

# Technical Information

## Overfill Prevention System SOP600

SIL2/SIL3 Tank overfill prevention  
For reliable and secure tank overfill prevention



### Application

The Overfill Prevention System is type-certified up to SIL3 according to IEC 61511 and meets the requirements of API2350 and WHG (German Water Resources Act). Two versions of the system are available (automatic and manual) and are designed for 1 to 16 tanks. If the High-High level is exceeded, a safety relay is disabled or field signaling is enabled (SIL function). Optionally, the High level can also be monitored as a warning (for information purposes only, no SIL function). The Overfill Prevention System features detailed warnings and alarms on the touch panel and on the optional 2" text display unit, system status indication via stack lights and safety-oriented alarm signaling in the field (optionally AOPS). The text display unit can be mounted in the cabinet door or in an external housing and helps users to read the current system status from afar. The system has an automated proof test cycle, which must be performed periodically to maintain functional safety. A corresponding report can be printed out on a printer (optional). The system offers an UPS (optionally AOPS) for 30-minute operation in the event of a power failure.





### Your benefits

- Solution with fully independent SIL2/SIL3 certification for maximum trust and reliability. Certification is performed by independent safety inspectors with operations worldwide
- Safe investment as the solution is modular, scalable and extensible
- Integrated automated proof testing shortens the time 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 EtherNet/IP or Modbus TCP
- Traceability and transparency with automatic event and user intervention log
- Reduced engineering and commissioning time and lower maintenance costs

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## Document information

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

## Function and system design

### Function

The Endress+Hauser Liquiphant (point level switch) transmits the current level (point level exceeded or not) to the Endress+Hauser Nivotester. If the High-High level is exceeded, the Nivotester opens the fault-signaling contact which is connected to the safety PLC. The safety PLC detects a level alarm and switches on the alarm siren and alarm strobe (field signaling MOPS) and/or opens the contact of the tank-specific safety relay (AOPS). In addition, an alarm message appears on the touch panel and text display unit, and the alarm is also signaled by the stack lights. If the High level is exceeded, this only causes a warning message to appear on the touch panel and text display unit, and the stack lights signal. A safety shutdown is not triggered, however. With the automated proof-testing feature, the system offers users a simple, time-saving function that guides users through the proof test on the touch panel. This proof test must be performed periodically (at least once per year) to guarantee the functional integrity of the safety function. The actuator that is connected to the tank-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 kinds of Overfill Prevention System:

- **MOPS:** The operator 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 operator via the alarms on the display and via the signaling equipment installed in the field (siren and strobe). In the event of a power failure, the integrated UPS ensures that the system remains fully functional for up to 30 minutes.
- **AOPS:** The system prevents imminent tank overfill by automatically opening the fault-signaling contacts, which in turn causes the connected actuator (valve/pump) to close/stop. No manual intervention is required.

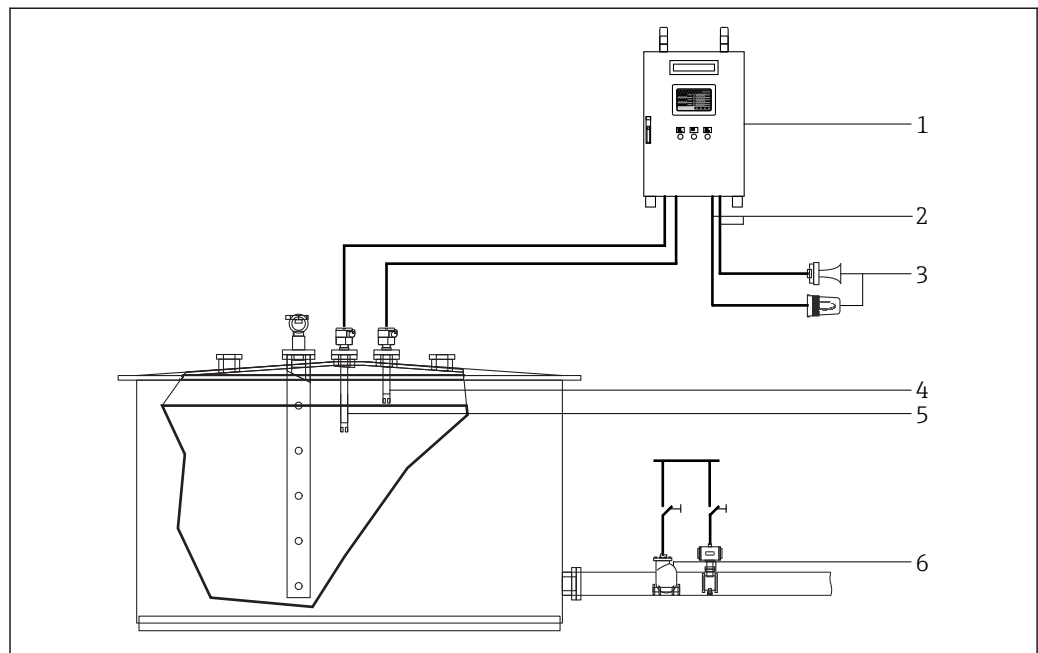
## System design

The Overfill Prevention System consists of:

- Cabinet for Overfill Prevention System
  - Power unit (optional: redundant power unit, UPS and battery)
  - SIL2 or SIL3 Nivotester (transmitter for Liquiphant)
  - SIL3 PLC including input/output modules
  - SIL3 safety relay
  - Cabinet signaling (stack lights)
  - 10" touch panel
  - 2" text display unit (optional)
- Field signaling (siren and strobe) optionally for AOPS
- Point level switch (Liquiphant not included in system scope of delivery)
- SIL2 or SIL3 type certificate
  - The SIL2/SIL3 type certificate considers the point level switches (Liquiphant), including the Nivotester, remote I/Os, safety PLC, safety relay (AOPS) or field signaling (MOPS)
  - The AOPS does not take the customer's actuator (valve/pump) into consideration
  - A project-specific calculation for the corresponding SIL circuit (including actuators) can be ordered as an option, or can be performed independently by the customer

### Manual Overfill Prevention System (MOPS)

If overfilling is imminent, the system automatically activates signaling in the control room and safety-oriented signaling in the field. The operating staff must then manually close or switch off the actuator (valve/pump).

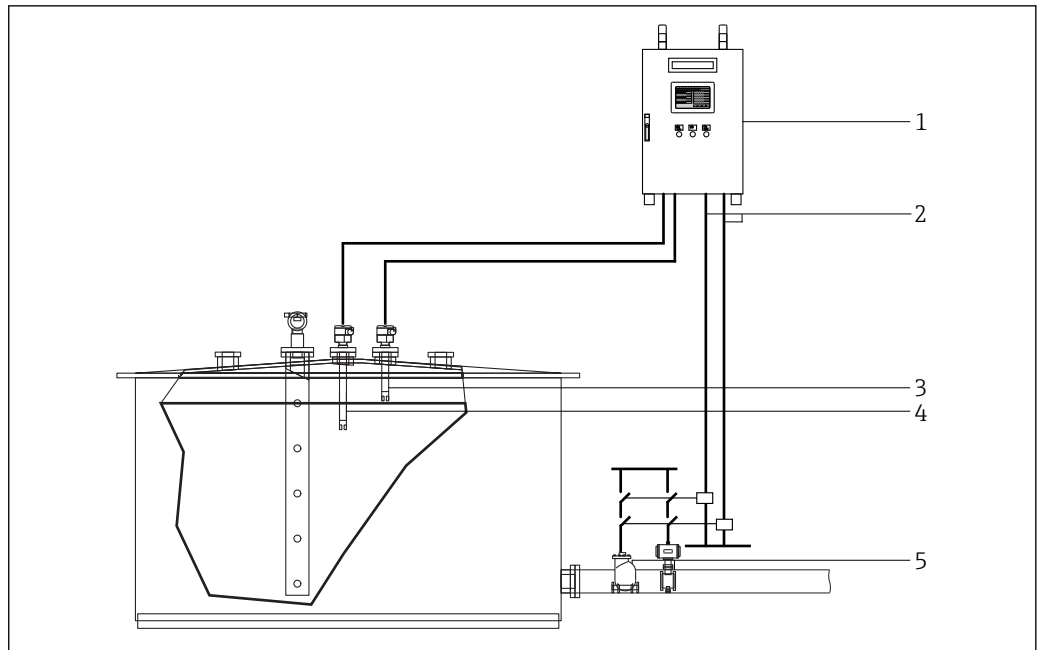


1 Manual Overfill Prevention System (MOPS) - overview

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

### Automated Overfill Prevention System (AOPS)

If overfilling is imminent, the system automatically disables the corresponding safety relay. Any actuators connected (valve/pump) are closed/switched off automatically.



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

## Input

<b>Measured variable</b>	Level
<b>Input signal</b>	<p><b>FTL8x (SIL3):</b></p> <ul style="list-style-type: none"> <li>■ Connectable point level switches: Liquiphant FailSafe FTL8x with FEL85 electronic insert</li> <li>■ Power supply for point level switch: Nivotester FailSafe FTL825</li> <li>■ Connecting cable between Nivotester and Liquiphant: twin-core, screening is not mandatory                             <ul style="list-style-type: none"> <li>- Max. length: 1 000 m (3 281 ft)</li> <li>- For detailed information about the electrical connection of the device, see the documentation of the Liquiphants → 12 used</li> </ul> </li> </ul> <p><b>FTL5x/7x (SIL2):</b></p> <ul style="list-style-type: none"> <li>■ Connectable point level switches                             <ul style="list-style-type: none"> <li>- Liquiphant M FTL50 (H), FTL51 (H), FTL51C with FEL57 electronic insert</li> <li>- Liquiphant S FTL70/71 with FEL57 electronic insert</li> </ul> </li> <li>■ Power supply for point level switch: Nivotester FTL325P</li> <li>■ Connecting cable between Nivotester and Liquiphant: twin-core, screening is not mandatory                             <ul style="list-style-type: none"> <li>- Max. length: 1 000 m (3 281 ft)</li> <li>- For detailed information about the electrical connection of the device, see the documentation of the Liquiphants → 12 used</li> </ul> </li> </ul>

## Output

<b>Output Signal</b>	 Output signal only possible with AOPS.
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- Two closing contacts per tank. Protected by 2A fuses (replaceable)
- Min. current/voltage: 10 mA 10 V
- Max. current/voltage:
  - UL: C 300
  - AC-15: 1.5 A 250 V<sub>AC</sub>
  - DC-13: 2 A 24 V<sub>DC</sub> (0.1 Hz)

Surge voltage resistance 2500 V

Overvoltage category (VDE 0110-1)  
III

## Power supply

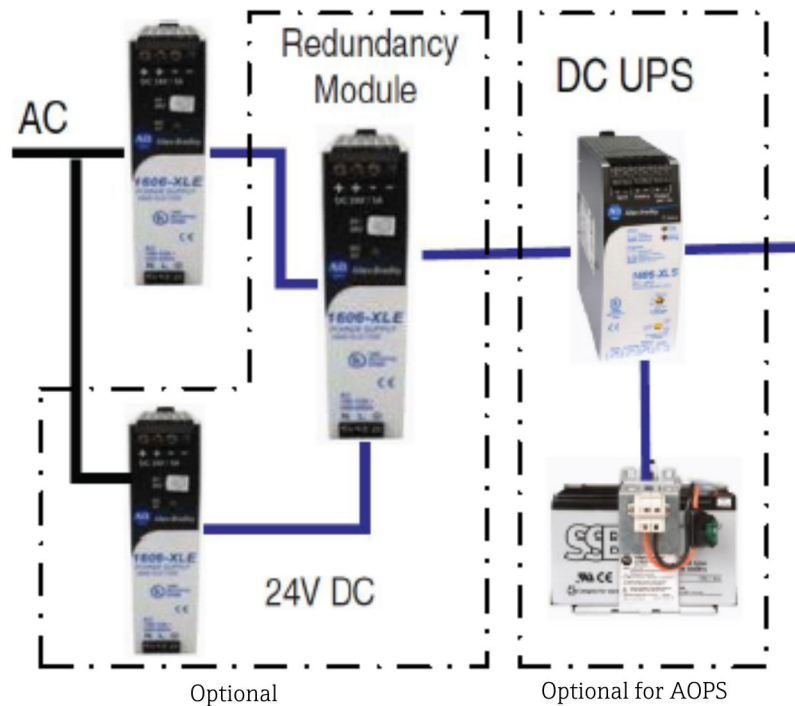
**Supply voltage**

Voltage range 90 to 132 V<sub>AC</sub> (100 to 120 V auto-select input)  
180 to 264 V<sub>AC</sub> (200 to 240 V auto-select input)

Power supply frequency 50 to 60 Hz(+/- 6%)

Power consumption Depends on the type of Overfill Prevention System (AOPS, MOPS, SIL2, SIL3, options used etc.) and the number of tanks  
Max. at 230 V: 3 A  
Max. at 115 V: 5 A

Max. back-up fuse 16 A, tripping characteristic C



**Electrical connection** Terminal strip (in cabinet, cable run from below)

## Environment

Control cabinet: Indoor installation (max. 25 °C), non-hazardous area  
External text display unit: Only indoors, non-hazardous area

Alarm strobe (field signaling): Inside/outside, non-hazardous area  
 Alarm siren (field signaling): Inside/outside, non-hazardous area

**⚠ WARNING**

The loud alarm siren (105dB) can cause hearing damage.

- ▶ Only mount sirens outdoors, not in enclosed spaces.

<b>Ambient temperature range</b>	Control cabinet:	5 to 25 °C (41 to 77 °F)
	External text display unit:	0 to 55 °C (32 to 131 °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)

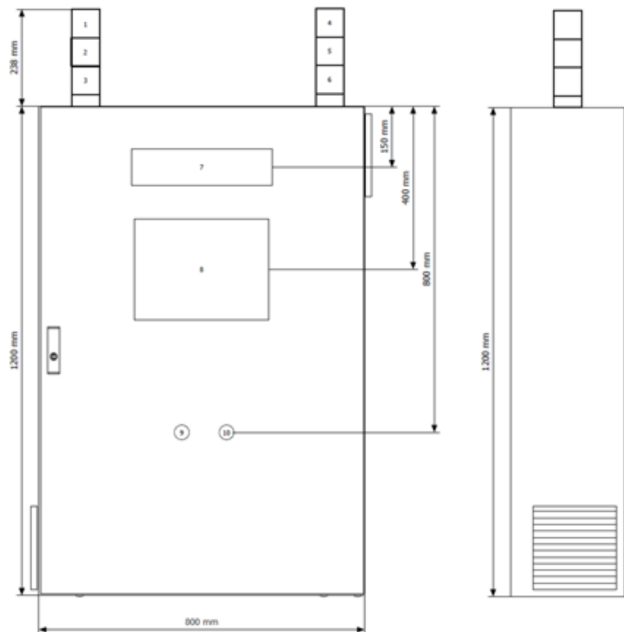
<b>Humidity</b>	Control cabinet:	5 to 85 %RH
	External text display unit:	5 to 95 % RH (non-condensating)
	Alarm strobe (field signaling):	0 to 90 %RH
	Alarm siren (field signaling):	0 to 90 %RH

<b>Degree of protection</b>	Control cabinet:	IP55 (EN 60529)
	External text display unit:	IP65 (EN 60529)
	Alarm strobe (field signaling):	IP 66/IP67 (EN 60529)
	Alarm siren (field signaling):	IP 66/67 (EN 60529)

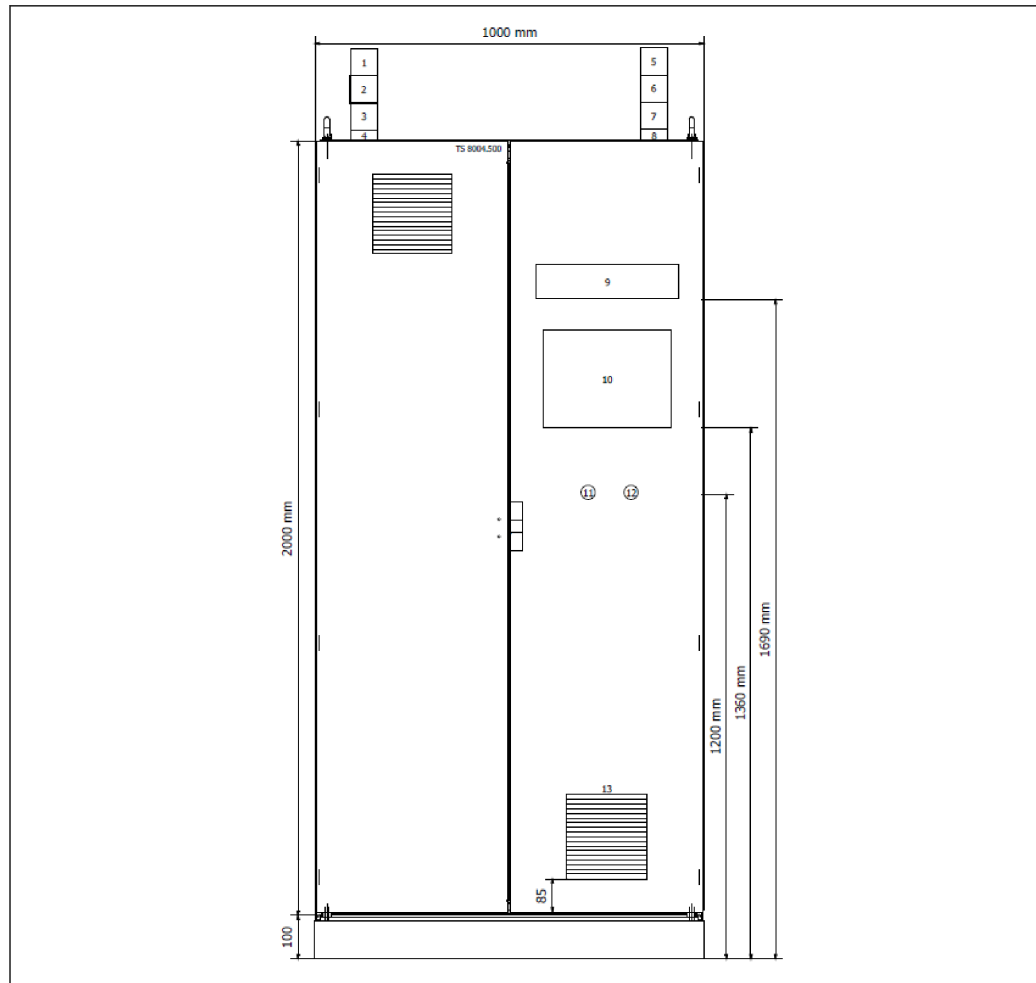
**Electromagnetic compatibility (EMC)** EC-EMC Directive 2014/30/EU

## Mechanical construction

Design, dimensions



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



A0031798

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

The dimensions of the cabinet depend on the type of Overfill Prevention System (AOPS, MOPS, SIL2, SIL3, options used etc.) and the number of tanks:

- Cabinet for 8 tanks:  
800x1200x300 (BxHxD in mm), for wall mounting + approx. 250 mm height for the signal lamps
- Cabinet for 12 tanks:  
1000x1200x300 (BxHxD in mm, double-door), for wall mounting + approx. 250 mm height for the signal lamps
- Cabinet for 12 tanks:  
800x2000x400 (BxHxD in mm), freestanding + approx. 250 mm height for the signal lamps + 100 mm height for the base
- Cabinet for 16 tanks:  
1000x2000x400 (BxHxD in mm, double-door), freestanding + approx. 250mm height for the signal lamps + 100 mm height for the base



Housing for external text display unit	400x200x80 (BxHxD in mm)
Alarm strobe (field signaling)	<p>150x150x143 (BxHxD in mm)</p>
Alarm siren (field signaling)	<p>130x130x130 (BxHxD in mm)</p>
Weight	<p>The weight of the cabinet depends on the type of Overflow Prevention System (AOPS, MOPS, SIL2, SIL3, options used etc.) and the number of tanks:</p> <ul style="list-style-type: none"> <li>■ Approx. 120 kg for cabinet measuring 800x1200x300 (BxHxD in mmm)</li> <li>■ Approx. 150 kg for cabinet measuring 1000x1200x300 (BxHxD in mmm)</li> <li>■ Approx. 180 kg for cabinet measuring 800x2000x400 (BxHxD in mmm)</li> <li>■ Approx. 250 kg for cabinet measuring 1000x2000x400 (BxHxD in mmm)</li> </ul>
Material	<ul style="list-style-type: none"> <li>■ Sheet steel, 1.5 mm</li> <li>■ Dipcoat primed, RAL 7035</li> </ul>
Terminals	Different types of terminals (standard, multi-tier and terminal blocks) are mounted on the underside of the mounting plate.
Operating concept	<p><b>General:</b> Local configuration and operation (including the proof testing procedure) 10" touch panel on the cabinet door</p> <p><b>MOPS:</b> If a High-High level alarm occurs, the operator must manually switch off the specific valve or the pump of the plant.</p>
Operating element	10" touch panel
Display element	2" text display unit (optional)

## 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, the text display unit and the outside signaling unit must be mounted in a non-hazardous area. The Liquiphants can be mounted in hazardous areas. Information about currently available hazardous area versions (IECEX, ATEX Ex ia; TIIS; NEPSI; FM ist; CSA IS) depend on the Liquiphants used.

**WHG overfill prevention**

- Overfill detection system: Z-65-11-507
- Leak detection system: Z-65-40-508

**Functional safety**

For safety functions in conjunction with FEL85 to SIL3 (MAX detection), see the **Functional Safety Manual (SIL) SD00350F/00/EN**.

For safety functions in conjunction with FEL57 to SIL2 (MAX detection), see the **Functional Safety Manual (SIL) SD00111F/00/EN**

**Other standards and guidelines**

- EC Low Voltage Directive 2014/35/EU
- IEC/EN 60204-1  
Safety of Machinery - Electrical Equipment of Machines
- IEC 61508  
Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems (E/E/PES)
- IEC 61511:2003  
Functional safety  
Safety Instrumented Systems for the Process Industry Sector, 2003

## Ordering Information

Order code:

SOP600	-	010	020	030	040	050	060	070	080	090	510	570	610
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Feature	Designation	Option model	
010	System	A	Automated overfill prevention system (AOPS)
		M	Manual overfill prevention system (MOPS)
020	Safety Integrity Level	2	2 (only High-High level, SIL-certified)
		3	3 (only High-High level, SIL-certified)
		9	Special version, TSP-no. to be spec.
030	Max. number of tanks	A11	4 (High-High level), AOPS
		A12	8 (High-High level), AOPS
		A13	12 (High-High level), AOPS
		A14	16 (High-High level), AOPS
		A21	4 (High + High-High level), AOPS
		A22	8 (High + High-High level), AOPS
		A23	12 (High + High-High level), AOPS
		A24	16 (High + High-High level), AOPS
		M11	4 (High-High level), MOPS
		M12	8 (High-High level), MOPS
		M13	12 (High-High level), MOPS
		M14	16 (High-High level), MOPS

Feature	Designation	Option model	
		M21	4 (High + High-High level), MOPS
		M22	8 (High + High-High level), MOPS
		M23	12 (High + High-High level), MOPS
		M24	16 (High + High-High level), MOPS
040	High-High level (SIL-certified)	AA	FTL325P-H1E1 (ATEX/IEC Ex), SIL2
		AB	FTL325P-N1E1 (NEPSI), SIL2
		AC	FTL325P-P1E1 (FM), SIL2
		AD	FTL325P-T1E1 (CSA), SIL2
		BA	FTL825-AA3E4 (NEx), SIL3
		BB	FTL825-CA3E4 (CSA), SIL3
		BC	FTL825-N23E4 (NEPSI), SIL3
		BD	FTL825-8B3E4 (ATEX/IECEX), SIL3
		BE	FTL825-8C3E4 (FM/CSA), SIL3
		YY	Special version, TSP-no. to be spec.
050	High level (not SIL-certified)	AA	W/o
		AB	FTL325P-H1E1 (ATEX/IEC Ex)
		AC	FTL325P-N1E1 (NEPSI)
		AD	FTL325P-P1E1 (FM)
		AE	FTL325P-T1E1 (CSA)
		BA	FTL825-AA3E4 (NEx)
		BB	FTL825-CA3E4 (CSA)
		BC	FTL825-N23E4 (NEPSI)
		BD	FTL825-8B3E4 (ATEX/IECEX)
		BE	FTL825-8C3E4 (FM/CSA)
		YY	Special version, TSP-no. to be spec.
		060	Analog signal
070	Power unit	A	Redundant + internal UPS
		B	Single + internal UPS
		E	Redundant; without UPS
		F	Single; without UPS
		J	Redundant + external (customer) UPS
		K	Single + external (customer) UPS
		Y	Special version, TSP-no. to be spec.
080	Control cabinet	1	BxHxD (800x1200x300), sheet steel
		2	BxHxD (1000x1200x300), sheet steel
		3	BxHxD (800x2000x400), sheet steel
		4	BxHxD (1000x2000x400), sheet steel
		9	Special version, TSP-no. to be spec.
090	System approval	0	SIL type approval in accordance with IEC 61511 (excl. valves or contactors/pumps)
		1	Specific SIL loop calculation (incl. valves or contactors/pumps) Safety data sheets from actuators needed from customer

Feature	Designation	Option model	
		9	Special version, TSP-no. to be spec.
510	Interface	B1	Modbus TCP (slave)
		B2	Ethernet/IP
570	Services	I1	Delivery of internal FAT report & photos
		I2	Internal FAT report & photos + 10% customer FAT
		IA	Customer FAT (100% test, 1-4 tanks)
		IB	Customer FAT (100% test, 5-8 tanks)
		IC	Customer FAT (100% test, 9-12 tanks)
		ID	Customer FAT (100% test, 13-16 tanks)
		I9	Special version, TSP-no. to be spec.
610	Accessory mounted	N1	Remote maintenance modem mbConnect (MDH834)
		N2	Text display unit in cabinet door
		N3	Text display unit in own housing (BxHxD; 400x200x80, sheet steel); display IP55 (indoor only)
		N4	SIL siren + SIL strobe (not relevant for SIL)

**Restrictions**

- 030: Axx only for AOPS (010 = A); Mxx only for MOPS (010 = M)  
040: Ax only with SIL2 (020 = 2)  
050: AA only available with A11-A14 + M11-M14 (030)  
All others only with A21-A24 + M21-M24 (030)  
060: Possible future option  
070: E, F, K only with AOPS  
080: 1 only available with A11-13 + A21-22 + M11-13 + M21-22 (030)  
2 only available with A11-22 + M11-22 (030)  
3 only available with A11-22 + M11-23 (030)  
Other configurations on request  
570: IA only available with A11 + A21 + M11 + M21 (030)  
IB only available with A12 + A22 + M12+ M22 (030)  
IC only available with A13 + A23 + M13+ M23 (030)  
ID only available with A11 + A21 + M11 + M21 (030)  
610: N4 only available with AOPS (010 = A)

**Supplementary documentation****Nivotester FailSafe FTL825**

- Technical Information TI01027F/00/EN
- Operating Instructions BA01038F/00/EN
- Functional Safety Manual (SIL) SD00350F/00/EN

**Nivotester FTL325P**

- Technical Information TI00350F/00/EN
- Brief Operating Instructions KA00167F/00/F/EN
- Functional Safety Manual (SIL) SD00111F/00/EN
- Functional Safety Manual (SIL) SD01508F/00/EN

**Liquiphant FailSafe FTL8x**

- Technical Information TI01026F/00/EN
- Operating Instructions BA01037F/00/EN

**Liquiphant M FTL5x**

- Technical Information TI00328F/00/EN
- Brief Operating Instructions KA00143F/00/EN

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**Liquiphant M FTL7x**

- Technical Information TI00354F/00/EN
- Brief Operating Instructions KA00143F/00/EN

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**Overfill Prevention System  
SOP600**

- Operating Instructions BA01587S/04/EN
- Functional Safety Manual (SIL) SD01599S/04/EN

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