

Technical Information

Proservo NMS5

Intelligent Tank Gauge with High Accuracy Performance Liquid Level, I/F, Density & Density Profile Application



Application

Proservo NMS5 of intelligent tank gauges is designed for high accuracy liquid level measurement in storage and process applications. It fulfills the exact demands of tank inventory management, loss control, total cost saving and safe operation.

Typical areas of application include:

- Oil (fuels), LPG/LNG, Chemicals, Water / chemical interface measurement Alcohols
- Tank mounted intelligence makes the NMS5 ideal for single or multi-task installation, converting a wide range of measurement functions including:
- Liquid level, Interface level, Spot density, Density profile, Tank bottom, Water Drop

Features and Benefits

- SIL2 Certified
- Measures liquid to an accuracy of +/- 0.7 mm
- Measures two clear interface levels and specific gravity of
- up to three liquid phases
- Profiling of liquid density throughout the tank (Tank profile) and upper layer (I/F profile)
- Latest microtechnology keeps the design simple, lightweight and compact
- Wetted parts are completely separated from the electronic circuit
- Tank top mounting with 3" flange weighing only 12kg (aluminum version)
- Wide range of output signals including V1, RS 485, WM550, M/S, Enraf BPM and HART protocol
- Material and pressure rating of the wetted parts can be selected according to the application.
- Suitable for atmospheric and high pressure applications up to 2.45MPa/24.5bar
- Maintenance prediction of the instrument
- Direct connection of spot or average temperature probes
- Easy to program using the E+H matrix system
- Robust IP67/NEMA 4X housing
- Selectable English, Japanese or Chinese display
- Proactive safety diagnostics output to display and System Operators (patent pending)





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Important Document Information

Notes on Safety Conventions and Symbols

Symbols for Safety Conventions

| Symbol | Meaning |
|---|--|
|  | <p>DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.</p> |
|  | <p>WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.</p> |
|  | <p>CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.</p> |
|  | <p>NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.</p> |

Symbols for Certain Types of Information

| Symbol | Meaning |
|---|---|
|  | <p>Allowed Indicates procedures, processes or actions that are allowed.</p> |
|  | <p>Recommendation Indicates procedures, processes or actions that are recommended.</p> |
|  | <p>Forbidden Indicates procedures, processes or actions that are forbidden.</p> |
|  | <p>Tip Indicates additional information.</p> |

Function and System Design

System Design

NMS5 is an intelligent tank gauge for measuring liquid levels with high precision, and employing the latest microprocessor technology. In addition to gauging level, NMS5 can measure the interfaces between up to three liquids, specific gravity of each and discern tank bottom. To enable accurate volume calculation or simple indication, NMS5 will accept input from either an average temperature probe NMT 53x series (via twisted pair cables, HART protocol) or spot temperature element (via 3 wire Pt. 100 RTD signal). Once installed, all calibration and operating functions can be done via the user friendly Matrix program and touch sensitive keypad. Tank side monitoring and operation can be performed by the Promonitor NRF 560.

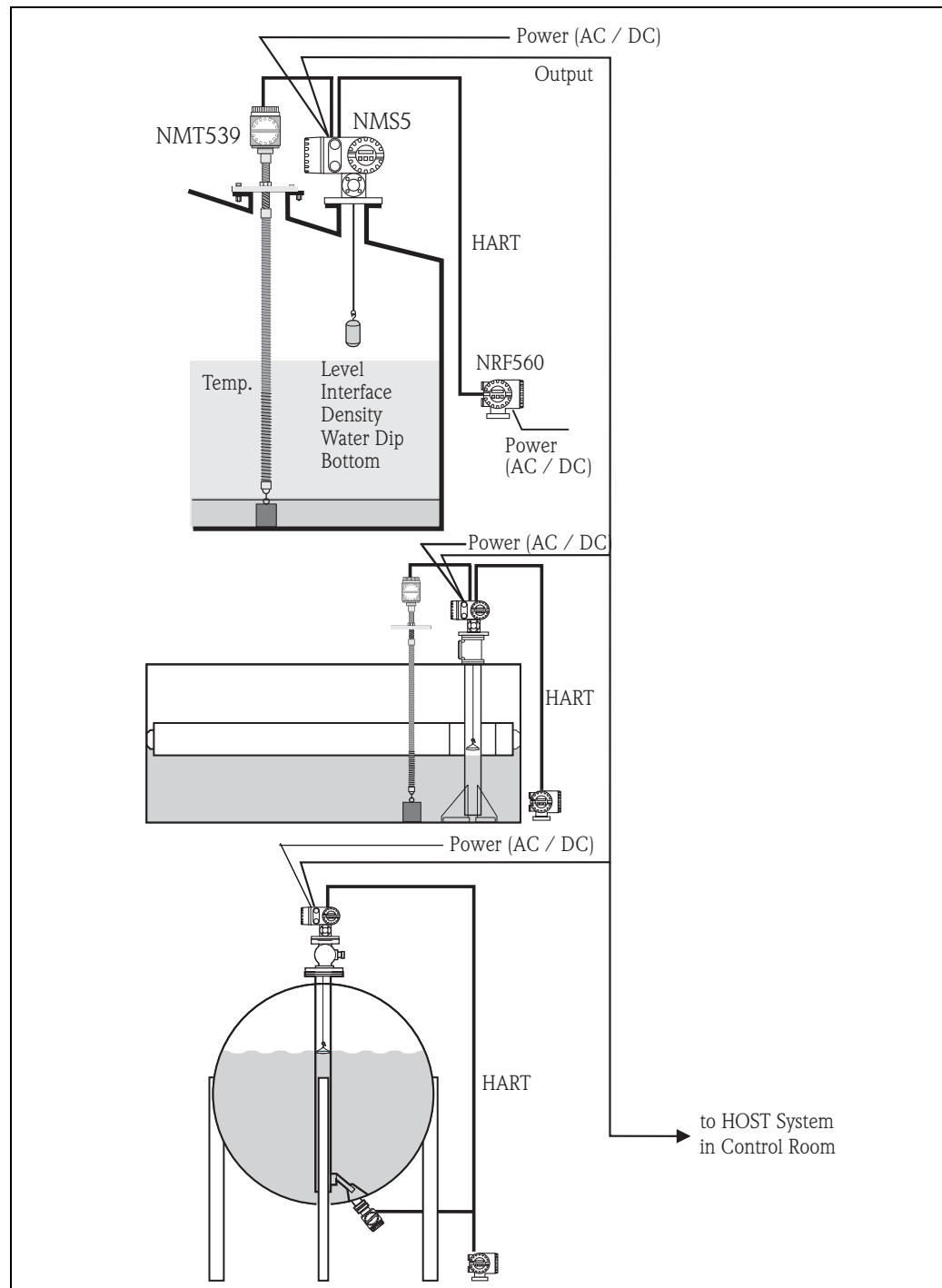


Figure 1: Measuring System

System Configuration

- From single tank level measurement to the largest oil refinery applications, NMS5 can be an integral part of tank farm management solutions. A wide variety of data output protocols are available for seamless integration into many commonly used systems.
- A primary example is Endress+Hauser’s revolutionary Tankvision., A scalable concept, offering local tank management for up to 225 tanks via Modbus, V1 or Whessomatic 550 protocols. Accumulated data is available to DCS and other plant management systems via a Host Link.
- Output protocols
 - Modbus, RS485 or current loop
 - V1 serial pulse
 - Whessomatic 550
 - local HART
 - Mark/Space
 - Enraf BPM

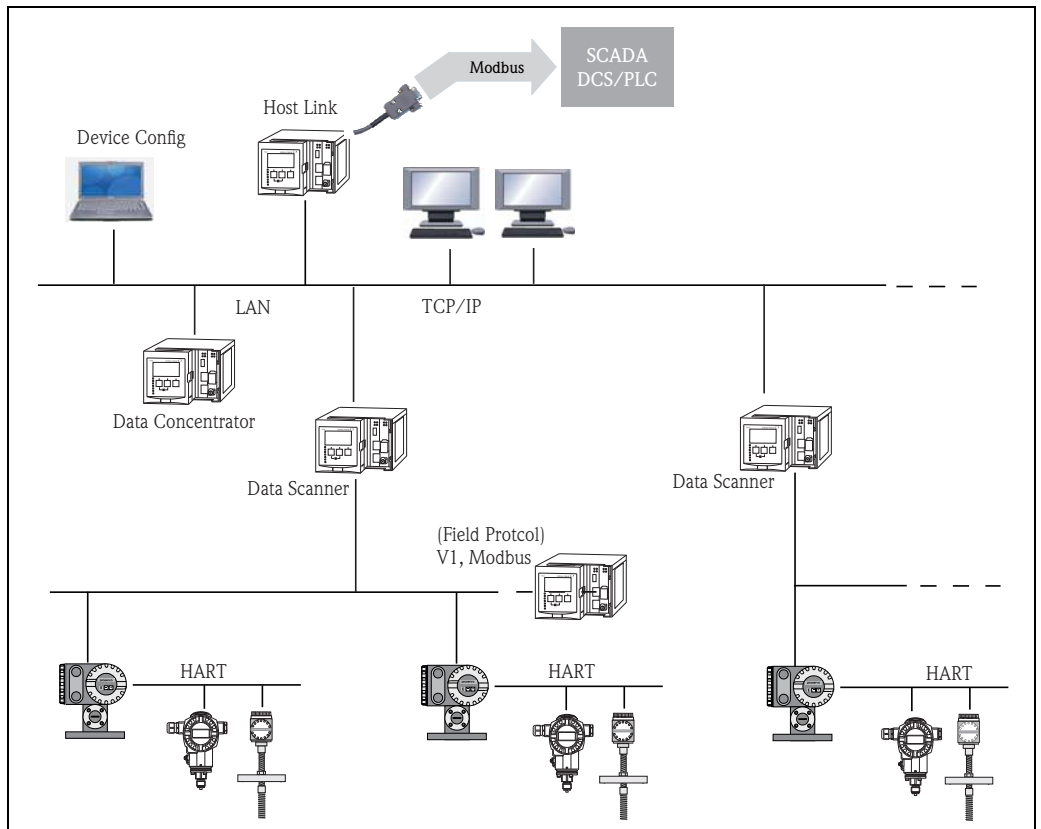


Figure 2: NMS5 system configuration Serial pulse output

Major Application

The number of measuring functions and output options as well as the lightweight compact design enables NMS5 to be installed in a wide range of applications at minimal cost.

Petroleum Industry

From oil production to storage at an oil depot, there exists an extensive need to measure and manage a wide variety of products. Remote tank gauging and an inventory management system combined into NMS5 and a receiving computer is an ideal way to measure and manage tank contents.

Chemical Industry

A wide choice of products are available in the wetted parts construction manufacturing industry, to ensure chemical compatibility and long life.

Power Plant

Fuel oil levels are a major applications where precise measurement is required to ensure safe operation.

Operating Principle

NMS5 tank gauging system is based on the principle of gauging displacement.

A small displacer is accurately positioned in a liquid medium using a servo motor. The displacer is then suspended on a measuring wire which is wound onto a finely grooved drum housing. NMS5 counts the rotation of the wire drum and calculates the traveling distance of the wire and then obtain the liquid level change.

The drum is driven via coupling magnets which are completely separated by the drum housing. Outer magnets are connected to the wire drum whilst inner magnets are connected to the drive motor. As the inner magnets turn, their magnetic attraction causes the outer magnets to turn, as well, causing the entire drum assembly to turn. The weight of the displacer on the wire creates torque on the outer magnets generating change of magnetic flux. These changes generated in the drum assembly are detected by a unique electromagnetic transducer on the inner magnets. The drive motor is actuated to balance the voltage generated by variations of magnetic flux to equal the reference voltage defined by operating commands.

When the displacer is lowered and touches a liquid, the weight of the displacer is reduced by liquid buoyancy force. As a result, torque in the magnetic coupling changes, which is measured by 5 sets of Hall sensors, (patented) chips which are temperature compensated. A signal, indicating the position of the displacer, is sent to the motor control circuit. As the liquid levels rise and fall, the displacer position is adjusted by the drive motor. The rotation of the wire drum is precisely evaluated to determine level value.

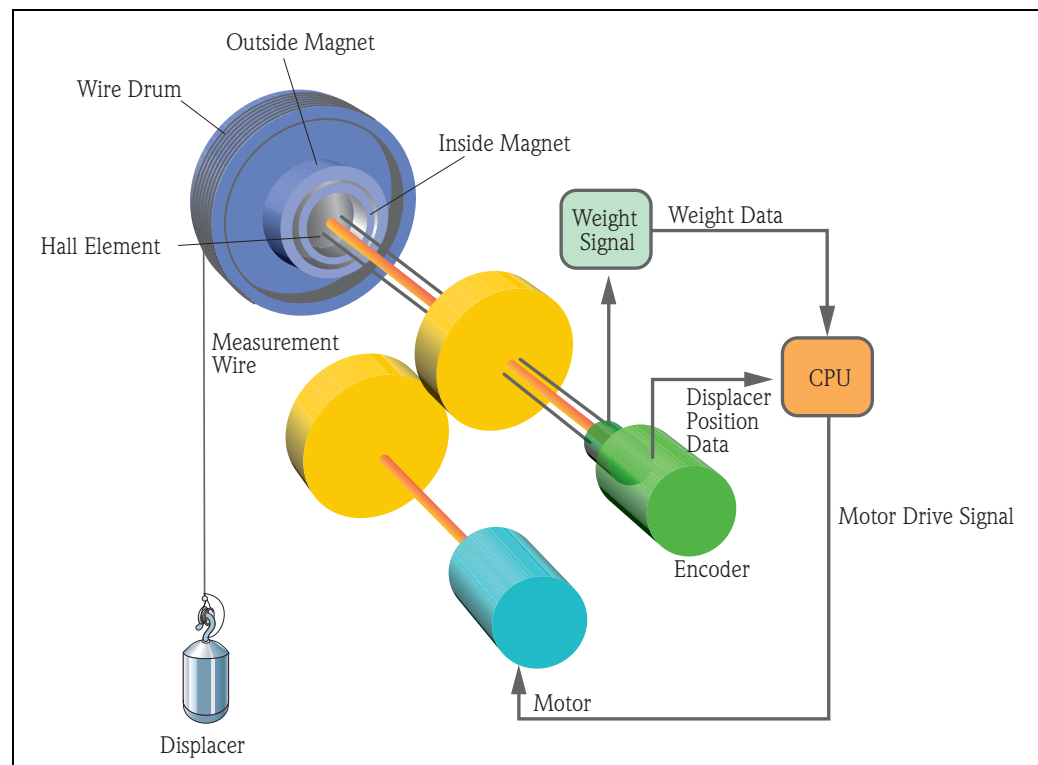


Figure 3: Direct Torque Detection

Typical Tank Installation

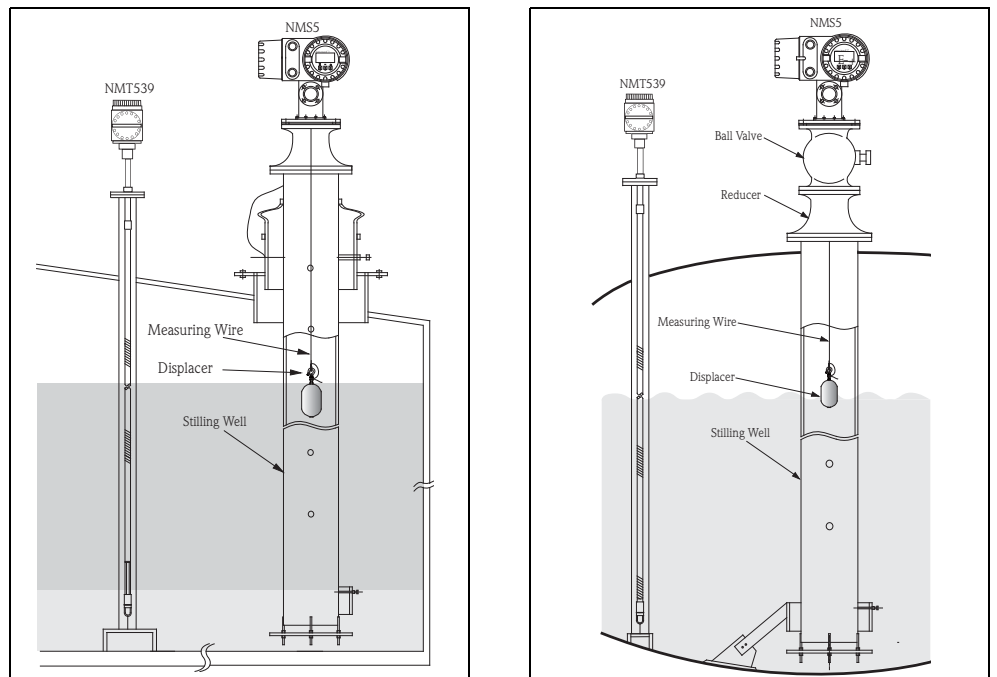


Figure 4: Fixed Roof Tank (Left) / High Pressure Tank (Right)

Floating Roof Tank/
Covered Floating Roof Tank

CAUTION

When installing NMS5 to floating roof tank, make sure to use stilling well.

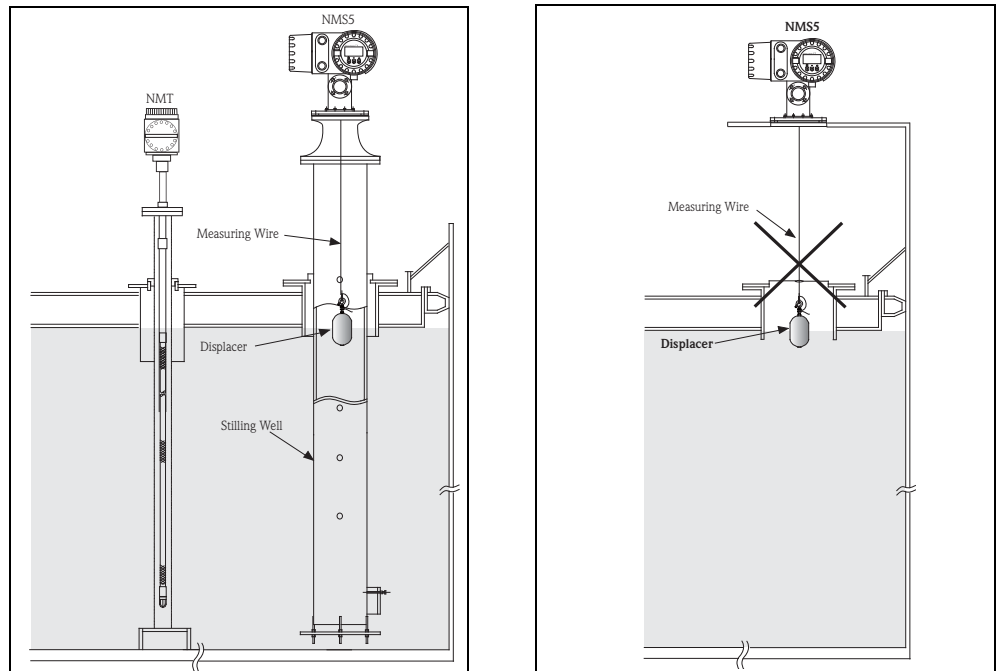


Figure 5: Floating Roof Tank

Measurement Terminology

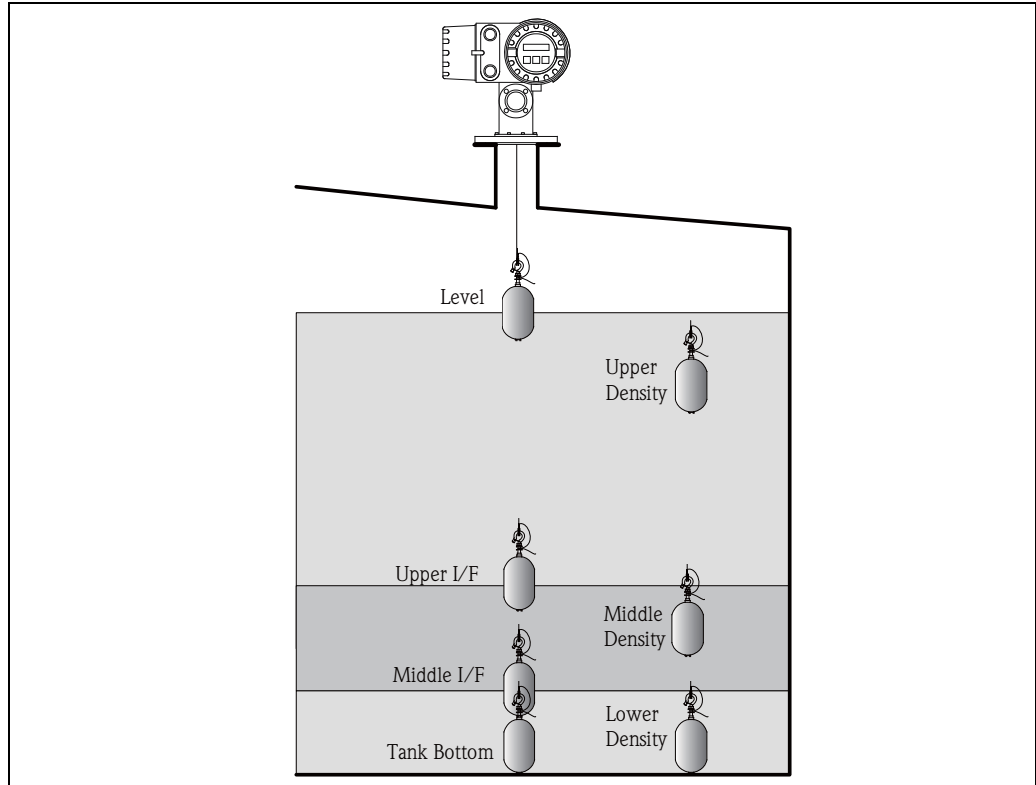


Figure 6: NMS5 with standard level, I/F x 2, Tank bottom and spot density x 3 measurement

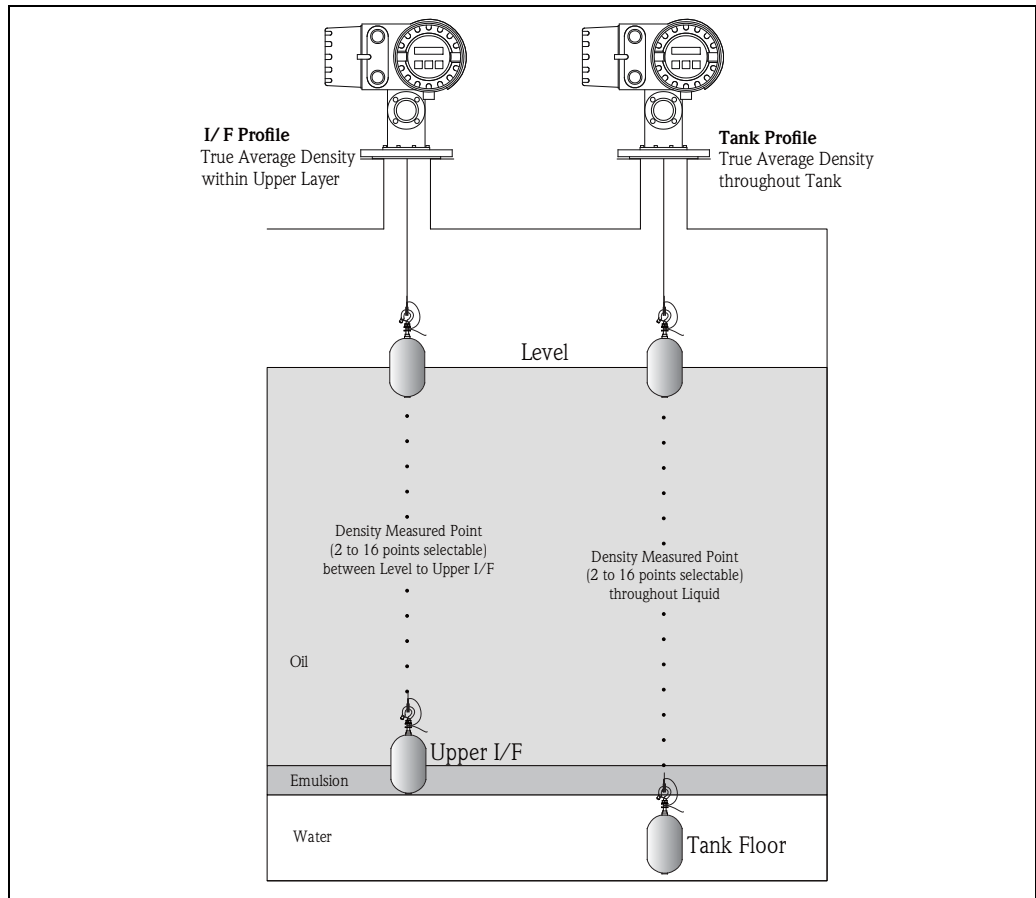





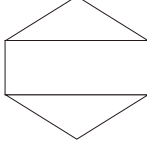
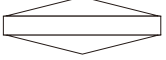
Figure 7: Density Profile measurement "I/F (Interface) Profile" (Left) "Tank Profile" Measurement Range (Right)

Application Selection

Displacer Selection Guide

A wide variety of displacers are available to meet your applications. Proper displacer selection ensures optimal performance and longevity. The following guidelines will assist you in selecting the ideal displacer for your application.

Displacer Types

| 30mm | 40mm | 50mm | 70mm | 110mm |
|---|---|--|---|---|
| ● ◆ | ● ◆ | ● ■ ◆ | ● | ● |
|  |  |  |  |  |
| (Standard materials available) | | | | |
| ● 316 ■ Alloy C ◆ PTFE | | | | |

Recommended Displacer by Application

| Application | Surface | Interface | Density |
|--------------------------|---------------------------|---------------------------|---------------------------|
| Viscous | 50mm PTFE | Not Recommended | Not Recommended |
| Crude | 50mm 316 50mm PTFE | 50mm 316 50mm PTFE | 50mm 316 50mm PTFE |
| Black oil | 50mm 316 | 50mm 316 | 50mm 316 |
| White oil | 50mm 316 | 50mm 316 | 50mm 316 |
| Liquefied gases, LPG/LNG | 70mm 316 | 70mm 316 | 50mm 316 |
| Aggressive | 50mm Alloy C 50mm PTFE | 50mm Alloy C 50mm PTFE | 50mm Alloy C 50mm PTFE |
| Custody Transfer | 70mm 316 110mm 316 | N/A | N/A |

NOTICE

The above table is for 80A (3") mounting flange or larger.

Point to Confirm**Application:**

What will be the primary measurement function in your application? Most applications can be generalized into three classifications: level data, density data, or both. NMS5 is primarily a highly accurate level measurement gauging instrument, with the added ability to measure density. Level is derived by determining fluid surface level, interface level(s) between different liquids, as well as finding tank floor or datum plate. Density served from single-point (called “spot” measurements), as well as profile measurements of all liquid(s) in a tank.

Surface Level:

In general, larger diameter displacers have better accuracy under similar conditions.

Interface Level(s):

Cylindrical-shaped displacers, with rounded top and bottom, reduce resistance while moving through liquid(s). Thus, providing smoother movement and faster interface measurements, compared to flat-based displacers, particularly in density profile measurements that span the full tank height.

⚠ CAUTION

Note that in order for a displacer to travel down through liquid(s), displacer density (its weight divided by its volume) must be higher than liquid(s) density.

Tank-bottom/Datum Plate Level:

(same as for Interface Levels)

Density:

Since the density is the calculated result of two or more measurements, a displacer with higher volume will usually yield the most accurate density measurement. In most cases we recommend our 50mm diameter displacer for density measurement.

Level and Density:

When an application calls for equal importance placed on measuring both level and density, the 50mm diameter, cylindrical displacer will give the best all-around performance.

Custody Transfer

What is the requirement for Custody Transfer approval?

- The 70mm, conical, 316 displacer is the choice for requirements per NMI
- The 110mm, conical 316 displacer is the choice for requirements per PTB

Material Compatibility

What are the liquid(s) characteristics of your application? Displacers are available in three different standard materials. Material compatibility should be confirmed to ensure safe operation and optimal NMS5 performance.

316:

Stainless steel is a highly versatile industrial material and provides good compatibility with a wide range of chemicals, including most white and black oils.

Alloy C:

This high-performance material is harder than 316, and provides excellent resistance to many of the harshest corrosive chemical applications.

PTFE:

One of the most well-known and versatile polymer materials, this high-performance material has one of the lowest friction coefficients. It provides excellent performance in viscous/sticky liquids, and also has excellent chemical resistance to a wide range of corrosives

Process Connection Size

The process connection defines the tank process entry, and may affect displacer size. The standard NMS5 process connections start at 3”/DN80 and fit most tank gauging applications. Accordingly, most applications can be covered with one of the 50mm or 70mm displacer options. Smaller diameter displacers are available when the process connection is smaller.

⚠ CAUTION

Note that, when the 110mm diameter custody transfer approval (PTB) displacer is selected, a separate calibration and maintenance chamber is recommended between the NMS5 and tank process connection.

Input and Output

Input for Local Devices

| | |
|------------------|---|
| Signal | Multi drop local HART protocol max. 4 devices |
| Power supply | DC 24V |
| Additional units | NMT 53x average temperature sensor NRF 560 field data processor Other - compatible HART devices Spot temperature Pt 100 Ohm ISO standard three wire connection |

Output Parameters based on Communication Protocol

| | V1 (new) | V1 (old) | MODBUS | HART | WM550 | ENRAF | M/S |
|-----------------------------------|----------|----------|---------|------|--------|-------|-----|
| Level | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Temperature (Product) | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Vapor Temperature | Yes | - | Yes | Yes | Yes | - | - |
| Upper I/F (Water Level) *1 | Yes | - | Yes | Yes | Yes | Yes | - |
| Middle I/F | Yes | - | Yes | Yes | - | - | - |
| Upper Density *2 | Yes | - | Yes | Yes | Yes | - | - |
| Middle Density*3 | Yes | - | Yes | Yes | | - | - |
| Lower Density*4 | Yes | - | Yes | Yes | | - | - |
| Average Density *5 | Yes | - | Yes | - | Yes | - | - |
| 1-16 points Individual Density *6 | Yes | - | Yes | - | - | - | - |
| Multi-Element Temperature | Yes | - | Yes | Yes | Yes | -- | - |
| HART device input (Device 1) | Yes | - | Yes | Yes | Yes | - | - |
| HART device input (Device 2) | Yes | - | Yes | Yes | Yes | - | - |
| Alarm data | Yes | Yes | Yes | Yes | Yes | Yes | - |
| Protocol Documentation | - | - | KA0002N | - | KA001N | - | - |

⚠ CAUTION

- Upper I/F output value can be either selected from the Proservo's own displacer measurement or Water Bottom measured value via the Prothermo NMT 539.
- A single point density measurement within the upper layer liquid in the tank. The measurement position is configured to 150mm below the liquid surface at default.
- A single point density measurement within the middle layer liquid in the tank. The measurement position is configured to 150mm below the upper interface level at default.
- A single point density measurement within the lower layer liquid in the tank. The measurement position is configured to 150mm below the middle interface at default
- The value of this "Average Density" is based on the calculation after performing the Density Profile operation at the Proservo.
- All of the selected number of density measured value from 1 ~ 16 points can be transmitted.

RS485 Modbus

| | |
|-----------------------|--|
| Module name | Commdule RS 485 communication module (~2008), COM - 5 (2009~) |
| No. of unit | Maximum 10 instruments per loop |
| Baud rate | 600/1,200/ 2,400/ 4,800/ 9,600/ 19,200 bit/s, selectable |
| Parity | Odd, Even, None, selectable |
| Cable | Two wire twisted cable with screening (DGND is connected to the ground cable) |
| Topology | Serial bus, electrically isolated, tree structure |
| Transmission distance | Maximum 1,200 m including limbs or branches (negligible with branches under 3 m) |
| Instrument address | Accessed via touch control |
| Isolation | Bus inputs are electrically isolated from the other electronics |

**Bidirectional Serial Pulse
(V1 Protocol)**

| | |
|-----------------------|---|
| Module name | COM - 1 |
| No. of units | Maximum 10 instruments per loop |
| Baud rate | 3,300 BPS |
| Cable | Two wire (twisted pair) unshielded cable |
| Topology | Serial bus, tree structure |
| Transmission distance | Maximum 6,000 m |
| Instrument address | Accessed via touch control |
| Isolation | Serial communication circuit isolated from other circuits |

HART Protocol

| | |
|-----------------------|--|
| Module name | Commdule HART (2009), COM - 6 (2009~) |
| No. of units | Maximum 15 instruments per loop |
| Baud rate | 1,200 BPS |
| Cable | Two wire, twisted pair screened cable Minimum core ϕ 0.15 (24AWG) |
| Transmission distance | Maximum 1,200 m |
| Instrument address | Accessed via touch control |
| Isolation | Bus input are electrically isolated from the other electronics |

Whessoematic 550

| | |
|-----------------------|---|
| Module name | WM550 communication module |
| No. of units | 15 instruments per loop (connected to RTU) |
| Baud rate | 1,200 / 2,400 bit/s |
| Cable | Two wire, twisted cable with screening |
| Topology | 20 mA current loop |
| Transmission distance | Depending on specifications (ask your E+H engineer) |
| Instrument address | Setting by DIP switches on communication board |
| Isolation | Current loop circuit isolated from other circuits |

Mark/Space

| | |
|-----------------------|---|
| Module name | Mark/Space communication module |
| No. of units | Depending on specification (ask to your E+H engineer) |
| Baud rate | 1,200 / 2,400 / 4,800 / 9,600 / 19,200 bit/s |
| Cable | Four wire |
| Topology | Serial bus, tree structure |
| Transmission distance | Depending on specifications (ask your E+H engineer) |
| Instrument address | Setting by DIP switches on communication board |
| Isolation | Serial pulse isolated from other circuits |

Enraf Bi Phase Mark (BPM)

| | |
|-----------------------|---|
| Module name | COM - 3 |
| No. of units | Maximum 10 instruments per loop |
| Baud rate | 1,200, 2,400 bit/s, selectable |
| Cable | Two wire, twisted cable with screening |
| Topology | Serial bus, electrically isolated, tree structure |
| Transmission distance | Maximum 10 km |
| Instrument address | Accessed via touch control |
| Isolation | Serial communication circuit isolated from other circuits |

Analogue Output

| | |
|----------------------|--|
| Module name | I/O - 5 |
| Output | 4 to 20 mA, active, two channels freely assignable value |
| On alarm | Switchable Max. 22mA, Min. 2mA or hold last measured value |
| Electrical isolation | Analogue output isolated from other circuits |
| Maximum load | 500 ohm |
| Conversion Accuracy | +/-0.3% |

Relay

| | | | |
|---|--|----------------------------|--------------------------|
| Module name | I/O - 3 | | |
| Alarm output, Standard (Order Code position 050= 1,2,3 or 5) | 4 relays with potential-free change-over contacts, freely assignable to measured value | | |
| Hysteresis, Alarm output | Switch points and switching hysteresis freely adjustable, residual current fail-safe mode: minimum or maximum, selectable | | |
| Operation output logic | | Relay Condition | |
| | Initial Configuration (Normal Status) | Open | Closed |
| | On alarm | Closed | Open |
| | On device error | Closed | Open |
| | On abnormal power supply (5% lower than, higher than specified power supply) | Custody Transfer Closed | Custody Transfer Open |
| | Power outage | Hold last condition | |
| Switching capacity, Alarm output | <ul style="list-style-type: none"> ▪ Max. 250VAC, 2A/62.5W ▪ Max. 220VDC, 2A/60W ▪ FM/CSA: 30VAC, 2A/42VDC, 2A, 60W ▪ TIIS: 250VAC, 1.5A/30VDC, 9W | | |

| | | |
|--|--|-----------------|
| Alarm output, Overspill prevention (Order Code position 050=4) | 2 relays with potential- free changeover contacts, assignable to Level | |
| Hysteresis, Alarm output | Switch points and switching hysteresis freely adjustable, residual current fail-safe mode: minimum or maximum, selectable | |
| Operation output logic | | Relay Condition |
| | Initial Configuration (Normal Status) | Closed |
| | On alarm | Open |
| | On device error | Open |
| | On abnormal power supply (5% lower than, higher than specified power supply) | Open |
| Power outage | Open | |
| Switching capacity | <ul style="list-style-type: none"> ▪ Umax. 200VDC/200VppAC ▪ Imax. 0.5AC, DC or peak AC ▪ Pmax. 15W | |

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

Auxiliary Energy (Wiring for Primary Output)

V1 Serial Pulse
 Modbus RS 485
 HART Enraf BPM

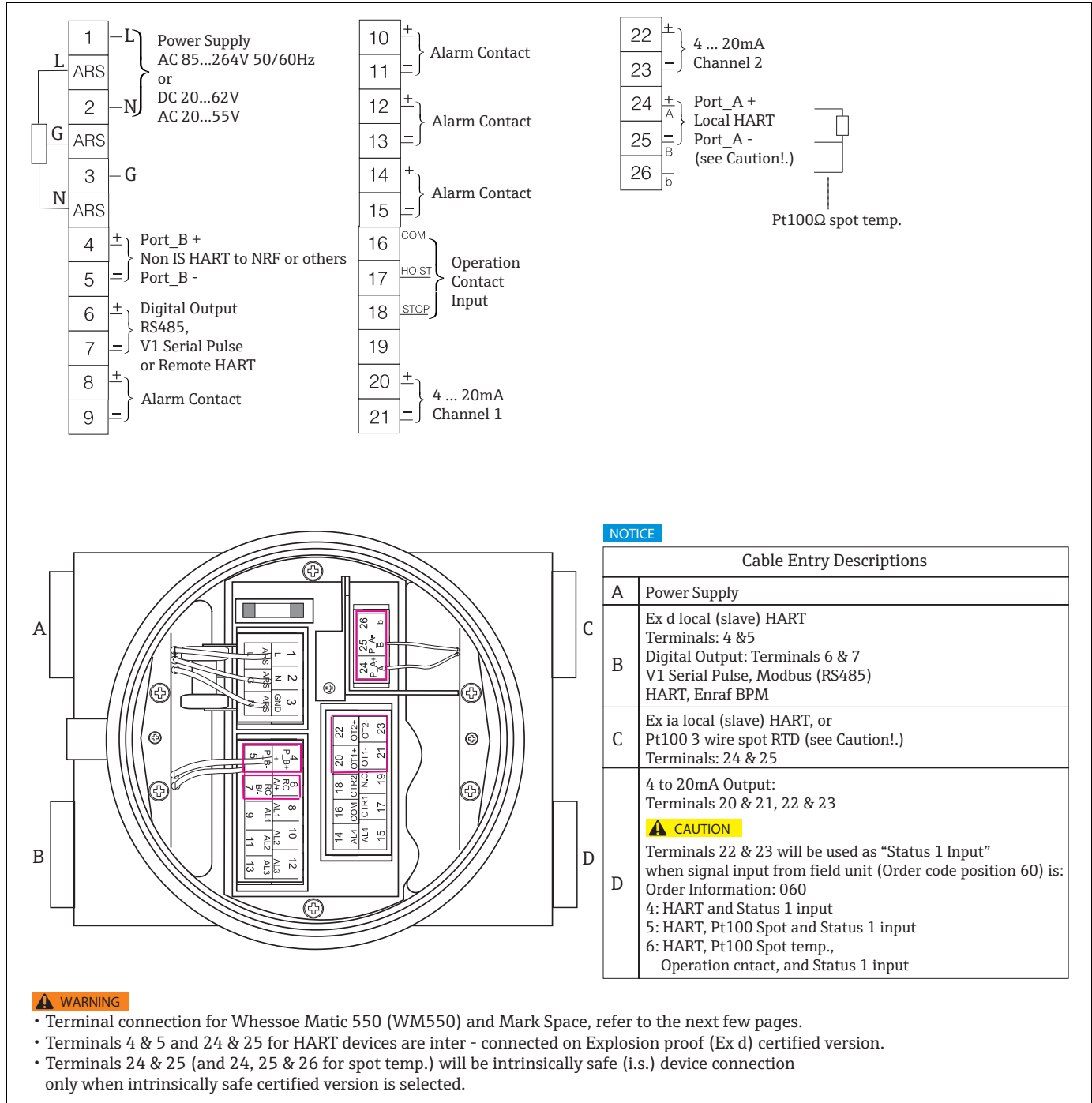


Figure 8: Wiring Sample 1

Whessoematic 550

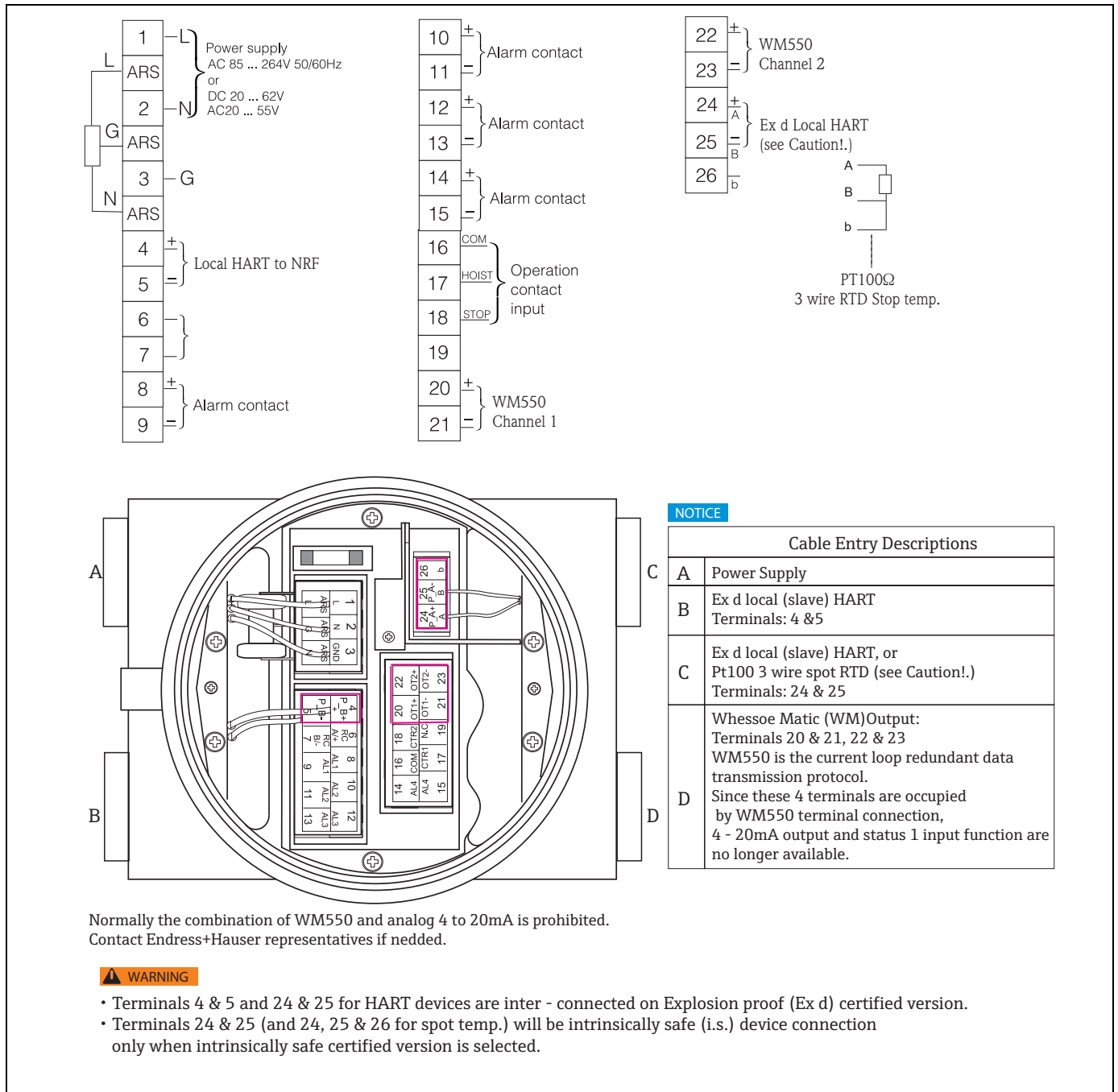


Figure 9: Wiring Sample 2

Mark/Space

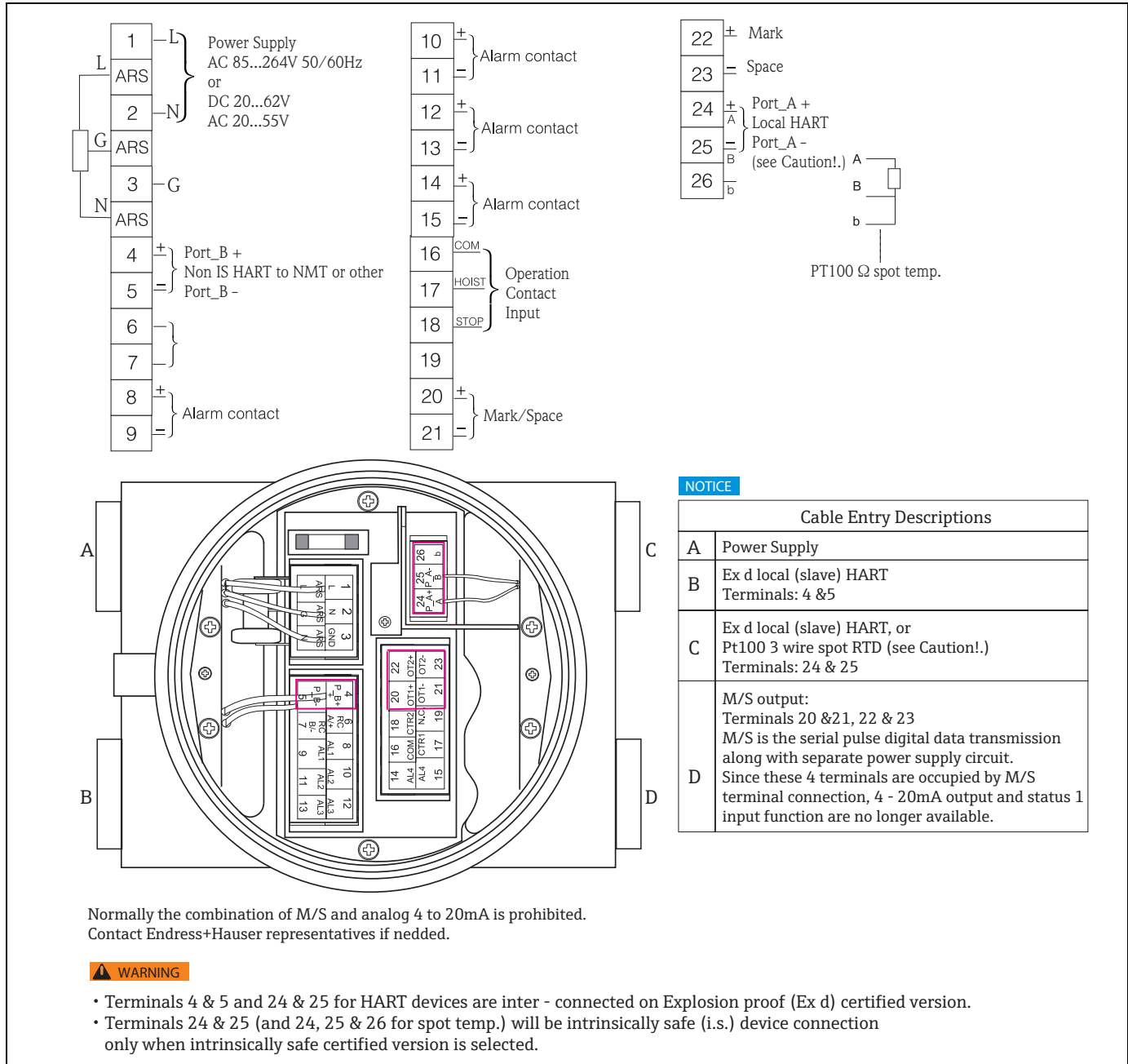


Figure 10: Wiring Sample 3

Cable Entry

Thread: G1/2, 3/4
NPT1/2,3/4
M20, 25
*TIIS: G only, CSA: NPT only

Overvoltage Protection

NMS5 has internal surge arrester which complies with EN/IEC 61000-4-5 (Line to Line 1.0kV, Line to ground 2.0kV) Connect the metallic housing of the NMS5 to the tank wall or screen directly with an electrically conductive lead to ensure reliable potential matching.

Supply Voltage

High voltage type: 85 to 264 VAC, 50/60 Hz
Low voltage type: 20 to 62 VDC / 20 to 55 VAC 50/60Hz



Allowable voltage supply is specifically stated depending on each Ex approval. Refer to the designated certification

Power Consumption

Maximum 50 VA, 50W

Safe Electrical Isolation

Between power supply and signal output, CPU, RS 485, relay and other electronics

Performance Characteristics

Maximum Measured Error

| | |
|--------------------|---|
| Level | $\pm 0.7\text{mm}$ ($\pm 0.027\text{ inch}$)* ¹ |
| Interface | $\pm 2.7\text{ mm}$ ($\pm 0.106\text{ inch}$)* ² |
| Density | $\pm 0.005\text{ g/cm}^3$ * ³ |
| Sensitivity | $\pm 0.1\text{ mm}$ ($\pm 0.004\text{ inch}$) |
| Motion delay timer | Configurable in 20ms steps from 0 to 9.9 seconds |

*¹ : Under reference conditions

*² : Difference of product densities 100kg/m^3 ($6.25\text{ lb}/\text{ft}^3$)

*³ : (optional) when calibrated and equipped for density measurement

Compensation

Displacer

Automatic compensation of displacer weight

Tank Wall

Compensation of depression and distortion

Operating Conditions: Environment

Bus Connection

Modbus (RS485 Output)

Termination Resistors

Set terminators as required in specific environments.

Bus Address

Each transmitter has an individual bus address configured in the software of the transmitter.

Bus Cabling

The bus cabling is galvanically isolated from the transmitter and the PC plug-in board or the interface adapter. The screening must be grounded and have electrical continuity throughout.

Bus Topology

When planning a system, attention should be paid to possible segmentation of the bus according to individual plant sections. Suitable topologies are:

- Tree of total length 1200 m
-

Sakura V1 Serial Pulse Output

The bus is connected to a RTU8, Tankvision or other Endress+Hauser V1- type receiver. The interface or receiver must be configured accordingly.

Termination Resistors

It is not necessary to set any termination resistors for serial pulse output.

Bus Address

Each transmitter on a signal loop has an individual bus address. This is defined within the transmitter software.

Bus Cabling

The bus cabling is electrically isolated from the transmitter and from the interface receiver. Standard communication cable (non-shielded twisted pair cable) can be used for the data transmission.

Bus Topology

The suitable topologies for the serial pulse output are:

Serial max. 6000m (Sakura V1)

Tree of total length 6000 m. (Sakura V1)

Enraf Bi Phase Mark Output The bus is connected to an Enraf I/F CIU or RTU8 to transmit measured value to upper host system as Entis (Enraf TG program) or Fuels Manager. These interface must be configured accordingly.

Termination Resistors

It is not necessary to set any termination resistors for serial pulse output.

Bus Address

Each transmitter on a signal loop has an individual bus address. This is defined within the transmitter software.

Bus Cabling

The bus cabling is electrically isolated from the transmitter and from the interface receiver. Standard communication cable can be used for the data transmission.

Bus Topology

The suitable topologies for Enraf BPM serial pulse output are:

Serial max. resistance: 400 ohm at 3 bus loops or less (10 transmitters per 1bus loop)

Serial max. capacitance: 1 micro F or less

Data Transmission & Operation

NMS5 is capable to transmit following sensory data as well as gauge operation command via Enraf BPM serial pulse output.

- Data: level, temperature, operation status
- Gauge command: STOP, UP, LEVEL, I/F

HART Output

The bus is connected to a HART master. The HART master must be configured accordingly.

Bus Address

Each transmitter on a signal loop has an individual bus address. This is defined within the transmitter software and / or auxiliary configuration environment such as host system or Field Communicator 375.

Bus Cabling

The bus cabling is galvanically isolated from the transmitter and the PC plug-in board or the interface adapter. The screening must be grounded and have electrical continuity throughout. EMC tests indicate the best result when the grounding at both ends and each transmitter is established. If there is a potential difference in between the grounds, measurement must be taken to equalize whilst observing a relevant hazardous area.

Bus Topology

The suitable topologies are:

Serial max. 1000 m

Tree of total length 1000 m.

Whessoematic 550 (WM 550) Output

The bus is normally connected to Whessoe 1098, RTU 8 or other upper host system via dual channel (can be single) WM550 current loop.

Termination Resistors

Admissible termination resistance should be calculated as follow.

- $R = [V_a - \{n \times (V_b + V_c)\}] / 0.02$
- R = terminal resistance in the system
- n = number of transmitter in the system
- V_a = max. available voltage at receiver
- V_b = voltage drop across transmitter
- V_c = voltage drop across receiver

Bus Address

Each transmitter on a signal loop has an individual bus address. This is defined within the transmitter by mechanical dip switch on com board.

Bus Cabling

The bus cabling is galvanically isolated from the transmitter and the PC plug-in board or the interface adapter. BS5308 or equivalent 1.5sq.mm screened twisted pairs are recommended for bus cabling.

Bus Topology

The suitable topologies for the WM550 current output are depending on number of transmitter & cable quality on the loop. Recommended number of transmitter on single loop shall be less than 15 units to achieve the maximum performance.

Varec Mark Space (M/S) Output

The bus is normally connected to Interface Unit (IFU), Data acquisition Processor (DAP), RTU 8 or other upper host system via 4 wire M/S serial bus link.

Termination Resistors

Admissible termination resistance should be calculated as follow.

- $R = (48 - 33) / \{60\text{mA} + N (2.0\text{mA})\}$
- R = terminal resistance in the system
- N = number of transmitter in the system
- 48 = supply voltage to receiver
- 33 = minimum M/S board operation voltage
- 60mA = required current for system operation
- 2.0mA = required current per transmitter

Bus Address

Each transmitter on a signal loop has an individual bus address. This is defined within the transmitter by mechanical dip switch on com board.

Bus Cabling

The bus cabling is galvanically isolated from the transmitter and the PC plug-in board or the interface adapter. The total length of field wiring shall be determined by calculation of maximum resistance within the system & required operation current. Once the total length is determined, distance has to be reduced by half because of current flow in both B+ & B- leads.

Bus Topology

The suitable topologies for the M/S serial pulse output are depending on number of transmitter & cable quality on the loop.

Ambient Temperature

-20 to +60°C (-4 to 140°F)
 -40 to +60°C (-40 to 140°F) ATEX approval cold temperature version

Storage Temperature

-40 to +60°C (-40 to 140°F)

Liquid Temperature

-200 to +200°C (-328 to +392°F)

Degree of Protection

IP 67, NEMA4x with closed housing and cable glands

Electromagnetic Compatibility (EMC)

Electromagnetic compatibility meets with EN 61326-1.

Operating Condition: Process

Process Pressure

| | Aluminum Drum Housing | Stainless Drum Housing |
|---|-----------------------|------------------------|
| 0 to 19.8kPa (Low Pressure) | NMS5-1 | NMS5-2 |
| 0 to 588kPa (Medium Pressure) | NMS5-4 | NMS5-5 |
| 0 to 2.45MPa (High Pressure) | | NMS5-6 |
| Maximum process pressure of JIS 10k/ASME Cl. 150/DIN PN10/JPI 150lbs: 0.98MPa | | |

Measuring Range

Level

| | |
|---|-----------------|
| 28m | Standard Option |
| 36m | Standard Option |
| 47m | Standard Option |
| Longer ranges available upon request. Contact Endress+Hauser representatives. | |

Density

0.430 to 2.000 g/cm³

Mechanical Construction

Design and Dimensions

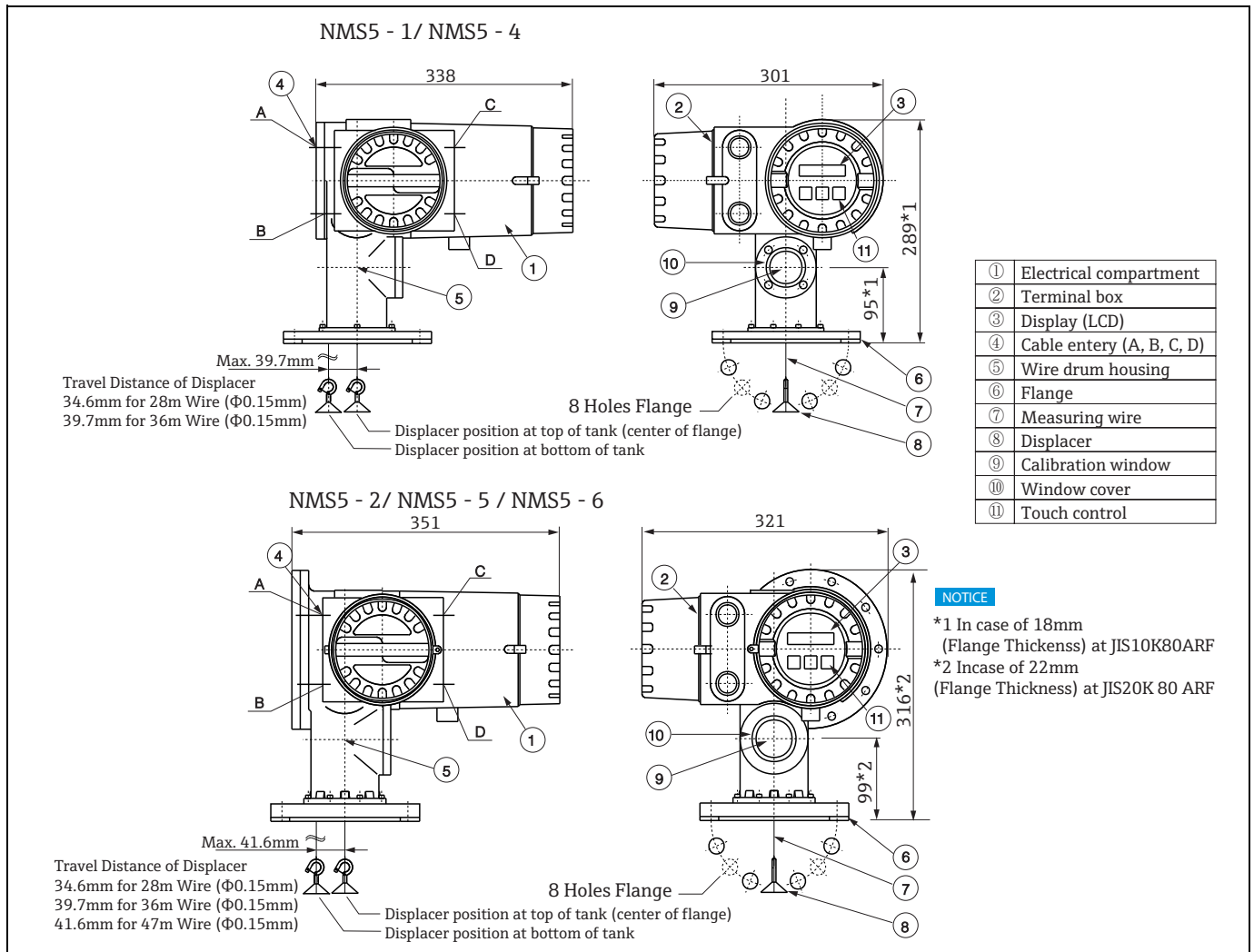


Figure 11: Dimensions of NMS5

Housing Materials of Construction

Electrical compartment: aluminum casting
 Drum chamber for NMS 5-1/5-4: aluminum casting
 Drum chamber for NMS 5-2/5-5/5-6: stainless steel 316 casting

Weight

NMS 5-1/5-4: 12 kg
 NMS 5-2/5-5/5-6: 27 kg

Flange Type

ASME, JIS, DIN 3" and 6" (standard) or equivalent. Refer to order code for full selection.
 Flange for NMS5-1/5-4: aluminum
 Flange for NMS5-2/5-5/5-6: stainless steel 304

Measuring Wire

- Material (Standard)
- Stainless steel 316, 0.15 mm (standard)
 - Alloy C. φ0.2 mm (max. 16 m range)
 - PFA coated St/St 316L, 0.4 mm (max. 16m range)

⚠ CAUTION

When liquid level in a tank becomes turbulent condition, use a stilling well pipe or a guide wire for installation.

Displacer

- Diameter: 50 mm (Standard), 30 to 110mm (option)
- Material (Standard): Stainless steel 316
- Material (optional): Alloy C, PTFE
- Traveling speed: 0 to 2500 mm /min to maximum

| Feature: 070 | Measuring Range/Material/ Diameter of Wire | Horizontal Movement Distance (mm/m) on Drum Wire |
|--------------|---|--|
| C | 0-28m; SUS316L, 0.15mm | 1.24 |
| H | 0-16m; PFA>SUS316, 0.4mm | 1.34 |
| K | 0-16m; Alloy C, 0.2mm | 1.57 |
| L | 0-36m; SUS316L, 0.15mm | 1.10 |
| M | 0-22m; Alloy C, 0.2mm | 1.57 |
| N | 0-47m; SUS316L, 0.15mm | 0.88 |

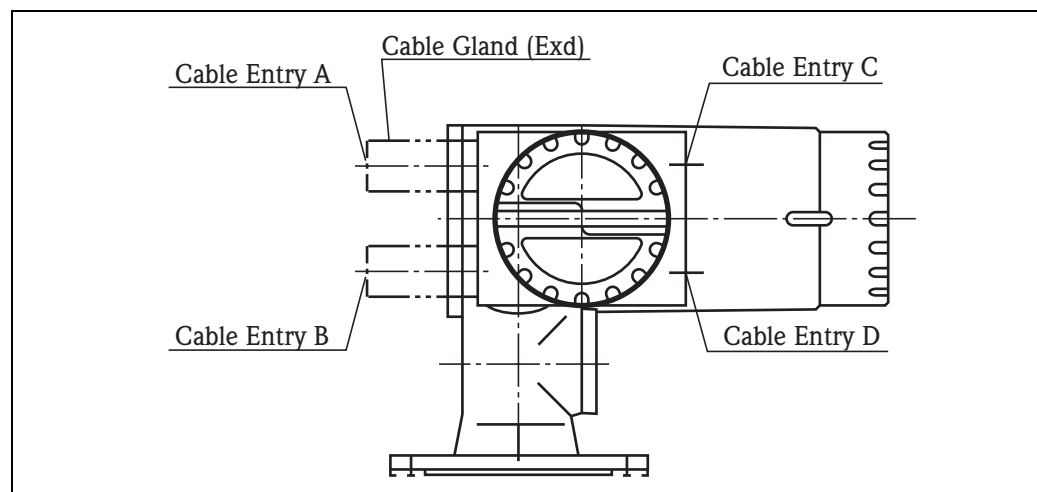
Cable Entry

Figure 12: Cable Entries

⚠ WARNING

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

Human Interface

Operating Concept

NMS5 is furnished with a four line illuminated liquid crystal display. With the E+H matrix driven operation, configuration is simple. Using only three keys, all parameters can be selected and modified. For example:

- Operation - level; interface; spot & profile density, water dip, & tank bottom
- Current output
- Relay output
- Maintenance prediction
- Calibration, etc.

The display can be configured to be displayed in English, Japanese or Chinese. Measurement unit & decimal point can be also configured within NMS matrix.

Operational Security

The programming information can be protected by software access codes that disable all programmable parameters or by a hardware switch to prevent changes from remote transmission or the touch control keypad. A self-diagnosis function checks for any operational failures.

Display

(LCD)

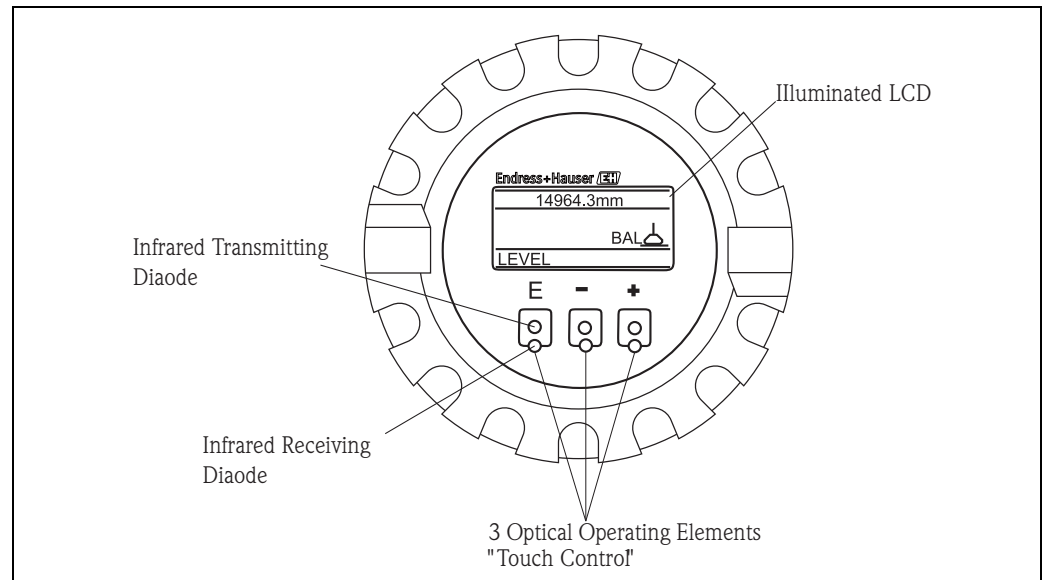


Figure 13: Display (LCD)

Four line 16-digit illuminated display English, Japanese, Chinese selectable

Programming

Three optical keys (touch control) for selection of matrix functions.

Memo Function

Memo of maintenance information.

Advanced Maintenance

| | |
|-------------------------------|--|
| Maintenance Prediction | NMS 5 will provide advance warning of required maintenance such as replacement of worn wire etc. The operating life-span of electrical and mechanical parts of the NMS 5 are factory set within the instruments memory. This information is checked involving with the built-in clock and compared and registered in the instrument. |
| Maintenance | The maintenance record can be accessed via the matrix and will provide information of alarm data (e.g. date, time, alarm type). A memo function allows the user or an E+H Service Engineer to enter maintenance data manually. |
| Proactive Safety | Proactive safety diagnostic function warns of mechanical failure, and outputs maximum level value, e.g. 99999 to local display and Fieldbus. |

Certificates and Approval

| | |
|--|--|
| CE Mark | By attaching the CE mark, Endress+Hauser confirms that the instruments pass the required tests. |
| Ex Approvals | <p> TIIS Ex d IIB T4 FM XP Cl. I Div. 1 Gr. C-D FM XP-AIS Cl. I Div.1 Gr. C-D CSA Cl. I Div. 1 Gr. C-D CSA Ex d[ia] Cl. I Div. 1 Gr. C-D ATEX II 1/2G Ex d IIB T6...T3 ATEX II 1/2G Ex d IIC T6...T3 ATEX II 1/2G Ex d IIB T6...T3, -40°C ATEX II 1/2G Ex d (ia) IIB T6...T3 ATEX II 1/2G Ex d (ia) IIB T6...T3, -40°C IEC Ex d ia IIB T6...T3 Ga/Gb IEC Ex d IIB T6...T3 Ga/Gb IEC Ex d IIC T6...T3 Ga/Gb IEC Ex d ia IIB T6...T3 Ga/Gb, -40°C IEC Ex d IIB T6...T3 Ga/Gb, -40°C NEPSI Ex d ia IIB T6...T3 NEPSI Ex d IIB T6...T3 NEPSI Ex d IIC T6...T3 NEPSI Ex d ia IIB T6...T3, -40°C NEPSI Ex d IIB T6...T3, -40°C </p> |
| Custody Transfer Approvals | <p> PTB: Germany NMi: Netherlands </p> |
| Overspill Prevention | TÜV: Germany |
| SIL | TÜV: Germany |
| External Standards and Guidelines | <p> EMC-Directive 89/336/EC PE-Directive 97/23/EC EN 10204-3.1B </p> <p> OIML-R85/1998 OIML-R85/2008 </p> <p> SIL IEC61508, IEC61511 </p> <p> ISO 9001:2008 </p> |

Order Information

NMS5

| | |
|--------------|---|
| 010 | Drum Housing Pressure Rating; Material: |
| 1 | 0... 200mbar/20kPa/2.9psi; Alu |
| 2 | 0... 200mbar/20kPa/2.9psi; stainless ste> |
| 4 | 0... 5.88bar/588kPa/85.28psi; Alu |
| 5 | 0... 5.88bar/588kPa/85.28psi; stainless steel |
| 6 | 0... 24.5bar/2.45MPa/355.34psi; stainless steel |
| 9 | Special version, TSP-no. to be spec. |
| 020 | Approval: |
| 0 | Weather proof, IP 67 NEMA 4X |
| 1 | TIIS Ex d IIB T4 |
| 5 | FM XP Cl. I Div. 1 Gr. C-D |
| N | FM XP-AIS Cl. I Div.1 Gr. C-D |
| 6 | CSA Cl. I Div. 1 Gr. C-D |
| O | CSA Ex d ia Cl. I Div. 1 Gr. C-D |
| G | ATEX II 1/2G Ex d IIB T6...T3 |
| Q | ATEX II 1/2G Ex d IIC T6...T3 |
| S | ATEX II 1/2G Ex d IIB T6...T3, -40°C |
| J | ATEX II 1/2G Ex d (ia) IIB T6...T3 |
| U | ATEX II 1/2G Ex d (ia) IIB T6...T3, -40°C |
| A | IEC Ex d ia IIB T6...T3 Ga/Gb |
| B | IEC Ex d IIB T6...T3 Ga/Gb |
| C | IEC Ex d IIC T6...T3 Ga/Gb |
| D | IEC Ex d ia IIB T6...T3 Ga/Gb, -40°C |
| E | IEC Ex d IIB T6...T3 Ga/Gb, -40°C |
| T | NEPSI Ex d ia IIB T6...T3 |
| V | NEPSI Ex d IIB T6...T3 |
| W | NEPSI Ex d IIC T6...T3 |
| X | NEPSI Ex d ia IIB T6...T3, -40°C |
| 4 | NEPSI Ex d IIB T6...T3, -40°C |
| 9 | Special version, TSP-no. to be spec. |
| 030 | Application: |
| A | Liquid Level |
| B | PTB (<1mm) type approval, liquid level |
| C | NMi (<1mm) type approval, liquid level |
| D | Multi measurement, liquid level, I/F level, bottom, density |
| E | PTB (<1mm) type approval, liquid level, I/F level, bottom, density |
| F | NMi (<1mm) type approval, liquid level, I/F level, bottom, density |
| G | Density profile multi measurement, liquid level, I/F level, bottom, density |
| H | PTB (<1mm)type approval, density profile, liquid level, I/F level, bottom, density |
| J | NMi (<1mm) type approval, density profile, liquid level, I/F level, bottom, density |
| Y | Special version, TSP-no. to be spec. |
| 040 | Output 1: |
| F | Not selected |
| A | 2-way 2-wire (V1 protocol) |
| J | 2-way 2-wire (MDP protocol) |
| B | 2-way 2-wire (BBB protocol) |
| C | 2-way 2-wire (MIC, RS232C protocol) |
| D | 2-way 2-wire (MIC protocol) |
| G | HART active |
| H | HART passive |
| L | Whessmatic 550, overvoltage protection |
| M | Mark Space |
| N | Enraf BPM |
| P | Modbus RS 485 |
| Y | Special version, TSP-no. to be spec. |
| NMS5- | Product designation (Continued on next page) |

| | | | | | | | | | | |
|--------------|--|--|--|--|--|--|--|--|--|--|
| 050 | | | | | | | | | | Output 2: |
| | | | | | | | | | | 0 Not selected |
| | | | | | | | | | | 1 4 x relay SPST |
| | | | | | | | | | | 2 2 x 4-20mA |
| | | | | | | | | | | 3 4 x relay SPST, 2 x 4 - 20mA |
| | | | | | | | | | | 4 2 x relay SPST, Overspill prevention TÜV |
| | | | | | | | | | | 5 4 x relay SPST, 1 x 4 - 20mA |
| | | | | | | | | | | 9 Special version, TSP-no. to be spec. |
| 060 | | | | | | | | | | Input: |
| | | | | | | | | | | 0 HART (NMT5xx, NRF560, pressure transmitter) |
| | | | | | | | | | | 1 1 x spot temperature Pt100, HART (NRF560, pressure transmitter) |
| | | | | | | | | | | 2 2 x operation contact, HART (NMT5xx, NRF560, pressure transmitter) |
| | | | | | | | | | | 3 1 x spot temperature Pt100, 2 x operation contact, HART (NMT5xx, NRF560, pressure transmitter) |
| | | | | | | | | | | 4 1 x status, HART (NMT5xx, NRF560, pressure transmitter) |
| | | | | | | | | | | 5 1 x spot temperature Pt100, 1 x status, HART (NMT5xx, NRF560, pressure transmitter) |
| | | | | | | | | | | 6 1 x spot temperature Pt100, 1 x status, 2 x operation contact, HART (NMT5xx, NRF560, pressure transmitter) |
| | | | | | | | | | | 9 Special version, TSP-no. to be spec. |
| 070 | | | | | | | | | | Measuring Range; wire: |
| | | | | | | | | | | C 0 - 28m; SUS316L, 0.15mm |
| | | | | | | | | | | L 0 - 36m; SUS316L, 0.15mm |
| | | | | | | | | | | N 0 - 47m; SUS316L, 0.15mm |
| | | | | | | | | | | H 0 - 16m; PFA>SUS316, 0.4mm |
| | | | | | | | | | | K 0 - 16m; Alloy C, 0.2mm |
| | | | | | | | | | | M 0 - 22m; Alloy C, 0.2mm |
| | | | | | | | | | | Y Special version, TSP-no. to be spec. |
| 080 | | | | | | | | | | Cable Entry: |
| | | | | | | | | | | E 4 x thread G1/2 |
| | | | | | | | | | | F 4 x thread G3/4 |
| | | | | | | | | | | G 4 x thread NPT1/2 |
| | | | | | | | | | | H 4 x thread NPT3/4 |
| | | | | | | | | | | L 4 x thread M20 |
| | | | | | | | | | | M 4 x thread M25 |
| | | | | | | | | | | Y Special version, TSP-no. to be spec. |
| 090 | | | | | | | | | | Process Connection: |
| | | | | | | | | | | A 10K 80A RF, flange JIS B2220 |
| | | | | | | | | | | C 10K 80A FF, flange JIS B2220 |
| | | | | | | | | | | U 10K 150A RF, flange JIS B2220 |
| | | | | | | | | | | E 20K 80A RF, flange JIS B2220 |
| | | | | | | | | | | G NPS 3" Cl.150 RF, flange ASME B16.5 |
| | | | | | | | | | | J NPS 3" Cl.300 RF, flange ASME B16.5 |
| | | | | | | | | | | W NPS 4" Cl.300 RF, flange ASME B16.5 |
| | | | | | | | | | | T NPS 6" Cl.150 RF, flange ASME B16.5 |
| | | | | | | | | | | L DN80 PN10 B1, flange EN1092-1 (DIN2527 B) |
| | | | | | | | | | | N DN80 PN25 B1, flange EN1092-1 (DIN2527 B) |
| | | | | | | | | | | Q 80A 150lbs RF, flange JPI 7S-15 |
| | | | | | | | | | | S 80A 300lbs RF (apply for NMS5-6), flange JPI 7S-15 |
| | | | | | | | | | | Y Special version, TSP-no. to be spec. |
| 100 | | | | | | | | | | Power supply: |
| | | | | | | | | | | 3 85 - 264 VAC, 50/60 Hz |
| | | | | | | | | | | 4 20 - 62 VDC, 20 - 55 VAC, 50/60 Hz |
| | | | | | | | | | | Y Special version, TSP-no. to be spec. |
| NMS5- | | | | | | | | | | Product designation (Continued on next page) |

| | |
|--------------|---|
| 110 | Displacer: |
| | N Cylindrical 30 mm, SUS316 K Cylindrical 40 mm, SUS316 D Cylindrical 50 mm, SUS316 W Cylindrical 30 mm, PTFE V Cylindrical 40 mm, PTFE U Cylindrical 50 mm, PTFE T Cylindrical 50 mm, Alloy C B Conical 50 mm, PTFE R Conical 70 mm, SUS316 S Conical 110 mm, SUS316 Y Special version, TSP-no. to be spec. |
| 120 | O-ring; chamber finishing: |
| | 0 NBR; not selected 1 Silicon rubber; not selected 5 Silicone rubber; FEP coated 3 PTFE (wire drum FKM); not selected 4 PTFE (Wire drum FKM); FEP coated 6 CR; not selected 2 FKM; not selected 7 FKM; FEP coated 8 FFKM; not selected A FFKM; FEP coated 9 Special version, TSP-no. to be spec. |
| 130 | Options: |
| | A not selected C Rc3/8 cleaning nozzle D Rc3/8 gas purging nozzle E Guide wire installation G Relief valve H Relief valve, pressure gauge J Sunshade L Rc3/8 gas purging nozzle, sunshade M Rc3/8 cleaning nozzle, sunshade N Rc3/8 gas purging nozzle, guide wire installation P Rc3/8 cleaning nozzle, guide wire installation Q Guide wire installation, sunshade R Relief valve, guide wire installation S Relief valve, pressure gauge, guide wire installation T Relief valve, sunshade U Relief valve, pressure gauge, sunshade Y Special version, TSP-no. to be spec. |
| NMS5- | Complete product designation |

Accessories

Calibration Chamber

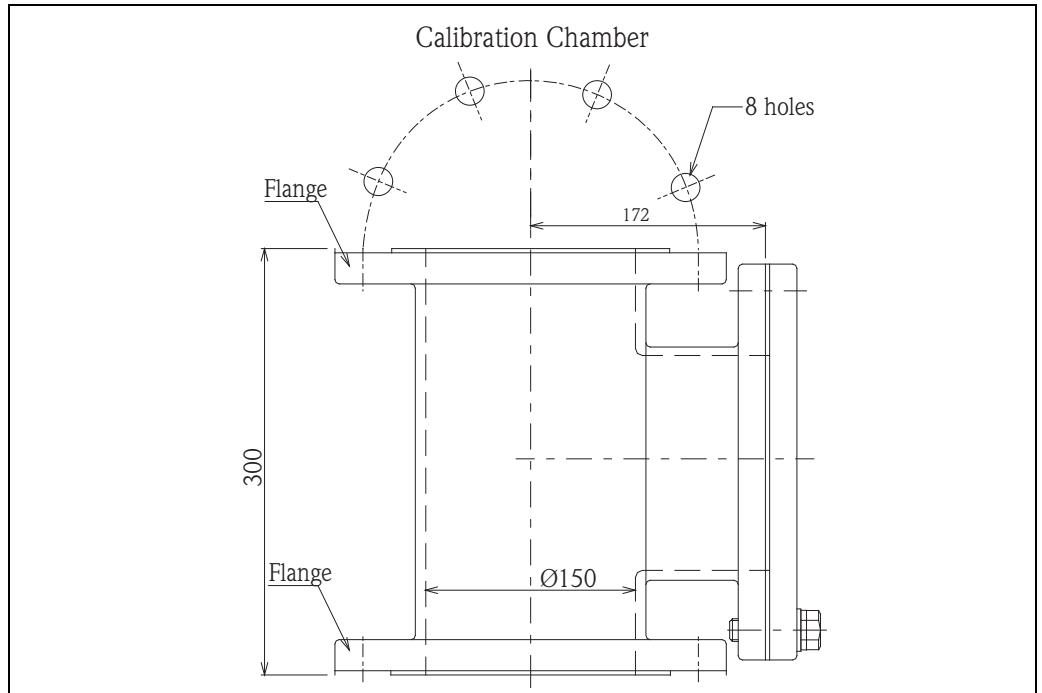


Figure 14: Calibration Chamber

Calibration chamber is recommended for use with tank level gauges in order to allow maintenance (removing displacers), while tank is in service.
Standard chamber is 6" flange, with bolts & packing for NMS connection.

NOTICE

The dimensions differ depending on material, flange size. Contact Endress+Hauser for details.

NHC4HP (High Pressure Version)

| | | | |
|----------------|--|--|------------------------------|
| 010 | Process Connection: | | |
| | A | 10K 150A RF, flange JIS B2220 | |
| | C | 10K 150A FF, flange JIS B2220 | |
| | E | 20K 150A RF, flange JIS B2220 | |
| | G | NPS 6" Cl.150 RF, flange ASME B16.5 | |
| | J | NPS 6" Cl.300 RF, flange ASME B16.5 | |
| | L | DIN 150 PN10 B1, flange EN1092-1(DIN2527 B)? | |
| | N | DIN 150 PN25 B1, flange EN1092-1(DIN2527 B) | |
| | Q | 150A 150lbs RF, flange JPI 7S-15 | |
| | S | 150A 300lbs RF, flange JPI 7S-15 | |
| | Y | Special version, TSP-no. to be spec. | |
| 020 | Pipe Material; Flange Material: | | |
| | 2 | STPG370; SS400 | |
| | 3 | SUS304TP; SUS304 | |
| | 9 | Special version, TSP-no. to be spec. | |
| 030 | Bolts, Packing: | | |
| | 0 | not used | |
| | 1 | SUS304, Valker #6502 | |
| | 9 | Special version, TSP-no. to be spec. | |
| 040 | Pressure Gauge, Relief Valve: | | |
| | 1 | Selected | |
| | 9 | Special version, TSP-no. to be spec. | |
| NHC4HP- | | | Complete product designation |

NHC4LP (Low Pressure Version)

| | | |
|----------------|--|---|
| 010 | Process Connection: | |
| | A | 10K 150A RF, flange JIS B2220 |
| | C | 10K 150A FF, flange JIS B2220 |
| | G | NPS 6" Cl.150 RF, flange ASME B16.5 |
| | L | DN150 PN10 B1, flange EN1092-1(DIN2527 B) |
| | Q | 150A 150lbs RF, flange JPI 7S-15 |
| | Y | Special version, TSP-no. to be spec. |
| 020 | Pipe Material; Flange Material: | |
| | 1 | AC4A ; AC4A |
| | 3 | SUS304TP ; SUS304 |
| | 9 | Special version, TSP-no. to be spec. |
| 030 | Bolts, Packing: | |
| | 0 | not used |
| | 1 | SUS304, Walker #6502 |
| | 9 | Special version, TSP-no. to be spec. |
| NHC4LP- | | Complete product designation |

Power + Control Switch

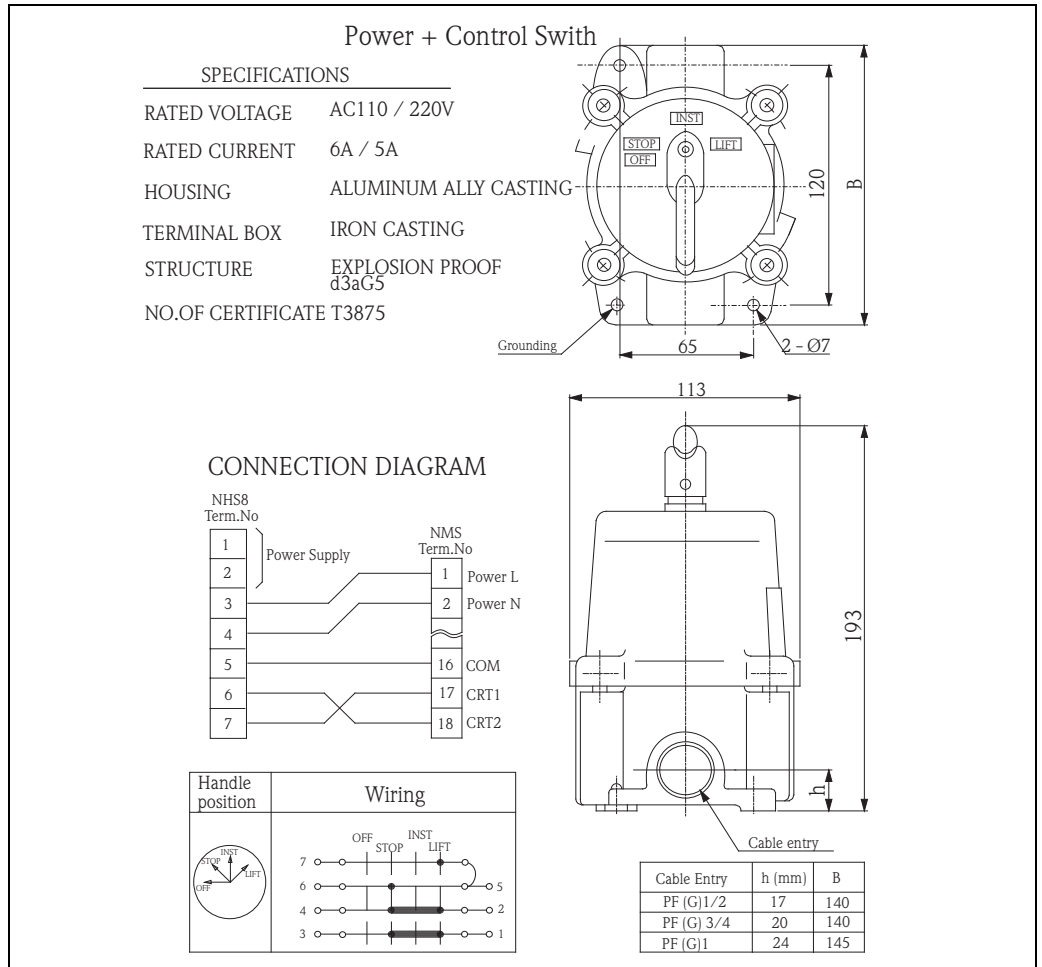


Figure 15: Power and Control Switch

Power & Control Switches are used for field mounted tank gauges. This provides additional gauge operation contact switching in order to control gauge's operation, such as hoisting up displacer.

NHS8

| | |
|--------------|--|
| 010 | Approval: |
| | 1 Weather proof IP67 |
| | 2 Flame proof (JIS d3aG5) |
| 020 | Cable entry: |
| | 0 2 x thread G3/4 |
| | 1 2 x thread G1 |
| | 2 2 x thread NPT3/4 |
| | 3 2 x thread NPT1 |
| | 9 Special version, TSP-no. to be spec. |
| NHS8- | Complete product designation |

Ball Valve

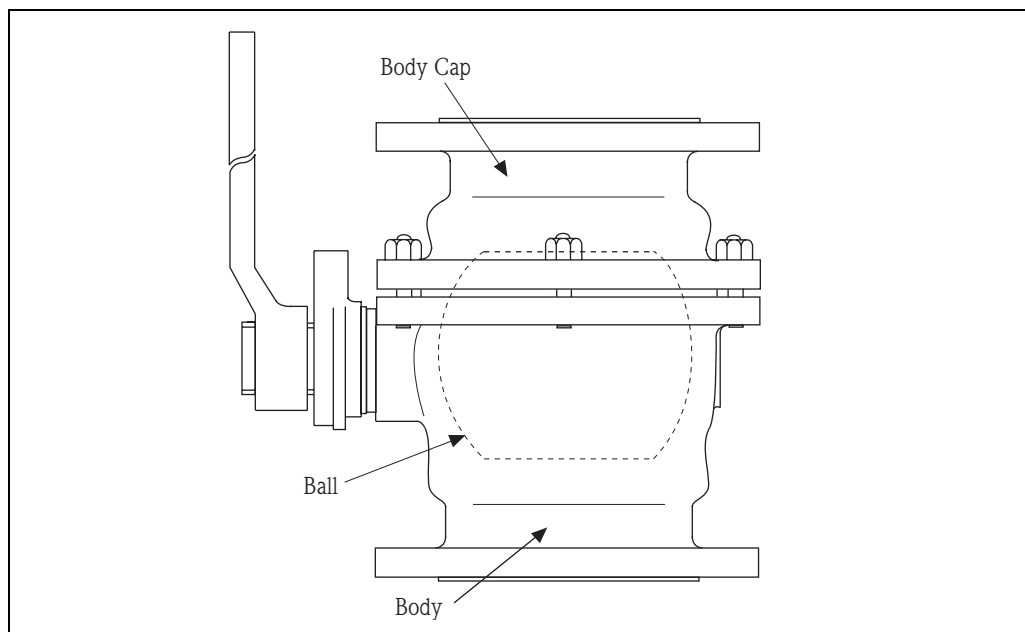


Figure 16: Parts Name of Ball Valve

Ball valves are recommended for use with tank level gauges in order to allow such maintenance as removing displacers, while tank is in service.

Standard ball valve with ASME flanges. Ball material is SS304, seat material is PTFE.

NOTICE

The dimensions vary depending on material, flange size. Contact Endress+Hauser for details.

NHV4A (ASME flanges)

Standard ball valve with ASME flanges. Ball material is SS304, seat material is PTFE.

| | | |
|---------------|----------------------------------|---|
| 010 | Process Connection; Body: | |
| | C31 | NPS 3" Cl.150 RF; steel casting flange ASME B16.5 |
| | C33 | NPS 3" Cl.300 RF; steel casting flange ASME B16.5 |
| | C61 | NPS 6" Cl.150 RF; steel casting flange ASME B16.5 |
| | C63 | NPS 6" Cl.300 RF; steel casting flange ASME B16.5 |
| | S31 | NPS 3" Cl.150 RF; SUS304 flange ASME B16.5 |
| | S33 | NPS 3" Cl.300 RF; SUS304 flange ASME B16.5 |
| | S61 | NPS 6" Cl.150 RF; SUS304 flange ASME B16.5 |
| | S63 | NPS 6" Cl.300 RF; SUS304 flange ASME B16.5 |
| | Y99 | Special version, TSP-no. to be spec. |
| 020 | Ball Type: | |
| | A | Full bore |
| | B | Reduced bore |
| | Y | Special version, TSP-no. to be spec. |
| NHV4A- | | Complete product designation |

NHV4J (JIS flanges)

For body in mild steel and in SS304, ball material is SS304, ball material is SS304. For body in SS316, ball material is SS316. Seal material is PTFE.

| | | |
|---------------|----------------------------------|--------------------------------------|
| 10 | Process Connection; Body: | |
| | C11 | 10K 80A RF; Steel flange JIS B2220 |
| | C12 | 10K 150A RF; Steel flange JIS B2220 |
| | C21 | 20K 80A RF; Steel flange JIS B2220 |
| | C22 | 20K 150A RF; Steel flange JIS B2220 |
| | S11 | 10K 80A RF; SUS316 flange JIS B2220 |
| | S12 | 10K 150A RF; SUS316 flange JIS B2220 |
| | S21 | 20K 80A RF; SUS316 flange JIS B2220 |
| | S22 | 20K 150A RF;SUS316 flange JIS B2220 |
| | H11 | 10K 80A RF; SUS304 flange JIS B2220 |
| | H12 | 10K 150A RF; SUS304 flange JIS B2220 |
| | H21 | 20K 80A RF; SUS304 flange JIS B2220 |
| | H22 | 20K 150A RF;SUS304 flange JIS B2220 |
| | Y99 | Special version, TSP-no. to be spec. |
| 20 | Ball Type: | |
| | A | Full bore |
| | B | Reduced bore |
| | Y | special version, TSP-no. to be spec. |
| NHV4J- | | Complete product designation |

Reducing Flange

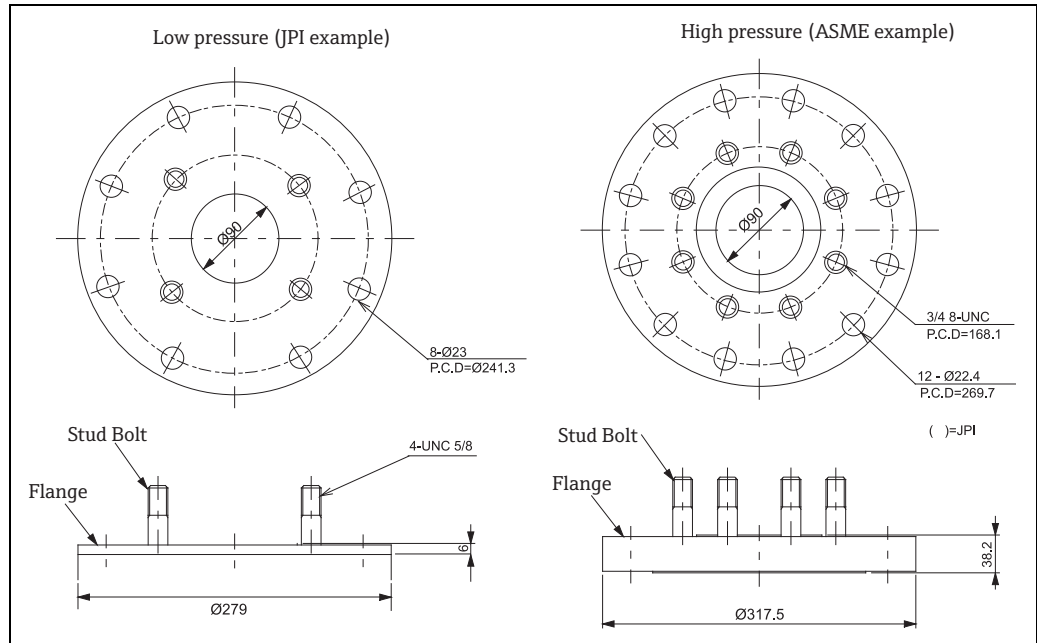


Figure 17: Reducing Flange
 Use reducing flange when NMS5 connection 80A(30") and mounting nozzle is 150A(6").

NHF4

| | |
|--------------|--|
| 10 | Process Connection; Body: |
| | A 10K 150A RF, flange JIS B2220 C 10K 150A FF, flange JIS B2220 E 20K 150A RF, flange JIS B2220 G NPS 6" Cl.150 RF, flange ASME B16.5 J NPS 6" Cl.300 RF, flange ASME B16.5 L DIN 150 PN10 B1, flange EN1092 (DIN2527 B) N DIN 150 PN25 B1, flange EN1092 (DIN2527 B) Q 150A 150lbs RF, flange JPI 7S-15 S 150A 300lbs RF, flange JPI 7S-15F Y Special version, TSP-no. to be spec. |
| 20 | Flange Material: |
| | 0 SS400 1 SUS304 9 Special version, TSP-no. to be spec. |
| NHF4- | Complete product designation |

NOTICE

NHF4 is not required if NMS5 is ordered with "Order Information; Guide Wire Installation (130-E)".
 When NHF4 is ordered as NMS5-xxxxxxxxxxxE with Guide Wire Installation, all the required mounting equipment is included.

Supplementary Documentation

Technical Information

TI00042G
Prothermo NMT 539

TI00462G
Promonitor NRF 560

Operating Manual

BA00401G
Proservo NMS5

Compact Instructions

KA001N
Whessoemtric 550

KA002N
RS485 Modbus

Safety Instructions

XA00578G
Proservo NMS5 - ATEX

XA00582G
Proservo NMS5 - IECEx

XA10257G
Proservo NMS5 - NEPSI

EX421-439
Proservo NMS5 - FM

EX540-742
Proservo NMS5 - CSA

Functional Safety Manual

SD00337G
Proservo NMS5 - (4-20mA Output, Overspill prevention)

Appendix

Stainless Steel Conversion Table

The stainless steel material used in products of Endress + Hauser Yamanashi normally have expressions according to Japanese industrial standards, such as JIS. Each country or region may have different expressions place to place.

The following conversion table contains the expression of equivalent stainless steel material based on the chemical composition and mechanical properties.

| County | Standard | Expressions | | | |
|---------|------------|--------------------------------|---------------|-----------------------------|--------------------|
| Japan | JIS | SUS304 | SUS304L | SUS316 | SUS316L |
| Germany | DIN 17006 | X5 CrNi 18 10 X5 CrNi 18 12 | X2 CrNi 18 11 | X5 CrNiMo 17 12 2 / 17 13 3 | X2 CrNiMo 17 13 2 |
| | W.N. 17007 | 1.4301 1.4303 | 1.4306 | 1.4401 / 1.4436 | 1.4404 |
| France | AFNOR | Z 6 CN 18-09 | Z 2CN 18-10 | Z 6 CND 17-11 / 17 12 | Z2 CND 17-12 |
| Italy | UNI | X5 CrNi 1810 | X2 CrNi 1911 | X5 CrNiMo 1712 / 1713 | X2 CrNiMo 1712 |
| U.K. | BSI | 304S15 / 304S16 | 304S11 | 316S31 / 316S33 | 316S11 |
| U.S.A. | AISI | 304 | 304 L | 316 | 316L |
| U.E. | EURONORM | X6 CrNi 1810 | X3 CrNi 1810 | X6 CrNiMo 17 12 2 / 17 13 3 | X3 CrNiMo 17 12 2 |
| Spain | UNE | X6 CrNi 19-10 | X2 CrNi 19-10 | X6 CrNiMo 17-12-03 | X2 CrNiMo 17-12-03 |
| Russia | GOST | 08KH18N10 06KH18N11 | 03KH18N11 | - | 03KH17N14M2 |
| - | ISO | 11 | 10 | 20 | 19 |
| - | ASME | S30400 | S30403 | S31600 | S31603 |

NOTICE

Since each standard carries its own mechanical and scientific definition, some expressions on the list above may not have a straight conversion from the Japanese standard. Consult a local authority or legislature to ensure proper comparison of the applied standard prior to determining specifications.

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