Technical Information
Overfill prevention system SOP300

For reliable and secure tank overfill prevention

Application

The overfill prevention system complies with API2350 and WHG. It can be used as an automatic or manual system and can detect signals for overflow, pump protection and leakage in the base of the tank and issue an alarm. If a defined level is overshot or undershot, or if a leak is detected in the base of the tank, the system automatically activates the signaling elements and outputs the relevant message on the touch display. The system is designed for up to 128 tanks and features automated proof tests, for which a report can be created and exported.

Your benefits

- High level of confidence and reliability thanks to a fully independent solution in accordance with API2350.
- A safe investment, as the solution is modular, scalable and extensible.
- The integrated, automated proof tests reduce the time required for commissioning and maintenance.
- Detailed warnings and alarms help users to make quick decisions and take immediate action.
- Seamless integration into monitoring systems for remote monitoring via standard interfaces such as Modbus TCP.
- Reduced engineering and commissioning time and lower maintenance costs.

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Table of contents

About this document

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.

Symbols for certain types of information

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.
	Visual inspection.

Function and system design

Function

Sensors transmit the current system status (point level ok or overshot/undershot) to the system. The system detects the relevant level alarm or leakage alarm and switches on the alarm siren and strobe (MOPS field signaling) and/or opens the contact of the function-specific safety relay (AOPS). In addition, an alarm is displayed on the touch display, and an appropriate signal is output via the signal lamps. The system specification and the assignment of functions to inputs and outputs is determined when ordering. With automated proof-testing for a Liquiphant, the system offers a simple, time-saving function that guides users through the proof test on the operator panel. This must be run periodically in order to guarantee the functional integrity of the safety function. The actuator, which is connected to the function-specific safety relays, is not included in the scope of delivery. These are plant-specific and the responsibility of the plant owner/operator. There are two types of overfill prevention system: MOPS and AOPS.

Manual overfill prevention system (MOPS)

The user stops the supply of media to the tank by closing the corresponding valve or by switching off the pump. This involves manual intervention in either case. The system alerts the user via the alarms on the touch display or via the signaling equipment installed in the field (alarm siren and alarm flashing light).

Automatic overfill prevention system (AOPS)

The system prevents a dangerous condition by automatically opening the fault-signaling contacts, which in turn causes the connected actuator (valve/pump) to close/stop. No manual intervention is required.

System design

The overfill prevention system consists of:
- Cabinet for overfill prevention system
  - Power unit (optional: redundant power unit, UPS and battery)
  - Nivotester (transmitter for Liquiphant), dependent on order configuration
  - Safety relay for function in question, dependent on order configuration
  - Control cabinet signaling/operation (signal lamps/push-buttons)
  - Gateway/remote maintenance modem for transferring data to a customer system or for remote maintenance. Remote maintenance via WLAN or 3G (SIM card not included in scope of delivery)
  - 7" touch display (optional)
- FIeld signaling (alarm siren/alarm flashing light), dependent on order configuration
- Sensor (not included in scope of delivery)
- Actuator (not included in scope of delivery)

Sensor (Liquiphant, radar): Up to 5 signals (HH/H/L/LL/Leak) per tank can be read in and alarmed.

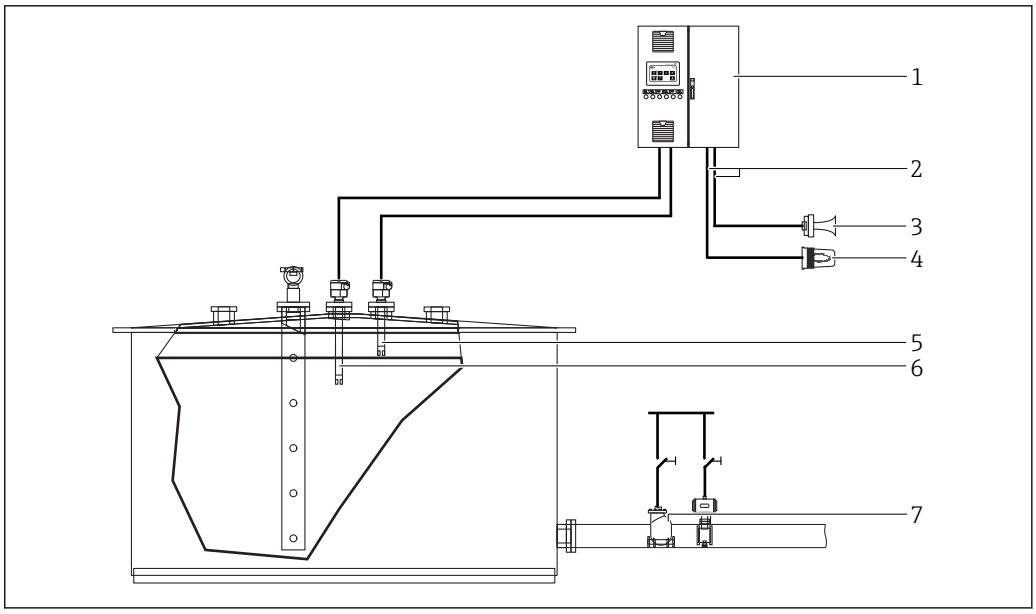
Actuator (valves, pumps): For each function, a safety relay with changeover contact can be installed and switched accordingly to provide an automatic response to a level overshoot or undershoot.

MOPS/AOPS

Depending on the order configuration, the overfill prevention system SOP300 can be used as both a manual and automatic overfill prevention system. In addition to the overfill signals (HH/H), the system can also detect lower limit values (L/LL) as well as leakage in the base of the tank, and issue an alarm. If a defined level is overshot or undershot, or if a leak is detected in the base of the tank, the system automatically activates signaling elements (signal lamps, buzzers) in the control room and outputs the relevant message on the touch display.

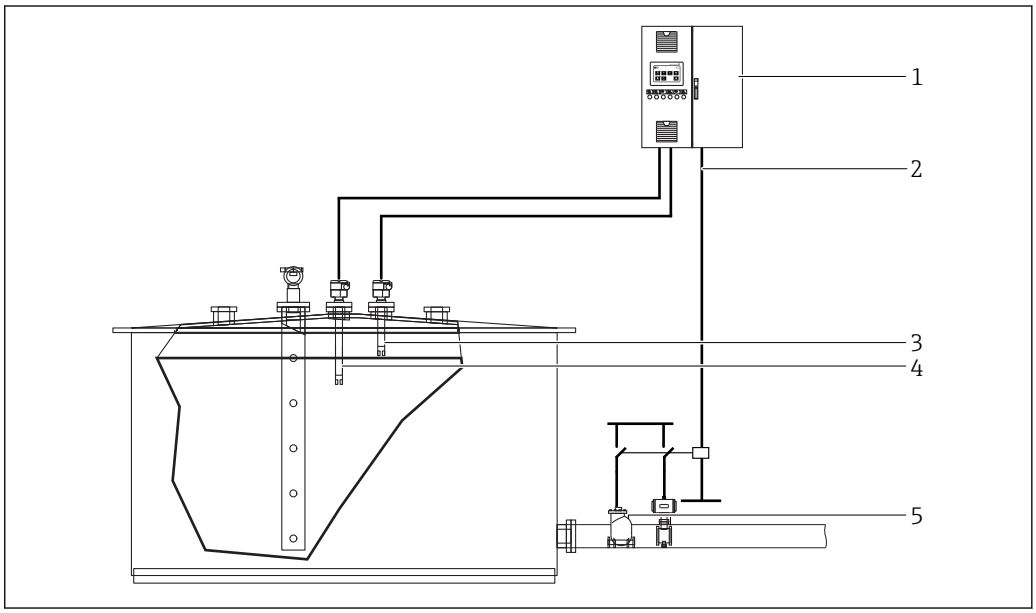
If no safety relays are ordered (order code "540") and only external field signaling (safety-oriented alarm siren and/or alarm flashing light) is available as a collective alarm (order code "541" or "542"), the system must be regarded as a manual system. In this case, the user must close or switch off the relevant actuator (valve/pump) manually.

However, if safety relays are ordered, a suitable actuator (valve/pump) can be connected via the potential-free contact. This actuator can then automatically close or switch off the actuator in the event of an incident. A relay can be ordered for each of the 5 functions, but this is not absolutely essential. Thus, it is also possible to provide a HH-level alarm with a relay, but not a H-level warning since no automatic response is required here. In addition to the function-based relays, it is also possible to use a collective alarm relay, which switches in the event of a system alarm (system status "Error"). This is also ordered using order code "540" (1 pc.). It is possible to order a combined "manual" and "automatic" system in which the relevant output signals are combined with each other.



1 *Overview of Manual Overfill Prevention System (MOPS), example*

1 *Cabinet for overfill prevention system*
2 *Safety relay output*
3 *Field signaling, alarm siren*
4 *Field signaling, alarm flashing light*
5 *Sensor, High-High alarm*
6 *Sensor, High warning*
7 *Actuator to be disabled manually*



2 *Overview of Automated Overfill Prevention System (AOPS), example*

1 *Cabinet for overfill prevention system*
2 *Safety relay output*
3 *Sensor, High-High alarm*
4 *Sensor, High warning*
5 *Automatically disabled actuator*

Input

Measured variable Point level, continuous level or leakage detection in base of tank

Input signal

FTL325P-#1E (order code "520"):
- Connectable point level switches
  - Liquiphant M FTL50 (H), FTL51 (H), FTL51C with FEL57 electronic insert
  - Liquiphant S FTL70/71 with FEL57 electronic insert
- Power supply for point level switch: via Nivotester FTL325P
- Connecting cable between Nivotester and Liquiphant: twin-core, screening not mandatory
  - Max length: 1000 m (3281 ft)
  - For detailed information regarding electrical connection, see documentation for the Liquiphant used: www.endress.com
- Max. monitoring (HH/H), min. monitoring (LL/L) possible
- Via proof-testing function, function can be tested periodically

Ordering information and approvals → 11

Point level (order code "521"):
Any sensor that activates a potential-free contact (NEx/Ex(d)) in the event of a point level being overshot or undershot can be used here.

It is advisable to use sensors where the "Good" state (level ok or no leak) is signaled by a closed floating contact (protection against wire breaks). It is also possible to use the reverse logic (must be specified when ordering). In this case, however, a wire break between the sensor and control unit cannot be detected.

Max. monitoring (HH/H), min. monitoring (LL/L) and leakage detection possible.

Ordering information→ 11

Point level with device fault (order code "522"):
Any sensor that has two potential-free contacts (NEx/Ex(d)), with one contact being used for point level detection and the other for a device fault, can be used here.

It is advisable to use sensors where the "Good" state (level ok, no leak or device ok) is signaled by a closed floating contact (protection against wire breaks). It is also possible to use the reverse logic (must be specified when ordering). In this case, however, a wire break between the sensor and control unit cannot be detected.

Max. monitoring (HH/H), min. monitoring (LL/L) and leakage detection possible.

Ordering information→ 11

Continuous level (order code "523"):
- Any sensor that has an analog 4 to 20 mA signal (NEx/Ex(d)) representing the continuous level [1] can be used here.
- All feasible point levels (HH/H/L/LL) are possible.
- One continuous signal per tank is possible.
- 2-wire (passive) or 4-wire (active) sensors can be connected.
- 4 to 20 mA HART-transparent input

Ordering information→ 11

Output

Output signal

Alarm relay (changeover contact) (order code "540"):
- One safety relay can be used per function (HH/H/L/LL/Leak), dependent on order configuration.
- A safety relay to signal the system status "Error" is also possible.
- All relays are activated in the "Good" state (level ok, no leak, system not "error").
- One changeover contact is available per relay for connecting a suitable actuator (min. 15 V AC/DC; max. 250 V AC/DC; switching capacity at 24 V_{DC}: 2 A, at 230 V_{AC}: 3 A)
- The correct function is monitored by returning a second contact into the control unit (forcibly guided contacts), and a signal is output in the event of an fault.
- Safety relay with forcibly guided contacts as per DIN EN 50205

Ordering information→ 11

1) (0 to 100 % (0 % = empty, 100 % = full))

Alarm siren with activation feedback (order code "541"):
- Safety-oriented alarm siren (field signaling) if system status "Error" activated
- 24 V_{DC} Power supply from cabinet
- Alarm siren supplied unassembled
- Sound pressure level: 105 dB(A)

You can test the alarm siren function periodically by means of a proof test. For this purpose, acoustic detection is performed in the device. The result is reported to the control system via a contact and output on the touch display.

Ordering information→ 11

Alarm flashing light with activation feedback (order code "542"):
- Safety-oriented alarm flashing light (field signaling) if system status "Error" activated
- 24 V_{DC} Power supply from cabinet
- Alarm flashing light supplied unassembled
- Energy: 10 J
- Flash rate: 1 Hz

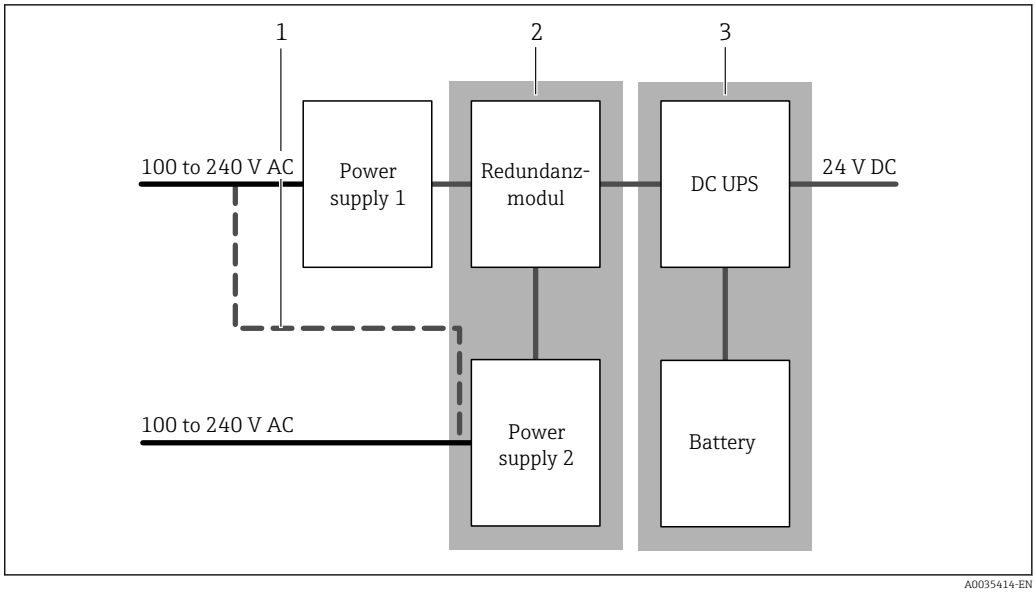
You can test the alarm strobe function periodically by means of a proof test. For this purpose, optical detection is performed in the device. The result is reported to the control system via a contact and output on the touch display.

Ordering information→ 11

Power supply

Supply voltage

Voltage range	100 to 240 V_{AC}
Power supply frequency	45 to 65 Hz
Power consumption	Depends on the order configuration 10 A Power unit: 264 VA 20 A Power unit: 529 VA
Max. back-up fuse	13 A, tripping characteristic D



3 Power supply

1 Bridge provided by the customer onsite, if two separate mains connections are not available in a redundant power supply system
2 Option – Redundant power supply, order code "040", version "2" or "4"
3 Option – Uninterruptible Power Supply (UPS), order code "630"

Electrical connection	Terminal strips in control cabinet (cable run from below)

Installation

Mounting location	Control cabinet:	Indoors (max. 30 °C), non-hazardous area
	Alarm strobe (field signaling):	Inside/outside, non-hazardous area
	Alarm siren (field signaling):	Inside/outside, non-hazardous area

⚠ CAUTION

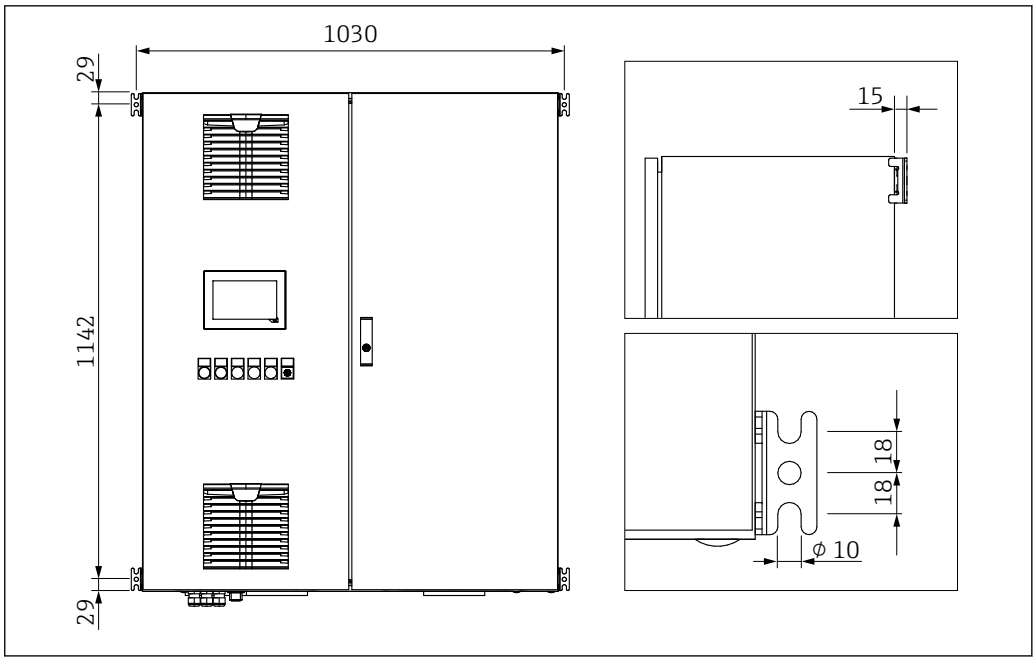
Noise from alarm siren (105 dB up to one meter)
The alarm siren signal can cause temporary hearing impairment and stress.
- ▶ Only install alarm siren outdoors.

Environment

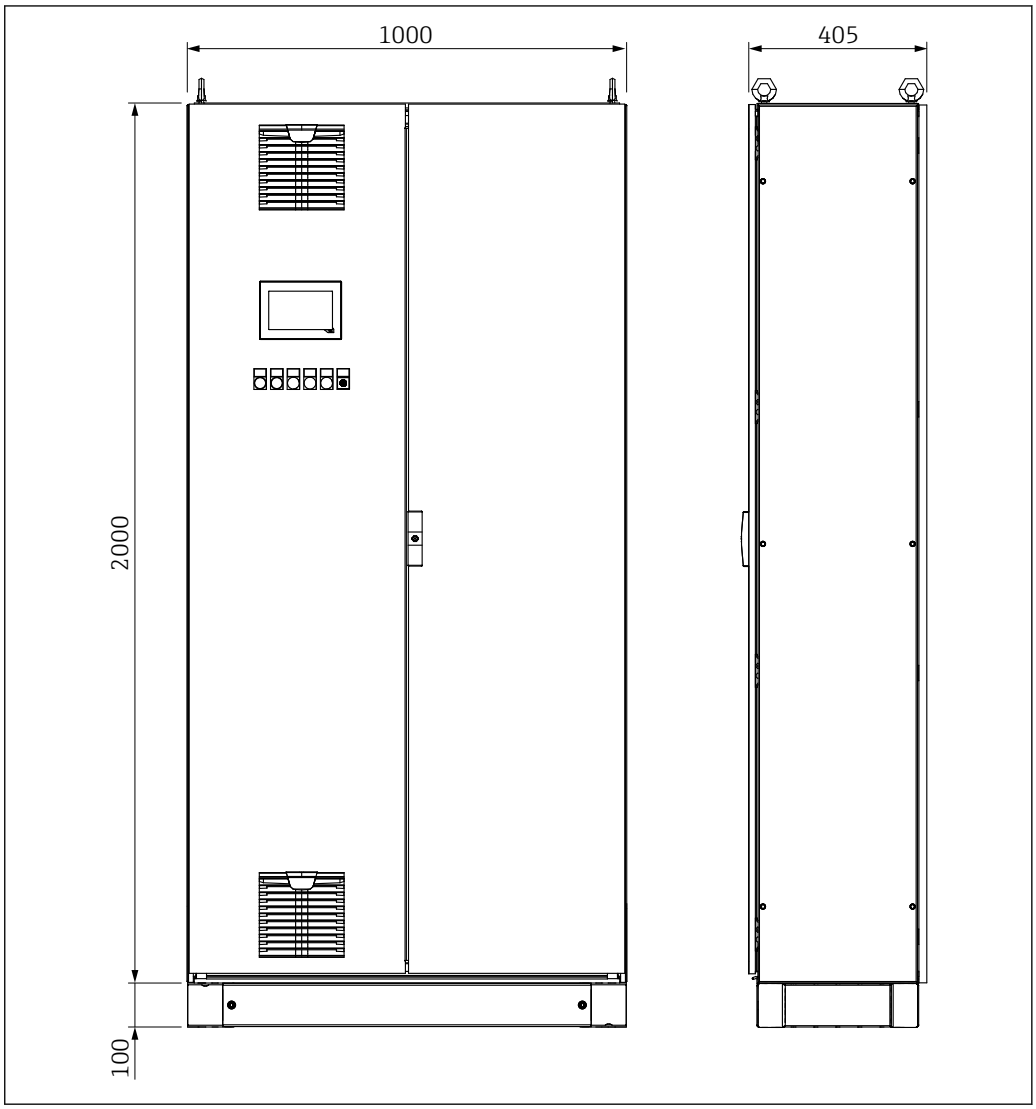
Ambient temperature range	Control cabinet:	5 to 30 °C (41 to 87 °F)
	Alarm strobe (field signaling):	–25 to 55 °C (–13 to 131 °F)
	Alarm siren (field signaling):	–25 to 55 °C (–13 to 131 °F)
Humidity	Control cabinet:	5 to 85 %RH
	Alarm strobe (field signaling):	0 to 90 %RH
	Alarm siren (field signaling):	0 to 90 %RH
Degree of protection	Control cabinet:	IP54 (EN 60529)
	Alarm strobe (field signaling):	IP66/IP67 (EN 60529)
	Alarm siren (field signaling):	IP66/IP67 (EN 60529)
Electromagnetic compatibility (EMC)	EC-EMC Directive 2014/30/EU	

Mechanical construction

Design, dimensions



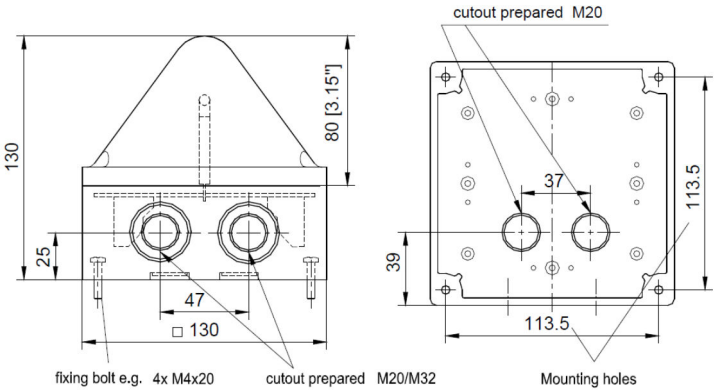
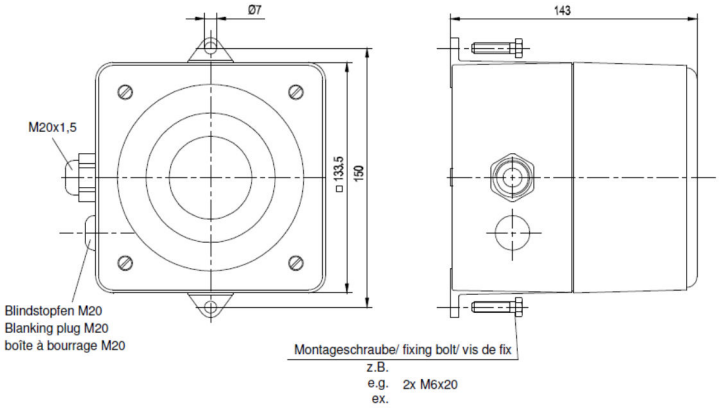
4 *Example: Control housing for wall mounting, order code "050", version "B"*



5 *Example: Control housing, free-standing, order code "050", version "D"*

The dimensions of the control cabinet are dependent on the order configuration (order code "050"):

- Version "A"
  800 x 1200 x 300 (W x H x D in mm, single door), for wall mounting
- Version "B"
  1000 x 1200 x 300 (W x H x D in mm, double door), for wall mounting
- Version "C"
  800 x 2000 x 400 (W x H x D in mm, single door), free-standing + 100 mm height for base
- Version "D"
  1000 x 2000 x 400 (W x H x D in mm, double door), free-standing + 100 mm height for base

Housing as separated operator panel	▪ Order code "510", version "BA" ▪ 380 x 380 x 210 (W x H x D in mm) ▪ Maximum distance to control cabinet: 100 m
Alarm strobe (field signaling)	150 x 150 x 143 (W x H x D in mm) 
Alarm siren (field signaling)	130 x 130 x 130 (W x H x D in mm) 
Weight	The weight of the cabinet depends on the order configuration: ▪ Approx. 120 kg for cabinet of 800 x 1200 x 300 (W x H x D in mm) ▪ Approx. 150 kg for cabinet of 1000 x 1200 x 300 (W x H x D in mm) ▪ Approx. 180 kg for cabinet of 800 x 2000 x 400 (W x H x D in mm) ▪ Approx. 250 kg for cabinet of 1000 x 2000 x 400 (W x H x D in mm)
Material	Material of control cabinet and separated operator panel: ▪ Sheet steel, 1.5 mm ▪ Dipcoat primed, RAL 7035

Terminals	Different types of terminals (standard, multi-tier and terminal blocks) are mounted on the underside of the mounting plate.
Operating concept	**General:** ▪ Configuration and operation including execution of proof tests via either 7" touch display or VNC client ▪ Operating elements such as signal lamps, "Acknowledge" and "Reset" push-buttons. The operating elements can be optionally installed in a separate housing. See this table, row entitled "Housing as separated operator panel". **MOPS:** If, in the case of a limit value violation (overshoot and undershoot), there is no provision made for an automatic system response (no safety relay to which a valve and/or pump is connected), the user must manually close the specific valve or switch off the system pump.

Certificates and approvals

CE mark

The devices have been designed and tested according to the safety requirements in such a way that they are delivered to the customer in perfect operating condition. The devices comply with the valid standards and regulations listed in the EC Declaration of Conformity and therefore meet the legal requirements of the EC Directive. Endress+Hauser confirms the conformity of the devices by affixing to them the CE mark.

Ex approval

The cabinet and field signaling must be installed in a non-hazardous area. A Liquiphant can be installed in hazardous areas. Information about the versions currently available for use in hazardous locations (IECEx, ATEX Ex ia; TIIS; NEPSI; FM; CSA) is dependent on the Liquiphant used.

Overfill prevention (WHG)

Depends on sensor.

Other standards and guidelines

- EC Low Voltage Directive 2014/35/EU
- IEC/EN 60204-1
  Safety of Machinery - Electrical Equipment of Machines

Ordering information

You must define the system configuration separately.

Order code:

SOP300	–	010	020	030	040	050	510	520, 521, 522, 523 or 539	540, 541, 542 or 559	600	630

Feature	Designation	Option model	
010	Display	1	7" touch display as HMI
		2	without, connection via VNC client possible
		9	Special version, TSP-no. to be spec.
020	Number of input signals	A	1 to 8
		B	9 to 16
		C	17 to 32
		D	33 to 64
		E	65 to 128
		Y	Special version, TSP-no. to be spec.

Feature	Designation	Option model	
030	Number of output signals	A	1 to 8
		B	9 to 16
		C	17 to 32
		D	33 to 64
		E	65 to 128
		Y	Special version, TSP-no. to be spec.
040	Power supply unit	1	24 V_{DC}/10 A
		2	24 V_{DC}/10 A, redundant (2 power supplies)
		3	24 V_{DC}/20 A
		4	24 V_{DC}/20 A, redundant (2 power supplies)
		9	Special version, TSP-no. to be spec.
050	Control housing width, height, depth	1	800 x 1200 x 300, sheet steel
		2	1000 x 1200 x 300, sheet steel
		3	800 x 2000 x 400, sheet steel
		4	1000 x 2000 x 400, sheet steel
		9	Special version, TSP-no. to be spec.
510	Operator panel	BA	Separated operator panel (max. 100 m) W x H x D; 380 x 380 x 210, sheet steel; IP54
		B9	Special version, TSP-no. to be spec.
520 [1]	Input signal 1	C1	... FTL325P-H1E1 (ATEX / IEC Ex)
		C2	... FTL325P-N1E1 (NEPSI)
		C3	... FTL325P-P1E1 (FM)
		C4	... FTL325P-T1E1 (CSA)
521 [1]	Input signal 2	CB	... Point level 1x floating contact (NEx/Ex(d))
522 [1]	Input signal 3	CC	... Point level with device fault 2x floating contacts (NEx/Ex(d))
523 [1]	Input signal 4	CD	... Continuous level 4-20mA HART; NEx/Ex(d)
539	Input signal	C9	Special version, TSP-no. to be spec.
540	Output signal 1	DA	... Alarm relay (changeover contact)
541 [2]	Output signal 2	DB	... Alarm siren (with activation feedback)
542 [3]	Output signal 3	DC	... Alarm flashing light (with activation feedback)
559	Output signal TSP	D9	Special version, TSP-no. to be spec.
600	Interface	MA	Modbus TCP (slave)
		M9	Special version, TSP-no. to be spec.
630	Uninterruptible power supply	S1	24 V_{DC}/10 A; 7.2 Ah (min. 20 minutes)
		S2	24 V_{DC}/10 A; 12 Ah (min. 50 minutes)
		S3	24 V_{DC}/20 A; 12 Ah (min. 20 minutes)
		S9	Special version, TSP-no. to be spec.

1) Specify exact number when ordering.
2) You can order a maximum of one alarm siren.
3) You can order a maximum of one alarm flashing light.

Supplementary documentation

Overfill prevention system SOP300	▪ Operating Instructions BA01787S/04/EN ▪ Brief Operating Instructions KA01345S/04/EN
Nivotester FTL325P	▪ Technical Information TI00350F/00/EN ▪ Brief Operating Instructions KA00167F/00/F/A6

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