ACT20X-(2)HDI-(2)SDO
NAMUR isolating switching amplifier

Safety Manual

Weidmüller

1.1 Revision history

Version	Date	Change
00	04/2014	First Edition
01	11/2017	Product added

1.2 Validity

This manual is valid for the following products:

Device version	Type	Order number
2	ACT20X-HDI-SDO-S	8965360000
2	ACT20X-2HDI-2SDO-S	8965390000
2	ACT20X-HDI-SDO-P	2456070000
2	ACT20X-2HDI-2SDO-P	2456100000

1.3 Contact address

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 16
32758 Detmold
Germany

T +49 5231 14-0
F +49 5231 14-292083
www.weidmueller.com

Table of contents

2. Observed standards

Standard	Description
IEC 61508	Functional safety of electrical / electronic / programmable electronic safety-related systems
IEC 61508-2:2000	Part 2: Requirements for electrical / electronic / programmable electronic safety-related systems
IEC 61508-3:1998	Part 3: Software requirements
IEC 61326-3-1:2008	Immunity requirements for safety-related systems

3. Acronyms and abbreviations

Acronym / Abbreviation	Designation	Description
Element		Term defined by IEC 61508 as “part of a subsystem comprising a single component or any group of components that performs one or more element safety functions”.
PFD	Probability of Failure on Demand	This is the likelihood of dangerous safety function failures occurring on demand.
PFH	Probability of dangerous Failure per Hour	The term “Probability” is misleading, as IEC 61508 defines a rate.
SFF	Safe Failure Fraction	Safe Failure Fraction summarizes the fraction of failures which lead to a safe state and the fraction of failures which will be detected by diagnostic measures and lead to a defined safety action.
SIF	Safety Integrity Function	Function that provides fault detection (to ensure the necessary safety integrity for the safety functions).
SIL	Safety Integrity Level	The international standard IEC 61508 specifies four discrete safety integrity levels (SIL 1 to SIL 4). Each level corresponds to a specific probability range regarding the failure of a safety function.

4. Purpose of the product

The ACT20X-HDI-SDO is a one channel, the ACT20X-2HDI-2SDO is a two channel pulse isolator for transmission of signals to the safe area from NAMUR sensors and mechanical switches installed in the hazardous area.

The device can be mounted in the safe area and in Zone 2 / Division 2 and receive signals from Zone 0, 1, 2, 20, 21, 22 and mines or Class I/II/III, Division 1, Group A-G. Error events, including cable breakage, are monitored and signaled via the individual status relay. The ACT20X-(2)HDI-(2)SDO has been designed, developed and certified for use in SIL 2 applications according to the requirements of IEC 61508.

5. Assumptions and restrictions for use of the product

5.1 Basic safety specifications

Operational temperature range:	-20...+60 °C
Storage temperature range:	-20...+85 °C
Power supply type:	Double or reinforced
Supply voltage:	19.2...31.2 V DC
Output pulse length, min.:	40 µs
Mounting area:	Zone 2 & Class I, Division 2 or safe area
Mounting environment:	Pollution degree 2 or better, Overvoltage category II

5.2 Associated equipment

5.2.1 Transistor output

The opto output signals are fed to SIL 2 compliant inputs of a safety PLC specified to receive a frequency of 5 kHz and a pulse length down to 40 µs or the field device signal pulse length minus 60 µs.

5.2.2 Field device

The field device must provide a minimum pulse length of 100 µs.

5.3 Failure rates

The basic failure rates from the Siemens standard SN 29500 are used as the failure rate database. Failure rates are constant; wear-out mechanisms are not included. External power supply failure rates are also not included.

5.4 Safe parameterization

The user is responsible for verifying the correctness of the configuration parameters (refer to chapter 16.5 "Safety-related configuration user responsibility" on page 27). Manual override may not be used for safety applications.

5.5 Installation in hazardous areas

The IECEx installation drawing, ATEX installation drawing and FM installation drawing shall be followed, if the products are installed in or connected to hazardous areas.

6. Functional specification of the safety functions

Pulse isolator as well as supply of NAMUR sensors and mechanical switches with cable error detection installed in the hazardous area. Cable error detection only works with NAMUR sensors or with the use of external resistors R_s and R_p. (refer to chapter 18 "Connection diagram" on page 29).

7. Functional specification of the non-safety functions

The status relay (terminal 53 and 54) and LED outputs are not suitable for use in any Safety Instrumented Function.

8. Safety parameters

Safety parameter	Ex output SIL2
Proof-test interval (T_{proof}), (10 % of loop PFD)	5 years
Safe Failure Fraction (SFF)	92 %
Demand response time, opto output	< 125 µs
Demand mode	High
Demand rate	1000 s
Diagnostic test interval	10 s
Mean Time To Repair (MTTR)	8 h
Hardware Fault Tolerance (HFT)	0
Component type	B
SIL capability	SIL 2
Description of the “safe state”, opto output	High impedance

PFD_{AVG}			PFH (see note 1)
T_{proof} = 1 year	T_{proof} = 2 years	T_{proof} = 5 years	
1.58×10^{-4}	3.17×10^{-4}	7.92×10^{-4}	3.62×10^{-8} h^{-1}

PFD_{AVG} = Average Probability of Failure on Demand

PFH = Probability of dangerous Failure per Hour

Note 1: The ACT20X-(2)HDI-(2)SDO contains no lifetime limiting components, therefore the PFH figures are valid for up to 12 years, according to IEC 61508.

9. Failure category SIL 2

Failure rates according to IEC 61508	
Total failure rate for dangerous detected failures (λ_{DD})	135.6 FIT
Total failure rate for dangerous undetected failures (λ_{DU})	36.18 FIT
Total failure rate for all safe failures (λ_{Safe})	275.5 FIT

FIT = 10^{-9} h^{-1} (Failure in time)

10. Hardware and software configuration

All configurations of software and hardware versions are fixed from factory and cannot be changed by end-user or reseller.

This manual only covers products labeled with the product version (or range of versions) specified on the front page.

11. Periodic proof test procedure

Step	Action
1	Bypass the safety PLC or take other appropriate action to avoid a false trip.
2	Connect a simulator identical to the input setup.
3	Perform an ON / OFF signal for each channel.
4	Observe whether the output channel acts as expected.
5	Restore the input terminals to full operation.
6	Remove the bypass from the safety PLC or otherwise restore normal operation.

This test will detect approximately 95 % of possible “DU” (dangerous undetected) failures in the pulse isolator. The proof test is equivalent to the functional test.

12. Procedures to repair or replace the product

Any failures that are detected and that compromise functional safety should be reported to the sales department at Weidmüller Interface GmbH & Co. KG.

Repair of the device and replacement of circuit breakers must be done by Weidmüller Interface GmbH & Co. KG only.

13. Maintenance

No maintenance required.

14. Configuration with FDT/DTM

The pulse isolator ACT20X-(2)HDI-(2)SDO will be configured via PC according to the FDT/DTM standard.

14.1 Concept

The FDT technology standardizes the configuration and communication interfaces between different devices and connected systems, IEC 62453. Therefore the FDT provides a common environment for accessing and connecting the devices features. Any device can be configured, operated and maintained through the standardized graphical user interfaces. These functions are regardless of supplier and type of communication protocol. The FDT interface is the specification describing the standard data exchange between field devices and PC.

A device driver with full fit the FDT mandatory interfaces are called device type manager (DTM). The DTMs are classified for the ACT20X product family into two categories:

- Device DTMs which represent the ACT20X product family with its configuration components
- Communication DTMs which create the connection to the ACT20X over the CBX 200 hardware

The FDT Frame Application is the software program that implements all DTMs. The FDT Frame Application, also called FDT container, provides the DTM management, navigation, user management and common environment. The Weidmüller FDT container is called “WI-Manager”.

14.2 Hardware / Firmware

The hardware of the ACT20X product family has a jack plug for the CBX 200 hardware. The CBX 200 hardware is used for the configuration via serial port and PC. The result is a point to point connection (PC to hardware).

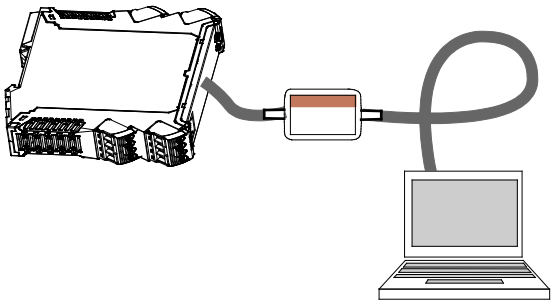


Figure 1 Point to point connection with the CBX 200 and an ACT20X device for the configuration

15. Parameterization by user interface

Configuration of the parameter via the General User interface "GUI" via the FDT / DTM software.

The parameterization according to the safety requirements is oriented towards the general using the product related DTM (Figure 2 "GUI DTM configuration (1) (example)" and Figure 3 "GUI DTM configuration (2) (example)" shows an example of a DTM).

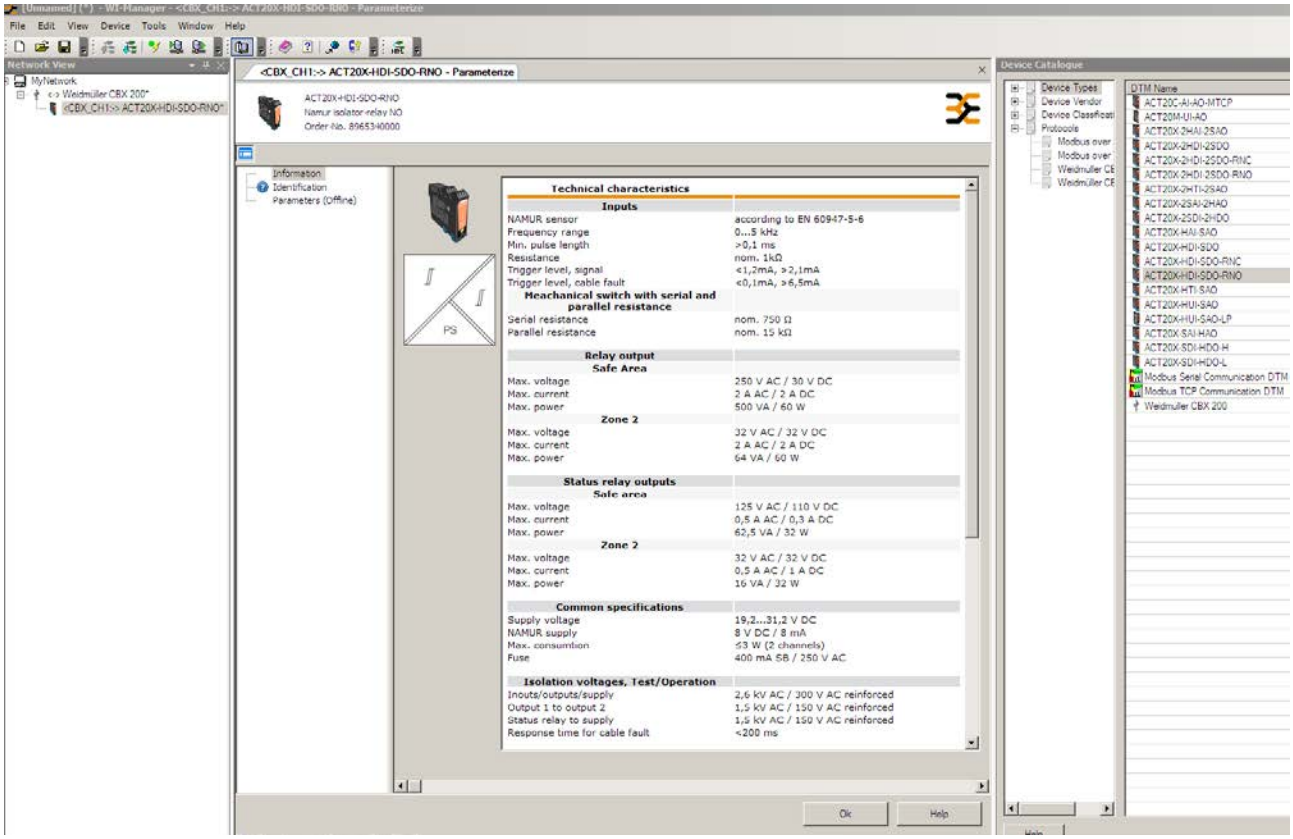


Figure 2: GUI DTM configuration (1) (example)

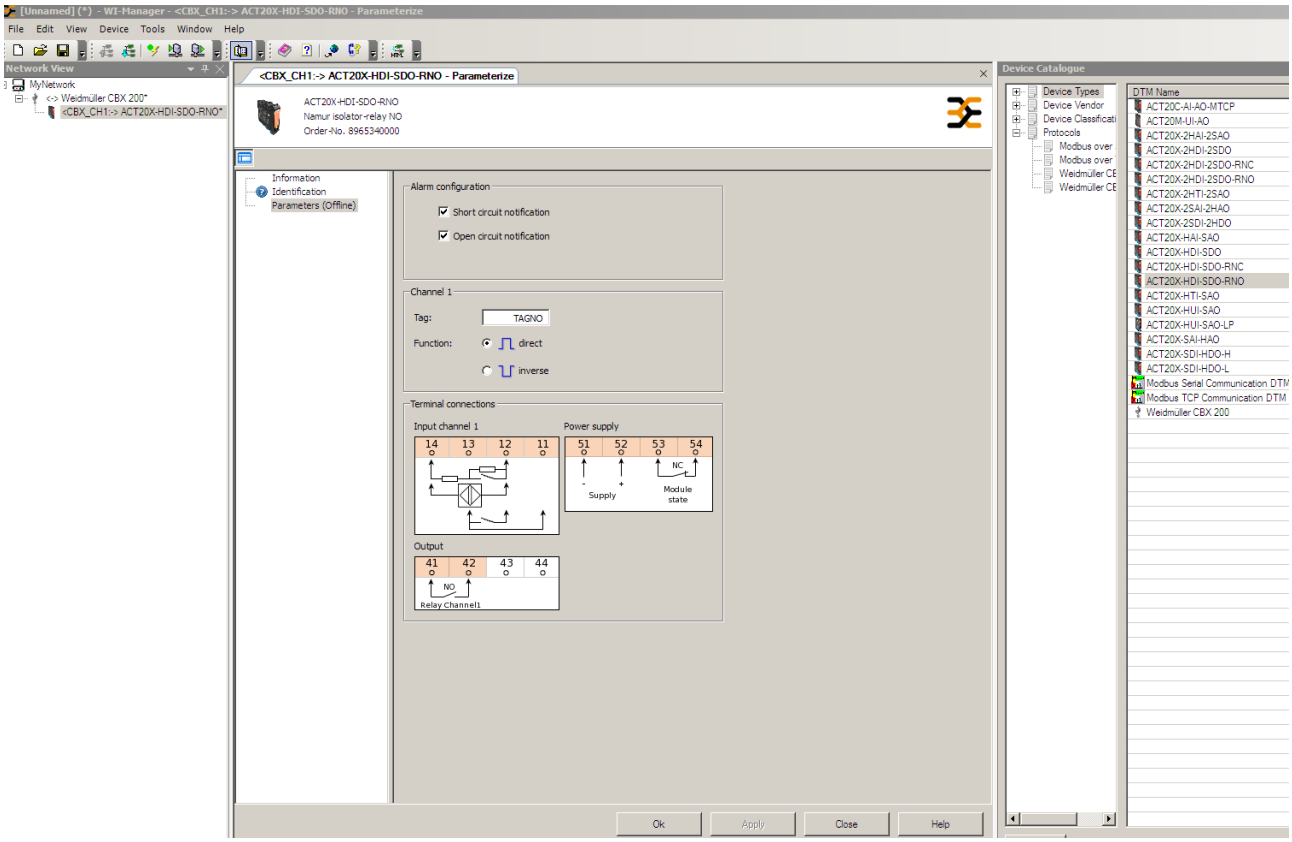


Figure 3: GUI DTM configuration (2) (example)

16. SIL concept for DTMs

16.1 Activate/deactivate safe parameterization

In online mode of the DTM the user can directly configure the device and / or the offline parameterization at the PC. For the SIL configuration the user shall shown “Change SIL state” in the additional functions of each DTM. The function is only available in online state and the hardware is verified, according Figure 4 "SIL configuration (example)".

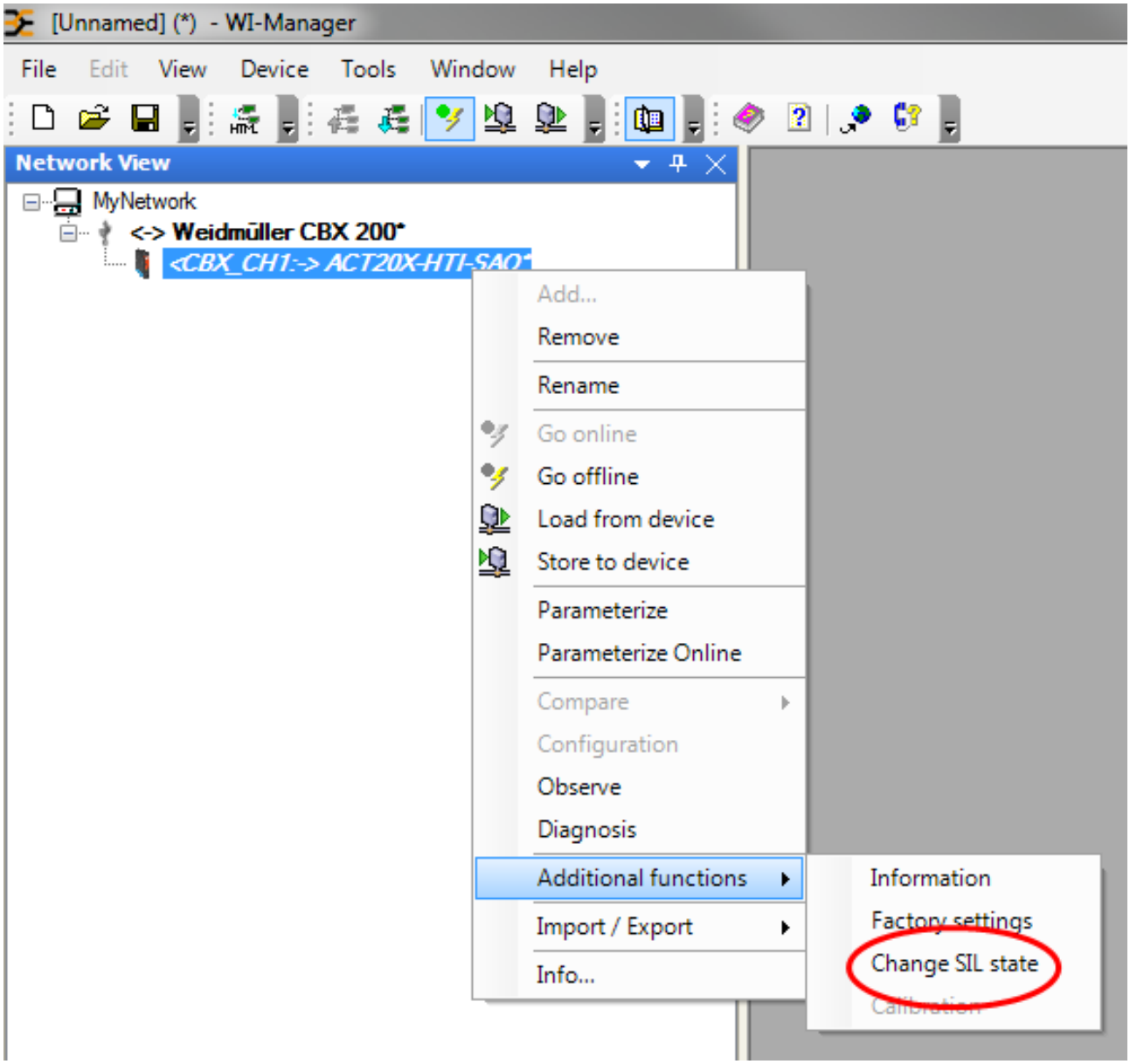


Figure 4 SIL configuration (example)

By activate the SIL configuration all other parameter views and functions are disabled (and closed) and vice versa, according to Table 1 "Function against SIL".

Functions against SIL		
Parameter	**SIL state: LOCK**	**SIL state: OPEN / FAIL**
Parameter Offline	Disabled	Enabled
Parameter Online	Disabled	Enabled
Upload	Enabled, execution follows an error message with reject the upload request	Enabled
Download	Enabled, execution follows an error message with reject the upload request	Enabled
Restore Factory Defaults	Disabled	Enabled
Additional Function – Text	Change SIL state	Change SIL state

Table 1 Function against SIL

By executing the SIL function the DTM request the SIL-state and the user has to enter the password. The SIL-state and the password (enable and password) are defined in open and lock, see Figure 5 "GUI SIL configuration (OPEN) (example)" and Figure 6 "GUI SIL configuration (LOCK) (example)".

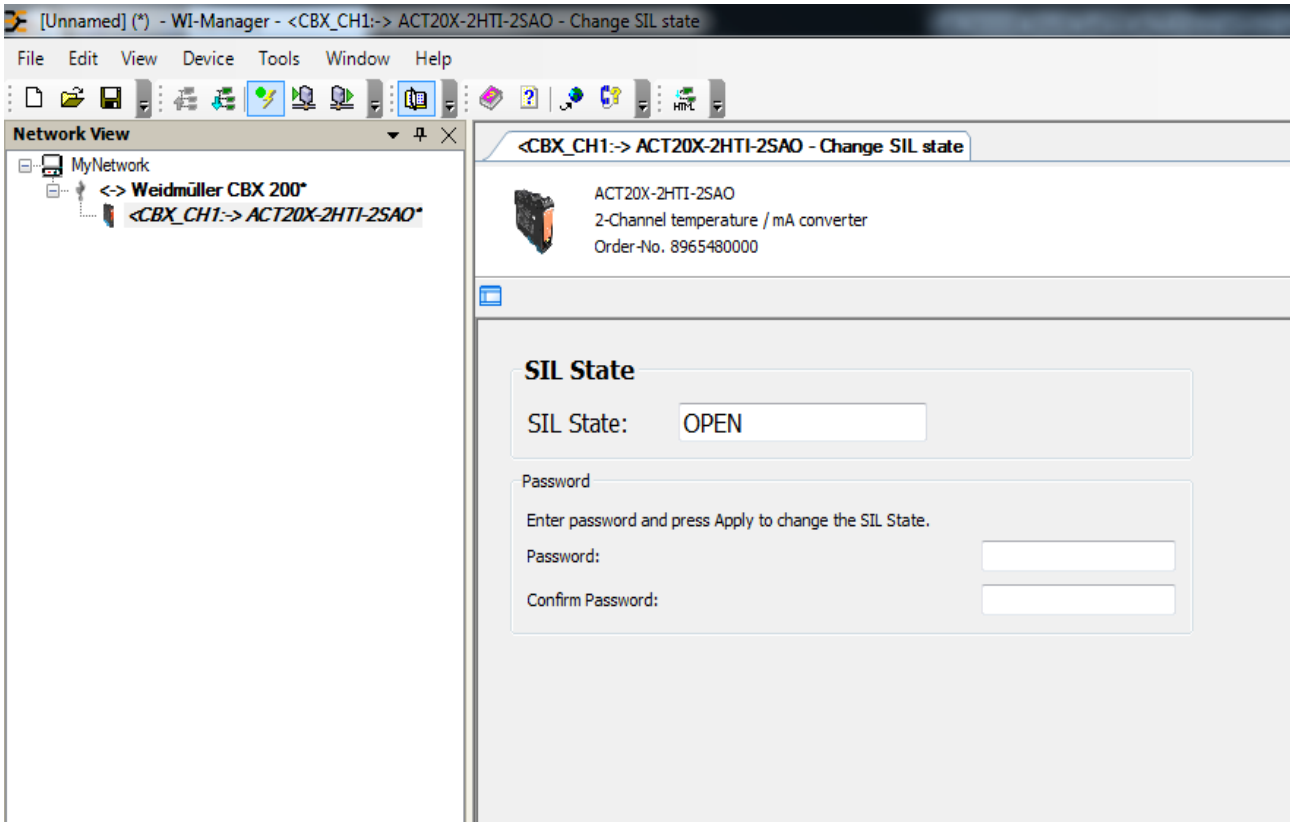


Figure 5: GUI SIL configuration (OPEN) (example)

To deactivate the SIL state the user has to enter the same password and confirm it to change the SIL state from locked to open.

16.2 Verification procedure

The configuration is re-load from the device and shown in a DTM GUI (Graphical User Interface). The user interface loaded the image (as image) with the loaded configuration in the same window. The user now sees a GUI with the configuration loaded from the device, the entered configuration (device parameters) and the stored image (written parameters) as a configuration and will be prompted to check the configuration.

The GUI for SIL configuration is continues read the SIL state and shall shown the change from “OPEN” to “LOCK”, see Figure 6 "GUI SIL configuration (LOCK) (example)". If the configuration is corrupted, then the devices rejected the configuration and change the state to “FAIL”. After successful locking the configuration the user get a list of all parameter from the DTM and from the stored image file.

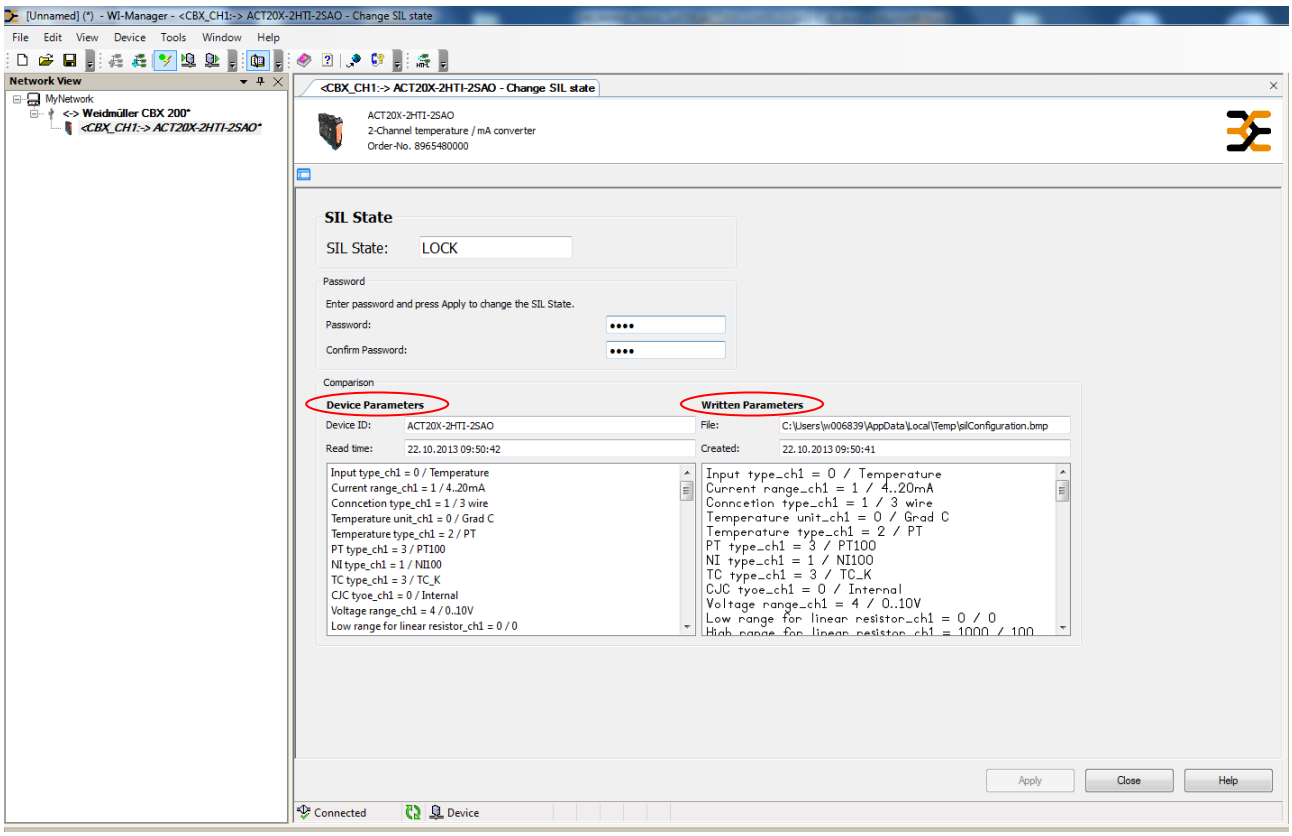


Figure 6: GUI SIL configuration (LOCK) (example)

If any parameter is found to be incorrect during verification deactivate the SIL state and go through the configuration menu and correct the parameter(s). After the correction, activate the SIL state by entering the password and confirm the password.

16.3 Configuration of a SIL active product

If the user would like to reconfigure a SIL activated product the software will show the message below.

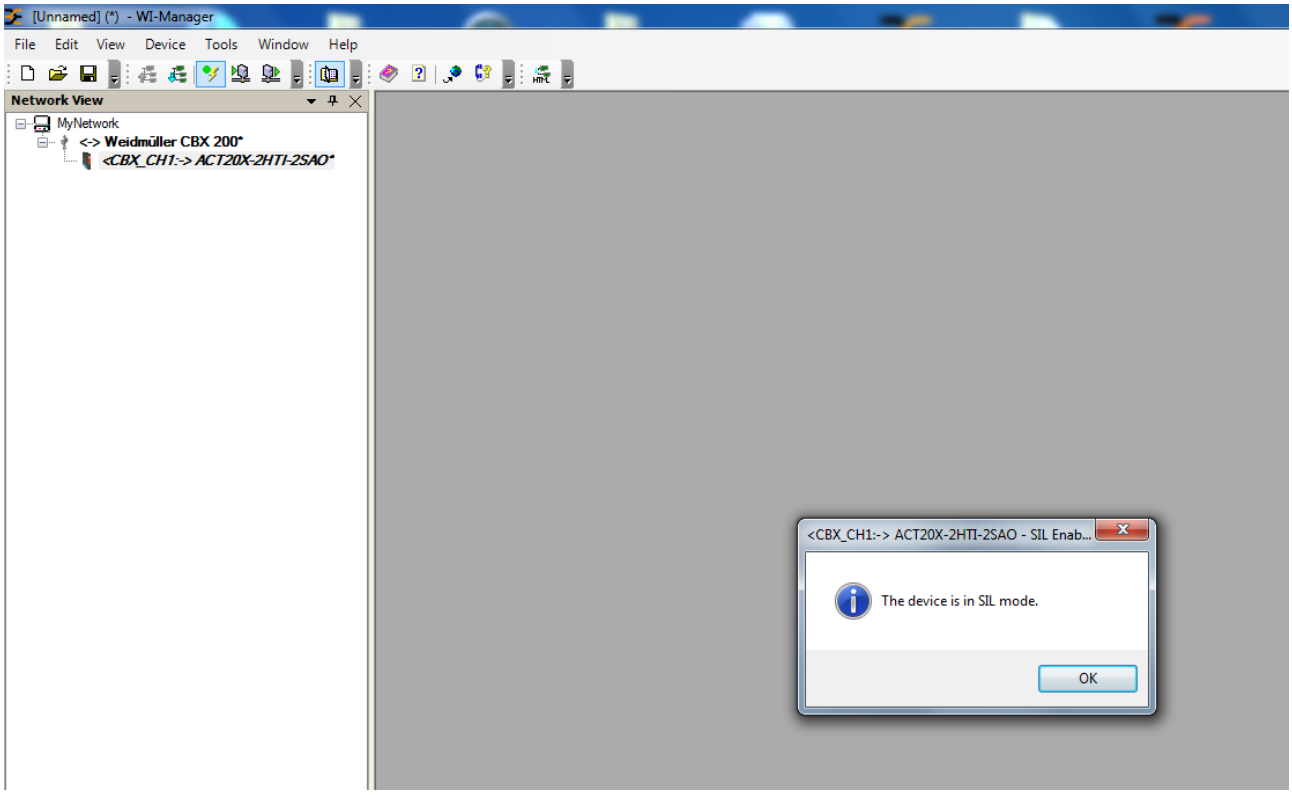


Figure 7: SIL active

To do a reconfiguration, the user needs to deactivate the SIL mode as described in chapter 16.1 "Activate/deactivate safe parameterization" on page 21. Then all parameters are available and can configure.

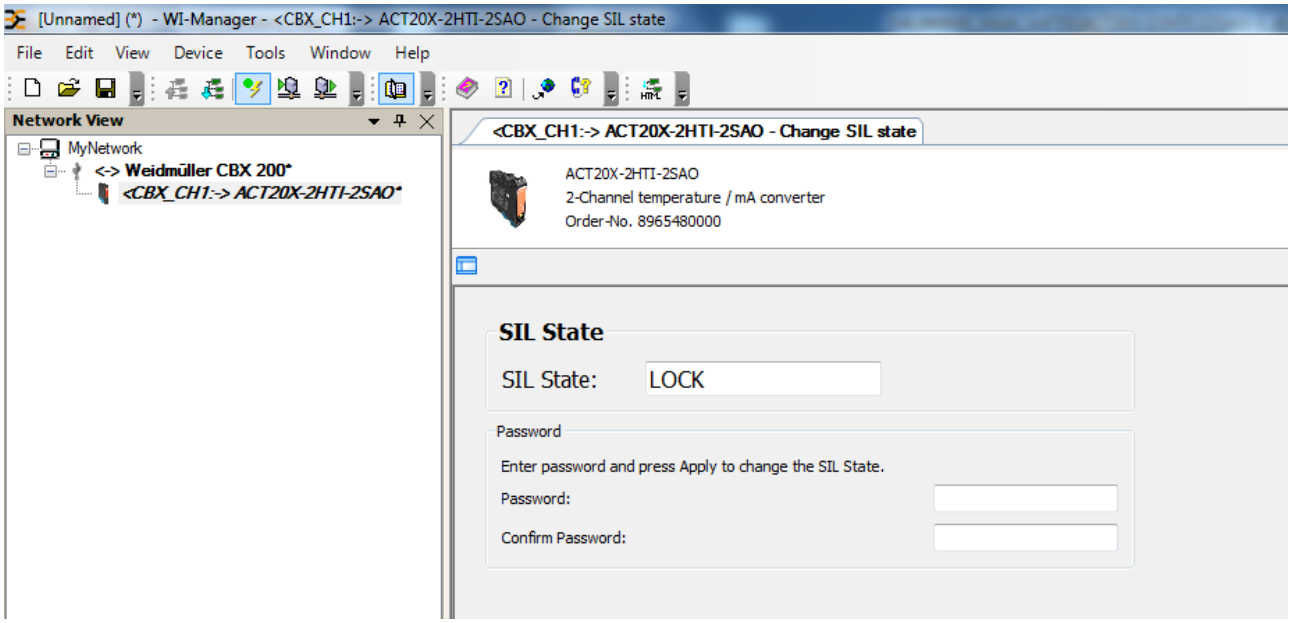


Figure 8: Locked SIL state after configuration

16.4 Changing SIL password

The user can change the SIL password in the SIL “OPEN” state, when the user type a new password and confirm it. The user can choose a password between 0000 and 9999 in order to protect the device against unauthorized modifications to the configuration. The device is delivered without password.

16.5 Safety-related configuration user responsibility

Parameter	Value	Description
Function (channel 1)	Direct / Inverse	Direct / inverted channel function
Function (channel 2)	Direct / Inverse	Direct / inverted channel function
Password	0…9999	New password
Confirm password	Password	Confirm password

16.6 Functional test

The user is responsible to make a functional test after verification of the safety parameters. The procedure for periodic proof test, described in chapter 11 "Periodic proof test procedure" on page 15, shall be used

17. Fault reaction and restart

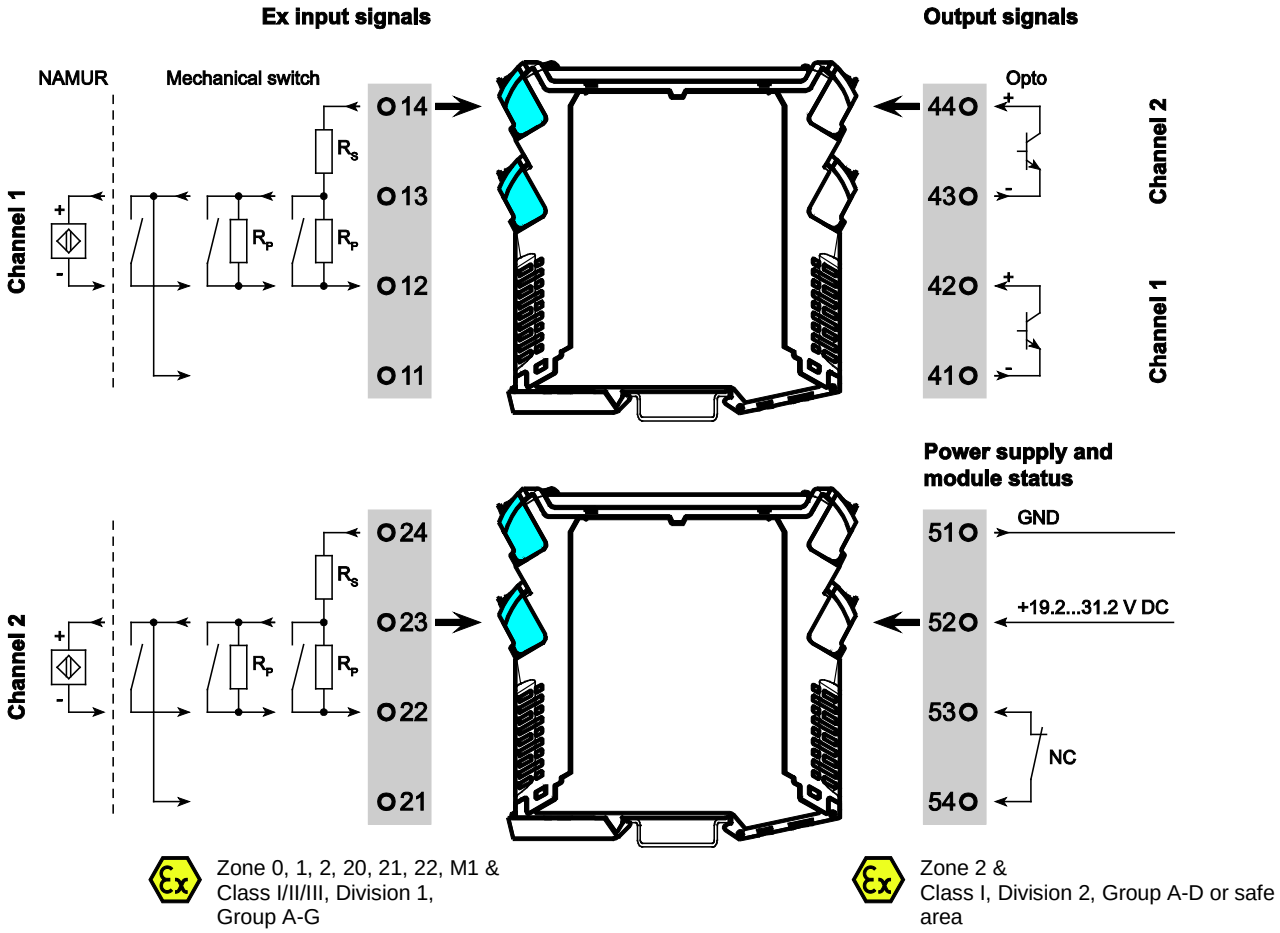
When the ACT20X-(2)HDI-(2)SDO detects a fault the output will go to Safe State, in which the opto output will go to“high impedance”. If the fault is application-specific (cable error detection) the device will restart when the fault has been corrected.

For device faults there are 2 ways of bringing the module out of Safe State.

1. Power cycle the module.
2. Bring the module out of SIL mode (refer to chapter 16.1 "Activate/deactivate safe parameterization" on page 21).
3. Set it back to SIL mode again (refer to chapter 16.1 "Activate/deactivate safe parameterization" on page 21).

18. Connection diagram

18.1 Application



18.2 Electrical connections

Terminal	Function	Connector
11	SW Sense	Ex input channel 1
12	NAMUR –	
13	SW Supply	
14	NAMUR +	
21	SW Sense	Ex input channel 2
22	NAMUR –	
23	SW Supply	
24	NAMUR +	
41	OPTO –	output channel 1
42	OPTO +	
43	OPTO –	output channel 2
44	OPTO +	
51	GND	power supply
52	+24 V DC	
53	COM	status relay
54	NC	

www.weidmueller.com

Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 16
32758 Detmold
Germany
T +49 5231 14-0
F +49 5231 14-292083
www.weidmueller.com

Order Number:
1485620000/01/11.2017