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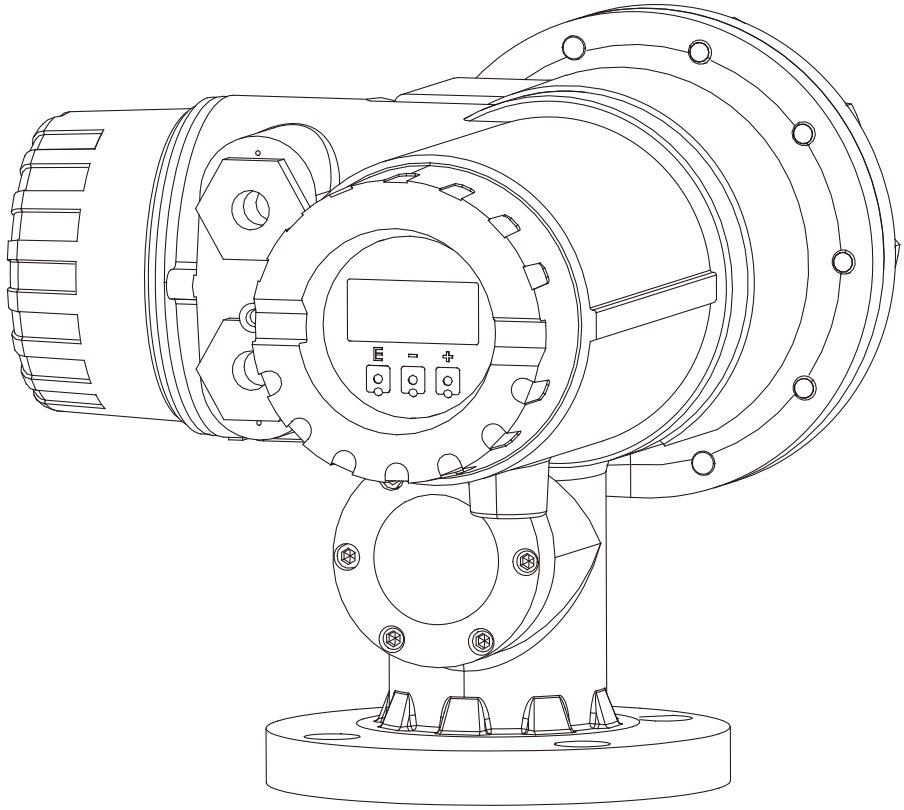
Operating Instruction
Proservo NMS7

Intelligent Tank Gauge



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1 Safety Instructions

1.1 Designated Use

Proservo NMS7 of intelligent tank gauge is designed for high-accuracy liquid level measurement in storage and process applications.
NMS7 performs the tank inventory management, loss control, total cost saving, and safe operation.
NMS7 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} ~10^{-8}	≥2	≥3	≥10	≥30
10^{-14}~10^{-12}	≥4	≥5	≥60	≥120
$\leq 10^{-14}$	≥10	≥10	≥120	≥240

(Japan National Institute of Occupational Safety and Health)

⚠ CAUTION

When NMS7 is not used for a long period due to opening a tank or tank rest, return the displacer to the original position and turn off the main power of NMS7.

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

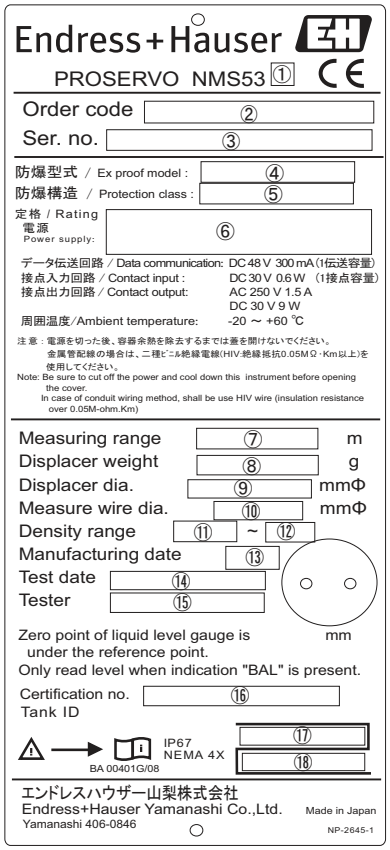
Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Recommendation** Indicates procedures, processes or actions that are recommended.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates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

2 Identification

2.1 Device Designation

2.1.1 Nameplate

The following technical data are given on the instrument nameplate:



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 1: TIIS Approval Type Ex d

2.2 Order Information

010	**Approval:**									
	0	Weather proof, IP67 NEMA4X								
	1	TIIS Ex d IIB T4								
	9	Special version, TSP-no. to be spec.								
020		**Application:**								
	A	Liquid level								
	B	Liquid level, I/F level, density								
	C	CIP liquid level								
	D	CIP liquid level I/F level density								
	Y	Special version, TSP-no. to be spec.								
030			**Output 1:**							
		F	Not selected							
		A	2-way 2-wire (V1 protocol)							
		B	2-way 2-wire (BBB protocol)							
		C	2-way 2-wire (MIC, RS232C protocol)							
		D	2-way 2-wire (MIC protocol)							
		J	2-way 2-wire (MDP 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.							
040						**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			
						5	4 x relay SPST, 1 x 4 - 20mA			
						9	Special version, TSP-no. to be spec.			
050							**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	1x status, 1x spot temperature Pt100, 2x operation contact, HART (NRF560, pressure transmitter)		
							9	Special version, TSP-no. to be spec.		
060								**Measuring Range; wire:**		
								B	0-16m; SUS316, 0.2mm	
								D	0-16m; PFA>SUS316, 0.4mm	
								E	0-22m; SUS316, 0.2mm	
								Y	Special version, TSP-no. to be spec.	
070									**Cable Entry:**	
									A	4x thread G1/2
									B	4x thread G3/4
									C	4x thread NPT1/2
									D	4x thread NPT3/4
									G	4x thread M20
									H	4x thread M25
									Y	Special version, TSP-no. to be spec.
NMS7-										**Product designation (Continued on next page)**

080		**Process Connection:**
	A	10K 80A RF, SUS304 flange JIS B2220
	B	10K 80A FF, SUS304 flange JIS B2220
	C	NPS 3" Cl.150 RF, SUS304 flange ASME B16.5
	D	DN80 PN10 B1, SUS304 flange EN1092-1 (DIN2527 B)
	E	80A 150lbs RF, SUS304 flange JPI 7S-15
	Y	Special version, TSP-no. to be spec.

90		**Power Supply**
	0	85 - 264 VAC, 50/60 Hz
	1	20 - 62 VDC, 20 - 55 VAC, 50/60 Hz
	9	Special version, TSP-no. to be spec.

100		**Displacer:**
	A	Cylindrical 50mm, SUS316 polished
	B	Cylindrical 40mm, SUS316 polished
	C	Cylindrical 30mm, SUS316 polished
	D	Cylindrical 50mm, PTFE
	E	Cylindrical 40mm, PTFE
	F	Cylindrical 30mm, PTFE
	Y	Special version, TSP-no. to be spec.

110		**O-ring; chamber finishing:**
	0	NBR; milled
	1	Silicone rubber; polished
	2	FKM; milled
	5	Silicone rubber; FEP coated
	9	Special version, TSP-no. to be spec.

120		**Nozzle**
	A	Rc3/8, cleaning
	B	NPT3/8, cleaning
	C	G3/8, cleaning
	D	Rc3/8, gas purging
	E	NPT3/8, cleaning
	F	G3/8, gas purging
	G	Rc3/8, cleaning, gas purging
	H	NPT3/8, cleaning, gas purging
	J	G3/8, cleaning, gas purging
	K	G1/2, cleaning
	Y	Special version, TSP-no. to be spec.

130		**Additional Option:**
	A	Not selected
	B	Custody transfer seal, wire lock
	C	Cleaned from oil + grease
	D	Sunshade
	E	Cleaned from Oil + grease, custody transfer seal, wire lock
	F	Sunshade, custody transfer seal, wire lock
	G	Sunshade, cleaned from oil + grease
	H	Sunshade, cleaned from oil + grease, custody transfer seal, wire lock
	Y	Special version, TSP-no. to be spec.

NMS7-	**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 +60°C (-40 to +140°F).

3.2 Terms Related to Tank Measurements

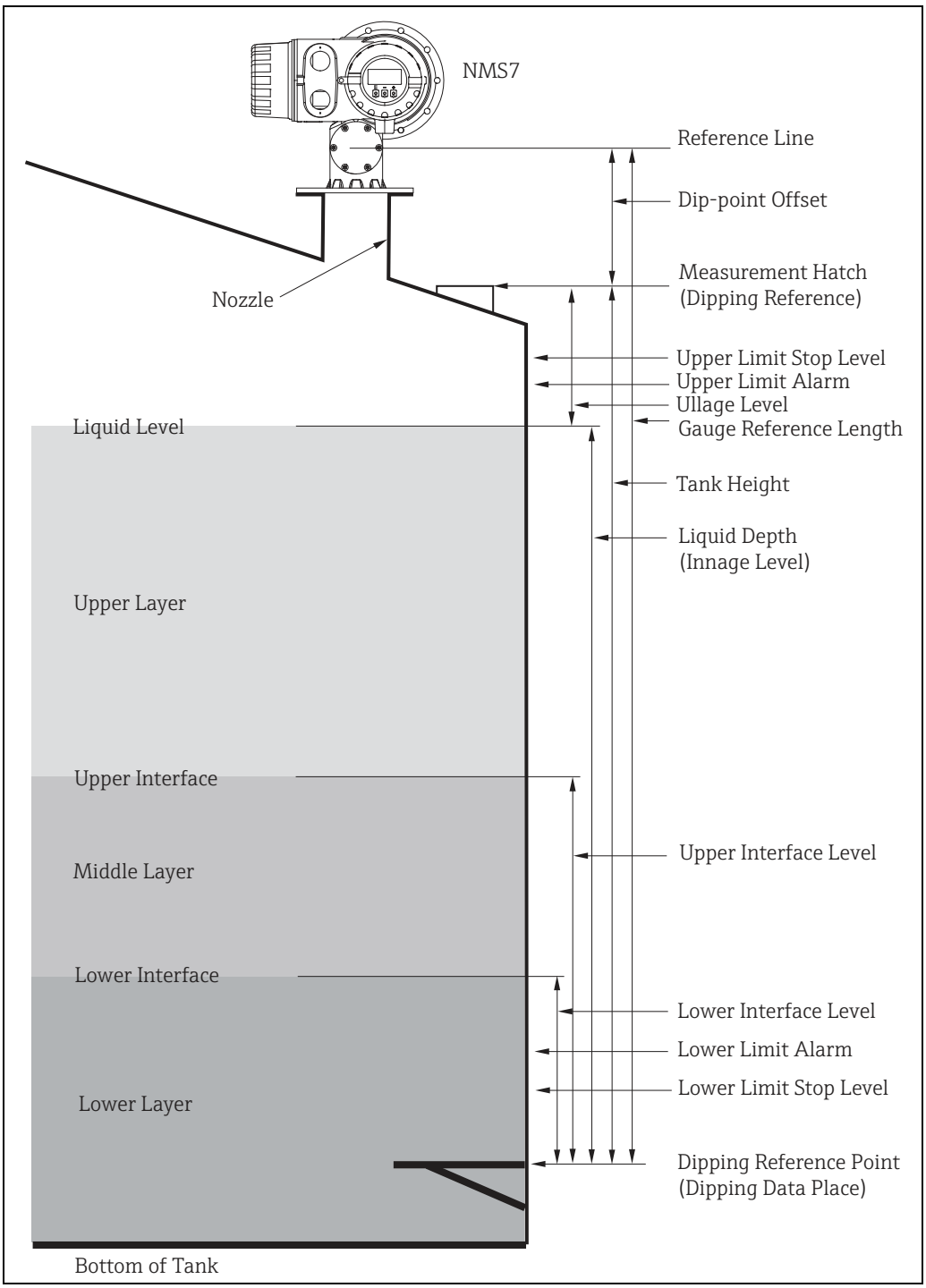
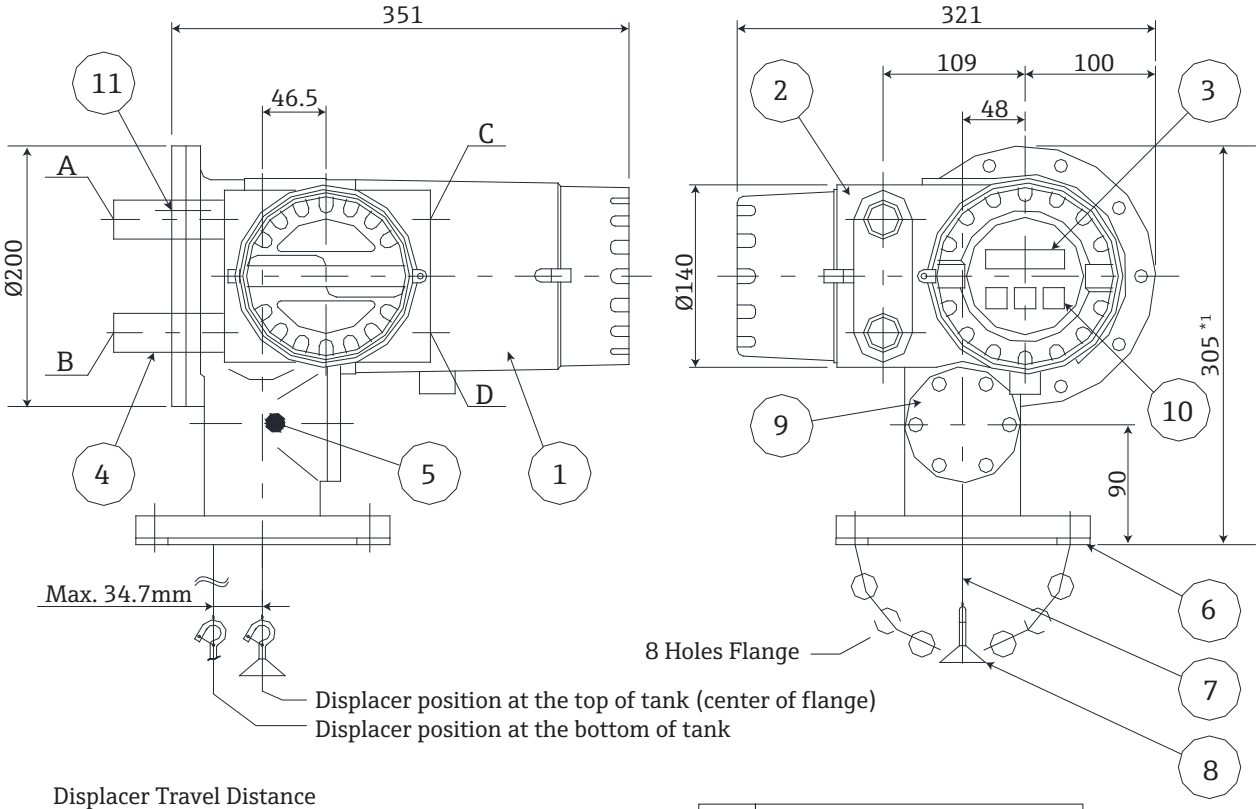


Figure 2: Terms Related to Tank Measurements

3.3 Design and Dimensions



Displacer Travel Distance
16m wire (Ø0.2mm): 25.1mm
16m wire (Ø0.4mm): 34.7mm
22m wire (Ø0.2mm): 34.5mm

①	Electrical Compartment
②	Termnal Box
③	Display (LCD)
④	Cable Entry (A, B, C, D)
⑤	Wire Drum Housing
⑥	Flange
⑦	Measuring Wire
⑧	Displacer
⑨	Window Cover
⑩	Touch Control
⑪	Cleaning Nozzle (Option)

NOTICE

*1 In case of 18mm
(Flange Thickenss) at JIS10K80AFF

Figure. 3: NMS7 Dimension

3.4 Necessary Tools for Installation

The following tools are required when installing NMS7.

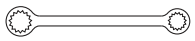
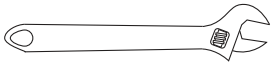
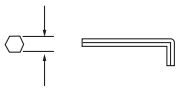
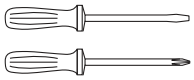
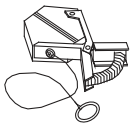
Box End Wrench	 17mm or size appropriate to bolts for flange
Crescent Wrench	 350mm
Allen Wrench (Hex Key)	 3mm and 5mm
Screw Driver ▪ Flat Head ▪ Phillips	
Wire Cutters or Terminal Pliers	
Wire Terminal	 M3 1.25sq, 2.0sq
Water Pump Pliers	
Density Calibration Test Weight	

Figure 4: Tools to Be Prepared

4 Displacer and Measuring Wire

4.1 Shape, Diameter, and Material

4.1.1 Displacer

There are several types of displacer available for NMS7.

- 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 two different materials are provided.

- The standard material is stainless steel SUS316.
- Solid PTFE, however, is not applied for flammable liquids.

4.1.2 Measuring Wire

- The standard material of the measuring wire is stainless steel SUS316L.
- Refer to the separate "Techenical Information TI00006G" for displacer selection information and Appendix "15.3 Displacer" in this chapter.

5 Mounting of NMS7

The following installation procedures are available for NMS7.

- Mounting without guide system.
- Mounting with stilling well

5.1 Application Drawing for Tank

Stilling well is required when strong agitator is used or strong turbulence arises in a tank. If stilling is not used, guide system is not available.

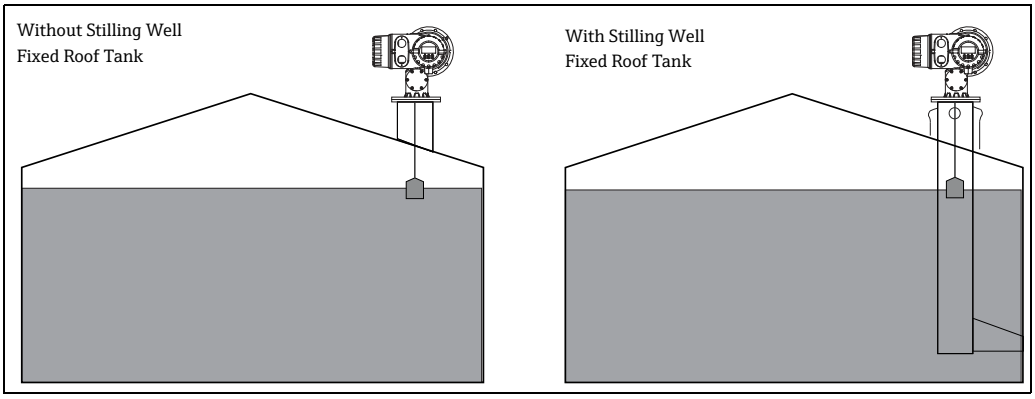


Figure 5: Application for Each Tank

5.2 Mounting without Guide System

NMS7 is mounted on a nozzle of the tank roof without any guide system. The mounting preparations require the observance of some recommendations for setting the nozzle and the minimum measuring level.

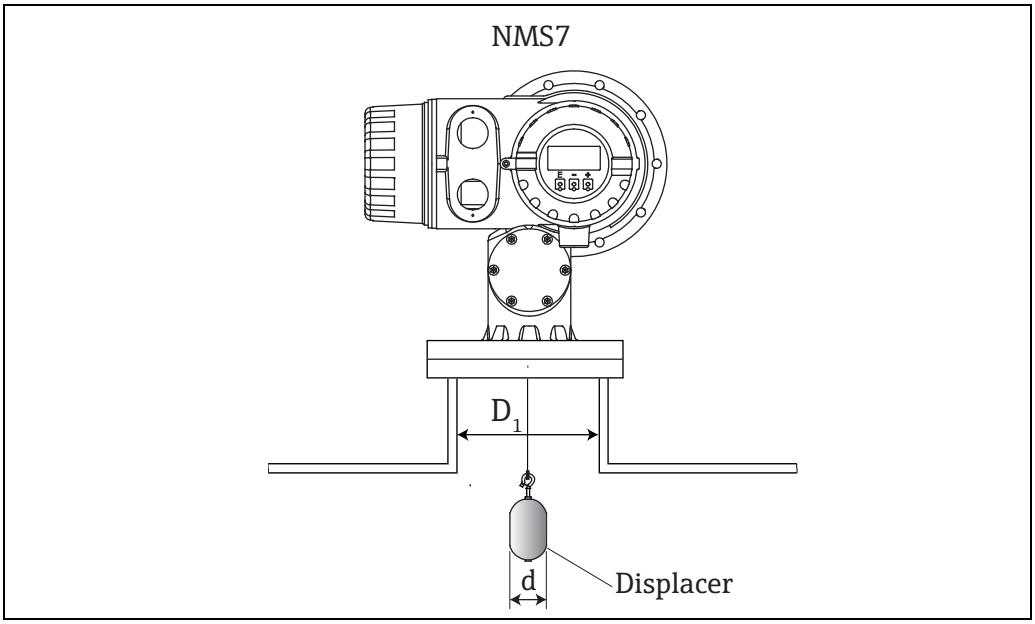


Figure 6: Mounting without Guide System

5.3 Mounting with Stilling Well

Stilling Well Diameter

There are two types of pipes (asymmetric pipe and concentric pipe) for stilling well. Ample thickness is required for the diameter of stilling well so that measuring wire activates correctly.

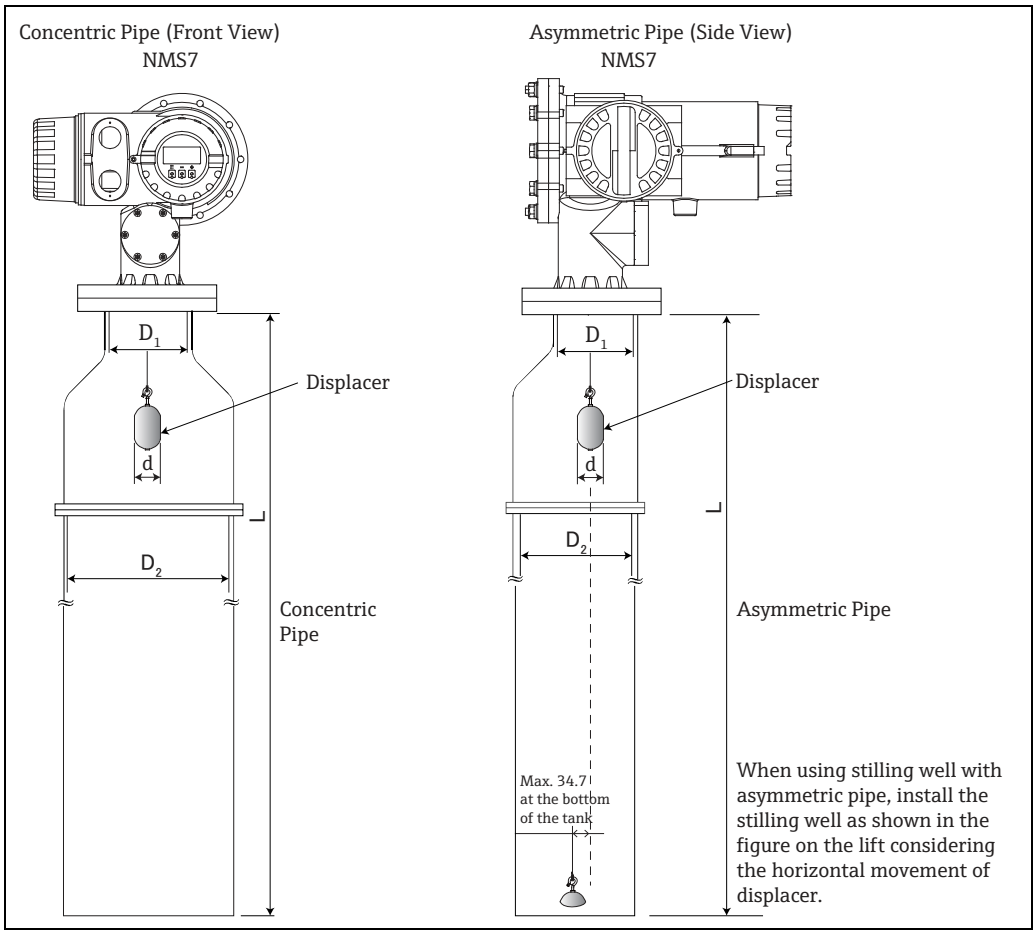


Figure 7: Mounting with Stilling Well, Asymmetric Pipe, and Connection Pipe

⚠ CAUTION

Displacer moves horizontally between the top of the tank and the bottom of the tank.
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 NMS7 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	Horizontal Movement Distance (mm/m)
B	0-16m: SUS316, 0.2mm	1.57
D	0-16m: PFA>SUS316, 0.4mm	2.17
E	0-22m: SUS316L, 0.2mm	1.57

- Upper Diameter of Stiiling Well

$$D_1 > d + 10mm$$

D_1 should be 3” or more.

- Lower Diameter of Stilling Well

- Asymmetric Pipe

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

- Concetric Pipe

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

Recommendations for Mounting Stilling Well

⚠ CAUTION

Follow the recommendations for mounting NMS7 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.
- Keep the pipe as perfectly vertical as possible. Check this by a plumb.
- Set the center of the lower part of the asymmetric pipe to the direction of the displacer motion.
- Confirm grounding between NMS7 and tank nozzle.

5.4 Type of Tanks

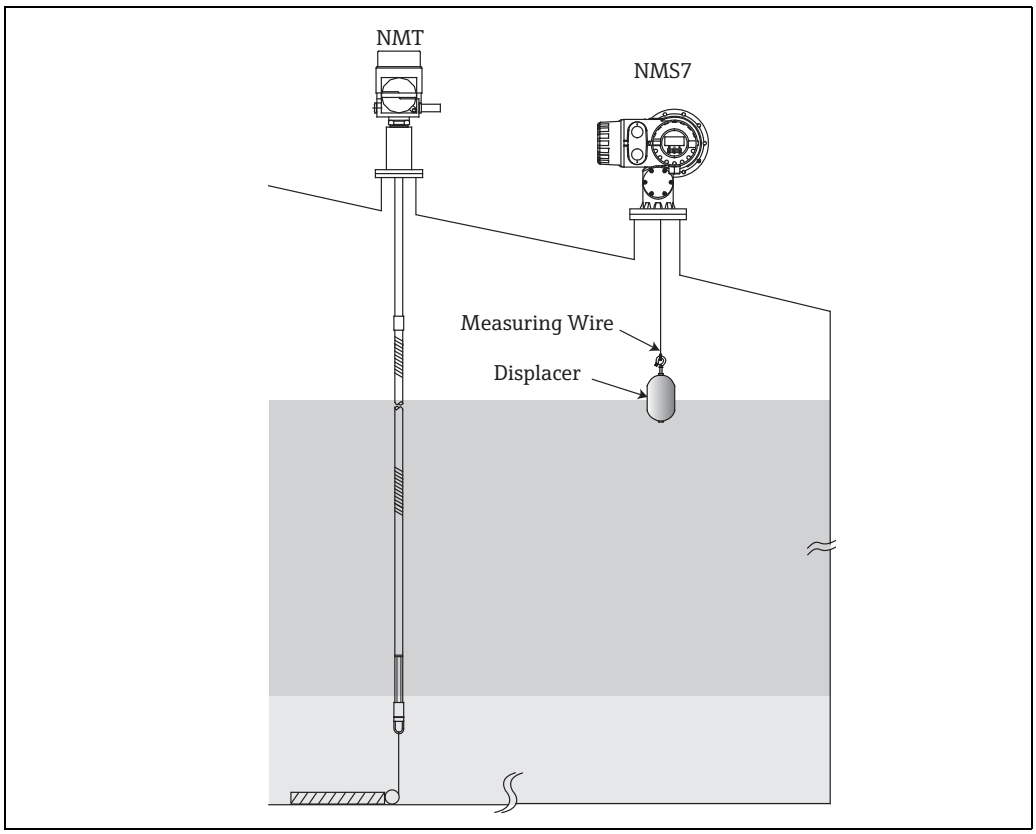


Figure 8: Fixed Roof Tank 1

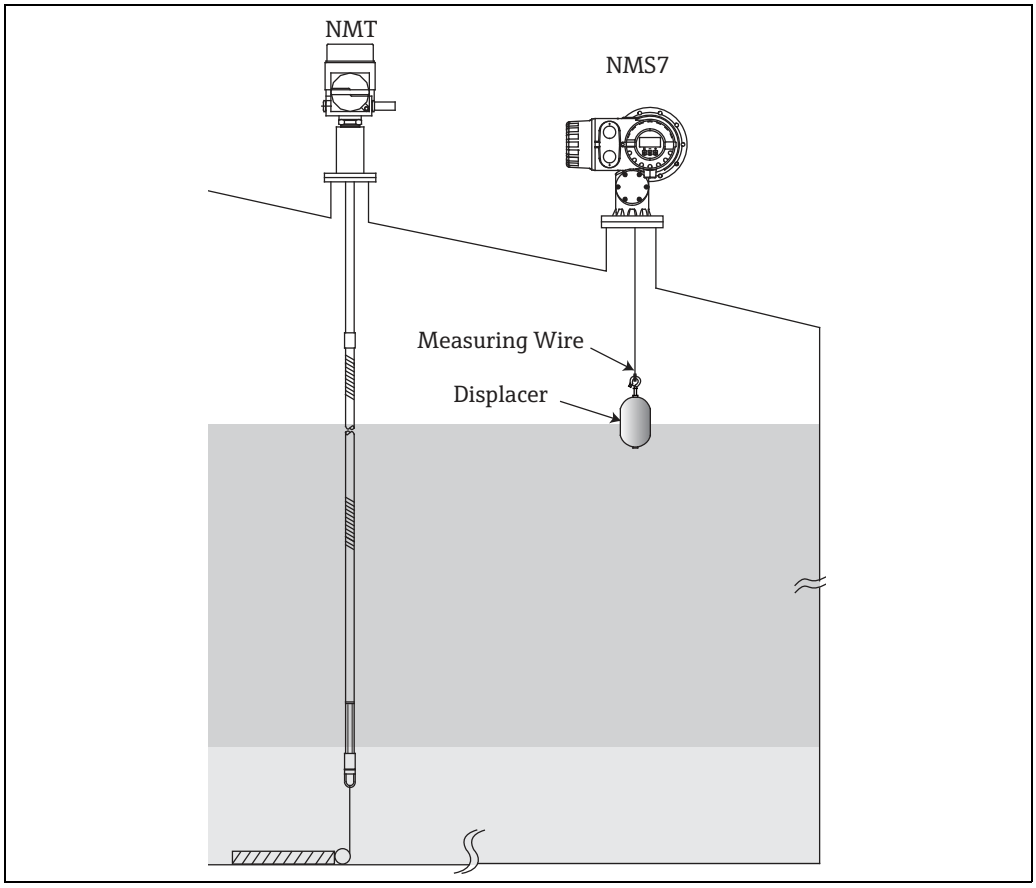


Figure 9: Fixed Roof Tank 2

5.5 Preparation for Mounting of NMS7

5.5.1 Flange

A nozzle and a flange should be prepared prior to mounting NMS7 on the tank. The flange size and the rating of NMS7 vary depending on the customer's specifications. The standard size of flange is 80A (3").

⚠ CAUTION

- Check the flange size of NMS7.
- 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 NMS7 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.

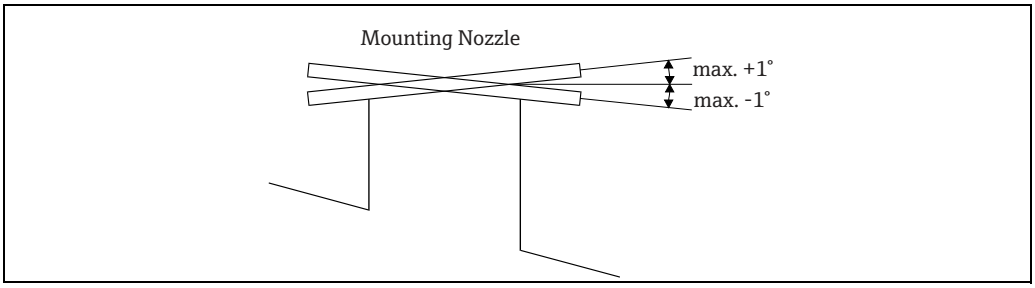


Figure 10: Allowable Inclination of Mounting Flange

⚠ CAUTION

When NMS7 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.

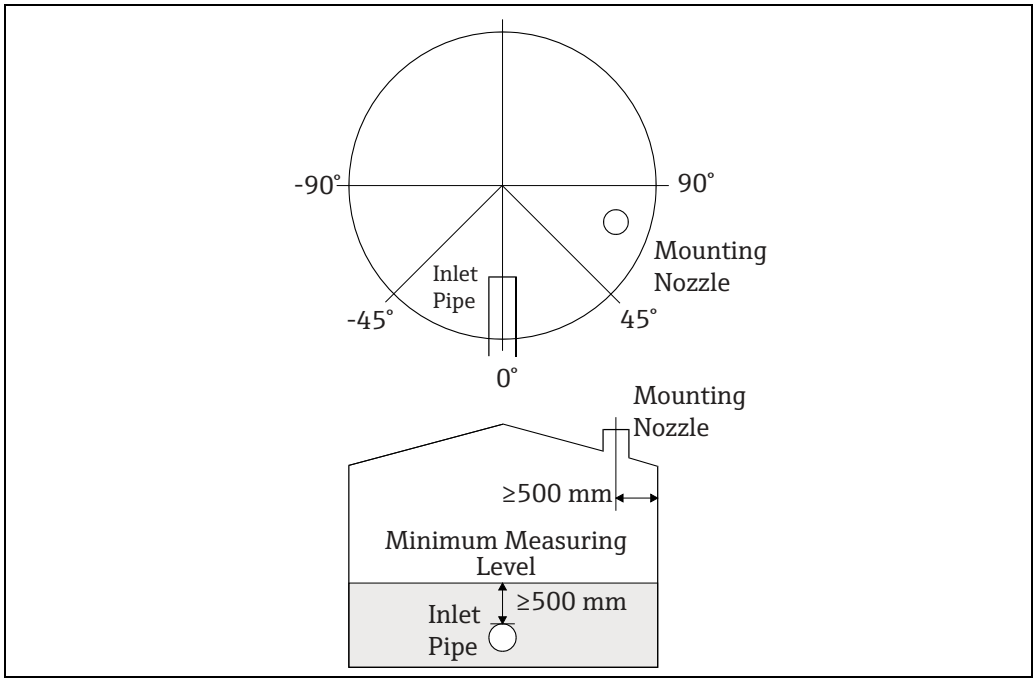


Figure 11: Recommended Setting of Mounting Nozzle and Minimum Measuring Level

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.

5.6 Electrostatic Charge

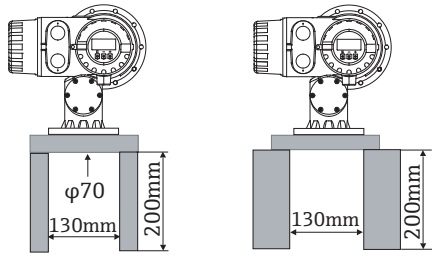
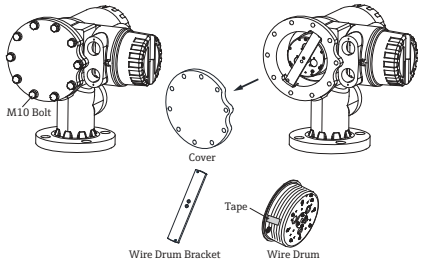
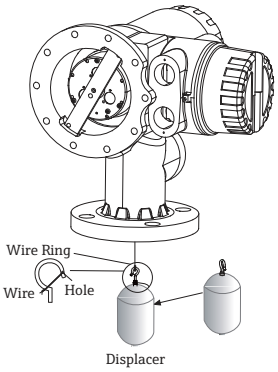
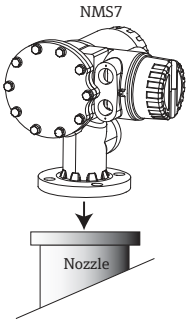
CAUTION

When liquid measured by NMS7 has a conductivity at 10^{-8} s/cm or less, it is quasi-non conductive. In this case, using a stilling well 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).

5.7 Installation for Wire Drum and Displacer

When NMS7 is delivered, displacer shipped separately. It is necessary to install the displacer in the measuring wire inside NMS7. Follow the instructions below.

5.7.1 Install Displacer prior to Installing NMS7 on Tank

Figures	Procedure	Notes
 Figure 12: Displacer Installation - 1A	1. Put NMS7 on the blocks or a pedestal. 2. Confirm that there is enough space under NMS7.	▪ Be careful not to drop NMS.
 Figure 13: Displacer Installation - 2A	3. Remove M10 bolts of the cover. 4. Remove the wire drum cover and bracket. 5. Remove the wire drum from the package. 6. Remove the tape of the measuring wire. 7. Mount the wire drum, the wire drum bracket, and the cover again.	▪ Handle the measuring wire with care.
 Figure 14: Displacer Installation - 3A	8. Rotate the wire drum clockwise until the measuring wire ring appears out side the flange. 9. Remove the blind window. 10. Hook the displacer on the wire ring. 11. To secure the displacer to the measuring wire, wind the attached wire onto the wire ring through the wire ring hole. 12. Rotate the wire drum counterclockwise until measuring wire ring appears in the blind window.	▪ Wire drum rotates every one-fifth revolution. ▪ Displacer moves 300mm each one revolution.
 Figure 15: Displacer Installation - 4A	13. Mount NMS7 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.

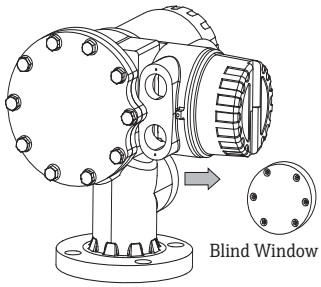
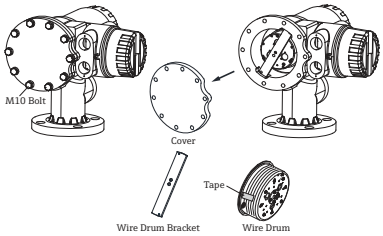
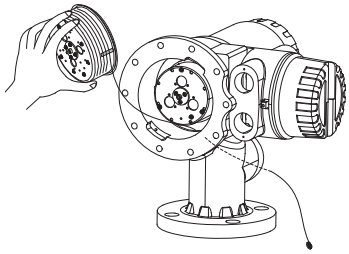
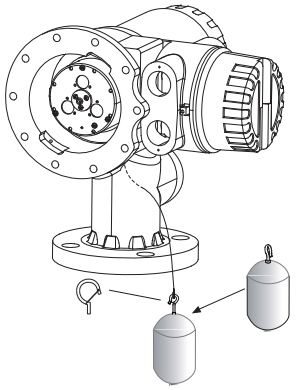
5.7.2 Install Displacer after Installing NMS7 on Tank

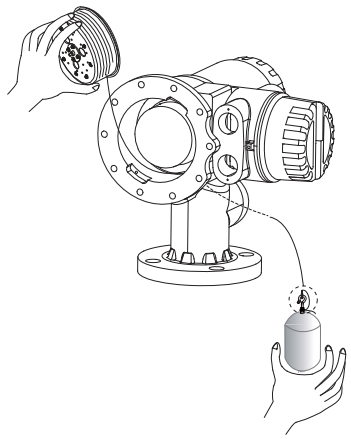
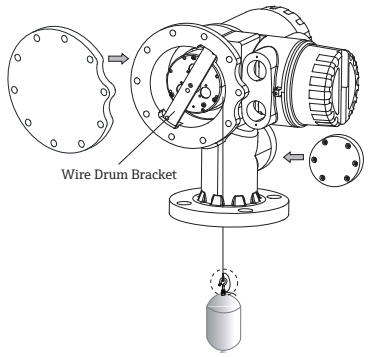
In the case of the diameter 50mm displacer, the displacer can be installed from the blind window.

⚠ CAUTION

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

- Except Ø50mm, SUS cylindrical displacer
- Except 0.2mm, SUS measuring wire

Figures	Procedures	Notes
 Figure 16: Displacer Installation - 1B	1. Remove the blind window cover.	
 Figure 17: Displacer Installation - 2B	2. Remove M10 bolts of the cover. 3. Remove the wire drum cover and bracket. 4. Remove the wire drum from the package. 5. Remove the tape of the measuring wire.	▪ Handle the measuring wire with care.
 Figure 18: Displacer Installation - 3B	6. Hold the wire drum by using single hand and drop the measuring wire down at approximately 50cm. 7. Secure the measuring 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 blind window.	▪ Handle the measuring wire with care.
 Figure 19: Displacer Installation - 4B	10. Insert the wire drum temporarily into the drum housing. 11. Hook the displacer on the wire ring. 12. To secure the displacer to the measuring wire, wind the attached wire onto the wire ring through the wire ring hole.	▪ Handle the measuring wire with care. It may cause damage by kink.

Figures	Procedures	Notes
 Figure 20: Displacer Installation - 5B	13. Hold the wire drum and the displacer by hands. 14. Remove the wire drum from the drum housing and drop the measuring wire down approximately 50 cm. 15. Hold the wire drum up and place the displacer into the calibration window. 16. Hold the displacer at center of calibration window. 17. Hold other hand (wire drum) up and add tension to measuring wire not to drop displacer down rapidly.	
 Figure 21: Displacer Installation - 6B	18. Release the hand from the displacer. 19. Remove the tape from the wire drum. 20. Insert the wire drum into the drum housing. 21. Set the wire drum bracket. 22. Rotate the wire drum with the hand a couple of times and check that the displacer does not touch inside the nozzle. 23. Pull the ring of the measuring wire up so that it can be seen from the calibration window. 24. Replace the covers of the wire drum and the calibration window.	▪ Wire drum rotates every one-fifth revolution. ▪ Confirm that the measuring wire is wrapped correctly in grooves before turning on the power. ▪ If not, rewind the wire correctly in grooves.

6 Wiring

6.1 Wiring Connection

The electrical connections of NMS7 are shown in 6.2 Terminal Assignment.

⚠ 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 NMS7 is 50 VA.

⚠ WARNING

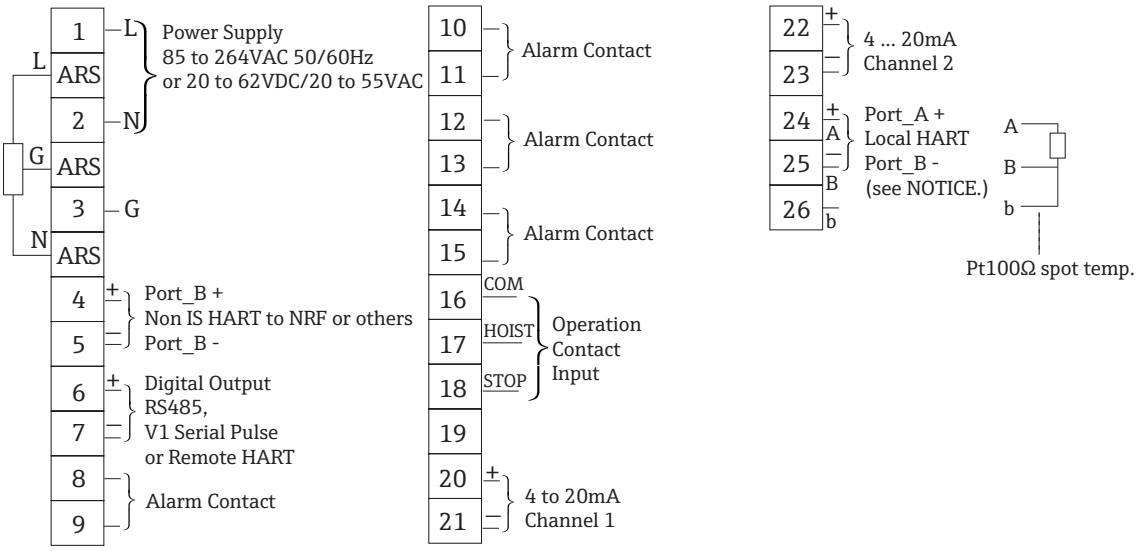
- Connect the ground terminal to the ground line inside or outside the terminal box.
- Use a wire 4mm^2 or more for ground.
- Use cables and wires of sufficient and appropriate size and length to make a solid connection at each terminal required.

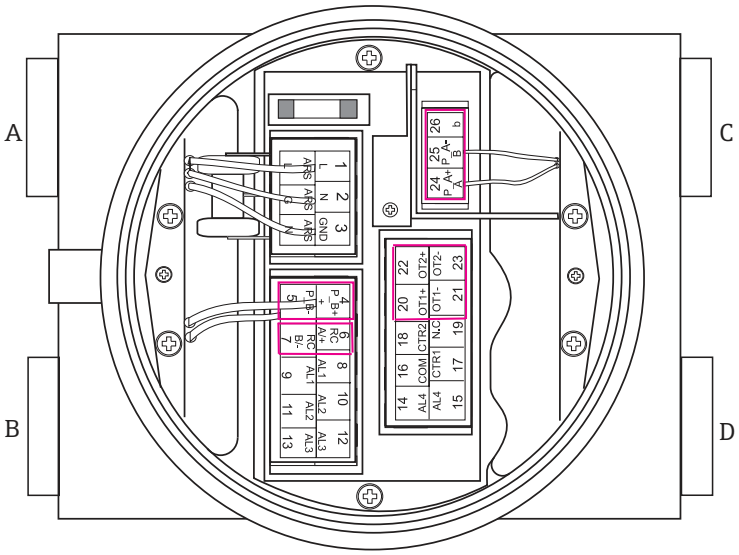
⚠ DANGER

- 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.

6.2 Terminal Assignment

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





NOTICE

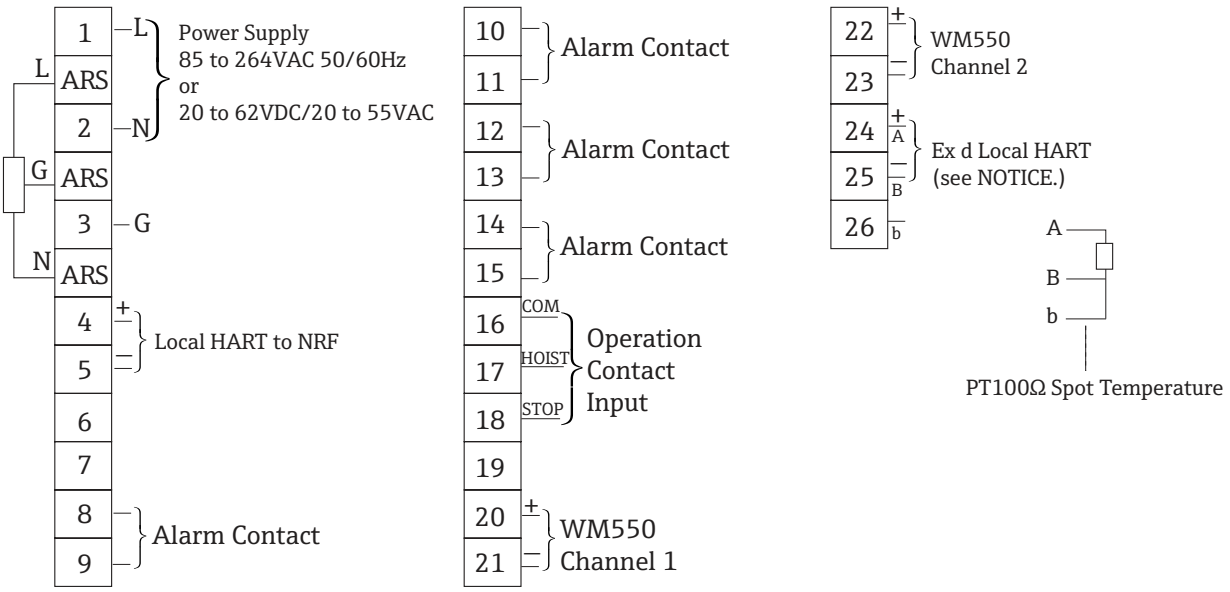
Cable Entry Descriptions	
A	Power Supply
B	Ex d local (slave) HART Terminals: 4 &5 Digital Output: Terminals 6 & 7 V1 Serial Pulse, Modbus (RS485) HART, Enraf BPM
C	Ex d local (slave) HART, or Pt100 3 wire spot RTD Terminals: 24 & 25
D	4 to 20mA Output: Terminals 20 & 21, 22 & 23 ⚠ CAUTION Terminals 22 & 23 will be used as “Status 1 Input” when signal input from field unit (Order code position 60) is: Order Information: 050 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

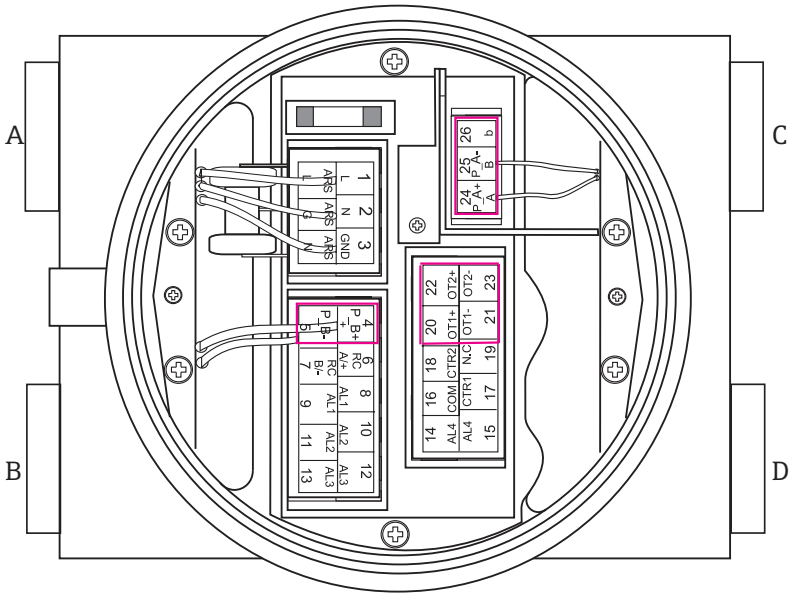
NOTICE

- 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.

Figure 22: Wiring Sample 1

6.2.2 Whessoe Matic 550





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 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 used by WM550 terminal connection, 4 - 20mA output and status 1 input function are no longer available.

NOTICE

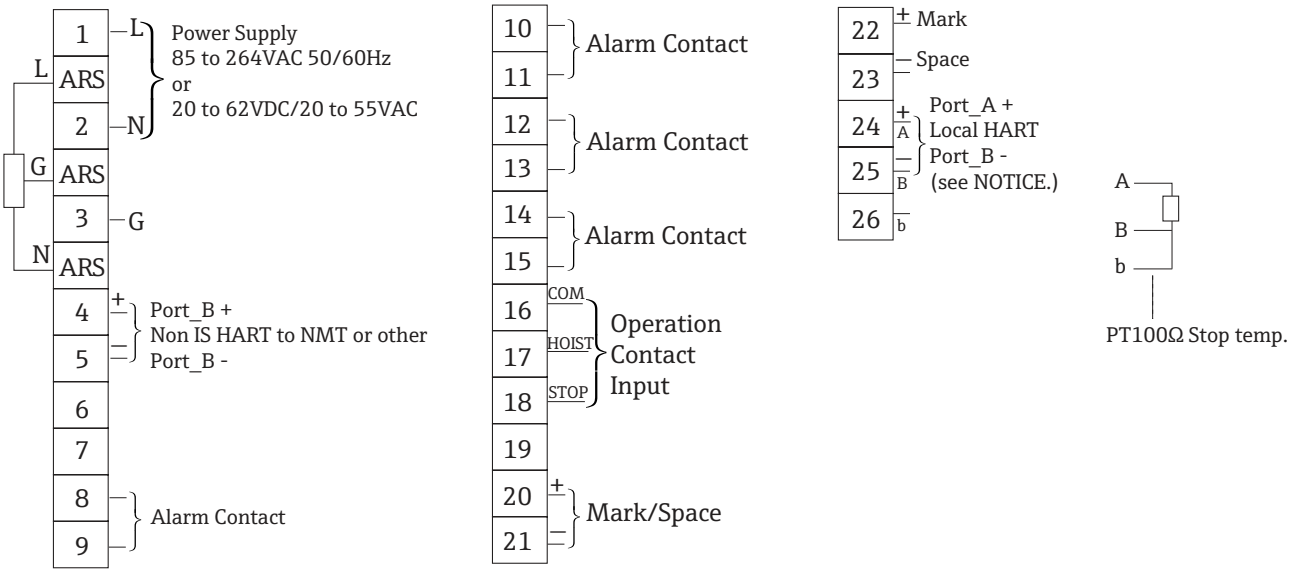
Normally WM550 and analog 4 to 20mA can not be connected.
Contact Endress+Hauser representatives if needed.

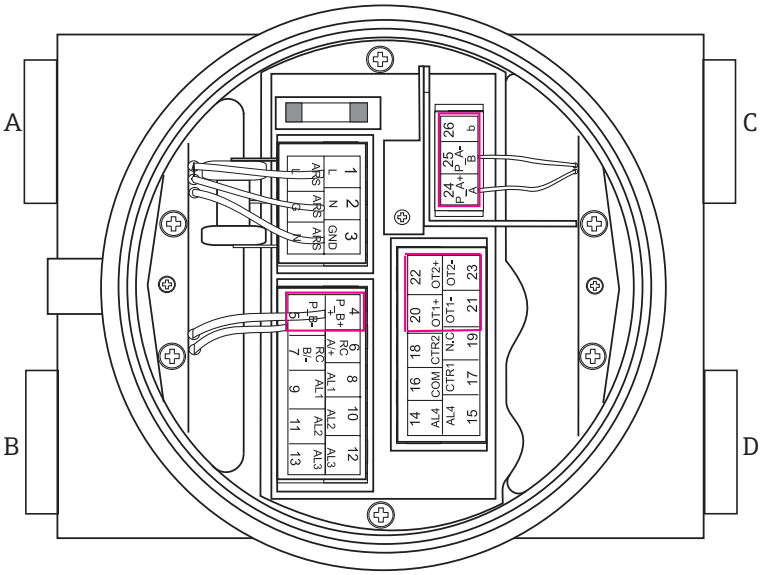
NOTICE

- Terminals 4 & 5 and 24 & 25 for HART devices are inter - connected.

Figure 23: Wiring Sample 2

6.2.3 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 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 used by M/S terminal connection, 4 - 20mA output and status 1 input function are no longer available.

Normally M/S and analog 4 to 20mA can not be connected.
Contact Endress+Hauser representatives if needed.

NOTICE

- Terminals 4 & 5 and 24 & 25 for HART devices are inter - connected.

Figure 24: Wiring Sample 3

6.2.4 Operation Contact Input

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

6.2.5 Input and Output

Input Signal

- Contact Switch (Non-voltage contact point)
- HART
- Pt 100

Output Signal

- V1
- WM550
- M/S
- ENRAF BPM
- MODBUS
- HART
- ANALOG 4 to 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 NMS7. The instrument has max. four cable entries.
- Check the cable size and the number of cables prior to ordering NMS7.

6.2.6 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 NMS7. Ensure to use the cable glands.

6.3 Temperature Input System

6.3.1 Ex d NMT Input + HART Input

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

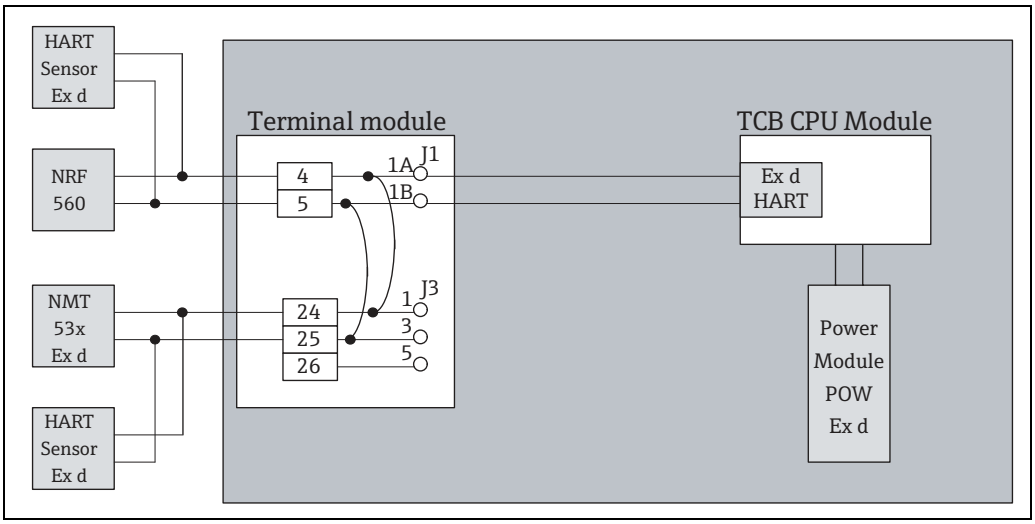


Figure 25: Ex d NMT Input and HART Input

6.3.2 Ex d Pt100 Spot Temperature Input +HART Input

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

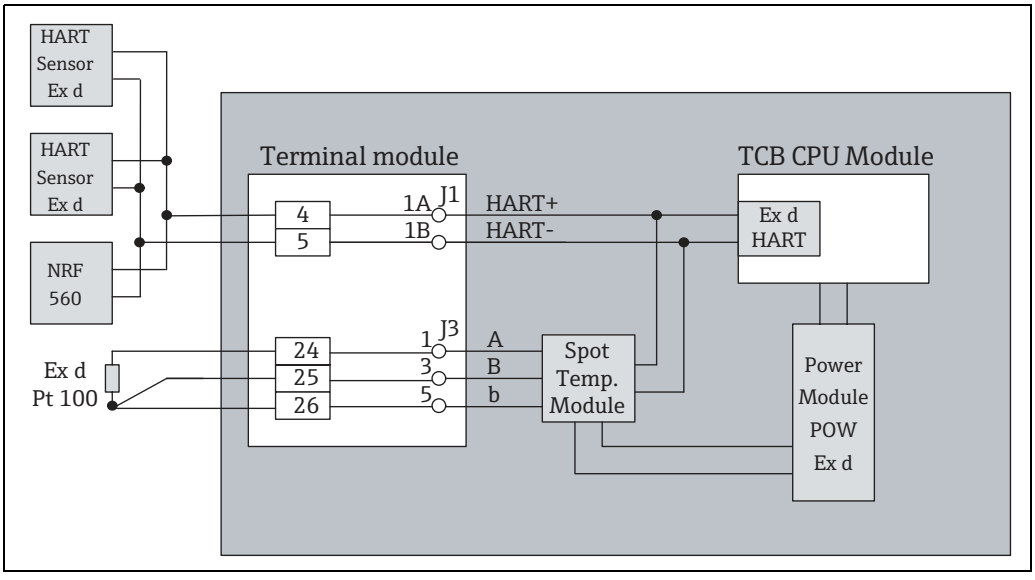


Figure 26: Ex d Pt100 Spot Temperature Input and HART Input

7 Operation

7.1 Touch Control and Programming Matrix

7.1.1 Display and Operating Elements

Display
During normal operation, NMS7 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, NMS7 uses a convenient programming matrix.

Operating Elements
NMS7 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 NMS7 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.

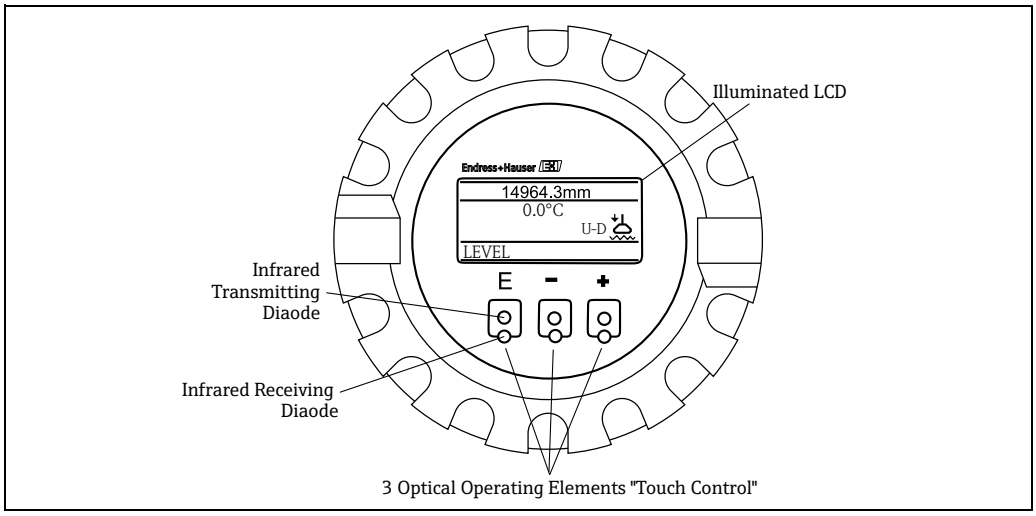


Figure 27: Display

7.1.2 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 "14 Matrix". The individual matrix groups, function groups, and functions within the programming matrix can be selected by alternately touching the operating elements.

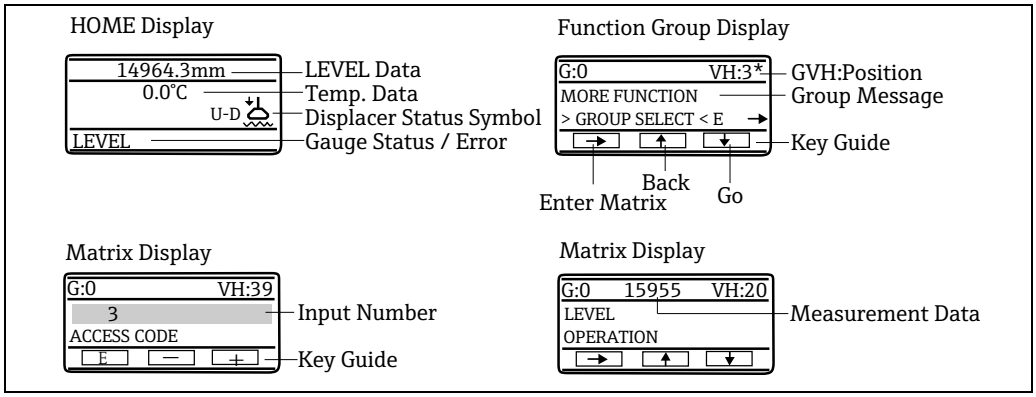


Figure 28: Displays

Matrix Construction

G1		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										

G2		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
Operation	2										
More Function	3	Device Data									
Contact Output	4										
Analog Out	5										
parts Data	6										
Input Signal	7										
Communication	8										
Status	9										

G3		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
Operation	2										
More Function	3	Service									
Meas. Wire & Drum	4										
Gauge data	5										
System Data	6										
Service	7										
Sensor Value	8										
Sensor Data	9										

G4		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
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										

G5		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
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										

G6		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
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										

G7		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
Operation	2										
More Function	3	Adjust Sensor									
Adjust Sensor	4										
HART Error Rate	5										
Unit	6										
HART Line	7										
Interface Adjust	8										
	9										

G8		0	1	2	3	4	5	6	7	8	9
Measured Value	10										
Measured Value	21										
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										

G9		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										



Figure 29: 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).

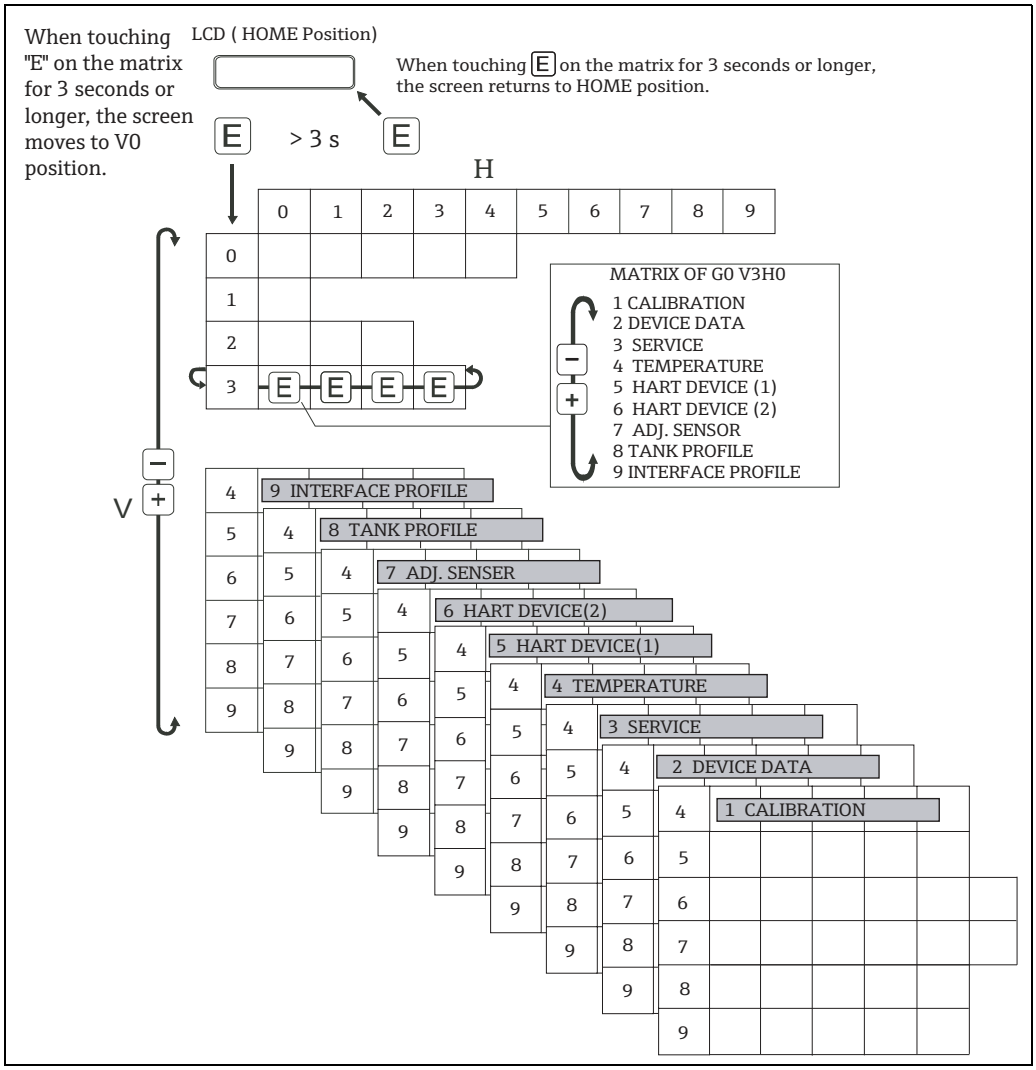


Figure 30: Selection Matrix Groups, Function Groups, and Functions with Programming Matrix

7.2 HOME Position

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

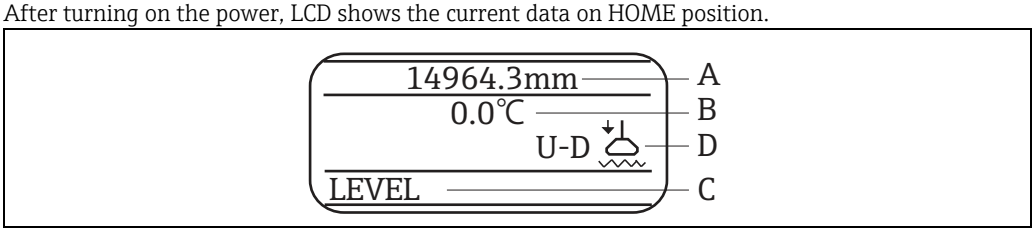


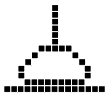
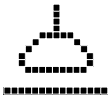
Figure 31: HOME Position

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, NMS7 will turn off the backlight of LCD 12 hour later. Touching LCD again after this time will turn on the backlight.

7.3 Access Code

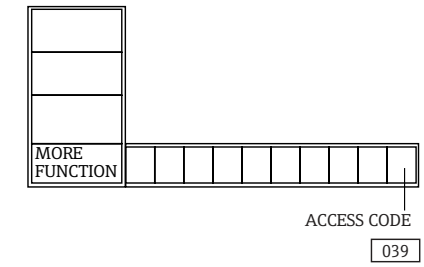
The access code is to ensure the confidentiality of the setup data. Three security levels are available along with access codes.

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.

Setting Access Code

Item	Procedure	Remarks
Static Matrix  Figure 32: Access Code	1. At the static matrix "MORE FUNCTION", select GVH039 "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 NMS7 specification.

7.4 Operation Command and New Operation Status

7.4.1 Operation Commands

Operation Commands can be sent to NMS7 from a host system. The following table explains the command codes which can be selected at GVH020

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	

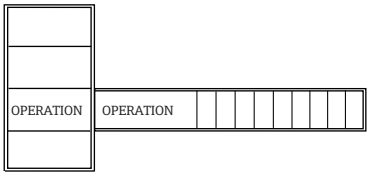
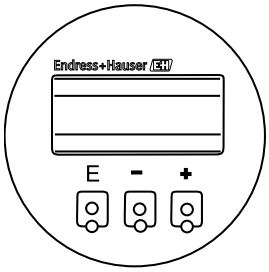
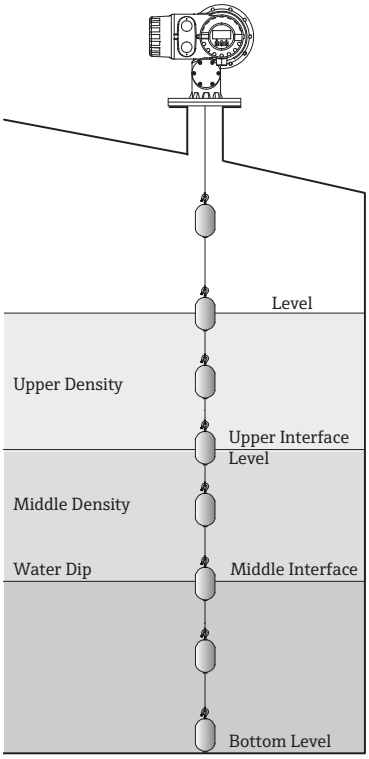
7.4.2 New Operation Status

The following table shows the new operation status, which is available when "NEW NMS STATUS", matrix position GVH272, 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

7.5 Operation of NMS7

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

Item	Procedure	Remarks
 Figure 33: Static Matrix  Figure 34: Touch Control	1. Select function groupGVH020 OPERATION 2. OPERATION at GVH020 is a selectable command. Using + and - key to select a actual measuring place.	▪ 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 35: 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 NOTICE Specify the number referring to 020 in Order Information if interface and density measurement are required.	▪ The optional operation commands are available when such options are set.

7.6 Calculation of Level and Densities

The section specifies the formula used by NMS7 to calculate levels and densities.

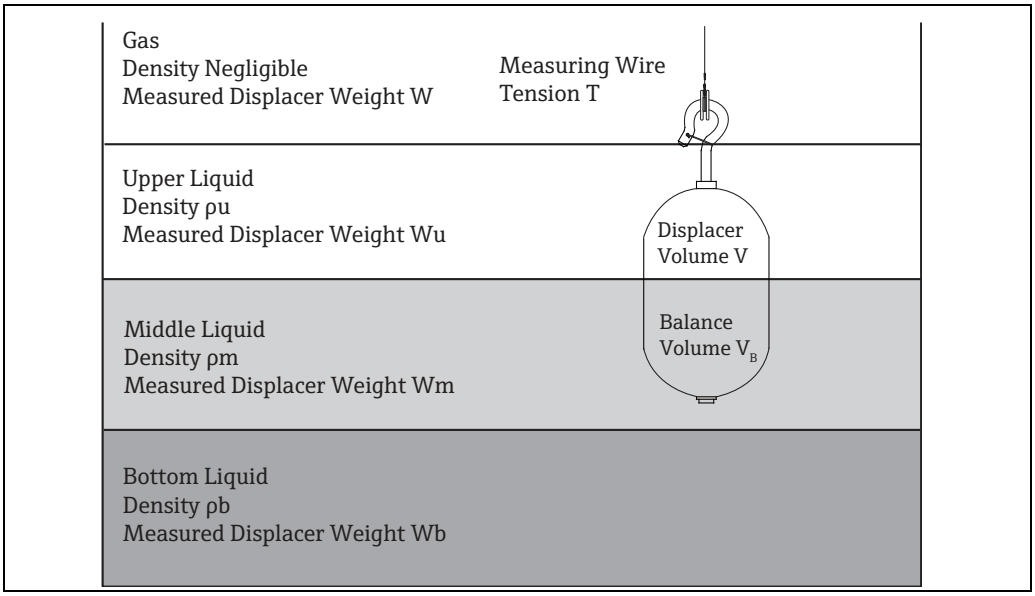


Figure 36: Calculation of Levels and Densities

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 GVH345 "VOLUME TOLERANCE", then the corresponding change will actuate the motor of the NMS7 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 (ρu) and Density profile

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

- Middle density (ρm)

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

- Bottom density (ρb)

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

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

$$D = (V1 - V2 - V3) / A \times 10 + h + h1$$

where the variables and constants have the following meanings.

V_1 Displacer Balance Volume (69cm³)
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

Sample: Standard Displacer Ø50.8mm Cylindrical Shape
V_1 Balance Volume (69ml)
V_2 Volume of Lower Cone (24.46ml)
V_3 Volume of End of Cone (0.12ml)
A Cross-section of Displacer (20.26cm2)
h Height of Lower Cone (20mm)
h_1 Displacer Bottom Stub Height (3mm)
D = (69 - 24.46 -0.12) / 20.26 x 10 + 20 + 3 = 44.92

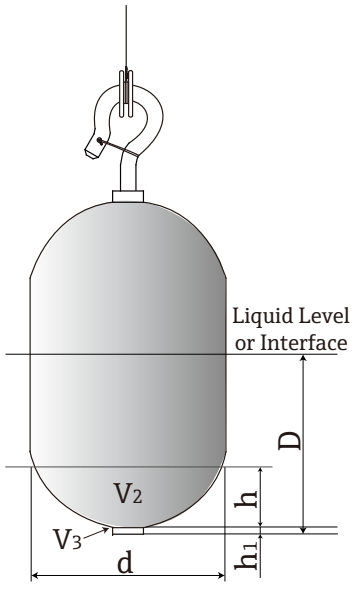


Figure 37: Variables and Constants for Displacer

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

8 Commissioning

8.1 Initial Settings

All of the initial settings are required for NMS7 in most case. However, depending on NMS7 specification, some settings may not be required. Set Access code 51 at GVH039 before applying the initial settings.

8.1.1 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.

8.1.2 Density Values (GVH005 to 007)

⚠ CAUTION
Always set GVH005 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: 0.758g/ml
- GVH006 Middle Density: 0.880g/ml
- GVH007 Density Bottom: 1.000g/ml

8.1.3 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 NMS7 reference position.

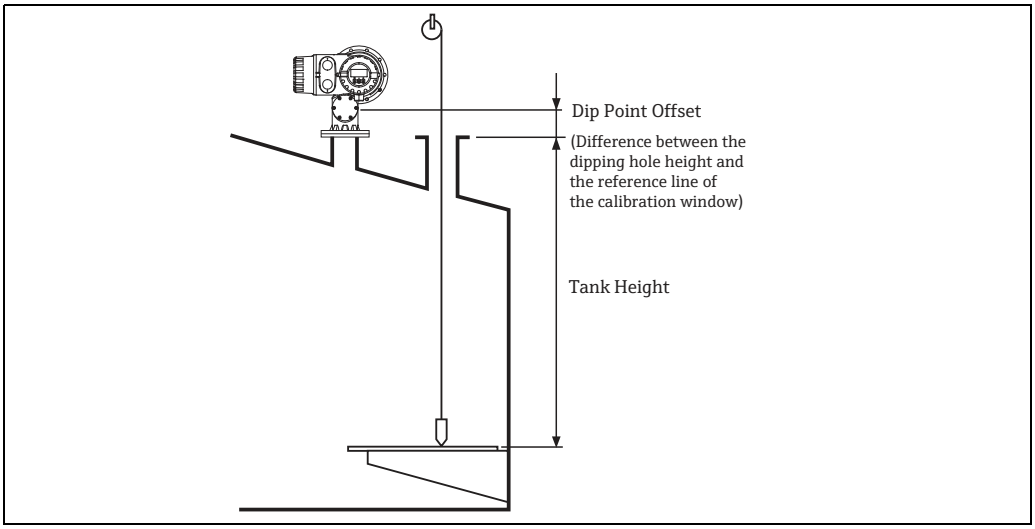


Figure 38: Tank Height

8.1.4 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.

8.1.5 Communications Address (GVH285)

Only minimal matrix parameter setting, Access code 51, is required.
Communications protocol is displayed and selected at G2V8H6 Protocol. NMS7 has been preset at factory, it is not necessary to change the setting.
At GVH285 select the desired device address for NMS7. 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 NMS7. For Rackbus, termination resistors should be set on NMS7 at end of loop. Enraf BPM address range is 00 to 99.
Refer to Sect. 7.5 for Address Setting details.

8.1.6 Proactive Safety Function (GVH157/158/159)

Matrix	Setting
GVH157	Service Mode: default = OFF. Select OFF if GVH158 Prosafety = ON. Select ON only when performing maintenance on NMS7. ⚠ WARNING Selecting ON disables the Proactive Safety function! Access code 530
GVH158	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
GVH159	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

8.1.7 Analogue Output (GVH250 to 256)

When specified and ordered from Endress+Hauser, NMS7 is equipped with analogue output hardware installed. Function settings may be changed as follows:

Function	Setting
Assign Output 1	Assign level, upper interface, 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 upper interface, 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

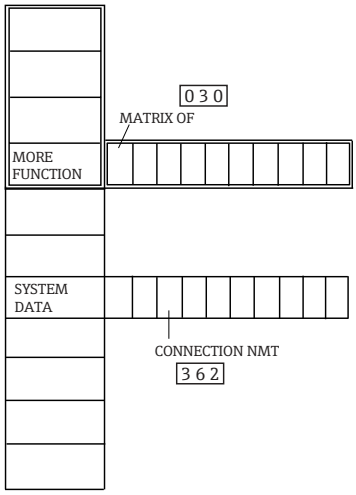
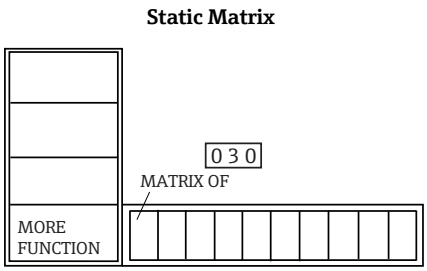
8.1.8 Contact Relay Alarm Output (GVH240 to 247)

When specified and ordered from Endress+Hauser, NMS7 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.

8.2 Settings for NMT 53x Connections

The following settings are required to display NMT 539 data on NMS7 screens.

Item	Procedure	Remarks
 Figure 39: Matrix Group: Service  Figure 40: Static Matrix	1. In Static Matrix "MORE FUNCTION", invoke GVH030 "MATRIX OF" and select "SERVICE". 2. Invoke the Dynamic Matrix GVH362 "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 "GVH030 MATRIX OF". NMS7 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 GVH440. 8. The temperature of each contact is displayed on Dynamic Matrix screens GVH450 to GVH459.	

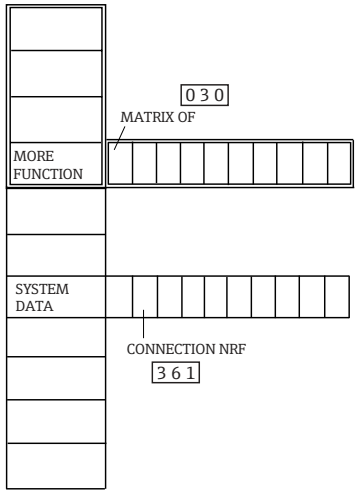
NOTICE

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

8.3 Settings for Connection to NRF560

To connect NRF560, NMS7 requires the following settings.

CAUTION
Turn on the power to NMS7 first.

Item	Procedure	Remarks
 Figure 41: Matrix Group: Service	1. In Static Matrix "MORE FUNCTION", invoke GVH030 "MATRIX OF" and select "SERVICE". 2. Invoke the Dynamic Matrix GVH361 "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.

8.4 Liquid Level Calibration

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.

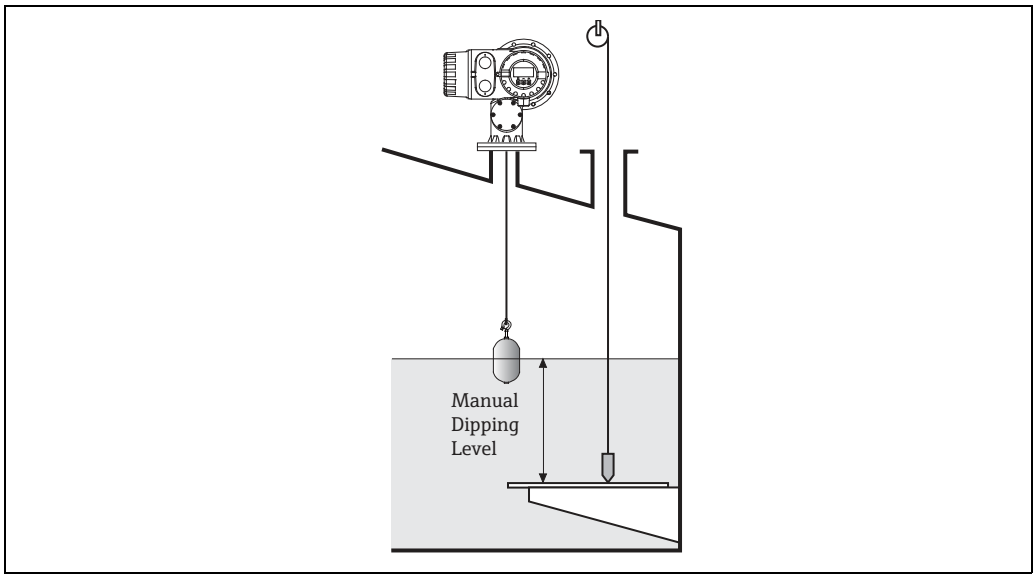


Figure 42: Calibration Level (Manual Dipping Level)

When there is not liquid in the tank;

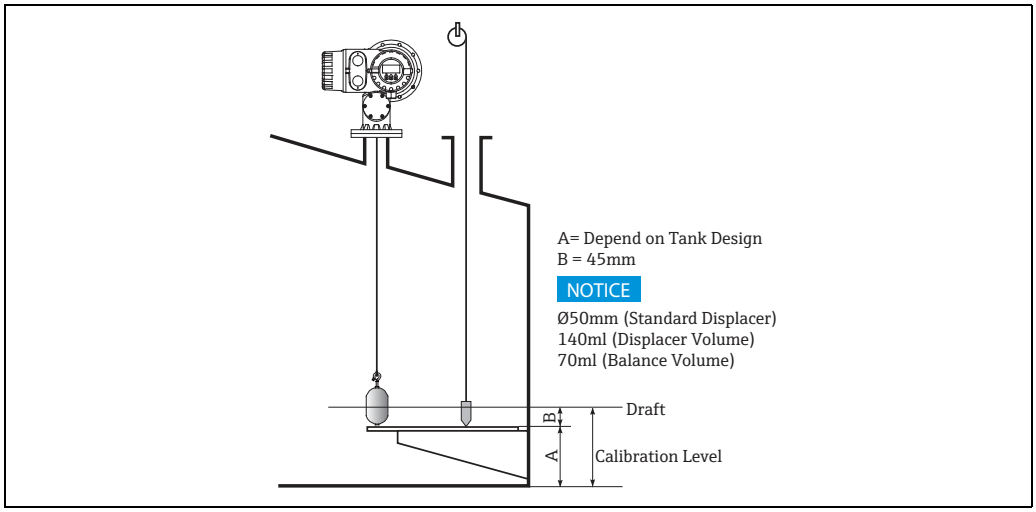


Figure 43: Calibration Level (Empty Tank)

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).

8.5 Remote Communications

8.5.1 Digital Output

The desired loop address for most digital protocols can be set at GVH285 (Address). The allowable range for setting varies depending on the protocol installed in NMS7. The range has 0 to 9, 00 to FF (FF is fixed for MIC protocol), or 1to 247 for Modbus.

- WM550 and Mark Space protocols addresses must be set by switches on the communications module inside NMS7.
- Enraf BPM: Address range is 00 to 99. A to F is not available.

8.5.2 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

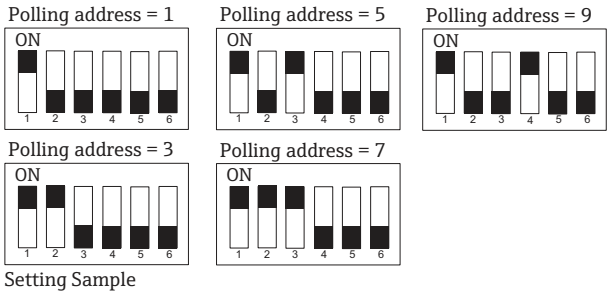
If software reset is required; J6 has to be short.

Polling Address Setting

WARNING

Polling addresses are set by mechanically at SW1 on WM550 communication board (not by accessing 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.

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

Jumper Setting

Jumper settings for M/S communication board

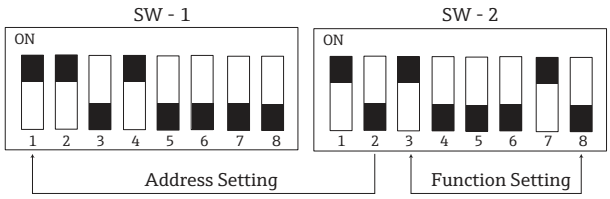
Jumper	Function	Default condition
J3 (Mode)	Use EPROM [IC4]->short	Short
J3 (Reset)	Reset	Open
J3 (WD)	Watch dog setting	Short

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 Sample (Sample shown 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

8.5.4 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
JP3 (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 GVH286.

Communication Setting
Polling address is set at GVH285 "ADDRESS" of NMS7 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

8.5.5 Analog Output

Setting of analog output 4 to 20mA is available when ordered from Endress+Hauser. NMS7 is delivered with analog output hardware installed. For the following matrix parameter settings, Access code 51, is required.

Matrix GHV	Item	Setting
250	Assign Output	Assign DC4 to 20mA (level, upper interface, or temperature) for channel 1.
251	Adjust 4mA	Set level or temperature value for 4mA output on channel 1. Available only when GVH251: "Level", "UPPER INTERF. LEVEL", or "Liquid Temp" Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
252	Adjust 20mA	Set level or temperature value for 20mA output on channel 1. Available only when GVH251: "Level" "UPPER INTERF LEVEL", or "Liquid Temp." Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
253	Assign Output 2	Assign DC4 to 20mA (level, upper interface, or temperature) for channel 1. Default: none
254	Adjust 4mA	Set level or temperature value for 4mA output on channel 2. Available only when GVH251: "Level", "UPPER INTERF. LEVEL", or "Liquid Temp" Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
255	Adjust 20mA	Set level or temperature value for 20mA output on channel 2. Available only when GVH251: "Level", "UPPER INTERF. LEVEL", or "Liquid Temp" Level: 0 to 99999mm Temperature: -999 to 999°C Default: 0mm / 0°C
256	Alarm/Error Output	When an error arises, the current which is set to Output Channel 1 and 2 is outputted. OFF: When an error arises, the current is not outputted. HOLD: When an error arises, the value of current which is being outputted is fixed. MAX: When an error arises, the current of 20mA replaces the current witch is being outputted. MIN: When an error arises, the current of 4mA replaces the current which is being outputted. Default: OFF

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

8.5.6 Contact Relay Alarm Output

The specification of alarm for output contact relay is delivered as a part of NMS7. This specification allows a maximum of 4 output contact relay settings. Set access code 51 in case of the following matrix parameters.

Matrix GVH	Item	Setting
240	Select Relay	Use +/- and E keys to select to activate Contact Output Relays 1 to 4. Default value = 1.
241	Assign Relay	Select output definition from range of choices: None, Level, Liquid Temp, Caution, Warning, Emergency Error, and Balance Signal. Default value = NONE.
242	Relay Function	Select High or Low function, available only when GVH241 = "Level" or "Liquid Temp." Default value = HIGH.
243	Switching Point	Set level (0-99999 mm) at which relay is activated, available only when GVH241 = "Level" or "Liquid Temp." Default value = 0 mm.
244	Hysteresis	Set hysteresis value (0-99999 mm) for selected relay, available only when GVH241 = "Level" or "Liquid Temp." Default value = 0 mm.
245	Relay on Alarm	Select from Normal Open or Normal Closed, available only when GVH241 = "Level" or "Liquid Temp." Default value = NORMAL OPENED.
246	On Delay time	Set delay time (0-999 seconds) for alarm output start, available only when GVH241= "Level" or "Liquid Temp." Default value = 0 seconds.
247	Off Delay Time	Set delay time (0-999 seconds) for alarm stop, available only when GVH241 = "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: GVH162 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

8.5.7 Relay Logic

<table>
<tr><td>Module name</td><td colspan="3">I/O - 3</td></tr>
<tr><td>Alarm output, Standard
(Order Code position 040= 1,3 or 5)</td><td colspan="3">Setting is available for non-voltage contact point, SPST 4 points, level or temperature.</td></tr>
<tr><td>Hysteresis, Alarm output</td><td colspan="3">Switch points and switching hysteresis freely adjustable, residual current fail-safe mode: minimum or maximum, selectable</td></tr>
<tr><td rowspan="6">Operation output logic</td><td></td><td colspan="2">Relay Condition</td></tr>
<tr><td>Initial Configuration
(Normal Status)</td><td>Open</td><td>Closed</td></tr>
<tr><td>On alarm</td><td>Closed</td><td>Open</td></tr>
<tr><td>On device error</td><td>Closed</td><td>Open</td></tr>
<tr><td>On abnormal power supply (5% lower than, higher than specified power supply</td><td>Custody Transfer Closed</td><td>Custody Transfer Open</td></tr>
<tr><td>Power outage</td><td colspan="2">Hold last condition</td></tr>
<tr><td>Switching capacity, Alarm output</td><td colspan="3">▪ Max. 250VAC, 2A/62.5W
▪ Max. 220VDC, 2A/60W
▪ TIIS: 250VAC, 1.5A/30VDC, 9W</td></tr>
</table>

<table>
<tr><td>Alarm output,
Overspill prevention
(Order Code position 040=4)</td><td colspan="2">Setting is available for non-voltage contact point, SPST 2points, or level.</td></tr>
<tr><td>Hysteresis, Alarm output</td><td colspan="2">▪ Switch points and switching hysteresis freely adjustable
▪ Residual current fail-safe mode: minimum or maximum, selectable</td></tr>
<tr><td rowspan="6">Operation output logic</td><td colspan="2">Relay Condition</td></tr>
<tr><td>Initial Configuration (Normal Status)</td><td>Closed</td></tr>
<tr><td>On alarm</td><td>Open</td></tr>
<tr><td>On device error</td><td>Open</td></tr>
<tr><td>On abnormal power supply (5% lower than, higher than specified power supply</td><td>Open</td></tr>
<tr><td>Power outage</td><td>Open</td></tr>
<tr><td>Switching capacity</td><td colspan="2">▪ Umax. 200VDC/200VppAC
▪ Imax. 0.5AC, DC or peak AC
▪ Pmax. 15W/VA</td></tr>
</table>

<table>
<tr><td>Operation Input</td><td colspan="3">2 photocouplers, for external input from controller (tumbler switch, DCS, etc.)</td></tr>
<tr><td rowspan="5">Operation input logic</td><td>Gauge Status</td><td>CTR1</td><td>CTR2</td></tr>
<tr><td>Level</td><td>0 (OFF)</td><td>0 (OFF)</td></tr>
<tr><td>UP</td><td>1 (ON)</td><td>0 (OFF)</td></tr>
<tr><td>STOP</td><td>0 (OFF)</td><td>1 (ON)</td></tr>
<tr><td>Interface Level</td><td>1 (ON)</td><td>1 (ON)</td></tr>
<tr><td>Input voltage</td><td colspan="3">15VDC, active circuit (supplied by NMS7)</td></tr>
<tr><td>Input current</td><td colspan="3">Approximately 5mA</td></tr>
</table>

8.6 Density Measurement

Density measurement is available when ordered from Endress+Hauser.

- Spot density measurement for up to 3 liquid phases

8.6.1 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.

- NMS7 must be configured for Spot density measurement as ordered from Endress+Hauser. For information regarding upgrading your NMS7, contact Endress+Hauser representatives.

- Density values:

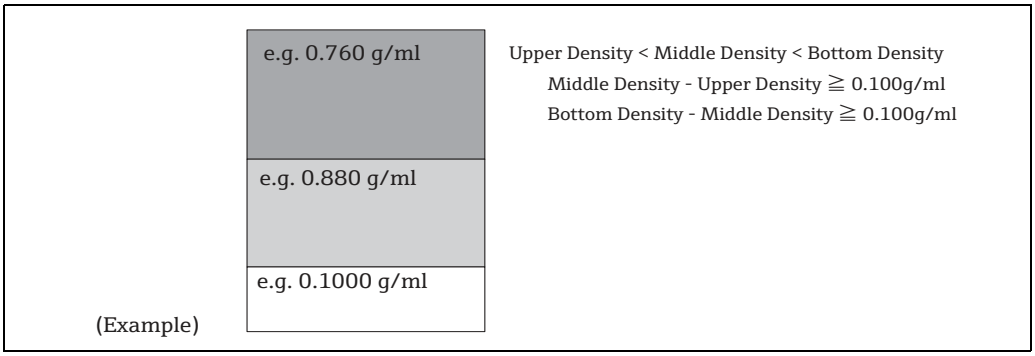


Figure 44: Density Measurement

- Density values can be viewed and changed at the following matrix positions:
  GVH005 Upper Density
  GVH006 Middle Density
  GVH007 Density Bottom

⚠ CAUTION
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: GVH143 + GVH144 = 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: GGVH143 + GVH144 = 300 n, where n = integer.

Operation
Select the measurement of the density desired from UPPER DENSITY, MIDDLE DENSITY, or DENSITY BOTTOM at GVH020 "OPERATION". NMS7 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 GVH020.

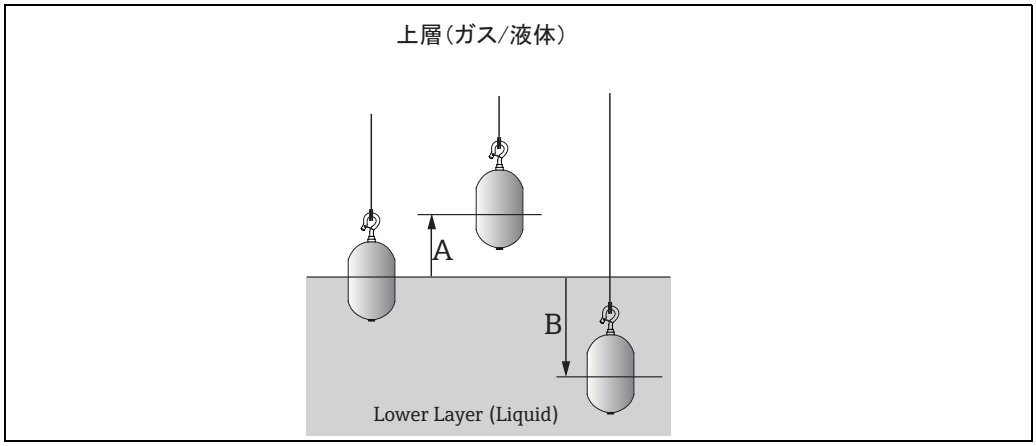


Figure 45: Density Measurement

8.7 Interface Measurement

NMS7 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:

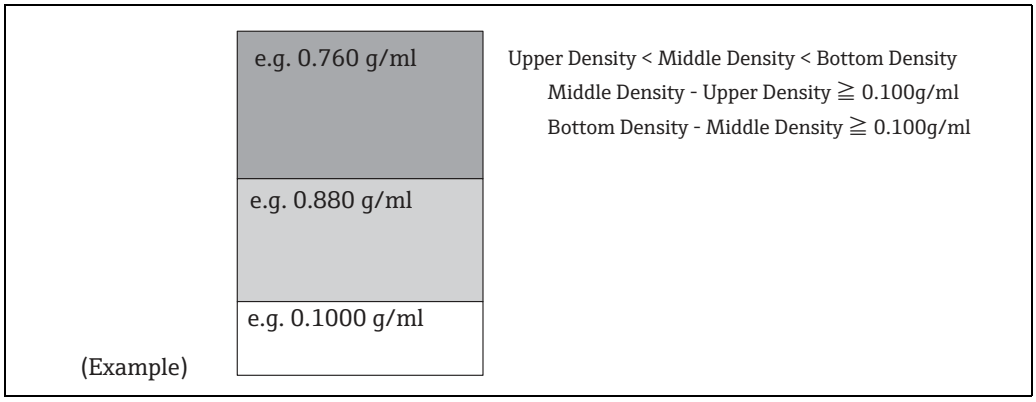


Figure 46: Interface Measurement

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

- GVH005 Upper Density
- GVH006 Middle Density
- GVH007 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 GVH020 OPERATION. When the desired operation is displayed, press the "E" key.

8.8 Sealing of NMS7

Sealing of NMS7 Procedure

1. Set OPE. DENSITY at GVH278 as the liquid density (if the density is expected to change during operation, set the average value.).
2. Turn off the power supply, open NMS7.
3. Turn the micro switch to the "on position" on the printed circuit board TCB (see figure below). NMS7 will then enter "write-protect" mode and not accept any further level, weight, or density data changes.

This completes the sealing of NMS7 procedure.

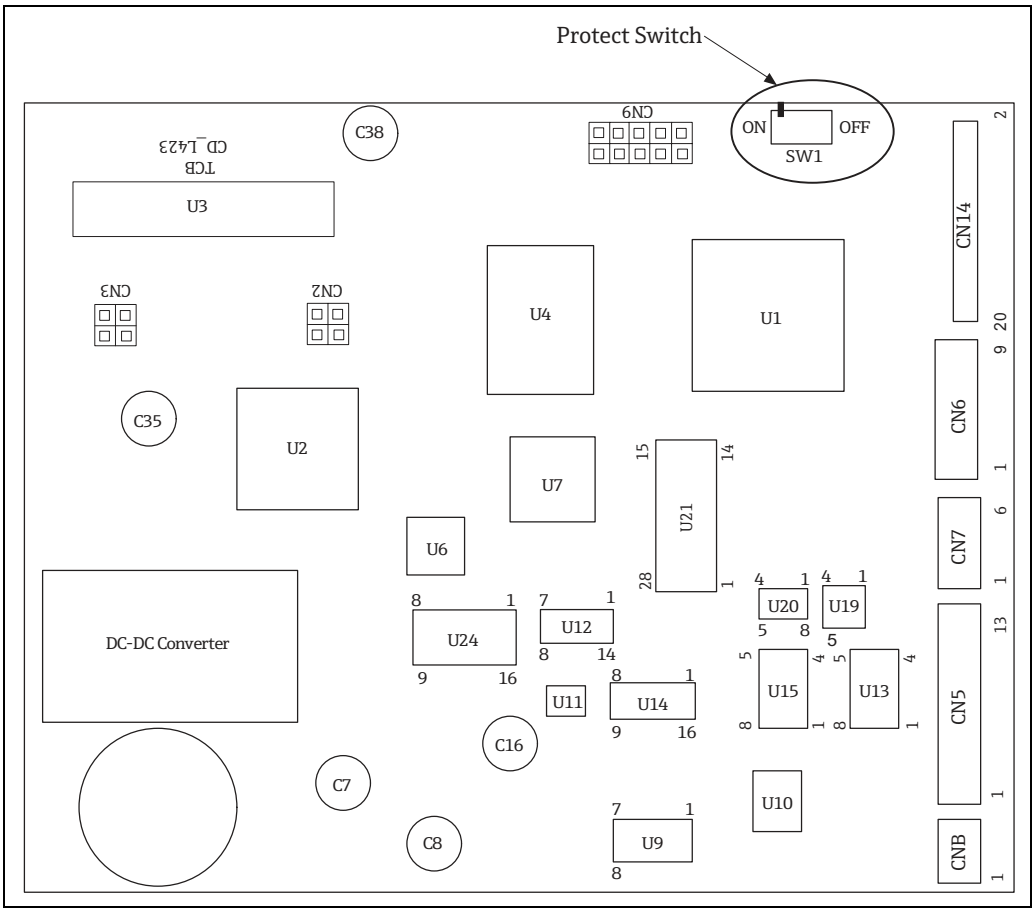


Figure 47: The printed circuit board TCB

9 Maintenance

NMS7 measuring instrument requires no special maintenance.

9.1 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.

9.2 Seals Replacement

NMS7 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.

9.3 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 NMS7, 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.

9.4 Repairs to Ex-approved Devices

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

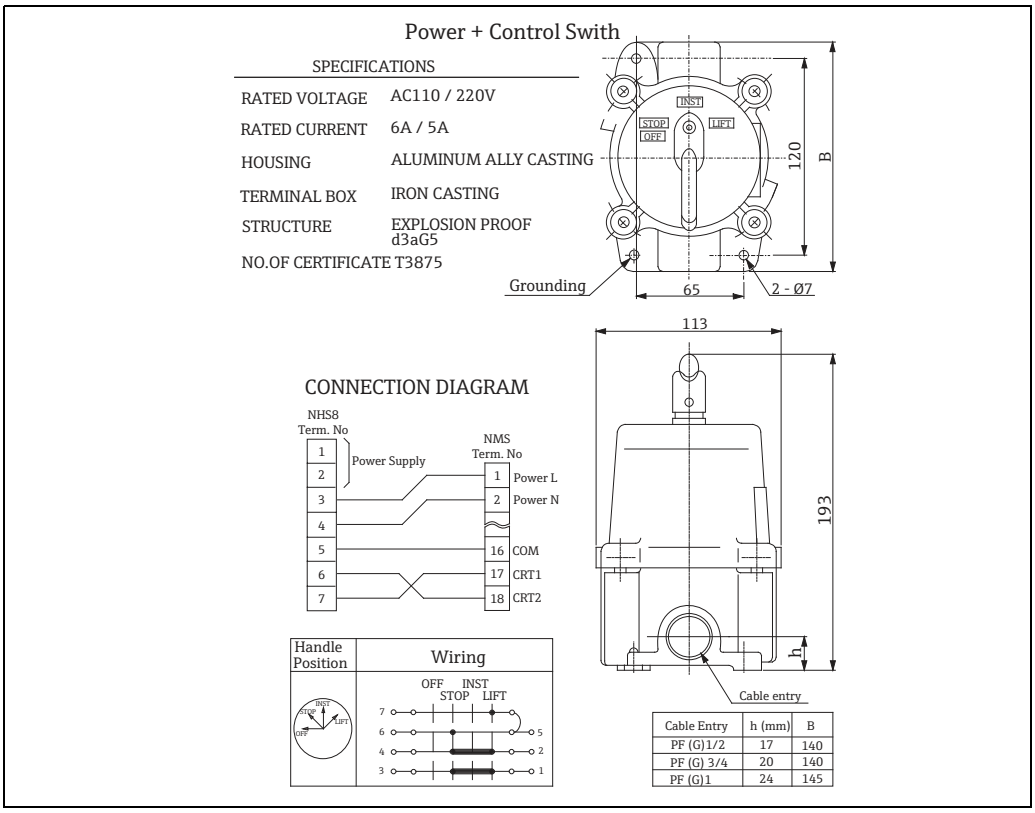
- Repairs of Ex-approved devices may only be performed by trained personnel or by Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and other relevant rules.
- Only use original spare parts provided by Endress+Hauser.
- When ordering 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.

9.5 Replacement

After replacing NMS7 or electronic module, the adjustment of a new sensor is required.

10 Accessories

10.1 Power and Control Switch



Cable Entry	h (mm)	B
PF (G)1/2	17	140
PF (G) 3/4	20	140
PF (G)1	24	145

Figure 48: Power and Control Switch NHS8

10.2 Reducing Flange NHF4

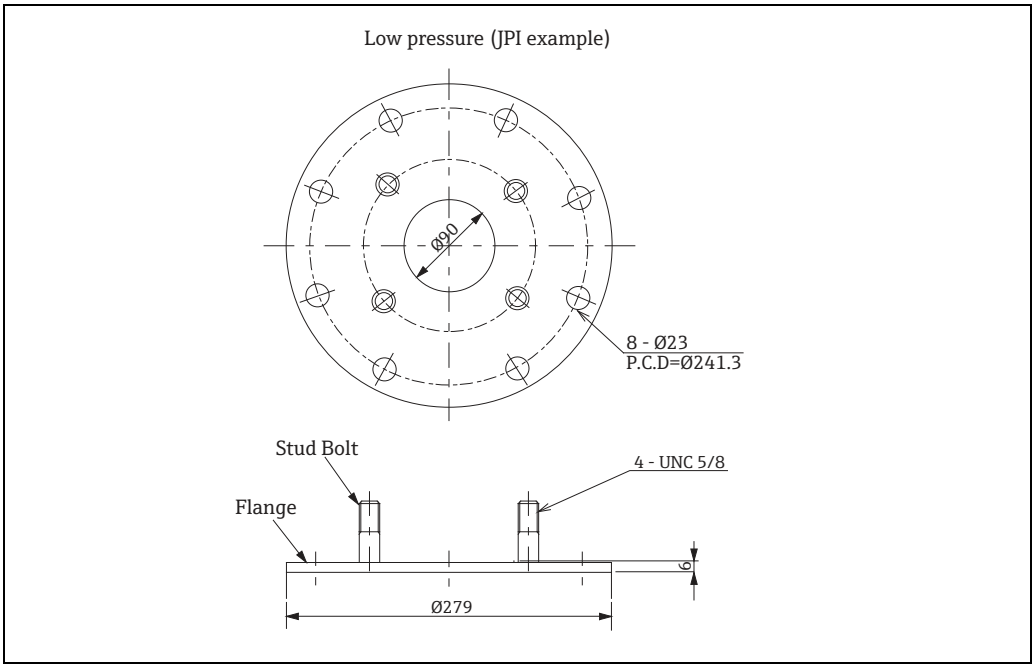
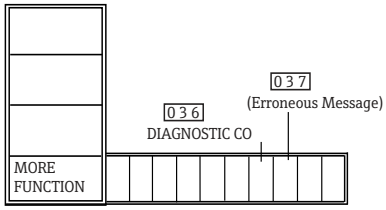
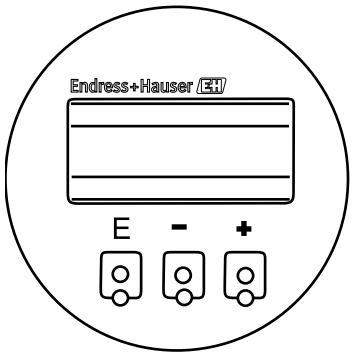


Figure 49: Reducing Flange

11 Troubleshooting

NMS7 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 NMS7. Matrix position GVH037 provides the diagnostic history.

11.1 Selection of Diagnostic Code and History

Item	Procedure	Remarks
Static Matrix: G0  Figure 50: Static Matrix **Touch Control**  Figure 51: Touch Control	1. On "MORE FUNCTION", select item GVH036 "DIAGNOSTIC CO." 2. Previous static matrix records are sequentially displayed in Static Matrix screen GVH037, 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 NMS7 was installed. ▪ Display includes the year, month, day, hour, minute, instrument temperature, and an error sequential number, in this order.	▪ Item GVH037 only shows error message, calendar, and pointer, but no label on the LCD.

11.2 Error and Status Messages

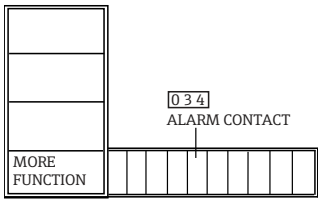
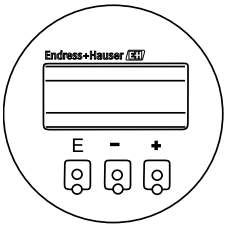
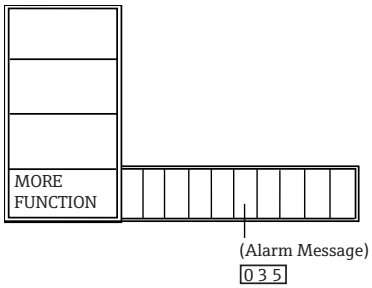
Message	Cause	Remedy	Error Code
-49.5 °C	Indication of shorted element in NMT temperature sensor	Check GVH450 through GVH459 to see element.	
358.0 °C	Element is not enabled, or not installed in NMT temperature sensor	Check GVH482 Total number of elements	
359.0 °C	Indication of open element in NMT temperature sensor	Check GVH450 through GVH459 to see element.	
ADC/SENSOR ERROR	The signal from the A/D converter is out of range.	Contact Endress+Hauser representatives.	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 contact Endress+Hauser representatives.	
A PHASE NO INPUT	The input of the A phase signal from the encoder is not available.	Replace the detector unit. Contact Endress+Hauser representatives.	122
BELOWBOT. POINT	Indicates NMS displacer position is below lowest of NMT temperature sensor.	Check the liquid level.	
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 temperature sensor at position GVH362 "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.	Check the connection of the wires.	
IMPOSSIBILITY	Operation is impossible because there is no weight table.	Perform weight calibration again.	
LOCAL ERROR: DEV1 (or 2)	NMS7 cannot access the local HART device 1 (or 2).	Check the connection of the HART device to NMS7. 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 GVH362 "CONNECTION NMT."	111
LOCAL ERROR: NRF	NMS7 cannot access NRF 560.	Check the connection of NRF 560 and register of the tank side monitor at position GVH361 "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. Contact Endress+Hauser representatives.	201
MPU RESET	Power to the CPU module fell below minimum value.	Make sure to ground the wire. Confirm there is no noise at outside.	
MPU: START ACT*	Power to NMS7 was turned OFF/ON.	Make sure that the main power turns off. If the message occurs frequently, contact Endress+Hauser representatives.	
OVERTENSION	The tension on the measuring wire exceeds the upper limit set at position GVH162 "OVER TENS. SET."	Check if the displacer motion is blocked by clogging or sticking. To release overtensioning, access position GVH371 "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	Replace the CPU board. Contact Endress+Hauser representatives.	
ROM ERROR	EEPROM	Replace the CPU board. Contact Endress+Hauser representatives.	132
SIFA ERROR	Error between communication board and CPU board for digital output.	Replace the CPU board. Contact Endress+Hauser representatives.	114
TEMP BELOW RANGE	Indicates the measured temperature data is below the fixed range of the NMT temperature sensor.	Check the NMT connection of wires. Confirm there is no breakage of NMT common line.	
TEMP COM OPEN	Indicates an open common line in the NMT temperature sensor	Confirm there is no shortage of NMT common line.	
TEMP COM SHORT	Indicates a shorted common line in the NMT temperature sensor	Confirm there is no breakage of wire and that displacer is positioned at the right spot. Check the installation of NMS7. Contact Endress+Hauser representatives if the system can not be recovered.	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.	Check the connection of wires. Replace the detector unit. Replace the CPU board. Contact Endress+Hauser representatives if the system can not be recovered.	106, 112
MPU:XXXX* (XXXX=text)	CPU error	The error might happen occasionally and might be registered in GVH037 (Erroneous Message). However, it is normally negligible. If it occurs frequently, then contact Endress+Hauser representatives.	
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 board 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 measure to avoid heat transfer from the tank to NMS7.	
DRIVER ERROR	A motor driver error has occurred	Contact Endress+Hauser representatives.	
DEVICE ERROR NMT	Breakage or shortage of element	Check NMT. Confirm the error message in operation manual of NMT. NMT repair is required in some cases.	231

NOTICE

These error histories are available (Erroneous Message) at position GVH037.

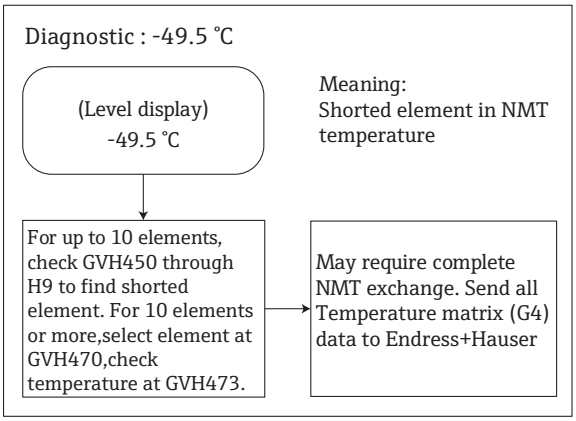
11.3 Alarm History Display

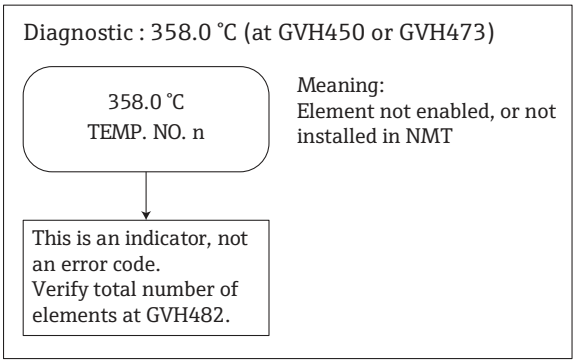
Item	Procedure	Remarks
Matrix Group: DEVICE DATA  Figure 52: Device Data **Touch Control**  Figure 53: LCD (Display)	1. Bring up Static Matrix GVH034 *ALARM CONTACT."	
Static Matrix  Figure 54: Static Matrix	2. Previous static matrix records are sequentially displayed in Static Matrix screen GVH035, 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 NMS7 was installed.	

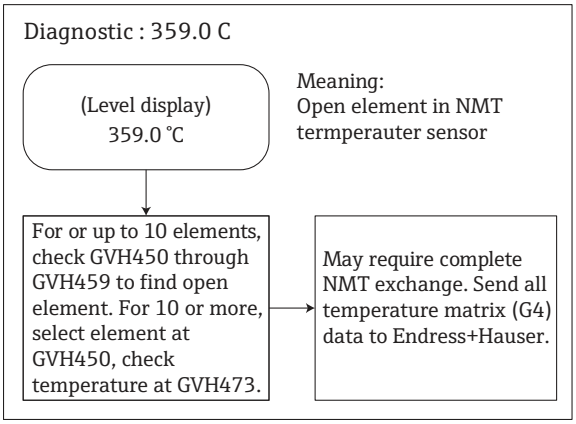
11.4 List of Alarm Messages

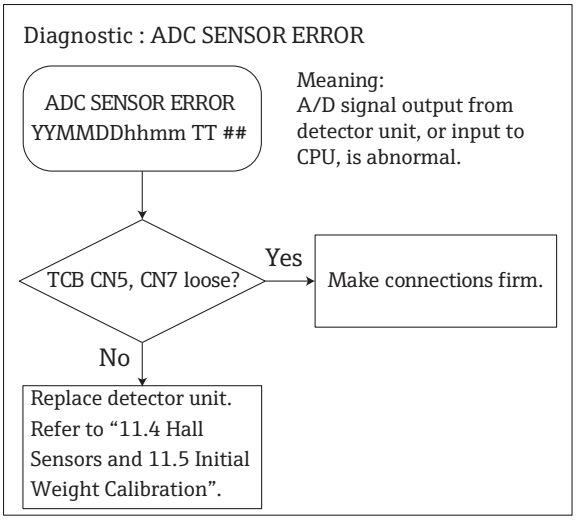
MESSAGE	Cause of Alarm
UPPER LIMIT LEVEL	The level has risen above the set alarm operation value.
LOWER LIMIT LEVEL	The level has fallen below the set alarm operation value.
UPPER LIMIT TEMP.	The temperature has risen above the set alarm operation value.
LOWER LIMIT TEMP.	The temperature has fallen below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

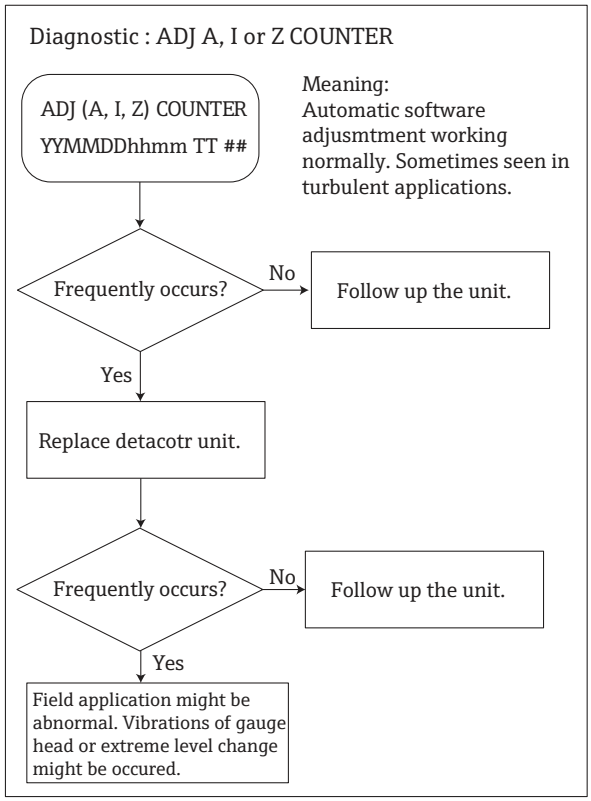
11.5 Flowcharts for Diagnostics and Troubleshooting

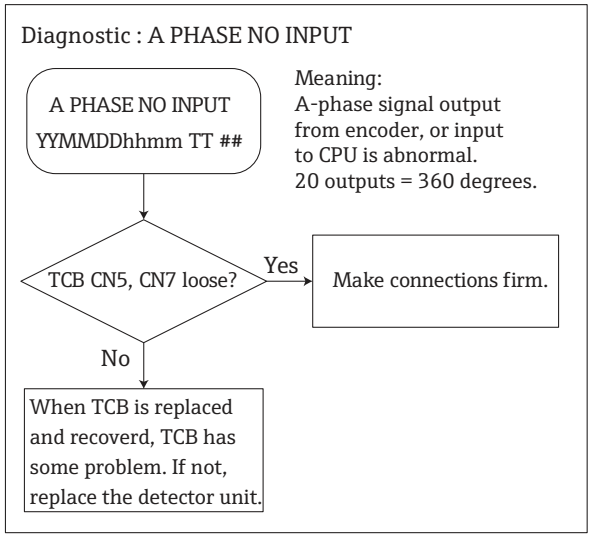




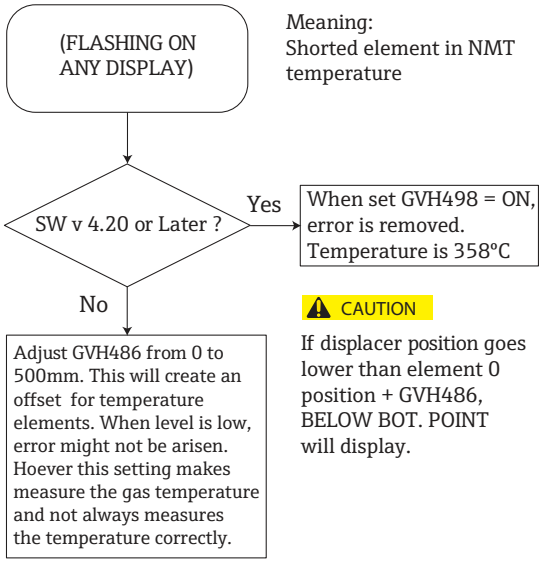




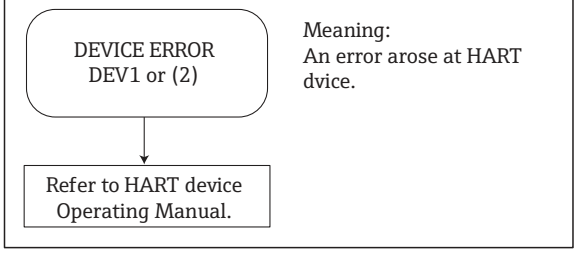




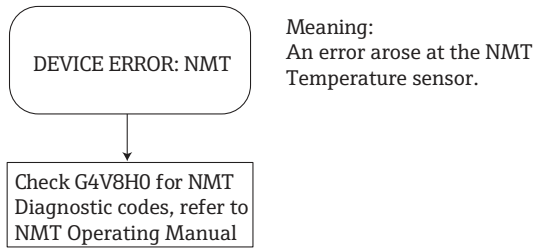
Diagnostic : BELOW BOT. POINT



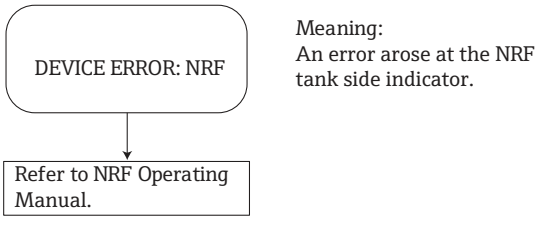
Diagnostic : DEVICE ERROR: DEV1 (2)



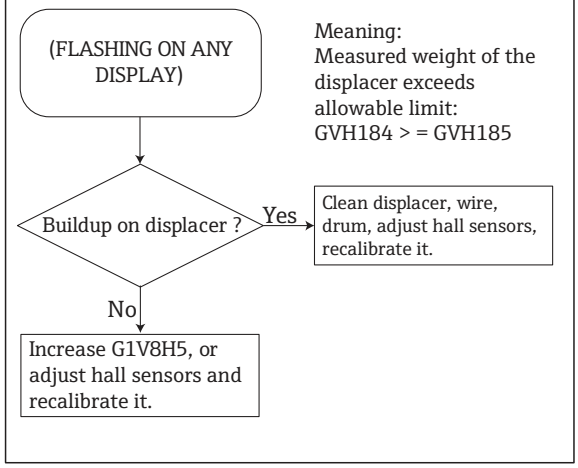
Diagnostic : DEVICE ERROR: NMT



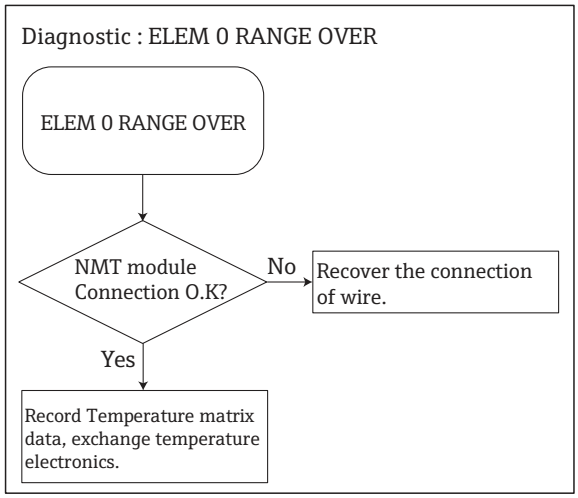
Diagnostic : DEVICE ERROR : NRF



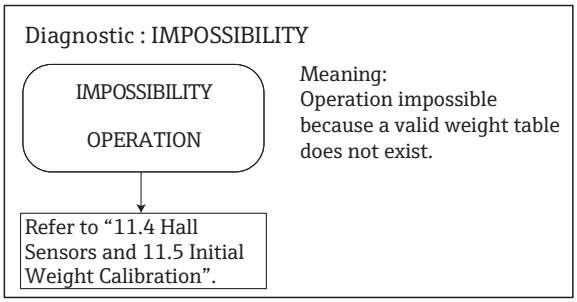
Diagnostic : DISPL CALIB ERROR

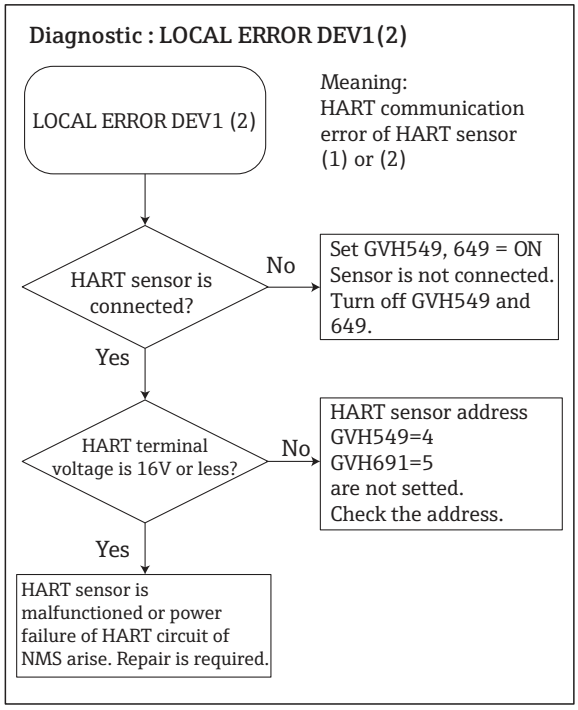


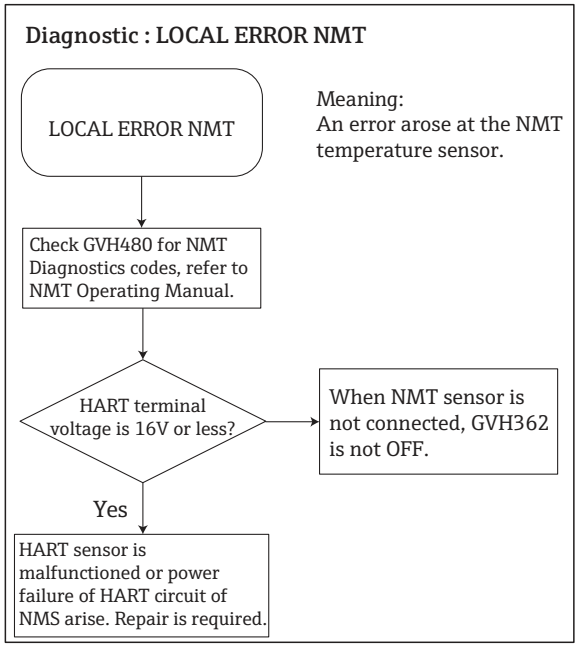
Diagnostic : ELEM 0 RANGE OVER

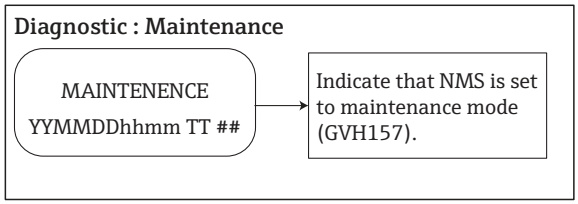


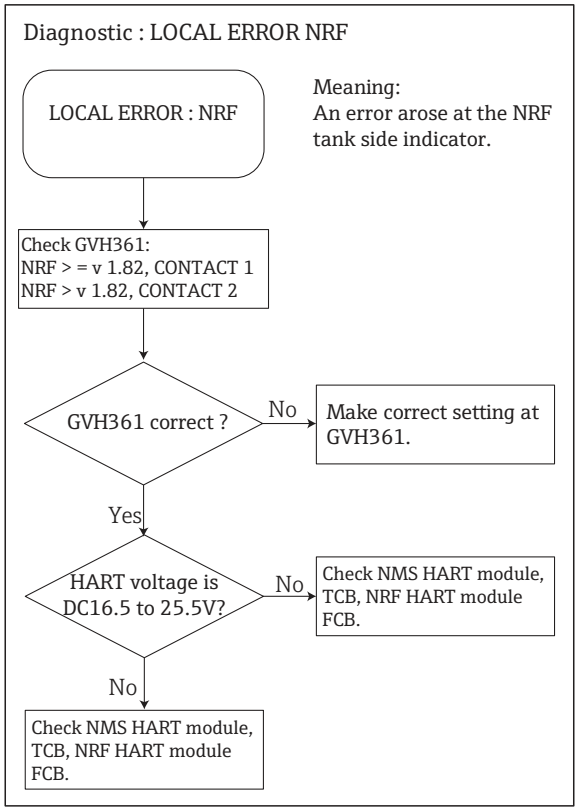
Diagnostic : IMPOSSIBILITY

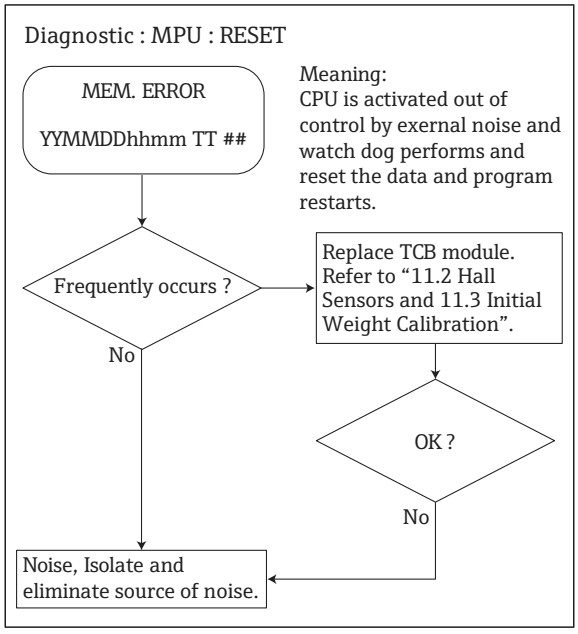


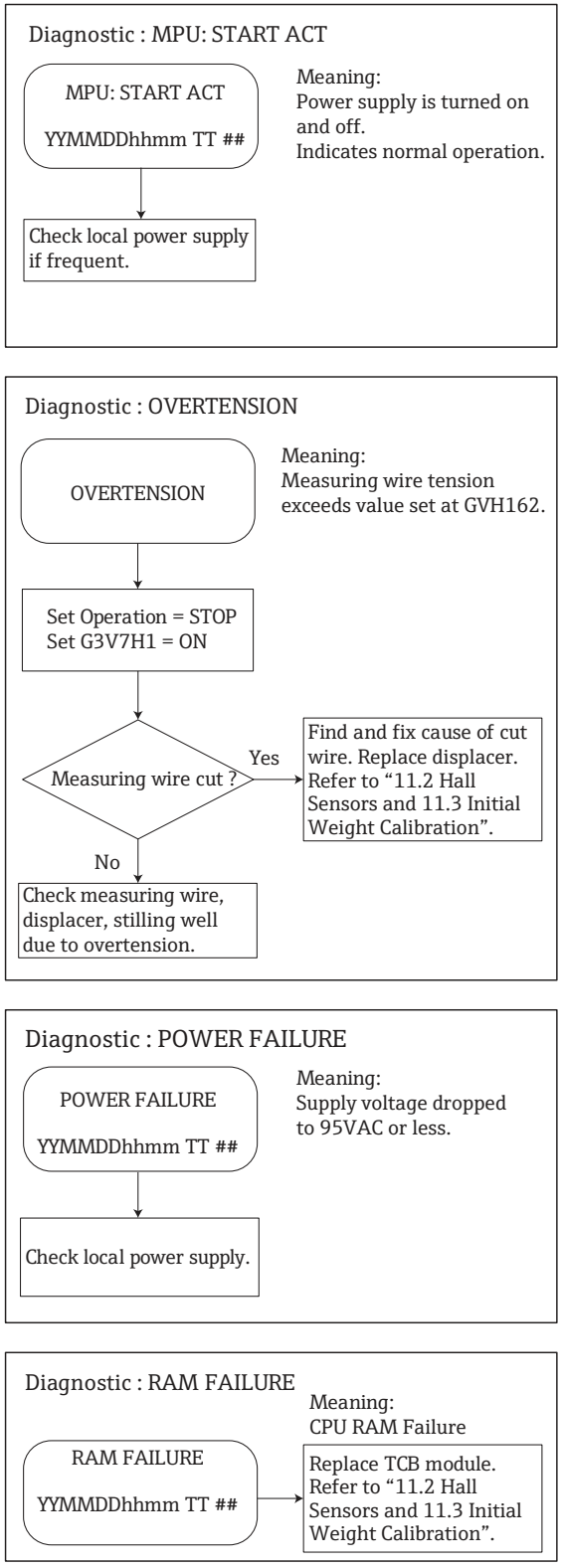

Diagnostic : LOCAL ERROR DEV1(2)
LOCAL ERROR DEV1 (2)
Meaning:
HART communication error of HART sensor (1) or (2)
HART sensor is connected?
No
Set GVH549, 649 = ON
Sensor is not connected.
Turn off GVH549 and 649.
Yes
HART terminal voltage is 16V or less?
No
HART sensor address
GVH549=4
GVH691=5
are not setted.
Check the address.
Yes
HART sensor is malfunctioned or power failure of HART circuit of NMS arise. Repair is required.

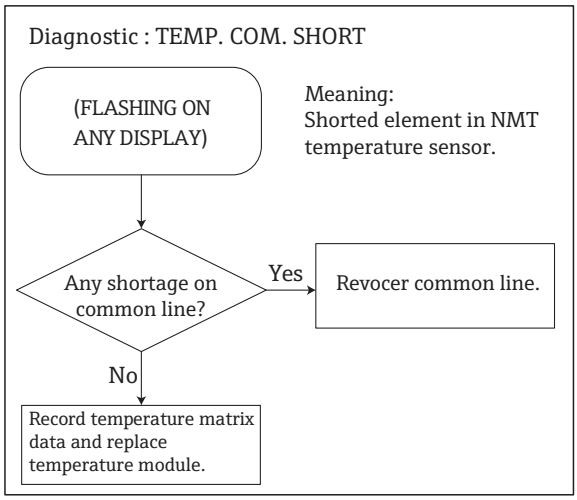

Diagnostic : LOCAL ERROR NMT
LOCAL ERROR NMT
Meaning:
An error arose at the NMT temperature sensor.
Check GVH480 for NMT Diagnostics codes, refer to NMT Operating Manual.
HART terminal voltage is 16V or less?
When NMT sensor is not connected, GVH362 is not OFF.
Yes
HART sensor is malfunctioned or power failure of HART circuit of NMS arise. Repair is required.

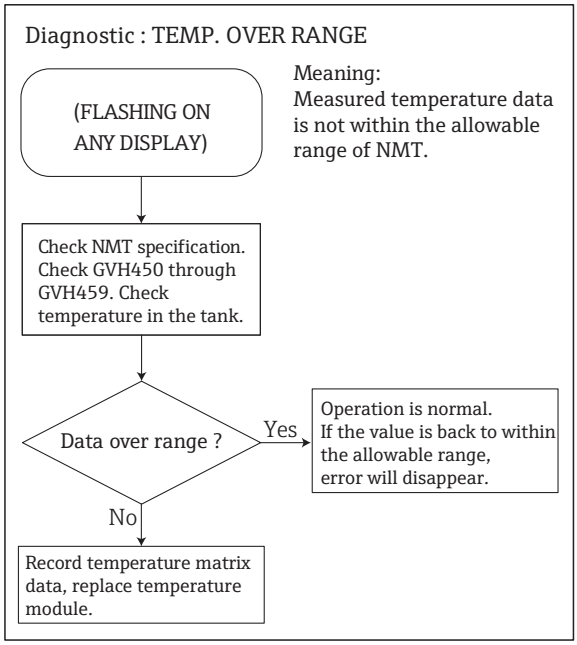

Diagnostic : Maintenance
MAINTENENCE
YYMMDDhhmm TT ##
Indicate that NMS is set to maintenance mode (GVH157).

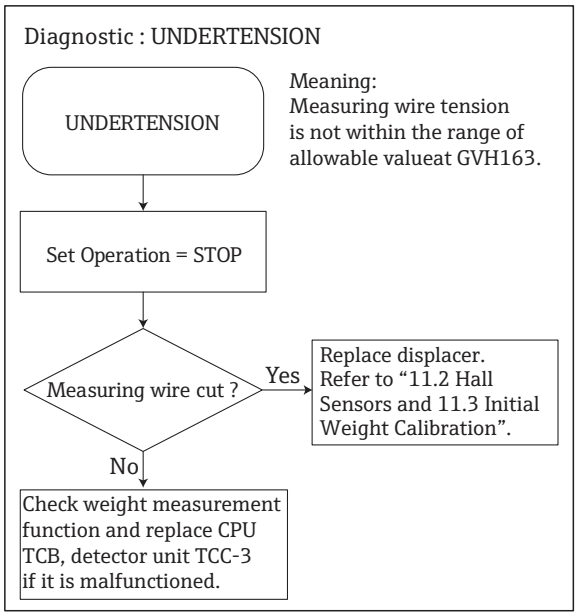

Diagnostic : LOCAL ERROR NRF
LOCAL ERROR : NRF
Meaning:
An error arose at the NRF tank side indicator.
Check GVH361:
NRF > = v 1.82, CONTACT 1
NRF > v 1.82, CONTACT 2
GVH361 correct ?
No
Make correct setting at GVH361.
Yes
HART voltage is DC16.5 to 25.5V?
No
Check NMS HART module, TCB, NRF HART module FCB.
No
Check NMS HART module, TCB, NRF HART module FCB.

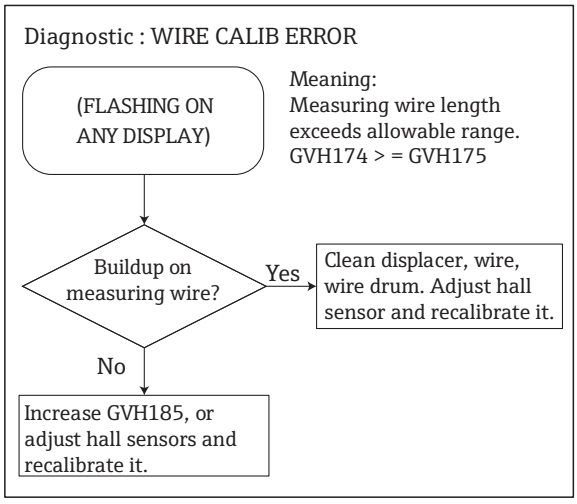

Diagnostic : MPU : RESET
MEM. ERROR
YYMMDDhhmm TT ##
Meaning:
CPU is activated out of control by exernal noise and watch dog performs and reset the data and program restarts.
Frequently occurs ?
Replace TCB module. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.
No
OK ?
No
Noise, Isolate and eliminate source of noise.

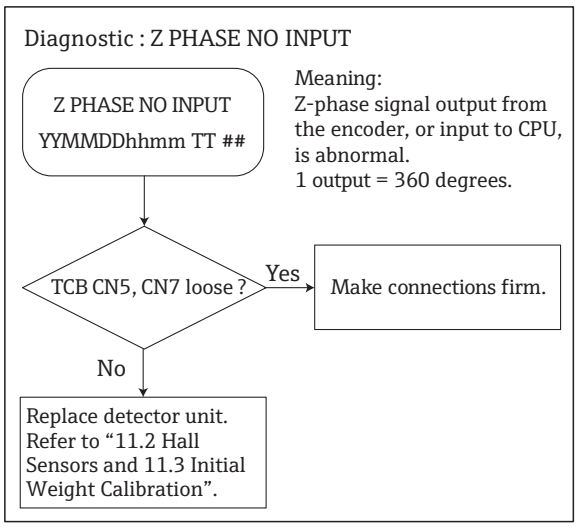

Diagnostic : MPU: START ACT
MPU: START ACT
YYMMDDhhmm TT ##
Meaning:
Power supply is turned on and off.
Indicates normal operation.
Check local power supply if frequent.
Diagnostic : OVERTENSION
OVERTENSION
Meaning:
Measuring wire tension exceeds value set at GVH162.
Set Operation = STOP
Set G3V7H1 = ON
Measuring wire cut ?
Yes
Find and fix cause of cut wire. Replace displacer. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.
No
Check measuring wire, displacer, stilling well due to overtension.
Diagnostic : POWER FAILURE
POWER FAILURE
YYMMDDhhmm TT ##
Meaning:
Supply voltage dropped to 95VAC or less.
Check local power supply.
Diagnostic : RAM FAILURE
Meaning:
CPU RAM Failure
RAM FAILURE
YYMMDDhhmm TT ##
Replace TCB module. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.
Diagnostic : ROM ERROR
Meaning:
CPU ROM Failure
ROM ERROR
YYMMDDhhmm TT ##
Replace TCB module. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.
Diagnostic : SIFA ERROR
Meaning:
CPU SIFA Failure
SIFA ERROR
YYMMDDhhmm TT ##
Replace TCB module. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.
Diagnostic : TEMP. BELOW RAM RANGE
(FLASHING ON ANY DISPLAY)
Meaning:
Measured temperature data is not within the allowable range of NMT.
Check NMT specification.
Check G4V5H0 through H9.
Check temperature in the tank.
Data below range ?
Yes
The operation is normal. If the value is back to within the allowable range, error will disappear.
No
Record temperature matrix data, replace temperature module.
Diagnostic : TEMP. COM. OPEN
(FLASHING ON ANY DISPLAY)
Meaning:
Open element in NMT temperature sensor.
Any shortage in common line?
Yes
Check the shortage point.
No
Record temperature matrix data, replace temperature module.

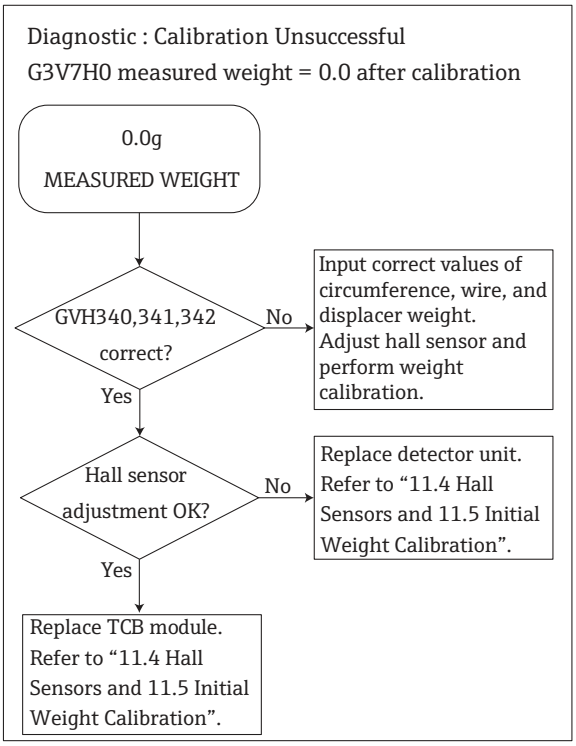

Diagnostic : TEMP. COM. SHORT
(FLASHING ON ANY DISPLAY)
Meaning:
Shorted element in NMT temperature sensor.
Any shortage on common line?
Yes
Revocer common line.
No
Record temperature matrix data and replace temperature module.

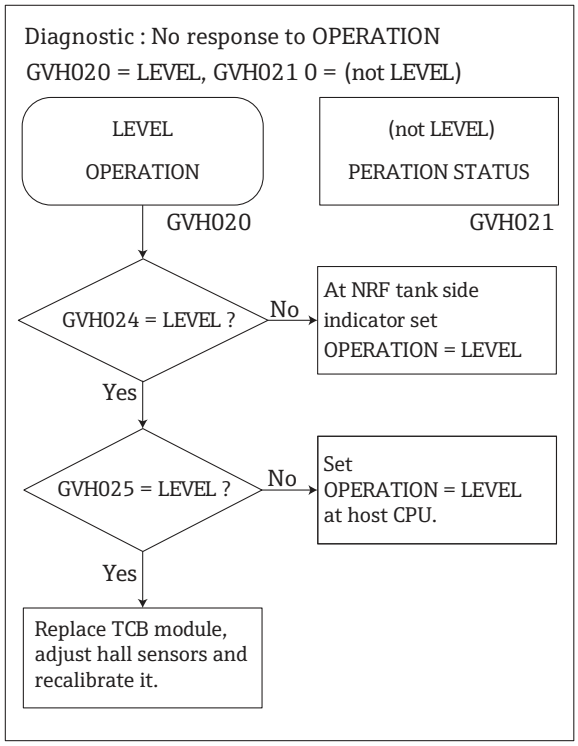

Diagnostic : TEMP. OVER RANGE
(FLASHING ON ANY DISPLAY)
Meaning:
Measured temperature data is not within the allowable range of NMT.
Check NMT specification. Check GVH450 through GVH459. Check temperature in the tank.
Data over range ?
Yes
Operation is normal. If the value is back to within the allowable range, error will disappear.
No
Record temperature matrix data, replace temperature module.


Diagnostic : UNDERTENSION
UNDERTENSION
Meaning:
Measuring wire tension is not within the range of allowable valueat GVH163.
Set Operation = STOP
Measuring wire cut ?
Yes
Replace displacer. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.
No
Check weight measurement function and replace CPU TCB, detector unit TCC-3 if it is malfunctioned.


Diagnostic : WIRE CALIB ERROR
(FLASHING ON ANY DISPLAY)
Meaning:
Measuring wire length exceeds allowable range.
GVH174 > = GVH175
Buildup on measuring wire?
Yes
Clean displacer, wire, wire drum. Adjust hall sensor and recalibrate it.
No
Increase GVH185, or adjust hall sensors and recalibrate it.


Diagnostic : Z PHASE NO INPUT
Z PHASE NO INPUT
YYMMDDhhmm TT ##
Meaning:
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
Replace detector unit. Refer to “11.2 Hall Sensors and 11.3 Initial Weight Calibration”.

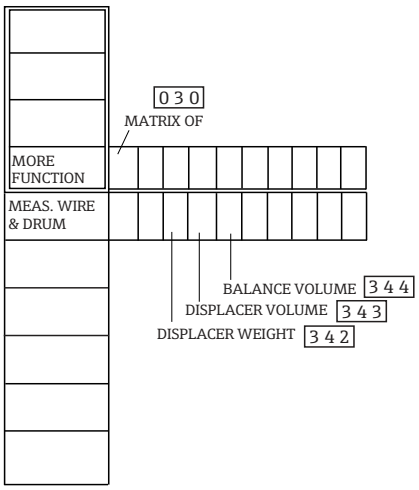
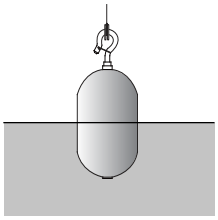

Diagnostic : Calibration Unsuccessful
G3V7H0 measured weight = 0.0 after calibration
0.0g
MEASURED WEIGHT
GVH340,341,342
correct?
No
Input correct values of circumference, wire, and displacer weight. Adjust hall sensor and perform weight calibration.
Yes
Hall sensor
adjustment OK?
No
Replace detector unit. Refer to “11.4 Hall Sensors and 11.5 Initial Weight Calibration”.
Yes
Replace TCB module. Refer to “11.4 Hall Sensors and 11.5 Initial Weight Calibration”.


Diagnostic : No response to OPERATION
GVH020 = LEVEL, GVH021 0 = (not LEVEL)
LEVEL
OPERATION
GVH020
(not LEVEL)
PERATION STATUS
GVH021
GVH024 = LEVEL ?
No
At NRF tank side indicator set OPERATION = LEVEL
Yes
GVH025 = LEVEL ?
No
Set OPERATION = LEVEL at host CPU.
Yes
Replace TCB module, adjust hall sensors and recalibrate it.

11.6 Setting after Parts Replacement

After any part of NMS7 is replaced, and before starting NMS7 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 NMS7 mounted on it (refer to Section "7 Commissioning").

Item	Procedure	Remarks
Matrix Group: SERVICE	3. In Static Matrix "MORE FUNCTION" bring up GVH030 "MATRIX OF" and select "SERVICE. 1. Select Dynamic Matrix GVH340 "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 55: Dynamic Matrix.  Figure 56: Displacer	2. Select the Dynamic Matrix screen GVH341. 3. Set Dynamic Matrix GVH342 "DISPLACER WEIGHT" at the value marked on the displacer. 4. Set Dynamic Matrix GVH343 "DISPLACER VOLUME" to the value marked on the displacer. 5. Set Dynamic Matrix GVH344 "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.

11.7 Intelligent Function

11.7.1 Maintenance Prediction Function

The history of maintenance is displayed at matrix screen GVH265 (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

11.8 Spare Parts

Spare parts are contained in kits. Spare parts for NMS7 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.

11.8.1 NMS7

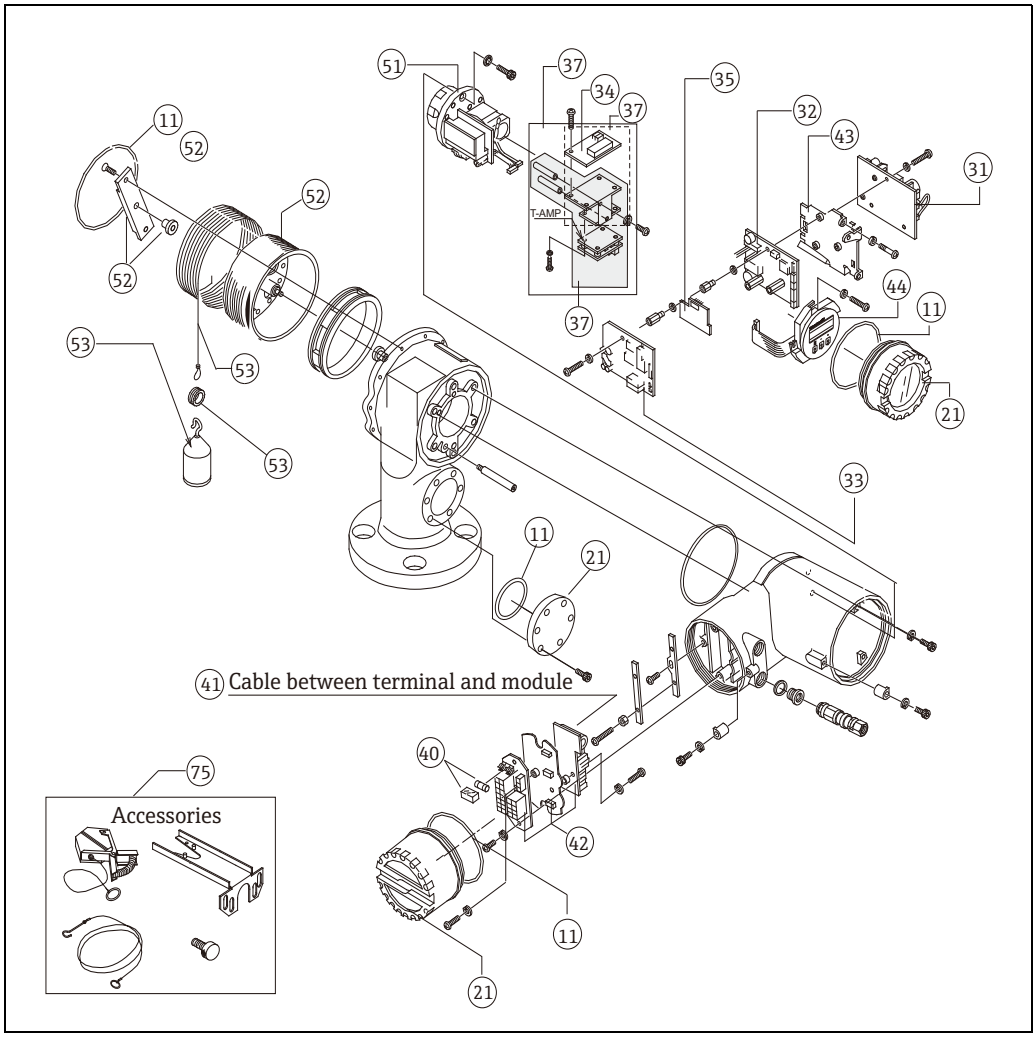


Figure 57: Spare parts

No.	Parts No.	Parts Name	No.	Parts No.	Parts Name
11	017803-0066	O-ring, cover drum housing SS, FKM	40	70106498	Fuse 250VAC T2A50, NMS, 10 pcs.
	017803-0035	O-ring, cover drum housing SS, Silicon		70106499	Fuse 20-62VDC T3A15, NMS, 10 pcs.
	70109105	O-ring, cover drum housing SS, NBR		70106500	Fuse cover 10set, NMS
	017803-0033	O-ring, calibration window, NBR	41	52013660	Wiring harness, Terminal-COM-1/RS485/BPM module
	017803-0041	O-ring, calibration window, silicon		52013650	Wiring harness, Terminal-HART passive module
	017803-0036	O-ring, calibration window, FKM		70106037	Wiring harness, Terminal-HART active module
	017803-0030	O-ring display cover, NBA		52013657	Wiring harness, Terminal-Mark Space module
	017803-0040	O-ring, terminal cover, NBA		52013648	Wiring harness, Terminal-ENRAF BPM module
21	017800-0111	Cover, display module, Aluminum		52013653	Wiring harness, Terminal-I/O-3 module
	017800-0112	Cover, terminal box, Aluminum, NMS		52013652	Wiring harness, I/O-3 TCB
	71103514	Calibration window, polished SS blind		52013655	Wiring harness, Terminal-I/O-5 module
31	70103940	POW-6, HV, non Ex i		70106033	CPU, T-AMP Ex d module cable
	70103941	POW-6, LV, non Ex i		70106034	Wiring harness, Terminal-T-AMP Ex d module
32	70103937	TCB-6, CPU module, upgrade of TCB-4	42	56004508	Terminal, noise filter, Exd
33	017800-0005	COM-1, Communication module, V1	43	017800-0015	PCB CPU Carrier set complete, spacer
	52013661	Upgrade kit V1	44	017800-0021	Display module 2 line, 3 key optical
	71086763	Modbus module RS485, COM-5		70103938	Display module 4 line, 3 key optical
	70106270	Upgrade kit Modbus RS485	51	017800-0043	Detector unit NMS, TCC-3
	56004484	COM-6 HART, passive remote communication, module		70103944	Detector unit NMS, TCC-3, V1
	52013651	Upgrade kit, HART, passive	52	71103519	Wire drum + wire 0.2mm, 10/16m
	56004485	COM-6 HART, active remote communication, module		71103518	Wire drum + wire Teflon, 10/16m
	70106039	Upgrade kit HART active output		71134074	Wire drum, wire 0.2mm 22m, flanged
	56004534	Communication module WM550, arrestor		56004527	Wire drum + 47m wire, SS
	52013662	Upgrade kit WM550		56004526	Wire drum bracket SS, teflon coated
	56004409	Communication module Mark Space		017800-0221	Bearing, wire drum bracket, PTFE
	52013658	Upgrade kit Mark Space	53	71103520	Set measuring wire 316 0.2mm, 16m (5pcs)
	56004355	Communication module ENRAF BPM, COM-3		56004909	Measuring wire, 0.2mm, SS, 16m
	52013649	Upgrade kit ENRAF BPM		56004256	5x measuring wire, 16m, d=0.4mm, PTFE
34	017800-0007	Alarm output, 2x contact, I/O3		56004912	5x measuring wire, 16m, d=0.4mm, PTFE coated
	70109108	Alarm output, 2x contact, I/O3, TUV OSP		017800-0241	Wire ring, 316
35	017800-0017	Output 4-20mA, I/O-5, TCB4		017800-0242	Wire ring, PTFE coated
	52013656	Upgrade kit I/O-5		70105994	Displacer, 50mm, cylindrical, PTFE solid
37	56004442	Operation I/C. O., spot temperature		71103517	Displacer, 50mm, cylindrical, SUS316 polished
	70106035	Upgrade kit operation I./C. O., Ex d temp.	75	71067825	Calibration weight 50g, NMS7
	70106032	Upgrade kit operation input/contact out			
	56004441	Operation input/contact out, carrier			
	56004491	Spot temp. with Chassis			
	56004490	Spot temp. input T-AMP Upgrade kit			

11.9 Return

1. The following procedure must be performed before returning NMS7 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 NMS7 or its plastic material. Unless hazardous materials are completely removed from NMS7, 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.

11.10 Disposal

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

11.11 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	
V4.08X, 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
V4.22, 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	
V4.24 T2, from 02.02	TCB-2 CPU, NMT, V1 level measurement	
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

12 Adjustment

12.1 Sensor Adjustment

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.

Hall Sensor Adjustment Procedure

1. Move the displacer to the side of blind window or put the displacer on a work bench so that the displacer can be touched.

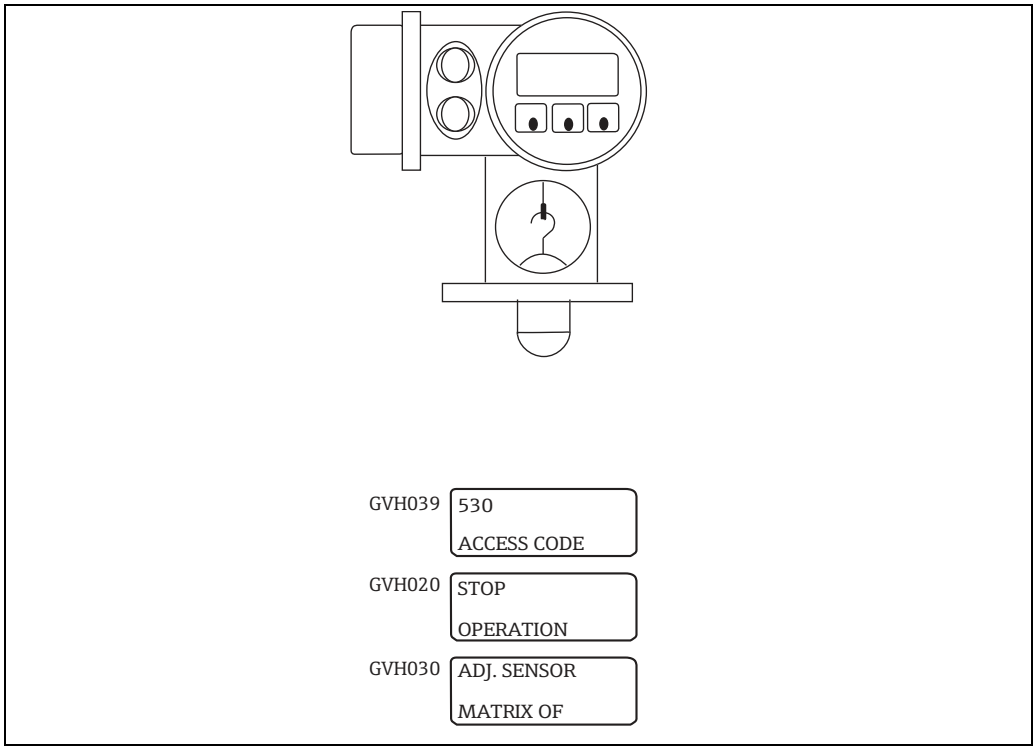


Figure 58: Hall Sensor Adjustment 1

2. Confirm that NMS7 is level and no vibration or other disturbance occurred.
3. Set access code to 530 at GVH039.
4. Set operation command to STOP at GVH020.
5. Select Adj. Sensor at GVH030.
6. Record Sensor Count (Wa2) at GVH741.

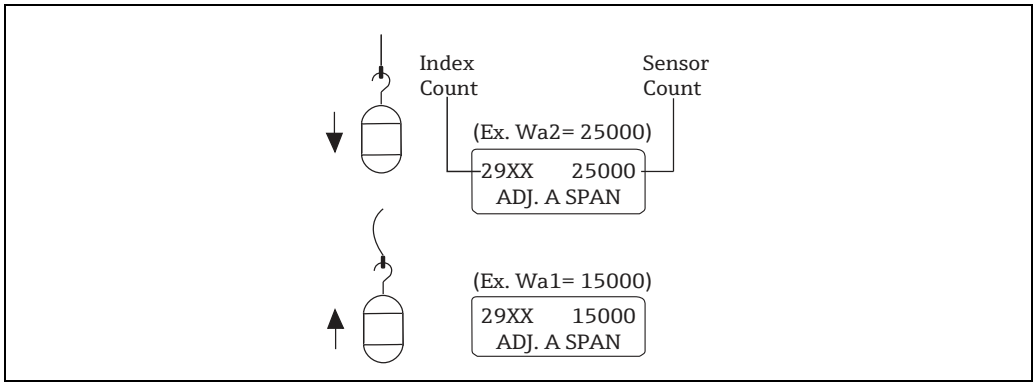


Figure 59: Hall Sensor 2

WARNING

Do not let wire fall off the wire drum.

7. To set 0 to load of the measuring wire, lift the displacer until Sensor Count is stable and record the value of Sensor Count (Wa1). Calculate the difference of Wa1 and Wa2 using the following formula.
   - |Wa2 - Wa1| = 10000 (+/-100)?
8. If Yes, go to step 7 "GVH740 A Zero".
9. If No, return the displacer to the original position at GVH741
   - If |Wa2 - Wa1|<9,900, increase Index Count using [+] key.
   - If |Wa2 - Wa1|>11,000, decrease Index Count using [-] key.
   - Repeat until |Wa2 - Wa1| = 10000 (+/-100).
10. Adjust A Zero Sensor Count = 21000 (+/-100) at GVH740 using [+] and [-] keys.

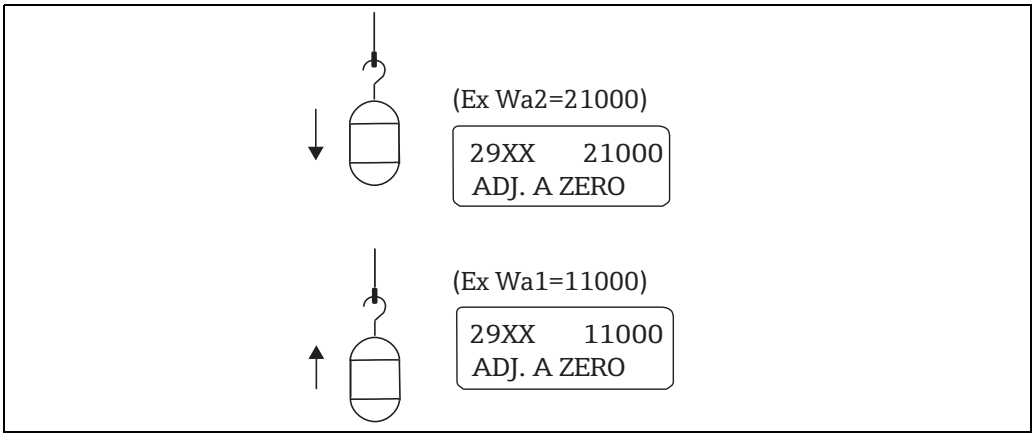


Figure 60: Hall Sensor Adjustment 3

11. Record the value of Sensor Counter (Wa2)
12. Follow step 7 above, lift the displacer until Sensor Count is stable and record the value of Sensor Count (Wa1). Calculate the difference of Wa1 and Wa2 using the following formula.
    - |Wa1 - Wa2| = 10000 (+/-100)?
13. If yes, go to step 12. "GVH743 B Span".
14. If not, repeat steps 6 and 12.
15. Follow step 6 to 9, set B Span to |Wa2 - Wa1|=10000 (+/-100) at GVH743.

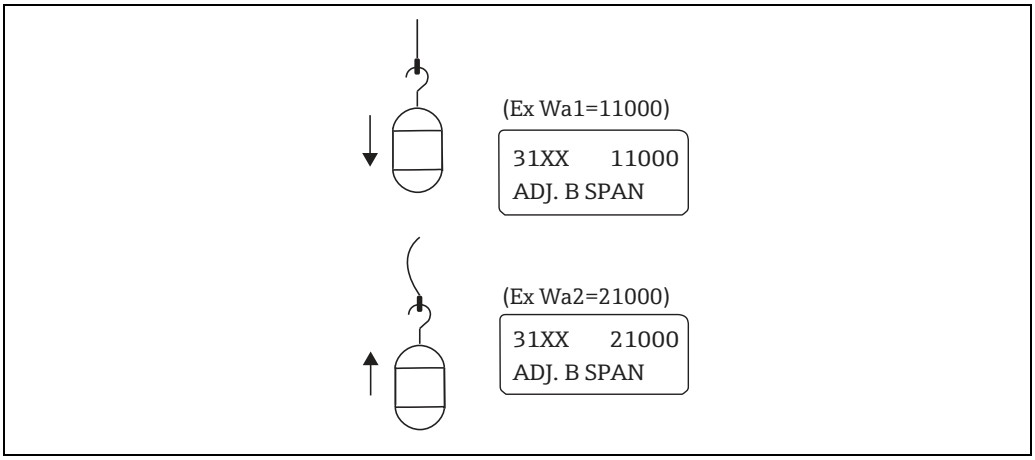


Figure 61: Hall Sensor Adjustment 4

16. Adjust B Zero Sensor Count = 11000 (+/- 100) at GVH742 using [+] and [-] keys.
17. Follow steps 11 to 14, adjust to |Wa2 - Wa1| = 10000 (+/-100) at GVH42.

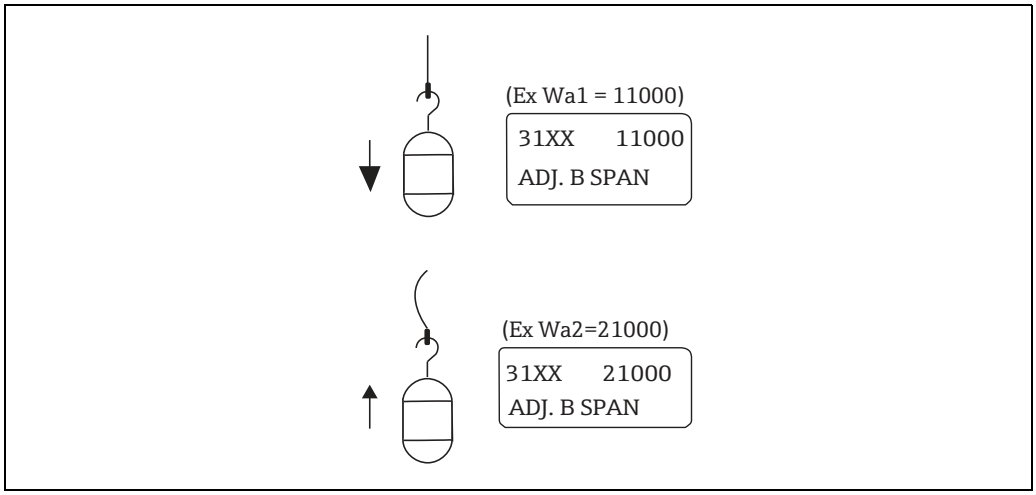


Figure 62: Hall Sensor Adjustment 5

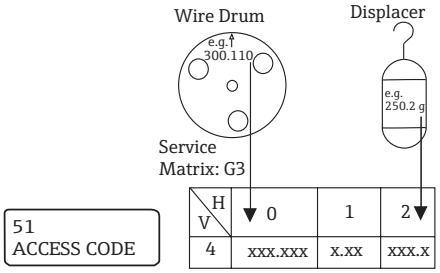
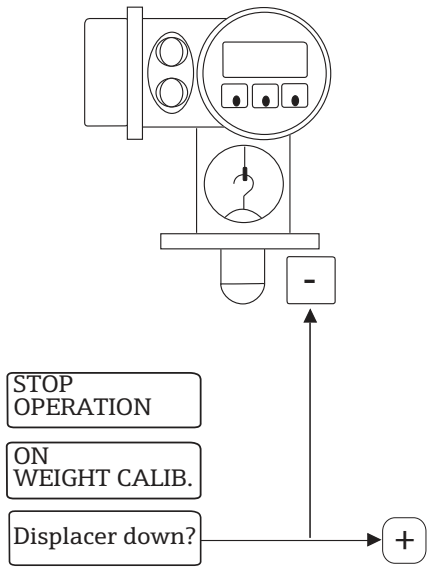
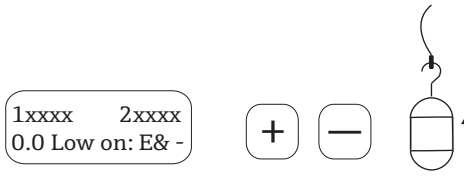
This completes the hall sensor adjustment.

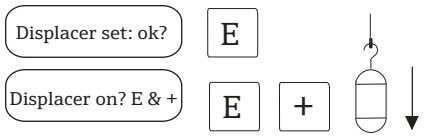
12.2 Initial Weight Calibration

Weight table calibration must be done after completing wire drum installation. The calibration procedures will vary depending on the measurement specifications. Use the following procedure ONLY for NMS7 with level measurement function. When NMS7 performs density and interface measurements other than level measurement, refer to "12.2.2 Weight Calibration (Density)".

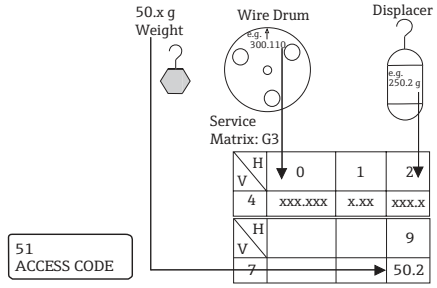
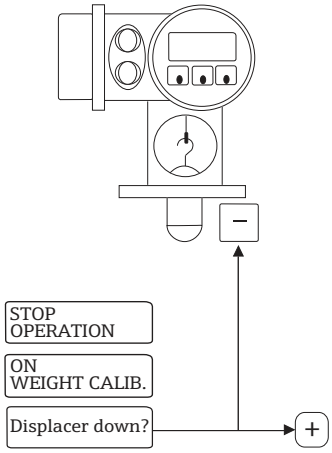
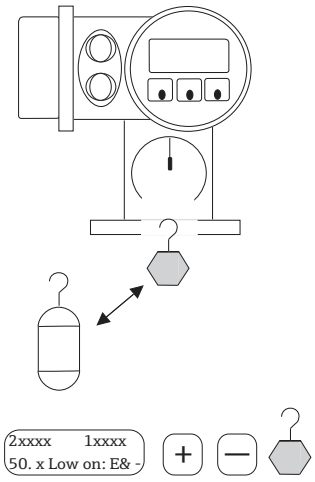
12.2.1 Weight Calibration (Standard)

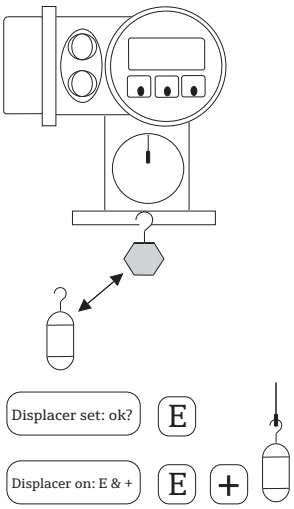
⚠ CAUTION
Wind and vibration may affect weight table calibration.

Item	Procedure	Remarks
 Figure 63: Calibration 1-A	1. Enter access code 51 at GVH039. 2. Confirm the following data. GVH340 wire Drum (engraved on wire drum), GVH342 Wire Weight Standard SUS = 2.50 PTFE=4.55, GVH342 Displacer Weight (engraved on displacer) 3. Confirm that the data engraved on displacer and data on matrix are same. ▪ If not, change the matrix data according to the engraved data.	
 Figure 64: Calibration 2-A	4. Select STOP at GVH020. 5. Set 0.0 to GVH379. 6. Select ON at GVH373. ▪ NMS7 automatically moves displacer up and down, calibrates, and stops. 7. Enter No = (-) at Displacer Down? +/-. ▪ When entering (-), displacer stop the current position. When entering (+), displacer moves 300mm down and stops.	▪ Displacer moves to blind window position.
 Figure 65: Calibration 3-A	8. Leave the displacer until Sa and Sb are stable. Press [E] and [-] keys simultaneously. 9. Return the displacer to the original position.	

Item	Procedure	Remarks
 Figure 66: Calibration 4-A	10. Press [E] at Displacer set ok?. 11. Press [E] and [+] keys simultaneously at Displacer on: E & +.	▪ Calibration automatically starts, which takes approximately 10 minutes.
 Figure 67: Calibration 5-A	12. Weight Calibration at GVH373 shows OFF. 13. Check the weight calibration at GVH370=GVH342 +/- 2.0 grams? 14. If not, adjust sensor or calibrate the weight again.	▪ Always enter N = -.

12.2.2 Weight Calibration (Density)

Item	Procedure	Remarks
 Figure 68: Calibration 1-B	1. Enter access code 51 at GVH039. 2. Confirm the following data. GVH340 wire Drum (engraved on wire drum), GVH342 Wire Weight Standard SUS = 2.50 PTFE=4.55, GVH342 Displacer Weight (engraved on displacer) 3. Confirm that the data engraved on displacer and data on matrix are same. ▪ If not, change the matrix data according to the engraved data.	
 Figure 69: Calibration 2-B	4. Select STOP at GVH020. 5. Set 50.2g (test weight) to GVH379. 6. Select ON at GVH373. ▪ NMS7 automatically moves displacer up and down, calibrates, and stops. 7. Enter No = (-) at Displacer Down? +/-. 8. When entering [-], displacer stop the current position. When entering [+], displacer moves 300mm down and stops.	▪ Displacer moves at calibration window or maintenance chamber position.
 Figure 70: Calibration 3-B	9. Replace the displacer with 50.2 g weight and wait until Sa and Sb are stable. 10. Press [E] and [-] key simultaneously.	

Item	Procedure	Remarks
 Figure 71: Calibration 4-B	11. Remove the 50.2g wight from the displace and mount the displacer on the wire. 12. Press [E] at Displacer set O.K? 13. Press [E} and [+] keys simultaneously at Displacer on: E & +.	▪ Calibration starts automatically, which takes approximately 10 minutes.
 Figure 72: Calibration 5-B	14. Weight Calibration at GVH373 shows OFF. 15. Check the weight calibration at GVH370=GVH342 +/- 2.0 grams? 16. If not, adjust sensor or calibrate the weight again.	▪ Always enter N = -.

13 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)
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	27kg Weight varies depending on specifications.
Degree of Protection	IP67 / NEMA4X
Ex Approval	Waterproof and dust-proof, IP67 NEMA 4X TIIS Ex d IIB T4
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)
Supplementary Documentation	Technical Information (TI00006G) Functional Safety Manual (SD00337G)

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

14 Matrix

14.1 Programming Matrix

Default Data
Display Text
Changeable parameters, units, etc.
Mode (Code)

NMS53x Programming Matrix (Static Matrix)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
MEASURED VALUE 1	0	16000.0 m m MEASURED LEVEL 0.0 - 99999.9 m m Display	0.0 m m ULLAGE LEVEL 0.0 - 99999.9 m m Display	0.0 m m UPPER INTERF. LEV 0.0 - 99999.9 m m Display	0.0 m m MIDD. INTERF. LEV 0.0 - 99999.9 m m Display	0.0 m m BOTTOM LEVEL 0.0 - 99999.9 m m Display	1.000 g/m l UPPER DENSITY 0.000 - 3.000 g/m l Display/Set (50)	1.000 g/m l MIDDLE DENSITY 0.000 - 3.000 g/m l Display/Set (50)	1.000 g/m l DENSITY BOTTOM 0.000 - 3.000 g/m l Display/Set (50)	0.0 m m LEVEL DATA 0.0 - 99999.9 m m Display	
MEASURED VALUE 2	1	0.0 °C LIQUID TEMP. -49.9 - 249.9 °C Display	HART DEVICE(1) Display	HART DEVICE(2) Display	0.0 °C GAS TEMPERATURE -49.9 - 249.9 °C Display	0.0 m m WATER BOTTOM Display			0.0 m m ZERO POINT 0.0 - 99999.9 m m Display	16000.0 m m SPAN 0.0 - 99999.9 m m Display	m m LENGTH UNIT Display
OPERATION	2	STOP OPERATION 16000 See operation com m ands below Select (50)	STOP OPERATING STATUS See status table below Display	UNBALANCED BALANCING STATUS BALANCED / UNBALANCED Display		LEVEL OPERAT.BY NRF Display	LEVEL OPERAT.BY HOST Display			0 DEVICE ID Display	x.xx SOFTWARE VERSION Display
MORE FUNCTION	3	CALIBRATION MATRIX OF Select			xx xxx x:xx:xx CALENDER Current Data Display	NO ALARM ALARM CONTACT Current Data Display	NO ALARM LA 0 0 0 0 Current Data Display	NO ERROR DIAGNOSTIC CODE Current Data Display	xx xxx xxx x x Current Data Display	OFF RESET ALM. DIAGNO	0 ACCESS CODE 0, 50, 51, 530 Set

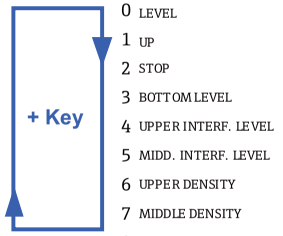
When new NMS status is selected at GVH=272, new status codes are shown to matrix position GVH=021 as follows;

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 m easurem ent, balanced	LEVEL
6	Upp. I/F level, balanced	UPPER.INTERF.LEV.
7	Midd. I/F level, balanced	MIDD.INTERF.LEV.
8	Bottom m eas. balanced	BOTTOM LEVEL
9	Upper Dens, finished	UPPER DENSITY
10	Middle Dens, finished	MIDDLE DENSITY

Code	Meaning	NMS Display
11	Bottom Dens, finished	DENSITY BOTTOM
12	Release over tension	RELE.OVER TENS.
13	Calibration activated	CAL. ACTIVE
14	Seek level	LEVEL SEEKING
15	Follow level	LEVEL FOLLOWING
16	Seek Upper Density	UPP.DEN. SEEKING
17	Seek Middle Density	MID.DEN.SEEKING
18	Seek Density Bottom	BOT.DEN.SEEKING
19	Seek Upper I/F level	UPP.INT.SEEKING
20	Follow up. I/F level	UPP.INT.FOLLOWING
21	Seek Mid. I/F level	MID.INT.SEEKING

Code	Meaning	NMS Display
22	Follow Mid. I/F level	MID.INT.FOLLOWING
23	Seek Bottom Level	BOTTOM SEEKING
24	Not initialised	NO INITIALIZE
25	Stopped at High Stop.	UPPER STOP
26	Stopped at Low Stop	LOWER STOP
27	Repeatability testing	REPEATABILITY
28	Seeking water level	WATER SEEKING
29	Water level, balanced	WATER LEVEL
30	Follow water level	WATER FOLLOWING
31	Over-/Under tension, Z-Phase, ADC error	EMARGENCY ERROR
32	Maintenance Mode (GVH157) = ON	"MANT" "MAINTENANCE"

Operation com m ands (Com m ands. Text)



0 LEVEL
1 UP
2 STOP
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

NMS53x Programming Matrix (Dynamic Matrix, Calibration: G1)

GROUP MESSAGE	H / V	0	1	2	3	4	5	6	7	8	9
LEVEL DATA	4	16000.0 mm TANK HEIGHT 0.0 - 99999.9 mm Set (50)	0.0 mm DIP POINT OFFSET -99999.9 - 99999.9 mm Set (50)	10.0 mm DISPLAC. DRAFT 0.0 - 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)	0.000 g/ml OFFSET UP DENS. MAX.. 0.200 g/ml Set (50)	0.000 g/ml OFFSET MID.DENS. MAX 0.200 g/ml Set (50)	0.000 g/ml OFFSET BOT.DENS. MAX. 0.200 g/ml Set (50)	5 CUT DOWN DIG. NUM. FOR V1 5 ROUND UP 5 ROUND OFF Set (50)	99999 mm LEVEL BELOW 0 0.0 - 99999.9 mm Set (51)
CALIBRATION	5	16000.0 mm SET LEVEL 0.0 - 99999.9 mm Set (50)		0.0 mm TANK CORRECT LEV 0.0 - 99999.9 mm Set (51)	0.000 mm/m TANK CORRE. COEF 0.000 - 59.999 mm/m Set (51)	OFF SAFE DENSITY ON IGNOR Set (51)	300.0 mm DEN.OPE.LEVEL 0.0 - 99999.9 mm Set (51)		OFF SERVICE MODE ON OFF Set (530)	ON PRO SAFETY ON OFF Set (530)	99999.0 mm SAFETY LEVEL 0.0 - 99999.0 mm Set (530)
ADJUSTMENT	6	16000 mm UPPER STOP 0.0 - 99999.9 mm Set (50)	0 mm LOWER STOP 0.0 - 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 s Set (51)	10 s DISPL.WAIT DIP 10-999 s Set (51)		
AUTO WIRE CALIB.	7										
AUTO CALIB.DISPL	8										
DISPLAY	9	MEASURED LEVEL SELECT DISP.MODE ULLAGE LEVEL MEASURED Select (51)	ENGLISH LANGUAGE JAPANESE CHINESE Select (51)	[redacted] LCD CONTRAST 0 - 15 Set (51)	1 YEAR SETTING 00 - 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)

NMS53x 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 1 - 4 Select (50)	NONE ASSIGN RELAY LELVEL, LIQUID TEMP CAUTION, WARNING EMEARGENCY ERROR BALANCE SIGNAL Select (50)	HIGH RELAY FUNCTION LOW Select (50)	0 m m / 0 ℃ SWITCHING POINT 0 - 99999 m m -999 - 999 ℃	0 m m / 0 ℃ HYSTERISIS 0 - 99999 m m -999 - 999 ℃ Set (50)	NORMAL OPENED RELAY ON ALARM NORMAL CLOSED Select (50)	0 s ON DELAY TIME 0 - 999 s Set (50)	0 s OFF DELAY TIME 0 - 999 s Set (50)	-1 SIM. RELAY OUT 1 - 4 Set (50)	
ANALOG OUT.ADJUST	5	NONE ASSIGN OUTPUT 1 LEVEL LIQUID TEMP. UPPER.INTERF.LEV Select (51)	0 m m / 0 ℃ ADJUST 4m A 0 - 99999 m m -999 - 999 ℃ Set (51)	0 m m / 0 ℃ ADJUST 20m A 0 - 99999 m m -999 - 999 ℃ Set (51)	NONE ASSIGN OUTPUT 2 LEVEL LIQUID TEMP. UPPER.INTERF.LEV Set (51)	0 m m / 0 ℃ ADJUST 4m A 0 - 99999 m m -999 - 999 ℃ Set (51)	0 m m / 0 ℃ ADJUST 20m A 0 - 99999 m m -999 - 999 ℃ Set (51)	OFF DEVICE AT ALARM HOLD CURNT.OUT MAX MIN Select (51)	-1% SIM. CURRENT OUT Up to 100% Set (50)	0 CH1 ADJ. ZERO Max. 9999 Set (50)	0 CH2 ADJ. ZERO Max. 9999 Set (50)
PARTS DATA	6	1 PARTS NUMBER 1 - 10 Set (51)	NONE PARTS TYPE POWER UNIT DISPLAY, MOTOR WIRE, BEARINGS SHAFT Select (51)	OPERATION HOUR MAINTEN. FACTOR DRUM REVOLT. Select (51)	1hour / 1 round MAINTEN. VALUE 0 - 999999hour Set (51)	0 hour / 0 round OPERATION TIME 0 - 999999hour Set (51)	POWER UNIT PH 0 0 0 Display (51)	NONE REPLACED PARTS POWER UNIT DISPLAY, MOTOR WIRE, BEARINGS SHAFT Select (51)	NONE MH 0 0 0		
INPUT SIGNAL	7	NONE OPE. CONTACT ACTIVATED Select (51)	OFF CUSTODY TRANSFER ON Display (51)	DISABLED NEW NMS STATUS ENABLED Select (51)			x.xx SW VERSION Display (51)	x.xx HW VERSION Display (51)		1.000 g/m l OPE. DENSITY 0 - 3.000 Set (51)	0 OPE. CONT. STATUS 0-15 Display (51)
COMMUNICATION	8	HIGH LEVEL ALARM 1 LOW NONE Select (51)	0.0 m m SET LEVEL ALARM1 0.0 - 99999.9 m m Set (51)	HIGH LEVEL ALARM 2 LOW NONE Select (51)	0.0 m m SET LEVEL ALARM2 0.0 - 99999.9 m m Set (51)	0.0 m m HYSTERISYS 0.0 - 99999.9 m m Set (51)	0 ADDRESS 00 - FF for MIC->FF fixed 1 - 247 Modbus Set (51)	WM550, M/S PROTOCOL BBB, MDP, V1, ENRAF, RACK BUS, HART, MarkSpace, WM550, MODBUS Select (51)	F COMMU. LINE ADJ. 0 - F（Hex） Set (51)	0 COMMUNIC. STATUS Display (51)	0 MODBUS Config 0 - 14 Set (51)
STATUS	9	0 s STATUS1 DELAY 0 -99 s Set (51)	NONE SELECT CONTACT NORMAL OPENED NORMAL CLOSED (ALARM = CLOSED) (ALARM = OPEN) Select (51)	1 WM550 ALM.SELECT 1 - 4 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 s Set (51)				5 s BALANCE DELAY 0 -99 s Set (51)

NMS53x Programming Matrix (Dynamic Matrix, Service: G3)

GROUP MESSAGE	H / V	0	1	2	3	4	5	6	7	8	9
MEAS.WIRE & DRUM	4	300.000 mm WIRE DRUM CIRC. 0.000 - 999.999 mm Set (51)	1.40 g/10m WIRE WEIGHT 0.00 - 999.99 g/10m Set (51)	xxx.x g DISPLACER WEIGHT 0.0 - 999.9 g Set (51)	xxx.x ml DISPLACER VOLUME 0.0 - 999.9 ml Set (51)	xxx.x ml BALANCE VOLUME 0.0 - 999.9 ml Set (51)	1.0 ml VOLUME TOLERANCE 0.0 - 99.9 ml Set (51)	0 X 100 mS MOTION DELAY TIM	20 X 100 mS DELAY 0 - 99 x 100 ms Set (51)	0.00 mm/m DRUM CORRECTION 0.00 - 99.00 mm/m Set (51)	0 count DISPL.HUNT.COUNT 0 - 99 count 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 s Set (51)	50 mm HI. ACC. DISP. UP 0 - 300 mm Set (51)	xxx °C GAUGE TEMP. -999 - 999 °C Display (51)			OFF DEFAULT VALUES ON Set (530)
SYSTEM DATA	6	LOCAL : MASTER SENSOR DATA REMOTED COM. ON SOFTWARE = 09.99 HARDWARE=TCB06 GEAR 1:36 NOT OVERSPILL PROTOCOL , LCD Display	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 BOTTOM2 Select (51)	OFF SOFT RESET ON Select (51)
SERVICE	7	0.0 g MEASURED WEIGHT 0.0 - 999.9 g Display	OFF RELE. OVER TENS ON Select (51)	OFF DRUM SETTING ON Select (51)	OFF WEIGHT CALIBR. ON Select (51)					60 mm DISPL. REFERENCE 0 - 999 mm Set (51)	0.0 g ZERO ADJ. WEIGHT 0.0 - 999.9 g Set (51)
SENSOR VALUE	8	Sa=21000:A=21000 Sb=11000:B=11000 Display (51)									
SENSOR DATA	9					x x x.x g WT.COUNT CAL A Display (51)	x x x.x g WT.COUNT CAL B Display (51)				

NMS53x Programming Matrix (Dynamic Matrix, Temperature: G4)

GROUP MESSAGE	V \ H	0	1	2	3	4	5	6	7	8	9
TEMPERATURE DATA	4	xx.x °C LIQUD TEMP. Depending on specification and measured value Display (51)	zz.z °C GAS TEMPERATURE Depending on specification and measured value Display (51)	aaaa.a mm MEASURED LEVEL Depending on specification and measured value Display (51)	VH00 LEV.DATA SELECT VH00 or VH08 Select (51)	0.0 mm WATER BOTTOM Depending on specification and measured value Display (51)			0.0 °C REFERENCE ZERO Depending on specification and measured value Display (51)		150.0 °C REFERENCE 150 Depending on specification and measured value Display (51)
ELEMENT TEMP.	5	aa.a °C TEMP. NO.1 Depending on specification and measured value Display (51)	bb.b °C TEMP. NO.2 Depending on specification and measured value Display (51)	cc.c °C TEMP. NO.3 Depending on specification and measured value Display (51)	dd.d °C TEMP. NO.4 Depending on specification and measured value Display (51)	ee.e °C TEMP. NO.5 Depending on specification and measured value Display (51)	ff.f °C TEMP. NO.6 Depending on specification and measured value Display (51)	gg.g °C TEMP. NO.7 Depending on specification and measured value Display (51)	hh.h °C TEMP. NO.8 Depending on specification and measured value Display (51)	ii.i °C TEMP. NO.9 Depending on specification and measured value Display (51)	jj.j °C TEMP. NO.10 Depending on specification and measured value Display (51)
ELEMENT POSITION	6	xxx.x mm ELEM.1 POSITION Depending on specification Display (51)	xxx.x mm ELEM.2 POSITION Depending on specification Display (51)	xxx.x mm ELEM.3 POSITION Depending on specification Display (51)	xxx.x mm ELEM.4 POSITION Depending on specification Display (51)	xxx.x mm ELEM.5 POSITION Depending on specification Display (51)	xxx.x mm ELEM.6 POSITION Depending on specification Display (51)	xxx.x mm ELEM.7 POSITION Depending on specification Display (51)	xxx.x mm ELEM.8 POSITION Depending on specification Display (51)	xxx.x mm ELEM.9 POSITION Depending on specification Display (51)	xxx.x mm ELEM.10 POSITION Depending on specification Display (51)
NMT ADJUSTMENT	7	0 SELECT POINT 0 - 15 Selectable SELECT POINT + 1 = ELEMENT No. Set (51)	x.x °C ZERO ADJUST -20.0 - 20.0 °C Set (51)	1.000 GAIN ADJUST Current data Set (51)	xx.x °C ELEMENT TEMP Current data Display (51)	xxx.x mm ELEMENT POSITION Current data Display (51)				2 AVERAGING 1 - 10 Set (51)	530 ACCESS CODE 0 - 999 Display (51)
SET DATA NMT	8	0 DIAGNOSTIC 0 - 255 Display (51)	°C TEMPERATURE UNIT Display (51)	XX TOTAL NO.ELEMENT 2 - 16 Set (51)	5 PREAMBLE NUMBER 2 - 20 Display (51)	mm LENGTH UNIT Display (51)	EQUAL KIND OF INTERVAL UNEQUAL Select (51)	500.0 mm BOTTOM POINT 0.0 - 500.0 mm Set (51)	2000.0 mm ELEMENT INTERVAL 0.0 - 99999.9 mm Set (51)	-49.5 °C TEMP.ELEM.SHORT Set (51)	359.0 °C TEMP.ELEM. OPEN Set (51)
DEVICE DATA NMT	9	INSTRUMENT CODE Display (51)	0 LAST DIAGNOSTIC 1 Display (51)	OFF OUTPUT AT ERROR ON Select (51)	OFF CUSTODY TRANSFER ON Display (51)	2 POLLING ADDRESS 1 - F Set (51)	17 MANUFACTURE ID Display (51)	x SW VERSION Display (51)	x.xx HW VERSION Display (51)	ON BELOW BOT.POINT OFF Select (530)	DEVICE DEVICE TYPE CODE Display (51)

NMS53x Programming Matrix (Dynamic Matrix, HART DEVICE (1): G5)

GROUP MESSAGE	H / V	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	SW VERSION Display	HW VERSIION Display	DEVICE ID Display		

NMS53x 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 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	SW VERSION Display	HW VERSIION Display	DEVICE ID Display		

NMS53x Programming Matrix (Dynamic Matrix, ADJ. SENSOR: G7)

GROUP MESSAGE	H / V	0	1	2	3	4	5	6	7	8	9
ADJ. SENSOR	4	XXXX YYYYY ADJ. A ZERO Set (530)	XXXX YYYYY ADJ. A SPAN Set (530)	XXXX YYYYY ADJ. B ZERO Set (530)	XXXX YYYYY ADJ. B SPAN Set (530)						
HART ERROR RATE	5	0.00% ERR.RATE NRF Display (530)	0.00% ERR.RATE NMT Display (530)	0.00% ERR.RATE DEV(1) Display (530)	0.00% ERR.RATE DEV(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/l g/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/m3, lb/gl, SGU, kg/l g/l, lb/in, st/y3 Select (51)		
HART LINE*	7	Terminal Port A NMT Terminal Port B 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 0.0 - 99.9 ml Set (51)	150 BRAKE RATE 1 - 255 Set (51)	15 BALANCE COUNT 0 - 255 Set (51)	0.0 mm IF1 OFFSET -9999.9 - 9999.9 mm Set (51)	0.0 mm IF2 OFFSET -9999.9 - 9999.9 mm Set (51)					
LEVEL CORRECTION	9										

NMS53x Programming Matrix (Dynamic Matrix, Tank Profile G8)

GROUP MESSAGE	H / V	0	1	2	3	4	5	6	7	8	9
PROFILE OPE.	4	0:spot OPE. SELECT 0:spot , 1:tank profile 2:I/F profile 3:MANU. I/F profile Select (51)	2 OPE. POINT 2 - 16 Set (51)		0.0 mm I/F MANU. LEVEL 0.0 - 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 Display		0.000 g/ml AVERAGE DENSITY 0.000 - 9.999 g/ml Display	0.0 C AVERAGE TEMP. 0 - 359.5 C Display				
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	0.0 mm NO.1 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.2 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.3 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.4 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.5 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.6 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.7 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.8 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.9 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.10 POSITION 0.0 - 99999.9 mm Display
POSITION 11 - 16	9	0.0 mm NO.11 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.12 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.13 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.14 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.15 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.16 POSITION 0.0 - 99999.9 mm Display				

NMS53x Programming Matrix (Dynamic Matrix, Interface Profile: G9)

GROUP MESSAGE	H / V	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 Display	0 mm I/F LEVEL 0 - 99999.9 mm Display	0.000 g/ml AVERAGE DENSITY 0.000 - 9.999 g/ml Display	0.0 C AVERAGE TEMP. 0 - 359.5 C Display				
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	0.0 mm NO.1 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.2 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.3 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.4 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.5 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.6 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.7 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.8 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.9 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.10 POSITION 0.0 - 99999.9 mm Display
POSITION 11 - 16	9	0.0 mm NO.11 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.12 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.13 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.14 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.15 POSITION 0.0 - 99999.9 mm Display	0.0 mm NO.16 POSITION 0.0 - 99999.9 mm Display				

14.2 Description of Programming Matrix

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select/ Display	Possible Entries	Index No. GVH
STATIC MATRIX (This word is not shown)	MEASURED VALUE 1	MEASURED LEVEL	-	Displays displacer position in relation to Ullage (Outage) or Innage as Defined by GVH190 Display Mode.	16000.0mm	Display	0.0 - 99999.9mm	000
		ULLAGE LEVEL	-	Displays difference between current displacer position and Tank Height.	0.0mm	Display	0.0 - 99999.9mm	001
		UPPER INTERF. LEV	-	Displays last recorded Upper Interface level measurement.	0.0mm	Display	0.0 - 99999.9mm	002
		MIDD. INTERF. LEV	-	Displays last recorded Middle Interface level measurement.	0.0mm	Display	0.0 - 99999.9mm	003
		BOTTOM LEVEL	-	Displays last recorded Bottom level measurement. Refer to GVH004.	0.0mm	Display	0.0 - 99999.9mm	004
		UPPER DENSITY	50	Displays last recorded Upper Density measurement OR manual setting. It is automatically overwritten when the density is measured in the NMS.	1.000g/ml	Display/Set	0.000 - 3.000g/ml	005
		MIDDLE DENSITY	50	Displays last recorded Middle Density measurement OR manual setting. It is automatically overwritten when the density is measured in the NMS.	1.000g/ml	Display/Set	0.000 - 3.000g/ml	006
		DENSITY BOTTOM	50	Displays last recorded Bottom Density measurement OR manual setting. It is automatically overwritten when the density is measured in the NMS.	1.000g/ml	Display/Set	0.000 - 3.000g/ml	007
		LEVEL DATA	-	Displays last recorded Measured Level measurement according to Balance Status.	16000.0mm	Display	0.0 - 99999.9mm	008

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
STATIC MATRIX (This word is not shown)	MEASURED VALUE 2	LIQUID TEMP.	-	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
		HART DEV(1)	-	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 Temperature data is also copied to G0V1H0 unless G6V4H9 = Gas temperature.		Display		011
		HART 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		012
		GAS TEMPERATURE	-	Displays Gas Temperature data reflected from G4V4H1, or from G5V4H0 if G5V4H9 = Gas Temperature, of from G6V4H0 if G6V4H9 = Gas Temperature.	0.0°C	Display	-49.9 - 249.9°C	013
		WATER BOTTOM	-	Displays water interface level data received from NMT539 WB device.	0.0mm	Display		014
		ZERO POINT	-	Displays Zero Point.	0.0mm	Display	0.0 - 99999.9mm	017
		SPAN	-	Displays Span.	16000.0mm	Display	0.0 - 99999.9mm	018
		LENGTH UNIT	-	Displays unit of length.	mm	Display	mm	019

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
STATIC MATRIX (This word is not shown))	OPERATION	OPERATION (from display key)	50	Select operation for movement of displacer	STOP	Select	Refer to G0 Static Matrix, Operation commands.	020
		OPERATING STATUS	-	Displacer operation mode, or position status of Proservo	STOP	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 Entries	Index No. GVH
STATIC MATRIX (This word is not shown)	OPERATION	BALANCE STATUS	-	Displays balance status of displacer.	UNBALANCED	Display	BALANCED UNBALANCED	022
		OPERAT. BY NRF	-	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	-	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	-	Displays the Device ID of NMS5 Proservo.	0	Display		028
		SOFTWARE VERSION	-	Displays the software version of NMS5 Proservo.	4.XX	Display		029

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
STATIC MATRIX (This word is not shown)	MORE FUNCTION	MATRIX OF	-	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 Tank Profile I/F Profile	030
		(Calendar)	-	Displays date, time as yymmdd __hh:mm:ss. Not transferred by Rackbus.	Current Time	Display	e.g. 141010__ 19:10:41 Year Month Day HH:MM:SS	033
		ALARM CONTACT	-	Display alarm message depending on current status.	NO ALARM	Display	Alarm message	034
		(Alarm History)	-	Use (+) and (-) keys, scroll through history of alarms. 035 Up to 99 alarms recorded, then oldest alarm is overwritten by new data.	NO ALARM	Display	Alarm history	035
		DIAGNOSTIC CO	-	Displays current self-diagnostic code	NO ERROR	Display	Error message	036
		(Error History)	-	Use (+) and (-) keys, scroll through history of errors, in format yymmdd hhmm$^{\infty}$ ##. Up to 99 alarms recorded, then oldest alarm is overwritten by new data.	MPU:START ACT	Display	Error history (Example: local communication Error: DEV1 504101355 40 61 Time ┘ Internal Temp Err. No. select with +, -	037
		RESET ALM. DIAGNO	-	Reset Error History by setting = ON.	OFF	Display/ Select	ON OFF	038
		ACCESS CODE	-	Set access code to view and change to matrix data. Higher access codes (except 777) give greater editing privileges. 50: Operator, 51,530: Technician 777: required to select EEx i HART line,	0	Set	0 - 999	039

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
CALIBRATION	LEVEL DATA	TANK HEIGHT	50	Elevation level of manual dipping reference.	16000.0mm	Set	0.0 - 99999.9mm	140
		DIP POINT OFFSET	50	Difference between Tank Height and Reference Position of Proservo NMS5. This data is automatically adjusted by Proservo software when Set Level procedure is performed.	0.0mm	Set	-99999.9 - 99999.9mm	141
		DISPLAC. DRAFT	50	Set the draft of displacer. This value is used to calculate G0V0H4 Bottom Level measurement. For typical displacer draft settings please see Appendix "Displacers"	10.0mm	Set	0.0 - 999.9mm	142
		DISPL. RAISE DENS	51	Set distance for displacer to rise above level position during Density operations. Observe the rule: G1V4H3+ G1V4H4 = 300 n, where n = integer	150mm	Set	0 - 300mm	143
		DISPL. SUBM. DENS	51	Set distance for displacer to sink below level position during density operations. Observe the rule: G1V4H3+ G1V4H4 = 300 n, where n = integer	150mm	Set	0 - 1500mm	144
		DIG. NUM. FOR V1	51	Number of digits for V1 communication	5 CUT DOWN	Select	5 CUT DOWN 5 ROUND UP 5 ROUND OFF 6 DIGIT	148
		LEVEL BELOW 0	51	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.	99999mm	Select	0.0mm 99999.9mm	149

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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.	16000.0mm	Set	0.0 - 99999.9mm	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.	0.0mm	Set	0.0 - 99999.9mm	152
		TANK CORRE. COEF.	51	Linear coefficient for tank roof compensation by level.	0.000mm/m	Set	0.000 - 59.999mm/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	Select	OFF ON IGNOR	154
		DEN. OPE. LEVEL	51	Set the lower limit for displacer movement during density profile operation.	300.0mm	Set	0.0 - 99999.9mm	155
		SERVICE MODE	530	Deactivate Prosafety function during maintenance; level value not valid.	OFF	Select	ON/OFF	157
		PROSAFETY	530	Proactive safety function outputs maximum level value during specified error conditions.	ON	Select	ON/OFF	158
		SAFETY LEVEL	530	Adjust maximum level output value, depending on receiver specification.	99999.0/65000.0mm	Set	0.0 - 99999.0mm	159

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
CALIBRATION	ADJUSTMENT	UPPER STOP	50	Set upper limit of displacer movement during normal operation.	16000.0mm	Set	0.0 - 99999.9mm	160
		LOWER STOP	50	Set lower limit of displacer movement during normal operation.	0.0mm	Set	0.0 - 99999.9mm	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. Magnetic coupling disconnects above 800 grams tension	350g	Set	0 - 999g	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.	50g	Set	0 - 999g	163
		SLOW HOIST	51	Displacer will enter slow speed hoist according to this value, useful if displacer contacts with narrow valves.	60mm	Set	60 - 1800mm	164
		DISPL. RAIS. REP.	51	Set the distance to raise displacer above liquid surface during repeatability test.	10mm	Set	10 - 99mm	165
		DISPL. WAIT REP.	51	Set the waiting time after displacer rises above liquid surface during repeatability test.	10s	Set	10 - 999s	166
		DISPL. WAIT DIP.	51	Used for Water Level command. Set the waiting time between displacer balance status and return to Level.	10s	Set	10 - 999s	167

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
CALIBRATION	DISPLAY	(CALIBR. AUTO/MAN)	51	Select method for measuring wire calibration. When activated, Proservo will hoist displacer into drum housing and check length of measuring wire. "Manual" setting is recommended to avoid unwanted calibration during tank loading etc.	NONE	Select	NONE	170
		(START TIME)	51	Set start time for Auto Wire Calibration. Available when G1V7H0 = "Auto"	99123123	Set	00000000 - 99999999	171
		(INTERVAL TIME)	51	Set interval time between automatic wire calibration operations. Available when G1V7H0 = "Auto"	0 hour	Set	0 - 9999 hour	172
		(AUTO COMPENSAT.)	51	Select to automatically compensate for measuring wire stretch or shrinkage detected at calibration.	OFF	Select	ON OFF	173
		(ZERO CORRECTION)	51	Displays measuring wire length deviation detected at calibration.	0.0mm	Display	0.0 - 99999.9mm	174
		(CONPENS. LIMIT)	51	Set upper limit for automatic compensation of measuring wire length. When G1V7H5 equals or exceeds this value "Wire Calib Error" displays at Home Position. Increase this parameter to clear error, or alternatively make new weight table, or replace wire drum/wire.	0.0mm	Set	0.0 - 99999.9mm	175

⚠ CAUTION

These parameters are not functional in version 4.27F and later.

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
CALIBRATION	AUTO CALIB. DISPL	(CALIBR. AUTO/MAN)	51	Select method for displacer weight calibration, useful when sludge attaches to displacer. When activated, Proservo will hoist displacer into drum housing and check weigth of displacer against data in G3V4H2. "Manual" setting is recommended to avoid unwanted calibration during tank loading etc.	NONE	Select	NONE	180
		(START TIME)	51	Set start time for Auto Displacer Calibration. Available if G1V8H0 - "Auto"	99123123	Set	00000000 - 99999999	181
		(INTERVAL TIME)	51	Set interval time between automatic displacer calibration operations. Available when G1V8H0 = "Auto"	0 hour	Set	0 - 9999 hour	182
		(AUTO COMPENSAT.)	51	Select to automatically compensate for displacer weight deviation detected at calibration.	OFF	Select	OFF ON	183
		(ZERO CORRECTION)	51	Displays displacer weight deviation detected at calibration.	0.0g	Display	0.0 - 999.9g	184
		(COMPENS. LIMIT)	51	Set upper limit for automatic compensation of displacer weight. When G1V8H5 equals or exceeds this value "Displ Calib Error" displays at Home Position. Increase this parameter to clear error, or alternatively make new weight table, or clean displacer.	0.0g	Set	0.0 - 999.9g	185

⚠ CAUTION

These parameters are not functional in version 4.27F and later

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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 display language.	ENGLISH	Select	ENGLISH JAPANESE CHINESE	191
		LCD CONTRAST	51	Adjust LCD display module contrast.	▮▮▮▮▮▮	Set	0 - 15	192
		YEAR SETTING	51	Current year.	Current year	Set	00 - 99	193
		MONTH SETTING	51	Current month.	Current month	Set	0 - 12	194
		DAY SETTING	51	Current day.	Current day	Set	0 - 31	195
		HOUR SETTING	51	Hour (24 hour format)	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 Entries	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	1 - 4	240
		ASSIGN RELAY	50	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 BALANCE SIGNAL	241
		RELAY FUNCTION	50	Select High or Low function, available only when G2V4H1 = "Level"or "Liquid Temp."	HIGH	Select	HIGH LOW	242
		SWITCHING POINT	50	Set level at which relay is activated, available only when G2V4H1= "Level" or "Liquid Temp."	0mm/0°C	Set	Level: 0 - 99999mm Liquid Temperature: -999 - 999°C	243
		HYSTERISIS	50	Set hysterisis value for selected relay, available only when G2V4H1= "Level" or "Liquid Temp."	0mm/0°C	Set	Level: 0 - 99999mm Liquid Temperature: -999 - 999°C	244
		RELAY ON ALARM	50	Select from Normal Open or Normal close, available only when G2V4H1= "Level" or "Liquid Temp." ⚠ CAUTION Alarm contact output does not change when turning power off.	NORMAL OPENED	Select	NORMAL OPEN (NO) NORMAL CLOSE (NC)	245
		ON DELAY TIME	50	Set delay time for alarm output start, available only when G2V4H1= "Level" or "Liquid Temp."	0s	Set	0 - 999s	246
		OFF DELAY TIME	50	Set delay time for alarm spot, available only when G2V4H1= "Level" or "Liquid Temp."	0s	Set	0 - 999s	247

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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"	0mm / 0.0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999mm For LIQUID TEMP.: -9999.9 to 9999.9°C	251
		ADJUST 20mA	51	Set level or temperature value for 20 mA output on channel 1. Available only when G2V5H0 = "Level" or "Liquid Temp"	0mm / 0.0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999mm For LIQUID TEMP.: -9999.9 to 9999.9°C	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"	0mm / 0.0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999mm For LIQUID TEMP.: -9999.9 to 9999.9°C	254
		ADJUST 20mA	51	Set level or temperature value for 20 mA output on channel 2. Available only when G2V5H3 = "Level" or "Liquid Temp"	0mm / 0.0°C	Set	FOR LEVEL or UPPER. INTEREF. LEV: 0 to 99999mm For LIQUID TEMP.: -9999.9 to 9999.9°C	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 Entries	Index No. GVH
DEVICE DATA	PARTS DATA	PARTS NUMBER	51	Set number for control-target parts (inside Proservo) to monitor.	1	Set	1 - 10	260
		PARTS TYPE	51	Allocate the partto the selected number.	NONE	Select	NONE POWER UNIT DISPLAY, MOTOR WIRE, BEARINGS SHAFT	261
		MAINTEN. FACTOR	51	Select method of monitoring part, either Operation Hours or Drum Revolutions.	OPERATION HOUR	Select	OPERATION HOUR DRUM REVOLT.	262
		MAINTEN. VALUE	51	Set the target maintenance (hours or revolutions) value for selected parts	1 hour or 1 round	Set	0 - 999999 hour or 0 - 999999 round	263
		OPERATION TIME	51	Displays the accumulated operation time or revolutions for selected part. Note : Reset this value to 0 after parts replacement.	1 hour or 1 round	Display/Se t	0 - 999999 hour or 0 - 999999 round	264
		(Parts Overused Data)	51	Displays date when parts reached terget value set in G2V6H3. POWER UNIT Data format : yy mm dd hh mm.		Display	Year Month Day Hour Minute	265
		REPLACED PARTS	51	Select part that has been replaced	NONE	Select	NONE POWER UNIT DISPLAY, MOTOR WIRE, BEARINGS SHAFT	266
		(Parts Replaced Data)	51	Displays date when parts were replaced. Data format : yy mm dd hh mm.	NONE	Display	Year Month Day Hour Minute	267

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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". Input State: Operation 1 OFF 2 ON: Level 1 ON 2 OFF: Hoist up 1 OFF 2 ON: Stop 1 ON 2 ON: Interface	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. ⚠ CAUTION 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	Display		275
		HW VERSION	51	Displays hardware version of NMS 53x Proservo. "2.00" = TCB-2, "4.00" = TCB - 4, "6.00 = TCB - 6"	6.00	Display		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	Display	0 - 15	279

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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.	0.0mm	Set	0.0 - 99999.9mm	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.	0.0mm	Set	0.0 - 99999.9mm	283
		HYSTERESIS	51	Set hysteresis for Alarm 1 and 2.	0.0mm	Set	0.0 - 99999.9mm	284
		ADDRESS	51	Set address. Range is 0-999.	0	Set	0 - 999	285
		PROTOCOL	51	Select communications protocol for remote/multi-drop communication.	Dependent on NMS specifications	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: 1200bps /Even | 3: 2400bps /Even | 6: 4800bps /Even | 9: 9600bps /Even | 12: 19200bps /Even 1: 1200bps /Odd | 4: 2400bps /Odd | 7: 4800bps /Odd | 10: 9600bps /Odd | 13: 19200bps /Odd 2: 1200bps /None | 5: 2400bps /None | 8: 4800bps /None | 11: 9600bps /None | 14: 19200bps /None	0	Set	0 - 14	289

<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 Entries</th><th>Index No. GVH</th></tr>
<tr><td rowspan="7">DEVICE DATA</td><td rowspan="7">STATUS</td><td>STATUS 1 DELAY</td><td>51</td><td>Set delay time between activation of Status 1 ON input signal and Status 1 output signal.</td><td>0s</td><td>Set</td><td>0 - 99s</td><td>290</td></tr>
<tr><td>SELECT CONTACT</td><td>51</td><td>Select normal relay condition for Status1: Normal Open or Normal Closed.</td><td>NONE</td><td>Select</td><td>NONE
NORMAL OPENED
NORMAL CLOSED
(ALARM = OPEN)
(ALARM = CLOSED)</td><td>291</td></tr>
<tr><td>WM550 ALM. SELECT</td><td>51</td><td>Set the Alarm Bit for WM550 communication.
(Available only with WM550 specification).
<table><tr><td>1: bit 0 Alarm No.1 (High-high)</td><td>2: bit 1 Alarm No.2 (High)</td><td>3: bit 2 Alarm No.3 (Low)</td><td>4: bit 3 Alarm No.4 (Low-low)</td></tr></table></td><td>1</td><td>Select</td><td>4-Jan</td><td>292</td></tr>
<tr><td>WM550 BSW SELECT</td><td>51</td><td>Select source of BSW level data for WM550 communication.
"0" = Upper I/F Level, "1" = (NMT539)Water Bottom level.
(Available only with WM550 specification)</td><td>0</td><td>Select</td><td>0 - 1</td><td>293</td></tr>
<tr><td>WM550 DENS. SEL.</td><td>51</td><td>Select source of data transmit in response to task 17, sub-task 11 query.
(Available only with WM550 specification).
<table><tr><th>Parameter</th><th>Density Data Source</th><th>Temp. Data Source</th></tr><tr><td>0: Upper Density</td><td>GVH005 Upper Density</td><td>GVH010 Liquid Temp.</td></tr><tr><td>1: Profile Ave. Dens.</td><td>GVH854 Average Density</td><td>GVH855 Average Temp.</td></tr><tr><td>2: IF Prof. Ave. Dens.</td><td>GVH954 Average Density</td><td>GVH955 Average Temp.</td></tr></table></td><td>0</td><td>Select</td><td>0 - 2</td><td>294</td></tr>
<tr><td>WMS550 SW_ID_20xx</td><td>51</td><td>Set the last 2 digits (xx) of the WM550 sensor address (20xx).
(Available only with WM550 specification)</td><td>37</td><td>Set</td><td>0 - 99</td><td>295</td></tr>
<tr><td>BALANCE DELAY</td><td>51</td><td>Sets time between displacer balance and Balance Signal output.</td><td>0s</td><td>Set</td><td>0 - 99s</td><td>299</td></tr>
</table>

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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.	300.000mm	Set	0.000 - 999.999mm	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	2.50g/10m	Set	0.00 - 999.99g/10m	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.	XXX.Xg	Set	0.0 - 999.9g	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.	XXX.Xml	Set	0.0 - 999.9ml	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.	XXX.Xml	Set	0.0 - 999.9ml	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.	1.0ml	Set	0.0 - 999.9ml	345
		DELAY	51	Interval until displacer responds to change in liquid level. Increase to counter small	20 x 100ms	Set	0 - 99 x 100ms	347
		DRUM CORRECTION	51	The error of the wire length of one drum revolution is set as correction value.	0.00mm/m	Set	0.00 - 99.00mm/m	348
		DISPL. HUNT. COUNT	51	Defines the number of times displacer searches for balance condition. To balance on solid surface set to non-zero value (e.g. 1)	0 count	Set	0 - 99 count	349

<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 Entries</th><th>Index No. GVH</th></tr>
<tr><td rowspan="10">SERVICE</td><td rowspan="8">GAUGE DATA</td><td>ACTUAL LEVEL</td><td>530</td><td>Level from Reference Position to displacer</td><td>0.0mm</td><td>Display</td><td>OK</td><td>350</td></tr>
<tr><td>ENCODER COUNT</td><td>530</td><td>Encoder pulse count</td><td>0 count</td><td>Display</td><td>OK</td><td>351</td></tr>
<tr><td>NON HYSTER. MODE</td><td>51</td><td>Non-Hysteresis Operation mode. When turned ON displacer is rasied approx. 2mm and then seeks balance condition again.</td><td>OFF</td><td>Select</td><td>OFF
ON</td><td>352</td></tr>
<tr><td>HI. ACCURACY MODE</td><td>51</td><td>When displacer reaches Temporary Balance condition, it is raised (GcV5H5) millimeters, weighed and then seeks balance condition again.</td><td>OFF</td><td>Select</td><td>OFF
ON</td><td>353</td></tr>
<tr><td>HI. ACCR. OPE TIME</td><td>51</td><td>Interval of Temporary Balance condition until displacer is raised and weighed.</td><td>0s</td><td>Set</td><td>0 - 600s</td><td>354</td></tr>
<tr><td>HI.ACC.DISP.UP</td><td>51</td><td>Distance displacer raised in High Accuracy Mode operation.</td><td>50mm</td><td>Set</td><td>0 - 300mm</td><td>355</td></tr>
<tr><td>GAUGE TEMP</td><td>51</td><td>Displays temperature inside electronics housing of NMS5.</td><td>XXX°C</td><td>Display</td><td>-999 - 999°C</td><td>356</td></tr>
<tr><td>DEFAULT VALUES</td><td>530</td><td>Initialization of device data. (factory reset)</td><td>OFF</td><td>Select</td><td>ON</td><td>359</td></tr>
<tr><td rowspan="4">SYSTEM DATA</td><td>SENSOR DATA</td><td>-</td><td>Displays NMS5 Proservo specifications :
software and hardware versions, remote communication (On/Off), drive gear ratio.</td><td>LOCAL: MASTER</td><td>Display</td><td>REMOTED COM. ON
SOFTWARE = xxx
HARDWARE= TCB0x
GEAR 1:36
NOT OVERSPILL</td><td>360</td></tr>
<tr><td>CONNECTION NRF</td><td>51</td><td>Selects switch for communications 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.</td><td>OFF</td><td>Select</td><td>OFF
CONTACT 1
CONTACT 2</td><td>361</td></tr>
<tr><td>CONNECTION NMT</td><td>51</td><td>Select switch for communication to NMT5 Series Prothermo.
Select Average or Spot.</td><td>OFF</td><td>Select</td><td>OFF, SPOT TEMP.
AVARAGE TEMP.</td><td>362</td></tr>
<tr><td>IF LEVEL SELECT</td><td>51</td><td>Select free scanning data source for water level (WM550 only).
<table>
<tr><th>Parameter</th><th>Free Scan Data Source</th></tr>
<tr><td>UP_IF_LEVEL</td><td>NMS Proservo: Upper Interface Level or Water Dip Operation</td></tr>
<tr><td>WATER BOTTOM</td><td>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 setting (upper interface or water dip opration). Water bottom data is taken via interrupt-scan in HART communication.</td></tr>
<tr><td>WATER BOTTOM 2</td><td>NMT539 WB: Water bottom level data is taken for HART FreeScan. Upper interface command returns data based on the proservo setting (upper interface or water dip opration). Water bottom data is taken via interrupt-scan in HART communication.</td></tr>
</table></td><td></td><td>Select</td><td>UP LEVEL SELECT
UP IF LEVEL
WATER BOTTOM
WATER BOTTOM 2</td><td>368</td></tr>
<tr><td>SOFT RESET</td><td>51</td><td>Restarts NMS5 Proservo software</td><td>OFF</td><td>Select</td><td>OFF
ON</td><td>369</td></tr>
</table>

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
SERVICE	SERVICE	MEASURED WEIGHT	-	Displays tension on measuring wire as calculated by NMS CPU module.	XXX.Xg	Display	0.0 - 999.9g	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 eparately, 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.	70mm	Set	0 - 999mm	378
		ZERO ADJ. WEIGHT	51	Low weight for weight calibration.	0.0g / 50.xg	Set	0.0 - 999.9g	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.	X X X.Xg	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.	X X X.Xg	Display		395

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
TEMPERATURE	TEMPERATURE DATA	LIQUD TEMP.	51	Displays current average liquid temperature.	XX.X °C	Display	Depending on specification and	440
		GAS TEMPERATURE	51	Displays current average gas temperature.	XX.X °C	Display	Depending on specification and	441
		MEASURED LEVEL	51	Displays Measured Level data received from NMS5 Proservo,depending on selection at G4V4H3 Level Data Select.	XXXXX.Xmm	Display	Depending on 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 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"	0.0mm	Display	Depending on specification and measured value	444
		DIAGNOSTIC	51	Displays reference resistance on circuit board corresponding to 0°C.	0.0 °C	Display	Depending on specification and	447
		REFERENCE 150	51	Displays reference resistance on circuit board corresponding to 150°C.	150 °C	Display	Depending on specification and	449

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
TEMPERATURE	ELEMENT TEMP. Depending on specification and measured value.	TEMP. NO.1	51	Displays temperature of element 1 (lowest element).	XXX.X °C	Display	Depending on NMT specifications	450
		TEMP. NO.2	51	Displays temperature of element 2.	XXX.X °C	Display	Depending on NMT specifications	451
		TEMP. NO.3	51	Displays temperature of element 3.	XXX.X °C	Display	Depending on NMT specifications	452
		TEMP. NO.4	51	Displays temperature of element 4.	XXX.X °C	Display	Depending on NMT specifications	453
		TEMP. NO.5	51	Displays temperature of element 5.	XXX.X °C	Display	Depending on NMT specifications	454
		TEMP. NO.6	51	Displays temperature of element 6.	XXX.X °C	Display	Depending on NMT specifications	455
		TEMP. NO.7	51	Displays temperature of element 7.	XXX.X °C	Display	Depending on NMT specifications	456
		TEMP. NO.8	51	Displays temperature of element 8.	XXX.X °C	Display	Depending on NMT specifications	457
		TEMP. NO.9	51	Displays temperature of element 9.	XXX.X °C	Display	Depending on NMT specifications	458
		TEMP. NO.10	51	Displays temperature of element 10.	XXX.X °C	Display	Depending on NMT specifications	459

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
TEMPERATURE	ELEMENT POSITION Depending on specification	ELEM.1 POSITION	51	Displays position of element 1, also called "Bottom" (lowest) element.	XXX.Xmm	Display	0 - 99999.9mm	460
		ELEM.2 POSITION	51	Displays position of element 2.	XXX.Xmm	Display	0 - 99999.9mm	461
		ELEM.3 POSITION	51	Displays position of element 3.	XXX.Xmm	Display	0 - 99999.9mm	462
		ELEM.4 POSITION	51	Displays position of element 4.	XXX.Xmm	Display	0 - 99999.9mm	463
		ELEM.5 POSITION	51	Displays position of element 5.	XXX.Xmm	Display	0 - 99999.9mm	464
		ELEM.6 POSITION	51	Displays position of element 6.	XXX.Xmm	Display	0 - 99999.9mm	465
		ELEM.7 POSITION	51	Displays position of element 7.	XXX.Xmm	Display	0 - 99999.9mm	466
		ELEM.8 POSITION	51	Displays position of element 8.	XXX.Xmm	Display	0 - 99999.9mm	467
		ELEM.9 POSITION	51	Displays position of element 9.	XXX.Xmm	Display	0 - 99999.9mm	468
		ELEM.10 POSITION	51	Displays position of element 10.	XXX.Xmm	Display	0 - 99999.9mm	469

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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	Set	0-15 Selectable 0(No.1) - 15(No.16)	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. This setting is made at factory before shipping and should not be adjusted in the field.	1.000	Set		472
		ELEMENT TEMP	51	Displays temperature for element No. 10-15 ⚠ CAUTION (No. 16 for NMT module only).	XXX.X°C	Display	Dependent on NMT specifications	473
		ELEMENT POSITION	51	Displays temperature for element No. 10-15 when selected at G4V7H0 Select Point. ⚠ CAUTION (No. 16 for NMT modules only)	XXX.Xmm	Display	0.0 - 99999.9mm	474
		AVERAGING	51	Set sampling coefficient for averaging data. Increase to reduce impact of noise.	2	Set	10-Jan	478
		ACCESS CODE	51	Displays current Access code.	530	Set	0 - 999	479

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	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.	℃	Display		481
		TOTAL NO. ELEMENT	51	Set total number of elements in NMT temperature sensor.	XX	Set	16-Feb	482
		PREAMBLE NUMBER	51	Display of preambles for HART protocol.	5	Display	20-Feb	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. This value is set at the factory. User does not have to set.	Dependent on NMT specifications	Select	EQUAL UNEQUAL	485
		BOTTOM POINT	51	Set position of element 1 (lowest element) above tank bottom. Available only when G4V8H5 = Equal. This value is set at the factory. User does not have to set.	500.0mm	Set	0.0 - 500.0mm	486
		ELEMENT INTERVAL	51	Set spacing between elements. Available only when G4V8H5 = Equal. This value is set at the factory. User does not have to set.	2000.0mm	Set	0.0 - 99999.9mm	487
		TEMP. ELEM. SHORT	51	Set temperature indication sent to NMS5 Proservo Home Position when element is shorted and G4V9H2 = ON.	-49.5℃	Set	-49.5 - 359.5℃	488
		TEMP. ELEM. OPEN	51	Set temperature indication sent to NMS5 Proservo Home Position when element is open and G4V9H2 = ON.	359.0℃	Set	-49.5 - 359.5℃	489

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
TEMPERATURE	DEVICE DATA NMT	INSTRUMENT CODE	51	Displays hardware unit number.		Display		490
		LAST DIAGNOSTIC	51	Displays most recent error message.		Display		491
		OUTPUT AT ERROR	51	Select ON for output and indication in case of element short or element open condition.	0	Select	0 (OFF) 1 (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 NMS.	2	Set	1 - F (16 addresses)	494
		MANUFACTURE ID	51	Displays identification number for NMT535/539/532 Prothermo. Endress+Hauser: 17	17	Display		495
		SW VERSION	51	Displays software version of NMT535/539/532 Prothermo.	XXX	Display		496
		HW VERSION	51	Displays hardware version of NMT535/539/532 Prothermo.	X.XX	Display		497
		BELOW BOT. POINT	530	Select ON to cancel "NMT Below Bottom Point" error message output to MMS when displacer sinks below lowest temperature element.	ON	Select	OFF ON	498
		DEVICE TYPE CODE	51	Dispklays device type code for NMT535/539/532 Prothermo.	XXX	Display		499

Matrix Group	Function Group	Item	Access Code	Short Description	Default Value	Set/Select /Display	Possible Entries	Index No. GVH
HART DEVICE (1)	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	-	Displays sensor serial number.		Display		560
		UPPER SENSOR LMT	-	Displays upper limit of the HART Device.		Display		561
		LOWER SENSOR LMT	-	Dispalys lower limit of the HART Device.		Display		562
	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. The following polling address are already used NRF=1, NMT=2, Level Device=3. When connecting a pressure sensor, ID(1)=4 and/or ID(2)=5 are used.	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.		Set		594
		SW VERSION	-	Displays the software version for the HART device.		Display		595
		HW VERSION	-	Displays 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 Entries	Index No. GVH
HART DEVICE (2)	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 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	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	-	Displays sensor serial number.		Display		660
		UPPER SENSOR LMT	-	Displays upper limit of the HART Device.		Display		661
		LOWER SENSOR LMT	-	Dispalys lower limit of the HART Device.		Display		662
	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. The following polling address are already used NRF=1, NMT=2, Level Device=3. When connecting a pressure sensor, ID(1)=4 and/or ID(2)=5 are used.	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.		Display		694
		SW VERSION	-	Displays the software version for the HART device.		Display		695
		HW VERSION	-	Displays 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 Entries	Index No. GVH
ADJ. SENSOR	ADJ. SENSOR	ADJ A ZERO	530	Hall Sensor A Zero signal		Set		740
		ADJ A ZERO	530	Hall Sensor A Zero signal		Set		741
		ADJ B SPAN	530	Hall Sensor B Full span signal		Set		742
		ADJ B SPAN	530	Hall Sensor B Full span signal		Set		743
	HART ERROR RATE	ERR. RATE NRF	530	Communication error rate	0.00%	Display		750
		ERR. RATE NMT	530	Communication error rate	0.00%	Display		751
		ERR. RATE DEV (1)	530	Communication error rate	0.00%	Display		752
		ERR. RATE DEV (2)	530	Communication error rate	0.00%	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	℃	Select	℃ ˚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/m^3, lb/gl, SGU, kg/l, g/l, lb/in^3, st/y^3	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	℃	Select	℃ ˚F ˚R ˚K	766
		DEN. UNIT	51	Select units for density value data displayed locally at NMS/NRF	g/ml	Select	kg/m^3, lb/gl, SGU, kg/l, g/l, lb/in^3, st/y^3	767
	HART LINE	NMT	777	Select Terminal Port A (Ex ia) or Terminal Port B (Ex d) for 770 the NMT connection	TERMINAL PORT B	Select	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	Select	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	Select	TERMINAL PORT B TERMINAL PORT A	772
	INTERFACE ADJUST	VOL. TOL. FOR I/F	51	Set Volume Tolerance for Balance condition during Interface measurement.	0.3ml	Set	0.0 - 99.9ml	780
		BRAKE RATE	51	Used for Interface Measurement. Increase Brake Rate to make the balance zone smaller and decrease interface measurement time.	150	Set	1 - 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	Set	0 - 255	782
		IF 1 OFFSET	51	Change this setting to correct Interface 1 level deviation.	0.0mm	Set	-9999.9 - 9999.9mm	783
		IF 2 OFFSET	51	Change this setting to correct Interface 2 level deviation.	0.0mm	Set	-9999.9 - 9999.9mm	784

15 Appendix

15.1 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.

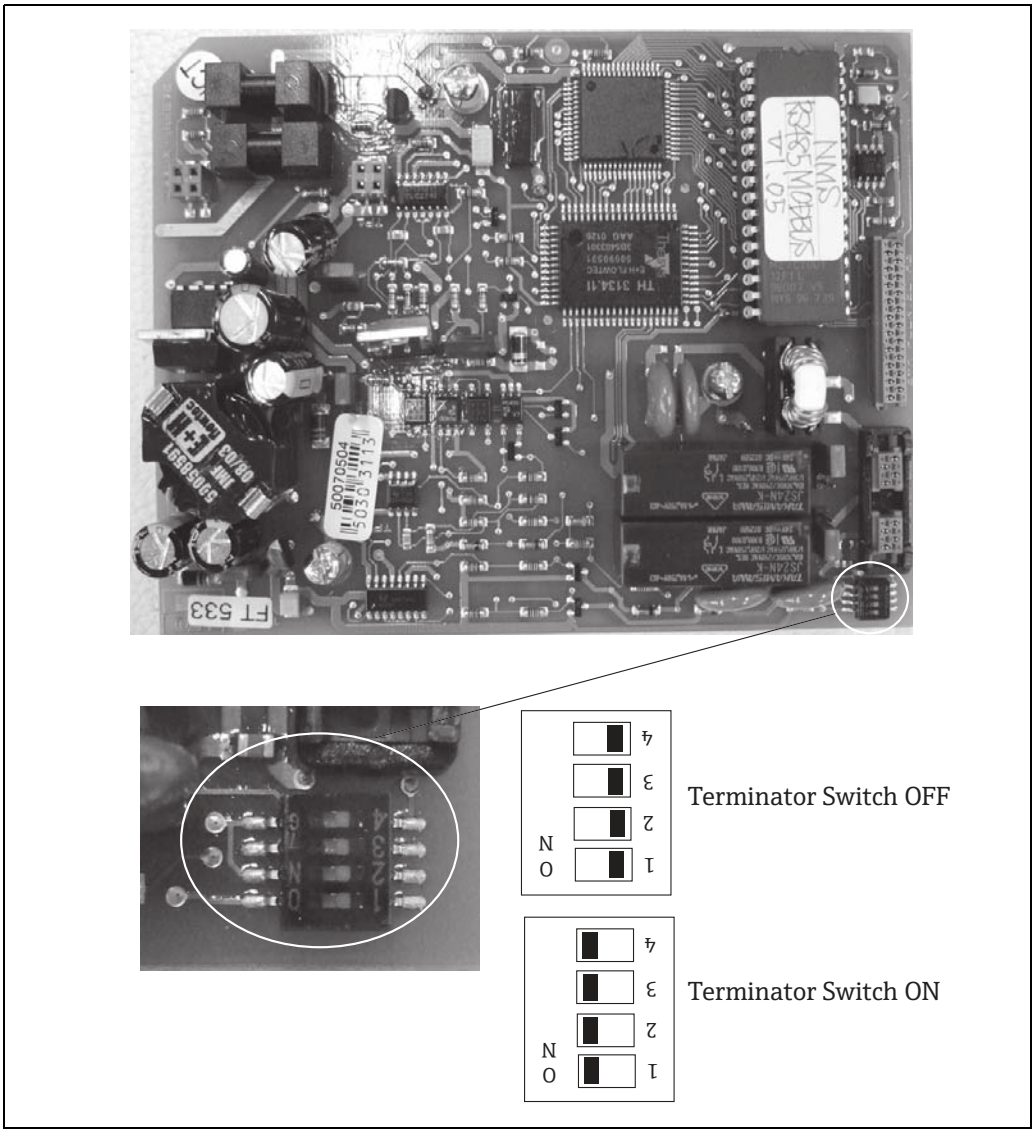


Figure 73: RS-485 Communication Module

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.

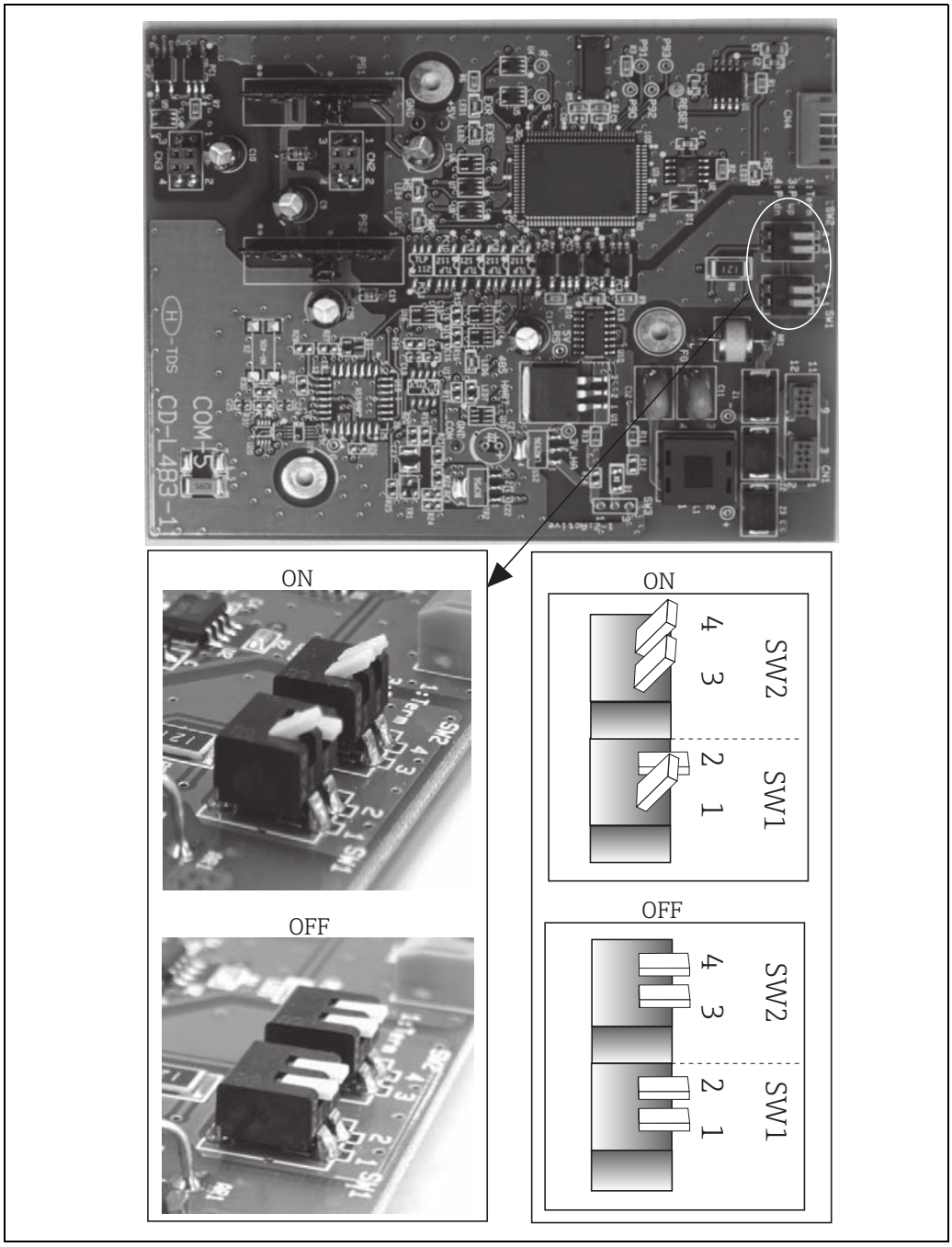


Figure 74: COM-5 RS-485 Communication Module

15.2 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 measuring wire into the box without twisting.
4. Put one end of the measuring wire into a hole on the wire drum groove.
5. Fix the end of the measuring wire by a screw.
6. Sit down on a chair.
7. Grasp the wire drum by left hand and hold the measuring wire by left thumb.
8. Hold the measuring wire by right thumb and index finger.
9. Make tension to secure the measuring wire, so as not to come out of the groove.
10. Rotate the wire drum to wind the measuring wire into groove with holding by left thumb.

This completes the winding wire onto wire drum procedure.

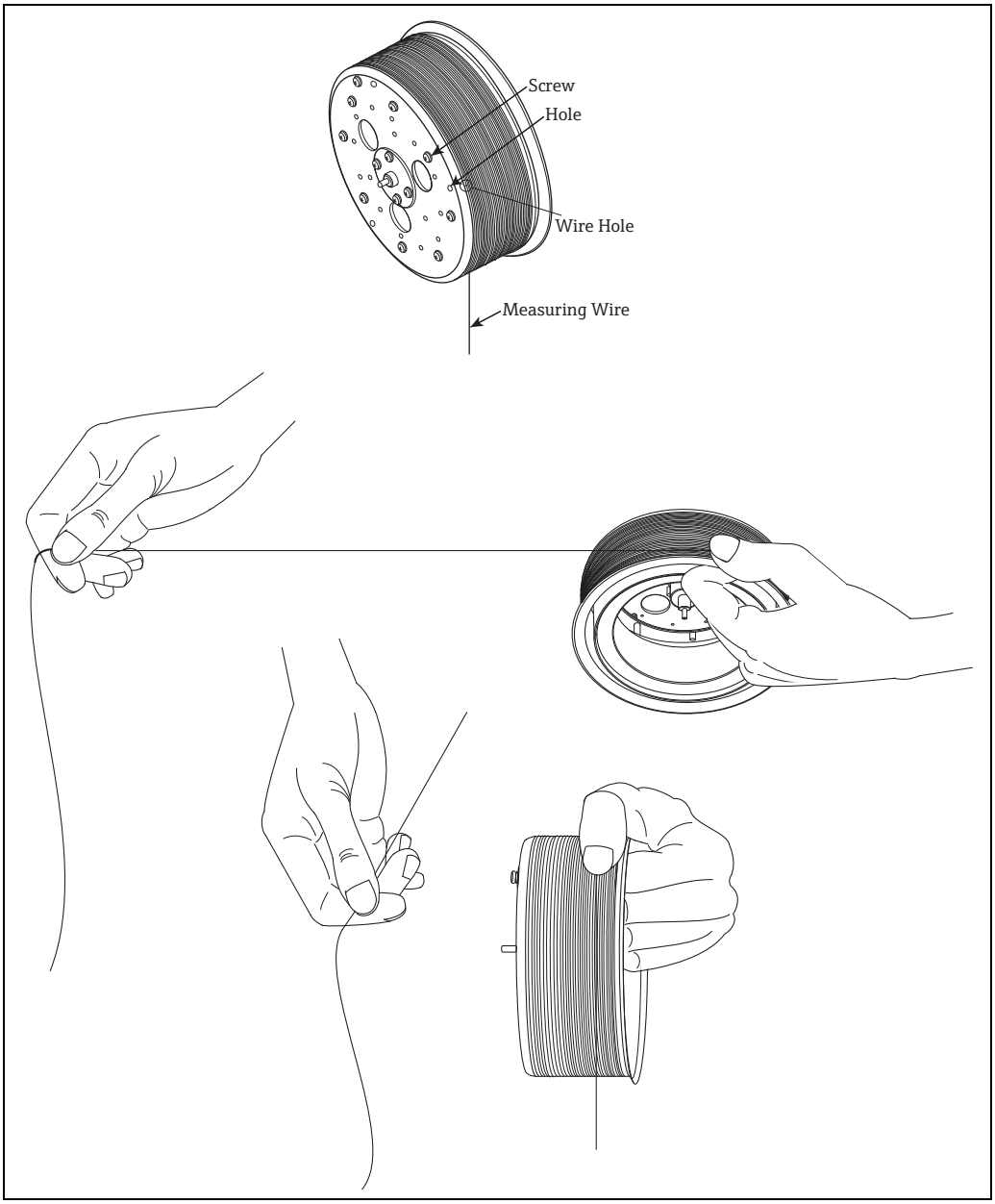


Figure 75: Measuring Wire

Fixing Wire Procedure

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

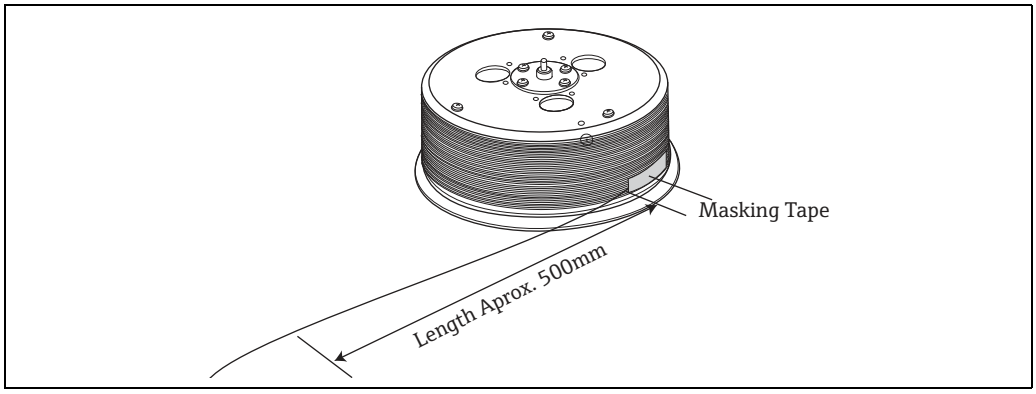


Figure 76: Wire and Wire Drum

2. Wind the measuring wire toward the wire drum 2 times around the ring.
3. Wind the measuring wire 10 times.
4. Keep a space as the triangle shape and wind the measuring wire 10 times toward arrow A.
5. Wind the measuring wire 10 times toward arrow B.
   - Keep a certain amount of tension to the wire ring.
6. Wind the measuring wire 10 to the wire ring times again.
7. Wind the measuring wire 10 times toward arrow C.
8. Wind the measuring wire 10 times toward arrow D.

This completes the fixing wire procedure.

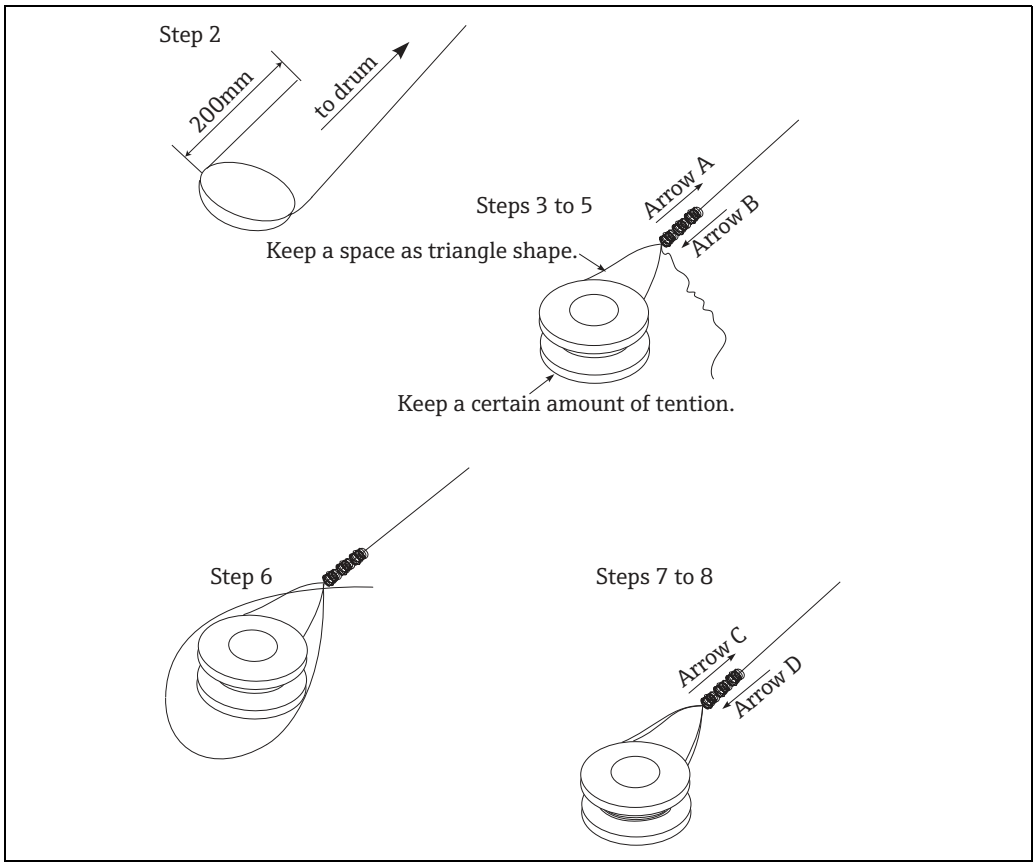


Figure 77: Fixing Wire

15.3 Displacer

15.3.1 Displacer Installation

Installation Procedure

1. Mount the displacer on the wire ring.
2. To secure the displacer to the measuring wire, wind the attached wire onto the wire ring through the wire ring hole.

This completes the displacer installation procedure.

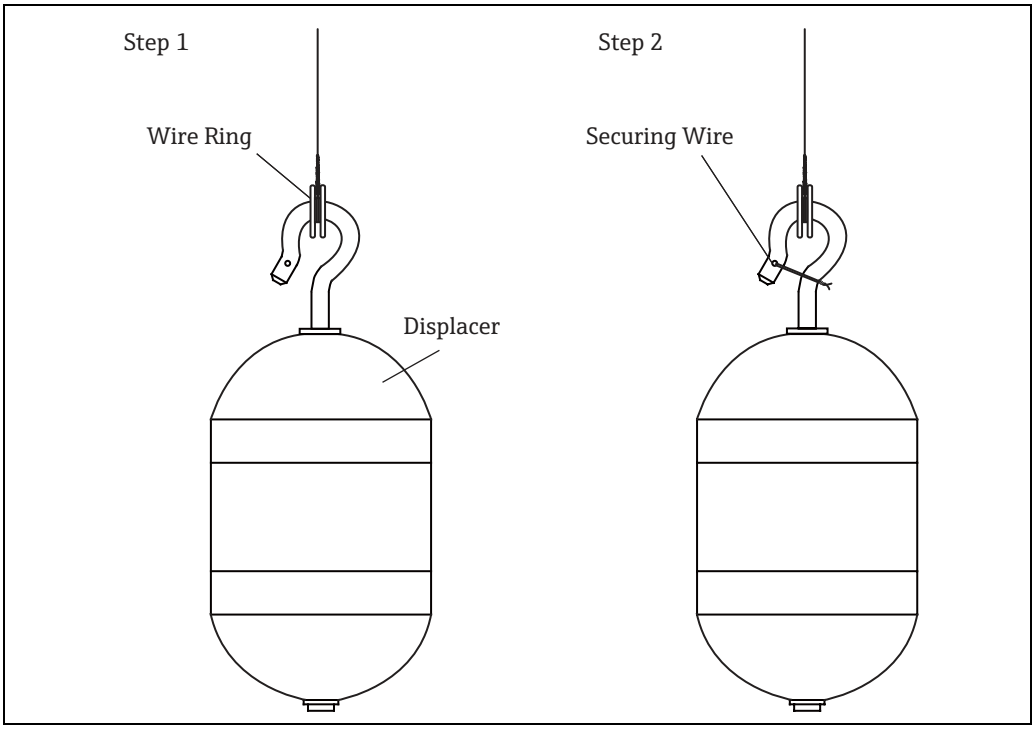


Figure 78: Displacer

15.3.2 Displacers

Actual draft position may change slightly with tank parameters.

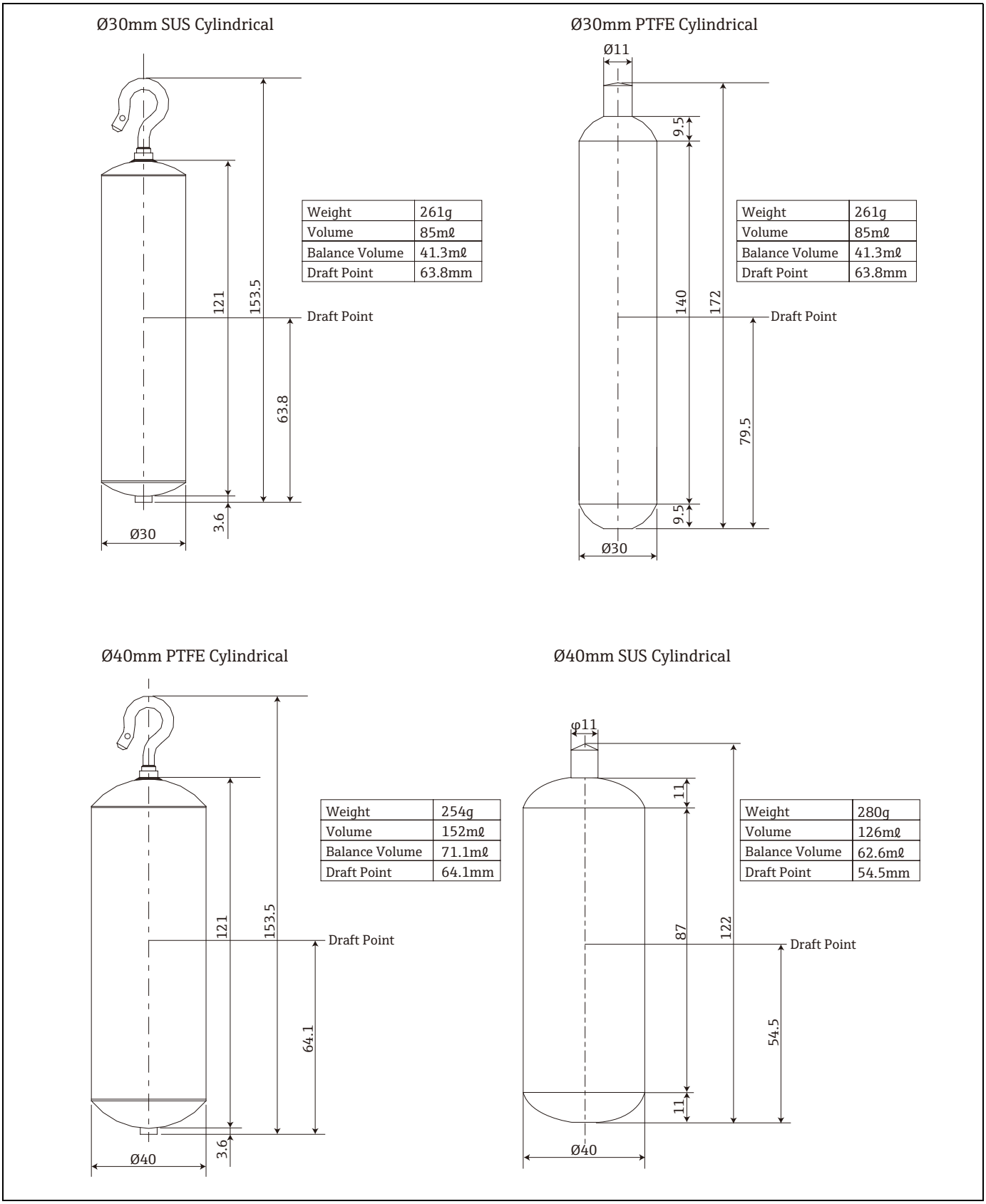


Figure 79: Dimensions 1

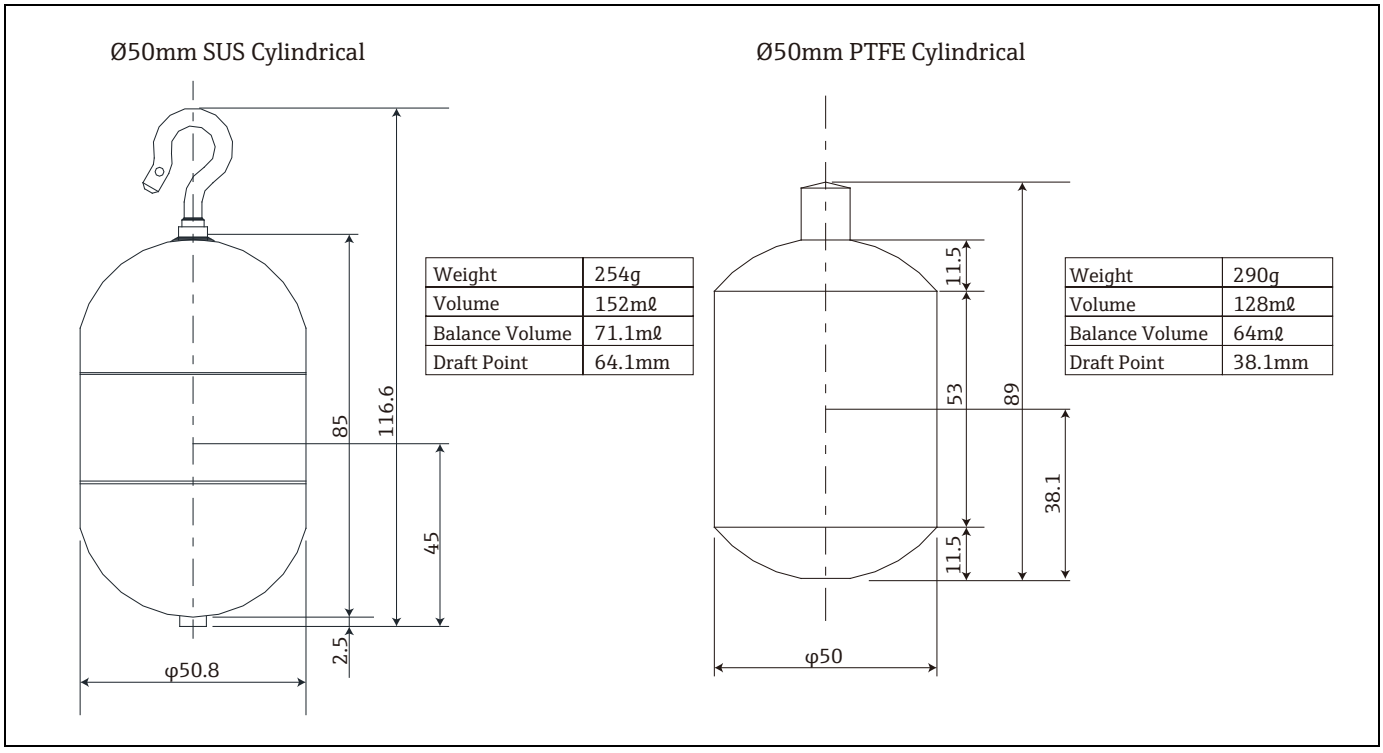


Figure 80: Dimensions 2

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Declaration of Hazardous Material and De-Contamination

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.

Descriptio n of failure / Fehlerbeschreibung _____

_____

_____

Company data / Angaben zum Absender

Company /Firma _____
_____
Address / Adresse
_____
_____

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

_____ (place, date / Ort, Datum)

_____ Name, dept./Abt. (please print /bitte Druckschrift)

_____ Signature / Unterschrift

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