Table of contents

1. Scope

The Safety manual at hand refers to devices CN 8*00 with the special requirements for safety technique in accordance with IEC 61508 (option position 24 X “SIL2”).

1.1. Device identification

The identification of a device is done by its nameplate. On the nameplate a 6-digit device name (CN 8*00) is noted. The device name is followed by a 40-digit typecode for identifying several options. Devices with the option SIL2 are marked with “E” at position 4 and “X” at position 24 of typecode.

UWT Level Control	D-87488 Betzigau Westendstr. 5
SN **********	
CN 8*00 ***E****** ********** ***X******* **********	
Supply Output Enclosure Conduit	L T (amb) T (process) P (process) Process con. Extension
⚠ See instruction manual for proper operation	

Figure: exemplary nameplate with typecode for device identification

1.2. Applicable documents

The following documents have to be considered additional to this Safety manual:

- Series CN 8000 Technical information / Instruction manual
- If necessary Ex-documentations

1.3. Restrictions

The Safety manual is only valid for devices listed in section 1.1. Modifications to devices are only allowed to the manufacturer under compliance of the safety life cycle.
Installation and configuration of the CN 8000 must be completed following the Instruction notes detailed in section 3. All application limitations and restrictions described in that manual must be observed. In addition:

- When the device is mounted in a vertical or diagonal position the maximum trip point level will be at the level where 100 mm of the probe is covered in material.
- When the device is mounted horizontally in the process the maximum trip point level will be when the process material is 50 mm above the top surface of the probe.

2. Device description

2.1. Application range

The CN 8000 is suitable for use for overfill protection in a safety instrumented function of Safety Integrity Level (SIL) 2 with a low demand mode 1oo1 architecture.
The proven in-use-assessment was carried out by RISKNOWLOGY according to IEC61508 / IEC 61511. Product revisions will be carried out by the manufacturer in accordance with IEC 61508.

2.2. Operating conditions

At transport, storage, installation, operation and maintenance of the device the requirements according *Series CN 8000 Technical information / Instruction manual* have to be obtained.
Additional to operating conditions the EMC-limits for general industrial applications according EN 61326-3-1 (Electrical equipment for measurement, control and laboratory use - EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) - General industrial applications) must not be exceeded.
All used materials are compatible with process conditions.
The safety-related settings (see *Settings* section) have been entered by local operation and checked before commencing safety-instrumented operation. The DIP switches must be in the safety positions described in the "Safety Parameters" section of chapter 3.2.
The CN 8000 is blocked against unwanted and unauthorized changes / operation.

2.3. Safety function

Overfill detection is the Safety Function for the CN 8000. The relay output (terminal 4/5) or the solid state switch (terminal 6/7) may be used as part of a safety instrumented function (SIF), but not both.
The difference in capacitance between an uncovered probe and a covered probe (for example, between a probe in air and a probe in water) is used to detect level, and to protect the process from a level that is too high. The output (relay or solid state switch) de-energizes when the change in capacitance is greater than the setting at the trip point. This causes the control system to bring the process into a safe state.
The trip point is set by potentiometer P2. This determines how large the difference in capacitance needs to be before the output is switched.
When the probe is covered, indicating an overfill condition, the relay and solid-state switch are de-energized:

- Relay contact between terminal 4 and 5 is open (recommended)
- Relay contact between terminal 3 and 4 is closed
- Solid state switch between terminal 6 and 7 is open

2.4. Safety-related characteristic data

The listed failure rates are valid for operating stress conditions typical of an industrial field environment similar to IEC 60654-1 class C with an average temperature over a long period of time of 40°C. For a higher average temperature of 60°C, the failure rates should be multiplied with an experience based factor of 2.5. A similar multiplier should be used if frequent temperature fluctuation must be assumed.

Assumptions for determining safety-related characteristic data:

- Single channel architecture (1001)
- Mean time to repair (MTTR) = 8h

SIL		2
HFT		0
Type		A
λ_{SD}		0 FIT
λ_{SU}		202 FIT
λ_{DD}		92 FIT
λ_{DU}		160 FIT
SFF		65%
PFD_{avg} depending on time interval for periodic functional test	1 year	8.8×10^{-4}
	2 years	1.4×10^{-3}
	5 years	3.48×10^{-3}
	10 years	6.93×10^{-3}

Using the CN 8000 correctly there are no known wear out mechanisms. The minimum lifetime of the relay output is 50,000 switching cycles.

WARNING: The settings and conditions listed in the “Settings” and “Safety characteristics” sections of this document must be met for the safety function specification to be valid.

3. Installation notes

3.1. Electrical connection

The instructions for electrical connection mentioned in the Technical information / Instruction manual have to be obtained (see *Series CN 8000 Technical information / Instruction manual*)

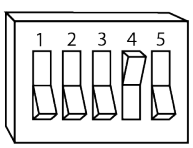
NOTE: The normally closed relay contact between terminal 3 and 4 may be used, but this will mean that if power to the device is lost or an alarm condition occurs, the contact will be closed.

3.2. Settings

3.2.1. Setup Procedure

The following steps outline the setup procedure for the CN 8000 for overfill detection:

1. Set up the dip switches on the device to the following values:



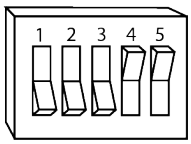
Switch Setting Comment
S1 On - Disables signal output delay (covered to uncovered)
S2 On - Disables signal output delay (uncovered to covered)
S3 On - Sets device to Failsafe High
S4 Off - Test delay settings disabled
S5 On - Set-up mode enabled

2. Turn potentiometer P1 fully counter clockwise.
3. Bring the process material to a level that is at least 250 mm below the lowest surface of the probe.

4. If the yellow Light Emitting Diode (LED), L1, is on skip to step 6.
5. Turn potentiometer P2 counter clockwise until the yellow LED, L1, is on.
6. Slowly turn potentiometer P2 clockwise until the yellow LED, L1, just turns off.
7. Set dip switch S5 to the off position (rocker down) to enable Run mode.

3.2.2. Safety parameters

During device operation please ensure the switch bank on the CN 8000 is set to the following values:



Switch Setting Comment
S1 On - Disables signal output delay (covered to uncovered)
S2 On - Disables signal output delay (uncovered to covered)
S3 On - Sets device to Failsafe High
S4 Off - Test delay settings disabled
S5 Off - Run mode enabled

Also ensure that potentiometer P1 is turned fully counter-clockwise.

3.3. Testing

To avoid systematic failures during installing as well as for periodic maintenance a functionl test has to be carried out. While the functional test is performed, the overall safety function has to be ensured otherwise than by the device.

WARNING: In case of failed functional test, the overall safety function has to be ensured otherwise than by the device until replacing.

3.3.1. Functional test

To ensure the proper operation of the CN 8000, we recommend that the basic functions of the CN 8000 are tested as described below:

1. Ensure that the process material is at least 250 mm below the lowest surface of the probe. Verify that the relay output or the solid-state switch is in the energized state.
   - Note that the process material level required for the probe to indicate uncovered will vary depending on the user specific installation.
   - The probe is considered uncovered when the yellow LED, L1, is off with the settings described in this manual.
2. Bring the process material level up to cover the probe and verify that the relay output or the solid-switch is in the de-energized state.
   - When the device is mounted in a vertical or diagonal position the trip point level shall be at the level where 100mm of the probe is covered in material or lower.
   - When the device is mounted horizontally in the process the trip point level shall be when the process material is 50 mm above the top surface of the probe or lower.
   - The probe is considered covered when the yellow LED, L1, is on with the settings described in this manual.

3.3.2. Functional safety proof test

To reveal possible undetected faults of the safety function, the entire SIF shall be tested according to IEC 61508 or 61511.
To reveal dangerous undetected faults the CN 8000 relay or solid-state switch output shall be tested using the following procedure:

Step Action

1. Bypass the safety PLC or take other appropriate action to avoid a false trip.
2. Inspect the product for signs of physical damage/defects or loose parts and replace/repair product as required.
3. Inspect the probe of the device for and verify that no build up of material has occurred. Clean the probe if necessary according to the Operating Instructions. Note that the probe will trip earlier than expected when there is material build up so this step will help reduce the likelihood of nuisance trips.
4. Perform the “Functional Test” as described in the section above.
5. Restore the loop to full operation.
6. Remove the bypass from the safety PLC or otherwise restore normal operation.

4. Application notes

4.1. Behaviour in case of failure

In case of failure the device turns to safe state.
The procedure in case of faults is described in the device Operating Instructions.
Defective devices should be sent to the Repair Department with details of the fault and the cause. When ordering replacement devices, please specify the serial number of the original device. The serial number can be found on the nameplate.

4.2. Fault reaction time

The maximum fault reaction time from appearance until switching to the safe state for failures able to diagnose is 120s.

4.3. Periodic functional testing

The maximum time interval for the periodic function test has to be calculated depending on the tolerable failure probability for the device and its PFD_{avg} – value (see section 2.4) according to IEC 61511.
We recommend that the functioning of the level transmitter be checked at regular intervals of one year.
The procedure of the periodic function test is described in section 3.3.

5. SIL Declaration of conformity

UWT GmbH
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declares as manufacturer, that the level limit switches CN 8*000 with the option position 24 X „SIL“
(CN 8*00 ***E****** ********** ***X****** **********) have been developed corresponding to the requirements of

IEC 61508:2010
Functional Safety of
Electrical/Electronic/Programmable Electronic
Safety-related Systems

and are suitable for the use as safety function in safety related systems.
The safety-related characteristic data (see section 2.4) have to be considered.
The safety-related characteristic data were determined by an external, independent institute.

Betzigau, 02/2018

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