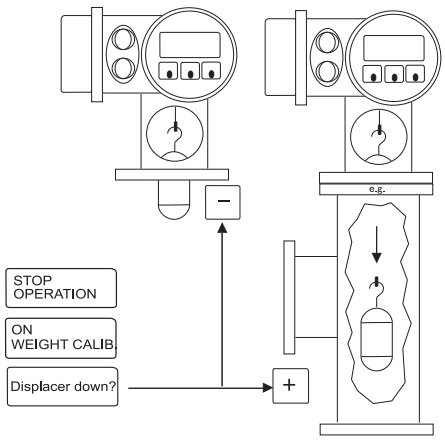
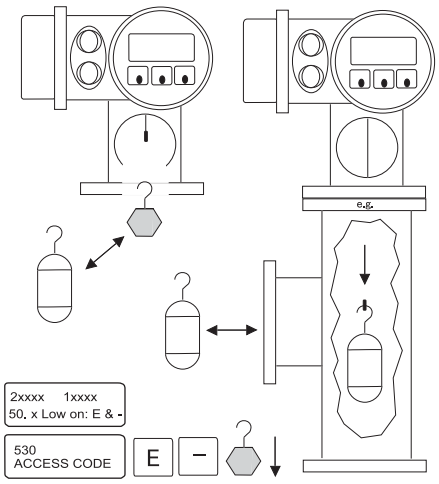
⚠ CAUTION
Wind and vibration may affect weight table calibration.
It is not necessary to do initial calibration for Startup "All-in-one" (displacer attached) shipments.

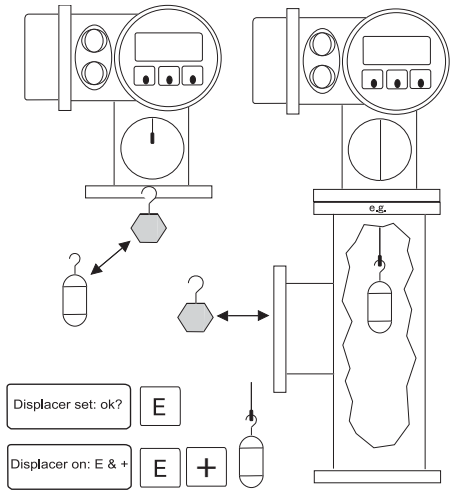
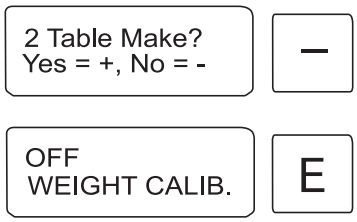
Weight Calibration for Standard Specification

Item	Procedure	Remarks
 Figure 95: Calibration 1-A	1. Enter Access Code 51. 2. Confirm the following data. G3V4H0 wire Drum Circum (engraved on wire drum) G3V4H1 Wire Weight Standard SUS = 1.40 PFA=4.55 Hastelloy=2.8 G3V4H2 Displacer Weight (engraved on displacer)	
 Figure 96: Calibration 2-A	3. Displacer is located in the calibration window or the maintenance chamber. Set the displacer in the following order. ▪ Set Operation = STOP ▪ Set G3V7H9=0.0 ▪ Set G3V7H3=ON ▪ at "Displacer Down? +/-" Enter No "-" for calibration window and enter yes "+" for maintenance chamber.	▪ Displacer moves at calibration window or maintenance chamber position.
 Figure 97: Calibration 3-A	4. Leave the displacer until Sa and Sb are stable. Press "E" and "-" keys at the same time. 5. Return the displacer to the original position.	

Item	Procedure	Remarks
 Figure 98: Calibration 4-A	6. Press "E" at "Displacer set ok?". 7. Press "E" and "+" keys together at "Displacer on: E & +".	▪ Calibration automatically starts, which takes approximately 10 minutes.
 Figure 99: Calibration 5-A	8. Enter "N = -" at "2 Table make?". 9. Enter "E" key at "Weight Calibration OFF". 10. Check the weight calibration at G3V7H0=G3V4H2+/- 2.0 grams? 11. If not, adjust sensor or calibrate the weight again.	▪ Always enter N = -.

Weight Table Calibration and Density

Item	Procedure	Remarks
 Figure 100:Calibration 1-B	1. Set Access Code at 51 and confirm the following data. ▪ G3V4H0 wire Drum Circum.(engraved on wire drum) ▪ G3V4H1 Wire Weight Standard SUS = 1.40PFA=4.55 Hastelloy=2.48 ▪ G3V4H2 Displacer Weight (engraved on displacer) ▪ G3V7H9 Zero Adjust Weght = e.g. 50.2 2. Confirm each engraved data in the wire drum and the displacer and values in Matrix are the same.	
 Figure 101:Calibration 2-B	3. Displacer is located in the calibration window or the maintenance chamber. Set Operation = STOP Set G3V7H9=e.g. 50.2g (test weight, in grams) Set G3V7H3 Weight Calib. =ON 4. Enter No "-" key at "Displacer down?" at calibration window to access displacer, and enter Yes "+" key for maintenance chamber.	▪ Displacer moves at calibration window or maintenance chamber position.
 Figure 102:Calibration 3-B	5. Replace the displacer with 50 x g weight and wait until Sa and Sb are stable. 6. Press "E" and (-) key together.	

Item	Procedure	Remarks
 Figure 103:Calibration 4-B	7. Remove the 50xg wight from the displace and mount the displacer on the wire. 8. Press "E" and (+) keys together at "Displacer on: E & "+".	▪ Calibration starts automatically, which takes approximately 10 minutes.
 Figure 104:Calibration 5-B	9. Enter N = - at "2 Table Make?" 10. Enter "E" at "WEGHT CALIB." 11. Check G3V7H2 +/- 2.0 grams? If yes, calibration is done. 12. If not, adjust sensor or calibrate the weight again.	▪ Always enter N = -.

12 Technical Data

Items	Descriptions
Measuring Range	0 to 16, 28, or 36m depending on material specification (longer ranges available upon consultation)
Density Limits	0.430 to 2.000 g/cm^3 (430 to 2000 kg/m^3)
Accuracy	Level: +/- 0.7mm (0.027 inch)*1 Interface: +/- 2.7mm (0.106 inch)*2 Density: +/- 0.005 g/cm^3 *3
Sensitivity	+/- 0.1mm (0.004 inch)
Self-diagnostic Function	CPU system health, measuring wire tension, communication, gauge status, level data input, etc
Input/Output	see Ordering Information
Motion Delay	Configurable in 20ms steps from 0 to 9.9 seconds
Power	85 to 264 VAC, 50/60 Hz 20 to 62 VDC, or 20 to 55 VAC, 50/60Hz
Max. Current	50VA / 50W
Surge Protection	Standard supply
Ambient Temperature	-20 to 60 °C (-4 to 140°F) -40 to 60 °C (-40 to 140°F) ATEX approval cold temperature version
Liquid Temperature	-200 to +200°C (-328 to +392°F)
Displacer Speed	Max. 2500mm/min
Display	Backlight LCD, level, temperature, status, diagnostics, menu-navigation, in English, Japanese and Chinese
Operation	Local operation by optical display keypad, external contact
Calibration	Optical display keypad for tank level and sensor adjustment by automated software routine
Weight	12kg (Aluminum drum housing NMS5-1, 5-4) 27kg (Stainless steel drum housing NMS5-2, 5-5, 5-6)
Degree of Protection	IP67 / NEMA4X
Ex Approval	TIIS Ex d IIB T4 FM XP Cl. I Div. 1 Gr. C-D FM XP-AIS Cl. I Div.1 Gr. C-D CSA Cl. I Div. 1 Gr. C-D CSA Ex d[ia] Cl. I Div. 1 Gr. C-D ATEX II 1/2G Ex d IIB T6-T3 ATEX II 1/2G Ex d IIC T6-T3 ATEX II 1/2G Ex d IIB T6-T3, -40°C ATEX II 1/2G Ex d (ia) IIB T6-T3 ATEX II 1/2G Ex d (ia) IIB T6-T3, -40°C IEC Ex d ia IIB T6-T3 Ga/Gb IEC Ex d IIB T6-T3 Ga/Gb IEC Ex d IIC T6-T3 Ga/Gb IEC Ex d ia IIB T6-T3 Ga/Gb, -40°C IEC Ex d IIB T6-T3 Ga/Gb, -40°C NEPSI Ex d ia IIB T6-T3 NEPSI Ex d IIB T6-T3 NEPSI Ex d IIC T6-T3 NEPSI Ex d ia IIB T6-T3, -40°C NEPSI Ex d IIB T6-T3, -40°C
Additional Certificates	Weights and Measures for custody transfer : NMi, PTB Overspill prevention : TÜV Nord SIL (Functional Safety Manual): TÜV Nord
Color	Body: blue (RAL5012); Covers: white (RAL7035)

Items	Descriptions
Supplementary Documentation	Technical Information (TI00452G) Installation Instruction (BA00401G) Safety Instruction (XA00578G: ATEX, XA00582G: IECEx EX421-439: FM, EX540-742: CSA, XA10257G: NEPSI) Functional Safety Manual (SD00337G)

*1 PTB reference conditions
*2 Difference of product densities at least 0.100 g/cm^3
*3 Optional when calibrated for density measurement

13 Matrix

13.1 Programming Matrix

Default Data
Display Text
Parameters, unit, etc
Mode (Code)

NMS5 Programming Matrix (Static Matrix)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
MEASURED VALUE 1	0	16000.00mm MEASURED LEVEL Display	0.0 mm ULLAGE LEVEL Display	0.0 mm UPPER INTERF. LEV. Display	0.0 mm MIDD. INTERF. LEV Display	0.0 mm BOTTOM LEVEL Display	1.000 g/ml UPPER DENSITY 0.000 - 3.000 Display/Set (50)	1.000 g/ml MIDDLE DENSITY 0.000 - 3.000 Display/Set (50)	1.000 g/ml DENSITY BOTTOM 0.000 - 3.000 Display/Set (50)	0.0 mm LEVEL DATA Display	
MEASURED VALUE 2	1	0.0°C LIQUID TEMP. Display	DEV(1) Display	DEV(2) Display	0.0°C GAS TEMPERATURE Display	0.0 mm WATER BOTTOM Display			0 mm ZERO POINT Display	16000.0 mm SPAN Display	mm LENGTH UNIT Display
OPERATION	2	STOP OPERATION 16000 See operation commands below Select (50)	STOP OPERATING STATUS See status table below Display	UNBALANCED BALANCING STATUS Display		LEVEL OPERAT.BY NRF Display	LEVEL OPERAT. BY HOST Display			0 DEVICE ID	8424 SOFTWARE VERSION
MORE FUNCTION	3	CALIBRATION MATRIX OF 0 - 8 Select			98 627 8:21:00 CALENDER Currect data Display	NO ALARM ALARM CONTACT 0 Currect data Display	NO ALARM LA 0 0 0 0 Currect data Display	NO ERROR DIAGNOSTIC CO 0 Currect data Display	MPU:START ACT 98 627 752 0 0 Currect data Display	OFF RESET ALM. DIAGNO.	0 ACCESS CODE 0, 50, 51, 777 Set

When new NMS status is selected at GVH=272, new status codes are showed at matrix position GVH=021 as follows;

Code	Meaning	NMS Display	Code	Meaning	NMS Display	Code	Meaning	NMS Display
0	No definition	–	12	Release over tension	RELE. OVER TENS.	24	Not initialised	NO INITIALIZE
1	Displacer at reference	REFERENCE	13	Calibration activated	CAL. ACTIVE	25	Stopped at High Stop	UPPER STOP
2	Displacer hoisting up	UP	14	Seek level	LEVEL SEEKING	26	Stopped at Low Stop	LOWER STOP
3	Displacer going down	DOWN	15	Follow level	LEVEL FOLLOWING	27	Repeatability testing	REPEATABILITY
4	Displacer stop	STOP	16	Seek Upper Density	UPP. DEN. SEEKING	28	Seeking water level	WATER SEEKING
5	Level measurement, balanced	LEVEL	17	Seek Middle Density	MID. DEN SEEKING	29	Water level, balanced	WATER LEVEL
6	Upp. I/F level, balanced	UPPER.INTERF.LEV.	18	Seek Density Bottom	BOT. DEN. SEEKING	30	Follow water level	WATER FOLLOWING
7	Midd. I/F level, balanced	MIDD.INTERF.LEV.	19	Seek Upper I/F level	UPP. INT. SEEKING	31	Over-/Under tension, Z-Phase, ADC error	EMARGENCY ERROR
8	Bottom meas. balanced	BOTTOM LEVEL	20	Follow up. I/F level	UPP. INT. FOLLOWING			
9	Upper Dens, finished	UPPER DENSITY	21	Seek Mid. I/F level	MID.INT.SEEKING	32	GVH157 Service Mode = ON,	MAINTENANCE (Modbus / HART only)
10	Middle Dens, finished	MIDDLE DENSITY	22	Follow Mid. I/F level	MID. INT. FOLLOWING			
11	Bottom Dens, finished	DENSITY BOTTOM	23	Seek Bottom level	BOTTOM SEEKING			

Operating commands

2. STOP
3. BOTTOM LEVEL
4. UPPER INTERF. LEVE
5. MIDD. INTERF. LEVE
6. UPPER DENSITY
7. MIDDLE DENSITY
8. DENSITY BOTTOM
9. REPEATABILITY
10. WATER DIP
0. LEVEL
1. UP

NMS5 Programming Matrix (dynamic Matrix, Calibration: G1)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
LEVEL DATA	4	16000.0 mm TANK HEIGHT 0 - 99999.9 mm Set (50)	0.0 mm DIP POINT OFFSET 0 - 99999.9 mm Set (50)	10.0 mm DISPLAC. DRAFT 0 - 999.9 mm Set (50)	150 mm DISPL. RAISE DENS 0 - 300 mm Set (51)	150 mm DISPL. SUBM DENS 0 - 1500 mm Set (51)					99999 mm LEVEL BELOW 0 0 mm Select (51)
CALIBRATION	5	16000.0 mm SET LEVEL 0 - 99999.9 mm Set (50)		0.0 mm TANK CORRECT LEV 0 - 99999.9 mm Set (51)	0.000 mm/m TANK CORRE. COEF 0 - 59.999 mm/m Set (51)	OFF SAFE DENSITY ON IGNOR Select (51)	300.0 mm DEN.OPE LEVEL 0 - 99999.9 mm Set (51)		OFF SERVICE MODE ON Set (530)	ON PROSAFETY OFF Set (530)	99999.0 mm SAFETY LEVEL 0 - 99999.0 mm Set (530)
ADJUSTMENT	6	16000.0 mm UPPER STOP 0 - 99999.9 mm Set (50)	0 mm LOWER STOP 0 - 99999.9 mm Set (50)	350 g OVER TENS. SET 0 - 999 g Set (51)	50 g UNDER TENS. SET 0 - 999 g Set (51)	60 mm SLOW HOIST 60 - 1800 mm Set (51)	10 mm DISPL. RAIS. REP. 10 - 99 mm Set (51)	10 s DISPL. WAIT REP. 10 - 999 sec. Set (51)	10 s DISPL. WAIT DIP 10 - 999 sec. Set (51)		
AUTO WIRE CALIB.	7	NONE CALIBR. AUTO/MAN MANUAL AUTOMATIC Set (51)	99123123 START TIME 0 - 999999 Set (51)	O hour INTERVAL TIME 0 - 9999 hour Set (51)	OFF AUTO COMPENSAT. ON Select (51)	0.0 mm ZERO CORRECTION 0 - 99999.9 set (51)	0.0 mm COMPENS. LIMIT 0 - 99999.9 Set (51)				
AUTO CALIB. DISPL	8	NONE CALIBR. AUTO/MAN 0 - 2 Select (51)	99123123 START TIME 0 - 999999 Set (51)	O hour INTERVAL TIME 0 - 9999 hour Set (51)	OFF AUTO COMPENSAT. ON Select (51)	0.0 g DEVIATION 0 - 999.9 Set (51)	0.0 g COMPENS. LIMIT 0 - 99.9 Set (51)				
DISPLAY	9	MEASURED LEVEL SELECT DISP. MODE ULLAGE LEVEL MEASURED LEVEL Select (51)	ENGLISH LANGUAGE JAPANESE CHINESE Select (51)	■■■■■■■■■■ LCD CONTRAST 0 - 15 set (51)	1 YEAR SETTING 0 - 99 Current year Set (51)	2 MONTH SETTING 0 - 12 Current month Set (51)	15 DAY SETTING 0 - 31 Current day Set (51)	13 HOUR SETTING 0 - 23 Current hour Set (51)	59 MINUTE SETTING 0 - 59 Current minute Set (51)	[.] SELECT DECIMAL , Select (51)	OFF LCD CHECK ON Select (51)

NMS5 Programming Matrix (Dynamic Matrix, Device Data : G2)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
CONTACT OUTPUT	4	1 SELECT. RELAY Max 4 Select (50)	NONE ASSIGN RELAY LEVEL, LIQUID TEMP., CAUTION, WARNING, EMEAGENCY ERROR Select (50)	HIGH RELAY FUNCTION LOW Select (50)	0 mm SWITCHING POINT Max. 99999 mm	0 mm HYSTERISIS Max. 9999 mm Set (50)	NORMAL OPENED RELAY ON ALARM NORMAL CLOSED Set (50)	0 s ON DELAY TIME Max. 999 s Set (50)	0 s OFF DELAY TIME Max. 999 s Set (50)		
ANALOG OUT. ADJUST	5	NONE ASSIGN OUTPUT 1 LEVEL LIQUID TEMP. Select (51)	0 mm ADJUST 4mA FOR LIQUID TEMP. Set (51)	0 mm ADJUST 20mA FOR LIQUID TEMP. Set (51)	NONE ASSIGN OUTPUT 2 LEVEL LIQUID TEMP. Set (51)	0 mm ADJUST 4mA FOR LIQUID TEMP. Set (51)	0 mm ADJUST 20mA FOR LIQUID TEMP. Set (51)	OFF DEVICE AT ALARM HOLD CURNT. OUT MAX MIN Select (51)			
PARTS DATA	6	1 PARTS NUMBER Max 10 Select (51)	NONE PARTS TYPE POWER UNIT, DISPLAY, MOTOR, WIRE, BEARINGS, SHAFT Select (51)	OPERATION HOUR MAINTEN. FACTOR DRUM REVOLT. Select (51)	1 hour MAINTEN. VALUE 999999 hour Set (51)	0 hour OPERATION TIME 999999 hour set (51)	POWER UNIT PH 0 0 0 Display(51)	NONE REPLACED PARTS Select (51)	NONE MH 0 0 0		
INPUT SIGNAL	7	NONE OPE. CONTACT ACTIVATED Select (51)	OFF CUSTODY TRANSFER Display	DISABLED NEW NMS STATUS ENABLED Select (51)			4.27 SOFT WARE VERSION Display	6.00 HARD WARE VERSION Display		1.00 g/ml OPE. DENSITY 0 - 3.000 Set (51)	0 OPE. CONT, STATUS 2 - 256 Display (51)
COMMUNICATION	8	HIGH LEVEL ALARM 1 LOW NONE Select (51)	0.0 mm SET LEVEL ALARM 1 Max. 99999.9 mm Set (51)	HIGH LEVEL ALARM 2 LOW NONE Select (51)	0.0 mm SET LEVEL ALARM 2 Max. 99999.9 mm Set (51)	0.0 mm HYSTERISYS Max. 99999.9 mm Set (51)	0 ADDRESS 0 - FF for MIC->FF fixed 1 - 247 Modbus Set (51)	WM550, M/S PROTOCOL BBB, MDP, V1, ENRAF, RACK BUS, HART Select (51)	F COMMU. LINE ADJ. 0 - F Set (51)	0 COMMUNIC. STATUS Display (51)	0 MODBUS Config 0 - 14 Set (51)
STATUS	9	O s STATUS1 DELAY to 99 s Set (51)	NONE SELECT CONTACT NORMAL OPENED NORMAL CLOSED (ALARM =OPEN) (ALARM=CLOSE) Select (51)	1 WM550 ALM. SELECT 1 - 3 Select (51)	0 WM550 BSW. SELECT 0 - 1 Select (51)	0 WM550 DENS. SEL. 0 - 2 Select (51)	37 WM550 SW_ID_20xx 0 - 99 Set (51)				0 s BALANCE DELAY to 99 s Set (51)

NMS5 Programming Matrix (Dynamic Matrix, Service: G3)

GROUP MESSAGE	H / V	0	1	2	3	4	5	6	7	8	9
MEAS. WIRE & DRUM	4	300.00 mm WIRE DRUM CIRC. 0 - 999.9 Set (51)	1.4g / 10m WIRE WEIGHT 0 - 999.9 Set (51)	255.0 g DISPLACER WEIGH 0 - 999.9 Set (51)	145.0 ml DISPLACER VOLUM 0 - 999.9 Set (51)	60 ml BALANCE VOLUME 0 - 999.9 Set (51)	1.0 ml VOLUME TOLERANCE 0 - 99.9 Set (51)		20 X 100 mS DELAY 0 - 99 Set (51)	0.00 mm/m DRUM CORRECTION 0 - 99.00 Set (51)	0 count DISPL. HUNT.COUNT 0 - 99 Set (51)
GAUGE DATA	5	0.0 mm ACTUAL LEVEL Display (530)	0 Count ENCODER COUNT Display (530)	OFF NON HYSTER. MODE ON Select (51)	OFF HI.ACCURACY MODE ON Select (51)	0 s HI. ACCR. OPE. TIME 0 - 600 Set (51)	50 mm HI. ACC. DISP. UP 0 - 300 Set (51)	999 °C GAUGE TEMP. Display (51)			
SYSTEM DATA	6	LOCAL : MASTER SENSOR DATA REMOTED COM. ON SOFTWARE =04.24 HARDWARE = TGB 04 GEAR 1:36 NOT OVERSPILL	OFF CONNECTION NRF CONTACT 1 CONTACT 2 Select (51)	OFF CONNECTION NMT SPOT TEMP. AVERAGE TEMP. Select (51)						IF_LEVEL SELECT UP_IF_LEVEL WATER BOTTOM WATER BOTTOM 2 Select (51)	OFF SOFT RESET Select (51)
SERVICE	7	0.0 g MEASURED WEIGHT Display	OFF RELE. OVER TENS ON Select (51)	OFF DRUM SETTING ON Select (51)	OFF WEIGHT CALIBR. ON Select (51)					70 mm DISPL. REFERENCE Set (51)	0.0 g ZERO ADJ. WEIGHT Set (51)
SENSOR VALUE	8	Sa=21000 : A=21000 Sb=11000 : B=11000 Display (51)									
SENSOR DATA	9					0 0 0.0 g WT. COUNT CAL A Display (51)	0 0 0..0 g WT. COUNT CAL B Display (51)				

NMS5 Programming Matrix (Dynamic Matrix, Temperature : G4)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
TEMPERATURE DATA	4	xx °C LIQUD TEMP. Depending on a specification and measured value Display (51)	zz °C GAS TEMPERATURE Depending on a specification and measured value Display (51)	aaaa.a mm MEASURED LEVEL Depending on a specification and measured value Display (51)	VH00 LEV. DATA SELECT VH00 or VH08 Select (51)	0.0 mm WATER BOTTOM Depending on a specification and measured value Display (51)			0.0 °C REFERENCE ZERO Depending on a specification and measured value Display (51)		150.0°C REFERENCE 150 Depending on a specification and measured value Dispaly (51)
ELEMENT TEMP.	5	aa.a °C TEMP. NO.1 Depending on a specification and measured value Display (51)	bb.b °C TEMP. NO.2 Depending on a specification and measured value Display (51)	cc.c °C TEMP. NO.3 Depending on a specification and measured value Display (51)	dd.d °C TEMP. NO.4 Depending on a specification and measured value Display (51)	ee.e °C TEMP. NO.5 Depending on a specification and measured value Display (51)	ff.f °C TEMP. NO.6 Depending on a specification and measured value Display (51)	gg.g °C TEMP. NO.7 Depending on a specification and measured value Display (51)	hh.h °C TEMP. NO.8 Depending on a specification and measured value Display (51)	ii.i °C TEMP. NO.9 Depending on a specification and measured value Display (51)	jj.j °C TEMP. NO.10 Depending on a specification and measured value Display (51)
ELEMENT POSITION	6	xxx.x mm ELEM. 1 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 2 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 3 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 4 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 5 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 6 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 7 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 8 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 9 POSITION Depending on a specification and measured value Dispaly (51)	xxx.x mm ELEM. 10 POSITION Depending on a specification and measured value Dispaly (51)
NMT ADJUSTMENT	7	0 SELECT POINT 0 - 15 Selectable SELECT POINT +1 = ELEMENT No. Set (51)	x.x °C ZERO ADJUST Set (51)	1.000 GAIN ADJUST Dispaly (51)	xx.x °C ELEMENT TEMP. Current data Dispaly (51)	xxx.x mm ELEMENT POSITION Current data Dispaly (51)				2 AVERAGE TIME Set (51)	530 ACCESS CODE Dispaly (51)
SET DATA NMT	8	0 DIAGNOSTIC Display (51)	°C TEMPERATURE UNIT Dispaly (51)	xx TOTAL NO. ELEMENT 2 - 16 Set (51)	5 PREAMBLE NUMBER 1 - 16 Set (51)	mm LENGTH UNIT Dispaly (51)	EQUAL KIND OF INTERVAL UNEQUAL Select (51)	500.0 mm BOTTOM POINT 0.0 mm to 500.0 mm valuable Set (51)	200.0 mm ELEMENT INTERVAL Set (51)	-49.5 °C TEMP. ELEM. SHORT Display (51)	359.0 °C TEMP. ELEM. OPEN Display (51)
DEVICE DATA NMT	9	xxxxxx INSTRUMENT CODE Display (51)	LAST DIAGNOSTIC Display (51)	OUTPUT AT ERROR Select (51)	OFF CUSTODY TRANSFER ON Display (51)	2 POLLING ADDRESS Display (51)	17 MANUFACTURE ID Display (51)	6 SOFTWARE VERSION Display (51)	2 HARDWARE VERSION Display (51)		DEVICE DEVICE TYPE CODE Display (51)

NMS5 Programming Matrix (Dynamic Matrix, HART DEVICE (1) : G5)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
MEASURED VALUE	4	PV DATA Display	SV DATA Display								OFF HART DEVICE (1) ON LIQUID TEMP. GAS TEMPERATURE Select (51)
P.V. SETTING	5	P. V. RANGE UNIT Set (51)	P. V. UPPER RANGE Set (51)	P. V. LOWER RANGE Set (51)	DAMP VALUE Set (51)						
SENSOR SPECIFIC	6	SENSOR SERIAL NO Display	UPPER SENSOR LMT Display	LOWER SENSOR LMT Display							
ALARM	7										
SELF DIAGNISTIC	8	ERROR CODE (1) Display	ERROR CODE (2) Display	ERROR CODE (3) Display	ERROR CODE (4) Display	ERROR CODE (5) Display					
DEVICE DATA	9		4 POLLING ADDRESS (FIXED ADDRESS) Display	MANUFACTURE ID Display	DEVICE TYPE CODE Display	PREAMBLES Set(51)	SW VERSION Display	HW VERSION Display	DEVICE ID Display		

NMS5 Programming Matrix (Dynamic Matrix, HART DEVICE (2) : G6)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
MEASURED VALUE	4	PV DATA Display	SV DATA Display								OFF HART DEVICE (2) ON LIQUID TEMP. GAS TEMPERATURE Select (51)
P.V. SETTING	5	P. V. RANGE UNIT Set (51)	P. V. UPPER RANGE Set (51)	P. V. LOWER RANGE Set (51)	DAMP VALUE Set (51)						
SENSOR SPECIFIC	6	SENSOR SERIAL NO Display	UPPER SENSOR LMT Display	LOWER SENSOR LMT Display							
ALARM	7										
SELF DIAGNISTIC	8	ERROR CODE (1) Display	ERROR CODE (2) Display	ERROR CODE (3) Display	ERROR CODE (4) Display	ERROR CODE (5) Display					
DEVICE DATA	9		5 POLLING ADDRESS (FIXED ADDRESS) Display	MANUFACTURE ID Display	DEVICE TYPE CODE Display	PREAMBLES Set(51)	SW VERSION Display	HW VERSION Display	DEVICE ID Display		

NMS5 Programming Matrix (Dynamic Matrix, ADJ. SENSOR : G7)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
ADJ. SENSOR	4	XXXX YYYYY ADJ. A ZERO Display (530)	XXXX YYYYY ADJ. A SPAN Display (530)	XXXX YYYYY ADJ. B ZERO Display (530)	XXXX YYYYY ADJ. B SPAN Display (530)						
HART ERROR RATE	5	0.00% ERR. RATE NRF Display (530)	0.00% ERR. RATE NMT Display (530)	0.00% ERR. RATE DE(1) Display (530)	0.00% ERR. RATE DE(2) Display (530)						
UNIT	6	mm LEV. UNIT (HOST) m inch cm ft Select (51)	°C TEMP. UNIT (HOST) °F °R °K Select (51)	g/mL DEN. UNIT (HOST) Kg/m³, lb/gl, SGU, Kg/gl/.l, lb/in,st/y³ Select (51)			mm LEV. UNIT m inch cm ft Select (51)	°C TEMP. UNIT °F °R °K Select (51)	g/mL DEN. UNIT Kg/m , lb/gl, SGU, Kg/gl/.l, lb/in,st/y Select (51)		
HART LINE	7	TERMINAL PORT B NMT TERMINAL PORT A Select (777)	TERMINAL PORT B HART DEVICE (1) TERMINAL PORT A Select (777)	TERMINAL PORT B HART DEVICE (2) TERMINAL PORT A Select (777)							
INTERFACE ADJUST	8	0.3 mL VOL. TOL. FOR I/F 0 - 99.9 mL Set (51)	150 BRAKE RATE 0 - 255 Set (51)	15 BALANCE COUNT 0 - 255 Set (51)	0.0 mm IF 1 OFFSET 0 - 9999.9 mm Set (51)	0.0 mm IF 2 OFFSET 0 - 9999.9 mm Set (51)					
LEVEL CORRECTION	9										

NMS5 Programming Matrix (Dynamic Matrix, Tank Profile : G8)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
PROFILE OPE.	4	O : SPOT OPE. SELECT 0 : spot 1 : tank profile 2 : I/F profile 3 : MANU.I/F profile Display/Set (51)	2 OPE. POINT 2 - 16 Set (51)		0 I/F MANU. LEVEL 0 - 99999.9 mm Set (51)	2.0 mm BAL. LEVEL 1.0 - 99.9 mm Set (51)	1 min UP WAIT TIME 1- 31 min Set (51)	1 min LIQ. WAIT TIME 1- 31 min Set (51)	1 min OPE. WAIT TIME 1- 31 min Set (51)		
STATUS/DATA	5	0 OPE. STATUS 0 - 6 Display	0 LEVEL CONDITION 0 - 4 Display	DDHHMM OPE. TIME 000000 - 312359		0.000 g/ml AVERAGE DENSITY 0.000 - 9.999 g/mL	0.0 °C AVERAGE TEMP. 0 - 369.5 °C				
DENSITY 1 - 10	6	0.000 g/ml NO. 1 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 2 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 3 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 4 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 5 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 6 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 7 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 8 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 9 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 10 DENSITY 0.000 - 9.999 g/ml Display
DENSITY 11 - 16	7	0.000 g/ml NO. 11 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 12 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 13 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 14 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 15 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 16 DENSITY 0.000 - 9.999 g/ml Display				
POSITION 1 - 10	8	0 mm NO.1 POSITION 0 - 99999.9 mm Display	0 mm NO.2 POSITION 0 - 99999.9 mm Display	0 mm NO.3 POSITION 0 - 99999.9 mm Display	0 mm NO.4 POSITION 0 - 99999.9 mm Display	0 mm NO.5 POSITION 0 - 99999.9 mm Display	0 mm NO.6 POSITION 0 - 99999.9 mm Display	0 mm NO.7 POSITION 0 - 99999.9 mm Display	0 mm NO.8 POSITION 0 - 99999.9 mm Display	0 mm NO.9 POSITION 0 - 99999.9 mm Display	0 mm NO.10 POSITION 0 - 99999.9 mm Display
POSITION 11- 16	9	0 mm NO.11 POSITION 0 - 99999.9 mm Display	0 mm NO.12 POSITION 0 - 99999.9 mm Display	0 mm NO.13 POSITION 0 - 99999.9 mm Display	0 mm NO.14 POSITION 0 - 99999.9 mm Display	0 mm NO.15 POSITION 0 - 99999.9 mm Display	0 mm NO.1 6POSITION 0 - 99999.9 mm Display				

NMS5 Programming Matrix (Dynamic Matrix, Interface Profile : G9)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
	4										
STATUS/DATA	5	0 OPE. STATUS 0 - 6 Display	0 LEVEL CONDITION 0 - 4 Display	DDHHMM OPE. TIME 000000 - 312359	0 mm I/F LEVEL 0 - 99999.9 mm	0.000 g/ml AVERAGE DENSITY 0.000 - 9.999 g/ml	0.0 °C AVERAGE TEMP. 0 - 369.5 °C				
DENSITY 1 - 10	6	0.000 g/ml NO. 1 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 2 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 3 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 4 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 5 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 6 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 7 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 8 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 9 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 10 DENSITY 0.000 - 9.999 g/ml Display
DENSITY 11 - 16	7	0.000 g/ml NO. 11 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 12 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 13 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 14 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 15 DENSITY 0.000 - 9.999 g/ml Display	0.000 g/ml NO. 16 DENSITY 0.000 - 9.999 g/ml Display				
POSITION 1 - 10	8	0 mm NO.1 POSITION 0 - 99999.9 mm Display	0 mm NO.2 POSITION 0 - 99999.9 mm Display	0 mm NO.3 POSITION 0 - 99999.9 mm Display	0 mm NO.4 POSITION 0 - 99999.9 mm Display	0 mm NO.5 POSITION 0 - 99999.9 mm Display	0 mm NO.6 POSITION 0 - 99999.9 mm Display	0 mm NO.7 POSITION 0 - 99999.9 mm Display	0 mm NO.8 POSITION 0 - 99999.9 mm Display	0 mm NO.9 POSITION 0 - 99999.9 mm Display	0 mm NO.10 POSITION 0 - 99999.9 mm Display
POSITION 11- 16	9	0 mm NO.11 POSITION 0 - 99999.9 mm Display	0 mm NO.12 POSITION 0 - 99999.9 mm Display	0 mm NO.13 POSITION 0 - 99999.9 mm Display	0 mm NO.14 POSITION 0 - 99999.9 mm Display	0 mm NO.15 POSITION 0 - 99999.9 mm Display	0 mm NO.1 6POSITION 0 - 99999.9 mm Display				

13.2 Description of Programming Matrix

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
STATIC MATRIX (This word is not shown)	MEASURED VALUE 1	MEASURED LEVEL	0	Displays displacer position in relation to Ullage (Outage) or Innage as Defined by GVH190 Display Mode.	16000.0 mm	Display	0.0 ... 99999.9 mm	000
		ULLAGE LEVEL	0	Displays difference between current displacer position and Tank Height.	0.0 mm	Display	0.0 ... 99999.9 mm	001
		UPPER INTERF. LEV	0	Displays last recorded Upper Interface level measurement	0.0 mm	Display	0.0 ... 99999.9 mm	002
		MIDD. INTERF. LEV	0	Displays last recorded Middle Interface level measurement	0.0 mm	Display	0.0 ... 99999.9 mm	003
		BOTTOM LEVEL	0	Displays last recorded Bottom level measurement Refer to GVH004	0.0 mm	Display	0.0 ... 99999.9 mm	004
		UPPER DENSITY	51	Displays last recorded Upper Density measurement OR manual setting.	1.000 g/ml	Display/ Set	0.000...3.000 g/ml	005
		MIDDLE DENSITY	51	Displays last recorded Middle Density measurement OR manual setting.	1.000 g/ml	Display/ Set	0.000...3.000 g/ml	006
		DENSITY BOTTOM	51	Displays last recorded Density Bottom measurement OR manual setting.	1.000 g/ml	Display/ Set	0.000...3.000 g/ml	007
		LEVEL DATA	0	Displays last recorded Measured Level measurement according to Balance Status.	16000.0 mm	Dispaly	0.000...3.000 g/ml	008
		STATUS 1	0	Switches the Contact Relay Input Status 1 Output Function on or off, especially for Oil Leak Detector Input. When input relay signal is ON, signal is output as Status 1 Alarm, and recorded in G0V3H7	OFF	Dispaly	OFF / ON	009

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
STATIC MATRIX (This word is not shown)	MEASURED VALUE 2	LIQUID TEMP.	0	Displays Liquid Temperature data reflected from G4V4H0 (NMT) or from G5V4H0 (HART Dev 1) if G5V4H9 = "Liquid Temperature"	0.0 °C	Display	-49.9 ... 249.9 °C	010
		DEV(1)	0	Displays Primary Variable data reflected from G5V4H0 (HART Dev 1) when G5V4H0 = ON, Liquid Temperature or Gas Temperature. Liquid Temperature data is also copied to G0V1H0. Gas Temeperature data is also copied G0V1H0 unless G6V4H9 = Gas temperature		Display	0.0 ... 99999.9 mm	011
		DEV(2)		Displays Primary Variable data reflected from G6V4H0 (HART Dev 2)when G6V4H9 = ON or Gas Temperature. Gas temperature data is also copied to G0V1H3		Display	0.0 ... 99999.9 mm	012
		GAS TEMPERATURE	0	Displays Gas Temperature data reflected from G4V4H1, or from G5V4H0 if G5V4H9= Gas Temeperature, or from G6V4H0 if G6V4H9 = Gas Temperature	0.0 °C	Display	-49.9 ... 249.9 °C	013
		WATER BOTTOM	0	Displays water interface level data received from NMT 539 Prothermo WB device.	0.0 mm	Display		014
		ZERO POINT	0	Displays Zero Point for Commuwin II bar graph	0 mm	Display	0.0 ... 99999.9 mm	017
		SPAN	0	Displays Span for Commuwin II bar graph	16000.0 mm	Display	0.0 ... 99999.9 mm	018
		LENGTH UNIT	0	Displays unit of length (selected at G7V6H0) for Commuwin II bar graph		Display	mm	019

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
STATIC MATRIX (This word is not shown)	OPERATION	OPERATION (from optical key)	50	Select operation for movement of displacer	STOP	Select	Refer to G0 Static Matrix, Operation commands.	020
		OPERATING STATUS	0	Displacer operation mode, or position status of Proservo	SPOT	Display	REFERENCE UP DOWN STOP LEVEL UPPER. INTERF. LEV. MIDD. INTERF. LEV. BOTTOM LEVEL UPPER DENSITY MIDDLE DENSITY DENSITY BOTTOM RELE. OVER TENS. CAL. ACTIVE LEVEL SEEKING LEVEL FOLLOWING UPP. DEN. SEEKING MID. DEN. SEEKING BOT. DEN. SEEKING UPP. INT. SEEKING UPP. INT. FOLLOWING MID. INT. SEEKING MID. INT. FOLLOWING BOTTOM SEEKING NO INITIALIZE UPPER STOP LOWER STOP REPEATABILITY WATER SEEKING WATER LEVEL WATER FOLLOWING EMARGENCY ERROR MAINTENANCE	021

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
STATIC MATRIX (This word is not shown)	OPERATION	BALANCE STATUS	0	Displays balance starus of displacer	UNBALANCED	Display	BALANCED UNBALANCED	022
		OPERAT. BY NRF	0	Displays operation status of NRF. If no NRF connected, display will show asterisks *******.	LEVEL	Display	LEVEL UP STOP BOTTOM LEVEL MIDD. INTERF. LEVEL UPPER DENSITY MIDDLE DENSITY DENSITY BOTTOM REPEATABILITY WATER DIP	024
		OPERAT. BY HOST	0	Displays operation status of Host CPU. If no HOST connected, display will show asterisks *******.	LEVEL	Display	LEVEL UP STOP BOTTOM LEVEL MIDD. INTERF. LEVEL UPPER DENSITY MIDDLE DENSITY DENSITY BOTTOM REPEATABILITY WATER DIP	025
		DEVICE ID	0	Displays the Device ID of NMS5 Proservo	0	Display		028
		SOFTWARE VERSION	0	Displays the software version of NMS5 Proservo	428	Display		029

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
STATIC MATRIX (This word is not shown)	MORE FUNCTION	MATRIX OF	0	Use (+) and (-) keys, scroll through 9 Dynamic Matrix Group selections. Press "E" key to select one for access to more data.	CALIBRATION	Select	CALIBRATION DEVICE DATA SERVICE TEMPERATURE HART DEVICE (1) HART DEVICE (2) ADJ. SENSOR	030
		(Calendar)	0	Displays date, time as yymmdd __hh:mm:ss. Not transferred by Rackbus.	Japanese local time	Display	e.g. 5 410 19:10:41 Year Month Day HH:MM:SS	033
		ALARM CONTACT	0	Display alarm message depending on current status.	NO ALARM	Display	Alarm message	034
		(Alarm History)	0	Use (+) and (-) keys, scroll through history of alarms. Up to 99 alarms recorded, then oldest alarm is overwritten by new data.	NO ALARM	Display	Alarm history	035
		DIAGNOSTIC CO	0	Displays current self-diagnostic code	NO ERROR	Display	Error message	036
		(Error History)	0	Use (+) and (-) keys, scroll through history of errors, in format yymmdd hhmm°° ##. Up to 99 alarms recorded, then oldest alarm is overwritten by new data.	MPU: START ACT	Display	Error history	037
		RESET ALM. DIAGNO	0	Reset Error History by setting = ON.	OFF	Display		038
		ACCESS CODE	0	Set access code to view and change to matrix data. Higher access codes (except 777) give greater editing privileges. 50: Operator, 51: technician, 777: required to select EEx i HART line,	0	Set	0, 50, 51, 530, 777	039

<table>
<tr><th>Matrix group</th><th>Function group</th><th>Item</th><th>Access code</th><th>Short description</th><th>Default value</th><th>Set Select Display</th><th>Possible settings, selection, or display</th><th>Index No, GVH</th></tr>
<tr><td rowspan="7">CALIBRATION</td><td rowspan="7">LEVEL DATA</td><td>TANK HEIGHT</td><td>50</td><td>Elevation level of manual dipping reference.</td><td>16000.0 mm</td><td>Set</td><td>0 - 99999.9 mm</td><td>140</td></tr>
<tr><td>DIP POINT OFFSET</td><td>50</td><td>Difference between Tank Height and Reference Position of Proservo NMS5. This data is automatically adjusted by Proservo software when Set Level procedure is performed.</td><td>0.0 mm</td><td>Set</td><td>0 - 99999.9 mm</td><td>141</td></tr>
<tr><td>DISPLAC. DRAFT</td><td>50</td><td>Set the draft of displacer. This value is used to calculate G0V0H4 Bottom Level measurement.
Typical Displacer Draft Settings
<table>
<tr><td>Diameter</td><td>30 mm</td><td>40 mm</td><td>50 mm</td><td>50 mm</td><td>70 mm</td><td>110 mm</td></tr>
<tr><td>Specification</td><td>Special</td><td>Special</td><td>Std</td><td>Conical</td><td>NMi</td><td>PTB</td></tr>
<tr><td>Draft</td><td>Varies</td><td>Varies</td><td>45 mm</td><td>35 mm</td><td>16.9 mm</td><td>10 mm</td></tr>
</table></td><td>10.0 mm</td><td>Set</td><td>0 - 999.9 mm</td><td>142</td></tr>
<tr><td>DISPL. RAISE DENS</td><td>51</td><td>Set distance for displacer to rise above level position during Density operations.
Observe the rule: G1V4H3+ G1V4H4 = 300 n, where = integer</td><td>150 mm</td><td>Set</td><td>0 - 300 mm</td><td>143</td></tr>
<tr><td>DISPL. SUBM. DENS</td><td>51</td><td>Set distance for displacer to sink below level position during Density operations.
Observe the rule: G1V4H3+ G1V4H4 = 300 n, where = integer</td><td>150 mm</td><td>Set</td><td>0 - 1500 mm</td><td>144</td></tr>
<tr><td>LEVEL BELOW 0</td><td>51</td><td>Select method for handling negative level data in V1 protocol communication. Select "99999 mm" to display negative level data backwards from 99999 mm. Select "0 mm" to display all negative level data as 0 mm.</td><td>99999 mm</td><td>Select</td><td>0 - 99999 mm</td><td>149</td></tr>
</table>

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
CALIBRATION	CALIBRATION	SET LEVEL	50	Calibrate NMS5 Proservo level display equal to manual dip level. With Operation = Level and NMS in balance status use +/- and E keys to adjust / set the data.	16000.0 mm	Set	0 - 99999.9 mm	150
		TANK CORRECT LEV.	51	Start level for tank roof compensation by level. This compensation is used in case of tank roof distortion due to hydrostatic pressure on tank wall.	0.0 mm	Set	0 - 99999.9 mm	152
		TANK CORRE. COEF.	51	Linear coefficient for tank roof compensation by level.	0.000 mm/m	Set	0 - 59.999 mm/m	153
		SAFE DENSITY	51	Select the desired resultant condition when density profile measurement fails due to displacer reaching the low-limit for density profile operation (set in G1V5H5). Selecting "ON" will result in STOP operation. Selecting "IGNOR" will result in"LEVEL" operation, displacer will return to liquid level. Selecting "OFF" will leave the displacer at the position where density profile measurement failed.	OFF	Set	OFF ON IGNOR	154
		DEN. OPE. LEVEL	51	Set the lower limit for displacer movement during density profile operation.	300 mm	Set	0 - 99999.9 mm	155
		SERVICE MODE	530	Deactivate Prosafety function during maintenance; level value not valid.	OFF	Set	ON / OFF	157
		PROSAFETY	530	Proactive safety function outputs maximum level value during specified error conditions	ON	Set	ON / OFF	158
		SAFETY LEVEL	530	Adjust maximum level output value, depending on receiver specification.	99999.0 / 65000.0	Set	0...99999.0	159

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
CALIBRATION	ADJUSTMENT	UPPER STOP	50	Set upper limit of displacer movement during normal operation.	16000 mm	Set	0 - 99999.9 mm	160
		LOWER STOP	50	Set lower limit of displacer movement during normal operation.	0 mm	Set	0 - 99999.9 mm	161
		OVER TENS. SET	51	Set this value such that if G3V7H0 Measured Weight of displacer equals or exceeds setting at G1V6H2, motor will freeze. Increase this parameter if necessary in high viscosity liquids. Caution!: Magnetic coupling disconnects above 800 grams tension.	350 g	Set	0 - 999 g	162
		UNDER TENS. SET	51	Set this value such that if G3V7H0 Measured Weight of displacer equals or is less than setting at G1V6H3, motor will freeze. Decrease this parameter if necessary in high viscosity liquids.	50 g	Set	0 - 999 g	163
		SLOW HOIST	51	Displacer will enter slow speed hoist according to this value, useful if displacer contacts with narrow valves.	60 mm	Set	60 - 1800 mm	164
		DISPL. RAIS. REP.	51	Set the distance to raise displacer above liquid surface during repeatability test.	10 mm	Set	10 - 99 mm	165
		DISPL. WAIT REP.	51	Set the waiting time after displacer rises above liquid surface during repeatability test.	10 s	Set	10 - 999 sec.	166
		DISPL. WAIT DIP.	51	Used for Water Level command. Set the waiting time between displacer balance status and return to Level.	10 s	Set	10 - 999 sec.	167

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
CALIBRATION	DISPLAY	SELECT DISP. MODE	51	Select either "Ullage (Outage) Level" or "Measured (Innage) Level".	MEASURED LEVEL	Select	ULLAGE LEVEL MEASURED LEVEL	190
		LANGUAGE	51	Select either "English" or "Japanese." [Chinese is also available by special order]	ENGLISH	Select	ENGLISH JAPANESE CHINESE	191
		LCD CONTRAST	51	Adjust LCD display module contrast.	▮▮▮▮▮▮▮▮▮▮	Set	0 - 15	192
		YEAR SETTING	51	Calender year.	Current year	Set	0 - 99	193
		MONTH SETTING	51	Calender month.	Current month	Set	0 - 12	194
		DAY SETTING	51	Calender day.	Current day	Set	0 - 31	195
		HOUR SETTING	51	Hour.	Current hour	Set	0 - 23	196
		MINUTE SETTING	51	Minute. Clock starts from 0 s when minuite is set.	Current minute	Set	0 - 59	197
		SELECT DECIMAL	51	Selection of decimal point indication by dot or comma.	[.]	Select	[.] , [,]	198
		LCD CHECK	51	When set = ON, display becomes dark as all pixels display for 3 seconds if normal. When set = OFF display become blank for 3 seconds if normal.	OFF	Select	OFF ON	199

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
DEVICE DATA	CONTACT OUTPUT	SELECT. RELAY	50	Use +/- and E keys to select to activate Contact Output Relays 1 to 4.	1	Select	Max 4	240
		ASSIGN RELAY	51	Select output definition from range of choices; None, Level, Liquid Temp, Caution, Warning, Emergency Error, Balance Signal.	NONE	Select	LEVEL, LIQUID TEMP, CAUTION, WARNING, EMERGENCY ERROR	241
		RELAY FUNCTION	51	Select High or Low function, available only when G2V4H1 = "Level"or "Liquid Temp."	HIGH	Select	HIGH LOW	242
		SWITCHING POINT	51	Set level at which relay is activated, available only when G2V4H1= "Level" or "Liquid Temp."	0 mm	Set	Max. 99999 mm	243
		HYSTERISIS	50	Set hysterisis value for selected relay, available only when G2V4H1= "Level" or "Liquid Temp."	0 mm	Set	Max. 9999 mm	244
		RELAY ON ALARM	50	Select from Normal Open or Normal close, available only when G2V4H1= "Level" or "Liquid Temp."	NORMAL OPENED	Select	NORMAL OPEN NORMAL CLOSE	245
		ON DELAY TIME	50	Set delay time for alarm output start, available only when G2V4H1= "Level" or "Liquid Temp."	0 s	Set	Max. 999 s	246
		OFF DELAY TIME	50	Set delay time for alarm spot, available only when G2V4H1= "Level" or "Liquid Temp."	0 s	Select	Max. 999 s	247

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
DEVICE DATA	ANALOG OUT. ADJUST	ASSIGN OUTPUT 1	51	Assign analog output for channel 1.	NONE	Select	NONE LEVEL UPPER. INTERF. LEV: LIQUID TEMP.	250
		ADJUST 4mA	51	Set level or temperature value for 4 mA output on channel 1. Available only when G2V5H0 = "Level" or "Liquid Temp"	0 mm /0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999 For LIQUID TEMP.: -999.9 to 999.9	251
		ADJUST 20mA	51	Set level or temperature value for 20 mA output on channel 1. Available only when G2V5H0 = "Level" or "Liquid Temp"	0 mm /0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999 For LIQUID TEMP.: -999.9 to 999.9	252
		ASSIGN OUTPUT 2	51	Assign analog output for channel 2.	NONE	Select	NONE LEVEL UPPER. INTERF. LEV: LIQUID TEMP.	253
		ADJUST 4mA	51	Set level or temperature value for 4 mA output on channel 2. Available only when G2V5H3 = "Level" or "Liquid Temp"	0 mm /0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999 For LIQUID TEMP.: -999.9 to 999.9	254
		ADJUST 20mA	51	Set level or temperature value for 20 mA output on channel 2. Available only when G2V5H3 = "Level" or "Liquid Temp"	0 mm /0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999 For LIQUID TEMP.: -999.9 to 999.9	255
		DEVICE AT ALARM	51	Select type of output for alarm. Select from OFF, HOLD current output, Maximum value or Minimum value OFF: no specific action is taken. HOLD: hold current value. MAX: output 22mA instead of current value. MIN: output 2mA instead of current value.	OFF	Select	OFF HOLD CURNT. OUT MAX MIN	256

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
DEVICE DATA	PARTS DATA	PARTS NUMBER	51	Set number for control-target parts (inside Proservo) to monitor.	1	Select	Max. 10	260
		PARTS TYPE	51	Select type of part to monitor.	NONE	Select	NONE, LEVEL, LIQUID TEMP,CUTION, WARNING, EMEARGENCY ERROR	261
		MAINTEN. FACTOR	51	Select method of monitoring part, either Operation Hours or Drum Revolutions.	OPERATION HOUR	Select	OPERATION HOUR DRUM REVILT.	262
		MAINTEN. VALUE	51	Set the target maintenance (hours or revolutions) value for selected parts	1 hour or 0 Round	Set	999999 hour	263
		OPERATION TIME	51	Displays the accumulated operation time or revolutions for selected part. Note : Reset this value to 0 after parts replacement.	0 hour or 0 Round	Display/ set	999999 hour	264
		(Parts Overused Data)	51	Displays date when parts reached terget value set in G2V6H3. Data format : yy mm dd hh mm.	POWER UNIT	Display		265
		REPLACED PARTS	51	Select part that has been replaced	NONE	Select		266
		(Parts Replaced Data)	51	Displays date when parts were replaced. Data format : yy mm dd hh mm.	NONE	Display		267

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
DEVICE DATA	INPUT SIGNAL	OPE. CONTACT	51	Displacer operation by contact input. Available if Contact Input (I/O 3 card) function is installed. Display shows either "NONE" or "Activated"	NONE	Select	NONE ACTIVATED	270
		CUSTODY TRANSFER	51	Displacer indicates whether Custody Transfer software is installed and activated or not (OFF or ON).	OFF	Display	OFF, ON	271
		NEW NMS STATUS	51	Switches NMS Status codes between old and new version, new version includes new operations and statuses. Note : For Rackbus communication, it is necessary to define "Operating Status"as On or OFF.	DISABLED	Select	DISABLED ENABLED	272
		SW VERSION	51	Displays software version of NMS 53x Proservo.	4.xx	Dispaly		275
		HW VERSION	51	Displays hardware version of NMS 53x Proservo. "2.00" = TCB-2, "4.00" = TCB - 4, "6.00 = TCB - 6"	-	Dispaly		276
		OPE. DENSITY	51	Displays liquid density setting used for computing buoyancy from a given balance volume in custody transfer mode.	1.00g/mL	Set	0 - 3.000	278
		OPE. CONT. STATUS	51	Displays the terminal numbers in use (binary converted to decimal)	0	Set	2 - 256	279

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
DEVICE DATA	COMMUNICATION	LEVEL ALARM 1	51	Select Upper or Lower limit on innage level relative to setting of Alarm 1 for bi-directional 2-wire communicatons.	HIGH	Select	HIGH LOW NONE	280
		SET LEVEL ALARM 1	51	Set alarm output level for Alarm 1	0.0 mm	Set	Max. 99999.9 mm	281
		LEVEL ALARM 2	51	Select Upper or Lower limit on innage level relative to setting of Alarm 2 for bi-directional 2-wire communicatons.	HIGH	Select	HIGH LOW NONE	282
		SET LEVEL ALARM 2	51	Set alarm output level for Alarm 2	0.0 mm	Set	Max. 99999.9 mm	283
		HYSTERESIS	51	Set hysteresis for Alarm 1 and 2	0.0 mm	Set	Max. 99999.9 mm	284
		ADDRESS	51	Set address. Range is 0-9, 00-FF (FF is fixed for MIC protocol or 1-247 Modbus) for remote/multi-drop communications.	0	Set	0 - FF for MIC.->FF Fixed 1 - 247 Modbus	285
		PROTOCOL	51	Select communications protocol for remote/multi-drop communication	WM550, M/S	Select	BBB, MDP, V1/ENRAF, RACk BUS, HART, MarkSpace, WM550, MODBUS	286
		COMMU. LINE ADJ	51	Adjust line resistance for serial pulse V1 communications.	F	Set	0 - F	287
		COMMUNIC. STATUS	51	Displays current communication status with Host. (See NMS Status Code)	0	Display		288
		MODBUS Config		Set configuration of Modbus communication. Modbus parameters for G2V8H9 0: 1200 bps /Even | 3: 2400 bps /Even | 6: 4800 bps /Even | 9: 9600 bps /Even | 12: 19200 bps /Even 1: 1200 bps /Odd | 4: 2400 bps /Odd | 7: 4800 bps /Odd | 10: 9600 bps /Odd | 13: 19200 bps /Odd 2: 1200 bps /None | 5: 2400 bps /None | 8: 4800 bps /None | 11: 9600 bps /None | 14: 19200 bps /None	0	Set	0 - 14	289

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
DEVICE DATA	STATUS	STATUS 1 DELAY	51	Set delay time between activation of Status 1 ON input signal and Status 1 output signal.	0 s	Set	0 s - 99 s	290
		SELECT CONTACT	51	Select normal relay condition for Status1: Normal Open or Normal Closed.	NONE	Select	NONE NORMAL OPENED NORMAL CLOSED (ALARM = OPEN) (ALARM = CLOSED)	291
		WM550 ALM. SELECT	51	Set the Alarm Bit for WM550 communication. (Available only with WM550 specification) 1: bit 0 Alarm No.1 (High-high) | 2: bit 1 Alarm No.2 (High) | 3: bit 2 Alarm No.3 (Low) | 4: bit 3 Alarm No.4 (Low-low)	1	Select	1 - 3	292
		WM550 BSW SELECT	51	Select source of BSW level data for WM550 communication. "0" = Upper I/F Level, "1" = (NMT539)Water Bottom level. (Avaiable only WM550 specification)	0	Select	0 - 1	293
		WM550 DENS. SEL.	51	Select source of data transmit in response to task 17, Sub-task 11 query. (Available only with WM550 specification) Parameter | Density data source | Temp. data source 0: upper Density | G0V0H5 Upper Density | G0V1H0 Liquid Temp. 1: Profile Ave. Dens. | G8V5H4 Average Density | G8V5H5 Average Temp. 2: IF Prof. Ave. Dens. | G9V5H4 Average Density | G9V5H5 Average Temp.	0	Select	0 - 2	294
		WM550 SW_ID_20xx	51	Set the last 2 digits (xx) of the WM550 sensor address (20xx). (Available only with WM550 specification)	37	Set	0 - 99	295
		BALANCE DELAY	51	Sets time between displacer balance and Balance Signal output.	0 s	Set	0 s - 99 s	299

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
SERVICE	MEAS. WIRE & DRUM	WIRE DRUM CIRC.	51	Circumference of wire drum is measured at factory and inscribed on the wire drum. Used by CPU to calculate Measured Level	300.00 mm	Set	0 - 999.9	340
		WIRE WEIGHT	51	Weight of measuring wire per 10 meters. Used by CPU to determine balance weight. Standard measuring wire is 1.40 g/10 m. PFA wire is 4.55 g/10 m. Hastelloy C wire is 2.8 g/10 m	1.40 g/10 m	Set	0 - 999.9	341
		DISPLACER WEIGHT	51	Weight of displacer is measured at factory and inscribed on the wire drum. Used by CPU to calculate Measured and Interface Levels and densities.	255.0 g	Set	0 - 999.9	342
		DISPLACER VOLUME	51	Total volume of displacer is measured at factory and inscribed on the wire drum. Used by CPU to calculate Interface Levels and Densities.	145.0 mL	Set	0 - 999.9	343
		BALANCE VOLUME	51	Balance volume of displacer is measured at factory and inscribed on the wire drum, approximately one-half of Displacer Volume (G3V4H3). Used by CPU to calculate Measured and Interface Levels.	60 mL	Set	0 - 999.9	344
		VOLUME TOLERANCE	51	Displacer immunity to variation in liquid surface level during Balance condition. Based on density = 1.0, setting for standard 50 mm displacer is 1.0 mL (1 g). Increase to counter turbulence and waves. Level accuracy varies inversely as Volume Tolerance.	1.0 mL	Set	0 - 99.9	345
		DELAY	51	Interval until displacer responds to change in liquid level. Increase to counter small	20 x 100 mS	Set	0 - 99 x 100mS	347
		DRUM CORRECTION	51	Used only for SW V2.xx	0.00 mm/m	Set	0 - 99.00	348
		DISPL. HUNT. COUNT	51	Defines the number of times displacer serches for balance condition.To balance on solid surface set = non-zero (e.g. 1)	0 count	Set	0 - 99	349

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
SERVICE	GAUGE DATA	ACTUAL LEVEL	530	Level from Reference Position to displacer	0	Display		350
		ENCODER COUNT	530	Encoder pulse count	0	Display		351
		NON HYSTER. MODE	51	Non-Hysterisis Operation mode. When turned ON displacer is raised pprox. 2mm and then seeks Balance condition again.	OFF	Select	OFF ON	352
		HI. ACCURACY MODE	51	When displacer reaches Temporary Balance condition, it is raised (G3V5H5) millimeters, weighed, and then seeks Balance condition again.	OFF	Slect	OFF ON	353
		HI. ACCR. OPE TIME	51	Interval of Temporary Balance condition until displacer is raised and weighed.	0 s	Set	0 - 600	354
		HI.ACC.DISP.UP	51	Distance displacer raised in High Accuracy Mode operation.	50 mm	Set	0 - 300	355
		GAUGE TEMP.	51	Displays temperature inside electronics housing of NMS5.	999 °C	Display		356
SERVICE	SYSTEM DATA	SENSOR DATA		Displays NMS5 Proservo specifications: software and hardware versions, remote communication (On/Off), drive gear ratio.	LOCAL: MASTER	Display	REMOTED COM. ON SOFTWARE = xxx HARDWARE= TCB0x GEAR 1:36 NOT OVERSPILL	360
		CONNECTION NRF	51	Selects switch for communicaton to NRF 560 Promonitor. For NRF 560 SW v1.81 and before, select Contact 1. For NRF 560 SW v1.82 and laten, select Contact 2.	OFF	Select	OFF CONTACT 1 CONTACT 2	361
		CONNECTION NMT	51	Select switch for communication to NMT5 Series Prothermo. Select Average or Spot.	OFF	Select	OFF, SPOT TEMP. AVARAGE TEMP.	362
		IF_LEVEL_SELECT	51	Select free scanning data source for water level (WM 550 only).		Select	UP_LEVEL_SELECT UP_IF_LEVEL WATER BOTTOM WATER BOTTOM 2	368
		SOFT RESET	51	Restarts NMS5 Proservo software	OFF	Set		369

Parameter	Free scan data source
UP_IF_LEVEL	NMS Proservo: Upper Interface Level or Water Dip Operation
WATER BOTTOM	NMT539 WB: Water Bottom level data is taken for HART FreeScan. If Upper interface command is received from host via Sakura V1 communication, Water Bottom level is returned. Other operations return data based on the Proservo settings (Upper Interface or water Dip operation). Water Bottom data is taken via interrupt-scan in HART communication.
WATER BOTTOM 2	NMT 539 WB: Water Bottom level data is taken for HART FreeScan. Upper interface command returns data based on the Proservo settings (Upper Interface or Water Dip operation). Water Bottom data is taken via interrupt-scan in HART communication.

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
SERVICE	SERVICE	MEASURED WEIGHT		Displays tension on measuring wire as calculated by NMS CPU module.	0.0 g	Display	0.0 - 999 g	370
		RELE. OVER TENS	51	Release displacer overtension condition. Note : First, set G0V2H0. Operation = STOP.	OFF	Select	OFF ON	371
		DRUM SETTING	51	Aligns wire drum with internal detector unit. When displacer is shipped separately, and wire drum is removed to install displacer, set this function prior to making new Weight Calibration. Not required for All-in-One shipments of NMS5 Proservo.	OFF	Select	OFF ON	372
		WEIGHT CALIBR.	51	Initiates Weight Table recalibration procedure. Overwrites existing weight table with new weight table. Caution!: Once recalibration procedure begins it must be completed, i.e. it connot be stopped or reversed.	OFF	Select	OFF ON	373
		DISPL. REFERENCE	51	Length for the starting position of weight calibration. The displacer will stop at this position without regard to the high stop level when it is hoisted, if the high stop level is set higher than this point.	70 mm	Set	10...999 mm	378
		ZERO ADJ. WEIGHT	51	Low weight for weight calibration.	0.0 g	Set	0.0...999.9 g	379
	SERVICE VALUE	SENSOR VALUE	51	Displays the A/D values from the encoder.	Sa≈21000: A ≈21000 Sb≈11000: B ≈ 11000	Display		380
	SERVICE DATA	WT. COUNT CAL A	51	Displays A/D and displacer weight correction values for Sensor A Use the + and - key to scroll through 50 points.	0 0 0.0 g	Display		394
		WT. COUNT CAL. B	51	Displays A/D and displacer weight correction values for Sensor B Use the + and - key to scroll through 50 points.	0 0 0..0 g	Display		395

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TEMPERATURE	TEMPERATURE DATA	LIQUD TEMP.	51	Displays current avarage liquid temperature.	xx °C	Display	Depending on a specification and measured value.	440
		GAS TEMPERATURE	51	Displays current average gas temperature.	zz °C	Display	Depending on a specification and measured value.	441
		MEASURED LEVEL	51	Displays Measured Level data received from NMS5 Proservo, depending on selection at G4V4H3 Level Data Select.	aaaa.a mm	Display	Depending on a specification and measured value.	442
		LEV. DATA SELECT	51	Select level data to receive from NMS5 Proservo, used for averaging calculations. Select "VH00" to receive Measured Level (actual displacer position). Select "VH08" to receive Level Data (last recorded level position).	VH00	Select	VH00 or VH08	443
		WATER BOTTOM	51	Displays water level data from the NMT 539 Water Bottom. G3V6H8 must be set to either "WATER BOTTOM" or "WATER BOTTOM2"	0.0 mm	Display	Depending on a specification and measured value.	444
		DIAGNOSTIC	51	Displays reference resistance on circuit board corresponding to 0°C.	0.0 °C	Display	Depending on a specification and measured value.	447
		REFERENCE 150	51	Displays reference resistance on circuit board corresponding to 150°C.	150.0 °C	Display	Depending on a specification and measured value.	449

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TEMPERATURE	ELEMENT TEMP. Depending on a specification and measured value.	TEMP. NO.1	51	Displays temperature of element 1 (lowest element).	aa.a °C	Display	-49.9 ... 249.9 °C	450
		TEMP. NO.2	51	Displays temperature of element 2.	bb.b °C	Display	-49.9 ... 249.9 °C	451
		TEMP. NO.3	51	Displays temperature of element 3.	cc.c °C	Display	-49.9 ... 249.9 °C	452
		TEMP. NO.4	51	Displays temperature of element 4.	dd.d°C	Display	-49.9 ... 249.9 °C	453
		TEMP. NO.5	51	Displays temperature of element 5.	ee.e °C	Display	-49.9 ... 249.9 °C	454
		TEMP. NO.6	51	Displays temperature of element 6.	ff.f °C	Display	-49.9 ... 249.9 °C	455
		TEMP. NO.7	51	Displays temperature of element 7.	gg.g °C	Display	-49.9 ... 249.9 °C	456
		TEMP. NO.8	51	Displays temperature of element 8.	hh.h °C	Display	-49.9 ... 249.9 °C	457
		TEMP. NO.9	51	Displays temperature of element 9.	ii.i °C	Display	-49.9 ... 249.9 °C	458
		TEMP. NO.10	51	Displays temperature of element 10.	jj.j °C	Display	-49.9 ... 249.9 °C	459

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TEMPERATURE	ELEMENT POSITION Depending on a specification.	ELEM.1 POSITION	51	Displays position of element 1, also called "Bottom (lowest) Element.	xxx.x mm	Display	0 ... 99999 mm	460
		ELEM.2 POSITION	51	Displays temperature of element 2.	xxx.x mm	Display	0 ... 99999 mm	461
		ELEM.3 POSITION	51	Displays temperature of element 3.	xxx.x mm	Display	0 ... 99999 mm	462
		ELEM.4 POSITION	51	Displays temperature of element 4.	xxx.x mm	Display	0 ... 99999 mm	463
		ELEM.5 POSITION	51	Displays temperature of element 5.	xxx.x mm	Display	0 ... 99999 mm	464
		ELEM.6 POSITION	51	Displays temperature of element 6.	xxx.x mm	Display	0 ... 99999 mm	465
		ELEM.7 POSITION	51	Displays temperature of element 7.	xxx.x mm	Display	0 ... 99999 mm	466
		ELEM.8 POSITION	51	Displays temperature of element 8.	xxx.x mm	Display	0 ... 99999 mm	467
		ELEM.9 POSITION	51	Displays temperature of element 9.	xxx.x mm	Display	0 ... 99999 mm	468
		ELEM.10 POSITION	51	Displays temperature of element 10.	xxx.x mm	Display	0 ... 99999 mm	469

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TEMPERATURE	NMT ADJUSTMENT	SELECT. POINT	51	Select element number for zero adjustment procedure. Selection begins at 0, which is element 1. Select 1 for element 2, etc. Also used to select elements 11-16 (input 10-15)	0	Select	0-15 Selectable 0(element No.1) 10(element No.11)	470
		ZERO ADJUST	51	Set zero adjustment value for element selected at G4V7H1.	0.0 °C	Set	-20.0 ...20.0°C	471
		GAIN ADJUST	51	Set gain adjustment value for temperature measurment. Caution!: This setting is mode at factory before shipping and should not be adjusted in field.	1.000	Set		472
		ELEMENT TEMP	51	Displays temperature for element number 11-15 (16 element NMT modules only)	xx.x °C	Display	-49.9 ...249.9°C	473
		ELEMENT POSITION	51	Displays temperature for element number 11-15 (16 element NMT modules only) when selected at G4V7H0 Select Point.	xxx.x mm	Display	0 ...99999 mm	474
		AVERAGING	51	Set sampling coeffifient for averaging data. Increase to counter noise factor.	2	Set	1 ...10	478
		ACCESS CODE	51	Displays current Access code.		Set		479

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TEMPERATURE	SET DATA NMT	DIAGNOSTIC	51	Displays current NMT diagnostic code.	0	Display	0 ... 255	480
		TEMPERATURE UNIT	51	Displays selected temperature unit.	C	Display		481
		TOTAL NO. ELEMENT	51	Set total number of elements in NMT temperature sensor.	XX	Set	a ... A HEX	482
		PREAMBLE NUMBER	51	Display of preambles for HART protocol.	5	Display	2 ... 14 HEX	483
		LENGTH UNIT	51	Displays selected length unit.	mm	Display		484
		KIND OF INTERVAL	51	Select type interval between temperature elements. If Unequal is selected, must set element poisitions at G4V6 H0 to 9, G4V7H4.	EQUAL	Select	EQUAL UNEQUAL	485
		BOTTOM POINT	51	Set position of element 1 (lowest element) above tank bottom. Available only when G4V8H5 = Equal.	500.0 mm	Set	0.0 mm to 500.0 mm valuable	486
		ELEMENT INTERVAL	51	Set spacing between elements. Available only when G4V8H5 = Equal.	2000.0 mm	Set	0.0 ... 99999.9 mm	487
		TEMP. ELEM. SHORT	51	Set temperature indication sent to NMS5 Proservo Home Position when element is shorted and G4V9H2 = ON. Default value = -49.5 °C	-49.5 °C	Set		488
		TEMP. ELEM. OPEN	51	Set temperature indication sent to NMS5 Proservo Home Position when element is open and G4V9H2 = ON. Default value = -359.0 °C	359.0 °C	Set		489

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TEMPERATURE	DEVICE DATA NMT	INSTRUMENT CODE	51	Displays hardware unit number.		Display		490
		LAST DIAGNOSTIC	51	Displays last error message.		Display		491
		OUTPUT AT ERROR	51	Select ON for output and indication in case of element short or element open condition.	ON	Select	OFF ON	492
		CUSTODY TRANSFER	51	Display status of custody transfer function.	OFF	Select	OFF ON	493
		POLLING ADDRESS	51	Select polling address (1-F) for NMT535/539/532 Prothermo for use in multi-drop applications. Set address 3 for connection with NMS5 Proservo	2	Select	1 ... F (Total 16 address can be set)	494
		MANUFACTURE ID	51	Displays identification number for NMT535/539/532 Prothermo. 17=Endress+Hauser	17	Display		495
		SW VERSION	51	Displays software version of NMT535/539/532 Prothermo.	5	Display	4.0 or higher	496
		HW VERSION	51	Displays hardware version of NMT535/539/532 Prothermo.	2	Display	1.4 or higher	497
		BELOW BOT. POINT	530	Select ON to cancel "NMT Below Bottom Point" error message output to NMS when displacer sinks below lowest temperature element.	ON	Select		498
		DEVICE TYPE CODE	51	Displays device type code for NMT535/539/532 Prothermo.	DEVICE	Display		499

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
HART DEVICE	MEASURED VALUE	PV DATA		Displays primary variable data of the HART Device.		Display		540
		SV DATA		Displays secondary variable data of the HART Device.		Display		541
		HART DEVICE (1)	51	Select HART Device 1 function: OFF, ON, Liquid Temperature, Gas Temperature. If "Liquid Temperature" is selected, value is reflected at G0V1H0 and G0V1H1	OFF	Select	OFF LIQUID TEMP. GAS TEMPERATURE ON	549
	P.V.SETTING	P.V.RANGE UNIT	51	Setting of range unit for primary variable in HART command code.		Set		550
		P.V.UPPER RANGE	51	Setting of upper range of primary variable.		Set		551
		P.V.LOWER RANGE	51	Setting of lower range of primary variable.		Set		552
		DAMP VALUE	51	Setting of damping of primary variable.		Set		553
	SENSOR SPECIFIC	SENSOR SERIAL NO		Dispalys sensor serial number		Display		560
		UPPER SENSOR LMT		Dispalys upper limit of the HART Device.		Display		561
		LOWER SENSOR LMT		Dispalys upper limit of the HART Device.		Display		562

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
HART DEVICE	SELF DIAGNISTIC Consult HART device operation/service manual	ERROR CODE (1)		Displays of the error code (1) the HART device.		Display		580
		ERROR CODE (2)		Displays of the error code (2) the HART device.		Display		581
		ERROR CODE (3)		Displays of the error code (3) the HART device.		Display		582
		ERROR CODE (4)		Displays of the error code (4) the HART device.		Display		583
		ERROR CODE (5)		Displays of the error code (5) the HART device.		Display		584
	DEVICE DATA	POLLING ADDRESS		Displays polling address of HART Device 1. Address (fixed) = 4.	4	Display		591
		MANUFACTURE ID		Displays manufacturer ID number of the HART Device.		Display		592
		DEVICE TYPE CODE		Displays device type code of the HART Device.		Display		593
		PREAMBLES		Set number of preambles for the HART device.		Display		594
		SW VERSION		Dispalys the software version for the HART device.		Display		595
		HW VERSION		Dispalys the hardware version for the HART device.		Display		596
		DEVICE ID		Displays the device ID for the HART device.		Display		597

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
HART DEVICE	MEASURED VALUE	PV DATA		Displays primary variable data of the HART Device.		Display		640
		SV DATA		Displays secondary variable data of the HART Device.		Display		641
		HART DEVICE (2)	51	Select HART Device 2 function: OFF, ON, Gas Temperature. If "Gas Temperature" is selected, value is reflected at G0V1H0 and G0V1H1	OFF	Select	OFF LIQUID TEMP. GAS TEMPERATURE ON	649
	P.V.SETTING	P.V.RANGE UNIT	51	Setting of range unit for primary variable in HART command code.		Set		650
		P.V.UPPER RANGE	51	Setting of upper range of primary variable.		Set		651
		P.V.LOWER RANGE	51	Setting of lower range of primary variable.		Set		652
		DAMP VALUE	51	Setting of damping of primary variable.		Set		653
	SENSOR SPECIFIC	SENSOR SERIAL NO		Dispalys sensor serial number		Display		660
		UPPER SENSOR LMT		Dispalys upper limit of the HART Device.		Display		661
		LOWER SENSOR LMT		Dispalys lower limit of the HART Device.		Display		662

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
HART DEVICE	SELF DIAGNISTIC Consult HART device operation/service manual	ERROR CODE (1)		Displays of the error code (1) the HART device.		Display		680
		ERROR CODE (2)		Displays of the error code (2) the HART device.		Display		681
		ERROR CODE (3)		Displays of the error code (3) the HART device.		Display		682
		ERROR CODE (4)		Displays of the error code (4) the HART device.		Display		683
		ERROR CODE (5)		Displays of the error code (5) the HART device.		Display		684
	DEVICE DATA	POLLING ADDRESS		Displays polling address of HART Device 2. Address (fixed) = 5.	5	Display		691
		MANUFACTURE ID		Displays manufacturer ID number of the HART Device.		Display		692
		DEVICE TYPE CODE		Displays device type code of the HART Device.		Display		693
		PREAMBLES		Set number of preambles for the HART device.		Set		694
		SW VERSION		Dispalys the software version for the HART device.		Display		695
		HW VERSION		Dispalys the hardware version for the HART device.		Display		696
		DEVICE ID		Displays the device ID for the HART device.		Display		697

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
ADJ. SENSOR	ADJ. SENSOR	ADJ A ZERO	530	Hall Sensor A Zero signal		Display		740
		ADJ A ZERO	530	Hall Sensor A Zero signal		Display		741
		ADJ B SPAN	530	Hall Sensor B Full span signal		Display		742
		ADJ B SPAN	530	Hall Sensor B Full span signal		Display		743
	HART ERROR RATE	ERR. RATE NRF	530	Communication error rate		Display		750
		ERR. RATE NMT	530	Communication error rate		Display		751
		ERR. RATE DEV(1)	530	Communication error rate		Display		752
		ERR. RATE DEV(2)	530	Communication error rate		Display		753
	UNIT	LEV. UNIT (HOST)	51	Select display units for level value data to be sent to host CPU via remote communications	mm	Select	m, inch, cm, ft	760
		TEMP UNIT (HOST)	51	Select units for temperature value data to be sent to host CPU via remote communications	°C	Select	°C, °F, °R, °K	761
		DEN. UNIT (HOST)	51	Select display units for density value data to be sent to host CPU via remote communications	g/mL	Select	Kg/m³, lb/gl, SGU, Kg/l, g/l, lb/in, st/y³	762
		LEV. UNIT	51	Select units for level value data displayed locally at NMS/NRF.	mm	Select	m, inch, cm, ft	765
		TEMP. UNIT	51	Select units for temperature data displayed locally at NMS/NRF	°C	Select	°C, °F, °R, °K	766
		DEN. UNIT	51	Select units for density value data displayed locally at NMS/NRF	g/mL	Select	Kg/m , lb/gl, SGU, Kg/l, g/l, lb/in, st/y	767
	HART LINE	NMT	777	Select Terminal Port A (Ex ia) or Terminal Port B (Ex d) for the NMT connection	TERMINAL PORT B	Set	TERMINAL PORT B TERMINAL PORT A	770
		HART DEVICE (1)	777	Select Terminal Port A (Ex ia) or Terminal Port B (Ex d) for the HART Device 1.	TERMINAL PORT B	Set	TERMINAL PORT B TERMINAL PORT A	771
		HART DEVICE (2)	777	Select Terminal Port A (Ex ia) or Terminal Port B (Ex d) for the HART Device 2.	TERMINAL PORT B	Set	TERMINAL PORT B TERMINAL PORT A	772
	INTERFACE ADJUST	VOL. TOL. FOR I/F	51	Set Volume Tolerance for Balance condition during Interface measurement	0.3 mL	Set	0 - 99.9 mL	780
		BRAKE RATE	51	Used for Interface Measurement. Increase Brake Rate to make the balance zone smaller and decrease interface measurement time.	150	Display	0 - 255	781
		BALANCE COUNT	51	Used for Interface Measurement. Balance signal is generated after motor movement changes from fast to slow specified number of times. Coordinate this setting with G2V9H9 Balance Delay setting.	15	Display	0 - 255	782
		IF 1 OFFSET	51	Change this setting to correct Interface 1 level deviation.	0.0 mm	Display	0 - 9999.9 mm	783
		IF 2 OFFSET	51	Change this setting to correct Interface 2 level deviation.	0.0 mm	Display	0 - 9999.9 mm	784

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TANK PROFILE	PROFILE OPE. NOTE!: Data in G8V4H0 to G8V4H9 are used for both Tank and Interface Profile measurement	OPE. SELECT	51	Select method for density measurement. 0: spot. 1: Tank Profile. 2: I/F Profile. 3: MANU. I/F Profile.	O: stop	Select	0: stop 1:tank profile 2: I/F profile 3: MANU. I/F profile	840
		OPE. POINT	51	Set the number of measurement points for Tank Profile measurement.	2	Set	2 - 16	841
		I/F MANU. LEVEL	51	Manually set the water interface level to be referenced during Tank Profile measurement.	0 mm	Set	0 - 99999.9 mm	843
		BAL. LEVEL	51	Set the allowance for level movement prior to Tank Profile operation. If level movement exceeds this value, Profile operation is canceled. Setting 99.9 mm allows Profile measurement to proceed, regardless of level movement	2.0 mm	Set	1.0 - 99.9 mm	844
		UP WAIT TIME	51	Set waiting time for displacer weight to be measured in air, when making the weight table at start of Profile operation	1 min.	Set	1 - 31 min	845
		LIQ. WAIT TIME	51	Set the time for displacer to stop at each measurement position during profile operation	1 min.	Set	1 - 31 min	846
		OPE. WAIT TIME	51	E.g. if level movement exceeds setting at G8V4H4, Proservo is in "stand by" for the time set in this matrix. After the maximum time elapses, profile operation is canceled.	1 min.	Set	1 - 31 min	847

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TANK PROFILE	STARUS/DATA	OPE. STATUS		Displays profile operation status. 0: Accepting – Accepting density profile command 1: Standby – Ready to execute density profile command 2: In operation – Executing density profile command 3: OPR.END – Density profile operation completed successfully 4: UN_BALANCE ERR – Fail: Required conditions for density profile operation not satisfied 5: OPR. ERR. STOP – Fail: Abnormal conditions occurred during density profile operation	0	Display	0 - 6	850
		LEVEL CONDITION		Displays status of liquid level/surface monitored prior to profile operation. 0: Off Level Meas – Active operation is not LEVEL (profile cannot start) 1: Stable – Liquid level/surface is stable (profile can start) 2: Unstable – Liquid level/surface is unstable (profile cannot start) 3: Ignor Condition – Ignores liquid level/surface condition (profile cannot start)	0	Display	0 - 4	851
		OPE. TIME		Displays time when Tank Profile operation finished (DD/HH/MM)	DDHHMM	Display	0000000 - 312359	852
		AVERAGE DENSITY		Displays average density value	0.000 g/ml	Display	0.000 - 9.999 g/ml	854
		AVERAGE TEMP.		Displays average temperature value	0.0 °C	Display	0 -0359.5 °C	855
		DIAG. CODE						858

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TANK PROFILE	DENSITY1 - 10	NO. 1 DENSITY		Displays density values for point No.1 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	860
		NO. 2 DENSITY		Displays density values for point No.2 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	861
		NO. 3 DENSITY		Displays density values for point No.3 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	862
		NO. 4 DENSITY		Displays density values for point No.4 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	863
		NO. 5 DENSITY		Displays density values for point No.5 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	864
		NO. 6 DENSITY		Displays density values for point No.6 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	865
		NO. 7 DENSITY		Displays density values for point No.7 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	866
		NO. 8 DENSITY		Displays density values for point No.8 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	867
		NO. 9 DENSITY		Displays density values for point No.9 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	868
		NO. 10 DENSITY		Displays density values for point No.10 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	869
	DENSITY11 - 16	NO. 11 DENSITY		Displays density values for point No.11 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	870
		NO. 12 DENSITY		Displays density values for point No.12 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	871
		NO. 13 DENSITY		Displays density values for point No.13 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	872
		NO. 14 DENSITY		Displays density values for point No.14 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	873
		NO. 15 DENSITY		Displays density values for point No.15 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	874
		NO. 16 DENSITY		Displays density values for point No.16 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	875

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TANK PROFILE	POSITION1 - 10	NO. 1 POSITION		Displays position No.1 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	880
		NO. 2 POSITION		Displays position No.2 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	881
		NO. 3 POSITION		Displays position No.3 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	882
		NO. 4 POSITION		Displays position No.4 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	883
		NO. 5 POSITION		Displays position No.5 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	884
		NO. 6 POSITION		Displays position No.6 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	885
		NO. 7 POSITION		Displays position No.7 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	886
		NO. 8 POSITION		Displays position No.8 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	887
		NO. 9 POSITION		Displays position No.9 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	888
		NO. 10 POSITION		Displays position No.10 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	889
	DENSITY11 - 16	NO. 11 POSITION		Displays position No.11 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	890
		NO. 12 POSITION		Displays position No.12 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	891
		NO. 13 POSITION		Displays position No.13 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	892
		NO. 14 POSITION		Displays position No.14 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	893
		NO. 15 POSITION		Displays position No.15 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	894
		NO. 16 POSITION		Displays position No.16 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	895

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
INTERFACE PROFILE	STATUS/DATA	OPE. STATUS		Displays profile operation status. 0: Accepting — Accepting density profile command 1: Standby — Ready to execute density profile command 2: In operation — Executing density profile command 3: OPR.END — Density profile operation completed successfully 4: UN_BALANCE ERR — Fail: Required conditions for density profile operation not satisfied 5: OPR. ERR. STOP — Fail: Abnormal conditions occurred during density profile operation	0	Display	0 - 6	950
		LEVEL CONDITION		Displays status of liquid level/surface monitored prior to profile operation. 0: Off Level Meas — Active operation is not LEVEL (profile cannot start) 1: Stable — Liquid level/surface is stable (profile can start) 2: Unstable — Liquid level/surface is unstable (profile cannot start) 3: Ignor Condition — Ignores liquid level/surface condition (profile cannot start)	0	Display	0 - 4	951
		OPE. TIME		Displays time when Interface Profile operation finished (DD/HH/MM).	DDHHMM	Display	0000000 - 312359	952
		I/F LEVEL		Displays Interface level used for Interface Profile measurement.	0.000 g/ml	Display	0.000 - 9.999 g/ml	953
		AVERAGE DENSITY		Displays average density value calculated from Interface Profile measurement.	0.0 °C	Dispaly	0 -359.5 °C	954
		AVERAGE TEMP.		Displays avarage temperature value calculated from Interface Profile measurement.				955

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TANK PROFILE	DENSITY1 - 10	NO. 1 DENSITY		Displays density values for point No.1 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	960
		NO. 2 DENSITY		Displays density values for point No.2 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	961
		NO. 3 DENSITY		Displays density values for point No.3 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	962
		NO. 4 DENSITY		Displays density values for point No.4 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	963
		NO. 5 DENSITY		Displays density values for point No.5 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	964
		NO. 6 DENSITY		Displays density values for point No.6 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	965
		NO. 7 DENSITY		Displays density values for point No.7 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	966
		NO. 8 DENSITY		Displays density values for point No.8 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	967
		NO. 9 DENSITY		Displays density values for point No.9 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	968
		NO. 10 DENSITY		Displays density values for point No.10 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	969
	DENSITY11 - 16	NO. 11 DENSITY		Displays density values for point No.11 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	970
		NO. 12 DENSITY		Displays density values for point No.12 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	971
		NO. 13 DENSITY		Displays density values for point No.13 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	972
		NO. 14 DENSITY		Displays density values for point No.14 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	973
		NO. 15 DENSITY		Displays density values for point No.15 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	974
		NO. 16 DENSITY		Displays density values for point No.16 in density profile	0.000 g/ml	Display	0.000 - 9.999 g/ml	975

Matrix group	Function group	Item	Access code	Short description	Default value	Set Select Display	Possible settings, selection, or display	Index No, GVH
TANK PROFILE	POSITION1 - 10	NO. 1 POSITION		Displays position No.1 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	980
		NO. 2 POSITION		Displays position No.2 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	981
		NO. 3 POSITION		Displays position No.3 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	982
		NO. 4 POSITION		Displays position No.4 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	983
		NO. 5 POSITION		Displays position No.5 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	984
		NO. 6 POSITION		Displays position No.6 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	985
		NO. 7 POSITION		Displays position No.7 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	986
		NO. 8 POSITION		Displays position No.8 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	987
		NO. 9 POSITION		Displays position No.9 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	988
		NO. 10 POSITION		Displays position No.10 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	989
	DENSITY11 - 16	NO. 11 POSITION		Displays position No.11 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	990
		NO. 12 POSITION		Displays position No.12 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	991
		NO. 13 POSITION		Displays position No.13 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	992
		NO. 14 POSITION		Displays position No.14 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	993
		NO. 15 POSITION		Displays position No.15 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	994
		NO. 16 POSITION		Displays position No.16 of measurement taken during density profile.	0 mm	Display	0 - 99999.9 mm	995

14 Appendix

14.1 RS 485 MODBUS (COM- 5) Terminator

Terminator Switch Setting Procedure

1. RS- 485 Communication Module until 2008

Set all slide switch (four bits) turn to ON when termination is required.

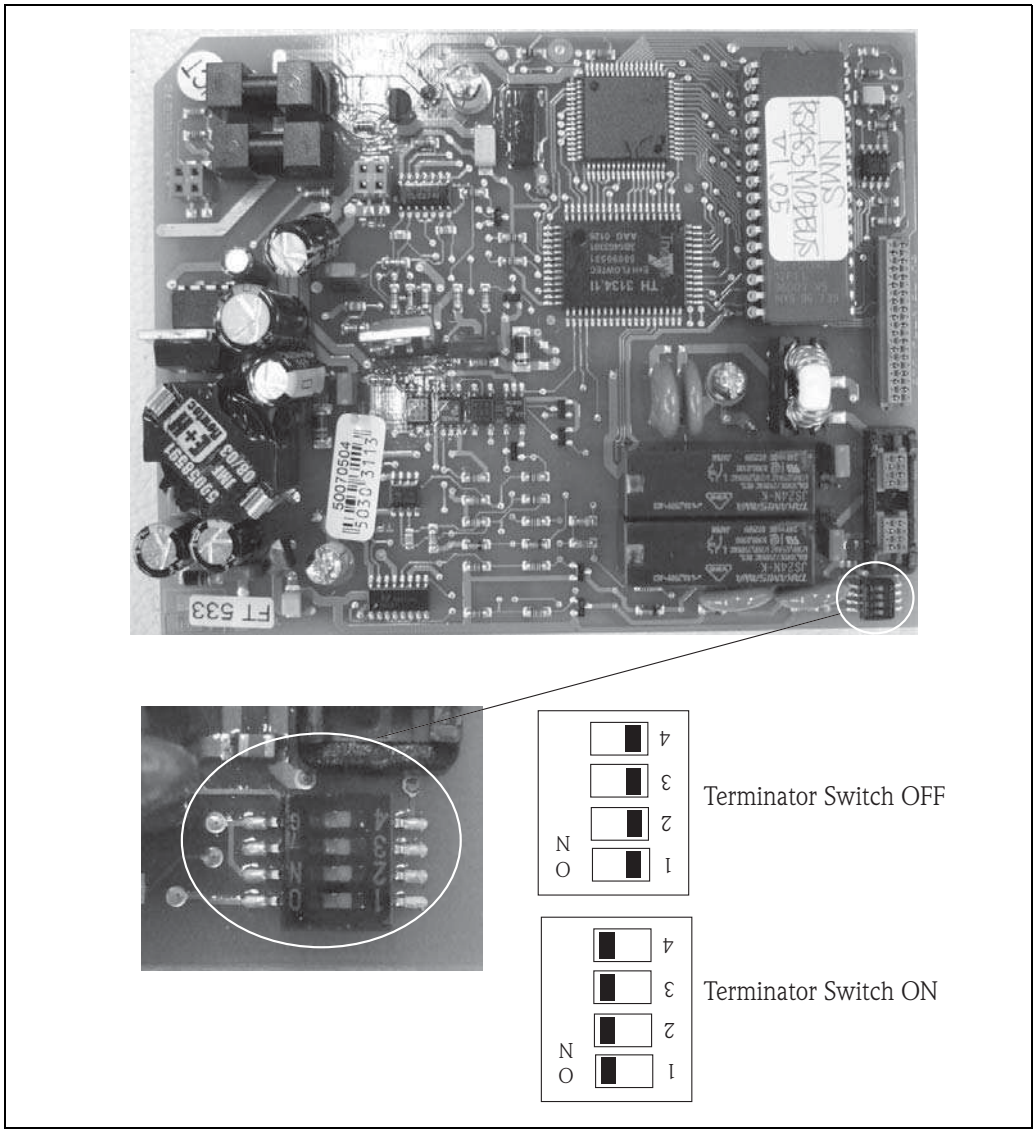


Figure 105:RS-485 Communication Module

2. COMM-5 RS- 485 Communication Module from 2009

Set piano type switch S1-1, S2-3, S2-4 to ON (UP) when termination is required.

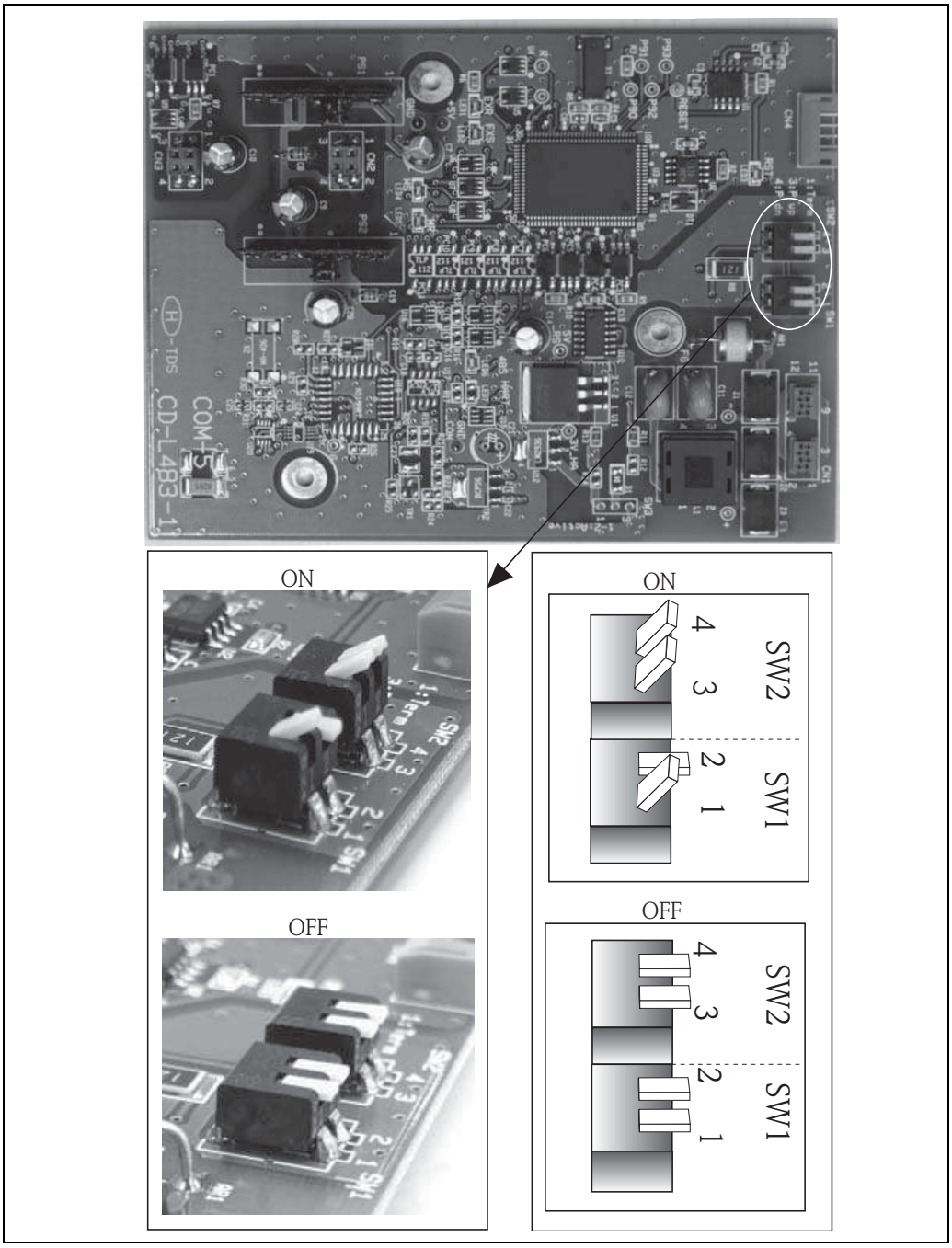


Figure 106:COM-5 RS-485 Communication Module

14.2 Measurement Wire Replacement

Procedure for Winding Wire onto Wire Drum

1. Prepare a box with approx. 300mm(w) × 300mm(d) × 50mm(h) for wire storing.
2. Take out the measurement wire from the plastic bag.
3. Put the wire into the box without twisting.
4. Put one end of the wire into a hole on the wire drum groove.
5. Fix the end of the wire by a screw.
6. Sit down on a chair.
7. Grasp the wire drum by left hand and hold the wire by left thumb.
8. Hold the wire by right thumb and index finger.
9. Make tension to secure the wire, so as not to come out of the groove.
10. Rotate the wire drum to wind the wire into groove with holding by left thumb.

This completes the winding wire onto wire drum procedure.

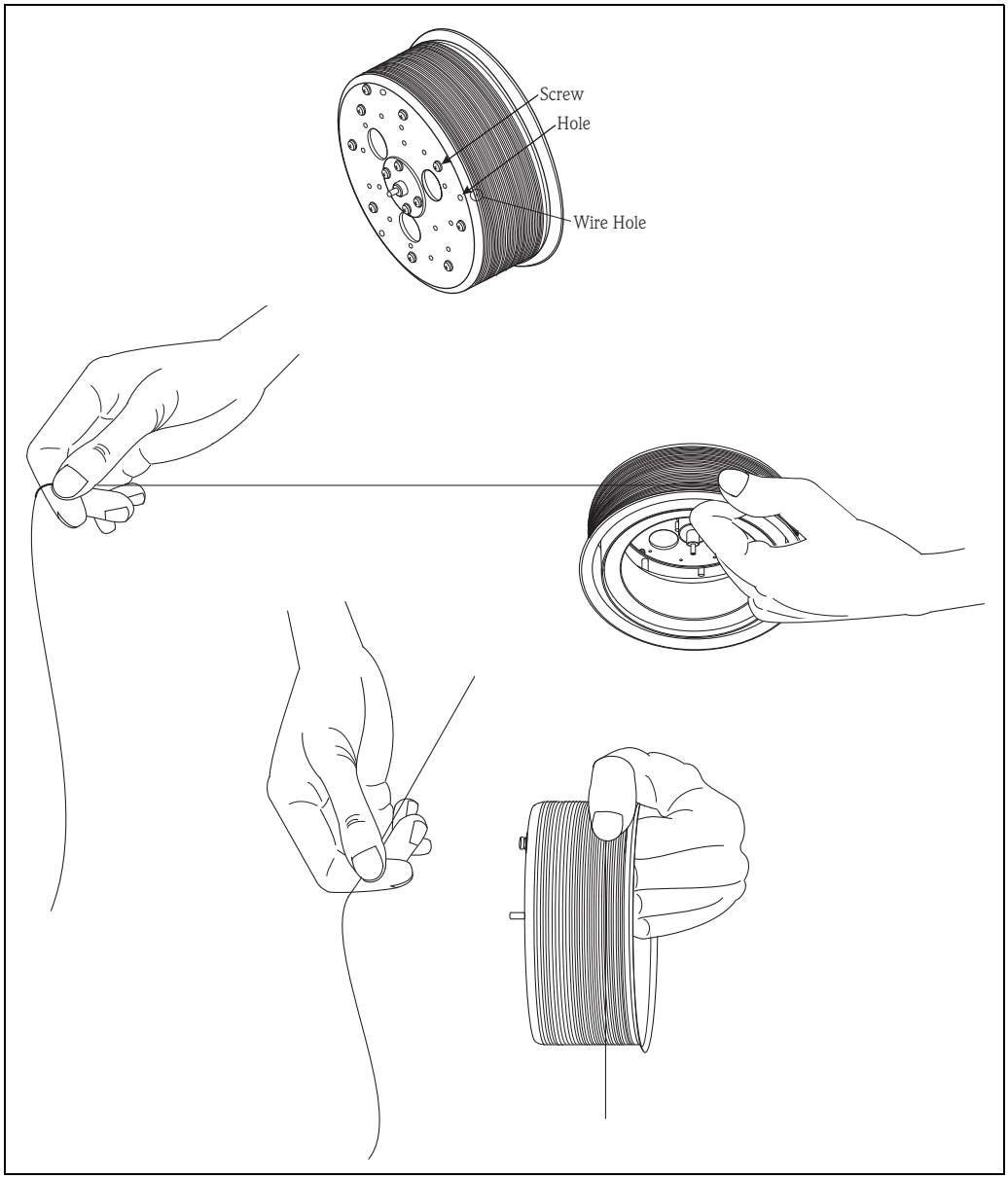


Figure 107:Measuring Wire

Fixing Wire Procedure

1. Put the wire drum on the desk and fix the wire by masking tape remaining 500mm wire.

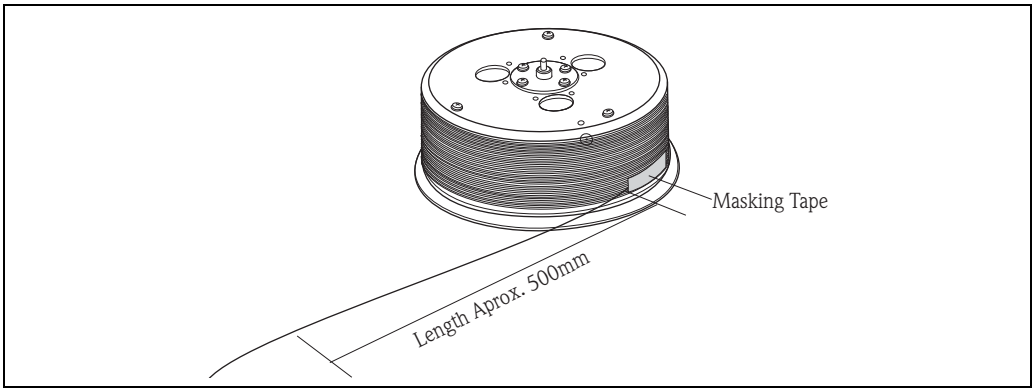


Figure 108:Wire and Wire Drum

2. Wind the wire toward the wire drum 2 times around the ring.
3. Wind the wire 10 times.
4. Keep a space as the triangle shape and wind the wire 10 times toward arrow A.
5. Wind the wire 10 times toward arrow B.
   - Keep a certain amount of tension to the ring.
6. Wind the wire 10 times again.
7. Wind the wire 10 times toward arrow C.
8. Wind the wire 10 times toward arrow D.
   - Leave the wind approximately 100mm to 200mm to mount it on the displacer.

This completes the fixing wire procedure.

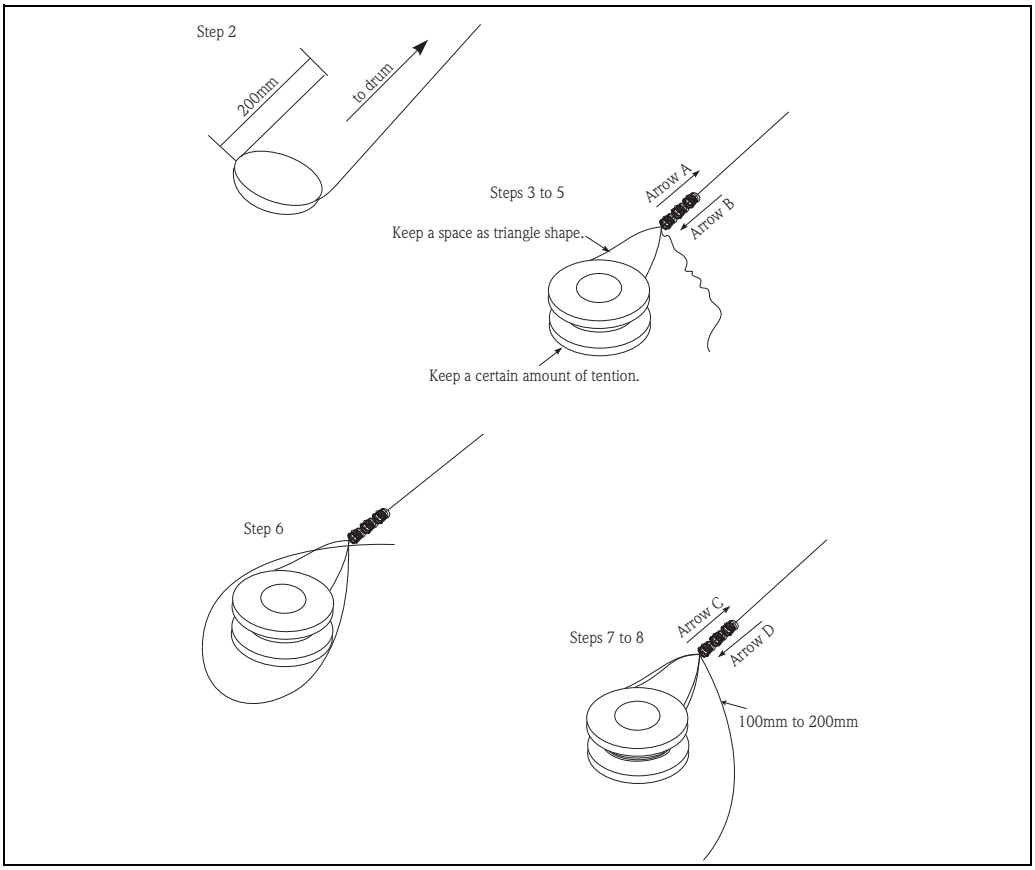


Figure 109:Fixing Wire

14.3 Displacer

14.3.1 Displacer Installation

Installation Procedure

1. Mount the displacer on the wire ring.
2. Wind the securing wire on the ring.
3. Wind the ground wire between washers twice.
4. Secure the nut with a wrench.

This completes the displacer installation procedure.

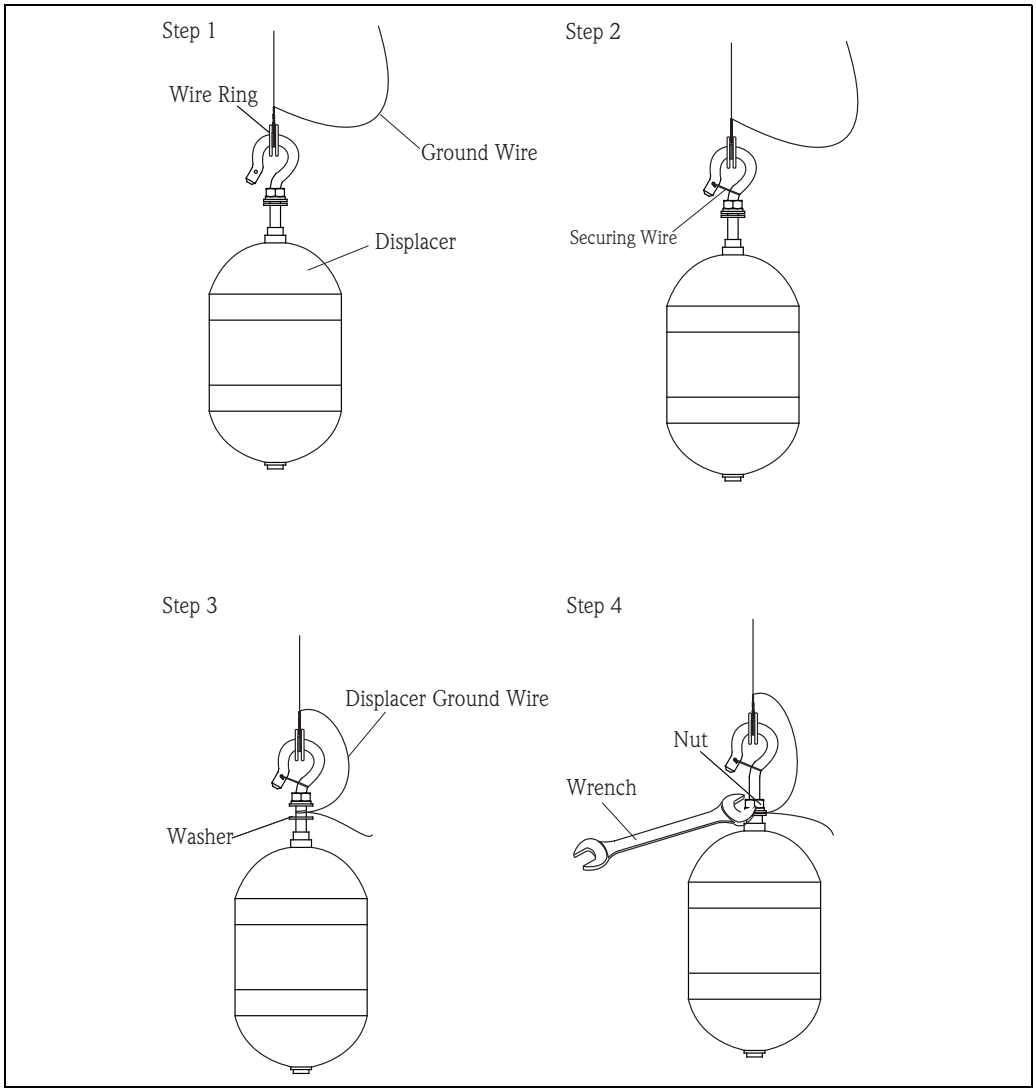


Figure 110:Displacer

14.3.2 PTFE Displacer Installation

Installation Procedure

1. Remove the screw using a flathead screwdriver.
2. Mount the displacer on the teflon-ring.
3. PTFE Wire: Install the ground wire of the displacer from the wire insertion slot until the ground wire touches to the wall of the screw hole.
4. SUS Wire: Install the ground wire of the displacer from the wire insertion slot until the ground wire touches to the wall of the screw hole. Then install the ground wire 10mm farther.
5. Tighten the screw.
   - Hold the ground wire with finger tip so that the wire does not come out from the slot.
6. Lift the displacer using the flathead screwdriver and confirm that the ground wire does not come out from the slot.

This completes the installation procedure.

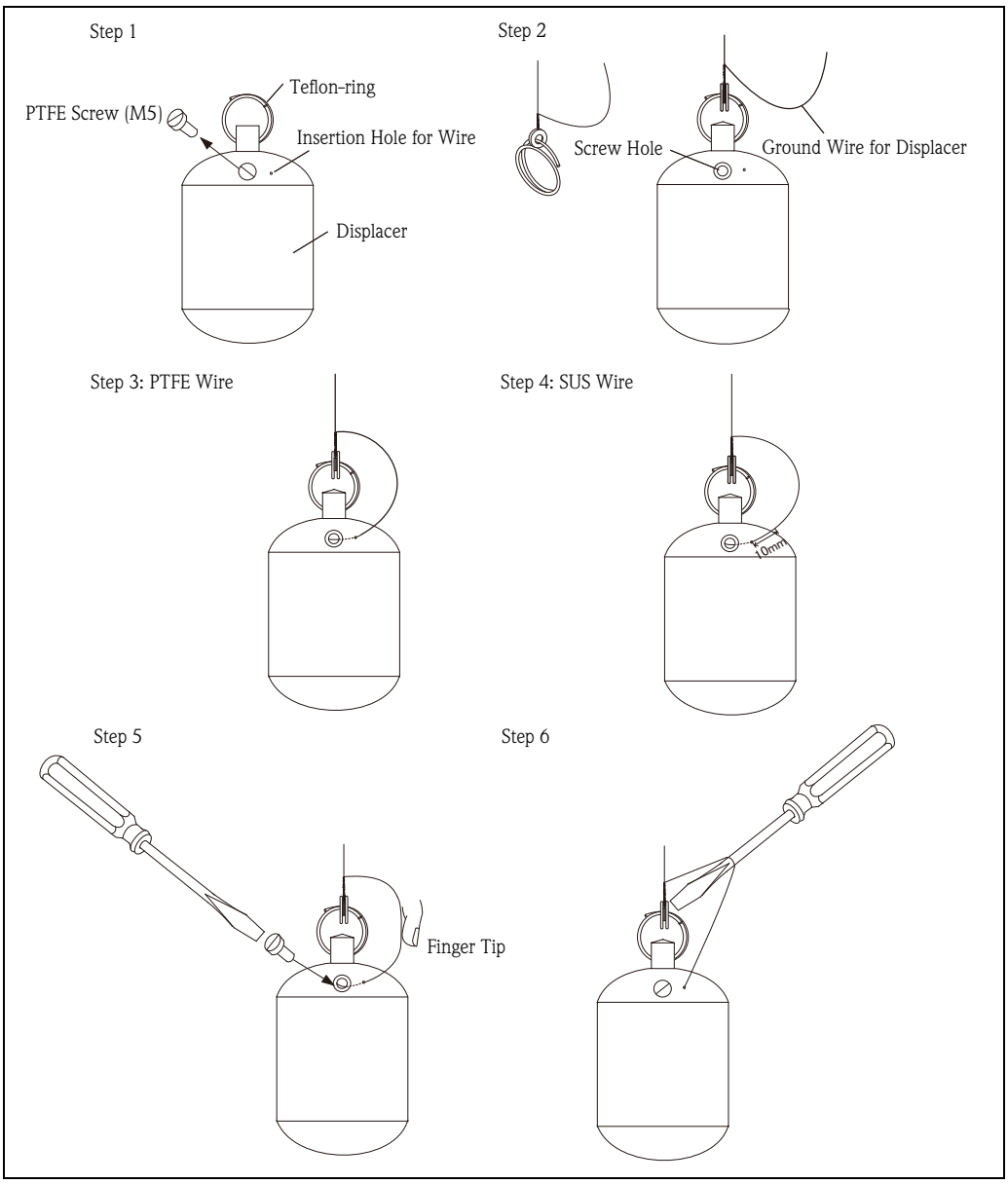


Figure 111:PTFE Displacer

14.3.3 Displacers

Actual draft position may change slightly with tank parameters.

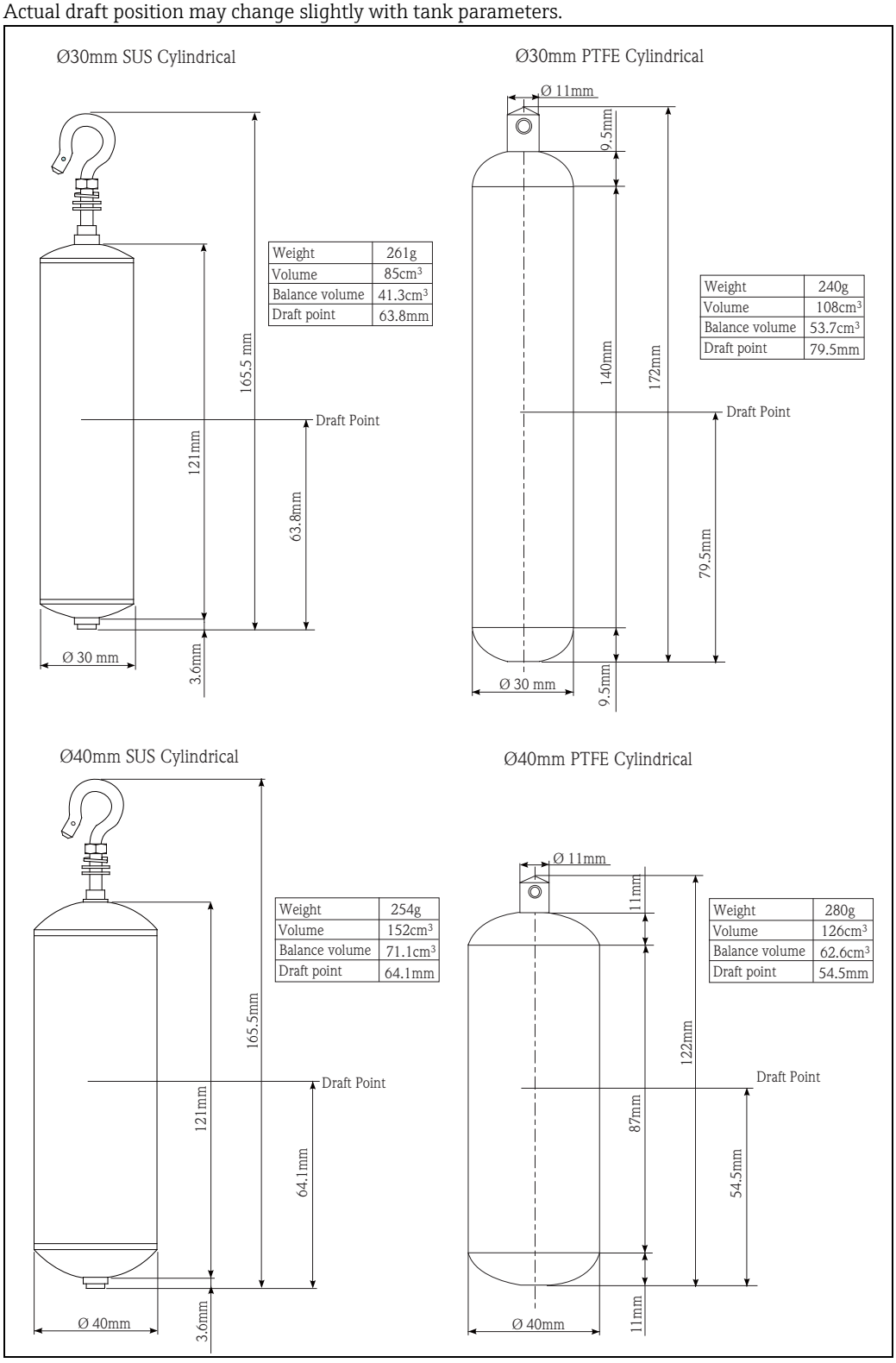


Figure 112:Dimension of Displacer 1

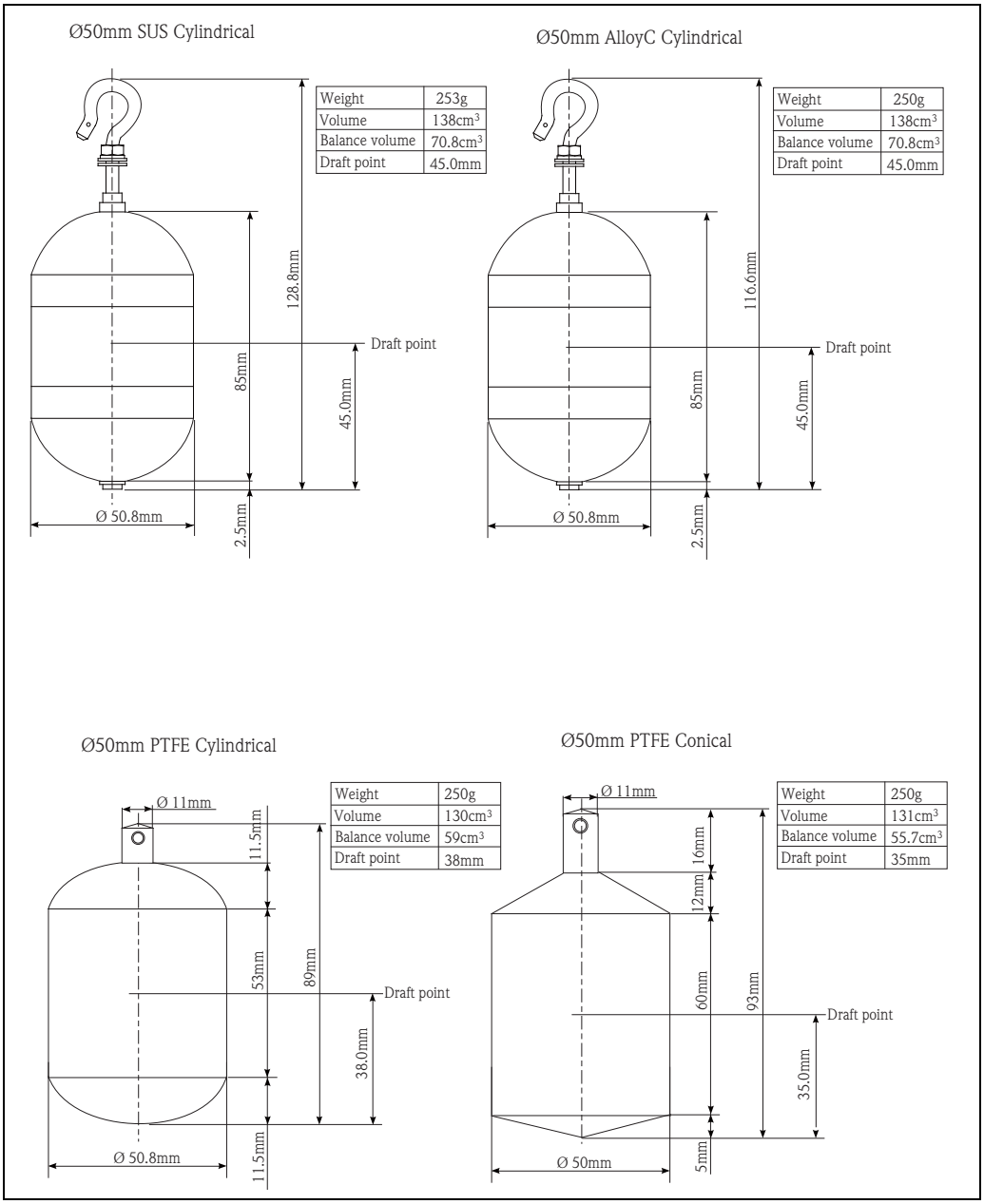


Figure 113:Dimension of Displacer 2

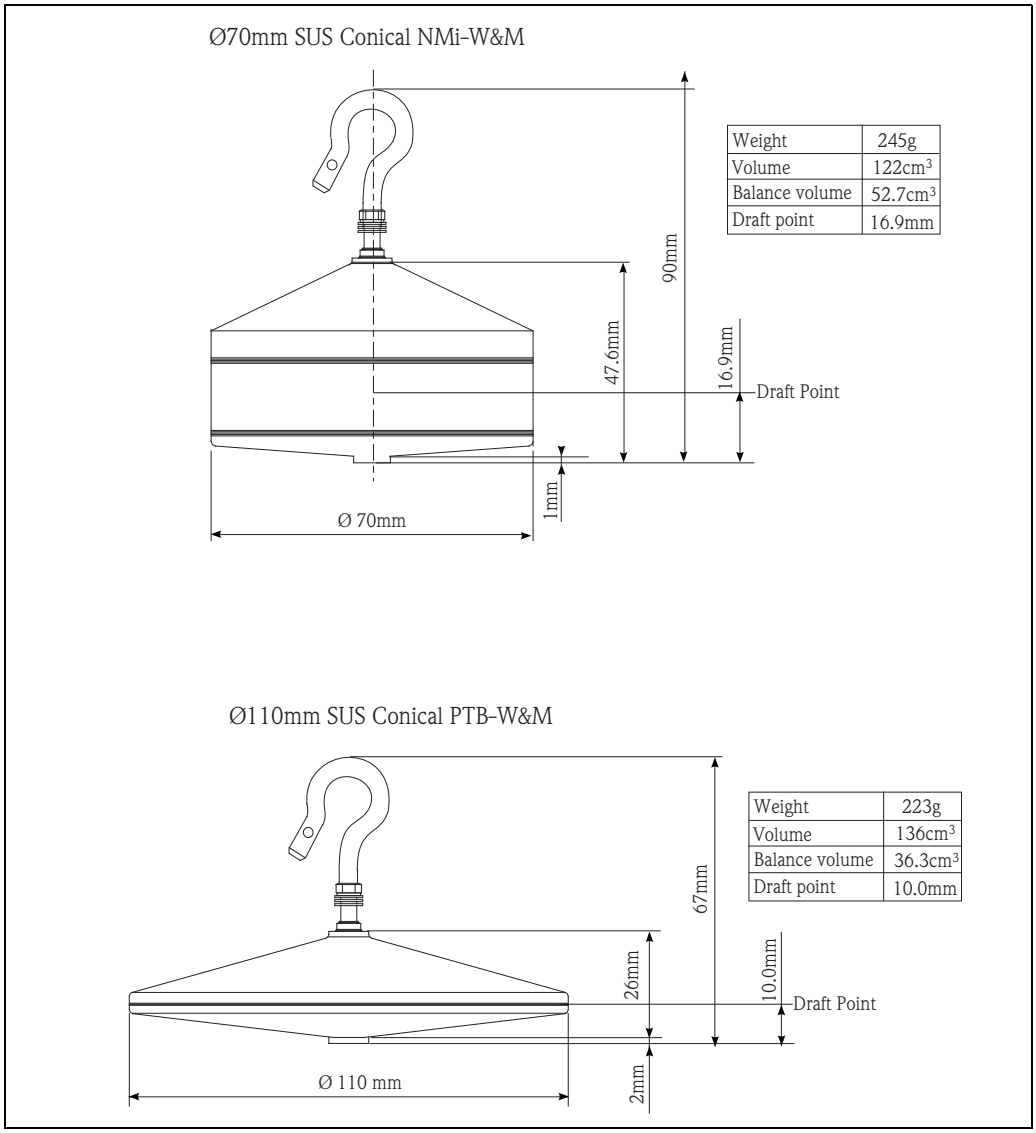


Figure 114:Dimension of Displacer 3

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Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐

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Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System** / Einsatz als SIL Gerät in Schutzeinrichtungen

Process data/Prozessdaten
Temperature / Temperatur_____ [°F] _____ [°C]
Pressure / Druck _____ [psi] _____ [Pa]
Conductivity / Leitfähigkeit _____ [µS/cm]
Viscosity /Viskosität _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium



	Medium /concentration Medium /Konzentration	Identification CAS No.	flammable entzündlich	toxic giftig	corrosive ätzend	harmful/ irritant gesundheits-schädlich/ reizend	other * sonstiges*	harmless unbedenklich
Process medium / Medium im Prozess								
Medium for process cleaning / Medium zur Prozessreinigung								
Returned part cleaned with / Medium zur Endreinigung								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* explosive;brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / Fehlerbeschreibung _____

_____

_____

Company data / Angaben zum Absender

Company /Firma _____

_____

Address / Adresse

_____

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Phone number of contact person / Telefon-Nr. Ansprechpartner:

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Fax / E-Mail _____

Your order No. / Ihre Auftragsnr. _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

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