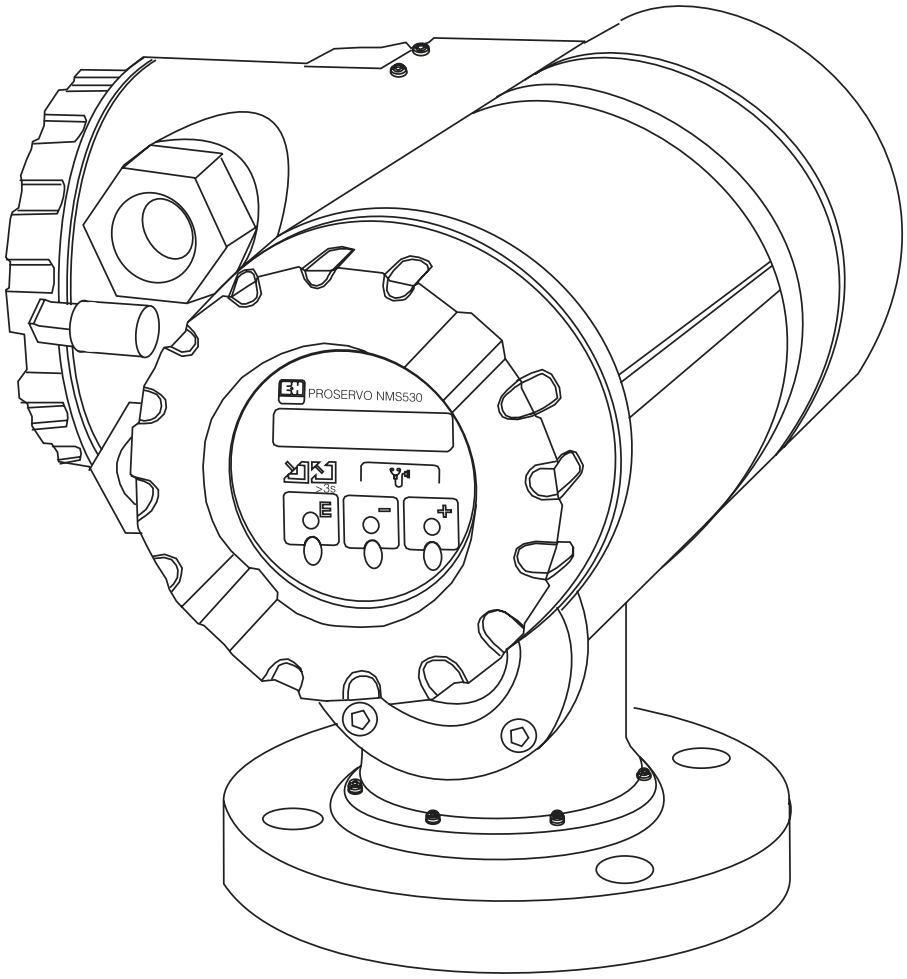
BA 001 N/08/EN
Software Version 4.24 for NMS53x

Proservo
NMS53x Series



Operating Manual



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General Notes

Instruction Manual:

- This instruction manual applies to the Proservo NMS53x with V.4.24 or later software installed.
- Please read this manual carefully and make sure you understand its contents before using the product.
- This manual is solely intended to describe product functions and should not be used for any other purpose.
- No part of this manual may be reproduced or reprinted without permission.
- This manual may be subject to change without prior notice.
- This manual was prepared with the highest degree of care. However, should you find any errors or have any questions, contact one of our service offices or your local sales agent.

On safety and improper use:

Follow the safety guidelines presented in this manual when using this product. This is important for ensuring the safe operation of the system to be controlled by the product. If the user does not follow these instructions properly, we cannot guarantee the safety of the system.

Safety Notes

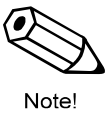
To maintain a high level of safety and to ensure correct operation, the operator should at all time observe the safety notes given in this operating manual. They are indicated by the following pictograms:



Observe this note to prevent serious personal or material damage.



Observe this note to prevent serious material damage.



Observe this note to achieve the specified performance of the instrument.

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.
- Use in hazardous areas
  When using the product in the first or second-class hazard location (Zone 1 or Zone 2) be sure to use an intrinsically safe or pressure and explosion-proof apparatus. Take the utmost care during the installation, wiring, and piping of such apparatus to ensure the safety of the system. For safety reasons, maintenance or repairs on the product while it is being used with such apparatus should only be performed by qualified personnel.
- External connection
  When an external connection is required, the product should be protectively grounded before it is connected to a measurement object or an external control circuit.

1. Safety Instructions

Warning!
Observe the following notes to prevent serious physical or material damage.



Power supply

- Check that voltage and frequency of the local power supply are in the range of the technical data of the instrument before turning on the power. Please refer to Sect.7.

Power supply cable

- Use the power supply cable attached to the instrument when it is ordered from the manufacturer, or the cable specified in the instruction.
- The power source should have a ground terminal, and the power supply cable should have a ground line. Please refer to Sect.7.

Grounding

- Do not remove the grounding of the instrument when the power supply is turned on. This may set the instrument in a dangerous condition. Please refer to Sect.7.

Wiring

- Make sure the grounding of the instrument before connecting input and output to another system.

Use of the instrument

The Proservo NMS53x series is designed for level measurement of a liquid in a storage tank or similar facilities.

- It is possible to connect auxiliary instruments in the specification described in this manual. However, the performance of the connected instruments is not guaranteed. Please refer to the instructions attached to the individual instruments when they are connected.
- A hazardous situation may occur if the instrument is used for a purpose that is not designed for or any other improper ways. The instrument has the IEC class 1 (ground terminal).

Use in explosion hazardous areas

- Please use the explosion-proof type for measurement in explosion-hazardous areas.
- Instruments used in explosion hazardous areas should be mounted and wired according to the explosion-proof regulations.
- Instruments mounted in explosion hazardous areas must not be opened when the Tighten the cable gland firmly.
- The maintenance and repair of the instrument are limited to fulfill the explosion proof regulations.

Electrostatic charge
Mounting with a stilling well (also called pipe) is recommended for use in a tank that contains a flammable liquid with low conductivity.
In case of installation without pipe, the first measurement or the measurement after hoisting the displacer must be carried out after a certain stilling time. This is shown in the following table (according to TIIS recommendation 1988).
With pipe, the stilling time is the same as for volume.

Table 1

Flammable liquid conductivity (S/cm)	Recommendation value of stilling time (minute)			
	Flammable liquid volume (m^3)			
	<10	10~50	50~100	>5000
$>10^{-8}$	>1	>1	>1	>2
$10^{-8} \sim 10^{-12}$	>2	>3	>10	>30
$10^{-12} \sim 10^{-14}$	>4	>5	>60	>120
$<10^{-14}$	>10	>10	>120	>240

(according to recommendation 1988)

Caution!
Observe the following notes to prevent serious material damage.



Handling of the measuring wire
The instrument detects the buoyancy force on the light displacer, and the thin wire is used for the transmission of forces as well as for the length measurement.
- Do not kink or twist the measuring wire. It is easily damaged by careless handling.
- Do not hoist the displacer by pulling the wire by hand. Do it by operation of the instrument.
- Do not touch the wire during operation.
- Do not bend the wire to a radius of less than 50 mm.

We do not guarantee the lifetime of the measuring wire if it is treated roughly.

Installation of the displacer
For the delivery of the instrument, the small displacer is either shipped mounted on the gauge or separately.
- In case of the all-in-one type, refer to the attached instruction for the removal of the stuffing material.
- In case of separate shipment, install the displacer to the measuring wire before mounting the gauge onto the mounting nozzle of the tank. Use a spacing stand or other approved procedures to level the Proservo NMS53x installation of the displacer. Make sure that the measuring wire is correctly located in the groove of the wire drum after mounting of the displacer.

Turbulent condition
- If turbulent conditions are expected at the liquid surface, use a stilling well, or hoist the displacer during turbulence
- If the measurement is carried out under turbulent condition, consult Endress+Hauser before operation.

The turbulent condition may influence the accuracy of the reading or damage the measuring wire.

Return

The following procedures must be carried out before a transmitter is sent to Endress+ Hauser for repair:

- Always enclose a duly completed “Declaration of Contamination” form. Only then can Endress + Hauser transport, examine and repair a returned device.
- Enclose special handing instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, posionous, carcinogenic, radioactive, etc.



Note!

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



Caution!

- No instrument should be sent back for repair without all dangerous material being completely removed first, e.g. in scratches or diffused through plastic.
- Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnal (burns, etc.). Any costs arising from this will be charged to the operator of the instrument.

2. System Configuration

The Proservo NMS53x can be used for a stand alone application or as a tank gauge system with spot or average temperature bulb and tank site monitor.
The output of the Proservo NMS53x could be chosen between digital output, analogue output, or both. For detailed information of the temperature bulb and the tank site monitor, refer to the separate documents.

Fig.1 shows an example of a Proservo NMS53x application.

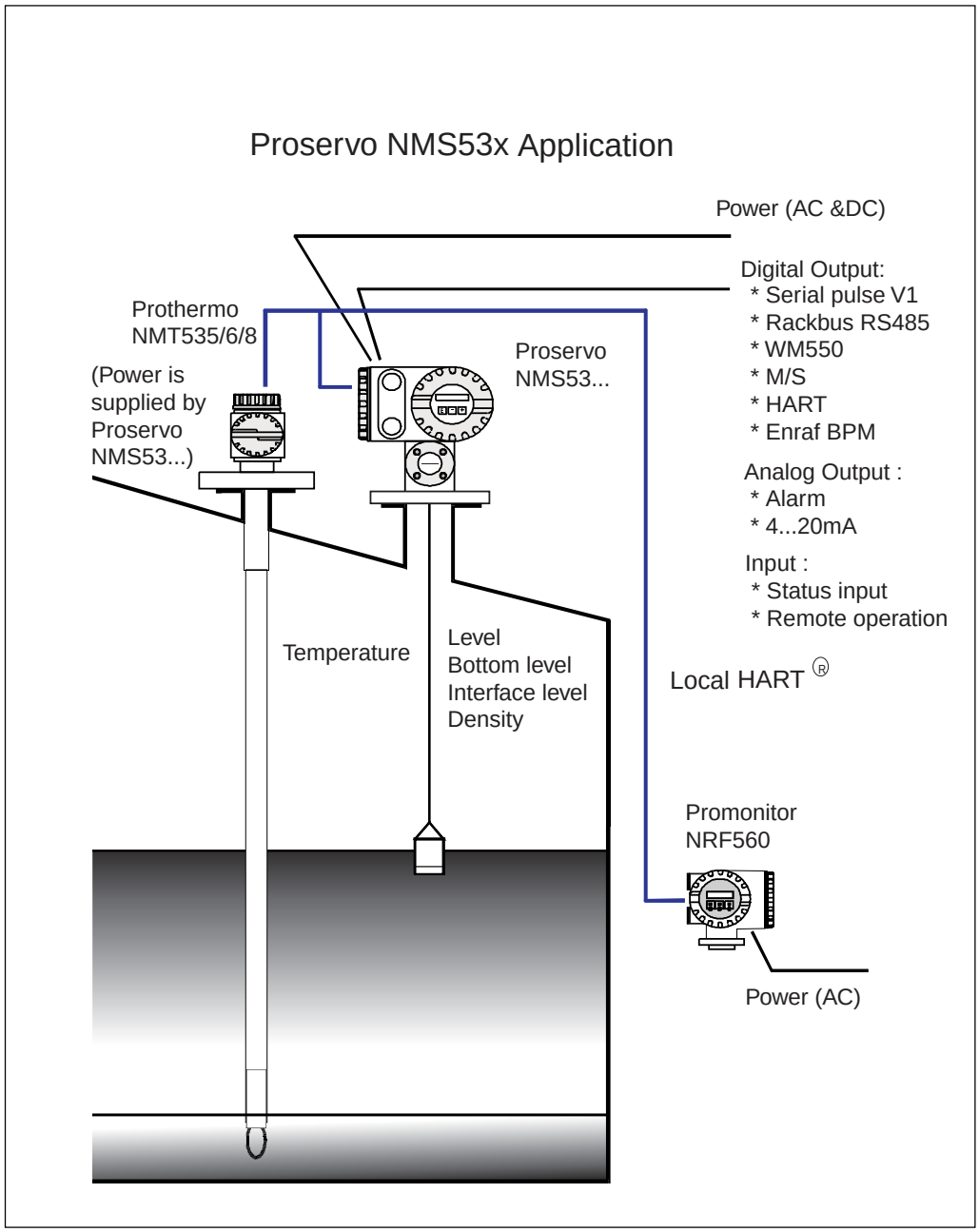


Fig. 1:
Example of a Proservo NMS53x application

Terms related to the tank measurements

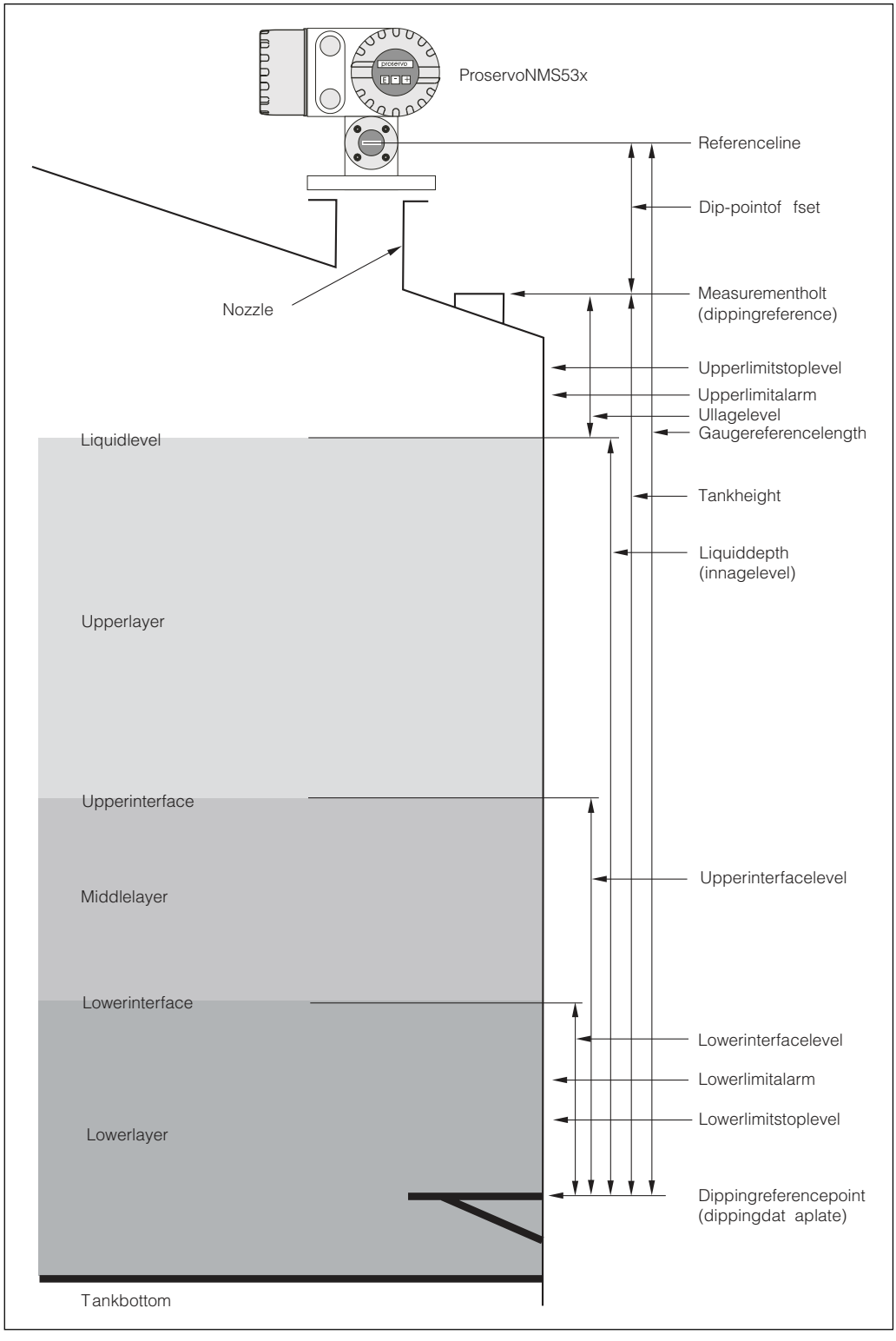


Fig. 2:
Terms related to the tank measurements

Fig. 3 shows possible combination of the Proservo NMS53x

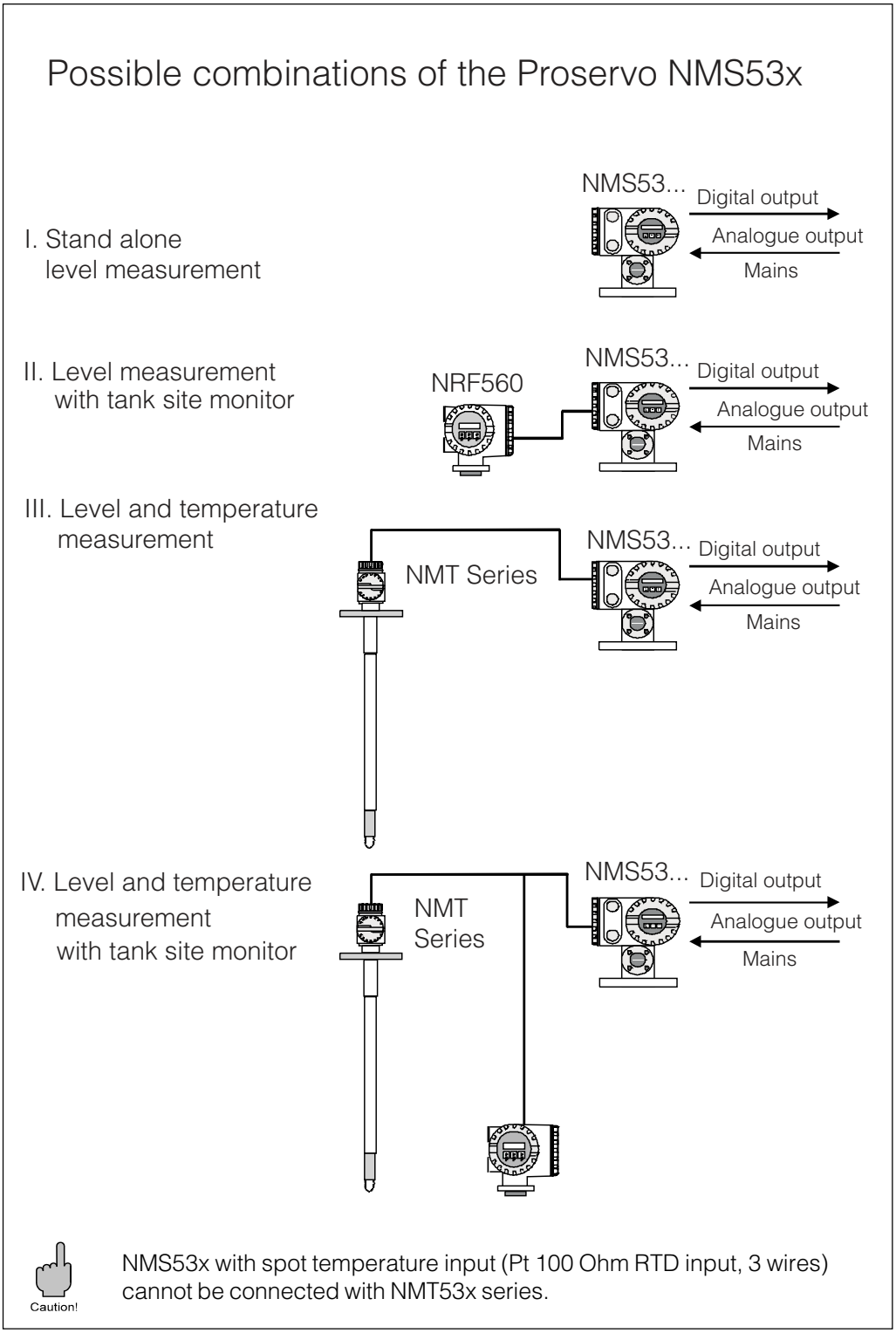


Fig. 3: Possible combination of the Proservo NMS53x

3. Specifications and Dimensions

3.1 Typical Specifications

Measuring range:	0 to 10/16/28 m
Density limits:	0.5 to 2.0 g/ml
Self-diagnostic function:	measuring wire tension, level data input, and communications, status, computer diagnostic, etc.
Liquid surface following speed:	0 to 2,500 mm/min. 0 to 99 sec.
Display:	Backlight LCD, 2 lines; 16 characters/line (indicating level and temperature at the same time) (Japanese/English, selectable)
Operation:	Via touch control (touch-sensitive keys) or external contact input
Calibration:	Automated (changes in displacer weight and wire stretching automatically compensated)
Compensation:	Compensation for tank distortion
Parts maintenance and management Information:	Load ratio calculated from the quantity of operation and operating ratio, then displayed and sent out as status information
Notepad function:	Maintenance notepad
Accuracy:	Liquid surface level: ±0.7 mm (density difference between two liquids 0.2g/ml; displacer diameter 50mm; measuring range 10m)
Density:	±0.005 g/ml
Tank bottom:	±2.1 mm
Power requirements:	high voltage type; 85 ... 264 V AC ,50/60 Hz low voltage type; 20 ... 60 V DC / 20 ... 55 V AC 50/60 Hz
Consumption:	Max. 50 VA, 20W (cos j=0.5)
Lightning arrestor:	Standard equipment
Temperature limits:	-20 to +60 deg. C (environmental temperature) -40 to +60 deg.C (ATEX)
Liquid-arrestor:	-200 to +200 deg. C
Weight:	NMS531/534: 12 kg NMS532/536: 27 kg
Protection class:	Ex d IIB T4, (TIIS) EEx d IIB T6, (PTB CENELEC) EEx d IIB T6 Zone0, (PTB CENELEC) XP Class1, Div.1, Gp.CD, (FM) Class1, Div.1, Gp.CD, (CSA) EEx d IIB T6, (ATEX) EEx d IIB T6 Zone0, (ATEX) EEx d[ia] IIB T6, (ATEX) EEx d[ia] IIB T6 Zone0, (ATEX) XP-AIS Class1, Div.1, Gp.CD, (FM)
Weights & Measures requirements approval:	PTB (Germany), NMi (Netherlands)
Liquid leakage alarm requirements approval:	TÜV Over Spill Protection (Germany)
Paint color:	Body: light blue; Covers: lightgrey
Input/Output:	External output: 4 to 20 mA, 4 contact outputs, Bi-directional digital pulse two-wire transmission , Rackbus RS485, Whessoe Matic 550, Mark/Space, HART, or Enraf Bi Phase Mark HART External input/output: Local HART, NMT& NRF, Status input Remote operation
Model name decoded	**NMS-53** □ Operating pressure 1. Atmospheric pressure (0.2 g/cm2: Aluminium casting) 2. Atmospheric pressure (0.2 g/cm2: Stainless steel) 4. Middle pressure (6 kg/cm2: Aluminium casting) 5. Middle pressure (6 kg/cm2: Stainless steel) 6. High pressure (25 kg/cm2: Stainless steel) 7. Sanitary version (Stainless steel)

3.2 Dimensions

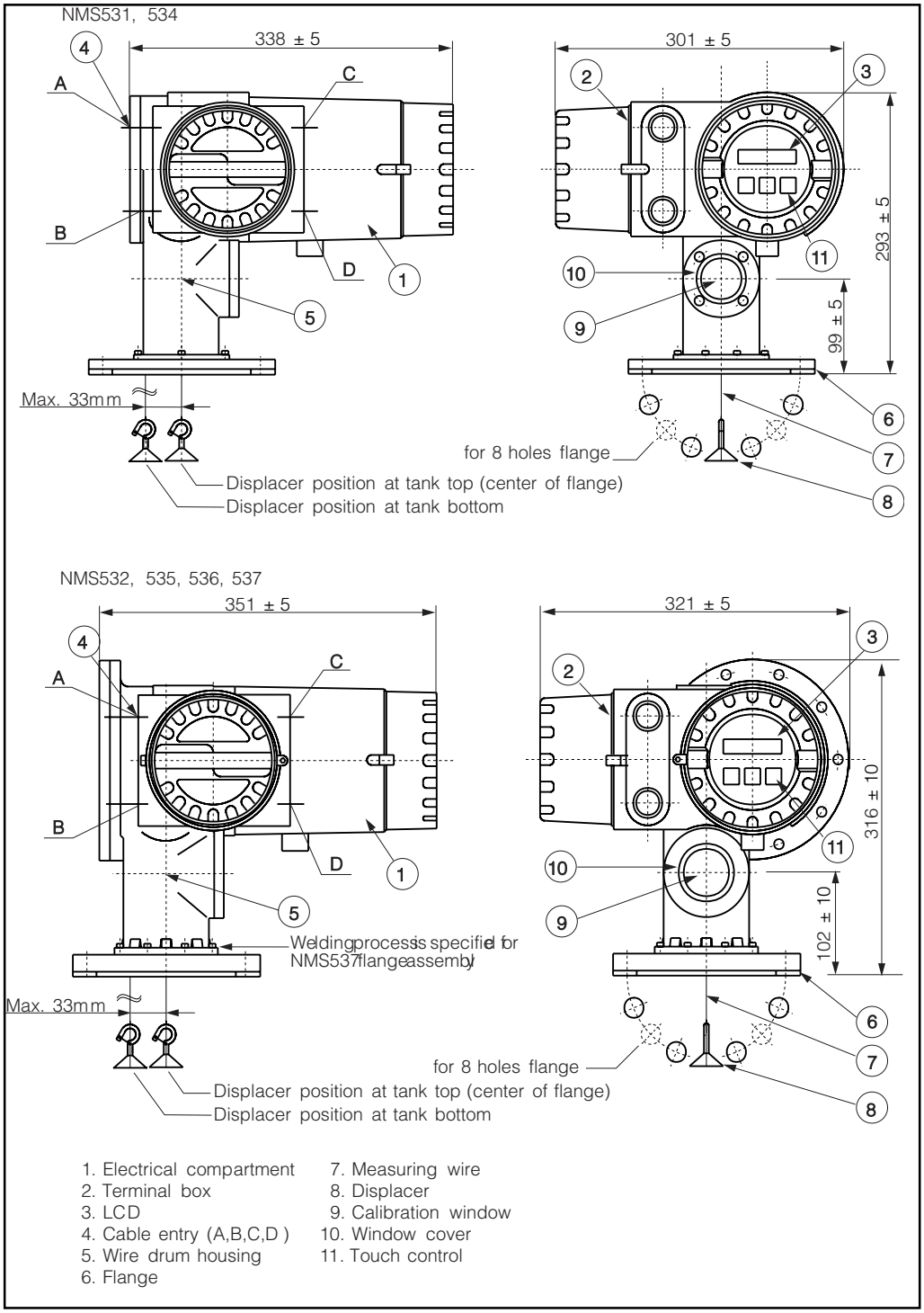
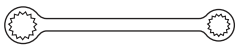
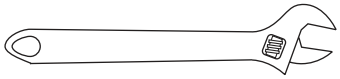
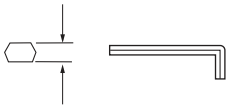
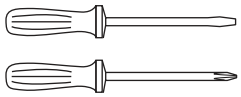
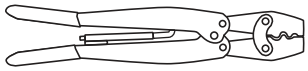
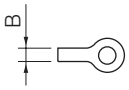
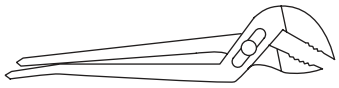
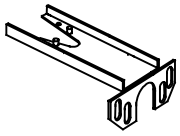


Fig. 4:
Dimensions of the Proservo NMS53x

4. Necessary Tools for Installation

You will need the following tools when installing the Proservo NMS53x.

Box wrench	 24,26,30,32 mm
Crescent wrench	 350 mm
Allen wrench	 3 mm
Screw driver flat head Philips	
Wire Cutters / Terminal pliers	
Wire terminal	 3 mm 1.25□, 2.0□
Waterpump pliers	
50gweight *	
Sliding tray *	
Wire / hook*	
Screw*	

* Tools are needed in calibration work for density and interface functions

5. Mounting

The following installation procedures are available for the Proservo NMS53x.

- Mounting without guide system.
- Mounting with stilling well (also called pipe)
- Mounting with guide wire

5.1 Application drawing for tanks

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

- Floating roof tank
- Covered floating roof tank
- Tank with strong agitator or heavy turbulence

Mounting without any guide system covers all cases that are not listed above.
Fig. 5 shows examples of applications with and without stilling well.

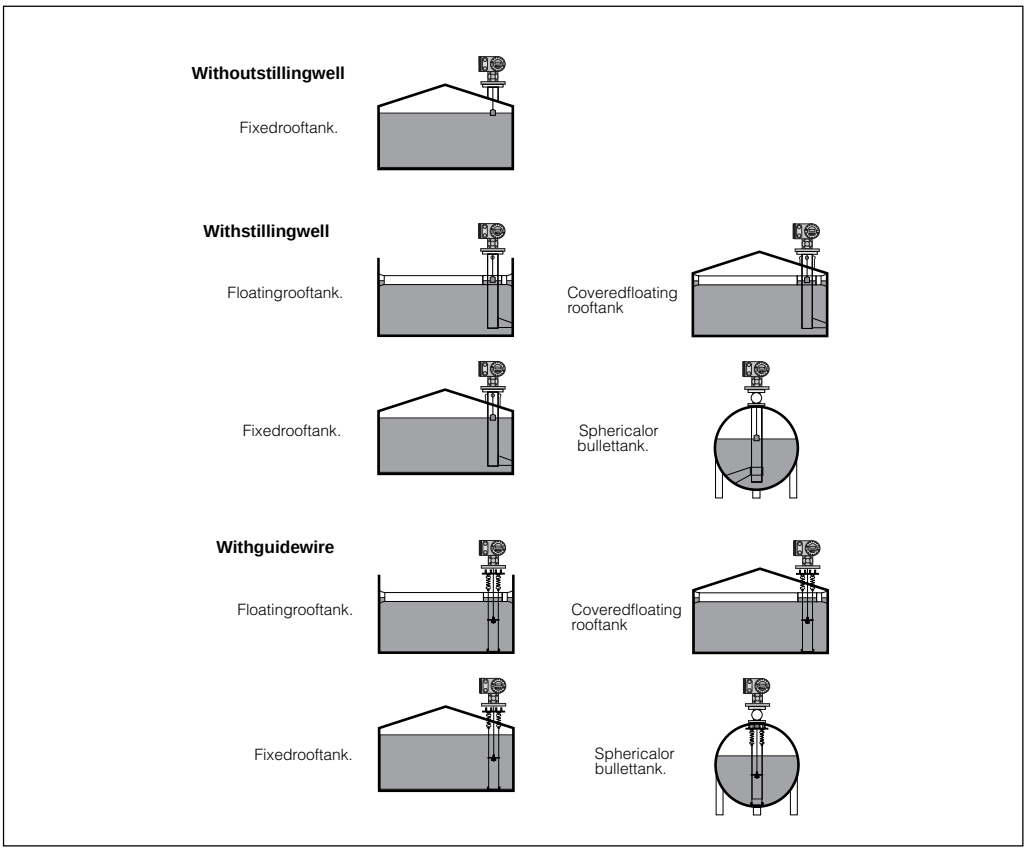


Fig. 5:
Application for each tank

5.2 Mounting without Guide System

In this case, the Proservo NMS53x is mounted on a nozzle of the tank roof without any guide system (see Fig. 6). The mounting preparations require the observance of some recommendations for setting the nozzle and the minimum measuring level. This is specified and explained in Sect. 6.1.

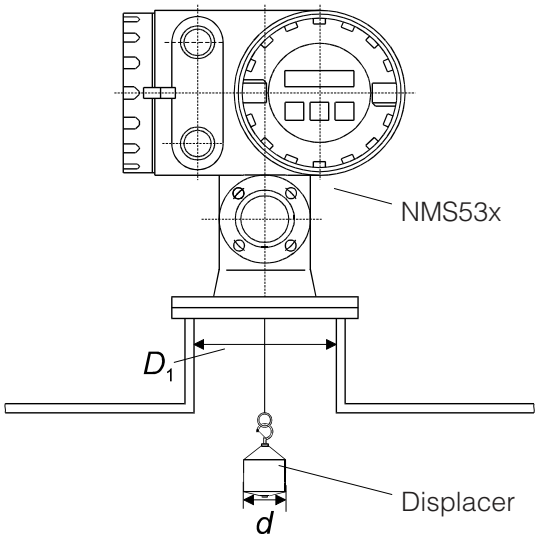


Fig. 6:
Mounting without guide system

5.3 Mounting with Stilling Well

Pipe diameter

The pipe diameter that is required to protect the measuring wire without disturbing its operation depends on the tank height. The pipe could either be constant diameter, or thinner at its upper part and thicker at its lower part. Fig. 7 shows two examples of the latter case, namely an asymmetric pipe and a concentric pipe.

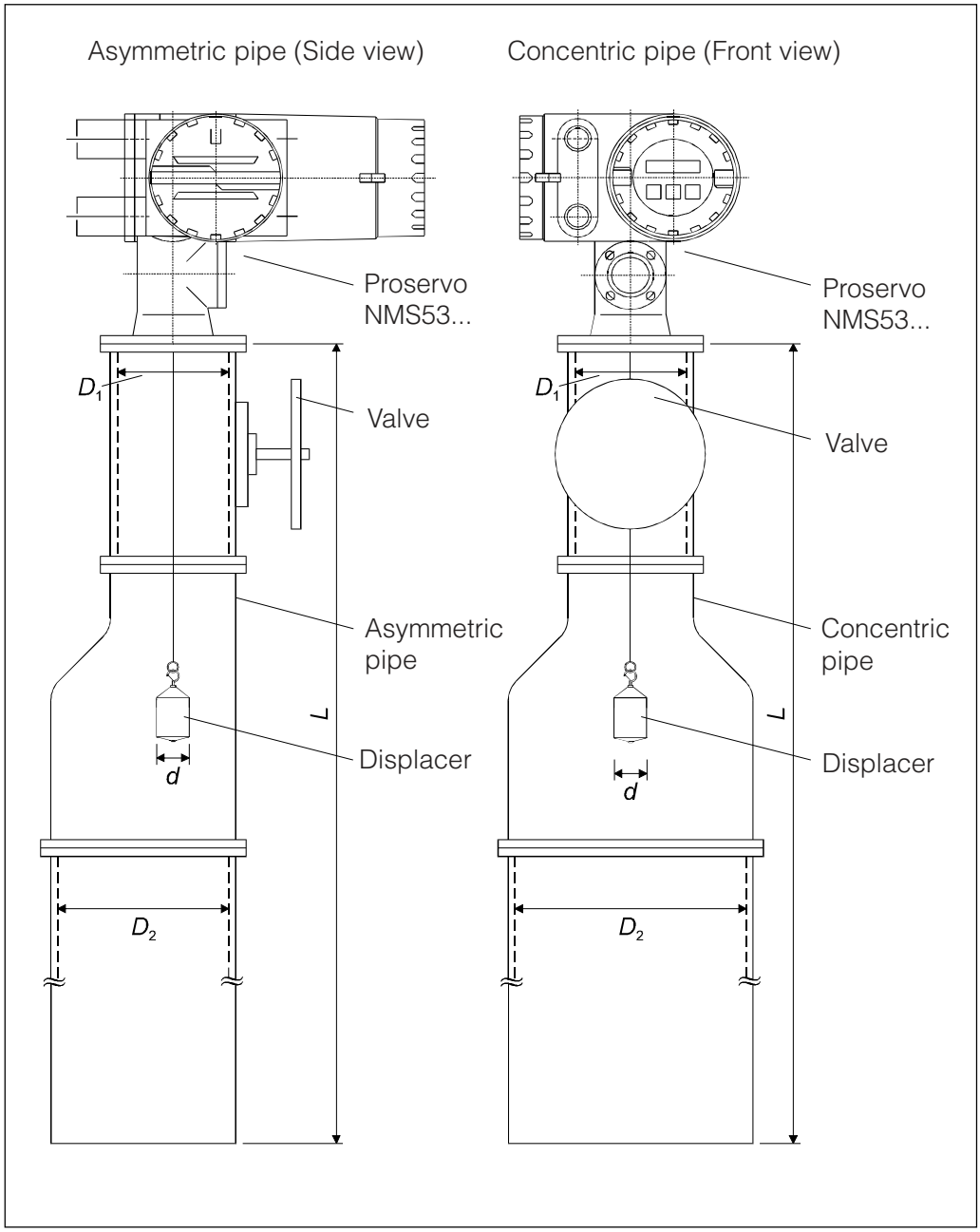


Fig. 7: Mounting with stilling well: Asymmetric pipe and connection pipe

Note!

- This valve is necessary when mounting the Proservo NMS53x onto pressurized liquid tanks.
- The Proservo NMS53x must be mounted on the asymmetric pipe in the direction shown above.

To calculate the required pipe diameters, the formulae below should be used.
The variables and constants have the following meanings:

D_1 Inner diameter of the upper part of the pipe

D_2 Inner diameter of the lower part of the pipe

L Length of the pipe (from the flange of the Proservo NMS53x to bottom of the stilling well) ...meters

v Deviation of the pipe from the vertical per length

d Diameter of the displacer

e Lateral shift of the displacer per length due to the groove of the wire drum (max.33 mm)

- Upper diameter

$$D_1 > d + 10 \text{ mm}$$

where $D_1 > 3"$ should be fulfilled.

- Lower diameter

  - Asymmetric pipe

$$D_2 > d + eL + 2vL + 10\text{mm}$$

  - concentric pipe

$$D_2 > d + 2eL + 2vL + 10\text{mm}$$

Recommendations for mounting

Note!

Observe the following recommendations for mounting with stilling well:


Note!

- Keep the pipe connection welds smooth.
- While drilling holes into the pipe, keep the interior surface of the holes clear of metal chips and burrs.
- Coat or paint the interior surface of the pipe to avoid rust.
- Keep the pipe as perfectly vertical as possible. Check this by a plumb.
- Install the asymmetric pipe under the valve and fit the centers of the Proservo and the valve.
- Set the center of the lower part of the asymmetric pipe to the direction of the displacer motion.

5.4 Mounting with Guide Wire

It is also possible to guide the displacer by a guide wire to prevent lateral motion. Fig. 8 shows this type of mounting.

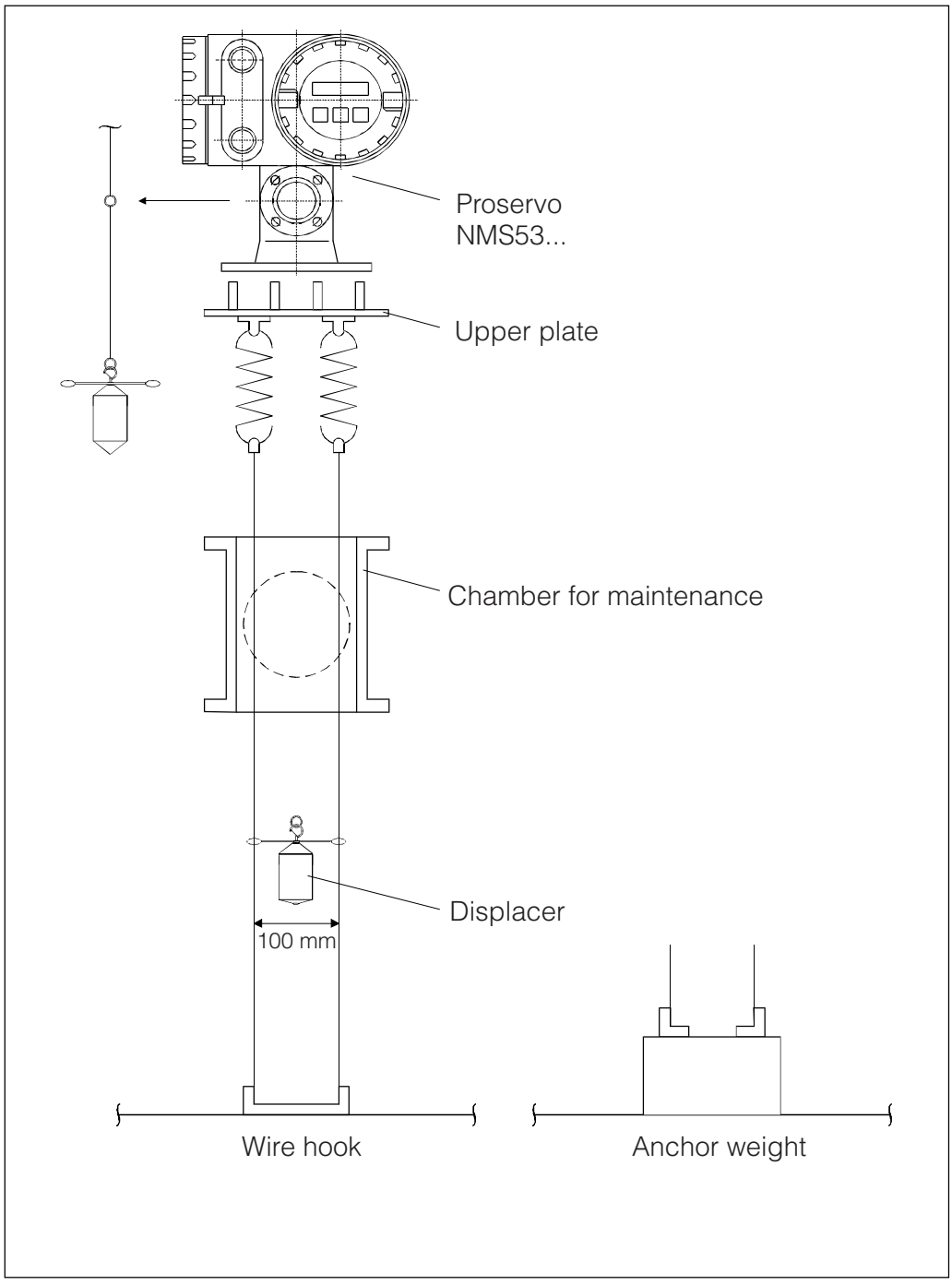


Fig. 8:
Mounting with guide wire

6. Mounting Preparations

6.1 Flange

The mounting flange should be prepared before mounting the Proservo NMS53x to the tank. The flange size and the rating of the Proservo NMS53x depend on the customers' specifications. However, the standard size of the flange is 3".

Note!

- Check the flange size which is on the surface of the Proservo NMS53x
- Install the flange on the top of the tank. Its deviation from the horizontal plane should not exceed +/- 1 deg (see Fig.9).
- For mounting the Proservo NMS53x onto a longer nozzle, make sure that the displacer does not touch the interior surface because of the vertical inclination of the nozzle.

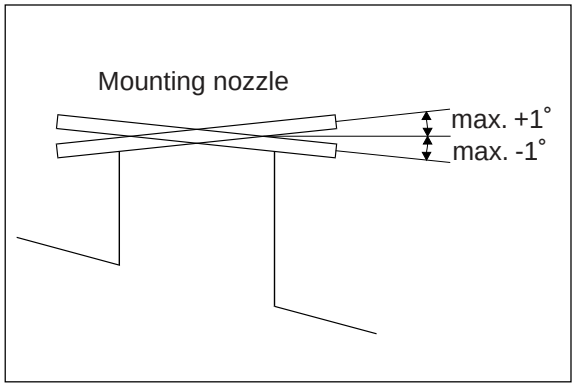


Fig. 9: Allowable inclination of the mounting flange

Note!

If the Proservo is installed without guide system, then consider the following recommendations (see Fig. 10):

- 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 will prevent heavy swing of the displacer caused by wave or turbulence of the inlet liquid.
- Set the mounting nozzle at least 500mm away from the tank wall. This will ensure that the measurement is not influenced by changes of the ambient temperature.
- Set the minimum measuring level at least 500mm above the top of the inlet pipe. This will protect the displacer from direct flow of the inlet liquid.

If it is not possible to install the Proservo NMS53x in such place, then we recommend mounting with guide system. Consult E+H Service for further information.

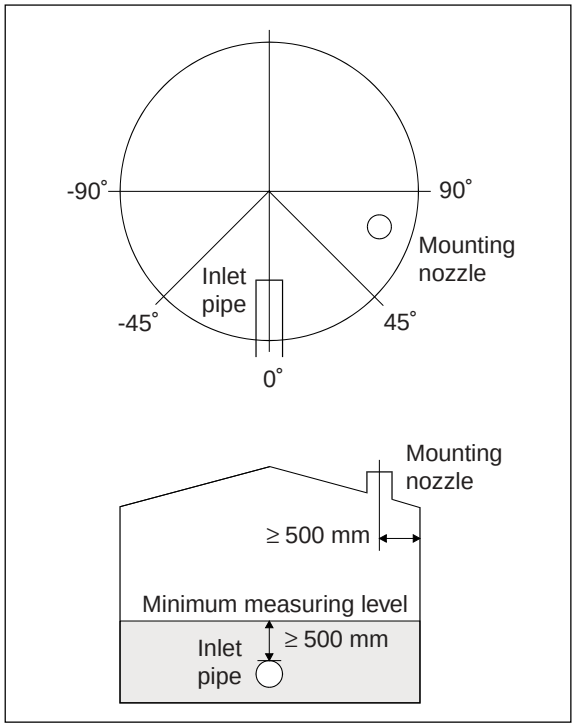


Fig. 10: Recommended setting of mounting nozzle and minimum measuring level

Warning!
Before pouring liquid into the tank, make sure that the flow from the inlet pipe cannot hit the displacer directly.
During discharging the tank, avoid suction of the displacer to the outlet pipe.

6.2 Electrostatic Charge


Note!

Note!

- If the liquid measured by the Proservo NMS53x has a conductivity of less than 10-8 S/cm, it is quasi-nonconductive. In that case, we recommend to use a stilling well or guide wire made of conductive material. This will release the electrostatic charge on the liquid surface.
- Without stilling well and guide wire, a certain stilling time must be kept before the displacer touches the liquid surface (see Sect. 1).

7. Cable Connection



The electrical connection of the Proservo NMS53x is shown in Figs. 11 - 16.

Note!
The power supply cable should have the following specifications:



- PVC, PE, or equivalently isolated
- 600 V insulation voltage or equivalent.

The size of the core will be defined by core resistance, voltage drop, and required power consumption. The maximum power consumption of the Proservo NMS53x is 50 VA.



Caution!

- Connect the ground line to the ground terminal inside or outside the terminal box.

7.1 Cabling

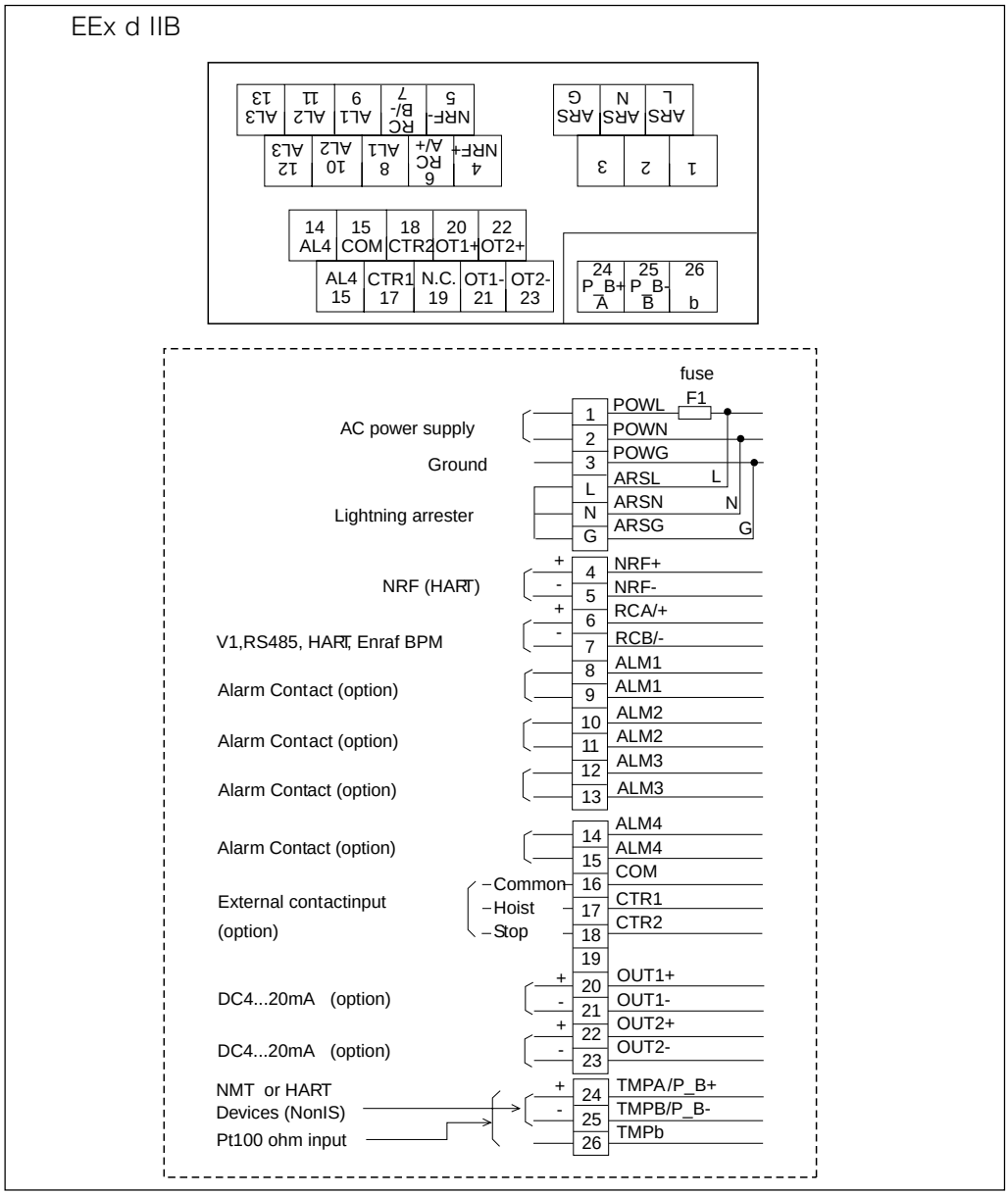


Fig. 11: Electrical connection of the Proservo NMS53x

The following table is the logic, if you use external contact input (Hoist-CTR1) (Stop-CTR2).

Caution!

CTR1	CTR2	OPERATION
OFF	OFF	LEVEL
ON	OFF	HOIST
OFF	ON	STOP
ON	ON	INTERFACE

The terminal board of following specifications are shown next pages.

- Whessoe Matic 550 Protocol
- Mark / Space Protocol
- EEx d[ia] IIB T6 & Zone0, ATEX

Note!

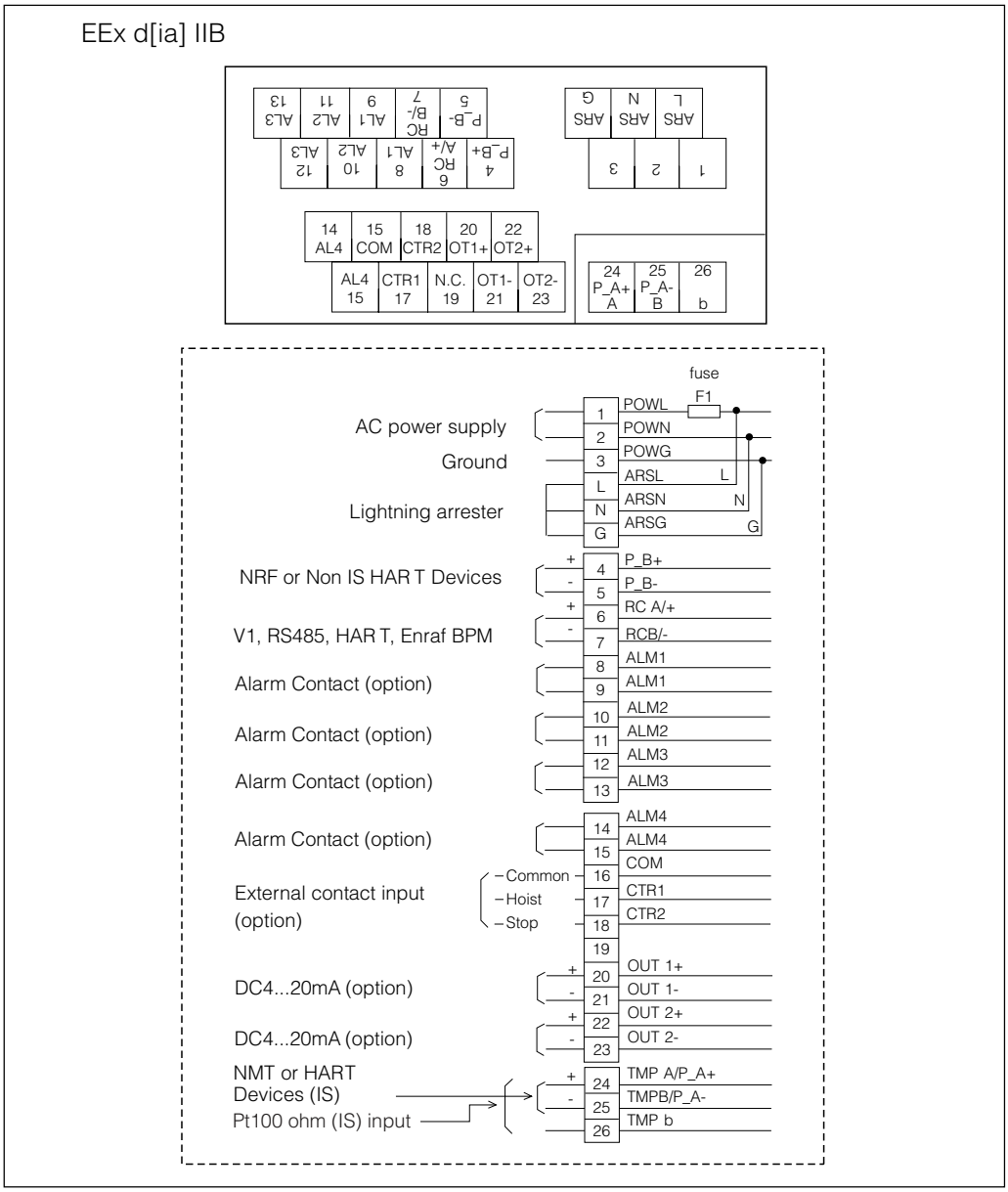


Fig. 12:
Electrical connection of the Proservo NMS53x with IS HART connection

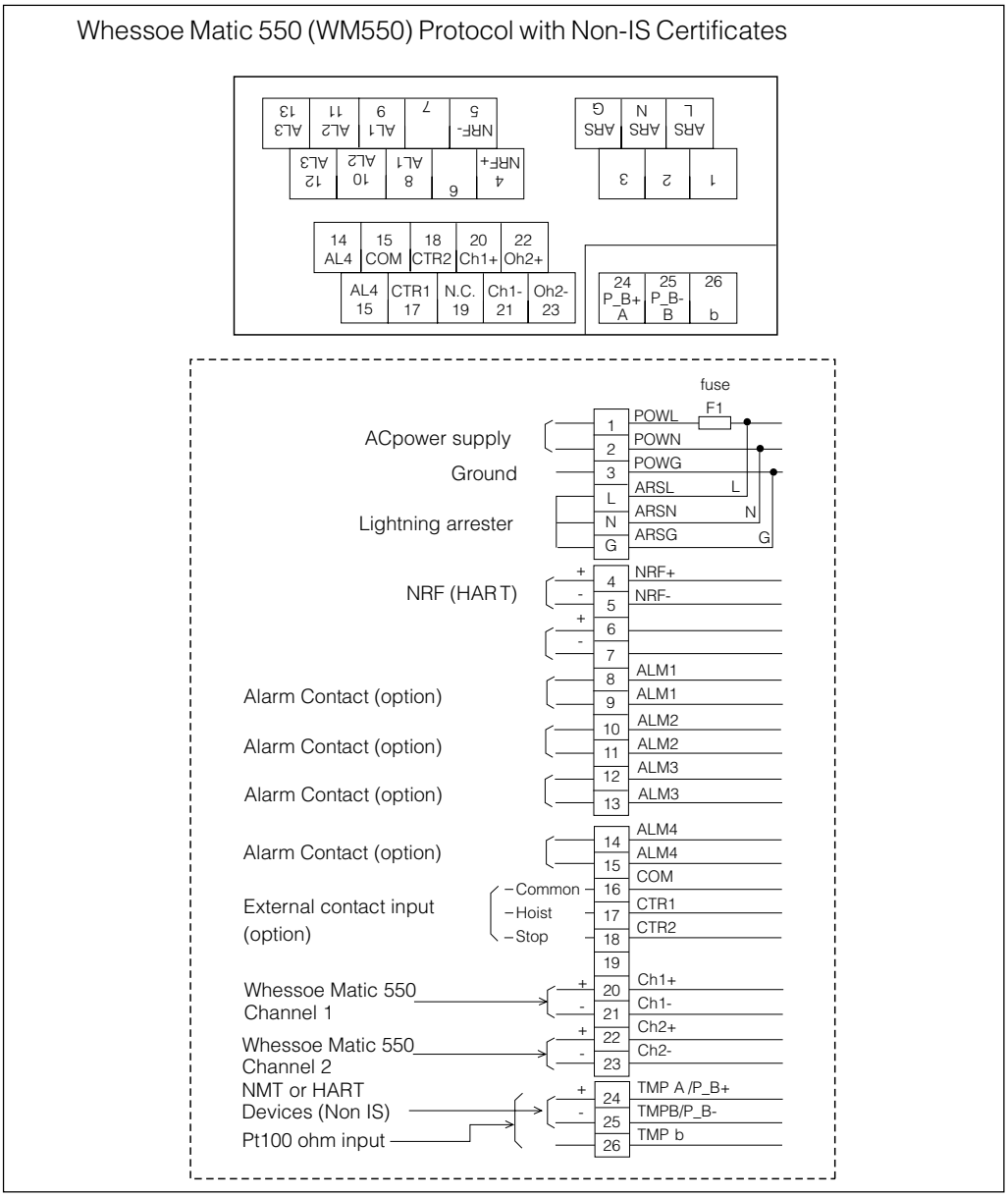


Fig. 13:
Electrical connection of the Proservo NMS53x with WM550 Protocol with Non-IS HART connection

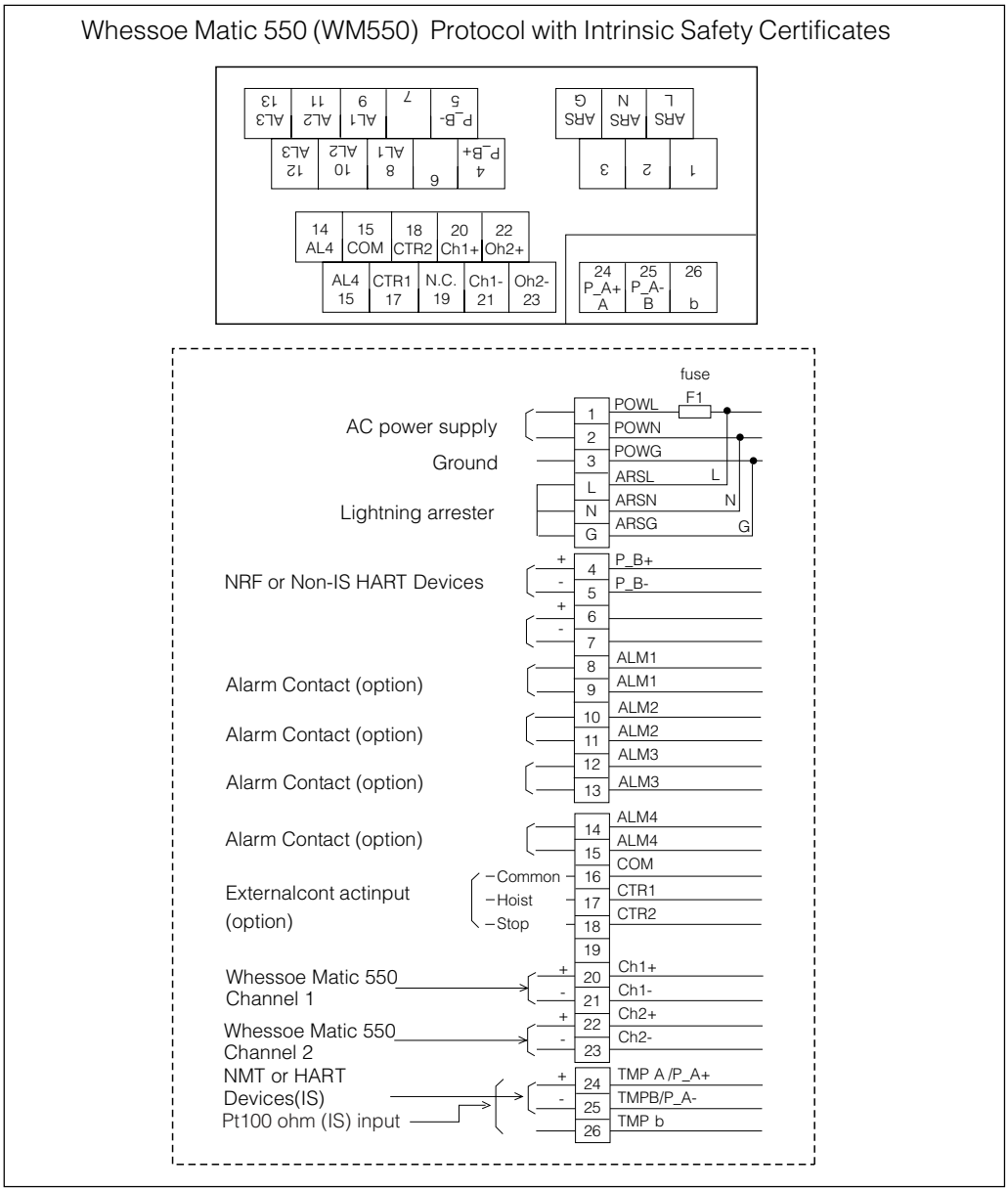


Fig. 14:
Electrical connection of the Proservo NMS53x with WM550 Protocol with IS HART connection

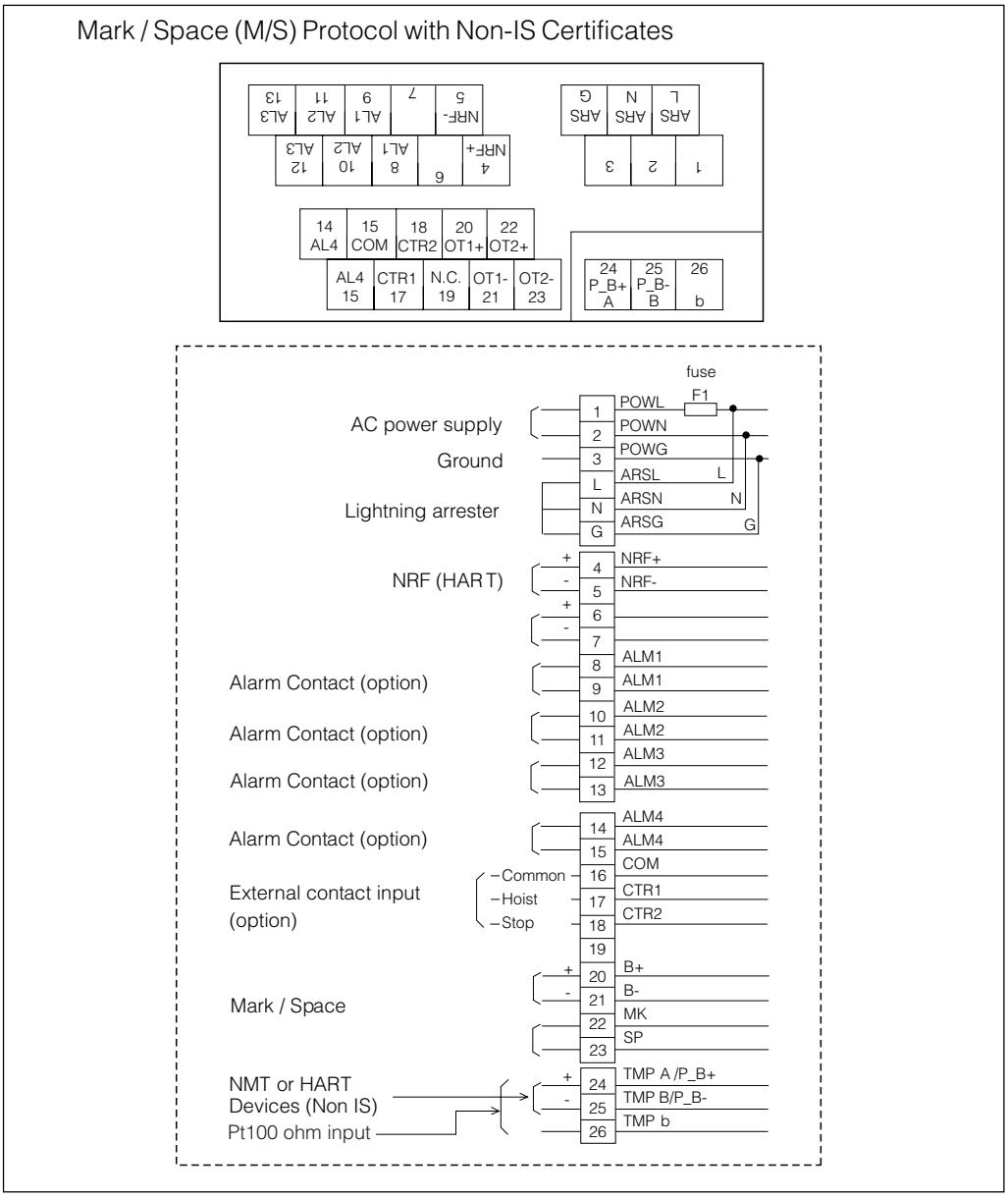


Fig. 15:
Electrical connection of the Proservo NMS53x with M/S Protocol with Non-IS HART connection

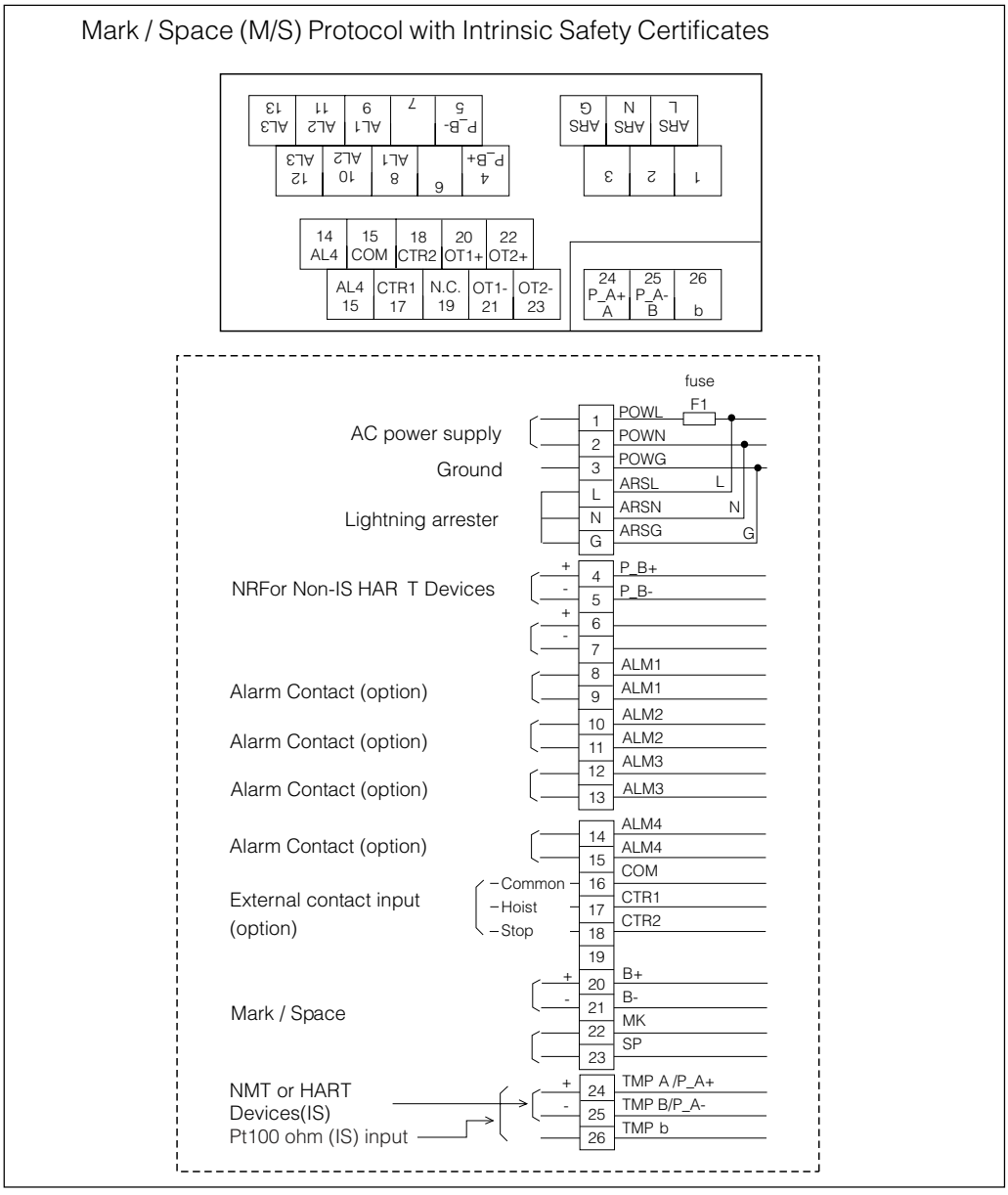


Fig. 16:
Electrical connection of the Proservo NMS53x with M/S Protocol with IS HART connection

7.2 Input and output

- V1 serial bus is used for the connection of the existing receiving system of Sakura Endress or the tank farm where the distance from the tank site to the control room is max. 6 km.
- RS 485 with Rackbus protocol is used for normal applications together with other Endress+Hauser products.
- Alarm contacts and external contact input analogue signal are available as optional output.
- A HART input is available where temperature sensor Prothermo NMT535/6/8, tank site monitor Promonitor NRF560, or other HART devices can be connected.
- A Pt100 ohm RTD input is available as optional input.

Warning!
The cable used for input and/or output must be more than 24 AWG screened or steel armored. A twisted pair is required for the 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 the Proservo NMS53x. The instrument has max. four cable entries.

Before you place an order for the Proservo NMS53x, please check the cable size and the number of cables.

7.3 Cable Gland

If you do not use all the cable entries, then take out unnecessary glands and put the plug to the thread to prevent intrusion of water.

8. Displacer and Measuring Wire

8.1 Shape, Diameter, and Material

Displacer

There are several types of displacer available for the Proservo NMS53x:

- The standard type has cylindrical shape and a diameter of 50 mm. Diameters from 30 to 50 mm are optional (PTB Weights & Measures type is a diameter of 110 mm. NMi Weights & Weights type is a diameter of 70 mm)
- Cylindrical shape is used for sticky material. It is also effective if the stilling well has a burr 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.
Displacers of three different materials are provided:

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

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

NMi (Netherlands)	Ø70 mm
PTB (Germany)	Ø 110 mm



Measuring wire

- The standard material of the measuring wire is stainless steel SUS 316 (Ø 0.15 mm).
- Hastelloy C (Ø 0.20 mm) and PTFE coated stainless steel SUS316 (Ø0.4 mm) are for corrosive liquids.

The following specification of measuring wire will be supplied, when you order the custody transfer approval.

SUS 316 (Ø 0.15 mm) for NMi and PTB.

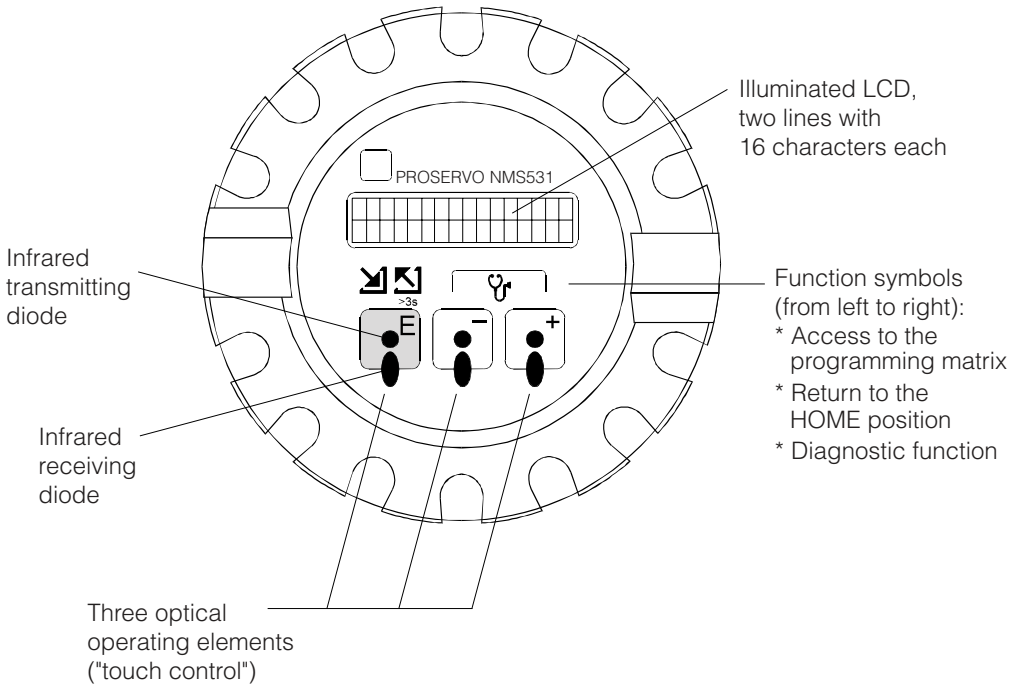


9. Touch Control and Programming Matrix

9.1 Display and Operating Elements

Display
The Proservo NMS53x has an illuminated LCD that consists of two lines with 16 characters each. During normal operation, it shows the level, the temperature, and the status of the device on the "HOME" position. The display of the HOME position will be explained in Sect. 10.3.
For the display of the other data and the programming of the parameters for operation, the Proservo NMS53x uses a convenient programming matrix.

Operating elements
The Proservo NMS53x 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 diode is not affected by external influences, e.g. direct sunlight. The software and hardware installed in the Proservo NMS53x rules 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.



9.2 Functions of the Operating Elements

The programming matrix consists of five matrix groups, namely one "static" matrix and additional "dynamic" matrices. They are described in detail in Section 10.5 ~ 10.7. The individual matrix groups, function groups, and functions within the programming matrix can be selected by alternately touching the operating elements. This is explained in the following table and in Fig. 17.

Key	Functions
E	• Access to the programming matrix (touching the key for more than 3 sec.) • Return to the HOME position (touching the key for more than 3 sec.) • Moving horizontally within a function group to select functions. • Saving parameters or access code.
+ −	• Moving vertically to select function groups • Selecting or setting parameters • Setting access code

Note!
The LCD will return to the HOME position if no key is touched for more than 10 min. Digits are incremented or decremented by + or -, respectively. If you touch + or - continuously, then the minimum digit will change first. After one cycle of the minimum, the second minimum will change. After one cycle of the second follows the third minimum, and so on. If you take off your finger from the touch control, then the procedure will start again from the minimum digit (Analogy of mechanical counter)

Note!

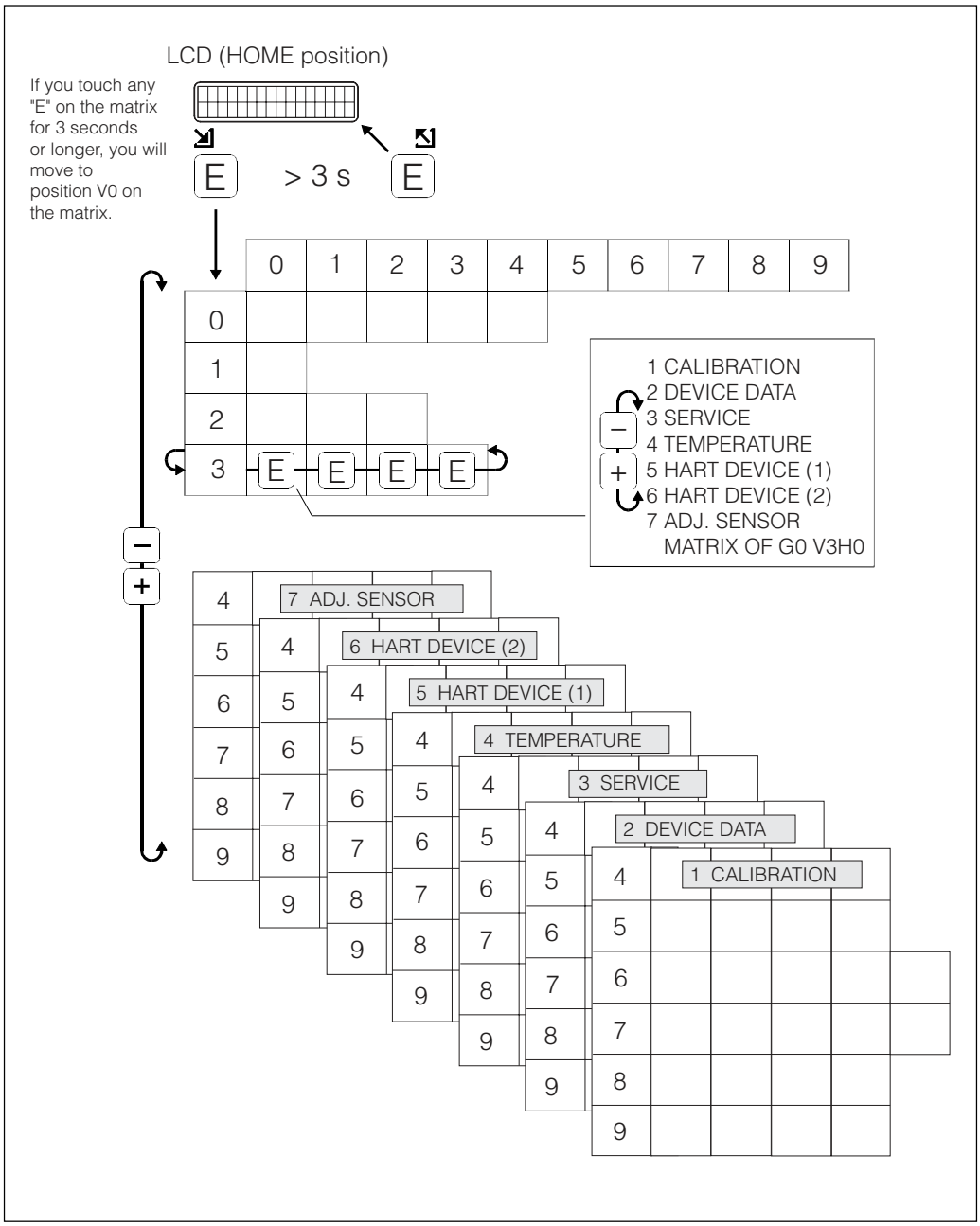
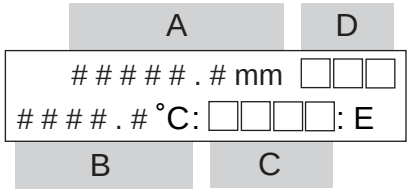


Fig.17: Selection matrix groups, function groups, and functions within the programming matrix

9.3 HOME Position

After turning on the power supply, the LCD first shows the current data on the HOME position. Its pattern is represented below, where # denotes a digit or a minus sign, and □ denotes a letter or a hyphen.



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

Area	Information
A	Current level
B	Current temperature
C	Gauge status
D	Displacer status

The meanings of gauge status and displacer status are explained in the following tables.

Gauge status	Meaning
G-RE	The displacer is resting at the reference position
UP	The UP command has been given.
STOP	The STOP command has been given.
LIQU	The Proservo NMS53x is measuring the surface level.
U-IF	The Proservo NMS53x is measuring the upper interface level.
LIF	The Proservo NMS53x is measuring the lower interface level.
BOTM	The Proservo NMS53x is measuring the tank bottom level.
U-DE	The Proservo NMS53x is measuring the upper liquid density.
M-DE	The Proservo NMS53x is measuring the middle liquid density.
B-DE	The Proservo NMS53x is measuring the bottom liquid density.
CAN	The RELE. OVER TENS command has been given.
TEAC	The Proservo NMS53x is carrying out calibration.
blank	The Proservo NMS53x cannot detect any level.

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

Note!
If no key is touched for more than 10 min., then the Proservo NMS53x will turn off the backlighting of the LCD to save energy, touching a key again after this time will turn on the backlighting.


Note!

9.4 Access Code

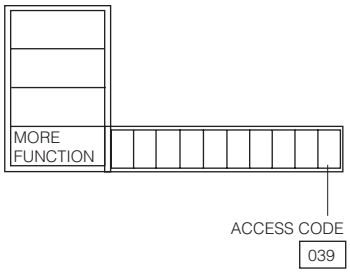
The access code is to ensure the confidentiality of the setup data. Three security levels are available, along with access codes.

Security level		Access code
0		None
1	For Operator	50
2	For Engineer	51 / 777

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 the I.S. terminal configuration.

A display of data or set values for security levels 0 and 1 is available without code. However, a display for security level 2 is not available without presetting of the access code 51.

Setting an access code

Item	Procedure	Remarks
Static Matrix 	1) At the static matrix “MORE FUNCTION”, select GVH=039 “ACCESS CODE” 2) The default value is “0”. Keep touching “+” key until you get to “50” or “51”. 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 you touch “E” while displaying an access code except 0, 50, or 51 “EDITING ENABLE” will appear. • If an access code has not been selected before performing any settings, the screen will automatically change to show • “EDITING ENABLED”. Select “50” or “51” according to the matrix table.

9.5 Description of the Programming Matrix

The rows 0...3 of the programming matrix are called the static matrix. Its functions display or allow programming of mainly measured values (primary variables) and basic operation of the Proservo NMS53x.

The rows 4...9 exist on six different “pages” called the dynamic matrix. These matrix groups are labelled as follows;

STATIC MATRIX
- STATIC (V0-V3) or DYNAMIC MATRIX (V0-V3)
- CALIBRATION (G1V4-G1V9)
- DEVICE DATA (G2V4-G2V9)
- SERVICE (G3V4-G3V9)
- TEMPERATURE (4V4-G4V9)
- HART DEVICE (1) (G5V4-G5V9)
- HART DEVICE (2) (G6V4-G6V9)
- ADJ. SENSOR (G7V4-G7V9)
  * G = Group
  * V = Vertical
  * H = Horizontal

Their functions display or allow programming of parameters that are required for operation and commissioning of the Proservo NMS53x, and/or the Prothermo NMT535/6/7. As already indicated in Fig. 17, the dynamic matrix is selected at position V3H0 (MATRIX OF) of the static matrix.

The individual functions of the matrix groups are described on the following pages.

The index number in the last column denotes matrix group (0 for the static matrix, 1...7 for the dynamic matrix), vertical position (or “FUNCTION GROUP”), and horizontal position (or “Item”) of the function.

9.6 Programming Matrix

This section shows the complete programming matrix of the Proservo NMS53x. Each matrix group appears on a separate page. The functions are described in the following way:

MATRIX GROUP		
V	H	Horizontal position
Vertical position: 0...3 (static) or 4...9 (dynamic)	FUNCTION GROUP	Item Default value Set/Select/Display (Access code)

The access code is additionally indicated by the tint of the table cell:

Tint	Access code
	none
	50
	51 / 777

Default Data

Display Text
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	16000.00 mm MEASURED LEVEL Display	0.0 mm ULLAGE LEVEL Display	0.0 mm UPPER INTERF. LEV Display	0.0 mm MIDD. INTERF. LEV Display	0.0 mm BOTTOM LEVEL Display	1.000 g/ml UPPER DENSITY 0.000 - 3.000 Display/Set (50)	1.000 g/ml MIDDLE DENSITY 0.000 - 3.000 Display/Set (50)	1.000 g/ml DENSITY BOTTOM 0.000 - 3.000 Display/Set (50)	0.0 mm LEVEL DATA Display	OFF STATUS1 ON Display
MEASURED VALUE 2	1	0.0°c LIQUID TEMP. Display	DEV(1) Display	DEV(2) Display	0.0°c GAS TEMPERATURE Display				0 mm ZERO POINT Display	16000.0 mm SPAN Display	mm LENGTH UNIT Display
OPERATION	2	STOP OPERATION 16000 See below operation commands Select (50)	STOP OPERATING STATUS See below status table Display	UNBALANCED BALANCING STATUS Display		LEVEL OPERAT.BY NRF Display	LEVEL OPERAT.BY HOST Display			411 DEVICE ID	8424 SOFTWARE VERSION
MORE FUNCTION	3	CALIBRATION MATRIX OF Select			98 627 8:21:00 CALENDER Currect data Display	NO ALARM ALARM CONTACT 0 Currect data Display	NO ALARM LA 0 0 0 0 Currect data Display	NO ERROR DIAGNOSTIC CO 0 Currect data Display	MPU:START ACT 98 627 752 0 0 Currect data Display		0 ACCESS CODE 0 , 50, 51, 777 Set

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 - 99999.9 mm Set (50)	0.0 mm DIP POINT OFFSET 0 - 99999.9 mm Set (50)	10.0 mm DISPLAC. DRAUGHT 0 - 999.9 mm Set (50)	150 mm DISPL. RAISE DENS 0 - 300 mm Set (51)	150 mm DISPL.SUBM DINS. 0 - 1500 mm Set (51)					
CALIBRATION	5	16000.0 mm SET LEVEL 0 - 99999.9 mm Set (50)		0.0 mm TANK CORRECT LEV 0 - 99999.9 mm Set (51)	0.000 mm/m TANK CORRE. COEF 0 - 59.999 mm/m Set (51)						
ADJUSTMENT	6	16000 mm UPPER STOP 0 - 99999.9 mm Set (50)	0 mm LOWER STOP 0 - 99999.9 mm Set (50)	350 g OVER TENS.SET 0 - 999 g Set (51)	50 g UNDER TENS.SET 0 - 999 g Set (51)	60 mm SLOW HOIST 60 - 1800 mm Set (51)	10 mm DISPL.RAIS.REP. 10 - 99-+ mm Set (51)	10 s DISPL.WAIT REP. 10-999 sec. Set (51)	10 s DISPL.WAIT DIP 10-999 sec. Set (51)		
AUTO WIRE CALIB.	7	NONE CALIBR. AUTO/MAN MANUAL AUTOMATIC Set (51)	99123123 START TIME 0 - 999999 Set (51)	O hour INTERVAL TIME 0 - 9999 hour Set (51)	OFF AUTO COMPENSAT. ON Set (51)	0.0 mm ZERO CORRECTION 0 - 99999.9 Display (51)	0.0 mm COMPENS. LIMIT 0 - 99999.9 Set (51)				
AUTO CALIB.DISPL	8	NONE CALIBR. AUTO /MAN MANUAL AUTOMATIC Set (51)	99123123 START TIME 0 - 999999 Set (51)	O hour INTERVAL TIME 0 - 9999 hour Set (51)	OFF AUTO COMPENSAT. ON Set (51)	0.0 g DEVIATION 0 - 999.9 Display (51)	0.0 g COMPENS. LIMIT 0 - 99.9 Set (51)				
DISPLAY	9	MEASURED LEVEL SELECT DISP.MODE ULLAGE LEVEL MEASURED LEVEL Select (51)	ENGLISH LANGUAGE JAPANESE Select (51)	■■■■■■■■■■ LCD CONTRAST 0 - 15 Select (51)	1 YEAR SETTING 0 - 99 Current year Set (51)	2 MONTH SETTING 0 - 12 Current month set (51)	15 DAY SETTING 0 - 31 Currennt 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 Max 4 Select (50)	NONE ASSIGN RELAY LELVEL, LIQUID TEMP, CAUTION, WARNING EMEARGENCY ERROR BALANCE SIGNAL Select (50)	HIGH RELAY FUNCTION LOW Select (50)	0 mm SWITCHING POINT Max. 99999 mm Set (50)	0 mm HYSTERISIS Max. 9999 mm Set (50)	NORMAL OPENED RELAY ON ALARM NORMAL CLOSED Set (50)	0 s ON DELAY TIME Max. 999 s Set (50)	0 s OFF DELAY TIME Max. 999 s Set (50)		
ANALOG OUT.ADJUST	5	NONE ASSIGN OUTPUT 1 LEVEL LIQUID TEMP. Select (50)	0 mm ADJUST 4mA FOR LIQUID TEMP. 0.0 °C Set (50)	0 mm ADJUST 20mA FOR LIQUID TEMP. 0.0 °C Set (50)	NONE ASSIGN OUTPUT 2	0 mm ADJUST 4mA FOR LIQUID TEMP. 0.0 °C Set (50)	0 mm ADJUST 20mA FOR LIQUID TEMP. 0.0 °C Set (50)	OFF DEVICE AT ALARM HOLD CURNT.OUT MAX MIN Select (50)			
PARTS DATA	6	1 PARTS NUMBER Max 10 Select (51)	NONE PARTS TYPE POWER UNIT, DISPLAY, MOTOR, WIRE, BEARINGS, SHAFT, Select (51)	OPERATION HOUR MAINTEN. FACTOR DRUM REVOLT. Select (51)	1hour MAINTEN. VALUE 999999hour Set (51)	0hour OPERATION TIME 999999hour Display (51)	NONE PH 0 0 0 POWER UNIT, DISPLAY, MOTOR, WIRE, BEARINGS, SHAFT, Select (51)	NONE REPLACED PARTS POWER UNIT, DISPLAY, MOTOR, WIRE, BEARINGS, SHAFT, Select (51)	POWER UNIT MH 0 0 0		
INPUT SIGNAL	7	NONE OPE. CONTACT ACTIVATED Select (51)	OFF CUSTODY TRANSFER Display	DISABLED NEW NMS STATUS ENABLED Select (51)			84.24 SOFTWARE VERSION Display	4.00 HARDWARE VERSION Display		1.00 g/mL OPE. DENSITY 0 - 3.000 Set (51)	0 OPE. CONT. STATUS 2 - 256 Display (51)
COMMUNICATION	8	HIGH LEVEL ALARM 1 LOW NONE Select (51)	0.0 mm SET LEVEL ALARM1 Max. 99999.9 mm Select (51)	HIGH LEVEL ALARM 2 LOW NONE Select (51)	0.0 mm SET LEVEL ALARM2 Max. 99999.9 mm Set (51)	0.0 mm HYSTERISYS Max. 99999.9 mm Set (51)	0 ADDRESS 0 - FF for MIC->FF fixed Set (51)	WM550, M/S PROTOCOL BBB, MDP, V1,ENRAF, RACK BUS, HART Select (51)	F COMMU. LINE ADJ. 0 - F Set (51)	0 COMMUNIC. STATUS Display (51)	
STATUS	9	0 s STATUS1 DELAY ~ 99 s Set (51)	NONE SELECT CONTACT NORMAL OPENED NORMAL CLOSED Select (51)								0 s BALANCE DELAY ~ 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	300.00 mm WIRE DRUM CIRC. 0 - 999.9 Set (51)	1.4 g / 10m WIRE WEIGHT 0 - 999.9 Set (51)	255.0 g DISPLACER WEIGHT 0 - 999.9 Set (51)	145.0 mL DISPLACER VOLUME 0 - 999.9 Set (51)	60 mL BALANCE VOLUME 0 - 999.9 Set (51)	1.0 mL VOLUME TOLERANCE 0 - 99.9 Set (51)		20 X 100 mS DELAY 0 - 99 Set (51)	0.00 mm/m DRUM CORRECTION 0 - 99.00 Set (51)	0 count DISPL.HUNT.COUNT 0 - 99 Set (51)
GAUGE DATA	5			OFF NON HYSTER. MOD. ON Select (51)	OFF HI. ACCURACY MOD. ON Select (51)	0 s HI. ACCR. OPE. TIME 0 - 600 Set (51)	50 mm HI. ACC. DISP. UP 0 - 300 Set (51)	Current Data GAUGE TEMP. Display (51)			
SYSTEM DATA	6	LOCAL : MASTER SENSOR DATA REMOTED COM. ON SOFTWARE = 04.20 HARDWARE=TCB04 GEAR 1:36 NOT OVERSPILL	OFF CONNECTION NRF CONTACT 1 CONTACT 2 Select (51)	OFF CONNECTION NMT SPOT TEMP. AVERAGE TEMP. Select (51)							OFF SOFT RESET ON Select (51)
SERVICE	7	0.0 g MEASURED WEIGHT Display	OFF RELE. OVER TENS ON Select (51)	OFF DRUM SETTING ON Select (51)	OFF WEIGHT CALIBR. ON Select (51)					70 mm DISPL. REFERENCE Set (51)	0.0 g ZERO ADJ. WEIGHT Set (51)
SENSOR VALUE	8	Sa=21000:A=21000 Sb=11000:B=11000 Display (51)									
SENSOR DATA	9					0 0 0.0g WT.COUNT CAL A Display (51)	0 0 0..0g 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 °C LIQUD TEMP. Current data Display (51)	zz °C GAS TEMPERATURE Current data Display (51)	aaaa.a mm MEASURED LEVEL Current data Display (51)	VH00 LEV.DATA SELECT VH08 Select (51)				0.0 °C REFERENCE ZERO Current data Display (51)		150.0 °C REFERENCE 150 Current data Display (51)
ELEMENT TEMP.	5	aa.a °C TEMP. NO.1 Current data Display (51)	bb.b °C TEMP. NO.2 Current data Display (51)	cc.c °C TEMP. NO.3 Current data Display (51)	dd.d °C TEMP. NO.4 Current data Display (51)	ee.e °C TEMP. NO.5 Current data Display (51)	ff.f °C TEMP. NO.6 Current data Display (51)	gg.g °C TEMP. NO.7 Current data Display (51)	hh.h °C TEMP. NO.8 Current data Display (51)	hh.h °C TEMP. NO.9 Current data Display (51)	jj.j °C TEMP. NO.10 Current data Display (51)
ELEMENT POSITION	6	xxx.x mm ELEM.1 POSITION Current data Display (51)	xxx.x mm ELEM.2 POSITION Current data Display (51)	xxx.x mm ELEM.3 POSITION Current data Display (51)	xxx.x mm ELEM.4 POSITION Current data Display (51)	xxx.x mm ELEM.5 POSITION Current data Display (51)	xxx.x mm ELEM.6 POSITION Current data Display (51)	xxx.x mm ELEM.7 POSITION Current data Display (51)	xxx.x mm ELEM.8 POSITION Current data Display (51)	xxx.x mm ELEM.9 POSITION Current data Display (51)	xxx.x mm ELEM.10 POSITION Current data Display (51)
NMT ADJUSTMENT	7	0 SELECT POINT 0 - 15 Selectable SELECT POINT + 1 = ELEMENT No. Set (51)	x.x °C ZERO ADJUST Set (51)		xx.x °C ELEMENT TEMP Current data Display (51)	xxx.x mm ELEMENT POSITION Current data Display (51)				2 AVERAGE TIME Set (51)	
SET DATA NMT	8	0 DIAGNOSTIC Display (51)		16 TOTAL NO.ELEMENT 2 - 16 Set (51)	5 PREAMBLE NUMBER 1 - 16 Set (51)		EQUAL KIND OF INTERVAL UNEQUAL Select (51)	500.0 mm BOTTOM POINT 0.0 mm to 500.0 mm valuable Set (51)	2000.0 mm ELEMENT INTERVAL Set (51)	-49.5 °C TEMP.ELEM.SHORT Display (51)	359.0 °C TEMP.ELEM. OPEN Display (51)
DEVICE DATA NMT	9	xxxxxx INSTRUMENT CODE Display (51)	LAST DIAGNOSTIC Display (51)	OUTPUT AT ERROR Select (51)	OFF CUSTODY TRANSFER ON Display (51)	2 POLLING ADDRESS Display (51)	17 MANUFACTURE ID Display (51)	6 SOFTWARE VERSION Display (51)	2 HARDWARE VERSION Display (51)		183 DEVICE TYPE CODE 181 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 Display (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	SOFTWARE VERSION Display	HARDWARE VERSIION Display	DEVICE ID Display		

NMS53x Programming Matrix (Dynamic Matrix, HART DEVICE (2): G6)

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 (2) ON GAS TEMPERATURE Select (51)
P.V.SETTING	5	P.V.RANGE UNIT Display (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	SOFTWARE VERSION Display	HARDWARE 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										
HART ERROR RATE	5										
UNIT	6										
HART LINE	7	TERMINAL PORT B NMT TERMINAL PORT A Select (777)	TERMINAL PORT B HART DEVICE (1) TERMINAL PORT A Select (777)	TERMINAL PORT B HART DEVICE (2) TERMINAL PORT A Select (777)							
INTERFACE ADJUST	8	0.3 mL VOL.TOL.FOR I/F 0 - 99.9 mL Set (51)	150 BRAKE RATE 0 - 255 Set (51)	15 BALANCE COUNT 0 - 255 Set (51)	0.0 mm IF1 OFFSET 0 - 9999.9 mm Set (51)	0.0 mm IF2 OFFSET 0 - 9999.9 mm Set (51)					
NONE	9										

9.7 Description of the Programming Matrix

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
STATIC MATRIX (This word is not shown)	MEASURED VALUE 1	MEASURED LEVEL	0	Measured innage level = Tank Height-ULLAGE LEVEL The innage level is calibrated to the manual dipping level at position GVH=150 (SET LEVEL). The LCD shows the displacer position during HOIST, density and interface measurement, and calibration	16000.0 mm	Display	0.0 ... 99999.9 mm	000
		ULLAGE LEVEL	0	Measured ullage level = distance from the Proservo to the liquid surface - DIP POINT OFFSET. The LCD shows the displacer position during HOIST, density and interface measurement, and calibration.	0.0 mm	Display	0.0 ... 99999.9 mm	001
		UPPER INTERF. LEV	0	Measured interface level between two liquids. If liquid layers exists, then this position shows the upper interface level.	0.0 mm	Display	0.0 ... 99999.9 mm	002
		MIDD. INTERF. LEV	0	If three liquids exist, then this position shows the middle (=lower) interface level.	0.0 mm	Display	0.0 ... 99999.9 mm	003
		BOTTOM LEVEL	0	Measured tank bottom or bottom sludge level.	0.0 mm	Display	0.0 ... 99999.9 mm	004
		UPPER DENSITY	50	Measured or set density for upper liquid layer. Manual setting is possible, but the set value will be overwritten after density measurement.	1.000 g/ml	Display/ Set	0.000 ... 3.000 g/ml	005
		MIDDLE DENSITY	50	Measured or set density for middle liquid layer. Manual setting is possible, but the set value will be overwritten after density measurement.	1.000 g/ml	Display/ Set	0.000 ... 3.000 g/ml	006
		DENSITY BOTTOM	50	Measured or set density for bottom liquid layer. Manual setting is possible, but the set value will be overwritten after density measurement.	1.000 g/ml	Display/ Set	0.000 ... 3.000 g/ml	007
		LEVEL DATA	0	Same as MEASURED LEVEL however, the last measured value is held during HOIST, density and interface measurement, and calibration.	16000.0 mm	Display	0.000 ... 3.000 g/ml	008
		STATUS1	0	If a device with status output is connected like oil detector unit, STATUS1 ON or OFF as alarm signal. For configuration, please refer dynamic matrix GVH=290, 291.	OFF	Display	OFF / ON	009

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
STATIC MATRIX (This word is not shown)	MEASURED VALUE 2	LIQUID TEMP.	0	If a temperature bulb is connected, then this position shows the measured liquid temperature. Otherwise the LCD will be blank.	0.0 °C	Display	-49.9 ... 249.9 °C	010
		(Primary Variable Data)	0	Display of the most important variable displayed on or measured by the connected HART device.		Display	0.0 ... 99999.9 mm	011
		(Secondary Variable Data		Display of the secondary important variable displayed on or measured by the connected HART device.		Display	0.0 ... 99999.9 mm	012
		GAS TEMPERATURE	0	If a temperature bulb is connected, then this position shows the measured gas temperature.	0.o °C	Display	-49.9 ... 249.9 °C	013
		ZERO POINT	0	Zero point for COMMUWIN II bar graph.	0.0 mm	Display	0.0 ... 99999.9 mm	017
		SPAN	0	Span for COMMUWIN II bar graph.	16000.0 mm	Display	0.0 ... 99999.9 mm	018
		LENGTH UNIT	0	Span for COMMUWIN II bar graph.		Display	mml	019
	OPERATION	OPERATION (from optical key)	50	Operation of the displacer. Selection of measuring functions. The position of the displacer is shown on the LCD.	STOP	Display	LEVEL UP STOP	020

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
STATIC MATRIX (This word is not shown)	OPERATION	OPERATING STATUS	0	Displacer operation mode or position status of the Proservo. For new operation status please refer matrix position GVH=272 and Appendix.	STOP	Display	REFERENCE UP DOWN STOP LEVEL BOTTOM LEVEL UPPER INTERF.LEV* MIDD INTERF.LEV* UPPER DENSITY* MIDDLE DENSITY* DENSITY BOTTOM* RELE.OVER TENS WEIGHT CALIBR.	021
		BALANCE STATUS	0	Balancing status of the displacer. When the displacer catches a product level or interface level, the LCD will show BALANCED.	UNBALANCED	Display	BALANCED UNBALANCED	022
		OPERAT. BY NRF	0	Displacer operation from the Promonitor NRF560.	LEVEL	Display	LEVEL UP STOP BOTTOM LEVEL UPPER INTERF. LEV MIDD.INTERF.LEV UPPER DENSITY MIDDLE DENSITY DENSITY BOTTOM REPEATABILITY WATER DIP	024

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
STATIC MATRIX (This word is not shown)	OPERATION	OPERAT. BY HOST	0	Displacer operation from a host system i.e. NXS310, NR30(MDP-II), NRS, NRM, COMMUWIN II, FuelsManager, etc.	LEVEL	Display	LEVEL UP STOP BOTTOM LEVEL UPPER INTERF. LEV MIDD.INTERF.LEV UPPER DENSITY MIDDLE DENSITY DENSITY BOTTOM REPEATABILITY WATER DIP	025
		DEVICE ID	0	Displays a device ID	411	Display		028
		SOFTWARE ID	0	Displays a software ID	8424	Display		029
	MORE FUNCTION	MATRIX OF	0	Selection of the dynamic matrix of the programming matrix	CALIBRATION	Select	CALIBRATION DEVICE DATA SERVICE TEMPERATURE HART DEVICE (1) HART DEVICE (2) ADJ. SENSOR	030
		(Calendar)	0	Calendar and clock without daylight saving system. NOT TRANSFERRED BY RACKBUS.	Japanese local time	Display	e.g. 1 410 19:10:41 Year Month Day HH:MM:SS	033
		ALARM CONTACT	0	Alarm message display, depending on current conditions.		Display	Alam message	034
		(Alarm Message)	0	Previous alarm with message. Only the last alarm code is transmitted by Rackbus.		Display	Alarm message (refer to attached table)	035
		DIAGNOSTIC CO	0	Self diagnosis at the moment		Display	Error message (refer to attached table)	036

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
STATIC MATRIX (This word is not shown)	MORE FUNCTION	(Erroneous Message)	0	Previous alarm with message. Only the last alarm code is transmitted by Rackbus.	(Erroneous Date)	Display	Error message (refer to attached table)	037
		ACCESS CODE	0	Access code for programming (see Sec. 10.4)	0	Set	0 ... 9999	039
CALIBRATION	LEVEL DATA	TANK HEIGHT	50	Elevation level of the manual dipping reference. This level is normally considered as tank height or dip point reference.	16000.0 mm	Set	0 ... 99999.9 mm	140
		DIP POINT OFFSET	50	Deference between elevation of the reference line of the Proservo NMS5/7 and dipping reference (TANK HEIGHT).	0.0 mm	Set	-99999.9 ... 99999.9 mm	141
		DISPLACER DRAUGHT	50	Draught of the displacer. This value is used for calibration of the Proservo NMS5/7, when the tank is empty.	10.0 mm	Set	0.0 ... 999.9 mm	142
		DISPL. RAIS DENS	51	Value of the displacer hoisted from surface or interface when density measurement is activated.	150 mm..	Set	0 ... 300 mm	143
		DISPL. SUBM DENS.		Value for the displacer lowered from surface or interface when density measurement is activated.	150 mm..	Set	0 ... 1500 mm	144
	CALIBRATION	SET LEVEL	50	Calibration or setting of level data. Level indication can be set to manual dipping or other data in this mode. The dip point offset will be changed according to the set here.	16000.0 mm	Set	0.0 ... 99999.9 mm	150
		TANK CORRECT LEV	51	Start level for tank roof compensation by level. This compensation is required in case of tank roof distortion due to hydrostatic pressure on the tank wall.	0.0 mm	Set	0.0 ... 99999.9 mm	152
		TANK CORRE. COEF	51	Linear coefficient for tank roof compensation by level.	0.000 mm7m	Set	0.000 ... 59.999 mm/m	153
	ADJUSTMENT	UPPER STOP	50	Upper limit of displacer motion.	16000 mm	Set	0 ... 99999 mm	160
		LOWER STOP	50	Lower limit of displacer motion.	0 mm	Set	0 ... 99999 mm	161
		SET OVER TENS.	51	Over tension value of the measuring wire. If the tension exceeds this value, then the Proservo stops operation, and an error message will be displayed.	350 g	Set	0 ... 999 g	162

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
CALIBRATION	ADJUSTMENT	SET UNDER TENS.	51	Under tension value of the measuring wire. If the tension falls below this value, then the Proservo stops operation, and an error message will be displayed.	50 g	Set	0 ... 999 g	163
		SLOW HOIST	51	Slow speed hoisting of the displacer to avoid the displacer hitting the opening of the mounting nozzle. If the size of the nozzle is less than or equal to 3" then set the value grater than the length of the nozzle +60 mm.	60 mm	Set	60 ... 1800 mm	164
		DISPL. RAIS. REP.	51	Set a hoist distance for displacer under repeatability testing.	10 mm	Set	10 ... 99 mm	165
		DISPL. WAIT REP.	51	Set a waiting time for displacer movement after hoist up under repeatability testing.	10 s	Set	10 ... 999 s	166
		DISPL. WAIT DIP.	51	Set a waiting time for displacer movement back to level measurement under water dipping function.	10 s	Set	10 ... 999 s	167
	AUTO WIRE CALIB.	CALIBR. AUTO/MAN.	51	Wire length calibration. When MANUAL is selected, the Proservo hoists the wire in the drum housing, and then measures the liquid surface again. By AUTO, the Proservo hoists the wire in accordance with set START TIME and INTERVAL TIME.	NONE	Set	NONE MANUAL AUTOMATIC	170
		START TIME	51	Start time of wire calibration when AUTO mode is selected.		Set	e.g. 12 31 23 month date time (hour)	171
		INTERVAL TIME	51	Interval of wire calibration when AUTO mode as selected.	0 hour	Select	0 ... 9999 hour	172
		AUTO COMPENSAT.	51	Automatic compensation of length data.	OFF	Display	OFF ON	173
		ZERO CORRECTION	51	Zero correction of length when the wire is hoisting from the liquid.	0.0 mm	Display	0 ... 99999.9 mm	174
		COMPENS. LIMIT	51	Allowable deviation of level after level calibration. If the deviation exceeds the set value, then an alarm will be emitted.	0.0 mm	Set	0.0 ... 99999.9 mm	175

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
CALIBRATION	AUTO CALIB. DISPL.	CALIBR. AUTO/MAN.	51	Displacer weight calibration. When MANUAL is selected, the Proservo hoists the displacer in the gas phase, once checks its weight, and then measures the liquid surface again. By AUTO, the Proservo hoists the displacer in accordance with set START TIME and INTERVAL TIME.	NONE	Set	NONE MANUAL AUTOMATIC	180
		START TIME	51	Start time of weight calibration when AUTO mode is selected.		Set	e.g. 12 31 23 month date time (hour)	181
		INTERVAL TIME	51	Interval of weight calibration when AUTO mode as selected.	0 hour	Select	0 ... 9999 hour	182
		AUTO COMPENSAT.	51	Automatic compensation of weight data.	OFF	Display	OFF ON	183
		DEVIATION	51	Deviation of weight when the displacer is hoisting from the liquid.	0.0 g	Display	0.0 ... 99.9 g	184
		COMPENS. LIMIT	51	Allowable deviation of weight after weight calibration. If "CAUTION" has been selected on GVH=241, and the deviation exceeds the set value and alarm will be emitted.	0.0 g	Set	0.0 99.9 g	185
	DISPLAY Note! - The default values of calendar and clock refer to Japanese local time. - A daylight saving function is not available	SELECT DISP. MODE	51	Selection of level display at HOME position: innage or ullage.	MEASURED LEVEL	Select	MEASURED LEVEL ULLAGE LEVEL	190
		LANGUAGE	51	Language that all text is to be displayed in.	ENGLISH	Select	ENGLISH JAPANESE (with original characters)	191
		LCD CONTRAST	51	The display contrast in 16 phases.	12th Phase	Set	Adjust brightnesswith the "+" or "-" keys	192
		YEAR SETTING	51	Calendar year.	Current year	Set	0 ...99	193
		MONTH SETTING	51	Calendar month.	Current month	Set	1 ... 12	194
		DAY SETTING	51	calendar day.	Current day	Set	0 ... 31	195
		HOUR SETTING	51	Hour	Current hour	Set	0 ... 23	196
		MINUTE SETTING	51	Minute. Clock starts from 0 s when minute is set.	Current minute	Set	0 ... 59	197

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
CALIBRATION	DISPLAY	SELECT DECIMAL	51	Selection of decimal point indication by dot or comma.	[.]	Select	[.] [,]	198
		LCD CHECK	51	The condition of the LCD's display section is checked. If the display is in good condition, the whole screen will darken for 3 second when "ON" is selected; and it will lighten for the same period of time when "OFF" is selected.	OFF	Select	OFF ON	199
DEVICE DATA	CONTACT OUTPUT Note! - The whole matrix is available when relay output is installed.	SELECT. RELAY	50	Selection of output relay.	1	Select	1 ... 4 (standard)	240
		ASSIGN RELAY	50	Selection of relay contact define by SELECT.RELAY. The contacts will be activated corresponding to the selected mode.	NONE	Select	NONE LEVEL LIQUID TEMP. CAUTION WARNING EMERGENCY ERROR BALANCE SIGNAL	241
		RELAY FUNCTION	50	Selection of an alarm message concerning the specified alarm/error output relay. Selected only when "LEVEL" or "LIQUID TEMP." is selected on matrix GVH0241.	HIGH	Select	HIGH LOW	242
		SWITCHING POINT	50	Selection of the alarm activation level of the specified alarm/error output relay. Selectable only when "LEVEL" or "LIQUID TEMP." is selected on matrix GVH=241.	0 mm	Set	0 ... 99999 mm -999 ... 999 °C	243
		HYSTERESIS	50	Set the hysteresis value at which the alarm of the selected alarm/error output relay is deactivated. Can be set only when "LEVEL" or "LIQUID TEMP." is selected on matrix GVH=241.	0 mm	Set	0 ... 99999 mm -999 ... 999 °C	244
		RELAY ON ALARM	50	Selection of the output action of the specified alarm/error output relay. Selectable only when "LEVEL" or "LIQUID TEMP." is selected on matrix GVH=241. NOTE: Turning off the power does not affect the alarm/error output contact point.	NORMAL OPENED	Select	NORMAL OPENED NORMAL CLOSED	245

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
DEVICE DATA	CONTACT OUTPUT	ON DELAY TIME	50	Set the alarm output start delay for the selected alarm/error output relay is deactivated. Can be set only when "LEVEL" or "LIQUID TEMP." is selected on matrix GVH=241.	0 s	Set	0 ... 999s	246
		OFF DELAY TIME	50	Set the alarm output stop delay for the selected alarm/error output relay is deactivated. Can be set only when "LEVEL" or "LIQUID TEMP." is selected on matrix GVH=241.	0 s	Set	0 ... 999s	247
	ANALOG OUT. ADJUS Note! - The whole matrix is available when analogue output is installed.	ASSIGN OUTPUT 1	50	Assignment of analogue output channel 1.	NONE	Select	NONE MANUAL AUTOMATIC	250
		ADJUST 4 mA	50	Sets output channel 1 (DC 4 - 20mA) to transmit a DC 4 mA current. Ban be set only when "LEVEL" or "LIQUID TEMP." is selected at matrix position GVH=250	0 mm	Set	0 ... 99999 mm -999 ... 999 °C	251
		ADJUST 20 mA	50	Sets output channel 1 (DC 4 - 20mA) to transmit a DC 20 mA current. Ban be set only when "LEVEL" or "LIQUID TEMP." is selected at matrix position GVH=250	0 mm	Set	0 ... 99999 mm -999 ... 999 °C	252
		ASSIGN OUTPUT 2	50	Assignment of analogue output channel 2.	NONE	Select	NONE MANUAL AUTOMATIC	253
		ADJUST 4 mA	50	Sets output channel 2 (DC 4 - 20mA) to transmit a DC 4 mA current. Ban be set only when "LEVEL" or "LIQUID TEMP." is selected at matrix position GVH=250	0 mm	Set	0 ... 99999 mm -999 ... 999 °C	254
		ADJUST 20 mA	50	Sets output channel 2 (DC 4 - 20mA) to transmit a DC 20 mA current. Ban be set only when "LEVEL" or "LIQUID TEMP." is selected at matrix position GVH=250	0 mm	Set	0 ... 99999 mm -999 ... 999 °C	255
		DEVICE AT ALARM	50	An error causes output channels 1 and 2 (DC 4-20mA) to transmit the preset current(s). HOLD: the output channels continue transmitting the current the were transmitting before the error. MAX: The output channels switch to transmit a 20mA current. MIN: The output channels switch to transmit 4mA current.	OFF	Select	OFF HOLD CURRENT PUT MAX MIN	256
	PARTS DATA	PARTS NUMBER	51	Sets the number of the control-target parts.	1	Select	1 ... 10	260

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
DEVICE DATA	PARTS DATA	TYPE OF PARTS	51	Parts unit corresponding to the selected parts number.	NONE	Select	NONE POWER UNIT DISPLAY UNIT MOTER UNIT WIRE UNIT BEARINGS UNIT SHAFT UNIT	261
		MAINTEN. FACTOR	51	Determines whether the control target parts are based on time or on the number of revolution of the wire drum.	OPERATIN HOUR	Set	OPERATION HOUR REVOLUTION DRUM	262
		MAINTEN. VALUE	51	Set a control reference operation time, or number of wire drum revolutions, depending on your selection at matrix position GVH=262.	o hour or o round	Set	0 ... 99999 hour 0 ... 99999 round	263
		OPERATION TIME	51	Displays the accumulated operation time of the parts selected as control targets of the accumulated number of wire drum revolutions. NOTE: When control target parts are replaced, be sure to reset the hours or revolutions display to 0.	o hour or o round	Display	0 ... 99999 hour 0 ... 99999 round	264
		(Parts Overused Date)	51	Shows when the control reference hours or revolutions you have set on matrix GVH=263 were reached. The display is in years, months, days, hours, and minutes.		Display	Parts unit YY MM DD TT MM	265
		REPLACEDPARTS	51	Parts replacement. Select the replaced parts unit and touch "E" key.	NONE	Select/ Set	NONE POWER UNIT DISPLAY UNIT MOTER UNIT WIRE UNIT BEARINGS UNIT SHAFT UNIT	266
		(Parts Replaced Date)	51	Maintenance history. Display the date and time when the selected parts unit was registered by REPLACED PARTS. The parts unit can be scrolled by the "+" and "-" keys.	NONE	Display	Parts unit YY MM DD TT MM	267

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
DEVICE DATA	INPUT SIGNAL	OPE. CONTACT This is an optional function, and is not available unless the contact input unit is connected.	51	Displacer operation by contact input. If ON is selected, then the operation will be as follows: Contact Operation 1 off, 2 off LEVEL 1 on, 2 off UP 1 off, 2 on STOP 1 on, 2 on INTERFACE	OFF	Select	ONN ON (2 contacts)	270
		CUSTODY TRANSFER	0	Shows whether the custody transfer mode, which does not allow any internal data to change one the apparatus is selected after customs duties have been paid, is active (regarding custody transfer, refer to Appendix D). Use this function when the apparatus is mounted to a tank with custody transfer feature. In addition, "ON" will be displayed if a switch in in a sealed mode.	OFF	Display	OFF (Non custody transfer mode) ON (Custody transfer mode)	271
		SOFTWARE VERSION	0	Software version of the Proservo NMS5/7	4.24	Display		275
		HARDWARE VERSION	0	Hardware version of the Proservo NMS5/7	4.11	Display		276
		OPE. DENSITY	51	This is a function conforming to PTB and NMi specifications that is used to set the liquid density setting for computing buoyancy from a given balance volume in custody transfer mode. (See Appendix C.) Ulterior level measurements do not after the value you specify here.	1.0 g/ml	Set	0.0 ... 3.0 g/ml	278
		OPE. CONT. STATUS	51	Displays the terminal numbers in use (binary data conversed to their decimal equivalents). NOTE: This is an optional function, and is not available unless the contact input unit is connected.	0	Set	0 ... 255	279
	COMMUNICATION	LEVEL ALARM 1	51	Select an upper/lower limit on innage level relative to the setting of ALARM 1 for bi-directional two-wire communications.	HIGH	Select	NONE HIGH LOW	280

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
DEVICE DATA	COMMUNICATION	SET LEVEL ALARM 1	51	Sets either the upper or the lower alarm activation level, as specified on matrix GVH=280.	0.0 mm	Set	0.0 ... 99999.9 mm	281
		LEVEL ALARM 2	51	Select an upper/lower limit on innage level relative to the setting of ALARM 2 for bi-directional two-wire communications.	HIGH	Select	NONE HIGH LOW	282
		SET LEVEL ALARM 2	51	Sets either the upper or the lower alarm activation level, as specified on matrix GVH=280.	0.0 mm	Set	0.0 ... 99999.9 mm	283
		HYSTERESIS	51	Sets a hysteresis for the alarm setting for bi-directional two-wire communications. Hysteresis here refers to the difference between the level at which the alarm is deactivated and the specified upper/lower limit. The alarm is deactivated when the liquid surface nears its normal height, the rising or lowering volume exceeding that difference.	0.0 mm	Set	0.0 ... 99999.9 mm	284
		ADDRESS	51	Sets an address for remote communication. A number for bi-directional two-wire communications is also specified here.	0	Set	0 - 9 A - F (for MIC: FF fixed) Total 16 addressed can be set.	285
		PROTOCOL	51	Selection of communication protocols.	WM550 / MS	Select	WM550 / MS BBB (MIC) MDP V1 / BPM RACKBUS (RS485) HART	286
		COMMU. LINE ADJ.	51	Line resistance for serial pulse output (Sakura protocol).	F	Set	0 - 9 A - F (for MIC: FF fixed) Total 16 addressed can be set.	287
		COMMUNIC. STATUS	51	Display of the communication status of the digital output.	0	Display		288
	STATUS	STATUS1 DELAY	51	Set a detay time for status 1 input.	0 S	Set	0 ... 99 s	290

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
DEVICE DATA	STATUS	SELECT CONTACT	51	Select a contact tape as follows: - NONE - NORMAL OPENED - NORMAL CLOSED	NONE	Select	NONE NORMAL OPENED NORMAL CLOSED	291
		BALANCE DELAY	51	Set a delay time for balance status according to the matrix position GVH=241.	0 S	Set	0 ... 99 s	299
SERVICE	MEAS. WIRE & DRUM	WIRE DRUM CIRC.	51	Circumference of the wire drum. Set the data marked on the wire drum.	300.00 mm	Set	0.00 ... 599.99 mm	340
		WIRE WEIGHT	51	Measuring wire weight per 10 m wire. - Stainless steel SUS316: 1.4 g / 10 m - PTFE coated wire: 4.55 g / 10 m - Hasteloy C wire : 2.48 g / 10 m	1.4 g / 10 m	Set	0.00 ... 99.99 g / 10 m	341
		DISPLACER WEIGHT	51	Displacer weight. Set the value marked on the displacer.	255.0 g	Set	0.0 ... 999.9 g	342
		DISPLACER VOLUME	51	Displacer volume. Set the value marked on the displacer.	145.0 ml	Set	0.0 ... 999.9 ml	343
		BALANCE VOLUME	51	Volume submerged in the liquid. For interface measurement, this is the volume submerged in the lower liquid. Set the value marked on the displacer.	60 ml	Set	0.0 ... 999.9 ml	344
		VOLUME TOLERANCE	51	Set the valid tolerance volume when the displacer is in a balanced state. This setting specifies the immunity of the displacer to level variation, beyond which the displacer will start moving and abandon ist balancing position. - Displacer less the 70 ml in diameter: 1.0 ml - Displacer less the 110 ml in diameter: 5.0 ml	1.0 ml	Set	0.0 ... 99.9 ml	345
		DELAY	51	Set the interval before the displacer responds to a liquid level variation that exceeds the preset VOLUME TOLERANCE. To prevent the displacer from responding to a momentary disturbance in the liquid's surface, the Proservo understands that the displacer returns to temporary balancing condition only after a certain time has passed.	5 x 100 ms	Set	0 ... 99 x 100 ms	347

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
SERVICE	MEAS. WIRE & DRUM	DRUM CORRECTION	51	Set the correction value to compensate for possible errors during one revolution of the wire drum. When drum circumference value has been input, drum correction is not required.	0.00 mm/m	Set	0.00 ... 99.99 mm/m	348
		HUNTING COUNT	51	Defines the number of huntings when the displacer touches the solid surfaces. If the set value is greater than or equal to 1, then the displacer moving speed slows down when the huntings exceeds the set count.	0 count	Set	9 ... 999 count	349
	GAUGE DATA	NON-HYSTER. MODE	51	Non-hysteresis measuring mode. If On is selected, then the Proservo will raise the displacer approx. 2 mm from the liquid surface after balancing and measure slowly downward. This mode allows measurement without hysteresis.	OFF	Select	OFF ON	352
		HI. ACCURACY MODE	51	Hi accuracy measurement. This is carried out in two phases, namely temporary and precise balance on the liquid surface. The Proservo hoists the displacer when it registers the temporary balance and weighs it. The displacer comes down slowly afterwards and registers the precise balance.	OFF	Select	OFF ON	353
		HI. ACCR-OPE.TIME	51	If the high accuracy measurement mode is activated, and the liquid surface ripples, the displacer goes into a temporary balanced state. Thereafter, the displacer is hoisted once to measure ist weight again. You can here specify the delay between when the displacer goes into its temporary balanced state and when it is weighed.	0 s	Set	0 ... 600 s	354
		HI.ACC.DISP.UP	51	Sets the height to which the displacer is hoisted to measure ist weight after the interval specified on matrix GVH=354 has passed.	0 mm	Set	0 ... 300 mm	355
		GAUGE TEMP.	51	Temperature in the Proservo	Current data	Display	-999 ... 999 °C	356

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
SERVICE	SYSTEM DATA	SENSOR DATA	51	The Proservo specification.		Display	SOFTWARE VERSION HARDWARE VERSION REMOTE COM. ON REMOTE COM. OFF GEAR 1:36 NOT OVERSPILL	360
		CONNECTION NRF	51	Connection of the Promonitor NRF560.	OFF	Select	OFF CONTACT 1 (connected to old type) CONTACT 2 (connected to new type)	361
		CONNECTION NMT	51	Connection of the Prothermo NMT53x series.	OFF	Select	OFF SPOT (three wire RTD input) Average (NMT535/6/7)	362
		SOFT RESET	51	Restart the Proservo software. If ON is selected then the software will start from the beginning as soon as power supply is switched on.	OFF	Select	OFF ON	369
	SERVICE	MEASURED WEIGHT	51	Measured displacer weight by the Proservo. NOTE: Before weight calibration measured weight shows 0.0 g.		Display	0.0 ... 999 g	370
		RELE. OVER TENS.	51	Release of overtension error from the displacer. If ON is selected, then the displacer will slowly till overtension error is cancelled. * Set OPERATION = STOP first.	OFF	Select	OFF ON	371
		DRUM SETTING	51	Adjustment of the internal unit of the Proservo and the wire drum.	OFF	Select	OFF ON	372
		WEIGHT CALIBR.	51	Calibration of weight data for the initialization of the Proservo. If ON is selected, then follow the instructions on the LCD display.	OFF	select	OFF ON	373
		DISPL. REFERENCE	51	Length for the starting position of weight calibration. The displacer will stop at this position without regard to the high stop level when it is hoisted, if the high stop level is set higher than this point.	70 mm	Set	10 ... 999 mm	378

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
SERVICE	SERVICE	ZERO ADJ. WEIGHT	51	Low weight for weight calibration.	0.0 g	set	0.0 ... 999.9 g	379
	SENSOR VALUE	Sa = : A= Sb = : B=	51	Displays the weight under measurement in "count" units. Sa and Sb correspond to the two current Hall sensors. The average "count" value over a certain period of time is displayed to the right of A and B.	A=21000 B=11000	Display	0 ... 32767 count	380
	SENSOR DATA	WT. COUNT CAL. A	51	Hall element A/D count and weight for correction of wire drum revolution by Hall element a. The weight table position can be scrolled by the "+" and "-" keys.	0.0 g	Display	0 ... 32767 count	394
		WT. COUNT CAL. B	51	Hall element A/D count and weight for correction of wire drum revolution by Hall element b. The weight table position can be scrolled by the "+" and "-" keys.	0.0 g	Display	0 ... 32767 count	395
TEMPERATURE Note! The whole matrix is available when NMT is connected and SPOT or AVERAGE temperature element is selected.	TEMPERATURE DATA	LIQUID TEMP.	51	Current average liquid temperature.		Display	-49.9 ... 249.9 °C	440
		GAS TEMPERATURE	51	Current average gas temperature.		Display	-49.9 ... 249.9 °C	441
		MEASURED LEVEL	51	Level from the Proservo. The level data are used for the averaging of liquid and gas temperatures.		Display	0.0 ... 99999 mm	442
		LEV. DATA SELECT	51	Possible to select a measured level data from matrix pos. GVH=000 (displacer position), or GVH=008 (level data after balanced).	VH00	Select	VH00 VH08	443
		REFERENCE ZERO	51	Display of reference resistance on printed circuit board that corresponds to 0 °C.	0.0 °C	Display		447
		REFERENCE 150	51	Display of reference resistance on printed circuit board that corresponds to 150 °C.	150.0 °C	Display		449
	ELEMENT TEMP.	TEMP NO. 1	51	Temperature of element No. 1 (deepest point)		Display	-49.9 ... 249.9 °C	450
		TEMP NO. 2	51	Temperature of element No. 2		Display	-49.9 ... 249.9 °C	451
		TEMP NO. 3	51	Temperature of element No. 3		Display	-49.9 ... 249.9 °C	452

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
TEMPERATURE Note! The whole matrix is available when NMT is connected and SPOT or AVERAGE temperature element is selected.	ELEMENT TEMP. Note! For elements with numbers beyond the value set at GVH=482, the LCD will show 358.0 °C	TEMP NO. 4	51	Temperature of element No. 4		Display	-49.9 ... 249.9 °C	453
		TEMP NO. 5	51	Temperature of element No. 5		Display	-49.9 ... 249.9 °C	454
		TEMP NO. 6	51	Temperature of element No. 6		Display	-49.9 ... 249.9 °C	455
		TEMP NO. 7	51	Temperature of element No. 7		Display	-49.9 ... 249.9 °C	456
		TEMP NO. 8	51	Temperature of element No. 8		Display	-49.9 ... 249.9 °C	457
		TEMP NO. 9	51	Temperature of element No. 9		Display	-49.9 ... 249.9 °C	458
		TEMP NO. 10	51	Temperature of element No. 10		Display	-49.9 ... 249.9 °C	459
	ELEMENT POSITION Note! The LCD shows the element position measured from the tank bottom (for previously set elements only).	ELEM. 1 POSITION	51	Position of temperature element No. 1 (deepest point), namely Bottom Element.		Display	0 ... 99999 mm	460
		ELEM. 2 POSITON	51	Position of temperature element No.2		Display	0 ... 99999 mm	461
		ELEM. 3 POSITON	51	Position of temperature element No.3		Display	0 ... 99999 mm	462
		ELEM. 4 POSITON	51	Position of temperature element No.4		Display	0 ... 99999 mm	463
		ELEM. 5 POSITON	51	Position of temperature element No.5		Display	0 ... 99999 mm	464
		ELEM. 6 POSITON	51	Position of temperature element No.6		Display	0 ... 99999 mm	465
		ELEM. 7 POSITON	51	Position of temperature element No.7		Display	0 ... 99999 mm	466
		ELEM. 8 POSITON	51	Position of temperature element No.8		Display	0 ... 99999 mm	467

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
TEMPERATURE Note! The whole matrix is available when NMT is connected and SPOT or AVERAGE temperature element is selected.	ELEMENT POSITION	ELEM. 9 POSITON	51	Position of temperature element No.9		Display	0 ... 99999 mm	468
		ELEM. 10 POSITION	51	Position of temperature element No.10		Display	0 ... 99999 mm	469
	NMT ADJUSTMENT	SELECT POINT	51	Element number selection for reading element temperature and position from element No. 11 to No. 16.		Display	0 (element No.1) 10 (element No.11)	470
		ZERO ADJUSTMENT	51	Zero adjustment		Set	-20.0 ... 20.0 °C	471
		ELEMENT TEMP.	51	Element temperature selected at "SELECT POINT"		Display	-49.9 ... 249.9 °C	473
		ELEMENT POSITION	51	Element position selected at "SELECT POINT"		Display	0 ... 99999 mm	474
		AVERAGING	51	Sampling coefficient for averaging of data. If there is a high degree of instability due to noise or other factors, increase ist value.	2	Set	1 ... 10	478
	NMT SET DATA	DIAGNOSTIC CODE	51	Display of current diagnostic code.	0	Display	0 ... 255	480
		TOTAL NO. ELEMENT	51	The total number of elements that are mounted in the flexible tube. This number is determined in accordance with the specifications provided when the order of the device is placed.		Set	a ... A HEX	482
		PREAMBLE NUMBER	51	Display of preambles for HART® protocol.	5	Display	2 ... 14 HEX	483
		KIND OF INTERVAL	51	Temperature element intervals. - Equal intervals: 0 - Unequal intervals: 1 If 1 is chosen, then set the element position on matrix from GVH=460 to GVH=469.		Set	0 or 1	485
		BOTTOM POINT	51	Height of bottom point. Only available when equal intervals are selected.		Set	0.0 ... 99999.9 mm	486
		ELEMENT INTERVAL	51	Interval between temperature elements. Only available when equal intervals are selected.		Set	0.0 99999.9 mm	487

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
TEMPERATURE Note! The whole matrix is available when NMT is connected and SPOT or AVERAGE temperature element is selected.	NMT SET DATA	TEM. AT SHORT ELE.	51	Temperature indication when element is shorted. This value is sent to the Proservo only when the error output is "ON" at GVH=492. When the error output is "OFF", the average temperature is sent to the Proservo.	-49.5 °C	Set		488
		TEM. AT OPEN ELE.	51	Temperature indication when element is opened. This value is sent to the Proservo only when the error output is "ON" at GVH=492. When the error output is "OFF", the average temperature is sent to the Proservo.	359.0 °C	Set		489
	NMT DEVICE DATA	INSTRUMENT CODE	51	Display of the hardware unit number		Display		490
		LAST DIAGNOSTIC	51	Display of the last error message. If there was no error, then the LCD will be blank.		Display		491
		OUTPUT AT ERROR	51	Selection of output and indication in case of short circuit or open circuit elements at GVH=488 or 498	1	Sdelect	0: OFF 1: ON	492
		CUSODY TRANSFER	51	Custody transfer mode. If this mode is switched on, then the LCD will show on.	OFF	Sdelect	OFF ON	493
		POLLING ADDRESS	51	Assignment of an address to Prothermo NMT535/6/8 when this and other HART® devices are multi-dropped on the HART® communication line. Polling address 2 is fixed by Proservo firmware.	2	Set	1 ... F (Total 16 address can be set.)	494
		MANUFACTURER ID	51	Identification number of the manufacturer (17 for Endress+Hauser).	17	Display		495
		SOFTWARE VERSION	51	Software version of the Prothermo NMT535/6/8.	5.0	Display	4.0 or higher	496
		HARDWARE VERSION	51	Hardware version of the Prothermo NMT535/6/8.	1.4	Display	1.4 or higher	497
		DEVICE TYPE CODE	51	Display of the device type code (181 for the Prothermo NMT535/6/8).	181	Display		499

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
HART DEVICE (1) (2) Note! This matrix can be used for reading of HART DEVICE (1) (2) data connected to the Proservo.	MEASURED VALUE	(Primary Variable Data)	0	Display of primary variable of the HART device (e.g. pressure sensor) connected to the Proservo with measuring unit.		Display		540 / 640
		(Secondary Variable Data)	0	Display of second HART device connection. If ON is selected, the HART device matrix will be available.				541 / 641
		HART DEVICE (1) (2)	51	Selection of HART device connection. - ON - LIQUID TEMP. - GAS TEMPERATURE (for HART device (1) only - OFF When LIQUID TEMP. Is selected, measured temperature data is reflecting to matrix position GVH=010. When GAS TEMPERATURE is selected, measured data is reflecting to matrix position GVH=013	OFF	Select	OFF LIQUID TEMP. GAS TEMPERATURE ON	549 / 649
	P. V. SETTING	P. V. RANGE UNIT	51	Setting of range unit for primary variable in HART command code.		Set		550 / 650
		P. V. UPPER RANGE	51	Setting of upper range of primary variable.		Set		551 / 651
		P. V. LOWER RANGE	51	Setting of lower range of primary variable.		Set		552 / 652
		DAMP VALUE	51	Setting of damping value for primary variable.		Set		553 / 653
	SENSOR SPECIFIC	SENSOR SERIAL NO.		Display of serial number of the HART device.		Display		560 / 660
		UPPER SENSOR LIMIT	0	Display of upper limit of the HART device.		Display		561 / 661
		LOWER SENSOR LIMIT	0	Display of lower limit of the HART device.		Display		562 / 662
	SELF DIAGNOSIS	ERROR CODE (1)		Display of the error code (1) of the HART device.		Display		580 / 680
		ERROR CODE (2)		Display of the error code (2) of the HART device.		Display		581 / 681

Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
HART DEVICE (1) (2) Note! This matrix can be used for reading of HART DEVICE (1) (2) data connected to the Proservo.	SELF DIAGNOSIS	ERROR CODE (3)		Display of the error code (3) of the HART device.		Display		582 / 682
		ERROR CODE (4)		Display of the error code (4) of the HART device.		Display		583 / 683
		ERROR CODE (5)		Display of the error code (5) of the HART device.		Display		584 / 684
	DEVICE DATA	POLLING ADDRESS		Display of the polling address of the HART device to be connected to the Proservo. By the Proservo firmware side, polling address is fixed as follows. Polling address 4: HART DEVICE (1) Polling address 5: HART DEVICE (2)		Display		591 / 691
		MANUFACTURER ID		Display of the manufacturer's ID of the HART device.		Display		592 / 692
		DEVICE TYPE CODE		Display of the device type code of the HART device.		Display		593 / 693
		PREAMBLES		Setting of the preamble number		Display		594 / 694
		SOFTWARE VERSION		Display of the software version of the HART device.		Display		595 / 695
		HARDWARE VERSION		Display of the hardware version of the HART device.		Display		596 / 696
		DEVICE ID		Display of the HART device IC connected to the Proservo.		Display		597 / 697

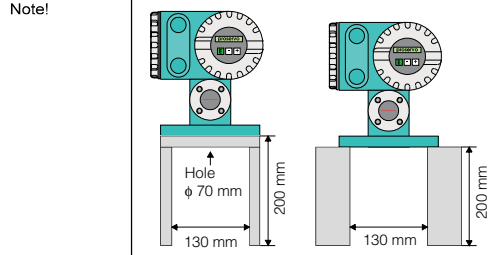
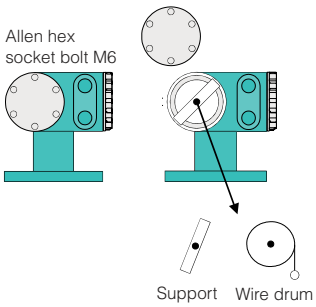
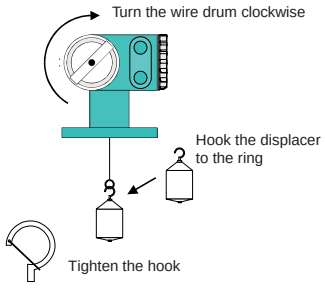
Matrix group	Function group	Item	Access code	Short description	Default vaule	Set Select Display	Possible settings, selections, or displays	Index No, GVH
ADJ. SENSOR	HART LINE Note! The ports selections have to be done, when the Proservo has EEx d[ia] certified.	NMT	777	Assignment of Prothermo NMT535/6/7 with IS HART or Non-IS HART connection. - TERMINAL PORT B: Non-IS HART connection - TERMINAL PORT A: IS HART connection	TERMINAL PORT B	Set	TERMINAL PORT B TERMINAL PORT A	770
		HART DEVICE (1)	777	Assignment of the HART DEVICE (1) with IS HART® or Non-IS HART® connection. - TERMINAL PORT B: Non-IS HART® connection - TERMINAL PORT A: IS HART® connection	TERMINAL PORT B	Set	TERMINAL PORT B TERMINAL PORT A	771
		HART DEVICE (2)	777	Assignment of the HART DEVICE (2) with IS HART® or Non-IS HART® connection. - TERMINAL PORT B: Non-IS HART® connection - TERMINAL PORT A: IS HART® connection	TERMINAL PORT B	Set	TERMINAL PORT B TERMINAL PORT A	772
	INTERFACE ADJUST.	VOL. TOL.FOR I/F	51	Set the volume tolerance for interface measurement.	0.3 ml	Set	0 ... 89.0 ml	780
		BREAK RATE	51	Set the break rate for displacer movement under interface measurement.	150	Set	0 ... 255	781
		BALANCE COUNT	51	Set the balance count under interface measurement.	15	Set	0 ... 255	782
		I/F 1 OFFSET	51	Set the offset value for upper interface level.	0.0 mm	Set	0 ... 9999.9 mm	783
		I/F 2 OFFSET	51	Set the offset value for middle interface level.	0.0 mm	Set	0 ... 9999.9 mm	784

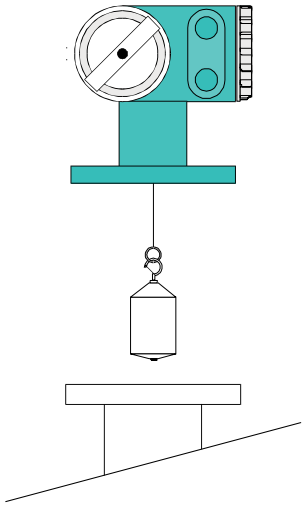
10. Setting/installation of the wire drum and displacer

10.1 Installation of the Displacer

If the displacer and the gauge of the Proservo NMS53x is delivered separately, the displacer should be installed before mounting of the Proservo NMS53x on the nozzle of the tank takes place. Standard type displacers can easily be installed through the calibration window.

Ø50mm displacers can easily be installed through the calibration window. The weight and the volume of the displacer are marked on it. Please note the data before installing the displacer to the Proservo NMS53x.

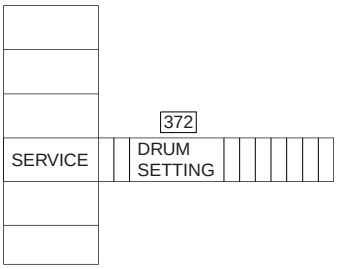
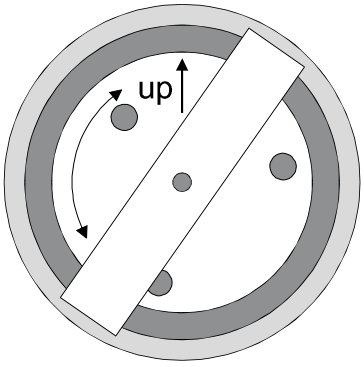
Item	Procedure	Remarks
Note! 	• Place the proservo NMS53x on a spacing stand or on two blocks. • Keep enough free space to lower the measuring wire and to install the displacer.	Note! Make sure that the Proservo NMS53x is steadily supported.
Caution! 	• Remove the cover of the wire drum housing. • Take out the stuffing material. • Remove the support from the housing. • Take out the wire drum. • Remove the sticking tape that is fixing the wire drum and the measuring wire.	Caution! Handle the wire drum with care. It must neither be damaged nor crimped.
Caution! 	• Turn the wire drum gently by hand clockwise till the ring attached to the measuring wire comes out from the opening of the Proservo flange. • Hook the displacer to the ring. • Tighten the hook by the wire attached to the displacer.	Caution! Handle the measuring wire with care. It should never be kinked, twisted, nor bent hard. The wire drum turns in intervals of 1/5 revolution. One revolution draws 300 mm displacer moving.

Item	Procedure	Remarks
	• Mount the Proservo NMS53x on the mounting nozzle of the tank. • Make sure that the displacer does not touch the interior surface of the mounting nozzle. • Turn the wire drum gently by hand till the ring attached to the measuring wire comes up to the reference line of the calibration window. • Close the cover of the wire drum housing.	Caution! Check that the measuring wire is correctly located in the groove of the wire drum before you turn on the power supply. If the wire runs out of the groove, then replace it carefully.

10.2 Wire drum setting

Drum setting is required in following cases:

- The wire drum is shipped separately from the housing.
- The measuring wire has been cut or replaced.

Item	Procedure	Remarks
Matrix Group SERVICE  Touch Control  	1) Remove the measuring wire, and attach the displacer to the end of the wire. 2) Attach the measuring wire with the pendent displacer to the bearing section. Inside the bearing section is a magnet; making attachment easy. 3) Select “MATRIX OF” GVH=030 in the MORE FUNCTION row of Static Matrix, and then select “SERVICE”. 4) Select GVH=372 “DRUM SETTING” 5) The default setting, “OFF” will show 6) Press the touch control or “+” or “-” key to change “OFF” to “ON”. 7) Now that ON is blinking, press the E key. 8) Z PHASE CHECK” will appear on the LCD screen. 9) The NMS’s motor will run for a while before ON changes back to OFF. 10) Set the wire drum attached to the Proservo NMS53x gently by hand so that its arrow points upward.	Note! This function requires previous setting of access code 51 on matrix G0V3H9 (please refer access code setting in Sect. 10.4) Note! Check carefully that the displacer moves. If the error message Z PHASE NO INPUT appears, then consult E+H Service. Caution! Handle with care not to damage either the measuring wire or the wire drum.

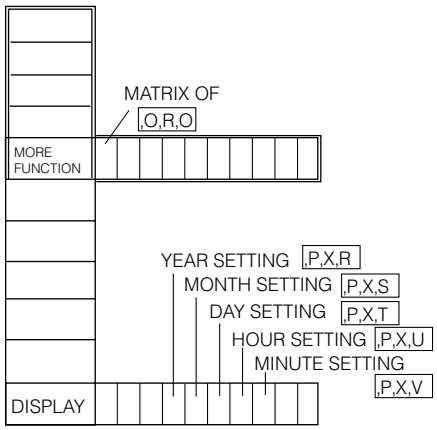
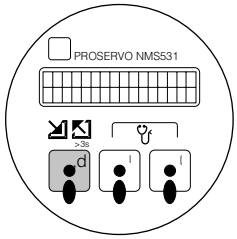
11. Initial Settings

The following must be set or specified before you attempt to use the Proservo NMS53x:

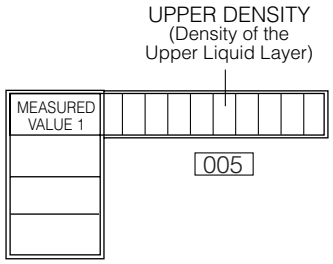
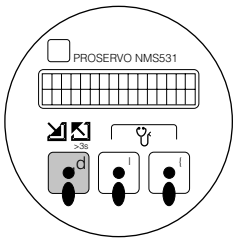
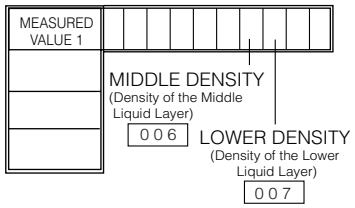
- Built-in calendar and clock
- Density measurement factors
- Tank height

11.1 Setting the System Date and Time

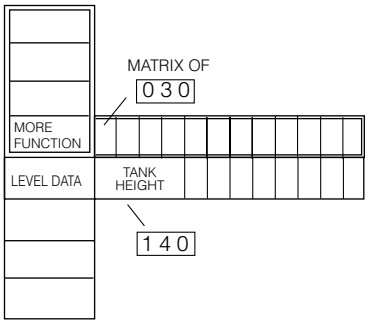
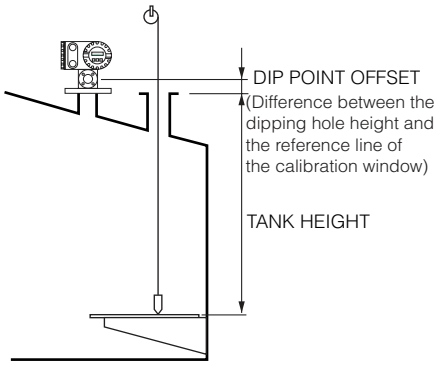
The Proservo has a built-in calendar and clock that are backed up by an internal power supply source and it is good for 100 hours if power to the Proservo is turned off. The system date and time are set to Japan local date and time before shipment. After installation, adjust them to your local date and time.

Item	Procedure	Remarks
Matrix Group: CALIBRATION  **Touch Control** 	1) Select GVH=030 ("MATRIX OF") in the "MORE FUNCTION" (GVH=030) row of Static Matrix, then select "CALIBRATION". 2) "EDITING ENABLED" will appear on the LCD screen. 3) Select GVH=193 ("YEAR SETTING"). 4) The current system year will appear on the LCD screen ("01" for example,, stands for 2001). 5) Press the touch control key "+" or "-" until the correct year appears 6) The year display should now be blinking. Press the E key to store the year you have set. "EDITING ENABLED" will appear on the LCD screen. 7) Select GVH=194 ("MONTH SETTING"), and enter the correct month just as you entered the year above. 8) As above, select GVH=195 ("DAY SETTING"), and enter the correct day. 9) As above, select G1V9H6 ("HOUR SETTING"), and enter the correct hour. 10) As above, select GVH=197 ("MINUTE SETTING"), and enter the correct minute.	• Access code 51 must be selected.

11.2 Initial Settings of Density Measurement

Item	Procedure	Remarks
Static Matrix  **Touch Control** 	1) Select function GVH=005 of the Static Matrix to display the "UPPER DENSITY". 2) Using the "+" and "-" keys, enter the value expressing the correct density,, then press the "E" key to confirm the entry. 3) "EDITING ENABLED" will appear on the LCD screen.	• Access code 51 must be selected.
Static Matrix 	If the liquid is layered,, the following steps must also be performed. 1) Select GVH=006 of Static Matrix to display the "MIDDLE DENSITY". 2) Using the "+" and "-" keys, enter the value expressing the correct density of the middle liquid layer. Press the "E" key to confirm the entry. 3) As above, select GVH=007 "LOWER DENSITY" and enter the density value of the lower liquid layer.	The interfacial measurement requires that the correct density of the middle and lower layers be entered. The density value is updated when the Proservo measures the density.

11.3 Setting the Tank Height

Item	Procedure	Remarks
Matrix Group: CALIBRATION  	1) Select GVH=030 "MATRIX OF" in the row of the "MORE FUNCTION" of Static Matrix, then select "CALIBRATION". 2) Select GVH=140 to display the "TANK HEIGHT." 3) Using the "+" and "-" keys, enter the value corresponding to the tank height, then press the "E" key to confirm the entry. 4) "EDITING ENABLED" will appear on the LCD screen.	• Access code 51 must be selected. • Enter the correct tank height, especially if you cannot conduct an on-site calibration (discussed later). • If the correct access code is already selected, pressing the "+" or "-" key at this stage will not bring you to the Access Code display; there is no need for you to select the code again.

Note!
Proservo NMS 53x automatically adjusts DIP POINT OFFSET. It is not necessary to adjust DIP POINT OFFSET manually.


Note!

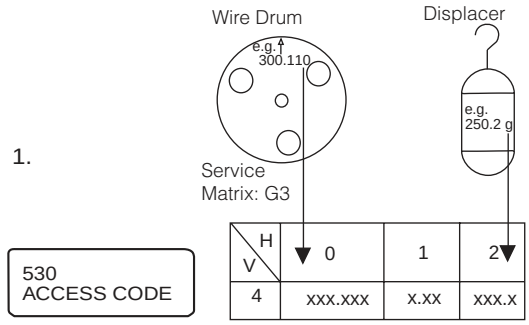
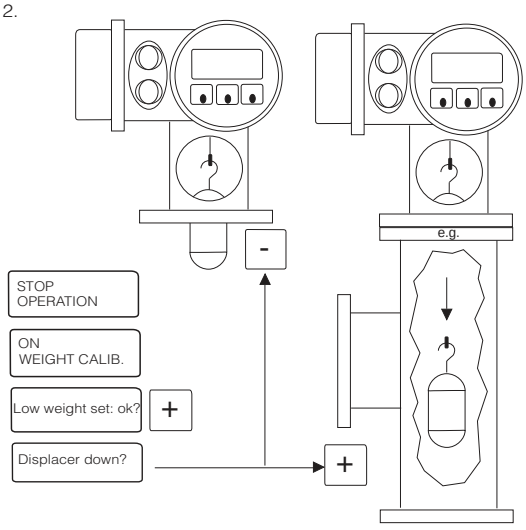
12. Initial Weight Calibration

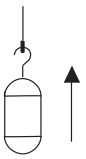
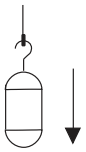
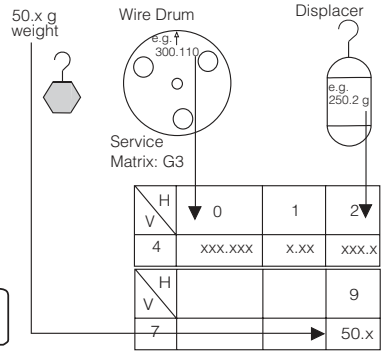
12.1 Displacer Weight Calibration

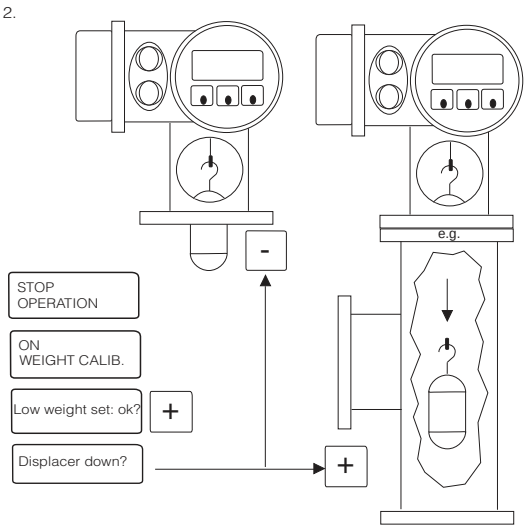
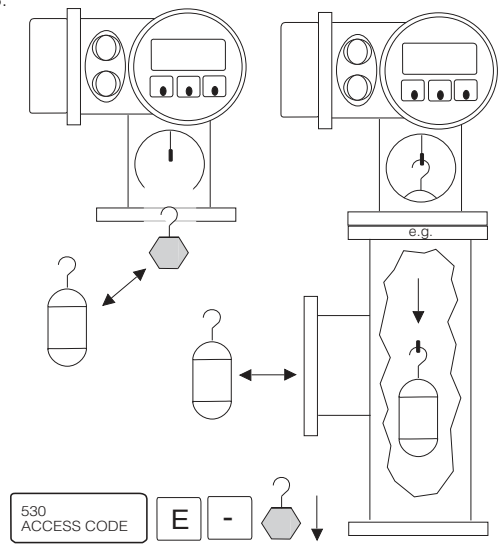
Weight table calibration must be done after Hall sensor adjustment. Use this procedure for NMS 53x with level measurement function only.

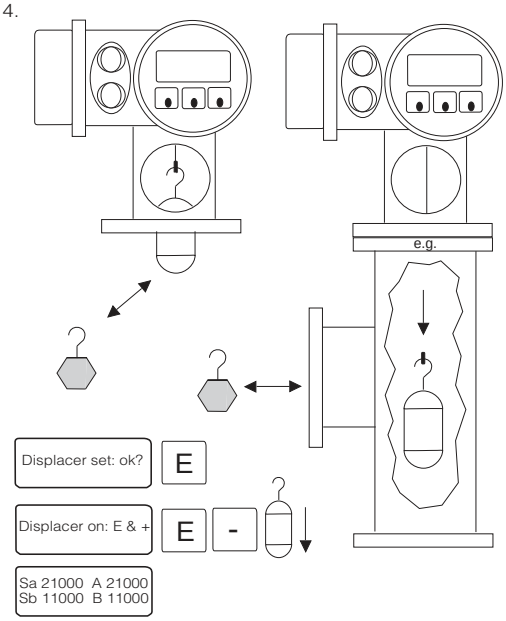
Note!

Note!
Wind and vibration affect weight table calibration.
Not necessary to make Initial Calibration for Startup “All-in-one” (displacer attached) shipments.

Item	Procedure	Remarks
Weight Table calibration,Basic 1. 	1) Enter Access Code 51 or higher, confirm the following data. G3V4H0 Wire Drum Circum.(engraved on wire drum) G3V4H1 Wire Weight Standard SUS =1.40 PTFE=4.55 Hastelloy=2.48 G3V4H2 Displacer Weight (engraved on displacer)	
2. 	2) Displacer is in calibration window or maintenance chamber Set Operation=STOP Set G3V7H3 Weight Calib.=ON At ”Low weight set?” enter Yes (+) At ”Displacer Down?” for calibration window, enter NO (-) for maintenance chamber, enter Yes (+)	

Item	Procedure	Remarks
3. Sa 11000 A 11000 Sb 21000 B 21000 E - 	1) Lift displacer until Sa and Sb are stable. Press “E” and (-) keys together.	
4. Displacer set: ok? Displacer on? E & + Sa 11000 A 11000 Sb 21000 B 21000 E E + 	1) At “Displacer set ok?” enter “E”. At “Displacer on: E & +”, and (+) keys together. Automatic calibration begins (about 10 minutes).	
5. 2 Table Make? Yes = +, No = - - OFF WEIGHT CALIB. E	1) At “2 Table make?” enter No (-). At “Weight Calibration OFF” enter “E”. Check: Dose G3V7H0=G3V4H2+/-2.0 grams? If yes, calibration is done. If no... -make sure there is no vibration during calibration -repeat Hall sensor adjustment and calibration.	
Weight Table Calibration, Density 1. 530 ACCESS CODE 	1) Enter Access Code 51 or higher, confirm the following data. G3V4H0 Wire Drum Circum.(engraved on wire drum) G3V4H1 Wire Weight Standard SUS =1.40 PTFE=4.55 Hastelloy=2.48 G3V4H2 Displacer Weight (engraved on displacer) G3V7H9 Zero Adjust Weight=50 x g	

Item	Procedure	Remarks
2. 	1) Displacer is in calibration window or maintenance chamber Set Operation=STOP Set G3V7H3 Weight Calib.= ON At"Low weight set?" enter Yes (+) At "Displacer Down?"... for calibration window, enter No (-) for maintenance chamber, enter Yes (+)	
3. 	3) Replace displacer with 50.x g weight, stabilize weight. Press "E" and (-) keys together	

Item	Procedure	Remarks
4.  	1) Replace displacer on wire. At “Displacer set ok?” enter “E”. AT “Displacer on: E & +”, press “E” and (+) keys together. Automatic calibration begins (about 10 minutes).	
5. 2 Table Make? Yes = +, No = - - OFF WEIGHT CALIB. E	1) At “2 Table Make? enter No (-). At “Weight Calibration OFF” enter “E”. Check: Dose G3V7H2 +/- 2.0 grams? If yes, calibration is done. If no... -make sure there is no vibration during calibration -repeat Hall sensor adjustment and calibration	

12.2 Weight Table

The weight table is the weight compensation table for one revolution of the wire drum. The output from the Hall elements normally shows a sine curve, and the weight table gives the correction of the measured value. Weight table making is carried out in connection with weight calibration.
To make the weight table, the displacer descends 300 mm in intervals of 6 mm. Thus 50 points of the weight correction curve are measured.
The table is checked while the displacer ascends back to the reference position. Fig. 18 shows the principle of the procedure.
After weight table making, the LCD shows "SECOND TABLE SET? Y=+, N=-.", set "N". Then, the weight table is finished.

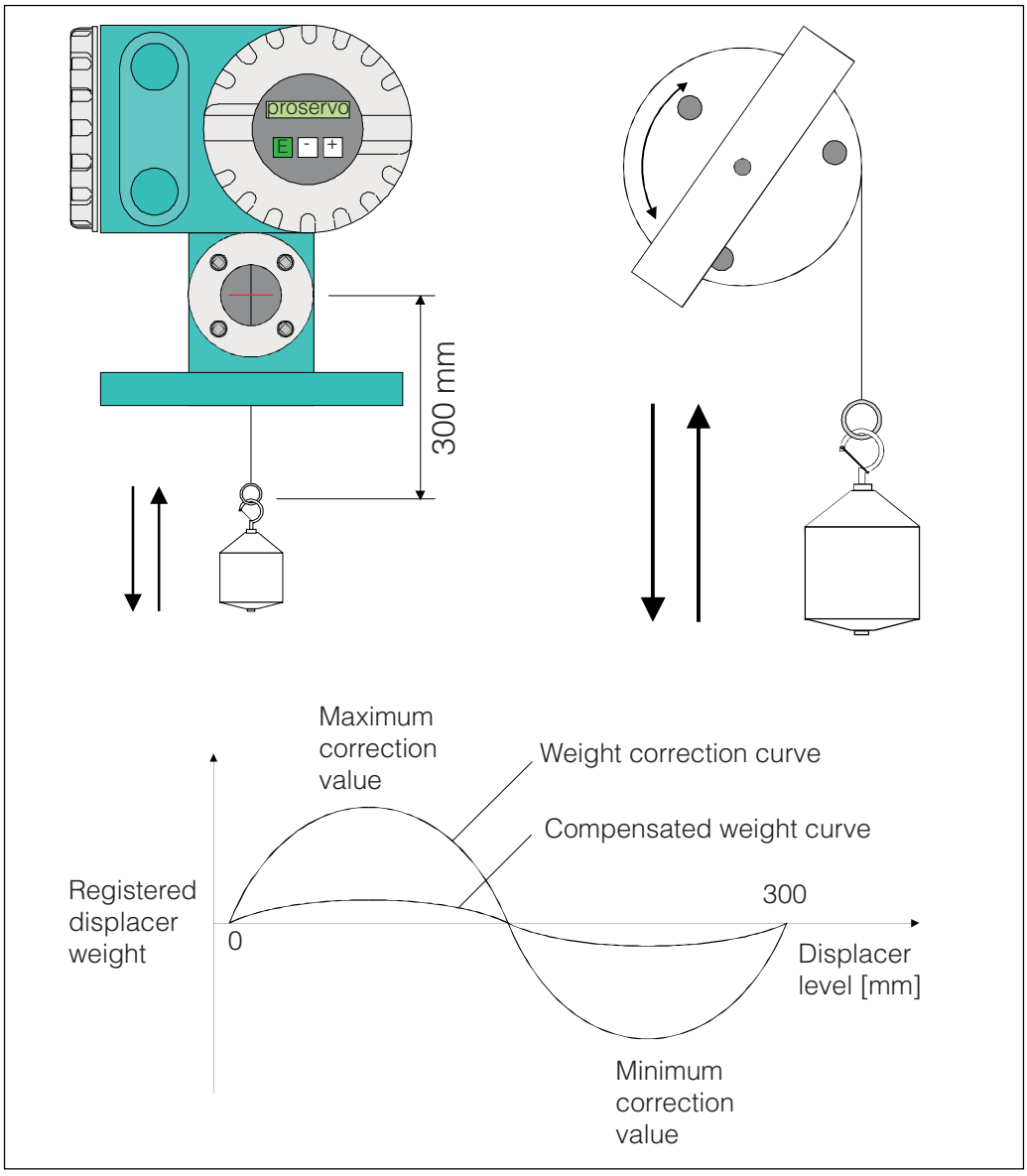


Fig. 18:
Weight table making

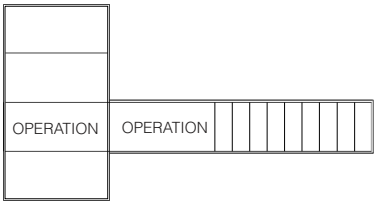
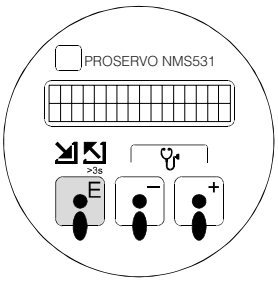
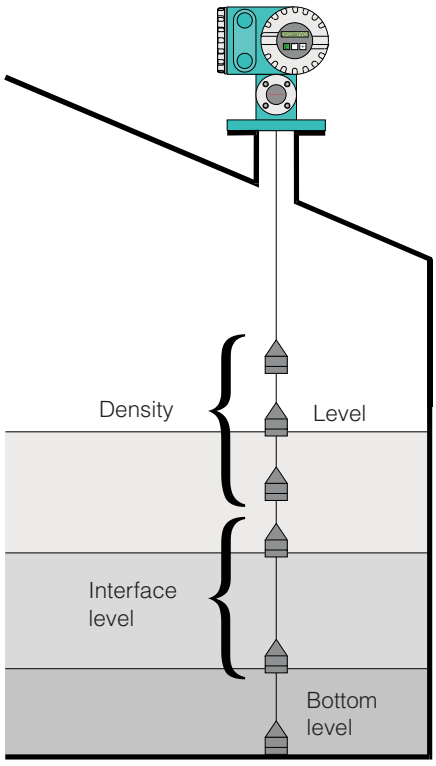
Note!

Note!

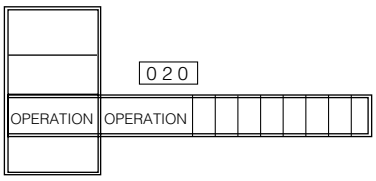
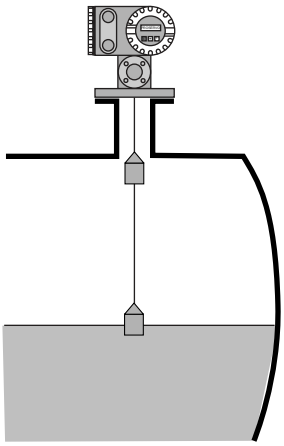
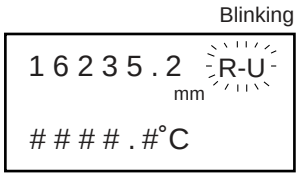
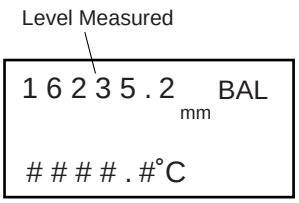
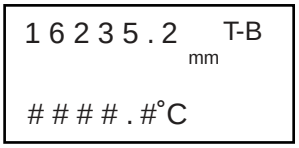
- Do not touch wire drum, measuring wire, nor displacer while the displacer descends.
- Do not vibrate the Proservo NMS53x
- Watch the motion of the measuring wire carefully. It must move smoothly at the vertical center of the calibration window.
- Do not turn off the power once the Proservo NMS53x starts to making weight table.

13. Operation of the Displacer

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

Item	Procedure	Remarks
Static Matrix  Touch Control  	1) Select function group GVH=020 OPERATION. 2) Select item OPERATION. The LCD shows the command given to the Proservo NMS53x and the displacer position.	• Set access code to 50. • If editing has previously been enabled by a valid access code, then the request for the code will not appear.
 	The following commands are available at this position: LEVEL UP STOP BOTTOM LEVEL UPPER INTERF.LEV* MIDD.INTERF.LEV* MIDDLE DENSITY* DENSITY BOTTOM* WATER DIP* REPEATABILITY TEST * Interface and density measurements are not available unless specifically requested.	• The optional operation commands are available when such options are set. • Density measurement is described in Appendix C.

14. Level Measurement

Item	Procedure	Remarks
Static Matrix     	1) Select GVH=020 "OPERATION" of Static Matrix, and select "MEASURED LEVEL" with the "+" and "-" keys. 2) "MEASURED LEVEL" should now be blinking in the LCD screen. Press the "E" key. 3) The displacer will descend down to the surface level and the measurement will begin. 4) Press and hold the "E" key for more than 3 seconds to bring up the Home position. 5) In the upper right corner of the screen shows "R-U" or "R-D." As the measurement goes on, this display will change to "T-B," and, when the measurement is over,, the "T-B" will change to "BAL." 6) The number (in mm) to the left of "BAL" is the level height.	• 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.

15. On-site Level Calibration

15.1 Before On-Site Level Calibration

The data listed below are important for the operation of the Proservo NMS53x. Please check them before performing on-site calibration.

Basic gauge related data	Matrix position
Circumference of the wire drum. Set the value marked on the drum.	340
Measuring wire weight per 10m wire. the value is 1.40 g / 10 m for stainless steel wire 4.55 g/10 m for PTFE coated, and 2.48 g/10 m for Hasteloy C. Consult E+H Service for other wires.	341
Displacer weight. Set the value marked on the displacer.	342
Displacer volume. Set the value marked on the displacer.	343
Balance volume. Set approximately half the displacer volume.	344
Tolerance on the balance volume. Set 1.0 ml for normal applications.	345
Delay time for judging the displacer from balancing position to motion. Set 5 x 100 ms for normal applications.	347

Liquid data	Matrix position
Density of upper layer.	005
Density of middle layer.	006
Density of lower layer.	007

Adjustment data	Matrix position
Upper limit of displacer movement, if required.	160
Lower limit of displacer movement, if required.	161
Overtension value of the measuring wire. Set 350 g for normal applications.	162
Undertension value of the measuring wire. Set 50 g for normal applications.	163

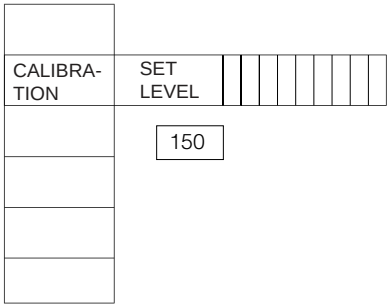
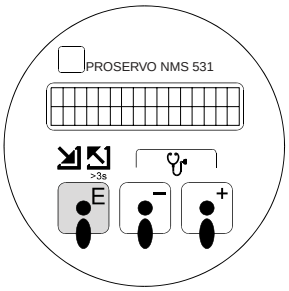
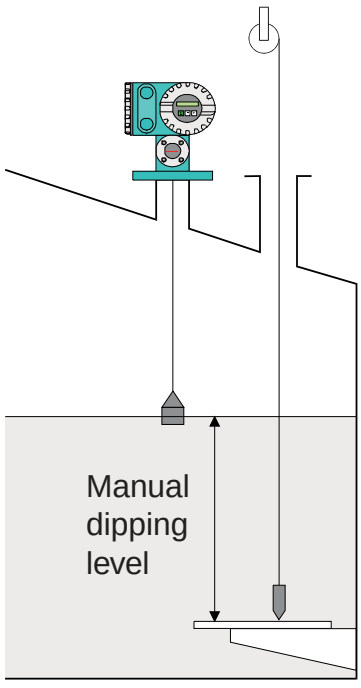
Tank data	Matrix position
Elevation level of the manual dipping reference (tank height).	140

Note!
Make sure that the measuring range of the Proservo NMS53x covers the tank height. Otherwise the measurement cannot be done to the tank bottom.



15.2 On-Site Level Calibration Procedure

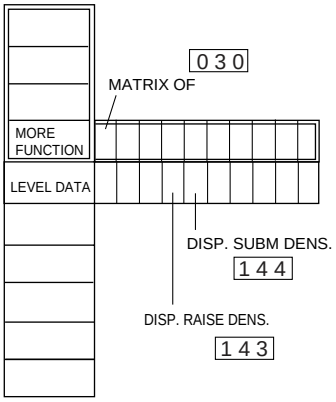
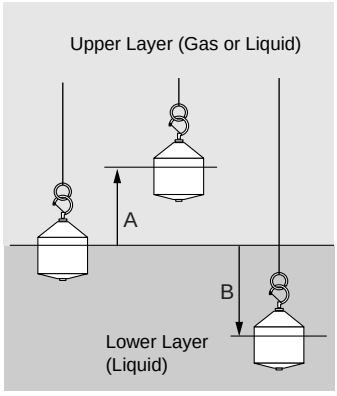
The Proservo NMS53x can measure the absolute distance between tank top and liquid surface by measuring wire and wire drum. A high accuracy of level measurement requires an on-site calibration that sets the gauge to the manual dipping level.

Item	Procedure	Remarks
Matrix Group CALIBRATION  Touch Control 	1) Select CALIBRATION in GVH=030 matrix of "MORE FUNCTION." 2) Select function group "CALIBRATION." 3) Select item G1V5H0 "SET LEVEL." 4) Touch once "+" or "-". The Proservo NMS5/7 asks the access code. 5) Set access code 50. 6) Touch "E". The LCD shows "INPUT STORED." 7) Touch "+" or "-" to set or correct the level data,, which are equal to the innage level by manual dipping. 8) Touch "E". The LCD changes to the set value.	• Set access code to 50. The "SET LEVEL" procedure is required after the installation of the Proservo on a tank is completed. • If editing has previously been enabled by a valid access code, then the request for the code will not appear. • The "SET LEVEL" procedure will automatically reflect the "DIP POINT OFFSET" procedure. The dip point offset will then be fitted to the input data.
		Note! Note! The data shown in the matrix are updated once when you open the matrix. They will not change automatically with regard to the level change.

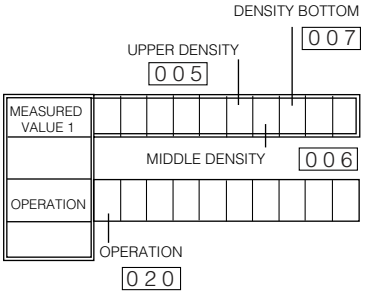
16. Density Measurement

(available only when requested)
The displacer weight is first measured in relation to the upper and lower layers, then from the data thus obtained, the density is computed.

16.1 Preliminary settings

Item	Procedure	Remarks
Matrix Group: CALIBRATION  	1) Select GVH=030 "MATRIX OF" in the row of "MORE FUNCTION" of Static Matrix, then select "CALIBRATION." 2) Select GVH=143 "DISP. RAISE DENS." of Dynamic Matrix. 3) Set the distance A the displacer will cover in ascending. 4) Select GVH=144 "DISP. SUBM DENS." of Dynamic Matrix. 5) Set the distance the displacer will cover in descending.	• Set access code to 50. • When the wire drum completes one revolution, the wire is extended for 300 mm. If you set values A and B so that their difference is a multiple of 300, the maximum accuracy of measurement is ensured. • Recommended distance: 150 mm (default) • Recommended distance: 150 mm (i.e. 150 mm below the liquid surface) • See Appendix C for the necessary formula.
	1) The displacer will stop temporarily at the liquid surface or interface. 2) The Proservo NMS5/7 hoists the displacer up to the A level, and measures the displacer weight. 3) The displacer descends down to the B level, and its weight is measured again. 4) Using the weight data thus obtained,, the density is computed.	• The upper layer is either gas or liquid,, depending on whether the tank contains one sort of liquid or two liquids different in nature, which should not be of concern at this stage. • For the necessary formula, see Appendix C

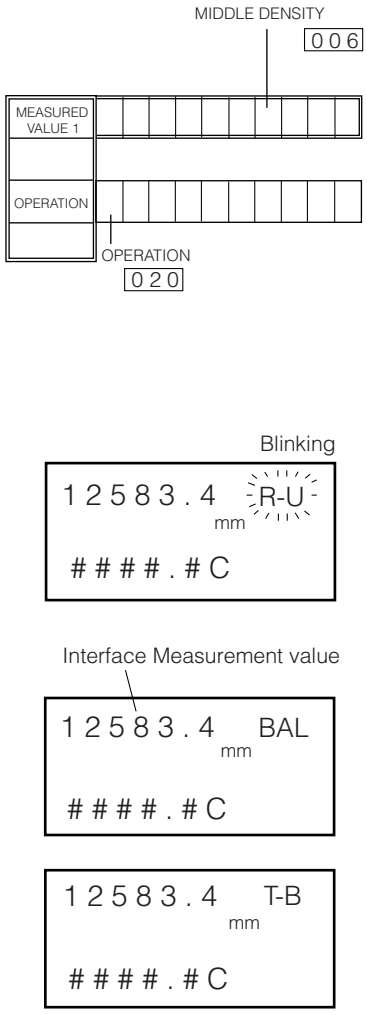
16.2 Density Measurement

Item	Procedure	Remarks
Static Matrix  	1) Select GVH=020 "OPERATION", then select "MIDDLE DENSITY" or "DENSITY BOTTOM" 2) The display you selected in step 1 should now be blinking. Press the "E" key. 3) The displacer will begin to descend,, stopping once at the liquid surface or interface. 4) The displacer will ascend up to the recommended 150 mm point (or the point you have set at matrix position GVH=143 "DISP. RAISE DENS.", pausing there for a few seconds. 5) The displacer will descend down to the point you have set at matrix position GVH=144 "DISP. SUBM. DENS." and stop there. 6) To display the density measured,, select GVH=005 "UPPER DENSITY", GVH=006 "MIDDLE DENSITY", or GVH=007 "DENSITY BOTTOM".	

17. Interface Measurement

Up to 2 interfacial levels can be measured (the upper interface, and the lower interface). Before proceeding the interface measurement, the density of both the upper and the lower layers need to be set correctly (the default is 1 for all layers). The user is responsible for obtaining the necessary data on density.

17.1 Upper Interface Measurement

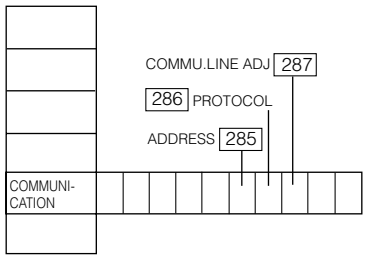
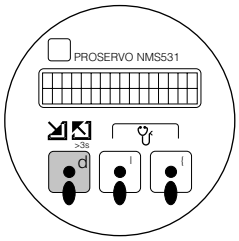
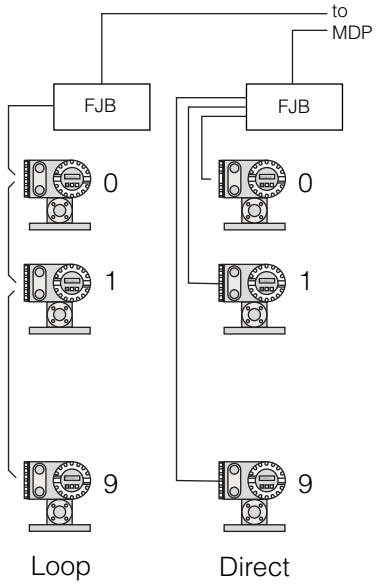
Item	Procedure	Remarks
Static Matrix 	1) Select GVH=006 "MIDDLE DENSITY", and enter the density of the liquid above the interface. (Skip this step if the unit you are using has the interface and density measurement functions, and you have already measured the density.) 2) Select GVH=002 "OPERATION",, then select "UPPER INTERF. LEV" with the "+" and "-" keys. 3) "UPPER INTERF. LEV" should now be blinking. Press the "E" key. 4) The displacer will descend down to the upper interface and the measurement will start. 5) Press and hold the "E" key for more than 3 seconds to return to the Home position. 6) "R-U" or "R-D" will appear in the upper right corner of the screen. As the measurement continues, it will change to "T-B" and, once the measurement is over, the "T-B" will change to "BAL." 7) The number (in mm) to the left of "BAL" represents the upper interface level.	

17.2 Lower Interface Measurement

Measure the lower Interface level as you measured the upper interface level.

18. Remote Communication

18.1 Serial Pulse Output (V1/022 protocol)

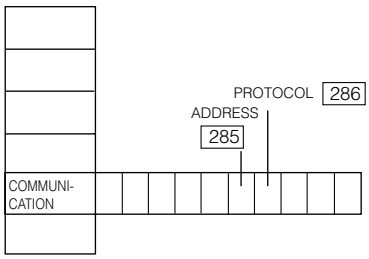
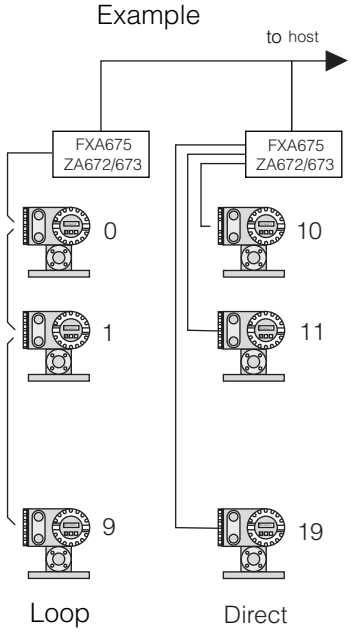
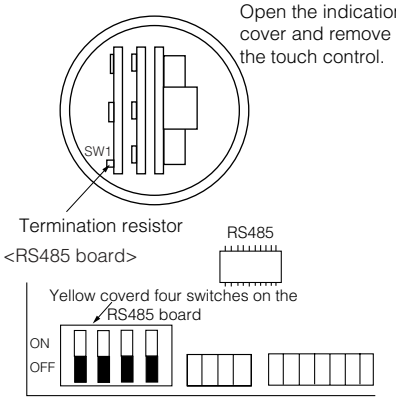
Item	Procedure	Remarks
Matrix Group: DEVICE DATA  Touch Control  Example 	1) Select "DEVICE DATA" in GVH=030 matrix of "MORE FUNCTION." 2) Select function group "COMMUNICATION." 3) Select item GVH=285 "ADDRESS." 4) Touch "+" or "-" to set or correct the address of the proservo on the remote communication line. For Sakura serial pulse communication (V1 or other), enter a value from 0 to 9. 5) Select item GVH=286 "PROTOCOL". 6) Select the type of the Sakura receiver or communication. The following types are available at this position: WM550, M/S BBB (also for MIC) MDP V1, ENRAF BPM RACKBUS (RS 485) HART 7) Select item G2V8H7 "COMMU.LINE ADJ. 8) Set "F" for Sakura receivers of the types BBB, MDP, and V1.	Note! • These items require previous setting of access code 51. The" COMMUNICATION" matrix is available when the digital output is ordered. • "ADDRESS" defines the address of the Proservo NMS5/7 on a serial pulse loop. • "PROTOCOL" defines the type of the Sakura receiver connected to the Proservo. Note! • RACKBUS defines the Rackbus RS 485 output. • "COMMU.LINE ADJ." is needed for tuning in connection with Sakura receivers of the type DX. • Consult E+H Service for the adjustment of type DX setting.


Note!

Note!

- The serial pulse communication requires:
- Two-wire twisted pair, screened or non-screened
- max. 120 Ohm
- max. 0.3 mF between cores
- max. 6 km.

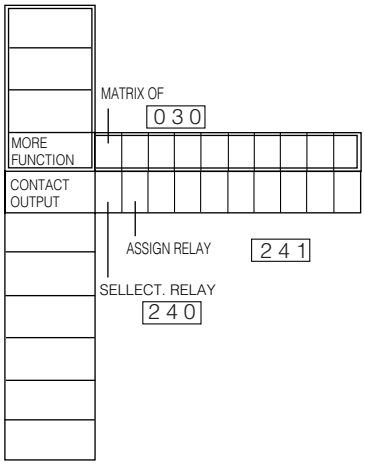
18.2 Rackbus RS 485

Item	Procedure	Remarks
Matrix Group: DEVICE DATA  Touch Control  Example 	1) Select "DEVICE DATA" in GVH=030 matrix of "MORE FUNCTION." 2) Select function group "COMMUNICATION." 3) Select item GVH=285 "ADDRESS." 4) Touch "+" or "-" to set or correct the address of the proservo on the remote communication line. For Rackbus RS 485 communication, enter a value from 0 to 63. When touch "E",, LCD shows next. 5) Select item GVH=286 "PROTOCOL." 6) Select the type of the Sakura receiver or communication. The following types are available at this position: RACKBUS (RS 485) The termination resistors are on the RS 485 card. The termination resistor switch is on the RS 485 communication card.	Note! These items require previous setting of access code 51. The "COMMUNICATION" matrix is available when the digital output is ordered. ● "ADDRESS" defines the address of the Proservo NMS5/7 on a Rackbus RS 485. ● For example while NRS or NRM's address is set to 1, this GVH=285 "ADDRESS" must be set to 1. Note! The other protocol defines the Sakura serial pulse output.
Termination resistor Open the indication cover and remove the touch control. 	7) Set the resistor switch of the Proservo NMS53x that is farthest from the host to "ON".	Note! The resistor switch is set to OFF on delivery.

19. Settings for Alarm Outputs (4 contacts)

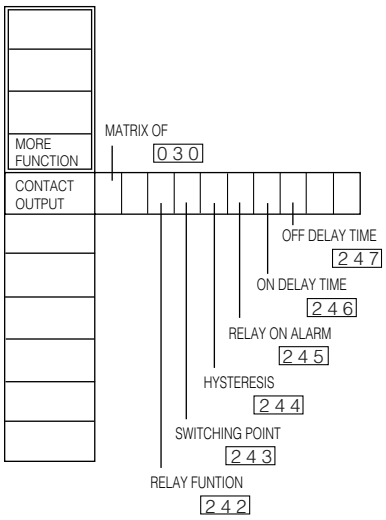
An optional function for providing outputs for up to four contacts when the level or the temperature exceeds a specified value can be selected for Proservo. All the parameters are included in screen GVH=240.

19.1 Alarm Setting

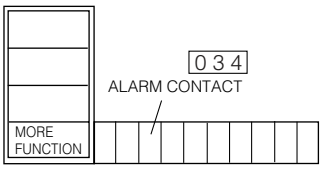
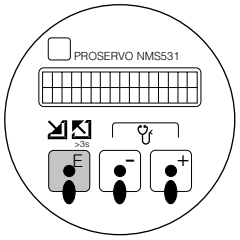
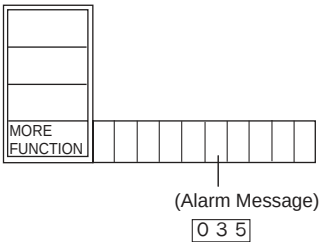
Item	Procedure	Remarks
Matrix Group: DEVICE DATA 	1) In Static Matrix "MORE FUNCTION," invoke GVH=030 "MATRIX OF" and select "DEVICE DATA." 2) Bring up the Dynamic Matrix GVH=240 "SELECT. RELAY" screen. 3) Since there are four contacts, select "1" and press "E" to display the next Matrix GVH=241 "ASSIGN RELAY." 4) Select an error type to be set from "LEVEL," "LIQUID TEMP.", "CAUTION", "WARNING", and "EMERGENCY ERROR".	• Set the access code at 50. • For the set error type, see the table below. • Select "LEVEL" and "LIQUID TEMP." and press "E" to pass to the next screen GVH=242. "EDITING ENABLED" is displayed, and if any error occurs, an alarm is output.

Error type	Contents
LEVEL	Set the upper and lower limits of the level using the screens GVH=242 to GVH=247. An alarm is output if either of these values is exceeded.
LIQUID TEMP.	Set the upper and lower limits of the temperature using the screens GVH=242 to GVH=247. An alarm is output if either of these values is exceeded.
CAUTION	Alarm-level errors are indicated by error message numbers 1 to 10, 14, 16, 17, 19, and 20.
WARNING	Warning-level errors are indicated by error message numbers 11, 12, 21, and 22.
EMERGENCY ERROR	Critical-level errors are indicated by error message numbers 13, 15, 18, and 23.

19.2 Setting Level and Temperature Alarms

Item	Procedure	Remarks
Matrix Group: DEVICE DATA 	1) When, in screen GVH=241, "LEVEL" or "LIQUID TEMP." is selected, provide the following settings. 2) In GVH=242" RELAY FUNCTION," set either the upper or the lower limit of the alarm. Press "E" to pass to the next screen GVH=243. 3) In GVH=243 "SWITCHING POINT," set an operation value at which an alarm is output. Press "E" to pass to the next screen GVH=244. 4) In GVH=244 "HYSTERESIS," set a hysteresis value (a value used from the start of the relay operation until it returns to the original state) at which the alarm for contact outputs is cancelled. Press "E" to pass to the next screen GVH=245. 5) In GVH=245 "RELAY ON ALARM," select an alarm output method between "NORM. OPENED" and "NORM. CLOSED." Press "E" to pass to the next screen GVH=246. 6) In GVH=246 "ON DELAY TIME," specify, in seconds, a delay until the output of the selected contact alarm begins. Press "E" to pass to the next screen GVH=247. 7) In GVH=247 "OFF DELAY TIME," set a delay until the output of the selected contact alarm is completed.	● The hysteresis value is approximately 100 mm and 2.. ● The delay varies according to the application.

19.3 Alarm History Display

Item	Procedure	Remarks
Matrix Group: DEVICE DATA  **Touch control** 	1) Bring up Static Matrix GVH=034 "ALARM CONTACT."	
Static matrix 	1) Previous static matrix records are sequentially displayed in "GVH=035", starting with the latest record. Up to 100 alarm records can be saved. If the number of records exceeds 100, it is sequentially overwritten starting with the oldest record. The display includes the year, month, day, hour, minute, instrument temperature, and an error sequential number, in this order. For example, 97 3192238 2402 means that an error occurred at 22:38 on March 19, 1997, when the instrument temperature was 24 °C and that this is the second error since Proservo was installed.	● For the details of alarm messages, see 19.4 "List of Alarm Messages."

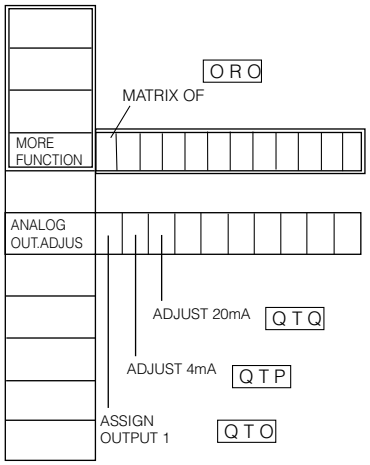
19.4 List of Alarm Messages

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.

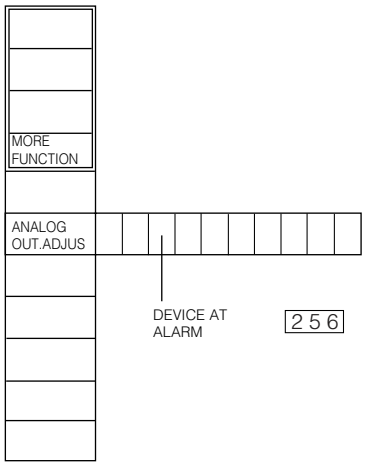
20. Settings for Analog 4...20 mA Outputs (2 channels)

Proservo has a function for outputting to the receiver a current of 4...20 mA that is proportional to the value of the level or the temperature when it reaches a set value.

20.1 Setting for Output Type

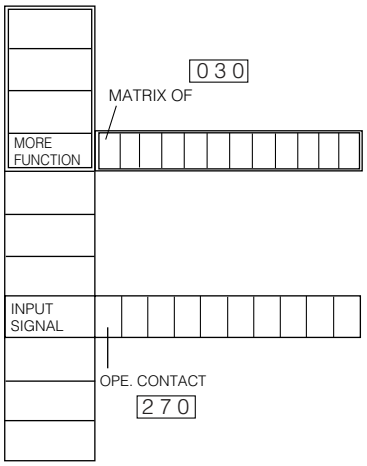
Item	Procedure	Remarks
Matrix Group: DEVICE DATA 	1) In Static Matrix "MORE FUNCTION," invoke G0V3H0 "MATRIX OF" and select "DEVICE DATA." Set the access code at 50. 2) Bring up the Dynamic Matrix GVH=250 "ASSIGN OUTPUT 1" screen. 3) Set a type for which 4...20 mA is output (the level or the temperature value). Select either "LEVEL" or "LIQUID TEMP." 4) Press "E" to make a selection and press "E" again to bring up the GVH=251 "ADJUST 4mA" screen. Set a value at which DC4mA is output. (Example) To set the value at 10.08 m, use the + key to set 10,080 mm. 5) To set a value at which DC20mA is output, specify the setting in step4 and then press "E" to invoke the GVH=252 "ADJUST 20mA" screen. The remaining part of the operation is the same as in step 4.	• To provide settings for a second channel, also use steps 4 and 5.

20.2 Settings for Current Output When Error Occurs

Item	Procedure	Remarks
Matrix Group: DEVICE DATA 	6) Next, set the current output when an error occurs. Press "E" to bring up the Matrix GVH=256 "DEVICE AT ALARM screen. 7) On the screen, select a current type from "HOLD," "MAX," and "MIN."	• HOLD: When an error occurs, the current value of the output current is fixed and will not respond to changes in level or temperature. MAX: When an error occurs, a 20 mA current is output instead of the current output current. MIN: When an error occurs, a 4 mA current is output instead of the current output current. OFF: No special current is output when an error occurs.

21. Settings for Operation Inputs

These settings enable the displacer to be operated by providing external contact inputs.

<table>
<tr><th>Item</th><th>Procedure</th><th>Remarks</th></tr>
<tr>
<td>Matrix Group: DEVICE DATA

</td>
<td>1) In Static Matrix "MORE FUNCTION," invoke GVH=030 "MATRIX OF" and select "DEVICE DATA."

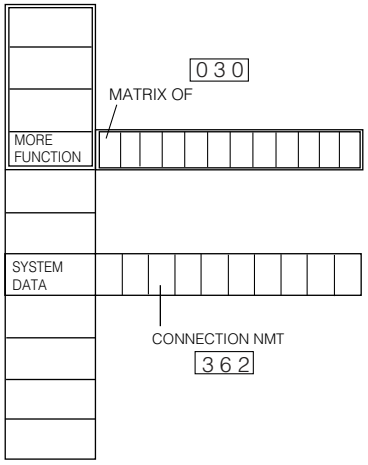
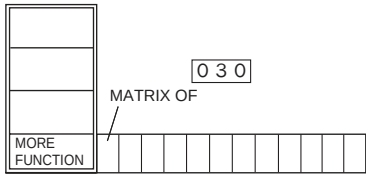
2) Invoke Dynamic Matrix GVH=270 "OPE. CONTACT.",

3) To provide external contact inputs, select "ON (2 contacts)."

External settings for contacts,
<table>
<tr><th>CTR1</th><th>CTR2</th><th>OPERATION</th></tr>
<tr><td>OFF</td><td>OFF</td><td>LEVEL</td></tr>
<tr><td>ON</td><td>OFF</td><td>HOIST</td></tr>
<tr><td>OFF</td><td>ON</td><td>STOP</td></tr>
<tr><td>ON</td><td>ON</td><td>INTERFACE</td></tr>
</table></td>
<td>• Set the access code at 50.</td>
</tr>
</table>

22. Settings for Prothermo NMT535/6/8 Connections

The following settings are required to display Prothermo NMT535/6/8 data on Proservo screens.

Item	Procedure	Remarks
Matrix Group: SERVICE 	1) In Static Matrix "MORE FUNCTION," invoke GVH=030 "MATRIX OF" and select "SERVICE." Set the access code at 51. 2) Invoke the Dynamic Matrix GVH=362 "CONNECTION NMT" screen. 3) Use the "+" and "-" keys to display "AVERAGE" and press "E" to provide a setting. 4) Press "E" to return to "SYSTEM DATA" and press the "-" key to return to "MORE FUNCTION." 5) Invoke Static Matrix "GVH=030 MATRIX OF." The Proservo matrix is divided into seven matrix groups. Select "TEMPERATURE" from these groups.	• Set the access code at 51. • NMS HART connection (terminal 24 & 25) must have corresponding IS input in order to configure NMT 535 IS version and NMT 538.
Static Matrix 	6) "EDITING ENABLED" is displayed on the LCD. 7) The average liquid temperature is displayed on Dynamic Matrix screen GVH=440. 8) The temperature of each contact is displayed on Dynamic Matrix screens GVH=450 to GVH=459.	• The Static Matrix GVH=010 "LIQUID TEMP." screen also displays the average temperature.



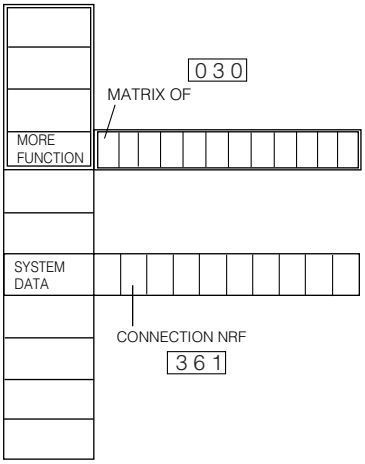
Caution!
For Prothermo NMT535/6/8 connections, see the Prothermo NMT535/6/8 operating manual (BA 006N/08/en, BA 020N/08/en)

23. Settings for Promonitor NRF560 Connections

To connect an Promonitor NRF560, the Proservo requires the following settings.

Caution!
Turn on the power to Proservo NMS35x first.

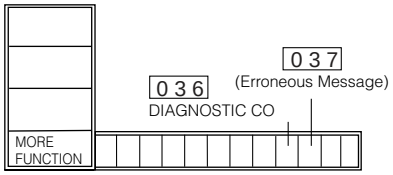
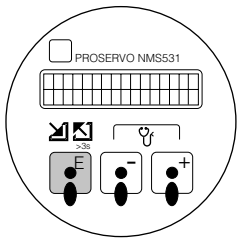


Item	Procedure	Remarks
Matrix Group: SERVICE  	1) In Static Matrix "MORE FUNCTION," invoke GVH=030 "MATRIX OF" and select "SERVICE." 2) Invoke the Dynamic Matrix GVH=361 "CONNECTION NRF" screen. 3) Use the "+" and "-" keys to select either "CONTACT 1" or "CONTACT 2." 4) The setting is completed.	• Set the access code at 50. • CONTACT 1 ... Promonitor NRF560 software version 1.6x and earlier (those Promonitor NRF560 that indicate no software version correspond to connection type 1). • CONTACT 2 ... Promonitor NRF560 software version 1.8x and later (those Promonitor NRF560 that indicate a software version correspond to connection type 2).

24. Diagnosis and Troubleshooting

The Proservo NMS53x has a superb self-diagnosis function that monitors its operation. If an error has 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 the Proservo NMS53x. Matrix position GVH=037 provides the diagnostic history.

24.1 Selection of Diagnostic Code and History

Item	Procedure	Remarks
Static matrix  **Touch Control**  	1) On "MORE FUNCTION",select item GVH=036 "DIAGNOSTIC CO." 2) Previous static matrix records are sequentially displayed in Static Matrix screen GVH=037, starting with the latest record. Up to 100 alarm records can be saved. If the number of records exceeds 100, it is sequentially overwritten starting with the oldest record. For example, 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 Proservo was installed. Display includes the year, month, day, hour, minute, instrument temperature, and an error sequential number, in this order.	• Item GVH=037 only shows error message,calendar, and pointer, but no label on the LCD.Refer to Sect. 24.2 for a table of possible messages.

24.2 Error and Status Messages

Message	Cause	Remedy
MPU:XXXX* (XXXX=text)	CPU error.	The error might happen occasionally and might be registered in GVH=037 (Erroneous Message). However, it is normally negligible. If it occurs frequently, then consult E+H Service.
MPU: START ACT*	Error during startup of the Proservo, or failure in resetting of the software.	Check if the power is turned on. If the message occurs frequently, then consult E+H Service.
OVERTENSION	The tension on the measuring wire exceeds the upper limit set at position GVH=162 "OVER TENS. SET."	Check if the displacer motion is blocked by clogging or sticking. To release overtensioning, access position GVH=371 "RELE. OVER TENS."
UNDERTENSION	The tension on the measuring wire falls below the lower limit set at position GVH=163 "UNDER TENS. SET."	Check if the measuring wire is cut or the displacer is lost. In this case, check the installation of the Proservo.
Z PHASE NO INPUT	The input of the Z phase signal from the encoder is not available.	Replace the detector unit. Consult E+H Service.
LOCAL ERROR: NMT	The signal from the Prothermo NMT535/6/8 temperature sensor is not available.	Check the connection of the Prothermo NMT535/6/8. Check the register of the temperature sensor at position GVH=362 "CONNECTION NMT."
ADC/SENSOR ERROR	The signal from the A/D converter is out of range.	Consult E+H Service.
LOCAL ERROR: NRF	The Proservo cannot access the Promonitor NRF560 tank side monitor.	Check the connection of the Promonitor NRF560 and register of the tank side monitor at position GVH=361 "CONNECTION NRF".
OPE.CODE ERROR	An illegal operation command is accessed.	If the message occurs frequently, then consult E+H Service.
SIFA ERROR	Error between communication board and CPU board for digital output.	Replace the CPU board. Consult E+H service.
LCD CHECK	Error between LCD (touch control) unit and CPU board.	Replace the touch control.
ROM ERROR	Check data of EEPROM	Consult E+H Service.
A PHASE NO INPUT	The input of the A phase signal from the encoder is not available.	Replace the detector unit. Consult E+H Service.
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 measurement to avoid heat transfer from the tank to the Proservo.
POWER FAILURE	The supply voltage falls below the allowed value.	Check the power source.
MEM. ERROR	Defect in the memory that is specially used for custody transfer sealing.	Replace the CPU board. Consult E+H Service.

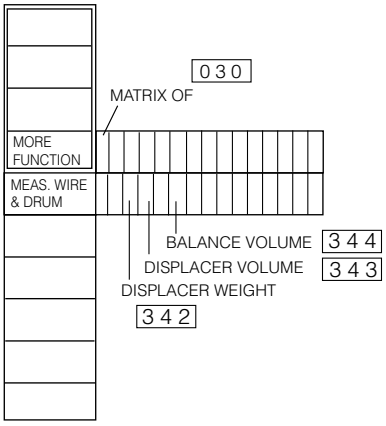
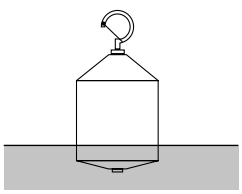
Message	Cause	Remedy
WIRE CALIB ERROR	The deviation of automatic wire calibration exceeds its set limit.	Check wire and wire drum.
DISPL CALIB ERROR	The deviation of automatic weight calibration exceeds its set limit.	Check build-up or deposit on the displacer.
ADJ.XXXCOUNTER (X=A, I, Z or combination)	Error of level data check by A, I, and/or Z phase encoder.	If the message appears frequently,, then consult E+H Service.
LOCAL ERROR: DEV1 (or 2)	The Proservo cannot access the local HART® device 1 (or 2)	Check the connection of the HART® device to the Proservo. Check the registration of the device(s) in matrix group G5/6.
DEVICE ERROR: NMT	The Prothermo NMT535/6/8 gives an error signal.	Check the Prothermo NMT535/6/8. Error messages are available in the Prothermo NMT535/6/8 manual.
LOCAL ERROR: NMT	The signal from the Prothermo NMT535/6/8 temperature sensor is not available.	Check the connection of the Prothermo NMT535/6/8. Check the register of the temperature sensor at position GVH=362 "CONNECTION NMT."
DEVICE ERROR: NRF	The Promonitor NRF560 gives an error signal.	Check the Promonitor NRF560. Error messages are available in the Promonitor NRF560 manual.
DEVICE ERROR: DEV1 (or 2)	The HART® device 1 (or 2) gives an error signal.	Check the HART® device 1 (or 2)

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

Appendix A: Settings after parts replacement

After any part of the Proservo NMS53x has been replaced, and before starting the Proservo NMS53x calibration, specify the data on the following equipment.

- Circumferential length of the wire drum
- Weight of the displacer (indicated on the body of the displacer)
- Volume of the displacer (indicated on the body of the displacer)
- Balance volume (indicated on the body of the displacer)
- Density of measured liquid (up to three layers)
- Height of the tank with the Proservo NMS53x mounted on it

Item	Procedure	Remarks
Matrix Group: SERVICE	1. In Static Matrix "MORE FUNCTION," bring up GVH=030 "MATIRX OF" and select "SERVICE." 2. Select Dynamic Matrix GVH=340 "WIRE DRUM CIRC." Check whether the displayed value is equal to the value marked on the wire drum. If not, adjust the displayed value.	• Set the access code at 50. • Set the access code at 51.
 Note: 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.	1. Select the Dynamic Matrix screen GVH=341. 2. Set Dynamic Matrix GVH=342 "DISPLACER WEIGHT" at the value marked on the displacer. 3. Set Dynamic Matrix GVH=343 "DISPLACER VOLUME" at the value marked on the displacer. 4. Set Dynamic Matrix "GVH=344 BALANCE VOLUME" at half the value set in "DISPLACER VOLUME. "This setting is provided to approximate the position of the displacer when it becomes stationary in the liquid, at the center of the straight pipe portion.	• For calculation methods of the draft position, see Appendix C.

Before starting the calibration of Proservo NMS53x, confirm the default values in the following table using the matrix table.

Basic data	Matrix position GVH
Setting for the weight of the wire (WIRE WEIGHT/10 m)	341
Setting for the unbalanced allowable volume when the displacer is balanced (VOLUME TOLERANCE)	345
Time from a change in level until a response is obtained from the displacer (DELAY)	347
Set a hunting count (DISP. HUNT. COUNT)	349

Initialization data	Matrix position GVH
Setting for the starting point for creating a weight table (DISPL. REFERENCE)	378
Setting for the lower weight limit used during calibration of the weight (ZERO ADJ. WEIGHT)	379

Adjustment data	Matrix position GVH
Setting for the upper limit stationary position of the displacer (UPPER STOP)	160
Setting for the lower limit stationary position of the displacer (LOWER STOP)	161
Setting for the upper limit of the weight of the displacer (OVER TENS. SET)	162
Setting for the lower limit of the volume of the displacer (UNDER TENS. SET)	163

Tank data	Matrix position GVH
Setting for the distance between the measurement port and the measurement table (TANK HEIGHT)	140
Setting for the difference between the reference position of the Proservo NMS53x and the position of the measurement table (DIP POINT OFFSET)	141

Appendix B: Intelligent Function

B.1 Measured Wire Length Calibration

After sustained periods of operation, measured liquid objects may be deposited on the wire or the wire drum, resulting in measurement errors. Therefore, periodically check the wire and the wire drum.

The screen GVH=175 "COMPENS. LIMIT" enables a tolerance to be set (the recommended value is 5.0 mm).

- If, at the displacer upper limit stationary position, the error for the wire and the wire drum exceeds the tolerance set in GVH=175 "COMPENS. LIMIT," an error message will be displayed on the LCD screen.

B.2 Displacer Weight Calibration

After sustained periods of operation, measured liquid deposited on the displacer increase the displacer's weight, resulting in errors. Thus, periodically, or arbitrarily, hoist the displacer and select GVH=180 "CALIBR. AUTO/MAN" and then invoke "AUTOMATIC," the weight of the displacer will be measured and calibrated. "MANUAL" can be selected for overwriting (the recommended value is 10.0 g).

- If the difference between the initial measured value of the weight of the displacer and the current measured value is within the tolerance set in GVH=185 "COMPENS. LIMIT", the Proservo automatically corrects the weight during level measurements.
- If the difference between the initial measured value of the weight of the displacer and the current measured value is beyond the tolerance, an error message is displayed on the LCD screen.

B.3 Maintenance Prediction Function

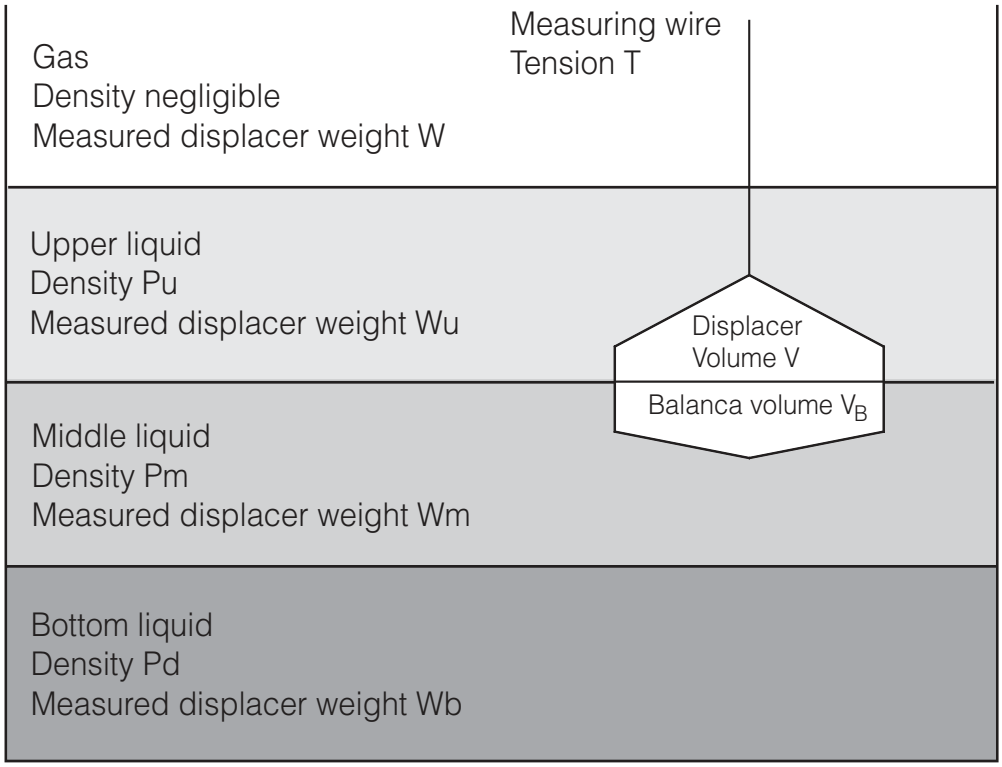
The history of maintenance is displayed on the Matrix screen GVH=265 "(Parts Overused Date)." The LCD screen displays the following contents.

- Total conducting 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

Appendix C: Calculation of Levels and Densities

This section specifies the formulae used by the Prosevo NMS53x to calculate 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:

- Surface $T \mu W - V_B r_u$
- Upper interface $T\mu W - V_B r_m - (V-V_B) r_u$
- Middle interface $T \mu W - V_B r_b - (V-V_B) r_m$

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

Tank Bottom Level

For bottom level measurement, the balancing condition is defined as

$$T \mu W - (V+V_B) r_b$$

Densities

The upper, middle, and bottom densities are calculated by the following formulae:

- Upper density

$$Pu = \frac{W - Wu}{V}$$

- Middle density

$$Pm = \frac{Wu - Wm}{V} + Pu$$

- Bottom density

$$Pb = \frac{Wm - Wb}{V} + Pm$$

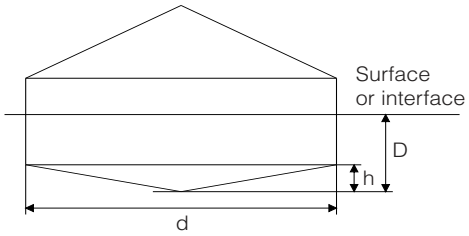
Draught

The draught depends on the shape of the displacer. For conical shape, the draught is

$$D = h + \frac{4000(Vs - V_1)}{d^2}$$

where the variables and constants have the following meanings;

V_2 Submerged volume
V_1 Volume of the lower cone
h Height of the lower cone
d Diameter of the displacer



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

The table shows the draught of a conical displacer with V1 = 4.23 ml, h = 7 mm, and d = 50 mm for some values of the submerged volume.

Vs [ml]	D [mm]
25	17.6
50	30.3
60	35.4
65	38.0

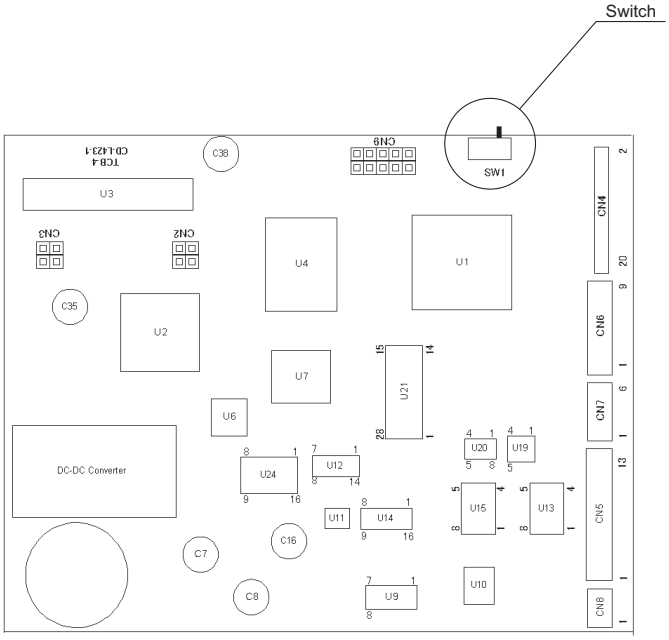
Appendix D: Sealing of the Proservo

The Proservo NMS53x can be sealed, and data can be made unchangeable for the custody transfer purpose as follows.

Set OPE. DENSITY at position GVH=278 as the density of the liquid. (If the density is expected to change during operation, then set the average value.)

Turn off the main supply, open the Proservo, and take the printed circuit board out of the enclosure.

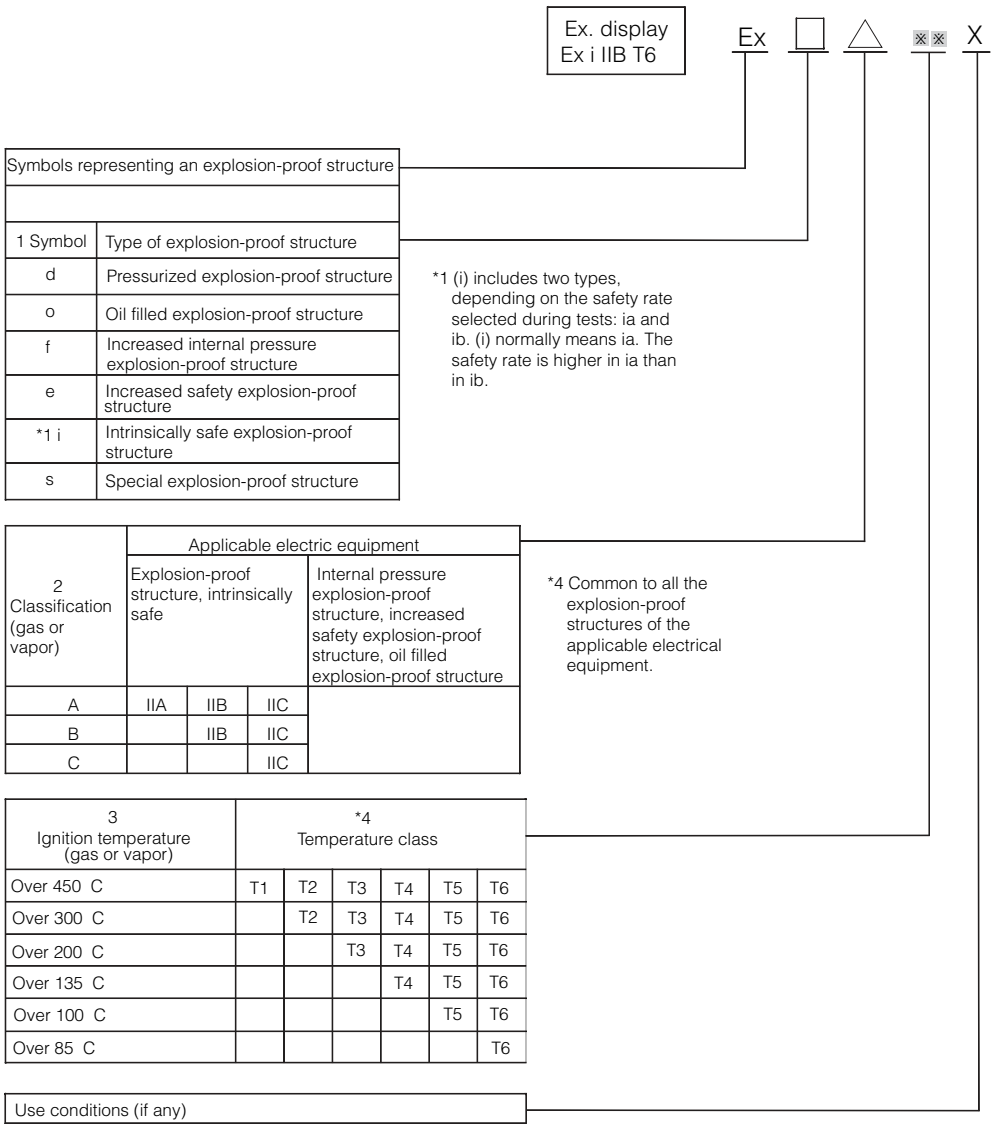
Turn a micro switch to “on position” on the printed circuit board TCB-4 (see figure below). The proservo will then set "write-protect" mode and not accept any change of level, weight, and density data.



- After the inspection by the authority is finished, the shroud will be sealed by the authority using a wire in its hole.

Appendix E: Technical Criteria of the Gas Vapor Explosion-Proof Structure

1) Indication Methods and Contents Sample indication



Symbols representing an explosion-proof structure	
1 Symbol	Type of explosion-proof structure
d	Pressurized explosion-proof structure
o	Oil filled explosion-proof structure
f	Increased internal pressure explosion-proof structure
e	Increased safety explosion-proof structure
*1 i	Intrinsically safe explosion-proof structure
s	Special explosion-proof structure

*1 (i) includes two types, depending on the safety rate selected during tests: ia and ib. (i) normally means ia. The safety rate is higher in ia than in ib.

2 Classification (gas or vapor)	Applicable electric equipment			
	Explosion-proof structure, intrinsically safe			Internal pressure explosion-proof structure, increased safety explosion-proof structure, oil filled explosion-proof structure
A	IIA	IIB	IIC	
B		IIB	IIC	
C			IIC	

*4 Common to all the explosion-proof structures of the applicable electrical equipment.

3 Ignition temperature (gas or vapor)	*4 Temperature class					
Over 450 C	T1	T2	T3	T4	T5	T6
Over 300 C		T2	T3	T4	T5	T6
Over 200 C			T3	T4	T5	T6
Over 135 C				T4	T5	T6
Over 100 C					T5	T6
Over 85 C						T6

Use conditions (if any)

2. Classification of Gas, Vapor, and the Applicable Electric equipment

Classification (gas or vapor)

- Classification of gas or vapor applied to electric equipment contained in the explosion-proof structure

Classification	Range of maximum safe gap for gas or vapor
A	Equal to or greater than 0.9 mm
B	Between 0.5 mm and 0.9 mm
C	Equal to or smaller than 0.5 mm

- Classification of gas or vapor applied to electrical equipment contained in the intrinsically safe explosion-proof structure

Classification	Range of maximum safe gap for gas or vapor
A	Equal to or greater than 0.8
B	Between 0.5 and 0.8
C	Equal to or smaller than 0.45

Note: The minimum ignition current ratio is indicated using the minimum ignition current for methane as reference.

3. Classification of Dangerous places

Type 0	Places where an explosive gas atmosphere may be continuously present for a long period of time.
Type 1	Places where an explosive gas atmosphere is likely to arise during normal operation.
Type 2	Places where an explosive gas atmosphere is unlikely to occur during normal operation. If it occurs, it is present for only a brief period of time.

* In accordance with the IEC Standard, types 0, 1, and 2 are expressed as Zone 0, 1, and 2.

Appendix F: Protection Class (IEC529)

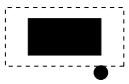
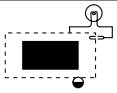
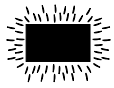
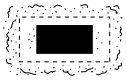
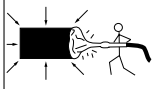
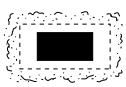
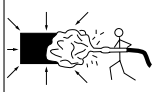
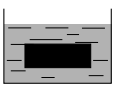
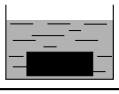
The IEC Standard 529 specifies a protection class for human beings and solid foreign matter as a first characteristic, and a protection class for the infiltration of water as a second characteristic, which are indicated by the protective structure of electrical equipment or enclosures. These protection classes are expressed as a protection characteristic symbol IP and two following digits; the first digit represents the first characteristic, while the second digit represents the second characteristic. If only one of the characteristics is indicated, X is inserted in the position of the other digit (for example, IP2X or IP5X).

IP ○ ○
- Second symbol (protection class for the infiltration of water 0 to 8)
- First symbol (protection class for human beings and solid foreign matter 0 to 6)
- Protection characteristic symbol (International Protection)

IP55... The protection class for human beings and solid foreign matter is 5, while the protection class for water proof is 5.

IP2X... The protection class for human beings and solid foreign matter is 2, whereas the protection class for water proof is not indicated.

IPX5... The protection class for water proof is 5, whereas the protection class for human beings and solid foreign matter is not indicated.

Protection for human beings and against solid foreign matter			Protection against the infiltration of water		
First symbol	Degree of protection		Second symbol	Not particularly protected	
0	Not completely protected.		0	Not completely protected.	———
1	No part of the body, such as a hand, with a large surface area will come into contact with any internal charging or movable section.		1	No adverse effects from vertically falling water drops; non-windy location, such as a basement.	
2	A fingertip can not touch any internal charging or movable \section.		2	No adverse effects from rain, even in an indoor or outdoor location that is exposed to both wind and rain	
3	The tip of a solid object such as a tool or a wire, which is larger than a specified size can not be inserted inside. The size is specified by classes.		3	No adverse effects from rain, even in an indoor or outdoor location that is exposed to both wind and rain.	
4			4	No adverse effects from rain or spray, on a tall iron tower that is subjected to horizontal or diagonal winds , or in a location that is subjected only to spray.	
5	The entry of dust is prevented. Normal operation is not inhibited even if some entry of dust occurs.		5	No advers effects from a direct jet of water in a periodically washed location.	
6	No dust can enter the inside of the unit.		6	No adverse effects from a direct, strong jet of water, for example, on the deck of a ship, where the equipment is subjected directly to waves.	
7	———	———	7	The equipment is not adversely affected if it is submerged in water under a specified pressure for a specified period of time, for example, when used beside a pool, where it may become submerged.	
8	———	———	8	The equipment can be continuously submerged in water if it must be used in that manner.	

Appendix G: Operation Commands and New Operation Status

Operation Commands

As explained at matrix details, operation commands are possible to send from host system. Following table explains operation commands including optional functions, i.e. density and/or interface level measurements.

Code	Longitutorial	Remarks
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	
0.	LEVEL	
1.	UP	

New Operation status

Following table shows the new operation status, which will be informed when “NEW NMS STATUS”, matrix position GVH=272, is selected to “ENABLED”. For W&M software, this matrix position is set “ENABLED” as a default setting.
Operation Status

No.	Code	Meaning	NMS Display
1	0	No definition	-
2	1	Displacer at reference position	REFERENCE
3	2	Displacer hoisting up	UP
4	3	Displacer going down	DOWN
5	4	Displacer stop	STOP
6	5	Level measurement, balanced	LEVEL
7	6	Upper I/F level, balanced	UPPER. INTERF. LEV.
8	7	Middle I/F level, balanced	MIDD. INTERF. LEV.
9	8	Bottom meas. Balanced	BOTTOM LEVEL
10	9	Upper S/G, finished	UPPER DENSITY
11	10	Middle S/G, finished	MIDDLE DENSITY
12	11	Bottom S/G, finished	DENSITY BOTTOM
13	12	Release over tension	RELE. OVER TENS.
14	13	Calibration activated	CAL. ACTIVE
15	14	Seek a level	LEVEL SEEKING
16	15	Follow a level	LEVEL FOLLOWING
17	16	Seek an upper S/G	UPP. DEN. SEEKING
18	17	Seek a middle S/G	MID. DEN. SEEKING
19	18	Seek a bottom S/G	BOT. DEN. SEEKING
20	19	Seek an upper I/F level	UPP. INT. SEEKING
21	20	Follow an upper I/F level	UPP. INT. FOLLOWING
22	21	Seek a middle I/F level	MID. INT. SEEKING
23	22	Follow a middle I/F level	MID. INT. FOLLOWING
24	23	Seek bottom level	BOTTOM SEEKING
25	24	no initialized	NO INITIALIZE
26	25	stopped at upper pos.	UPPER STOP
27	26	stopped at lower pos.	LOWER STOP
28	27	repeatability testing	REPEATABILITY
29	28	seeking a water level	WATER SEEKING
30	29	water level, balanced	WATER LEVEL
31	30	follow a water level	WATER FOLLOWING
32	31	over-/under tension, Z-Phase, ADC error	EMERGENCY ERROR

Appendix H: 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

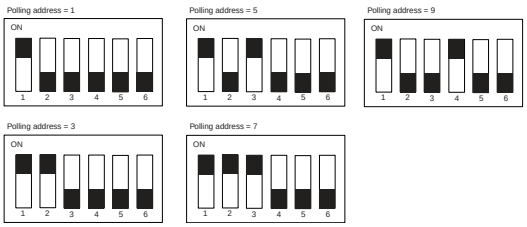
Loaded software into processor [IC1] is used; J3 has to be opened.
Software testing is required; J4 has to be opened
Software reset is required; J6 has to be shortened.

Polling address setting

Caution!
Polling addresses are set by mechanically at SW1 on WM550 communication board (not by accessing to NMS programming matrix!). Check all polling addresses before proceed all setting works. Following table shows about address setting.



Switch Position	Value
1	1
2	2
3	4
4	8
5	16
6	32



Setting Example

Note!
For current roop setting, please refer a operating manual for Whessoe 1098 or RTU8130 operating manual.



Appendix I: Mark/Space (M/S) Communication Board Setting

Jumper setting

Jumper settings for M/S communication board

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

Polling address setting



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

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



Setting Example (above example: 265)

Function setting
Each function is set with SW-2 as following table.

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 as measured temperature unit, OFF: Deg. C	OFF

Appendix J: ENRAF Bi Phase Mark Communication Board (COM-3) Setting

Jumper setting

COM-3 communication board jumper setting

Jumper	Function	Default condition
JP1	ROM type setting 1-2 short: 27C4096 2-3 short: 27C1024	2-3 short
JP2	CPU mode setting	1-2 open 3-4 short 5-6 short
J3	Baud rate setting 1-2 short: 1200 bps 1-2 open: 2400 bps	1-2 short

Communication setting

At the matrix position GVH=286, select “V1/ENRAF BPM”.

Polling address setting

Polling address setting is possible by accessing to the Proservo matrix, GVH= 285 “ADDRESS”. As polling address, 00 - 99 is possible to use.

Caution!
As polling address, A - F is not possible to use!

Others

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



Glossary

A

A/D converter	A circuit for converting an analogue signal into a digital signal.
Access Code	An identification number required to switch the matrix or to change set data
AD Count	A number that is a count value represents the digital signal into which the analogue output of the Hall sensor is converted.
Alarm Contact	A contact output if it reaches a certain value or meets a certain condition.
Alarm Relay	A relay that outputs a contact if it reaches a certain value or meets a certain condition.
Analogue Signal	A signal with a temporally continuous value
Anchor Weight	A weight used in the guide wire method when the wire hook cannot be welded to the bottom of the tank.
Asymmetric Pipe	A short pipe that is used for the steel pipe method and that is mounted between the pipe in the tank and the Proservo NMS53x flange to connect them by eccentrically varying its diameter if there is a difference between the pipe and the Proservo NMS53x flange in diameter.
Automatic Compensation	After a long operation time, deposits are collected on the Weight Data displacer, resulting in a change in the weight of the displacer. This function automatically corrects such change.

B

Balance	The displacer is balanced and can detect the level or the interface.
Balance Volume	The volume (ml) of that part of the displacer, which is submerged in the liquid when it is balanced.
Bearing Unit	A section that holds the shaft of the wire drum.
Burr	Protrusions that occur when steel pipes are welded, connected, or cut.

C

Cable	A collection of various conductors, which are provided with a cover.
Cable Gland	A fixture installed to draw the cable into the terminal box.
Calibration	Adjustment or calibration conducted after suspending the operation.
Calibration Window	A window for checking the position of the displacer after calibration.
Calibration Window Reference Line	A position or line used as a reference during calibration.
Chamber for Maintenance	A T-shaped, short pipe normally mounted for maintenance when the guide wire method and a pressurized tank are used.
Circumference of the Wire Drum	The length of the wire rolled around the wire drum per its rotation.

Common	A wire common to plural signals of the same type (potential)
Communication I C (SIFA)	A sensor interface ASIC (a customer IC) developed by Endress+Houser Inc. and having various functions. In Proservo NMS53x, it is used as an integrated circuit to process HART signals.
Concentric Pipe	A short pipe that is used for the steel pipe method and that is mounted between the pipe in the tank and the Proservo NMS53x flange to connect them by concentrically varying its diameter if there is a difference between the pipe and the Proservo NMS53x flange in diameter.
Conductivity	S/m or an inverse of the resistance rate (j/m). According to the Ohm's law, I = eE is established wherein (I) is the density of a current, "E" is an electrolytic strength, and e is a conducting rate.
Conical Displacer	A displacer shape.
Contact Output	A close signal that can be obtained when the relay is activated.
Correction of Balance	A condition in which the apparatus is operating very slowly to find a balance point.
Correction value for tank roof distortion	Distortion rate mm/m
Covered Floating Roof Tank	A tank with a double roof.

I

Insulation Voltage	Cables, the covers of which are not damaged if a disturbance of a relatively high voltage level occurs.
Intelligent Thermometer	A thermometer with a microcomputer (Prothermo NMT535/6/7 series thermometers)
Interface Measurement	Measuring the depth of the interface between multiple liquids if they are completely separated from each other.
Interface measurement	To measure the depth of the interface between multiple liquids that are completely separated from one another.
IP67 (water proof)	One of the protection class symbols specified in the JIS Standard.

J

Jumper Pin	A pin used to connect multiple portions in order to create a certain condition.

K

Kink	A condition in which the measuring wire is bent.

L

LCD	Liquid crystal display
Level	The level at which, during level measurements, the displacer is first balanced after being lowered from the reference position.
Level Measurement	A condition in which Proservo NMS53x detects the level.
Line Resistance	A value input to adjust the resistance of a transmission path used for communication with the exclusive receiver.

Low Weight	A set value required during adjustments in order to accurately measure the weight (0.0 g).
Lower Stop	The position at which the motor automatically stops when, during measurements, the value of the level, interface, or tank bottom falls below the set value.

M

Managed part	A part that is periodically changed.
Matrix Position	LCD display screens for the static and the dynamic matrixes.
Maximum Correction Value	The maximum value of the corrections (the weight of the displacer minus the measured weight) stored after the creation of a weight table.
Measurement Port	A port through which the operator inserts a measurement tape to measure the height of the liquid in the tank from its bottom.
Measurement Port Reference Position	A roof-side reference position for measurements.
Measuring Wire	A wire used to hoist the displacer.
Measuring Wire Tension	Applied tension when the measuring wire is pulled in the direction of the displacer.
Middle Density	The density of the intermediate layer of liquid when three types of liquids are separated from one another.
Middle Interface Level	The boundary between the intermediate layer of liquid and the lower layer of liquid when three types of liquids are separated from one another.
Minimum Weight Correction Value	The minimum value of the corrections (the weight of the displacer minus the measured weight) stored after the creation of a weight table.
Mounting Nozzle	A short pipe disposed at the top of the tank to mount Proservo NMS53x on it.

N

Normal Close	A contact is closed during normal operation and opened when a set value is reached.
Normal Open	A contact is open during normal operation and closed when a set value is reached.
Number of Cable Cores	The number of conductor cores accommodated in the covered cable.

O

Operation Parameter	Set values and data required for operations.
Optical Operating Element	A part (a product) that provides an optical signal when touched by a hand.
Output	Outputting information or data in Proservo NMS53x.
Over Tension	An error in which the weight detected by the detector exceeds the upper limit (set value).
Over Tension	A set value used to automatically stop level measurements if a weight larger than a specified value is applied to the measuring wire, in order to prevent the wire from snapping.

P

PE	Polyethylene (a synthetic resin)
Power Supply Cable	An electric wire that supplies power to the power supply section.
Power Unit	An electric circuit for generating power required to operate the apparatus.

Programming Matrix	A collective name for the static and the dynamic matrixes.
Pt100 ohm RTD Input	Platinum resistance 100 ohm input (spot thermometer input)
PTEE	Poly Tetra Fluore Ethylene; commonly referred to as “Teflon”.
PVC	Stands for Poly Vinyl Chloride (a synthetic resin).

R

RACK BUS	A digital signal used in a rack system commercially available from Endress+Hauser.
RACK BUS RS485	A digital communication method in which a rack bus is used for field communications.
Receiver Protocol	A unique address assigned to Proservo NMS53x in order to communicate with a receiver.
Relay Output	A contact signal output when the contact reaches a certain value or meets a certain condition.
Resistance	The longer a cable is or the smaller its cross section is, the more difficulty a current has in flowing through the cable. The resistance value represents the degree of such a difficulty.
Resistor input	An input to a spot thermometer.
Rod	A stick-like object used to adjust the weight of the displacer by somewhat raising the displacer.

S

Serial bus (pulse)	A signal that enables a large amount of information to be exchanged between multiple devices through two cables.
Serial Pulse Output	A form of signal communication in which data can be updated in both directions, that is, during both transmission and reception. Proservo NMS53x uses an exclusive pulse signal for this form of communication.
Spherical tank	A spherical tank that is often used as a high pressure tank.
Stilling Well	A steel pipe generally made of iron that is often used for a floating roof tank.
Support	A supporting plate for fixing the wire drum to the drum chamber.
SUS316	One of the metallic materials and their grades specified in the JIS Standard (SUS means stainless).
Static Matrix	A group of matrixes that display and set basic data for Proservo NMS53x.

T

Tank Bottom	The bottom surface of the tank (bottom plate, zero point)
Tank Roof Distortion	The degree of the expansion of the side and the bottom walls of the tank varies depending on whether the tank is empty or filled.
Tank Side Monitor	Displays at the starting portion of a companionway the same data on the level and temperature as in the Proservo NMS53x disposed on the tank (Promonitor NRF560).
Tape-armored Measuring Cable	One type of measuring cable that is used to provide mechanical protection against external force.
Terminal Block	A relay point used when equipment is connected to the cables and operated.

Terminating Resistance	An impedance that is used to terminate the transmission path and that is approximately equal to the characteristic impedance of the line.
Tolerance	A tolerance used in measurements. In the Proservo NMS53x matrix, it is considered to be a maximum value that can be output in the presence of an error.
Touch Control	The operator can touch the touch control to change the display and to carry out calibrations and operations.
Twisted Pair	One or more pairs of twisted cables wrapped by a metallic tape or net, which is further covered with an insulating material.

U

Ullage Level	The distance between the measurement port and the interface.
Unbalanced Status	A condition in which the displacer can not detect the level accurately.
Under Tension	A set value used to indicated when the weight detected by the detector is abnormally small compared to the weight of the displacer.
Upper Density	Density of the top layer of liquid, when three types of liquids are separated from one another.
Upper Interface Level	The boundary between the highest layer of liquid and the second highest layer of liquid, when three types of liquids are separated from one another.
Upper Plate	A metallic plate mounted immediately below the Proservo flange in the guide-wire method in order to fix the guide wires.

V

Valve	A valve for a pressurized tank, which releases the pressure from the tank during maintenance.
Very Accurate Measurement Mode	A mode used to guarantee higher accuracy in level measurements.
Voltage Drop	A phenomenon in which a current flowing through a resistor or an inductor causes the voltage to decrease.
Volume tolerance	Changes in weight, from balanced status to the beginning of the movement of the displacer, are based on this volume.

W

Weight Calibration	Adjustments provided to accurately measure the weight
Weight Correction Curve	A curve generated when the correction values (the weight of the displacer minus the measured weight) stored after the creation of a weight table are expressed in a graph.
Weight Table (drum correction values)	Correction values used to automatically save the imbalance on the diagonal line on the wire drum.
Wire drum	A part that the measuring wire is rolled around to convert the distance over which the displacer has moved into a rotational movement in order to transmit it to the detector.
Wire Hook	A fixture that is used for the guide wire method and around which the terminal of the guide wire is wound.
Without Guide System	A Proservo NMS53x mounting method that does not use the guide wires or the steel pipes.

Z

Z Phase Signal	One pulse output from the level encoder every 300mm.

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Declaration of contamination

Dear costumer,
Because of legal determinations and for the safety of our employes and operating equipment we need this "Declaration of contamination" with your signature before your order can be handled. Please put the completely filled in declaration to the instrument and to the shipping documents in any case. Add also safety sheets and/or specific handling instructions if necessary.

type of instrument / sensor: _____ serial number: _____

medium / concentration: _____ temperature: _____ pressure: _____

cleaned with: _____ conductivity: _____ viscosity: _____

Warning hints for medium used:



☐ radioactive ☐ explosive ☐ caustic ☐ poisonous ☐ harmful of health ☐ biological hazardous ☐ inflammable ☐ safe

Please mark the appropriate warning hints.

Reason for return:

_____

_____

Company data:

company: _____ contact person: _____

_____ _____

_____ department: _____

address: _____ phone number: _____

_____ Fax/E-Mail: _____

_____ your order no.: _____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

_____ _____

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