KA01256S/04/EN/01.16
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Brief Operating Instructions
Overfill Prevention System SOP600

For reliable and secure tank overfill prevention

Endress+Hauser
People for Process Automation

Table of contents

1 Document information

These Brief Operating Instructions describe how to commission the SOP600 Overfill Prevention System in conjunction with the documents listed.

1.1 Symbols used

1.1.1 Safety symbols

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

1.1.2 Symbols for certain types of information

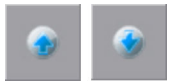
Symbol	Meaning	Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.		**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.		**Tip** Indicates additional information.
	Reference to documentation		Reference to page
	Reference to graphic	1., 2., 3...	Series of steps
	Result of a step		Visual inspection

1.1.3 Electrical symbols

Symbol	Meaning	Symbol	Meaning
⎓	Direct current	~	Alternating current
⎓~	Direct current and alternating current	⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.	⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.1.4 Software symbols

Symbol	Function	Meaning
	Login	Opens the dialog box for user login/logout
	Lamp Test	Opens the **Lamp/Horn-Test** screen
	Proof Test	Opens the **Proof-Test** screen
	Settings	Opens the **Settings** screen
	Alarms	Opens the **Alarm** screen
	Logout	Logout (the DEFAULT user is logged in automatically)
	Password	Opens the **Standard Panel Password Input** dialog box
	History	Opens the **History** screen (only users with **Operator** and **Administrator** roles)
	Module Status	Opens the **Safety I/O Module Status** screen
	Reset	Resets the safety relays (same function as door button)

Symbol	Function	Meaning
	Ack. All	Acknowledge all the warnings and alarms (same function as door button)
	Ack.	Acknowledge a single warning or alarm that has been selected
	Arrow keys	Scroll up or down
	Keys with double arrows	Scroll up or down a page
	Close	Closes the window
	Yes	Notification that the check was successful
	No	Notification that the check was not successful
	Next	Opens the next screen
	Print	Opens a new screen with a white background
	Start	Opens the **Step 1** screen and starts the proof test (High-High Level transmitter)
	Cancel	Cancels the operation
	Repeat	Repeats the operation
	Tank Sett.	Opens the **Tank Settings** screen
	Date/Time	Opens the **Date/Time** dialog box
	Test Time	Opens the **Proof-Test Time** dialog box
	License Key	Opens the **License Key** dialog box
	Remote	Opens the **Remote Modem** dialog box

Symbol	Function	Meaning
	Events	Opens the **Log File** screen
	System Info	Opens the **System Info** screen
	Apply	Applies the changes made to the settings
	Enable	Enables the remote maintenance modem (after confirming with **Apply**)
	Disable	Disables the remote maintenance modem (after confirming with **Disable**)
	Overview	Opens the **Overview** screen
	Proof-Test	Opens the **Proof-Test** screen
	Lamp-Test	Opens the **Lamp-Test** screen
	Enable	Manually enable the corresponding component

1.2 Text emphasis

Emphasis	Meaning	Example
Bold	Keys, buttons, program icons, tabs, menus, commands	**Start → Programs → Endress+Hauser** In the **File** menu, select the **Print** option.
Angle brackets	Variables	<DVD drive>

1.3 Acronyms used

Acronyms	Meaning
AC	Alternating Current
AOPS	Automated Overfill Prevention System
DC	Direct Current
HMI	Human Machine Interface (e.g. operating panel)
MOPS	Manual Overfill Prevention System
PLC	Programmable logic controller (PLC)

Acronyms	Meaning
UPS	Uninterruptible power supply
WAN	Wide Area Network (possible communication channel for remote maintenance modem)
WHG	German Federal Water Act
3G	Wireless data transmission standard (possible communication channel for remote maintenance modem)
I/O	Input/output

1.4 Valid versions

Component	Version
PLC program	V1.02.xx
HMI program	V1.02.xx
Hardware platform	V1.02.xx

1.5 Registered trademarks

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All other brand and product names are trademarks or registered trademarks of the respective companies and organizations.

2 Basic safety instructions

2.1 Requirements for personnel

The staff responsible for installation, commissioning, diagnosis and maintenance must meet the following requirements:

- They must be suitably qualified experts who have been trained by Endress+Hauser, or they must be experts from the Endress+Hauser service organization
- The safety-related components must be installed, repaired or replaced by certified Endress+Hauser staff
- They must be authorized by the plant owner/operator
- They must be familiar with the regional/national requirements and regulations
- Prior to commencing work, the staff must have read and understood the instructions in these Operating Instructions and in the supplementary documentation (depending on the application)
- They must follow the instructions and comply with the basic requirements.

Operating personnel must meet the following requirements:
- They must be instructed and authorized to suit the requirements of the task
- They must comply with the instructions in these Operating Instructions
- They must comply with the instructions in the Functional Safety Manual

2.2 Designated use

The SOP600 has been designed as a safety function to monitor High-High Levels in tanks (1 to 16). The function is only guaranteed with appropriate Endress+Hauser point level switches (Liquiphant FTL5x, 7x or 8x (depending on the safety level)). Any other use is considered to be non-designated use. Designated use entails compliance with the operating and maintenance requirements specified by the manufacturer. Furthermore, the SOP600 must be installed in a safe environment (not in danger zones or Ex zones). It is advisable to install the SOP600 in a dry, air-conditioned room.

The SOP600 is a Safety Integrated System. Anyone making changes to the system must be appropriately trained and authorized. Any modifications to the hardware or software must be agreed beforehand with Endress+Hauser Process Solutions AG.

Dangers

It is the responsibility of the owner/operator to assess any dangers for the systems. These dangers must be assessed by the owner/operator and the measures resulting from the assessment must be implemented. While the SOP600 can be form part of such a measure, responsibility for the entire safety function always rests with the owner/operator, particularly the taking of suitable measures if the SOP600 signals an alarm. We also specifically state that relevant measures must also be assessed from a process engineering perspective.

Incorrect use

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

2.3 Workplace safety

- Wear the necessary personal protective equipment as stipulated in regional/national regulations when working on and with the device
- When welding, do not ground the welding unit via the system
- If working on and with the device with wet hands always wear gloves due to the increased risk of electric shock

2.4 Operational safety

- Operate the device in proper technical and fail-safe condition only
- The operator is responsible for trouble-free operation of the device

2.5 Product safety

This device is designed in accordance with industry 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 general safety standards and legal requirements. It also complies with the EC

directives listed in the product-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.6 IT security

We only provide a warranty if the system is installed and used as described in the Operating Instructions. The system is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

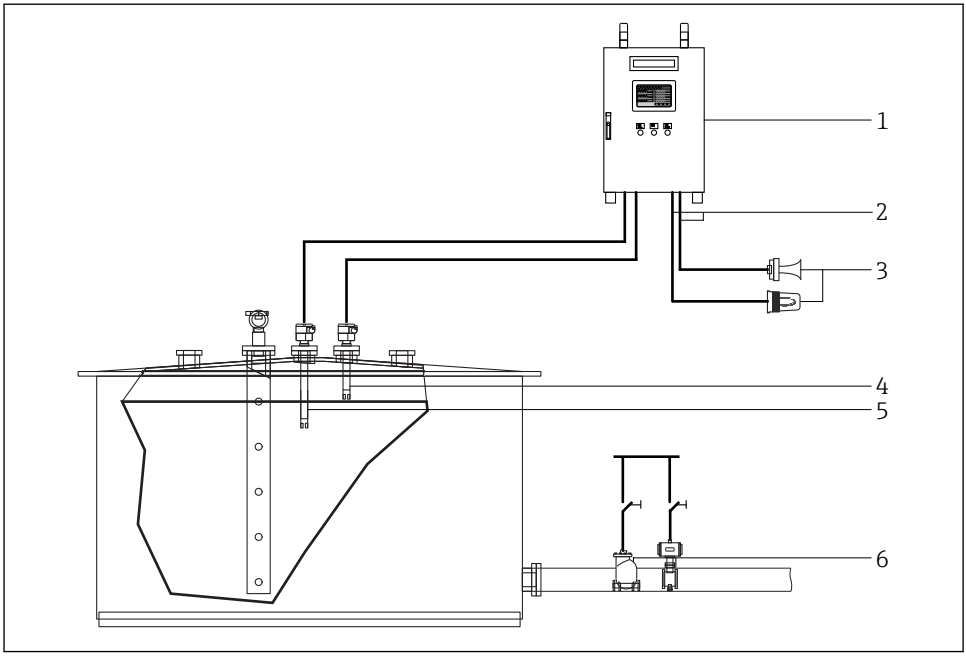
IT security measures in line with operators' security standards and designed to provide additional protection for the system and system data transfer must be implemented by the operators themselves.

3 Product description

3.1 Product design

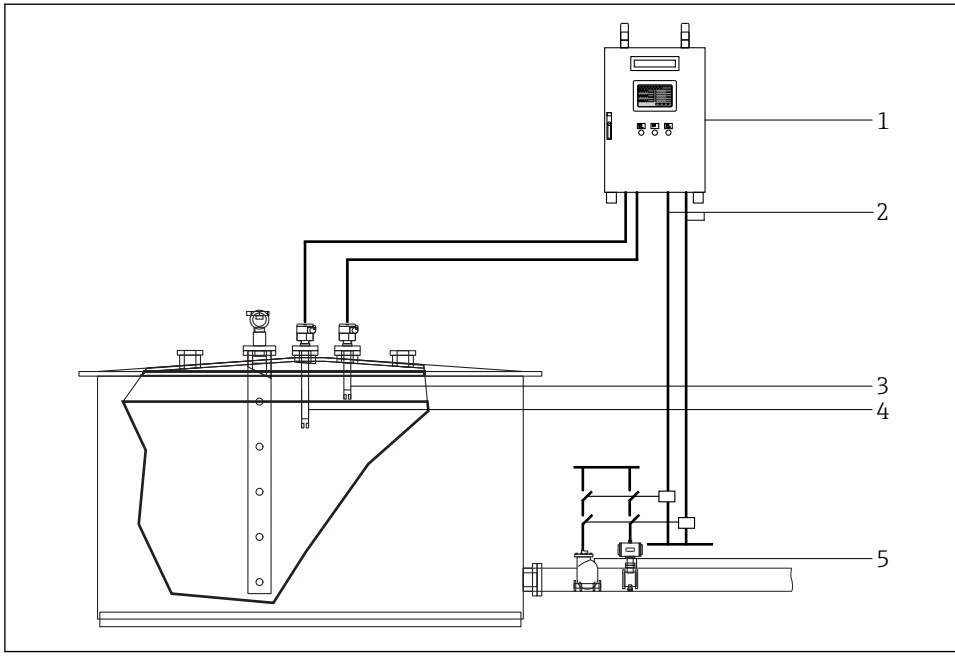
This solution package offers superior safety compliance (up to SIL3 according to IEC 61511) for an Overfill Prevention System that is primarily geared to the oil, gas and chemical industry. The system measures the level using Endress+Hauser sensors and transmitters and, in the event of an alarm, switches the safety relays and activates alarm signalization devices in the field.

The system supports Manual Overfill Prevention Systems (MOPS) and Automated Overfill Prevention Systems (AOPS). The actuator connected to the safety relay is not part of this product. Actuators are plant-specific and are therefore the responsibility of the plant owner/ operator.



1 Manual Overfill Prevention System (MOPS) - overview

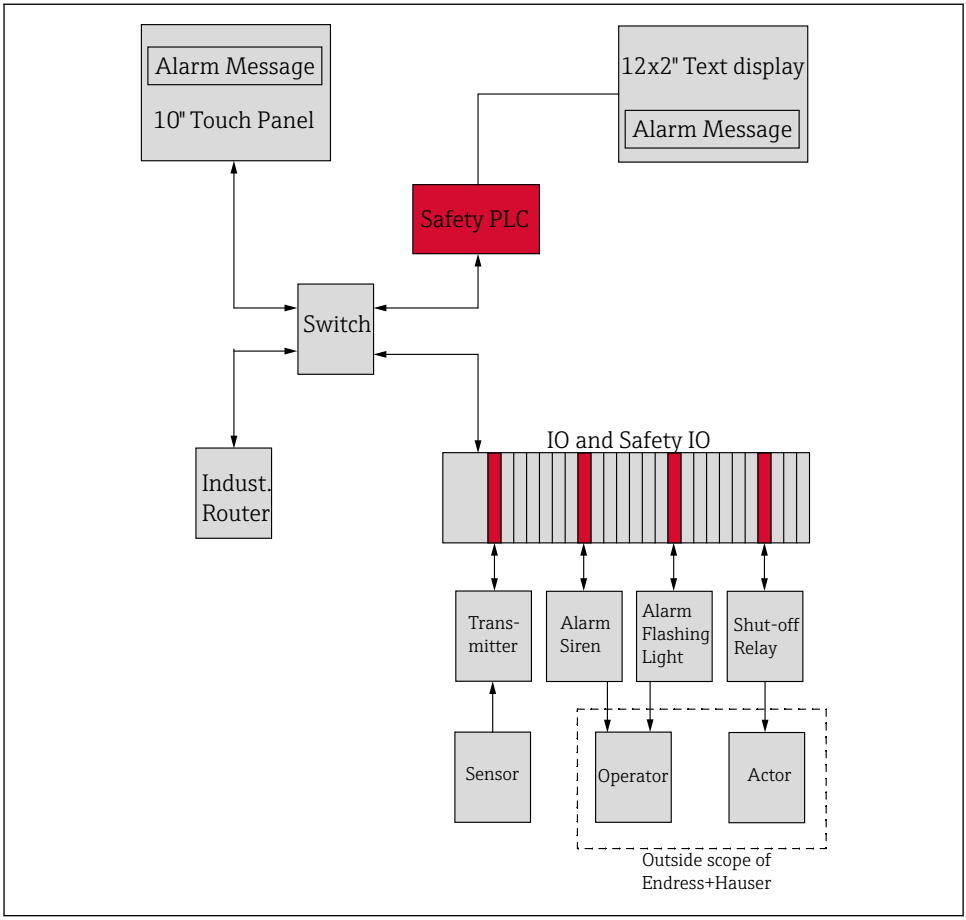
1 Cabinet for Overfill Prevention System
2 Safety relay output
3 Field signalization
4 Sensor, High-High alarm
5 Sensor, High warning
6 Actuator to be disabled manually



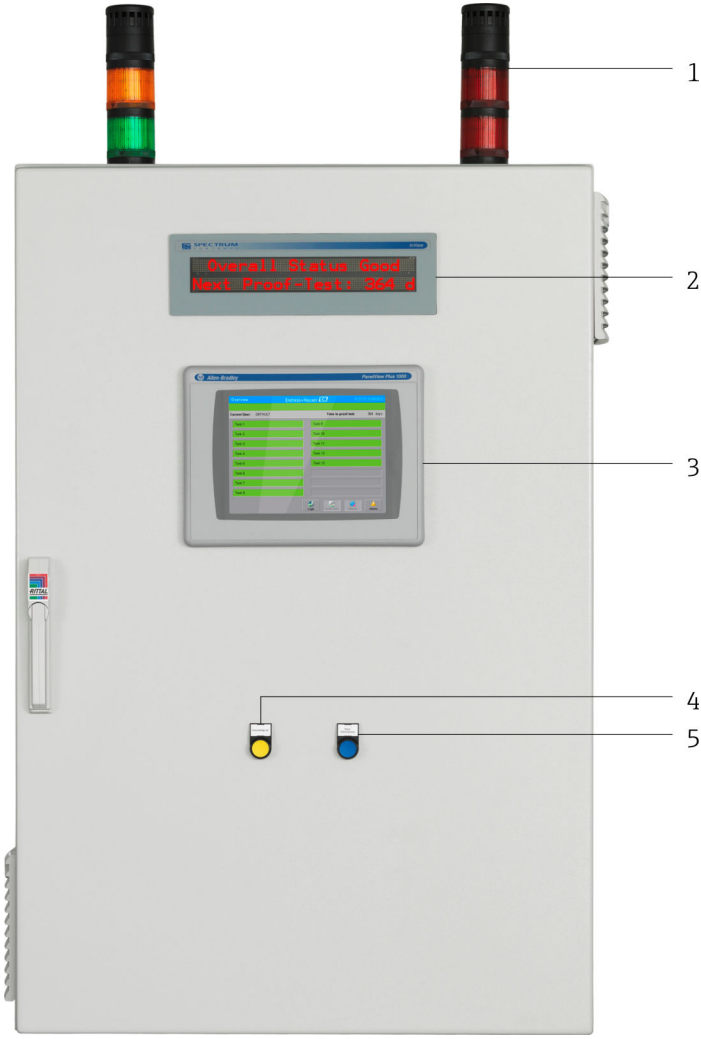
2 *Automated Overfill Prevention System (AOPS) - overview*

1 *Cabinet for Overfill Prevention System*
2 *Safety relay output*
3 *Sensor, High-High alarm*
4 *Sensor, High warning*
5 *Automatically disabled actuator*

3.1.1 System overview

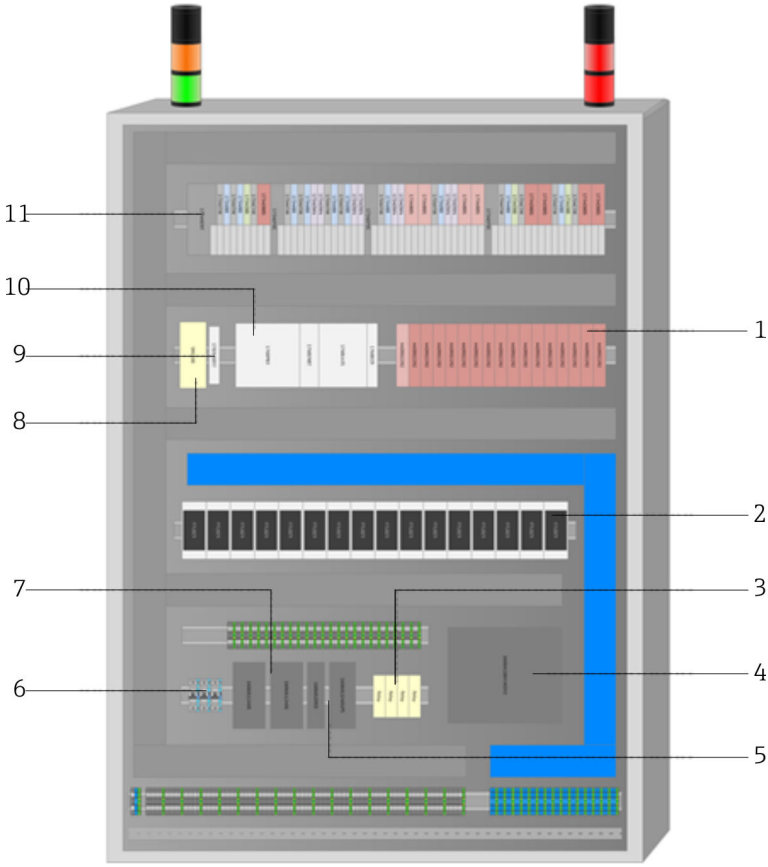


3 System overview



4 *Cabinet, exterior view for 16 tanks (SIL3, High-High Level, AOPS)*

1 *Control room stack lights*
2 *12 x 2" text display unit (optional)*
3 *10" touch panel*
4 *Acknowledge all button*
5 *Reset safety device button*



5 *Cabinet, interior view for 16 tanks (SIL3, High-High Level, AOPS)*

1 *Safety relay (AOPS)*
2 *Nivotester*
3 *Safety relay (general and MOPS)*
4 *Battery pack for UPS (30 min.)*
5 *UPS*
6 *Protection switch*
7 *Power supply*
8 *Remote maintenance modem*
9 *Ethernet switch*
10 *Safety PLC*
11 *PLC input/output modules*

The arrangement varies depending on the configuration.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

- Check the packaging for visible damage arising from transportation
- To avoid damage, remove the packaging with care
- Retain all the accompanying documents
- The documentation is included in the scope of delivery of the Overfill Prevention System and comprises:
  - These **Operating Instructions BA01587S/04/EN**
  - Overfill Prevention System wiring drawing

The device may not be put into operation if the contents are found to be damaged beforehand. In this case, please contact the Endress+Hauser Sales Center. Return the device to Endress+Hauser in the original packaging where possible.

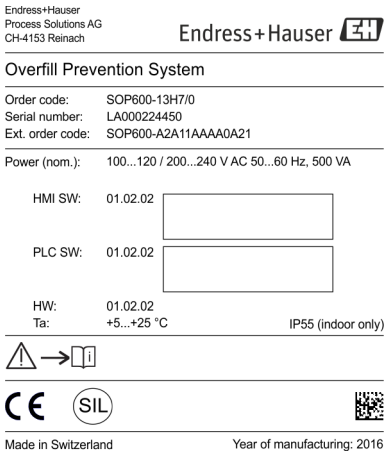
4.2 Product identification

The system can be identified by the nameplate, which is fitted on every cabinet.

4.2.1 Endress+Hauser products

You can identify the components in the following ways:

- Enter the serial number indicated on the nameplate in W@M Device Viewer (www.endress.com → About us → W@M Life Cycle Management → Operations → The right device information always at hand (find spare part) → Access device-specific information → Enter serial number): all the information relating to the system/device is then displayed.
- Enter the serial number indicated on the nameplate into the Endress+Hauser Operations App or scan the 2-D matrix code (QR code) on the nameplate with the Endress+Hauser Operations App: all the information relating to the measuring device is then displayed.



4.3 Storage and transport

- The cabinet is packed in such a way that it is fully protected against shock when in storage and during transportation. The original packaging offers the best protection.
- The permitted storage temperature is –20 to 60 °C (–4 to 140 °F), preferably 20 °C (68 °F).
- When transporting the cabinet protect it from direct sunshine to avoid excessively high surface temperatures
- Store the cabinet packaged in a dry place
- Transport the cabinet to its final destination in the transportation box in which it was delivered

5 Installation

⚠ DANGER

If the cabinet or field signalization system are installed in a hazardous area,
an explosion can result.
- ▶ The cabinet and field signalization system must be installed in a safe environment (non-hazardous zone).

5.1 Installation conditions

Control cabinet
- The cabinet must be installed in a dry, air-conditioned and explosion-proof indoor area
- Ambient temperature range: 5 to 25 °C
- Humidity: maximum 85%

⚠ CAUTION

Defective cables and components
cause a short-circuit.
- ▶ Avoid moisture on the cabinet interior.
- ▶ Check cables and components regularly.

Field signalization:
- The strobe light and siren can be mounted in the field in an explosion-proof area
- Ambient temperature range: –25 to 55 °C
- Humidity: maximum 90%
- The strobe light and siren must be protected from direct sunlight

Liquiphant:
For precise installation conditions see:
- Operating Instructions BA01037F/00/EN
- Brief Operating Instructions KA00143F/00/EN
- Brief Operating Instructions KA00172F/00/EN

5.2 Mounting the cabinet

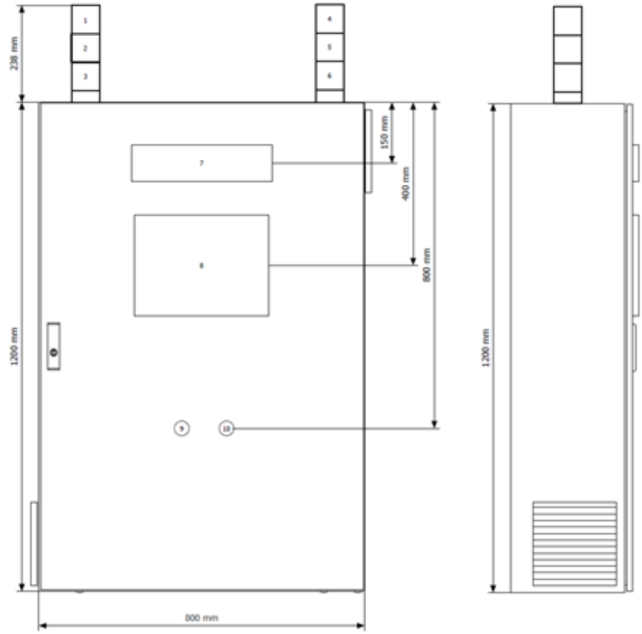
⚠ CAUTION

When the cabinet is being mounted or removed or if the cabinet is incorrectly secured
the cabinet can topple over and cause crushing.
► Observe the mounting instructions and technical aids.

⚠ CAUTION

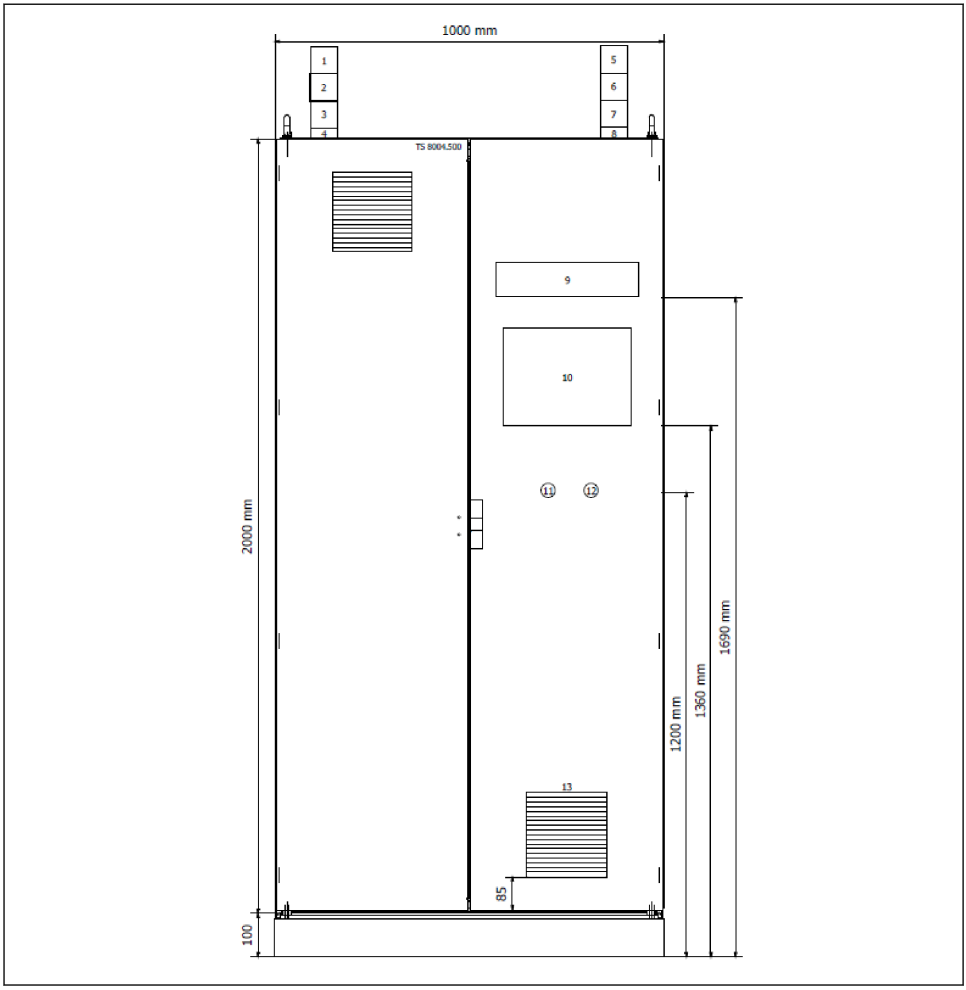
If the cable connections are not routed correctly,
people can trip or fall, resulting in injury.
► Connecting cables must be laid correctly in appropriate cable ducts.

The 1 200 mm high wall cabinet is supplied with brackets for wall mounting and must be mounted on a stable wall using suitable mounting equipment.



6 Example: cabinet for wall mounting (e.g. for 8 tanks)

The 2 000 mm high freestanding cabinet is supplied with a 100 mm base. The customer must ensure that the cabinet is screwed onto a firm, even floor.



7 *Example: freestanding cabinet (e.g. for 16 tanks)*

The cable entries are located on the underside of the cabinet in the case of both the 1 200 mm high wall cabinet and the 2 000 mm high freestanding cabinet.

5.2.1 Mounting a signalization system on the cabinet

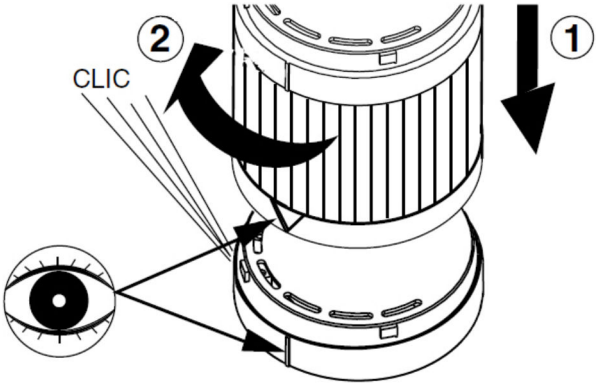
You must first mount the O-rings supplied with the documents in the cabinet bag.

8 Plug-in base without O-ring

9 Plug-in base with O-ring

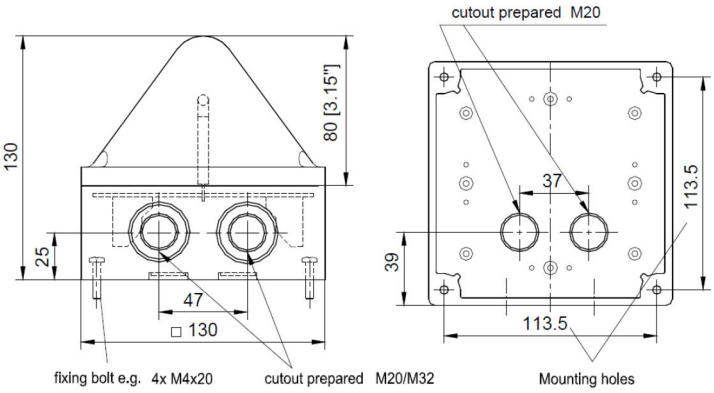
Then the stack light with the green light can be mounted on the left-hand side and the stack light with the red light can be mounted on the right-hand side.

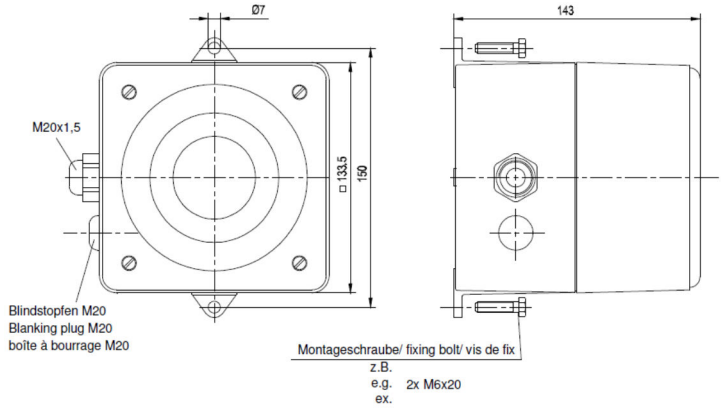
The stack lights are supplied unassembled in the cabinet.



5.2.2 Mounting the field signalization system

The strobe light and siren must be mounted on a stable and even apparatus using the dimensioned drawings provided below. If possible, the devices should be mounted with the cable glands pointing downwards.





5.3 Post-installation check

Are the mounted components undamaged (visual inspection)?	❑
Do all the components meet the required specifications? For example: ▪ Ambient temperature ▪ Humidity ▪ Explosion protection	❑
Is the correct orientation selected?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Are the securing screws tightened securely?	❑

6 Electrical connection

6.1 Connection conditions

6.1.1 Required tools

- For cable entries: use suitable tools
- Wire stripper
- When using stranded cables: crimper for wire end ferrule
- For removing cables from terminal: flat blade screwdriver ≤ 3 mm (0.12 in)

6.1.2 Requirements for connecting cable

The connecting cables provided must fulfill the following requirements.

Electrical safety

In accordance with applicable national regulations

Power feed

- L/N/PE
- 115 to 230 V_{AC}
- 50 to 60 Hz
- 3 to 5 A depending on the system design
- The owner/operator must fuse the SOP600 Overfill Prevention System with a 16 A fuse
- The supply cable should have a cross-section of 2.5 mm^2 (individual country-specific standards must be observed)

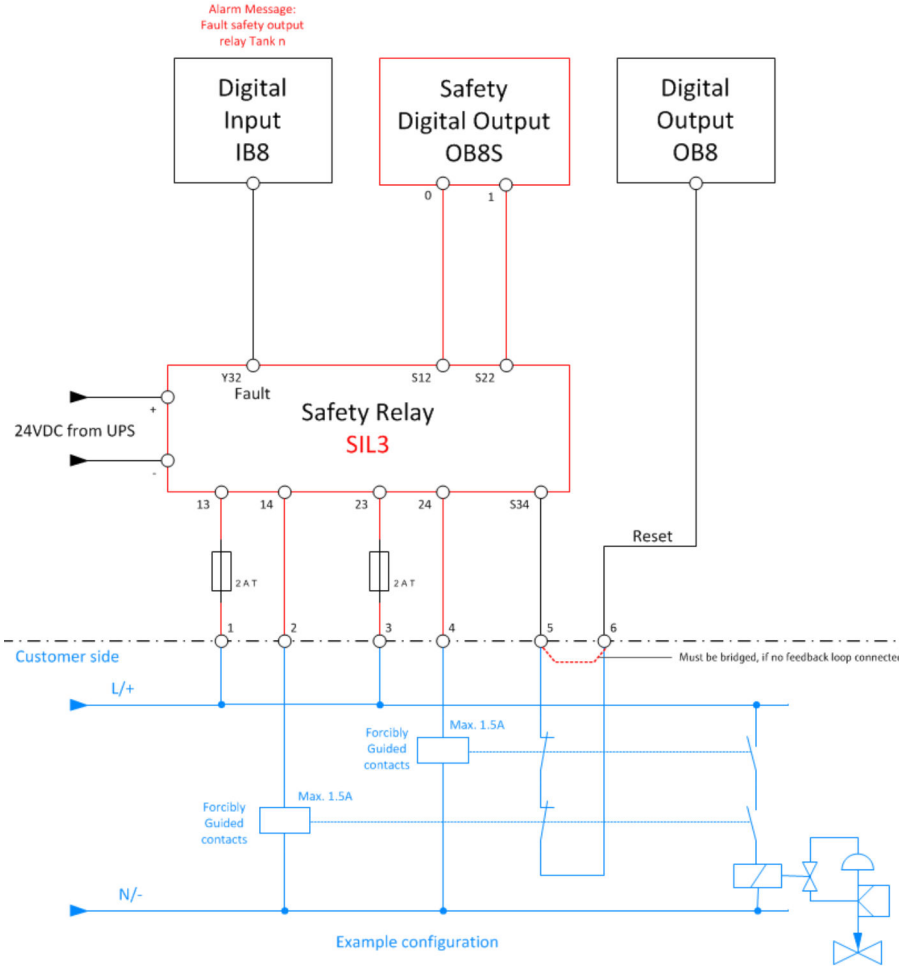
Connecting the actuators

Two floating safety contacts switch the actuators through the safety relay. The safety contacts are fused with a 2 Ampere slow-blow terminal fuse.

Output nominal load

- UL: C 300
- AC-15: 1.5 A/250 V_{AC}
- DC-13: 2 A/ 24 V_{DC} (0.1 Hz)

Connection example for a valve



NOTICE

If there is no feedback signal from the actuator (valve closed/pump switched off),
it is not possible to reset the safety relay.

- The reset signal must be bridged (terminals 5 and 6 in the example above).

Connecting the field signalization system

Robust cables with a conductor cross-section of 1.5 to 2.5 mm^2 must be used. We recommend routing the cables for the strobe light and the siren separately or in different protective conduits. It is essential to ensure that the cables are suitable for outdoor use.

Connecting the sensors (Liquiphant sensors)

The twin-core connecting cable (instrument cable) with a maximum length of 1000 m is connected to the screw terminals (conductor cross-sections 0.5 to 2.5 mm^2) in the connection compartment.

In the event of increased electromagnetic interference, a shielded connecting cable is recommended and the shield must be connected to the sensor and the power supply.

More information on the connection procedure and on the cable specifications can be found in the documentation for the Liquiphant and Nivotester devices used.

Cable diameter

- The wall cabinet is provided with M20 cable glands for cable diameters of 8 to 12 mm for the supply cable and control cable
- M16 cable glands for cable diameters measuring 6 to 10 mm are available for the signal cables
- M20 cable glands for cable diameters measuring 8 to 12 mm are available for the field devices (strobe and siren)

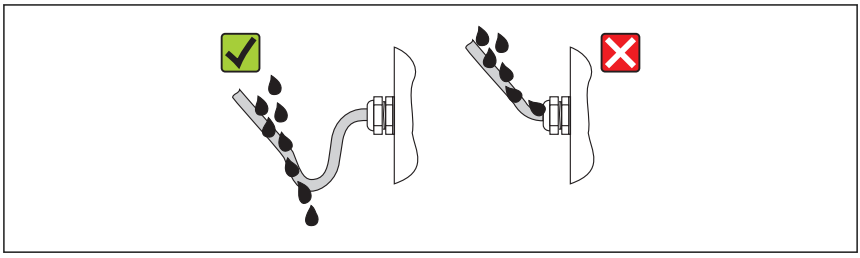
6.1.3 Terminal assignment

The terminal assignment varies depending on the system layout. Therefore, the cabling must always be performed according to the project-specific circuit diagram.

6.1.4 Ensuring the degree of protection

- The cabinet is only approved for indoor use (IP55)
- The field signalization system meets all the requirements of IP66/67 protection
- Depending on the version ordered, the Liquiphant meets all the requirements from IP65 protection and higher

1. Ensure that the housing seals are clean and mounted correctly. Dry, clean or replace the seals if necessary.
2. Tighten all housing screws and screw covers.
3. Tighten cable glands.
4. Ensure that moisture cannot penetrate the cable entry by laying the cable in such a way that it forms a U shape in front of the cable entry (**water trap**).



5. Seal off any unused cable entries using dummy plugs.

6.2 Post-connection check

Are the device and cable undamaged (visual check)?	❑
Do the cables comply with the requirements ?	❑
Do the cables have adequate strain relief?	❑
Are all cable glands installed, securely tightened and leak-tight? Cable run with water trap?	❑
Does the supply voltage match the specifications on the device nameplate?	❑
Is the terminal assignment correct ?	❑
Are all housing covers installed and securely tightened?	❑
Are all unused cable entries sealed with a dummy plug?	❑
Are the cables of the field signalization system routed separately?	❑

7 Operation options

The device is operated via the touch panel installed in the cabinet door. In addition, there is a button for acknowledging alarms and a button to reset the safety alarm. For signalization, there are stack lights (alarm and warning stack lights) and an optional text display in addition to the touch panel. Safety-oriented field signalization devices (strobe and siren) are also supplied for manual systems. Field signalization is optional for automated systems (AOPS) but is not relevant to SIL. In addition, there is the added option of supplying data to a higher-order system via Modbus TCP or Ethernet/IP.

8 Commissioning

8.1 Function check

Before commissioning the Overfill Prevention System:
Make sure that the post-installation and post-connection checks have been performed:
– "Post-installation" checklist, **Section 5.3** → 🖹 21
– "Post-connection" checklist, **Section 6.2** → 🖹 25

8.2 Switching on the Overfill Prevention System

Switch on the Overfill Prevention System once everything has been mounted, the cables have been connected and the checks performed:

1. Switch on the three two-pole circuit breakers on the left-hand side.
2. Insert the fuse for the UPS battery into the fuse holder.

8.3 Configuring the Overfill Prevention System

- Acknowledge warnings and alarms using the **Acknowledge all** built-in door button
- Reset safety alarms using the **Reset safety device** built-in door button
- Assign a password for every user, **Section 9.3.2**
- Set the current local time using the touch screen **Section 9.3.16**
- Set the desired proof test interval using the touch screen **Section 9.3.16**
- Activate the proof test using the touch screen **Section 9.3.15**
  Only if the system is in perfect operating condition and no error messages are displayed (the warning **UPS not ready** is displayed until the battery is fully charged)
- Print out proof test log

8.4 Configuring the measuring devices

More information on the Liquiphant FTL8x and Liquiphant M FTL5x/FTL7x can be found in:
- Operating Instructions BA01037F/00/EN
- Brief Operating Instructions KA00143F/00/A6
- Brief Operating Instructions KA00143F/00/A6

8.4.1 Liquiphant FTL8x

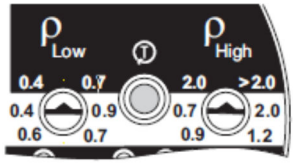
Density settings

- The decision to operate in the MIN or MAX detection mode is made when you wire the device
- The device is not ready for operation when it is delivered
- The density range must be set to commission the device. Otherwise the device starts with an error message.

WARNING

If the wrong medium density range is set
the safety function can no longer be guaranteed.
▶ The density range must be adjusted to suit the medium.

The density of the medium under the prevailing process conditions dictates the density range to be set. The density ranges that can be selected at the electronics are preprogrammed for typical groups of media (e.g. liquefied gas, alcohol, aqueous solution, acid) under the maximum process parameters that are permitted. When the device is delivered the position of the rotary switches is not valid.



10 Position of rotary switches when delivered

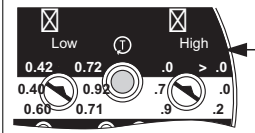
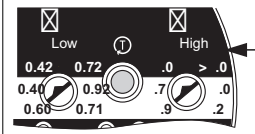
The rotary switches are surrounded by scales that indicate the individual density ranges (MIN detection - white, MAX detection - black). The rotary switches must be parallel to one another to select a valid density range. The pointer of the left rotary switch (low density) must point to the lower density value of the selected range and the pointer of the right rotary switch (high density) must point to the upper density value of the selected range.

⚠ WARNING

If the rotary switches are not parallel to one another,
the selected density range is not valid and the red error LED flashes in alternation with the green LED.

► The rotary switches must be set so that they are parallel to one another.

Setting for MAX detection mode

Type of liquid	Low density P_{Low} g/cm³ (SGU)	High density P_{High} g/cm³ (SGU)	MAX detection operating mode (black area above rotary switch)
e.g. liquefied gas	0.4 (0.4)	2.0 (2.0)	
Other liquids	0.7 (0.7)	> 2.0 (>2.0)	

The configuration can be confirmed in two different ways:
- By pressing the test button on the Liquiphant FailSafe FTL80, FTL81, FTL85
- By disconnecting the measuring system (FailSafe) from the supply voltage (restart)

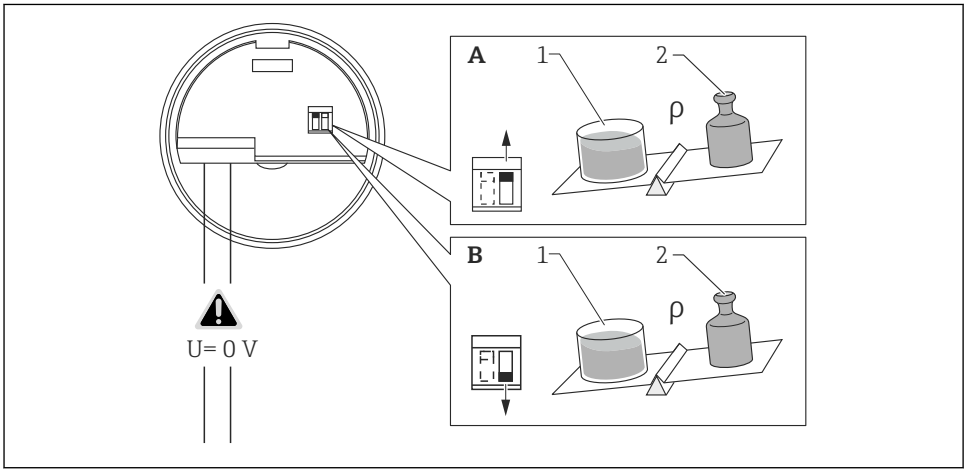
8.4.2 Liquiphant M FTL5x/FTL7x

Density settings

WARNING

If the wrong medium density range is set
the safety function can no longer be guaranteed.
▶ The density range must be adjusted to suit the medium.

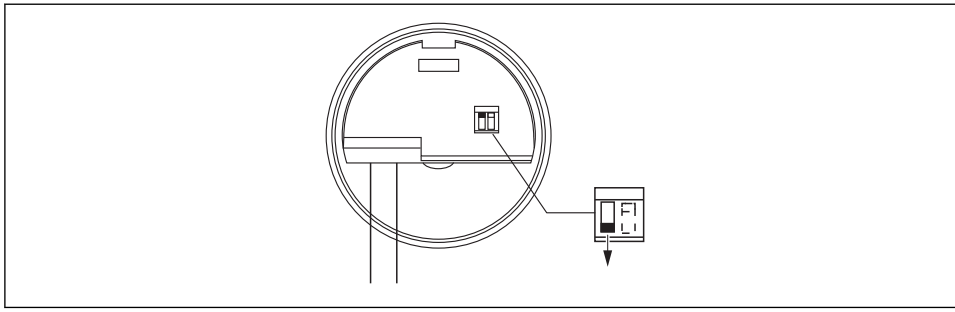
The density of the medium under the prevailing process conditions dictates the density range to be set. The density ranges that can be selected at the electronics are preprogrammed for typical groups of media (e.g. liquefied gas, alcohol, aqueous solution, acid) under the maximum process parameters that are permitted.



A Standard >0.7
A-1 1l
A-2 Min. 0.7 kg
B e.g. propane >0.5
B-1 1l
B-2 0.5 to 0.7kg

Self-test settings:

The self-test must be set to EXT as otherwise the proof test will not work via the operator terminal.



The Liquiphant must be disconnected from the supply voltage (restart) to confirm the configuration.

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