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2026-06-18

Operating Instructions
Level Switch MPC2

Tank Gauging

Endress+Hauser
People for Process Automation

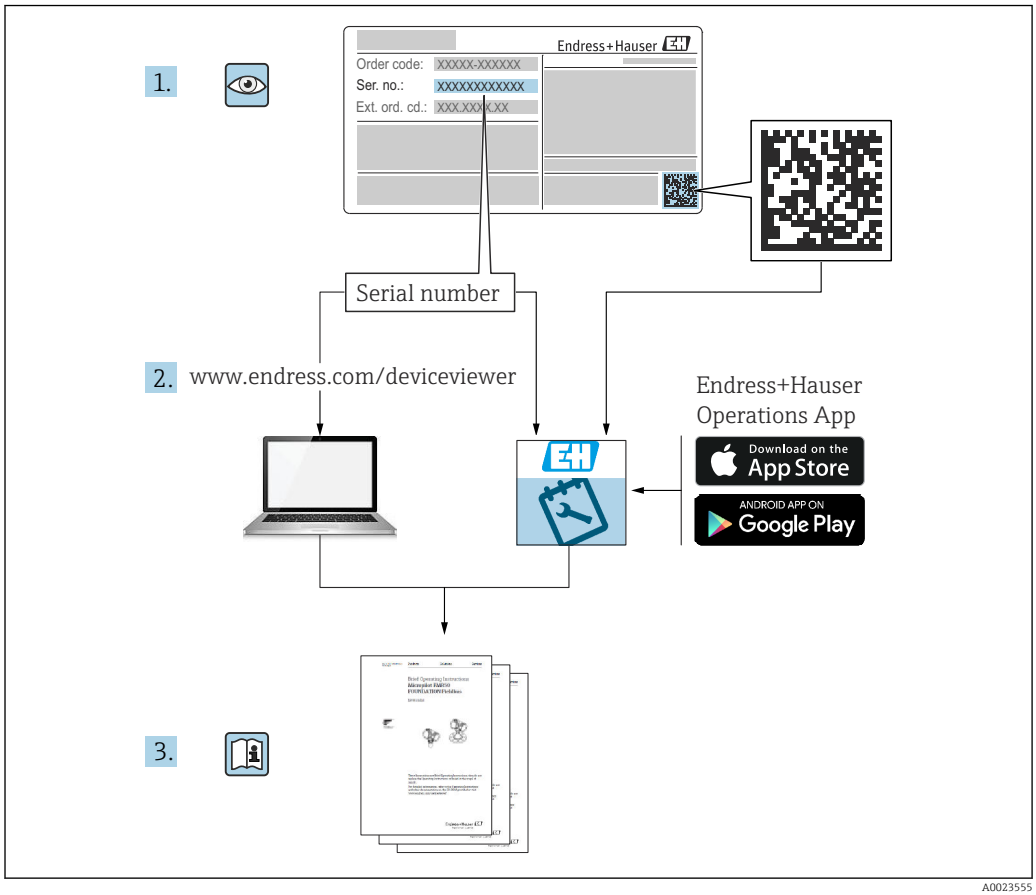

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Table of contents

1 About this document

1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective earth (PE)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: protective earth is connected to the mains supply. ▪ Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Tool symbols

Phillips head screwdriver

Flat blade screwdriver

Torx screwdriver


Allen key


Open-ended wrench

1.2.4 Symbols for certain types of information and graphics

Permitted
Procedures, processes or actions that are permitted

Preferred
Procedures, processes or actions that are preferred

Forbidden
Procedures, processes or actions that are forbidden

Tip
Indicates additional information


Reference to documentation


Reference to graphic

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps


Result of a step


Visual inspection


Operation via operating tool


Write-protected parameter

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

Safety instructions
Observe the safety instructions contained in the associated Operating Instructions

Temperature resistance of the connection cables
Specifies the minimum value of the temperature resistance of the connection cables

1.3 Documentation

The following documentation types are available in the Downloads area of the Endress +Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
W@M Device Viewer (www.endress.com/deviceviewer): Enter the serial number on the nameplate.

1.3.1 Technical Information (TI)

Planning aid
This document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

1.3.2 Operating Instructions (BA)

Operating Instructions contain all the information required for all stages in the device life cycle (from product identification, incoming acceptance, storage, mounting, connection, operation, and setting to troubleshooting, maintenance, and disposal).

2 Safety-related basic instructions

2.1 Basic safety instructions

2.1.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

Applications and measured materials
Equipment intended for use in hazardous locations, sanitary applications, or high-risk applications due to process pressure have the corresponding label attached to their nameplates.

To ensure that the device remains in proper condition for the operation time:
- Only use the device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Check the nameplate to ensure that the ordered equipment has the correct specifications for the certification-related area (example: explosion proof, safety of pressure vessels).
- If the device is not operated at an atmospheric temperature, compliance with the relevant basic conditions specified in the relevant device documentation is absolutely essential.
- Provide permanent protection for the equipment against corrosion caused by environmental effects.
- Do not exceed the limit values in "Technical Information."

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to local/national regulations.

2.4 Operational safety

Risk of injury!
- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
- If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories from the manufacturer.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):
- Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

2.5 Product safety

This device was designed in accordance with GEP (Good Engineering Practice) to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. It meets the general safety standards and legal requirements.

2.5.1 CE mark

This measuring system meets the legal requirements of the applicable EU Directive. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

Endress+Hauser affixes the CE mark to this equipment as a sign of guarantee that this equipment has successfully passed testing.

3 Product description

Level Switch MPC2 is a displacement type level switch. Its mechanical construction does not require a power supply, allowing for a wide range of liquid level control applications. It indicates liquid level alarms with a lamp and outputs a contact signal for controlling pumps and valves. It provides 1 to 4 control output contacts while activating micro switches with a magnet.

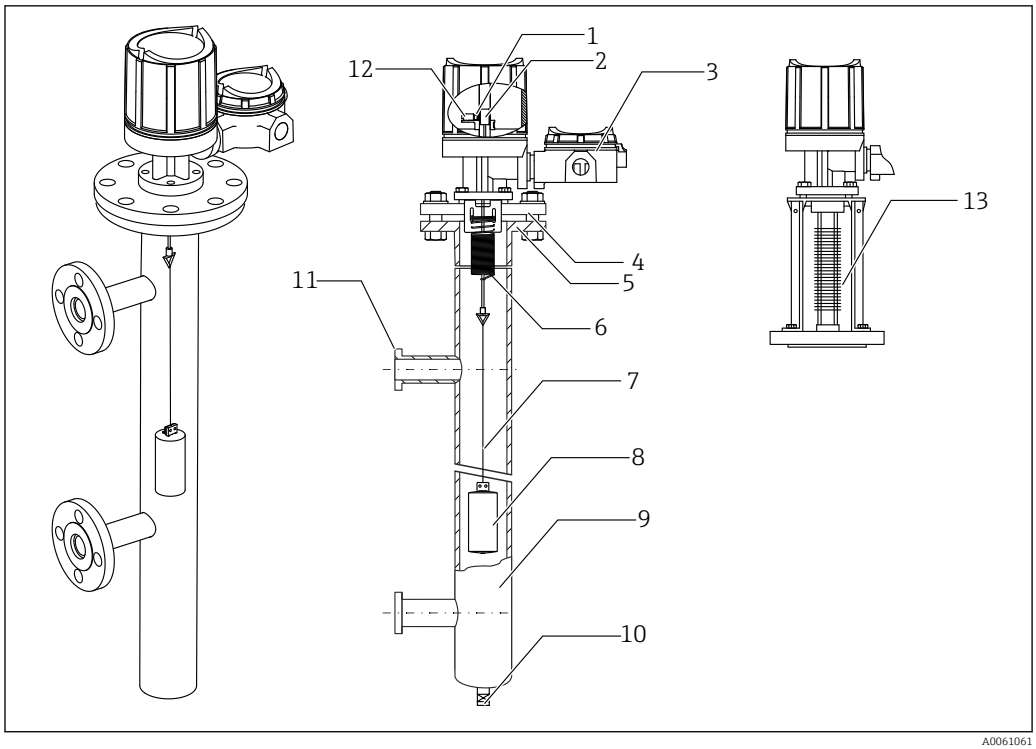
MPC2 is primarily suitable for the following applications:

- Safe tank operation (upper limit and lower limit alarm)
- Locations where a power supply is not available or cannot be used
- Applications requiring heat and pressure resistance

3.1 Product design

MPC2 is mainly configured in combination with the following products.

The following figure illustrates the 1-point switch type with an external guide pipe (side-side mounting) and single fins (optional). For information on the different specifications, refer to → 15.



1 MPC2 configuration

1 Magnet
2 Iron core
3 Terminal box (supplied with TIIS specification)
4 Flange 1
5 Flange 2 (refer to Note)
6 Spring
7 Wire
8 Displacer
9 External guide pipe
10 Drain cap
11 Nozzle flange
12 Switch
13 Radiation fins (select between single/double, optional)

Flange 2 for the external guide pipe type is supplied upon delivery. Flange 2 must be supplied by the customer if the internal guide pipe type or no guide pipe has been selected.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of the goods, check the following:
- Are the order codes on the delivery note and the product label identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?

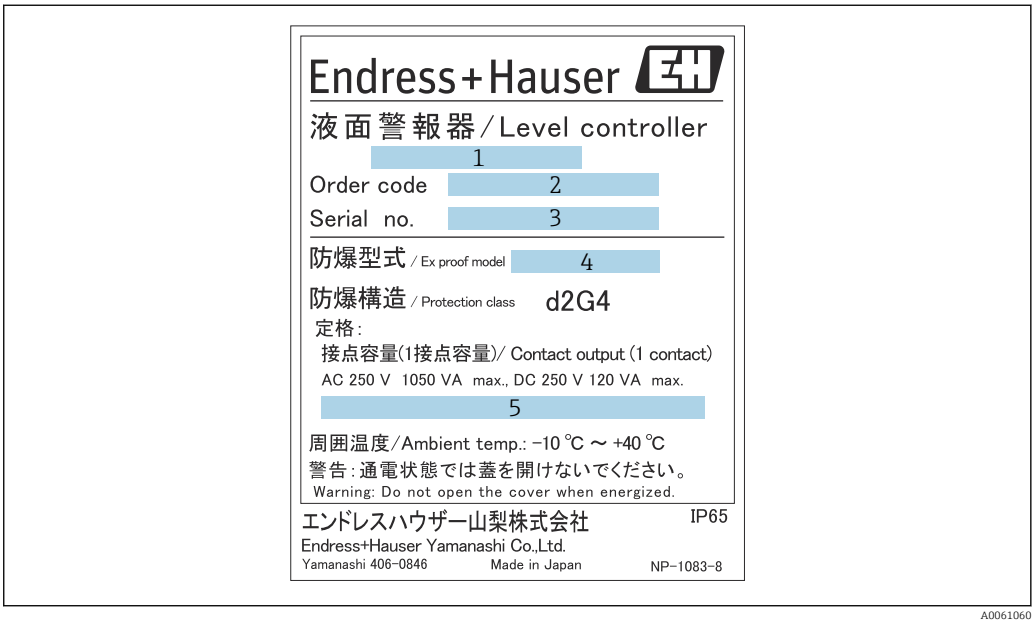
If any one of these conditions is not met, contact your nearest Endress+Hauser sales office or distributor.

4.2 Product identification

The following options are available for identification of the device.
- Nameplates
- Extended order code with breakdown of the device features on the delivery note
- Entering the serial number from the nameplate in *W@M Device Viewer* (www.endress.com/deviceviewer) will display all the information about the device.

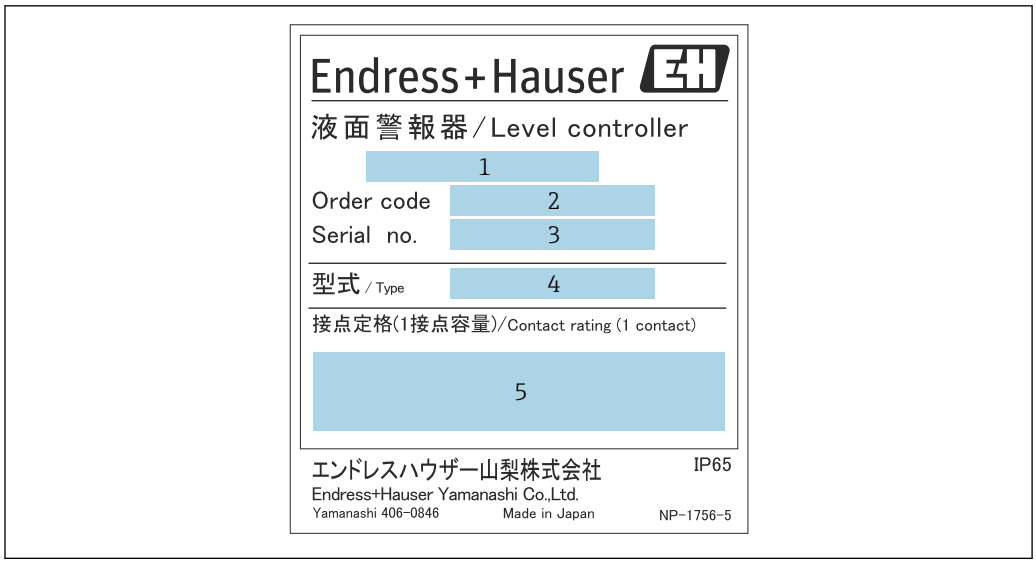
Note that the information on a nameplate may be changed without notice when credentials and certificates are updated.

4.2.1 Nameplates



2 *TIIS explosion-proof nameplate*

1 *Tag number*
2 *Order code*
3 *Serial number*
4 *Explosion-proof model*
5 *Contact rating*



3 Nameplate for waterproofing

1 Tag number
2 Order code
3 Serial number
4 Version
5 Contact rating

4.3 Manufacturer address

Endress+Hauser Yamanashi Co., Ltd.
406-0846
862-1 Mitsukunugi, Sakaigawa-cho, Fuefuki-shi, Yamanashi

4.4 Storage and transport

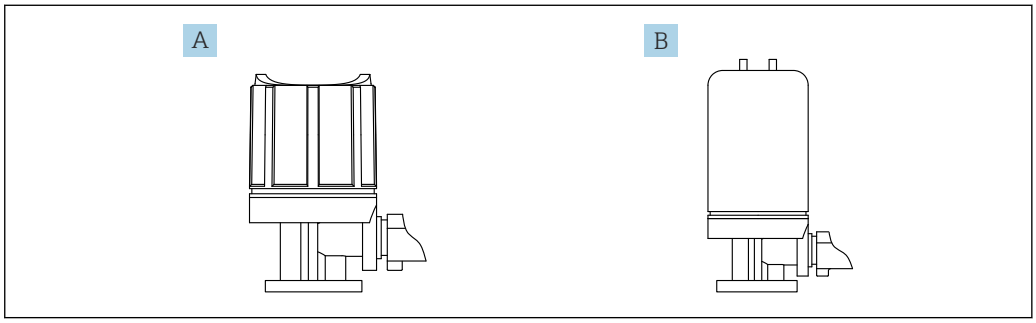
4.4.1 Storage conditions

- Storage temperature: −10 to 60 °C (14 to 140 °F)
- Store the device in its original packaging.

4.4.2 Storage method

MPC2 main body

Store MPC2 using a box with the cushioned packing material in which MPC2 was delivered.

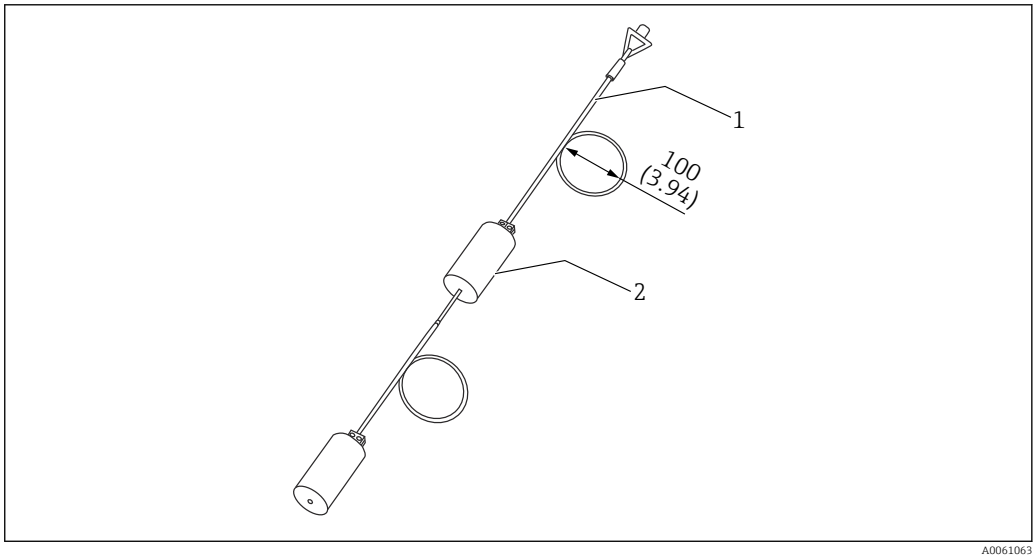


4 *MPC2 main body*

A Main body for 1-point switch
B Main body with 2 or more switch points

Displacer unit

Without bending or crimping the wire, store the displacer using a box with the cushioned packing material in which the displacer was delivered. Wind the upper and lower wires around the displacer in 100 mm (3.94 in)-diameter coils if the wire is long.

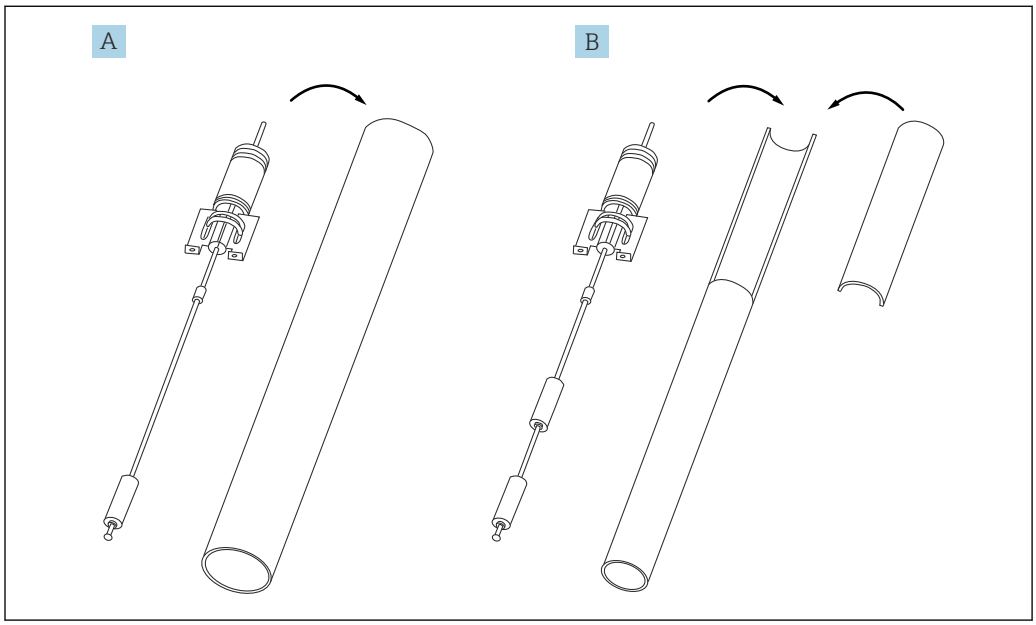


5 *Displacer unit*

1 Wire
2 Displacer

Spring unit

- For 1- to 2-point switches, store the spring with iron core in a cylindrical box to protect it.
- For 3- to 4-point switches, store the spring with iron core in a cylindrical box, then cover the box and seal with tape to protect the spring.



6 *Spring unit (includes an iron core)*

A 1- to 2-point switch specifications
B 3- to 4-point switch specifications

4.4.3 Transport

NOTICE

The housing may become damaged or dislodged.

Risk of injury

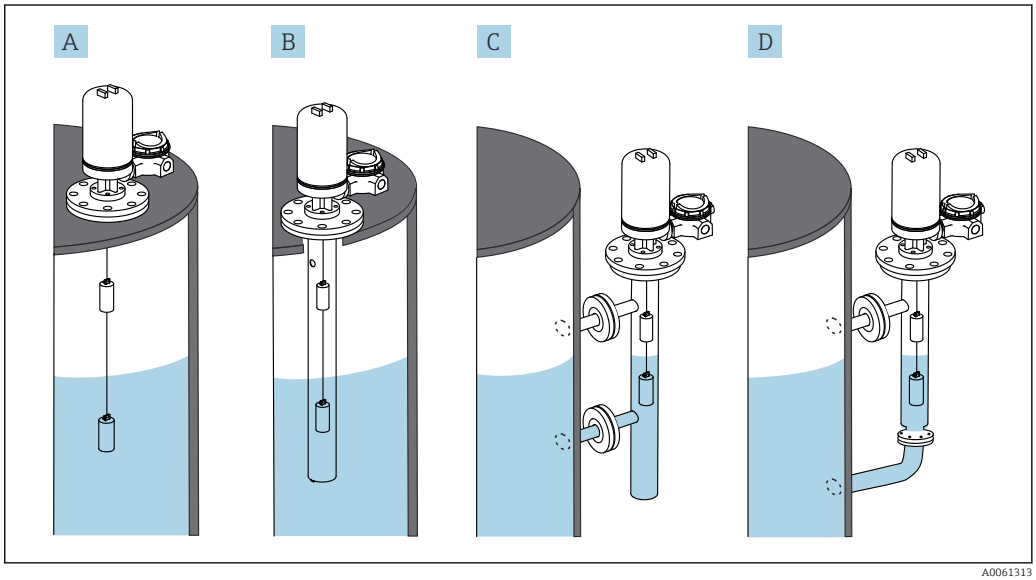
- ▶ When transporting the device to the measuring point, either use the device's original packaging or hold by the process connector.
- ▶ Secure a hoisting device (such as a hoisting ring or a lifting eye bolt) to the process connector, not to the housing. Pay attention to the device's center of gravity to prevent unexpected tilting.
- ▶ Comply with the safety precautions and transportation conditions for devices that weigh 18 kg (39.6 lbs) or more (IEC61010).

5 Installation

5.1 Installation types

There are four common ways to mount MPC2 as described below. The following figure shows a typical mounting example.

- Without guide pipe
- Internal guide pipe type: Tank top mounting
- External guide pipe type: Side-side mounting
- External guide pipe type: Side-bottom mounting



7 *Installation types*

A Without guide pipe
B Internal guide pipe type: Tank top mounting
C External guide pipe type: Side-side mounting
D External guide pipe type: Side-bottom mounting

5.2 Design and dimensions

Standard dimensions of parts are used for the installation conditions. Contact your nearest Endress+Hauser sales office or distributor for more details.

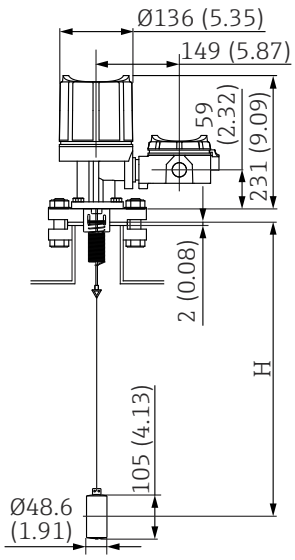
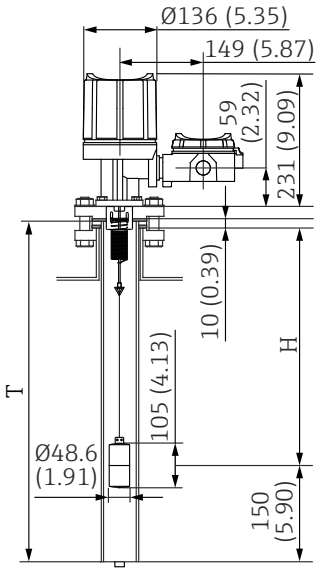
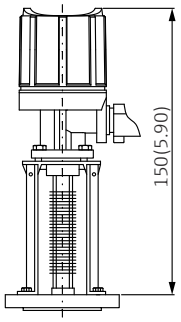
For parts names, refer to → 9

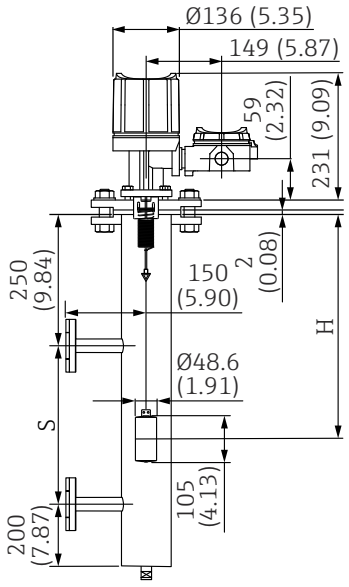
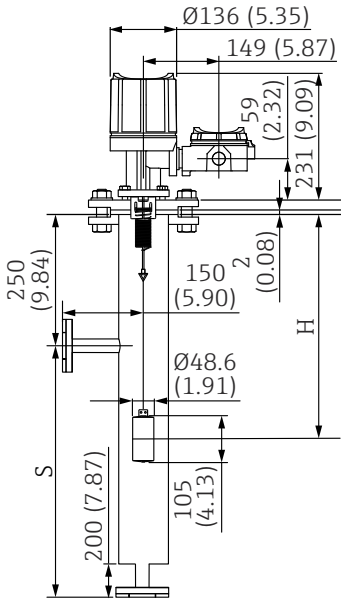
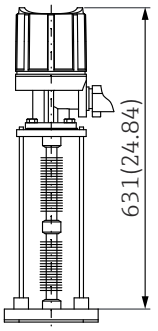
5.2.1 1-point switch position

Description of symbols

The specific position, spacing, and length will vary based on the customer's specifications.

- H: Alarm position
- S: Nozzle spacing
- T: Pipe length

Without guide pipe	Internal guide pipe type: Tank top mounting	Radiation fins
MPC - 20 xxE	MPC-21 xxE	Single fin
		

External guide pipe type: Side-side mounting	External guide pipe type: Side-bottom mounting	Radiation fins
MPC - 22 xxE	MPC-23 xxE	Double fins
		

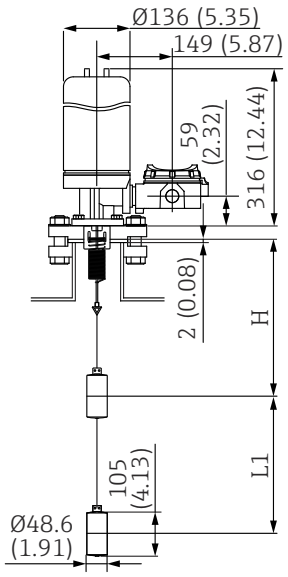
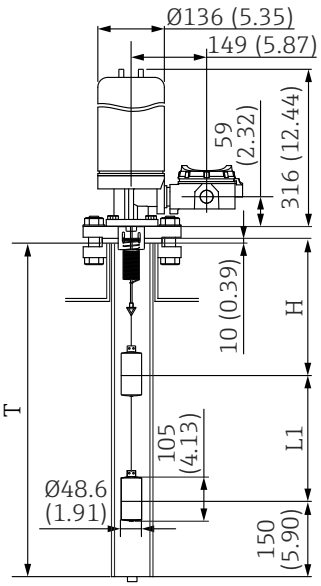
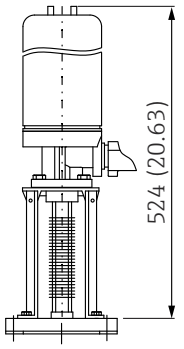
The size of a nozzle flange for an external guide pipe type is 25A/1".

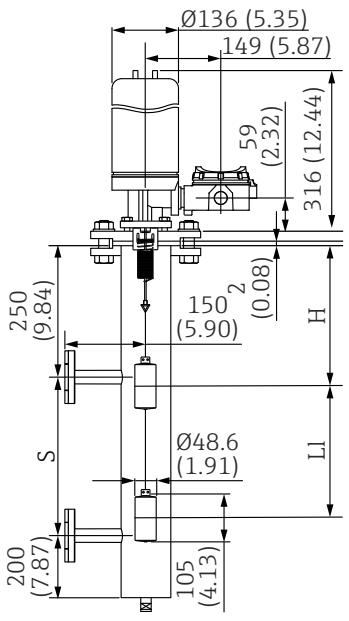
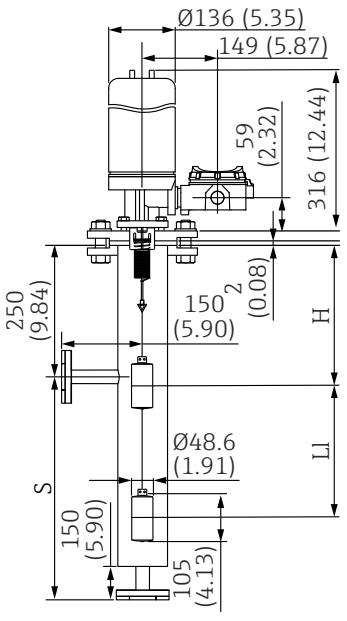
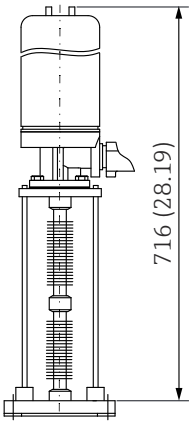
5.2.2 2-point switch position

Description of symbols

The specific position, spacing, and length will vary based on the customer's specifications.

- H: Alarm position
- L1: Alarm spacing
- S: Nozzle spacing
- T: Pipe length

Without guide pipe	Internal guide pipe type: Tank top mounting	Radiation fins
MPC - 20 xxE	MPC-21 xxE	Single fin
		

External guide pipe type: Side-side mounting	External guide pipe type: Side-bottom mounting	Radiation fins
MPC - 22 xxE	MPC-23 xxE	Double fins
		

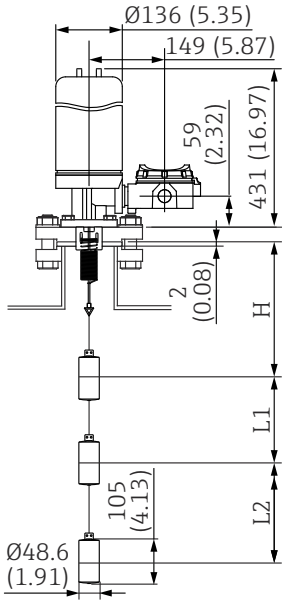
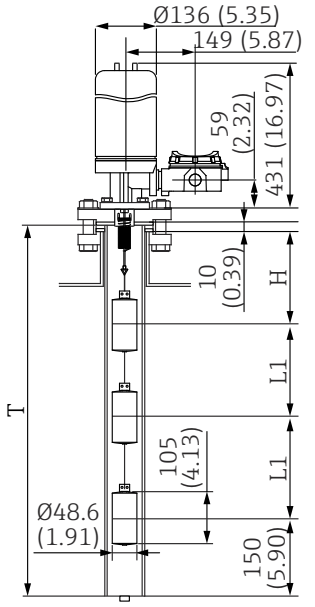
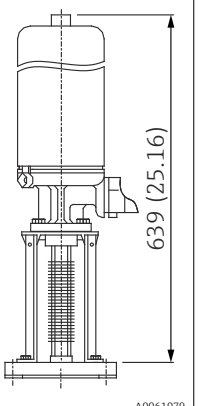
The size of a nozzle flange for an external guide pipe type is 25A/1".

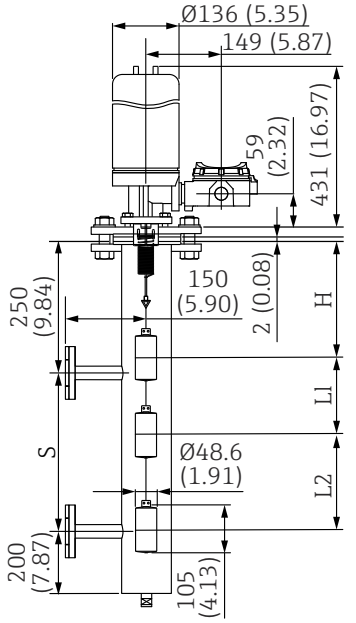
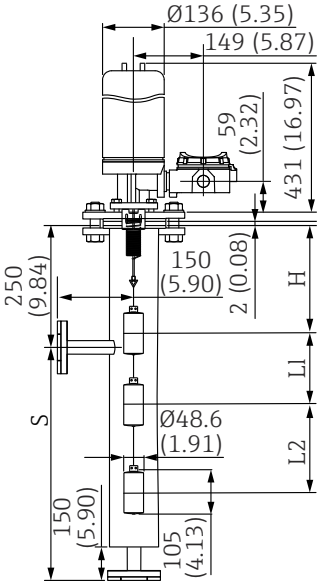
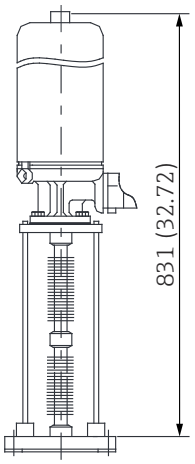
5.2.3 3-point switch position

Description of symbols

The specific position, spacing, and length will vary based on the customer's specifications.

- H: Alarm position
- L1: Alarm spacing
- S: Nozzle spacing
- T: Pipe length

Without guide pipe	Internal guide pipe type: Tank top mounting	Radiation fins
MPC - 20 xxE	MPC-21 xxE	Single fin
		

External guide pipe type: Side-side mounting	External guide pipe type: Side-bottom mounting	Radiation fins
MPC - 22 xxE	MPC-23 xxE	Double fins
		

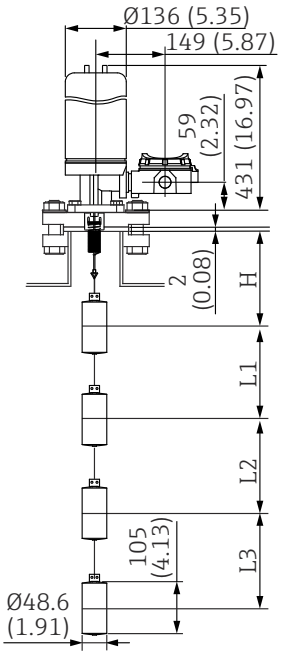
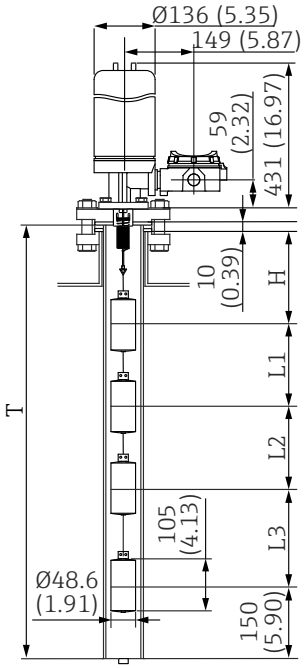
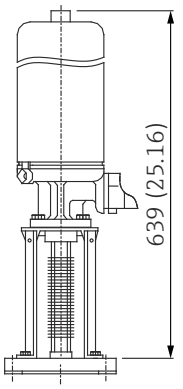
The size of a nozzle flange for an external guide pipe type is 25A/1".

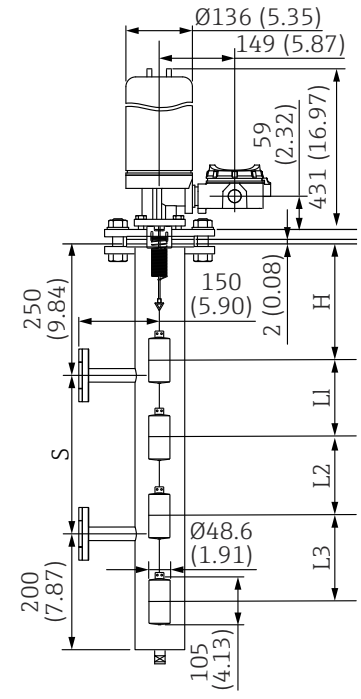
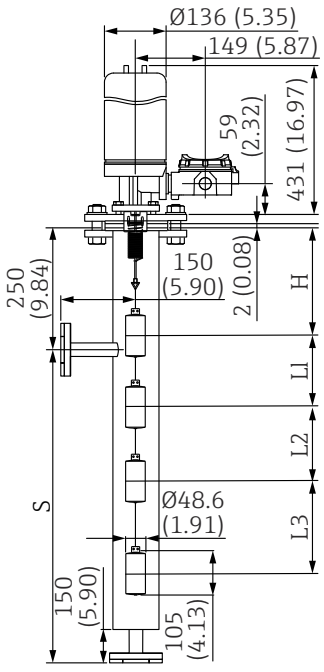
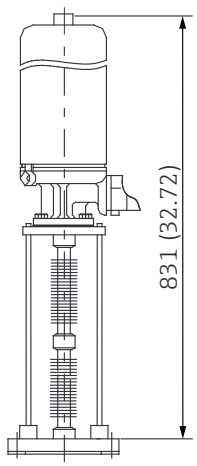
5.2.4 4-point switch position

Description of symbols

The specific position, spacing, and length will vary based on the customer's specifications.

- H: Alarm position
- L1: Alarm spacing
- S: Nozzle spacing
- T: Pipe length

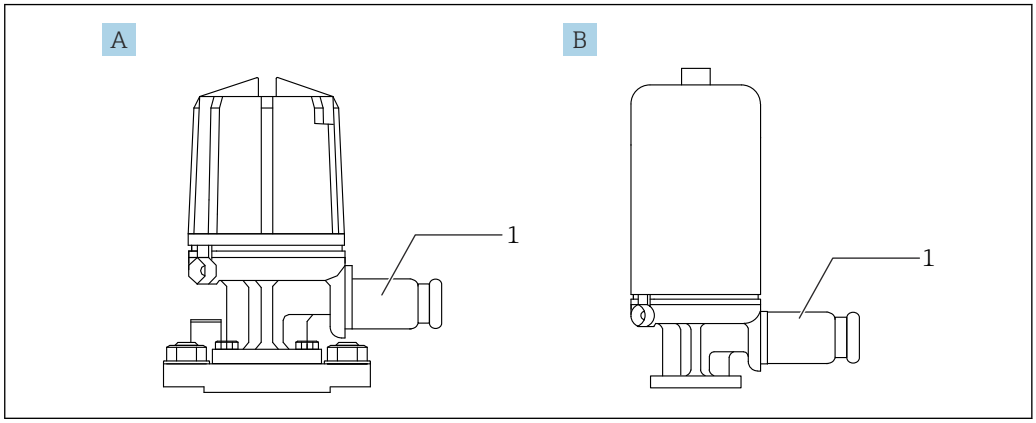
Without guide pipe	Internal guide pipe type: Tank top mounting	Radiation fins
MPC - 20 xxE	MPC-21 xxE	Single fin
		

External guide pipe type: Side-side mounting	External guide pipe type: Side-bottom mounting	Radiation fins
MPC - 22 xxE	MPC-23 xxE	Double fins
		

The size of a nozzle flange for an external guide pipe type is 25A/1".

5.3 Waterproof type option

A cable connector can optionally be attached to the waterproof type.



8 *Waterproof type option*

A MCP2 for 1-point switch type
B MCP2 for 2- to 4-point switch type
1 Cable connector (optional)

5.4 Overflow alarm

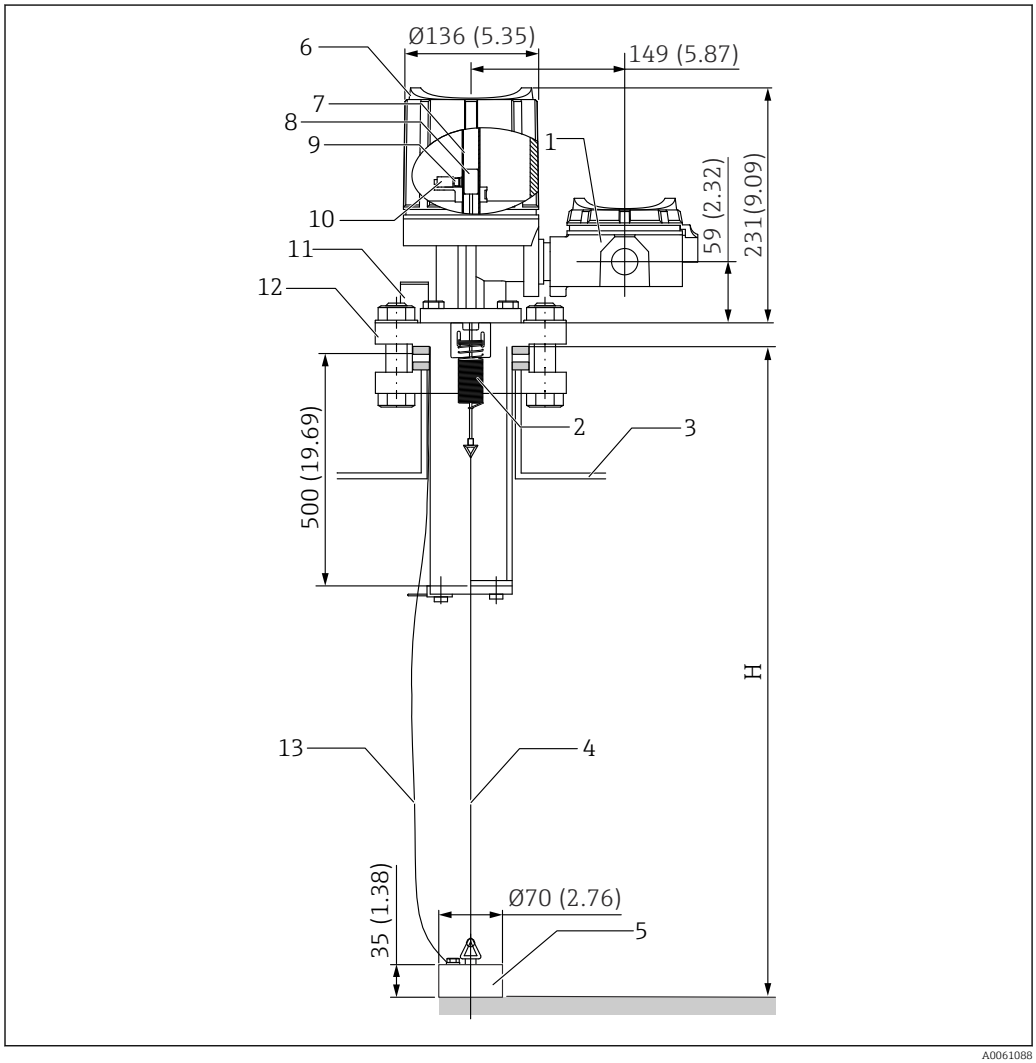
Either of the two following specifications can be used for an overflow alarm:

- Weight type for FRT
- Displacer type for CRT

When a displacer or a weight reaches a specified position (upper limit), an alarm signal is output to prevent an overflow in advance. The operation and function are the same as those of the 1-point switch type, but with an operation check function. Unscrew the plug of the test wire seal unit at the top of the flange and pull the ring connected to the test wire. This raises the displacer or weight, creating a simulated alarm mode, which allows the device's operation to be checked.

5.4.1 Floating roof tank (FRT)

Order info.: 030 (switch count) code: 5 (1 x FRT overflow detection)

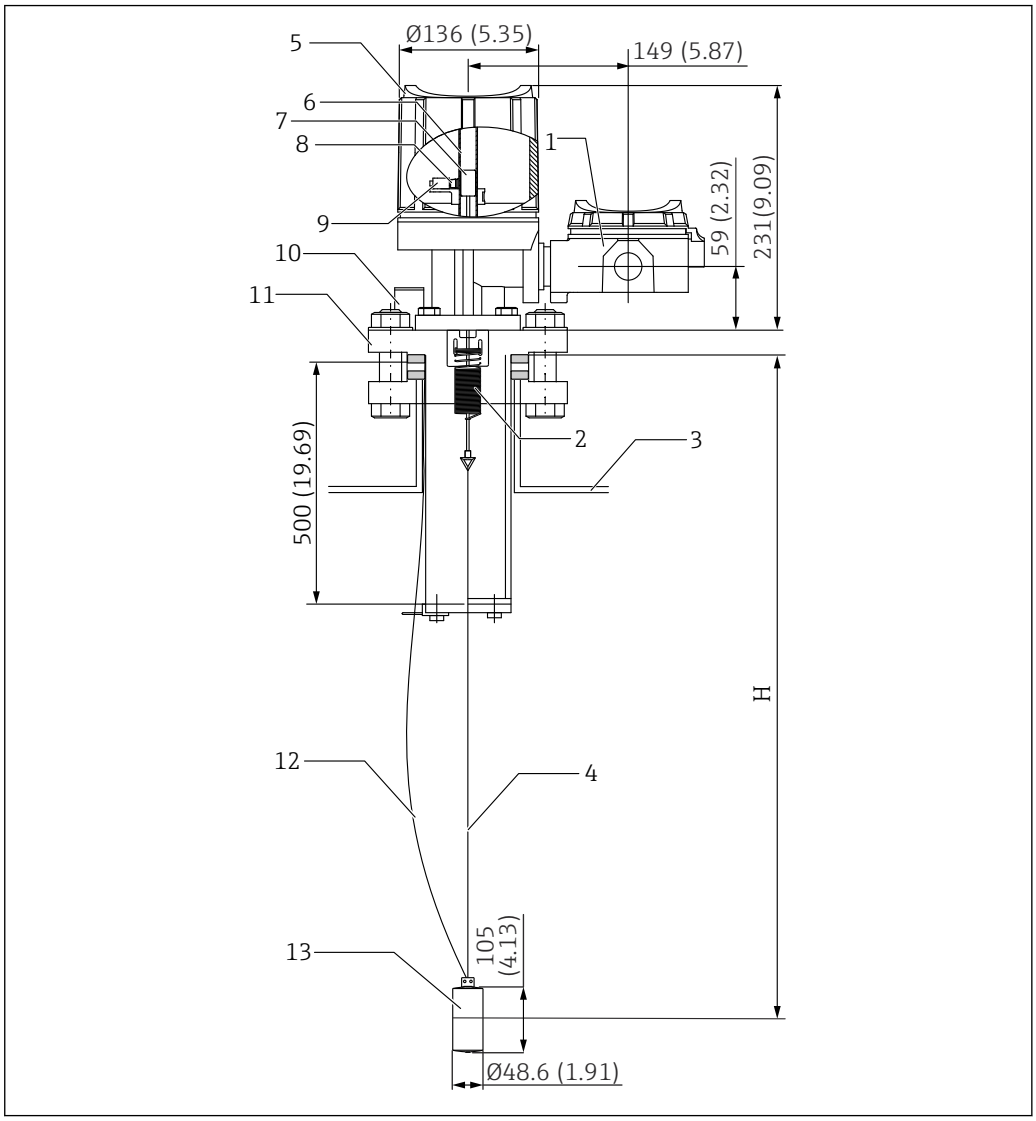


9 *Overflow detection (weight type)*

1	Terminal box	6	Cover	11	Test wire seal unit
2	Spring	7	Protection pipe	12	Top-mounted flange
3	100A/4" nozzle	8	Iron core	13	Test wire
4	Weight wire	9	Magnet	H	Alarm position
5	Weight	10	Micro switch		

5.4.2 Cone roof tank (CRT)

Order info.: 030 (switch count) code: 6 (1 x CRT overflow detection)



10 Overflow detection (displacer type)

1	Terminal box	6	Protection pipe	11	Top-mounted flange
2	Spring	7	Iron core	12	Test wire
3	100A/4" nozzle	8	Magnet	13	Displacer
4	Displacer wire	9	Micro switch	H	Alarm position
5	Cover	10	Test wire seal unit		

5.5 Mounting MPC2

MPC2 is delivered in four separate parts. Note that a guide pipe will not be included if "No guide pipe" has been selected.

- Main body (includes a terminal box: explosion-proof specifications)
- Spring unit (includes an iron core)
- Displacer unit
- Pipe (internal or external guide pipe)

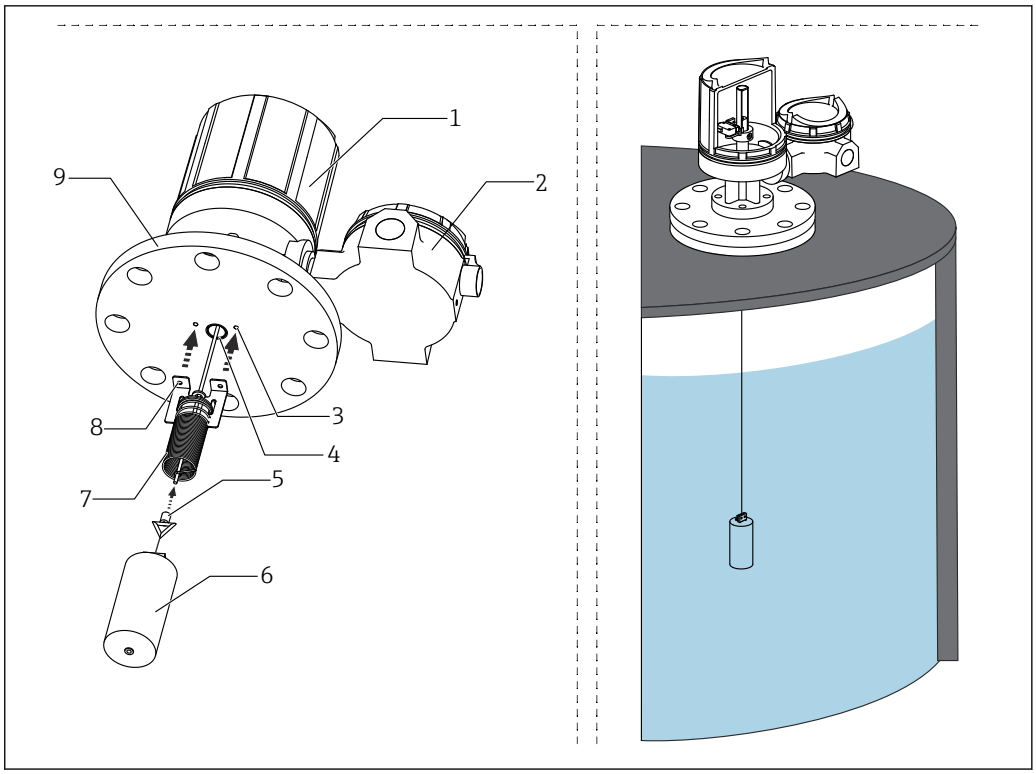
⚠ CAUTION

Kinks in the wire:
The displacer is secured to a wire.
▶ Handle the wire very carefully as a kink in the wire may cause breakage.

1. Remove washer and screw [3] from the back of the flange of the main body [1].
2. Insert the spring unit [7] into the hole of the flange [9].
   ↳ Make sure to not bend the spring or force it into the main body.
3. Position the spring lock screw [8] on the hole and screw it firmly into the main body.
4. Screw the thread on the tip of the spring into the threaded groove of the triangular joint [5].
   ↳ Support the displacer [6] firmly by hand to prevent it from falling.
5. Secure spring and displacer firmly by tightening the lock nut of the triangular joint.
   ↳ The displacer's position has already been adjusted before shipping. Do not change the position.
6. Mount the assembled MPC2 onto a tank or a guide pipe (internal or external).

This completes the mounting procedure.

The following figure shows an example of an MPC2 explosion-proof type. No terminal box is installed on the waterproof type.

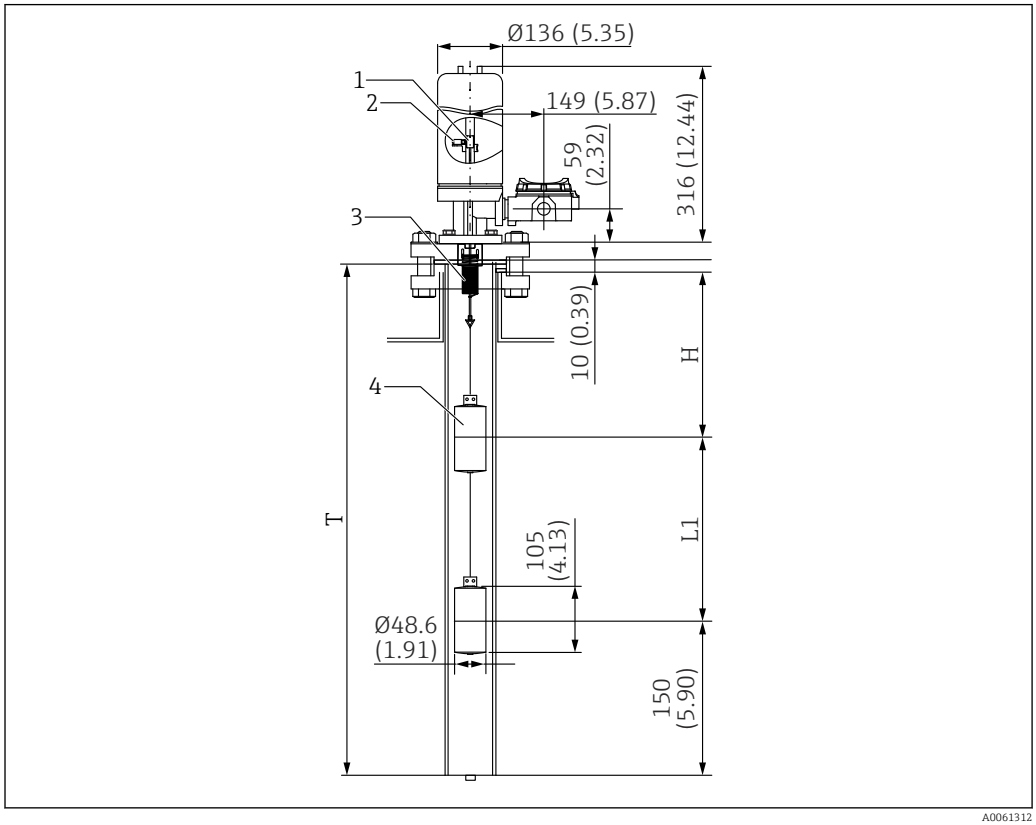


11 Assembling MPC2

1 Main body
2 Terminal box
3 Screw hole on the flange side
4 Spring hole
5 Triangular joint
6 Displacer
7 Lock screw
8 Spring
9 Flange

5.6 Adjusting the alarm point

The position of the alarm point can change within the range of the wire on which the displacer is hanging. To change the position, move the displacer in the direction required (e.g., to lower the upper alarm point by 100 mm, lower the upper displacer by 100 mm). Do not touch the main body switch.



12 *Adjusting the alarm point (e.g., 2-point switch with th explosion-proof type)*

H Alarm position
L1 Alarm spacing
T Pipe length
1 Iron core
2 Switch
3 Spring unit
4 Displacer

5.7 Instructions for use at high temperatures

Although it is recommended to lower the temperature around the spring as much as possible when using MPC2, it can still be used at high temperatures by making adjustments based on the temperature around the spring. The following specialized springs are used for MPC2 depending on the number of switch points.

Switch points	1	2	3	4
Spring coefficient	4 g/mm	5 g/mm	7 g/mm	8 g/mm
Temperature characteristic	−0.05% / ℃			

The spring coefficients at 25 ℃ (77 ℉) are as follows.

4 g	4 - 4 x (0.05/100) x 25 = 3.95
5 g	5 - 5 x (0.05/100) x 25 = 4.94
7 g	7 - 7 x (0.05/100) x 25 = 6.91
8 g	8 - 8 x (0.05/100) x 25 = 7.10

Since the constant for spring load rate decreases as temperature rises, switch position adjustment is required. The temperature characteristics are the same for all springs at −0.05% / ℃. Since this characteristic is linear, setting the correction value to a normal temperature in advance is possible when operating temperature is limited (specified).

Upon adjustment completion, accuracy in high temperature conditions is within ±7 mm (0.28 in) for 2 points and ± 10 mm (0.39 in) for 3 to 4 points.

Description of symbols used in equation

S (cross-section of displacer)	18.55 cm^2
W (weight)	g (intermediate axis + nx displacer)
ρ1 (water density at (25 ℃ (77 ℉))	0.997
ρ2 (liquid density)	g/cm^3
K1 (spring constant at (25 ℃ (77 ℉))	g/mm
K2 (spring constant at operating temperature)	g/mm

5.7.1 Correction formula for switch points: N (N = 1 to 4)

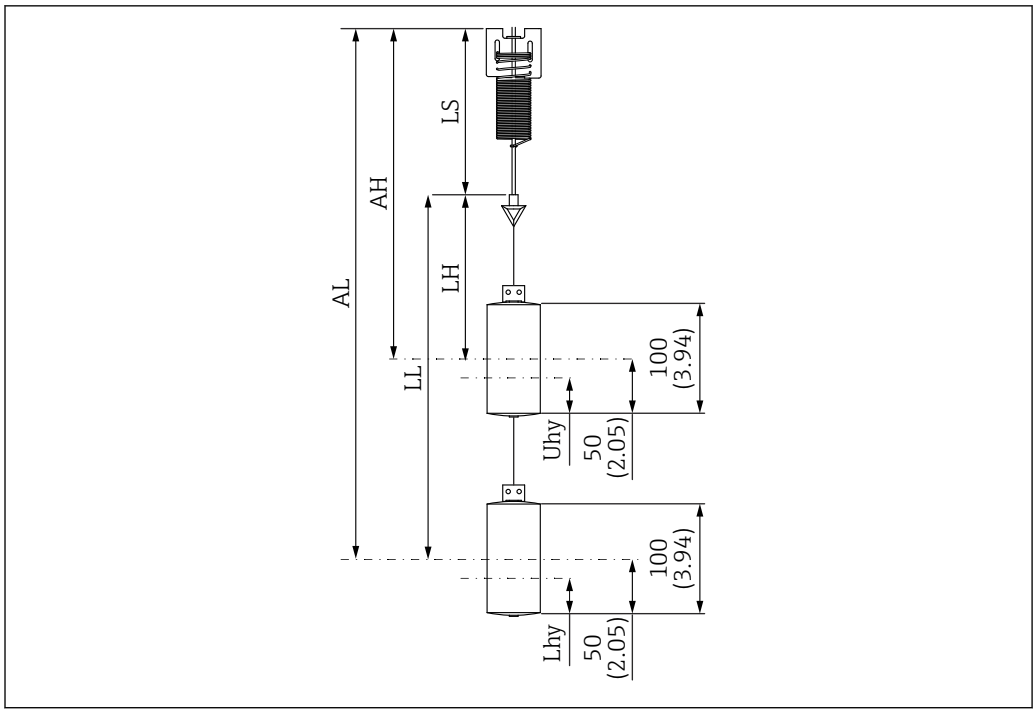
The following is the correction formula for N (N = 1 to 4) switch points.

(W-ρ2 x S x (10 (N-1) + 5)) / K2 = (W-ρ1 x S x (10 (N-1) +0.1hy)) / K1 [1]

5.7.2 Change in characteristics for 2-point switch and example of correction at normal temperature

When setting the draft line to the center of the displacer at operating temperature, the dimension hy (mm/in) (corrected) at 25 ℃ (77 ℉) will be the calculated value of the following formula.

Lower level	(W -ρ2 x W -ρ2 x S x 5) / K2 = (W -ρ1 x S x 0.1hy) / K1 [2]
Upper level	(W -ρ2 x S x (10 + 5)) / K2 = (W -ρ1 x S x (10 + 0.1hy)) / K1 [3]



13 *Correction example*

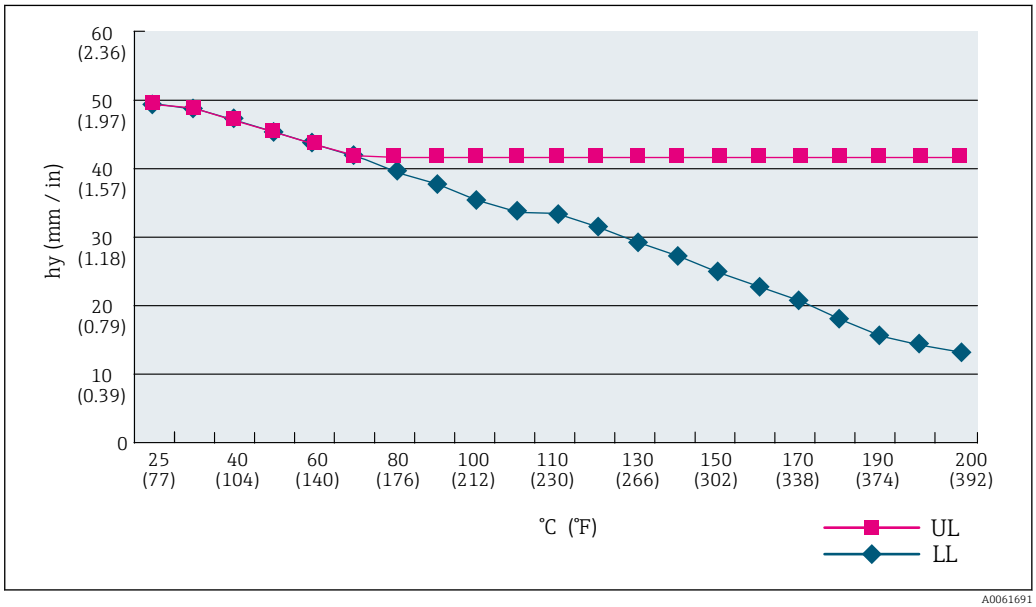
AL Customer-specified lower alarm position
AH Customer-specified upper alarm position
LL Manufacturing adjustment length
LH Manufacturing adjustment length
LS Each alarm length
Uhy Upper hysteresis
Lhy Lower hysteresis

The following table shows hysteresis values derived from the formula above for various temperatures. The dimension of Uhy is calculated by taking hysteresis (hy) (7 mm (0.28 in) to 40 mm (1.57 in)) into consideration. The maximum hysteresis 40 mm (1.57 in) is adjusted at 5 % for a margin of 42 mm (1.65 in). For the lower level, the dimension of hysteresis in actual liquid is set to 50 mm (1.97 in). The values can be corrected up to approximately 200 °C (392 °F).

Table 1 Correction value (for 2-point switch)

Temperature (°C / °F)	Density (x10^{-3} g/ mm^3)	Spring coefficient (g/mm)	Lower level hy (mm)	Lower limit with actual liquid hy (mm)	Upper level (hy mm)	Upper limit with actual liquid hy (mm)
25 / 77	0.997	4.94	50.0	50.0	50.0	50.0
30 / 86	0.996	4.93	49.2	50.0	49.3	50.0
40 / 104	0.992	4.90	47.4	50.0	47.6	50.0
50 / 122	0.988	4.88	45.6	50.0	45.9	50.0
60 / 140	0.983	4.85	43.7	50.0	44.0	50.0
70 / 158	0.978	4.83	41.8	50.0	42.2	50.0
80 / 176	0.972	4.80	39.9	50.0	42.0	51.9
90 / 194	0.965	4.78	37.9	50.0	42.0	54.1
100 / 212	0.958	4.75	35.8	50.0	42.0	56.4
110 / 230	0.951	4.73	33.7	50.0	42.0	58.7
120 / 248	0.943	4.71	31.6	50.0	42.0	61.2

Temperature (°C / °F)	Density (x10-³ g/ mm³)	Spring coefficient (g/mm)	Lower level hy (mm)	Lower limit with actual liquid hy (mm)	Upper level (hy mm)	Upper limit with actual liquid hy (mm)
130 / 266	0.935	4.68	29.4	50.0	42.0	63.8
140 / 284	0.926	4.66	27.2	50.0	42.0	66.5
150 / 302	0.917	4.63	24.9	50.0	42.0	69.4
160 / 320	0.907	4.61	22.6	50.0	42.0	72.4
170 / 338	0.897	4.58	20.2	50.0	42.0	75.6
180 / 356	0.887	4.56	17.8	50.0	42.0	78.8
190 / 374	0.876	4.53	15.3	50.0	42.0	82.3
195 / 383	0.870	4.52	14.0	50.0	42.0	84.2
200 / 392	0.865	4.51	12.8	50.0	42.0	85.9



14 *Dimensions of hysteresis based on temperature*

hy *Hysteresis*
UL *Upper level*
LL *Lower level*

5.7.3 Change in characteristics for 1-point switch and example of correction at normal temperature

W (weight) = 375 g, if using a spring with 4 g/mm

(W-ρ2 x S x (10(N-1)+5)) / K2 = (W-ρ1 x S x (10(N-1)+0.1hy)) / K1 (N = 1)

The following table shows hysteresis values derived from the formula above for various temperatures. The dimension of hysteresis at the upper level is calculated by taking (7 mm (0.28 in) to 40 mm (1.57 in)) into consideration. The maximum hysteresis 40 mm (1.57 in) is adjusted at 5 % for a margin of 42 mm (1.65 in). For the lower level,

the dimension of hysteresis in actual liquid is set to 50 mm (1.97 in). The values can be corrected up to approximately 250 °C (482 °F).

Table 2 Correction value (for 1-point switch)

Temperature (°C / °F)	Density (x10^{-3} g/mm^3)	Spring coefficient (g/mm)	First point hy (mm)
25 / 77	0.997	3.95	50.0
30 / 86	0.996	3.94	49.2
40 / 104	0.992	3.92	48.6
50 / 122	0.988	3.90	47.6
60 / 140	0.983	3.88	46.5
70 / 158	0.978	3.86	45.5
80 / 176	0.972	3.84	44.3
90 / 194	0.965	3.82	43.1
100 / 212	0.958	3.80	41.9
110 / 230	0.951	3.78	40.7
120 / 248	0.943	3.76	39.4
130 / 266	0.935	3.74	38.1
140 / 284	0.926	3.72	36.8
150 / 302	0.917	3.70	35.4
160 / 320	0.910	3.68	34.1
170 / 338	0.901	3.66	32.7
180 / 356	0.893	3.64	31.3
190 / 374	0.885	3.62	29.9
200 / 392	0.877	3.60	28.5
210 / 410	0.868	3.58	27.1
220 / 428	0.860	3.56	25.7
230 / 446	0.852	3.54	24.2
240 / 464	0.844	3.52	22.7
250 / 482	0.835	3.50	21.2

5.7.4 Change in characteristics for 3-point switch and example of correction at normal temperature

W (weight) = 670 g + 295 g, weight of 1 displacer: 295 g, using a spring with 7 g/mm

(W-ρ2 x S x (10 (N-1) + 5)) / K2 = (W-ρ1 x S x (10 (N-1) + 0.1hy)) / K1

The following table shows hysteresis values derived from the formula above for various temperatures. The dimension of hysteresis at the upper level is calculated by taking (7 mm (0.28 in) to 40 mm (1.57 in)) into consideration. The maximum hysteresis 40 mm (1.57 in) is adjusted at 5 % for a margin of 42 mm (1.65 in). For the lower level, the dimension of hysteresis in actual liquid is set to 50 mm (1.97 in). The values can be corrected up to approximately 150 °C (302 °F).

Table 3 Correction values (at the first point of a 3-point switch)

Temperature (°C / °F)	Density (x10^{-3} g/mm^3)	Spring coefficient (g/mm)	First point hy (mm)
25 / 77	0.997	6.91	50.0
30 / 86	0.996	6.90	49.0

Temperature (°C / °F)	Density (x10^{-3} g/mm^3)	Spring coefficient (g/mm)	First point hy (mm)
40 / 104	0.992	6.86	46.4
50 / 122	0.988	6.83	43.8
60 / 140	0.983	6.79	41.2
70 / 158	0.978	6.76	38.5
80 / 176	0.972	6.72	35.8
90 / 194	0.965	6.69	32.9
100 / 212	0.958	6.65	30.1
110 / 230	0.951	6.62	27.2
120 / 248	0.943	6.58	24.2
130 / 266	0.935	6.55	21.2
140 / 284	0.926	6.51	18.1
150 / 302	0.917	6.48	14.9

Table 4 Correction values (at the second point of a 3-point switch)

Temperature (°C / °F)	Density (x10^{-3} g/mm^3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
25 / 77	0.997	6.91	50.0	50.0	50.0
30 / 86	0.996	6.90	50.0	49.1	50.0
40 / 104	0.992	6.86	50.0	46.6	50.0
50 / 122	0.988	6.83	50.0	44.2	50.0
60 / 140	0.983	6.79	50.0	42.0	50.5
70 / 158	0.978	6.76	50.0	42.0	53.1
80 / 176	0.972	6.72	50.0	42.0	56.1
90 / 194	0.965	6.69	50.0	42.0	59.1
100 / 212	0.958	6.65	50.0	42.0	62.1
110 / 230	0.951	6.62	50.0	42.0	65.2
120 / 248	0.943	6.58	50.0	42.0	68.5
130 / 266	0.935	6.55	50.0	42.0	71.8
140 / 284	0.926	6.51	50.0	42.0	75.4
150 / 302	0.917	6.48	50.0	42.0	78.9

Table 5 Correction values (at the third point of a 3-point switch)

Temperature (°C / °F)	Density (x10^{-3} g/mm^3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
25 / 77	0.997	6.91	50.0	50.0	50.0
30 / 86	0.996	6.90	50.0	49.1	50.0
40 / 104	0.992	6.86	50.0	46.6	50.0
50 / 122	0.988	6.83	50.0	44.2	50.0
60 / 140	0.983	6.79	50.0	42.0	50.1
70 / 158	0.978	6.76	50.0	42.0	52.8
80 / 176	0.972	6.72	50.0	42.0	55.7

Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
90 / 194	0.965	6.69	50.0	42.0	59.0
100 / 212	0.958	6.65	50.0	42.0	62.3
110 / 230	0.951	6.62	50.0	42.0	65.6
120 / 248	0.943	6.58	50.0	42.0	69.2
130 / 266	0.935	6.55	50.0	42.0	72.8
140 / 284	0.926	6.51	50.0	42.0	76.8
150 / 302	0.917	6.48	50.0	42.0	80.8

5.7.5 Change in characteristics for 4-point switch and example of correction at normal temperature

W (weight) = 670 g + 590 g, weight of 2 displacers: 295 g, using a spring with 8 g/mm

(W-ρ2 x S x (10 (N-1) + 5)) / K2 = (W-ρ1 x S x (10 (N-1) + 0.1hy)) / K1 [1]

The following table shows hysteresis values derived from the formula above for various temperatures. The dimension of hysteresis at the upper level is calculated by taking (7 mm (0.28 in) to 40 mm (1.57 in)) into consideration. The maximum hysteresis 40 mm (1.57 in) is adjusted at 5 % for a margin of 42 mm (1.65 in).

For the lower level, the dimension of hysteresis in actual liquid is set to 50 mm (1.97 in). The values can be corrected up to approximately 130 °C (266 °F).

Table 6 Correction values (at the first point of a 4-point switch)

Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	First point hy (mm)
25 / 77	0.997	7.90	50.0
30 / 86	0.996	7.88	48.8
40 / 104	0.992	7.84	46.2
50 / 122	0.988	7.80	43.7
60 / 140	0.983	7.76	41.0
70 / 158	0.978	7.72	41.0
80 / 176	0.972	7.68	35.6
90 / 194	0.965	7.64	32.7
100 / 212	0.958	7.60	29.9
110 / 230	0.951	7.56	29.9
120 / 248	0.943	7.52	24.0
130 / 266	0.935	7.48	21.0
140 / 284	0.926	7.44	17.9
150 / 302	0.917	7.40	14.8

Table 7 Correction values (at the second point of a 4-point switch)

Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
25 / 77	0.997	7.90	50.0	50.0	50.0
30 / 86	0.996	7.88	50.0	49.1	50.0

Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
40 / 104	0.992	7.84	50.0	46.6	50.0
50 / 122	0.988	7.80	50.0	44.2	50.0
60 / 140	0.983	7.76	50.0	42.0	50.6
70 / 158	0.978	7.72	50.0	42.0	53.3
80 / 176	0.972	7.68	50.0	42.0	56.1
90 / 194	0.965	7.64	50.0	42.0	59.2
100 / 212	0.958	7.60	50.0	42.0	62.2
110 / 230	0.951	7.56	50.0	42.0	65.3
120 / 248	0.943	7.52	50.0	42.0	68.6
130 / 266	0.935	7.48	50.0	42.0	72.0
140 / 284	0.926	7.44	50.0	42.0	75.5
150 / 302	0.917	7.40	50.0	42.0	79.1

Table 8 Correction values (at the third point of a 4-point switch)

Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
25 / 77	0.997	7.90	50.0	50.0	50.0
30 / 86	0.996	7.88	50.0	49.1	50.0
40 / 104	0.992	7.84	50.0	46.6	50.0
50 / 122	0.988	7.80	50.0	44.2	50.0
60 / 140	0.983	7.76	50.0	42.0	50.2
70 / 158	0.978	7.72	50.0	42.0	52.9
80 / 176	0.972	7.72	50.0	42.0	55.8
90 / 194	0.965	7.64	50.0	42.0	59.1
100 / 212	0.958	7.60	50.0	42.0	59.1
110 / 230	0.951	7.56	50.0	42.0	65.7
120 / 248	0.943	7.52	50.0	42.0	69.3
130 / 266	0.935	7.48	50.0	42.0	72.9
140 / 284	0.926	7.44	50.0	42.0	76.9
150 / 302	0.917	7.40	50.0	42.0	80.9

Table 9 Correction values (at the fourth point of a 4-point switch)

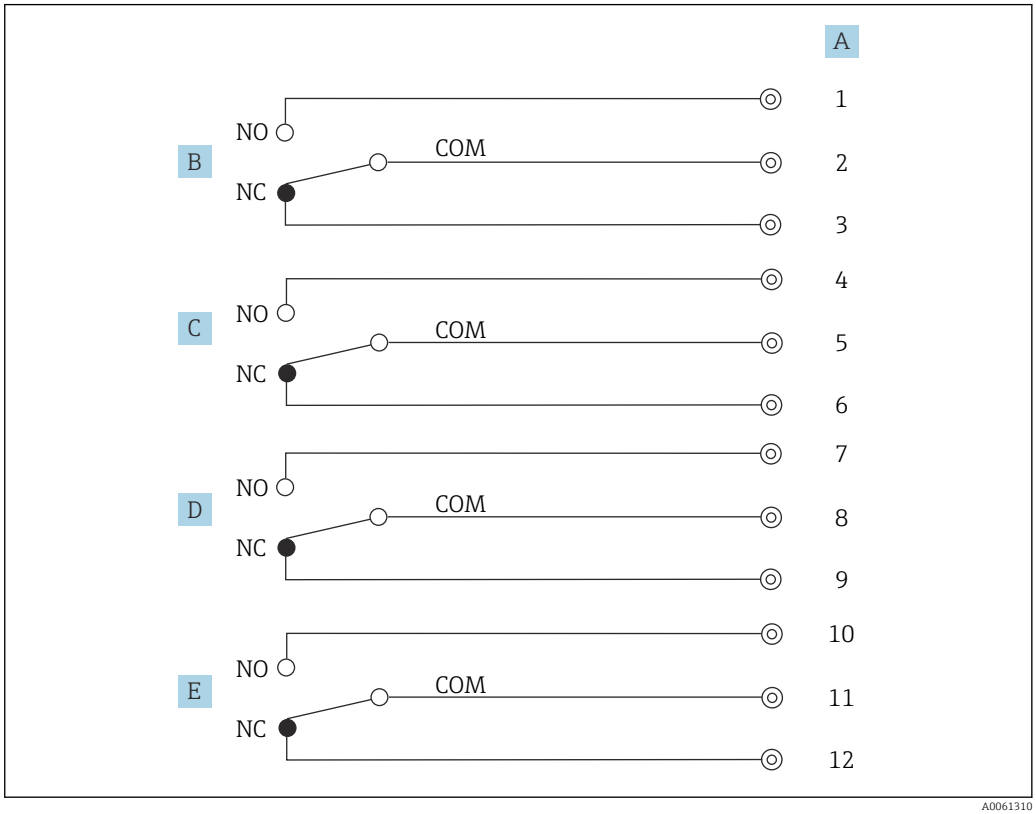
Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
25 / 77	0.997	7.90	50.0	50.0	50.0
30 / 86	0.996	7.88	50.0	49.1	50.0
40 / 104	0.992	7.84	50.0	46.6	50.0
50 / 122	0.988	7.80	50.0	44.2	50.0
60 / 140	0.983	7.76	50.0	42.0	50.2
70 / 158	0.978	7.72	50.0	42.0	52.5

Temperature (°C / °F)	Density (x10-3 g/mm3)	Spring coefficient (g/mm)	Lower limit with actual liquid hy (mm)	Second point hy (mm)	Upper limit with actual liquid hy (mm)
80 / 176	0.972	7.68	50.0	42.0	55.6
90 / 194	0.965	7.64	50.0	42.0	59.0
100 / 212	0.958	7.60	50.0	42.0	62.5
110 / 230	0.951	7.56	50.0	42.0	66.0
120 / 248	0.943	7.52	50.0	42.0	69.9
130 / 266	0.935	7.48	50.0	42.0	73.9
140 / 284	0.926	7.44	50.0	42.0	73.9
150 / 302	0.917	7.40	50.0	42.0	82.7

6 Electrical connection

6.1 Wiring diagram

The figure shows each switch contact condition when the level is normal.



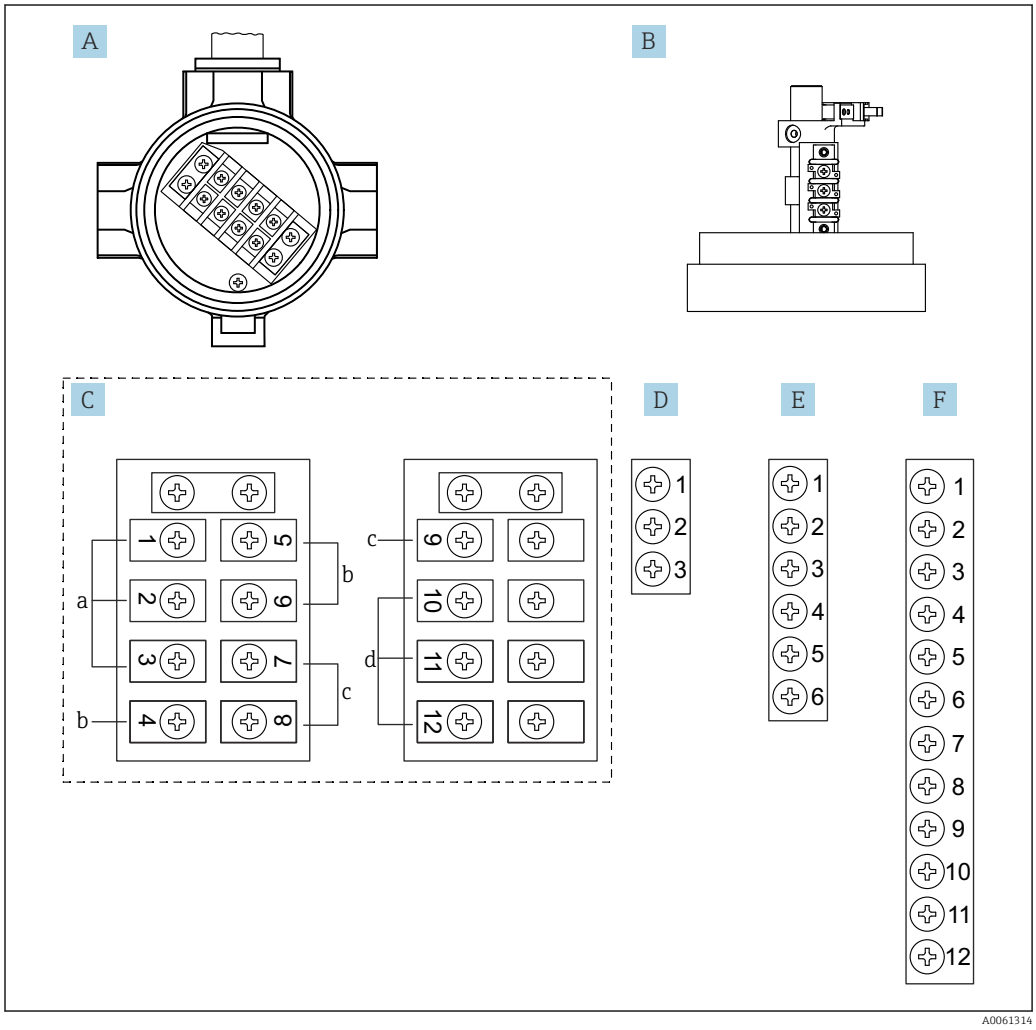
15 *Wiring diagram*

A Terminal number
B 1 point
C 2 points
D 3 points
E 4 points

6.2 Terminal connection

Each MPC2 switch has 3 wires (NO, NC, COM) for terminal connection. This means that each switch requires 3 terminal connectors (e.g., C-a is used for a 1-point switch explosion-proof type; D is used for a 1-point switch waterproof type). The wires are numbered in sequence along the terminal boxes as shown in the figure below. This is a standard factory sequence, but it can be changed to any position. Contact your nearest Endress+Hauser sales office or distributor for more details.

Overview A below, which includes the casting of a terminal block, is for a 1- to 2-point switch (explosion-proof type), and Overview B is a sample diagram of a 1-point switch (waterproof type).



16 *Arrangement of terminal box*

A Terminal box for explosion-proof type
B Terminal box for waterproof type
C Terminal box for explosion-proof type
D Terminal box for waterproof type (for 1-point switch)
E Terminal box for waterproof type (for 2-point switch)
F Terminal box for waterproof type (for 3- and 4-point switch)
a Explosion-proof terminal box (for 1-point switch)
a, b Explosion-proof terminal box (for 2-point switch)
a to c Explosion-proof terminal box (for 3-point switch)
a to d Explosion-proof terminal box (for 4-point switch)

7 Diagnostics and troubleshooting

Causes of malfunctioning and countermeasures

Error	Possible causes	Solutions
No signal generated	1 Iron core is not moving due to bent intermediate shaft	1 Remove device and repair the bent intermediate shaft
	2 Faulty micro switch	2 Replace micro switch
	3 Foreign substances have collected on spring, impairing movement	3 Remove device and clean or replace spring
	4 Displacer is not moving due to bent flange	4 Reinstall
	5 Displacer sinks	5 Replace displacer
Unstable signal	1 Faulty wiring connection	1 Repair/rewire connection
	2 Faulty lead-in conductor connection	2 Repair faulty contacts
	3 Faulty micro switch connection (internal switch terminal connection is faulty, internal switch contact is faulty)	3 Replace micro switch
Upper/lower limit positions deviate	1 Liquid density has changed	1 Readjust
	2 Displacer and iron core are not working smoothly due to misaligned installation component(s)	2 Reinstall
	3 Foreign substances have collected on displacer causing weight to increase	3 Remove the device, lift the displacer and remove the foreign substances

8 Maintenance

8.1 Maintenance work

No specific maintenance work is required.

8.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

8.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

9 Repair

9.1 General information on repairs

9.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser Service Department or specially trained customers.

Spare parts are contained in suitable kits. They also come with relevant replacement instructions.

For more information on service and spare parts, contact the Service Department at Endress+Hauser.

9.1.2 Repairs to Ex-approved devices

⚠ WARNING

Incorrect repairs compromise the safety of the device.
Explosion hazard!
- ▶ Only specialists or Endress+Hauser service representatives may repair Ex-certified devices in accordance with national regulations.
- ▶ Relevant standards and national regulations on hazardous areas, safety instructions, and certificates must be observed.
- ▶ Only use original spare parts from the manufacturer.
- ▶ Note the device designation on the nameplate. Only identical parts may be used as replacements.
- ▶ Carry out repairs according to instructions.

9.2 Spare parts

Some replaceable device components are clearly listed on the overview label found on the terminal unit cover.

The spare parts overview label contains the following information:
- List of major device spare parts (including ordering information for the spare parts)
- URL of *W@M Device Viewer* (www.endress.com/deviceviewer):
  All spare parts for the device are listed together with their order codes so that you can order them. If available, users can also download the associated Installation Instructions.

9.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

9.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information: https://www.endress.com
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

9.5 Disposal

Observe the following notes during disposal:
- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

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