MSK200-SIL-DX

DIN rail transmitter with redundant input for high voltage

Features

- Fail-safe transmitter for DIN-Rail mounting
- Redundant voltage input for up to 1000 V DC
- Supply and RS458 connection via DIN rail TBUS connector
- 2 measurement inputs with reinforced isolation from all other circuit parts
- SIL 2 according to IEC / EN 61508
- Device type B according to IEC / EN 61508
- High availability of the safety function secured by 2 relays
- Error display according to NAMUR NE 43
- LED status display: power, error and alarms

Description

The MSK 200-SIL-DX is used e.g. for balance voltage monitoring in chlor-alkali electrolysis systems or as a voltage converter in test systems for the automotive sector. The redundant measuring inputs enable self-monitoring for the reliable detection of an error. With the two measuring inputs, the absolute value of a DC voltage can be represented as a 0 / 4-20 mA signal or a 0 / 2-10 V signal.
Two relays are available for signaling the safety function, which can be interconnected either with one another or with the analogue output or alarm outputs 1 and 2.

Warning: High Voltage / Danger
This device is electrical equipment with voltage inputs for up to 1000 VDC. It is designed for use in safety-oriented operating environments.
The specified safety conditions must be observed for installation and operation and security policies (including national security policies),
Accident prevention regulations and general technical regulations. Please also note the safety regulations and instructions for Installation on page 4.

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Operating manual for MSK200-SIL-DX

WINSMART-Support from MSK200-Version 4.0
MODBUS-RTU Communication

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Modbus™ is a registered trademark of Modicon Inc.
Windows™ is a registered trademark of Microsoft Corp.

Disclaimer

We have checked the content of the printed document for compliance with the described hardware and software. Nevertheless, deviations cannot be excluded and consequently we cannot assume any guarantee for complete accordance. The data in this printed document are checked regularly. Corrections and additions are made in the following version in each case. We would be grateful for any suggestions for improvement.

Technical modifications reserved

Contents

1 Safety instructions and installation

Note: Installation, operation and maintenance may only be carried out by qualified specialist personnel. When installing and operating the device, the applicable safety guidelines (including the national safety guidelines), accident prevention regulations and general technical regulations must be observed.

Note: The circuits in the device must not be accessed

Do not repair the device yourself, but replace it with an equivalent device. Repairs may only be carried out by the manufacturer.

Note: The device is suitable for protection class IP20 if:

- It is installed outside of potentially explosive areas
- The environment is clean and dry

Install the device in a suitable housing with a suitable degree of protection according to IEC 60529 to protect against mechanical and electrical damage.
The safety-relevant data can be found in the operating instructions or in other certificates (if necessary).

2 Classification of the safety instructions

This manual contains instructions that you have to observe for your personal safety as well as to avoid material damage. These instructions are highlighted using a triangular warning sign and shown as follows, depending on the degree of risk.

HAZARD

means that death or severe physical injury will occur if the appropriate precautionary measures are not taken.

WARNING

means that death or severe physical injury may occur if the appropriate precautionary measures are not taken.

CAUTION

with a triangular warning sign means that minor physical injury may occur if the appropriate precautionary measures are not taken.

CAUTION

without a triangular warning sign means that material damage may occur if the appropriate precautionary measures are not taken.

ATTENTION

means that an undesired result or state may ensue if the corresponding instruction is not followed.

NOTE

denotes important information about the product, handling of the product or the respective part of the documentation, is aimed at drawing special attention to the latter and should be complied with.

In addition to the instructions in this manual, the generally applicable safety and accident prevention regulations must be observed.
If the information contained in this document should not be sufficient in any specific case, you can obtain more detailed information from our telephone service.
Please read this manual carefully prior to installation and commissioning.

3 General instructions

This device left the plant in flawless condition in terms of its safety features. To preserve this condition and ensure safe operation of the device, the user has to observe the instructions and warning notes indicated in this operating manual.

NOTE

For the sake of clarity the manual does not contain complete detailed information on all product types and can therefore not take into account every conceivable case with respect to installation, operation and maintenance.
Should you wish further information or should special problems arise that are not treated in sufficient detail in the manual, you can obtain the necessary information by telephone.
Moreover, we point out that the content of the manual shall not constitute part of or amend a previous or existing contract, agreement or legal relationship. All obligations of Mütec Instruments GmbH shall result from the respective contract of purchase, which also contains the complete and solely valid warranty terms. These contractual warranty terms shall neither be extended nor limited by the information contained in the manual.
The content reflects the technical state of the art regarding printing. It is subject to technical modifications in the course of further development.

WARNING

Devices with the type of protection designated as “intrinsic safety” lose their conformity certification as soon as they have been operated in circuits that do not meet the values specified in the test certificate. Flawless and safe operation of this device requires proper transport, proper storage, installation and assembly as well as careful operation and maintenance. The device may only be used for the purposes specified in this operating manual.

DISCLAIMER

All modifications to the device fall within the responsibility of the user unless expressly specified otherwise in the operating manual.

Qualified PERSONNEL

are persons who are familiar with installation, assembly, repair and operation of the product and have the qualifications necessary for their work, such as:

- Training, instruction and/or authorization to operate and maintain equipment/systems in accordance with the standards of safety technology for electrical circuits, high pressures and corrosive as well as hazardous media.
- In the case of equipment with explosion protection: training, instruction and/or authorization to perform work on electrical circuits for potentially explosive equipment.
- Training or instruction in accordance with the standards of safety technology regarding care and use of appropriate safety equipment.

CAUTION

Potentially electrostatic components may be destroyed by voltage that is far below the limits of human perception. Such voltage occurs even when you touch a component or electrical connections of a component and are not electrostatically discharged. The damage that occurs to a component because of overvoltage usually cannot be detected immediately and does not become noticeable until after a longer operating period.

4 Technical data

4.1 Certificate

Functional Safety	SIL 2 according to IEC 61508

4.2 Analog input E1/E2 (Terminal T-17 + T-21 and Terminal T-19 + T-22)

For the measuring inputs a filter of 1st order (0.1 – 99.9 s) can be parameterized!
Enhanced galvanic isolation to all circuit elements and power supply ! A split ferrite braid-breaker can be placed on the cable for the measurement input to improve the EMC!
Mütec Instruments order no.: E30724

Measurement Inputs	
Measuring range:	0 ... +/- 1000 VDC
Overloadability:	max. 1200 V (permanently)
Measuring range :	infinitely configurable
Input resistance:	6000 kΩ
Accuracy	
Maximum:	< 0,1 % of final value
Typical:	< 0,05 % of final value

4.3 Analog output (Terminal T-11 + T-12)

For the analog outputs a filter of 1st order (0.1 – 9.9 s) can be parameterized!
Enhanced galvanic isolation to all circuit elements and power supply!

	Constant current	**Voltage**
Max. range:	0...22 or 22...0 mA	0...11 or 11...0 V
Standard range:	0/4-20 mA	0/2-10 V
Load:	max. 500 Ω at 20 mA	min. 50 kΩ
Accuracy:	0,02 % of final value	0,02 % of final value
Load effect:	< 0,005 %	0,5 % at $R_L \geq 100$ kΩ
Rise time:	< 250 ms	< 250 ms

4.4 Contact output Rel1/Rel2 (Terminal T-1 + T-2 and Terminal T-6 + T-15)

Configuration:	WINSMART®-Software
Contact:	normally open or normally closed (dependent on jumper position)
Alarm delay:	freely configurable between 0 ... 9,9 s
Switching hysteresis:	freely configurable between 0 ... 99,9 %
Operating mode:	open or closed current principle
Alarm function:	Signal monitoring and indication of maintenance requirement
Switching power:	max. 62,5 VA / max. 30 W
Switching voltage:	max. 125 V AC or 110 V DC
Switching current:	max. 1 A
Min. contact voltage:	10 mVDC
Min. contact current:	10 µA
Contact material:	AG Pd + 10 µAu
Relay type:	according to IEC 947-5-1 / EN60947

4.5 Transistor output (Terminal T-7 + T-8)

Galvanic isolation to all circuit elements and power supply !

Configuration:	WINSMART®-Software
Type:	Transistor
Alarm delay:	freely configurable between 0 ... 9,9 s
Switching hysteresis:	freely configurable between 0 ... 99,9 %
Operating mode:	open or closed current principle
Alarm function:	Signal monitoring
Switching power:	< 1,4 W
Switching voltage:	< 28 VDC
Switching current:	< 50 mA

4.6 LED-status indication

Power:	green LED	Supply OK
Error:	red LED	Activated safety function
Alarm 1 – 3 :	yellow LED	Limit value alarm

4.7 Contact outputs REL3/REL4 (Terminal T-9 + T-10 and Terminal T-13 + T-14)

Operating mode:	closed current
Alarm function:	safety function activated
Contact position:	closed in good condition
Switching power:	max. 62,5 VA / max. 30 W
Switching voltage:	max. 125 V AC or 110 V DC
Switching current:	max. 1 A
Min. contact voltage:	10 mV DC
Min. contact current:	10 µA
Contact material:	AG Pd + 10 µAu
Relay type:	according to IEC 947-5-1 / EN60947

The safety function is activated by relays Rel3 and Rel4, which operate on the closed current principle and whose setting cannot be parameterized. The relay contacts, which are closed when in good condition, offer the possibility of series connection with the relay contacts of other devices for collective alarm monitoring. A further series connection with REL1, REL2 or the analog output and the contacts of REL3 and REL4 is also possible.

4.8 Interfaces COM/RS485 (Front socket, T-BUS contacts T-B1 + T-B2)

Galvanic isolation between COM / RS485 and all other circuit elemts and power supply!

RS232/COM:	front socket for PC connection via the Mütec-interface cable
RS485:	half duplex, without scheduling
Baud rate:	9600 bps
Device address:	1-248

4.9 Power supply (Terminal T-3 + T-4 or T-B4 + T-B5)

Supply voltage:	24V DC (min. 20V DC, max. 30V DC)
Power consumption	1,4 W (at 24V DC and 4 mA analog output) 1,7 W (at 24V DC and 20 mA analog output)

4.10 General data

Temperature coefficient	
Maximum:	< 0,01 %/K
Typical:	< 0,005 %/K
Galvanic isolation	
Input / output / supply:	3-port isolation
Input / output:	4.3 kV AC test voltage (50 Hz, 1 min.)
Input / supply:	4.3 kV AC test voltage (50 Hz, 1 min.)
Overvoltage category:	CAT II 1000V AC/DC, pollution degree 1 according to IEC 61010-1
Environmental conditions	
Permissible temperature:	-10 °C ... +60 °C
Storage/transport:	-20 °C ... +70 °C
Permisable humidity:	10 % … 95 % rel humidity no condensation
Pollution level:	pollution level 2 according to IEC 60664-1
Electrical connection	
T-1 to T-15:	screwed connector/grey, 3,0 mm^2
T-17 to T-23:	screwed connector/grey, 7,5 mm^2
T-B1 to T-B5:	TBUS connector/black, 5,0 mm^2
Wire:	0,2 mm^2 / 2,5 mm^2 (min/max)
Braid:	0,2 mm^2 / 2,5 mm^2 (min/max)
Conductor cross-section:	AWG/kcmil = 14/24 (min/max)
Stripping length:	7 mm
Connection:	pluggable screw
Tightening torque:	0,5 … 0,6 Nm
Housing	
Material:	Polyamide – light grey
Protection class:	IP20
Flammabillity class/UL 94:	V0
Weight:	250 g
Form of construction:	terminal box for mounting rails
Housing mounting type:	35 mm DIN-rail
Assembly/installation:	arbitrary

4.11 Standards

EMC Standard	Product Family Standard EN 61326-1 Emission: Class A Immunity: Industry area
LVD Standard	Low Voltage Derictive IEC 61010-1

4.12 Self-monitoring

Measuring input:	1 monitoring measurement circuit with adjustable tolerance
Analog output:	1 monitoring measurement circuit with adjustable tolerance
Supply voltage:	2 monitoring measurement circuit
Reference voltage:	redundant and monitored
EPROM memory:	cycling tests to ensure relative integrity
µP-Controller:	self monitoring/ DuoTec®-Technology
Relay (REL1 … REL4):	indirect contact monitoring

4.13 Installation

The ME-MAX housing can be combined with a 5-pin TBUS connector / DIN rail connector. The RS485 interface and the supply voltage can be easily wired through the TBUS connector that is snapped into the DIN rail. The TBUS connection is self-establishing in the grid of the devices involved. This makes time-consuming pre-configuration or reworking the TBUS connection on site obsolete.

Technical Data:	5-pole connector in 3.81mm pitch 8A maximum contact load gold plating ensures high contact quality designed for mounting to NS 35/7.5 or NS 35/15 top hat rails
Important note:	The device may only be attached to or removed from the TBUS-Connection when power is switched off.

Attach the housing to a 35 mm DIN-Rail according to EN 60715. For installation, mount the snap-lock to the DIN-rail and lock it. For dismounting, use a screw-driver to unlock the snap-lock

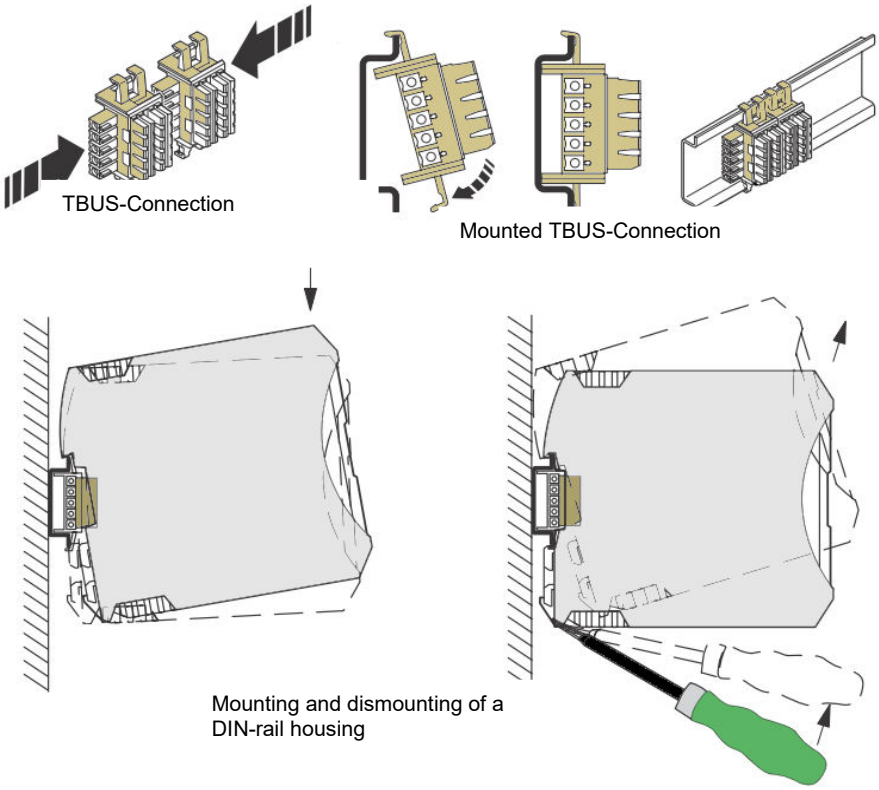


Fig. 1

4.14 Housing dimensions

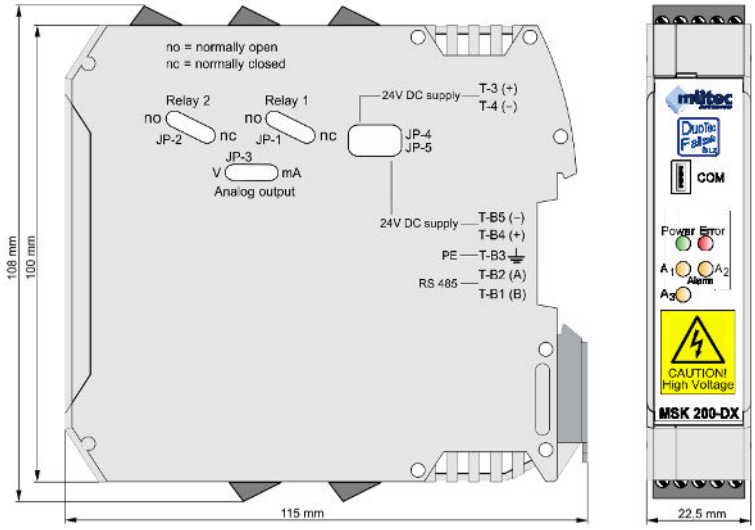


Fig. 2

4.15 Block diagram

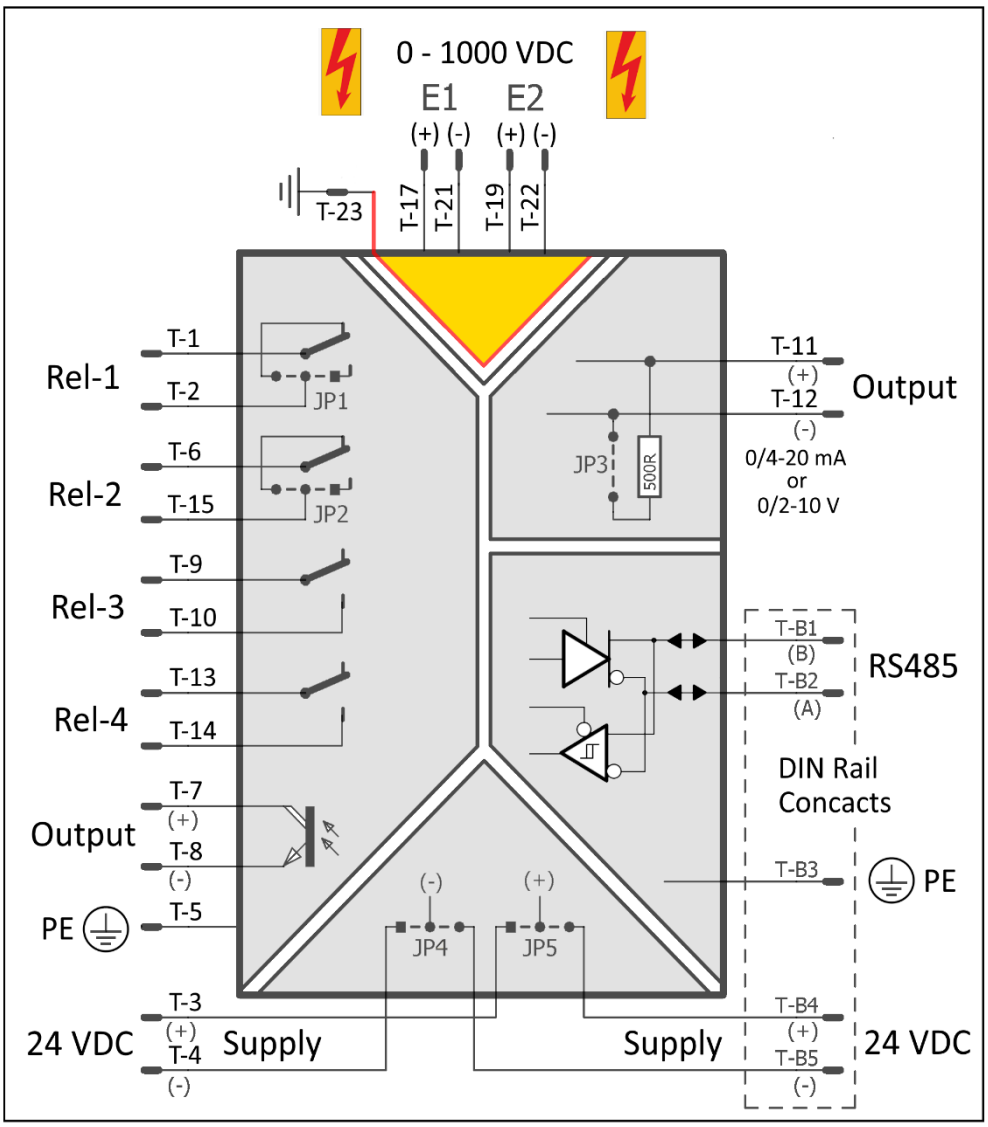


Fig. 3

4.16 Nameplate

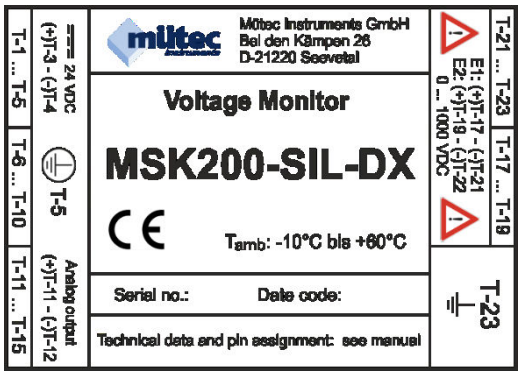


Fig. 4

5 Variants of measurement value acquisition

5.1 Absolute value measurement

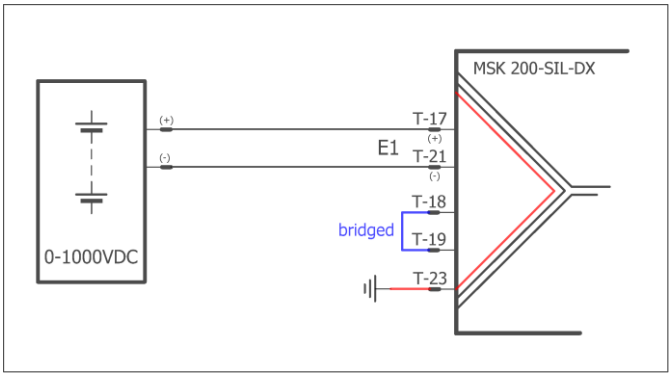


Fig. 5

The absolute value measurement with only one measuring input is a possibility of interconnection with the signal source (e.g. 0-1000 VDC) and the transmitter, if the terminals T-18 and T-19 are bridged.

However, this configuration does not meet the requirements resulting from IEC 61508 according to SIL2. A wire break in the measuring circuit can not be detected safely. Thus, it is possible that a hazardous voltage at the input remains undetected in case of a wire break !

5.2 Redundant absolute value measurement

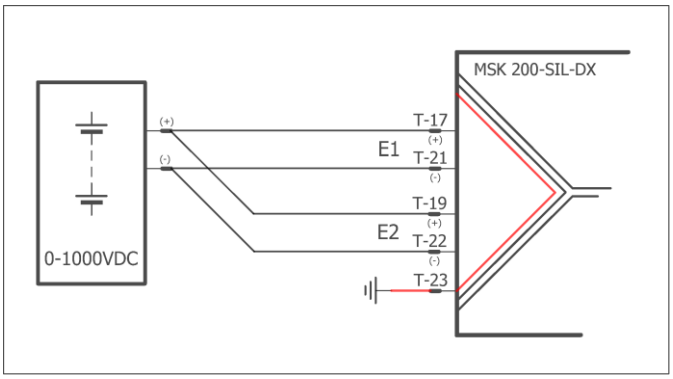


Fig. 6

A break in the measuring lines at (+) E1 or (+) E2 is recognized by the transmitter and triggers the safety function. The measuring lines at (-) E1 and (-) E2 are connected in the transmitter, so that the correct measured values are retained even in the event of a line break.

Important: Multiple errors cannot be reliably detected under SIL2!

6 Jumper settings

Jumper JP1 and JP2:
Depending on the position of the jumper JP1 for the contact of the relay REL-1, this is made available as a break or make contact at the terminals T-1 and T-2. Depending on the position of the jumper JP2 for the contact of the relay REL-2, this is provided as a break or make contact on the terminals T-6 and T-15.
Jumper JP3:
With jumper JP3 the analogue output can be switched from constant current (mA) to voltage (V). For this purpose, the constant current is passed through a resistor of 500 Ω, so that a voltage of 0/2-10V is available at terminals T-11 and T-12.
Jumper JP4 and JP5:
The jumpers JP4 and JP5 determine the supply of the supply voltage, which is optional via the terminals T-3 and T-4 or via the TBUS connector placed in the DIN rail can be produced with the contacts T-B4 and T-B5. Access to the jumpers is via correspondingly marked openings on the right side of the top-hat rail housing (see page 9).

7 Loop resistance computation for the mA-output

Analog output (AA) data for constant current: max. 22 mA at a load ≤ 500 Ω
The maximum load for the analog output is the sum of the forward and return lines and the input resistance (shunt) of the following module:

$$R_{Load,\,max} = 2x\ R_{Line} + R_{Shunt} \leq 500\ \Omega$$

The following applies to the line resistance:

$$R_{Line} = l \times \varrho \times A^{-1}\ [\Omega]$$

ϱ = 0,0178 [Ω mm² m⁻¹]
A = 0,25 x d² x π [mm²]

Maximum line length (distance):

$$l = 0{,}5\ (500\ \Omega - R_{Shunt}) \times \varrho^{-1} \times A\ [m]$$

Wire length depending on the wire cross section and the shunt resistor:

R_{Shunt} [Ω]	$L_{diameter}$ [mm]	$L_{cross\text{-}section}$ [mm²]	L_{Length} [m]	L_{Length} [km]
100	0,6	0,283	3179	3,18
	0,7	0,385	4325	4,33
	0,8	0,502	5640	5,64
	0,9	0,636	7146	7,15
	1,0	0,785	8820	8,82

R_{Shunt} [Ω]	$L_{diameter}$ [mm]	$L_{cross\text{-}section}$ [mm²]	L_{Length} [m]	L_{Length} [km]
200	0,6	0,283	2385	2,39
	0,7	0,385	3244	3,24
	0,8	0,502	4230	4,23
	0,9	0,636	5360	5,36
	1,0	0,785	6615	6,62

R_{Shunt} [Ω]	$L_{Durchmesser}$ [mm]	$L_{Querschnitt}$ [mm²]	$L_{Länge}$ [m]	$L_{Länge}$ [km]
300	0,6	0,283	1590	1,59
	0,7	0,385	2163	2,16
	0,8	0,502	2820	2,82
	0,9	0,636	3573	3,57
	1,0	0,785	4410	4,41

8 Safety function

The safety function is a function that is carried out by a safety-related E / E / PE system, a safety-related system of other technology or external risk reduction facilities. The goal is to achieve or maintain a safe system state in case of a a dangerous incident.

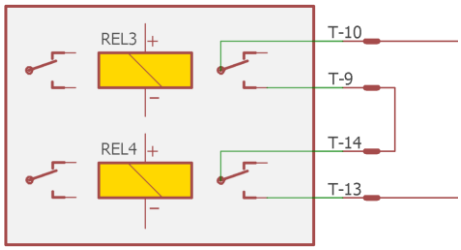


Fig. 7

The signaling of the safety function with REL3 + REL4 is fixed in the device and cannot be changed. The relays are operated according to the closed-circuit principle, so that in the good state (safety function is not activated) the contacts on T-9/10 and T-13/14 are always closed.

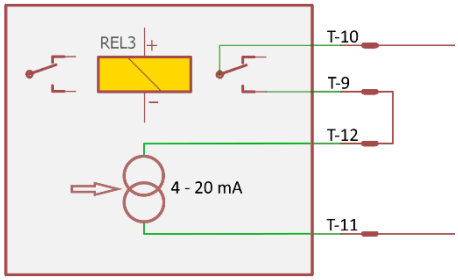


Fig. 8

The safety-related mA output can also be integrated for reporting the safety function, as shown in Figure 9. This enables the highest availability of the safety function. The permissible deviation from the setpoint between 0.2% and 5.0% can be parameterized for the analog output as well as for the input signal. Any exceeding of these limit values is recognized as an error and signaled externally with an analog value of 0 mA.

9 Safety-relevant features

Properties	FMEDA
Category	SIL 2
Device type	Type B
HFT	0
SFF	95 %
DC	89 %
Safe failure rate	331 FIT
Safe detected failure rate	0 FIT
Safe undetected failure rate	331 FIT
Dangerous failure rate	362 FIT
Dangerous detected failure rate	325 FIT
Dangerous undetected failure rate	37 FIT

10 Safety-oriented applications for SIL 2

Safety integrity requirements (see Technical Report 123.493-10 – rev. 1.0)

Error rates:
Type B-Gerät (according to EN 61508-2), Safety Integrity Level (SIL) 2

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	SFF
0	331	325	37	95%

λ_{su} includes errors that do not lead to error triggering!
SFF = Safe Failure Fraction
FIT = Failure in Time (1 FIT = 1 Failure / 10^9 h)

PFD_{AVG} values of the MSK 200-SIL-DX:
The beta factor is 2% and was derived from IEC / EN 61508-6, Appendix D.

T [Proof]	**1 Year**	**5 Years**	**10 Years**	**20 Years**
PFD_{AVG}	1,8E-4	8E-4	1,6E-3	3E-3
% SIL 2	**1,8%**	8%	16 %	30%

PFD_{AVG} = Average probability of failure on demand
T [Proof] = Detection test interval

The calculated PFDAVG values are within the permissible range for SIL 2 in accordance with Table 2 of IEC / EN 61508-1 and meet the requirement not to cover more than 16 % of the permissible range after 10 years.

PFS_{AVG} for 1 year: **1,4E-3**

PFS_{AVG} = Average probability of safe failure

Failure limit:
The operating mode with a low request rate is used as a basis. The proportion of the **MSK 200-SIL-DX** at the PFD_{AVG} value of the entire safety chain should not exceed 30%.

Signal source	**MSK 200-SIL-DX**	**Signal processing (PLS)**
35 %	**30 %**	**35 %**

Conditions:

- The failure rates of the components used are constant over the period of use.
- The spread of errors by the device in the system is not considered.
- The repair time (= exchange) should be less than 72 hours.
- The average temperature at which the device is to be used is + 40 ° C.
  Normal industrial conditions are assumed.
  The specified error rates refer to an ambient temperature of + 40 ° C.
  For an ambient temperature of + 60 ° C, the error rates must be a factor of 2.5 be multiplied. This factor is based on experience.

Verification test:

Take the right steps to avoid misuse. By simulating the values <3.6 mA and >22 mA, it can be verified whether the subsequent devices in the signal chain can also process the signal outside the measuring range. In the event of an error, the device must be replaced with an equivalent one. Then restore the full function of the safety circuit. Finally, check normal operation.

11 Configuration protocol

A printout can be created for the MSK 200-SIL-DX using the WINSMART® program command "Print configuration". The device address, the tag no., the serial no. and the version no. of the the devices' software is logged. The first 60 characters of the comment text stored in the device with a maximum of 2000 ASCII characters and can be printed out in the configuration log. All parameters for input, output and alarm setting as well as the defined tolerance deviations of the monitoring measuring circuits are documented, as well as the behavior of the relays, the transistor output and the analog output in the event of a error.

```
MÜTEC GmbH   Configuration protocol for MSK-200                24-06-2020
-----------------------------------------------------------------------
TAG No.: MEC20-19                                Software version: 4.02
Serial No.: 20-32/01                               Device address: 1

MEASURE VALUE
   Start of measure range..................      50.0 V
   End of measure range....................    1000.0 V
   Filter time.............................       1.0 s
Measure value controlling
   MAX-value...............................    1010.0 V
Physical representation
   Start of measure range..................      50.0 V
   End of measure range....................    1000.0 V

OUTPUT
   Start of range..........................       4.0 mA
   End of range............................      20.0 mA
   MIN-limit...............................       3.5 mA
   MAX-limit...............................      20.5 mA
   Alarm value.............................       3.0 mA
   Filter time.............................       0.5 s

ALARM 1
   Alarm type..............................    MAX alarm
   Function................................    De-energized
   Alarm value.............................     800.0 V
   Hysteresis..............................       1.0 %
   Alarm delay time........................       0.5 s
ALARM 2
   Alarm type..............................    MAX alarm
   Function................................    De-energized
   Alarm value.............................     900.0 V
   Hysteresis..............................       1.0 %
   Alarm delay time........................       0.5 s
ALARM 3
   Alarm type..............................    MAX alarm
   Function................................    De-energized
   Alarm value.............................    1000.0 V
   Hysteresis..............................       1.0 %
   Alarm delay time........................       0.5 s

   Time window for gradient alarm..........        20 s

System controlling
   Analog input - maximum tolerance........  +/- 1.0 %
   Analog output - maximum tolerance.......  +/- 1.0 %

Behaviour of analog output and alarm outputs in case of errors
   Error sources:          Analog output     relay1  relay2  logic1
   Analog output........   Alarm value        limit    limit    off
   Analog input.........   Alarm value        on       on       off
   Maximum V value......   Alarm value        on       on       off
   Relay 1,2,3 & 4  ......Alarm value        off      off      off
   Internal device error  Alarm value        on       on       off
```

12 Configuration program

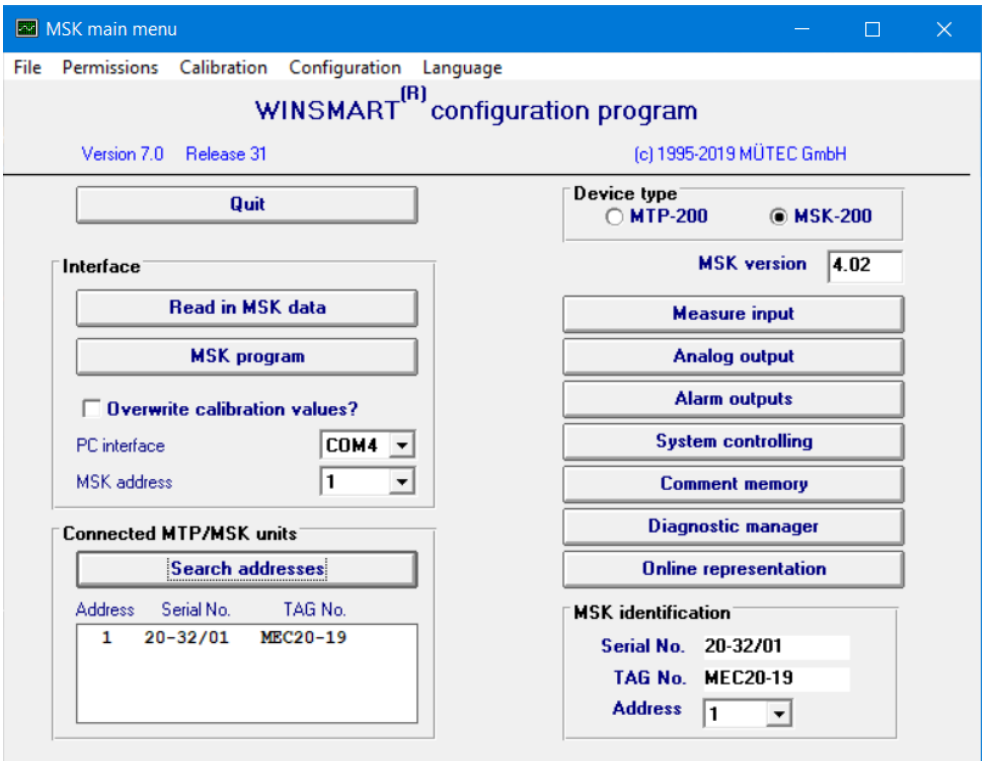


Fig. 9

The figure above shows the opening mask of the WINSMART configuration program with the version and release number. With the **File** command, existing configuration files can be accessed, saved in a folder or a configuration can be printed out. Of the 3 operating levels in the WINSMART program, 2 are secured by passwords, the access of which is made possible with the command **Permissions**. The operating level is particularly important for the calibration of the measurement inputs and the analog output. Access to one of the two masks is only possible after entering the password and the **Calibration** command.
For communication with the WINSMART program, the COM address must be entered in the field **PC interface** and **MSK address**. A device with an unknown address can be identified using the **search addresses** function. After finding the device address, **Serial-No**. and **TAG-No**. are displayed. In addition to the MSK200, the WINSMART configuration program also supports the MTP200.

For information about the MTP200, which will not be covered in the following description, refer to the existing MTP200 manual.

The configurable and parameterizable inputs and outputs are accessed via separately labeled buttons. In the **System Controlling** mask, the analog output and the alarm outputs can be linked with special functions that are only activated in the event of an error.A **diagnostic manager** provides information about the status of the device and can distinguish between an errer that is no longer present and an error that is present. The status of the input and output signals as well as the alarm status are clearly shown in the **online representation** mask.

12.1 Menu bar and commands

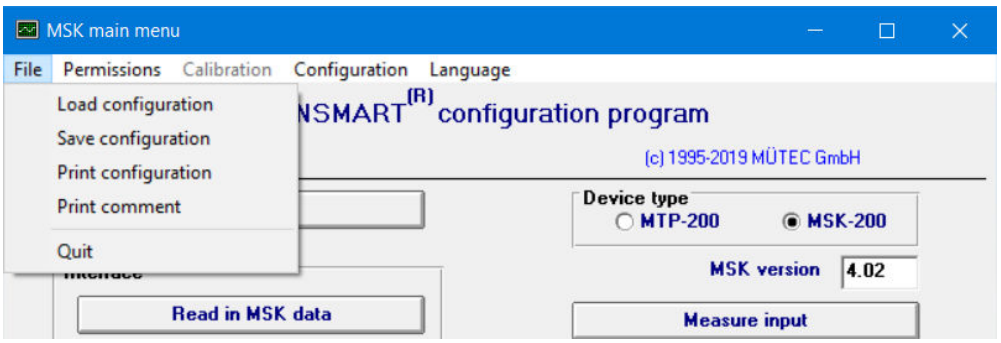


Fig. 10

12.1.1 File → Load configuration

The MSK200 parameter set saved in a file with extension ***.MSK** on the hard drive is loaded into the WINSMART configuration program. This allows a saved parameter set to be duplicated quickly and securely in other devices.

12.1.2 File → Save configuration

The MSK200 parameters of the configuration program are saved in a file with the extension *.**MSK** on the hard drive. To restore a configuration, the file must be loaded into the WINSMART program and then transferred to the MSK200 using **Program MSK**.

12.1.3 File → Print configuration

All MSK200 parameters of the configuration program as well as the first 60 characters of the comment text are printed out as a protocol with the date and the device data on a DIN A4 page using the printer available under WINDOWS. The font and the format of the printout are fixed and cannot be changed by the user.

12.1.4 File → Print comment

The comment text stored in the device comprises a maximum of 2000 ASCII characters and can be printed out on a DIN A4 page as a protocol with the date and the device characteristics. The printer available under WINDOWS is used for this. The font and the format of the printout are fixed and cannot be changed by the user.

12.1.5 File → Quit program

The message **Quit Program** appears with a request for confirmation by **OK** or **Cancel**.

12.1.6 Access rights → Enter password

After the corresponding password is entered, entry is enabled to the otherwise locked functions of the configuration program.

Fig. 11

The configuration program distinguishes 3 access levels, 2 of which are password protected. The open area contains masks with which no function or parameter changes are connected. Access level-1 with password includes all masks with parameter settings.

Free input to this level is secured only after password assignment

Password level 2 includes access to all masks for calibration. This access is already blocked against unauthorized access by a password assigned by the manufacturer (5180) and can be replaced by assigning your own password. Password 2 also authorizes access to all parameters and functions of the device.

12.1.7 Access rights → Change password → Password level 1

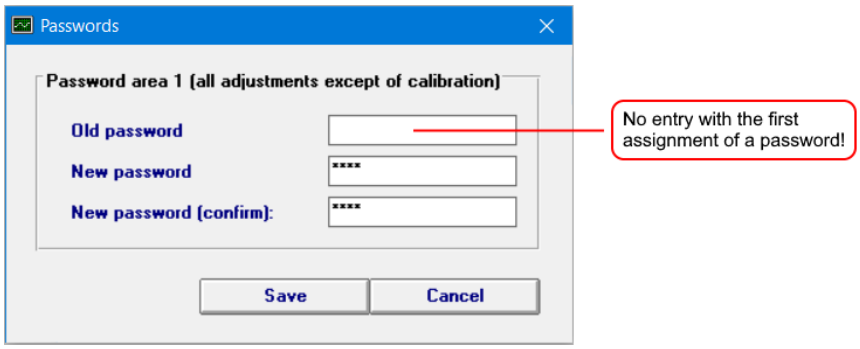


Fig. 12

Password level 1 with all parameter settings is intended to give authorized users such as maintenance staff or service technicians access to all parameterizable settings. The password with a maximum of 20 alphanumeric characters must be entered and saved in the two designated fields on the mask.

12.1.8 Access rights → Change password → Password level 2

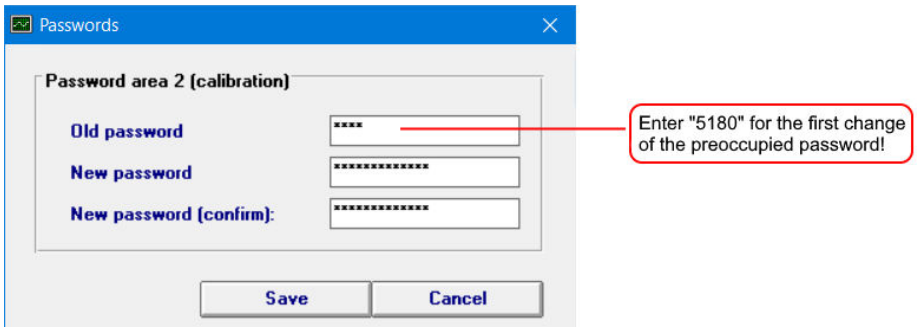


Fig. 13

In addition to parameter and calibration settings, **password level 2** includes the function **overwrite calibration values** and should only be carried out with great care in the test field. **Password level 2** is blocked by a password "**5180"** assigned by the manufacturer. The new password may contain a maximum of 20 alphanumeric characters and must be entered and saved in the two designated fields.

12.1.9 Calibration → Calibrate input

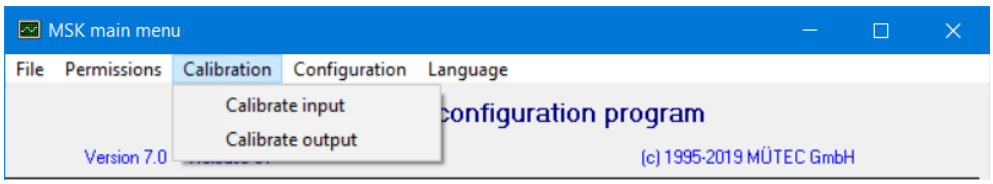


Fig. 14

Calibration is necessary for the analog input and output signal. Before starting the calibration, the MSK200 parameter set must be read into the WINSMART program.

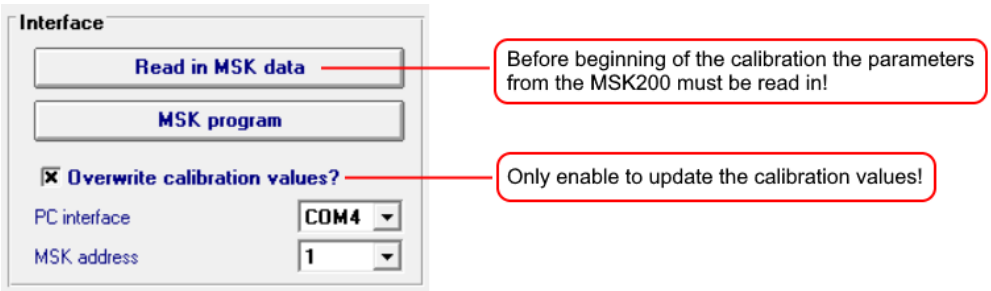


Fig. 15

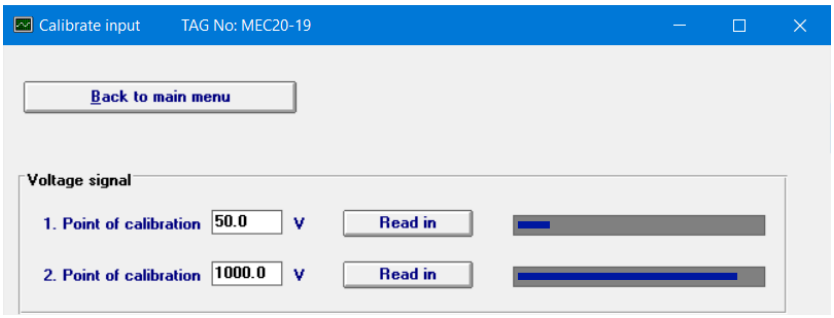


Fig. 16

The calibration of the input for E1 and E2 is always done in 2 steps with a corresponding DC voltage source. The calibration points can be chosen freely, but should be chosen for a high accuracy within the measuring range and with a corresponding large distance. For the 1st calibration point, the corresponding Voltage is simulated in the input in order to then start the process with the **Read in** button. The messages **Measurement running** and **ready** appear in the mask as feedback. By acknowledging with **OK**, the calibration value is accepted and displayed as an analog bar. The procedure for the second calibration value is the same. In order to avoid calibration errors, the proportional representation of the values as a bar chart is used for clear presentation and for checking.

Same calibration values for the 1st and 2nd calibration point ⇒same bar lengths ⇒ no measured value illustration is possible ⇒ output jumps!

12.1.10 Calibration → Calibrate output

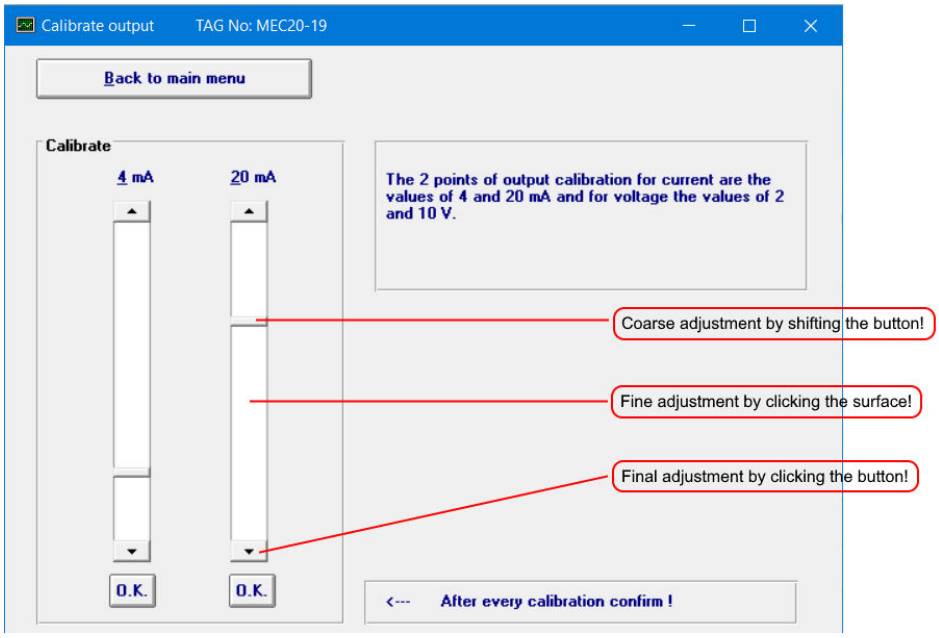


Fig. 17

Before starting the calibration, the parameter set must be read from the device into the WINSMART program. For checking purposes, a 4½-digit multimeter should be connected to contacts T11 and T12 of the output circuit. The jumper JP3 is used to set the required output signal for constant current or voltage.
The calibration points are fixed at 2 V and 10 V for the voltage output and 4 mA and 20 mA for current output. The adjustment process for the coarse, fine and final settings can be carried out in any order. The end of each calibration process is the acknowledgment with the **OK** button. After the ZERO and SPAN values have been adjusted, the calibration parameters must be transferred to the MSK 200 by programming them in the main mask with **Program MSK** and **overwrite calibration values**.

The output signal 0/2-10 V is generated by a constant current 0/4-20 mA, which runs over a resistive shunt of 500 Ω, assuming that JP3 is set on "**V**".
The voltage value is distorted by 1 % at a load resistance of 50 kΩ.
A recalibration completely eliminates this error.

12.1.11 Restore configuration

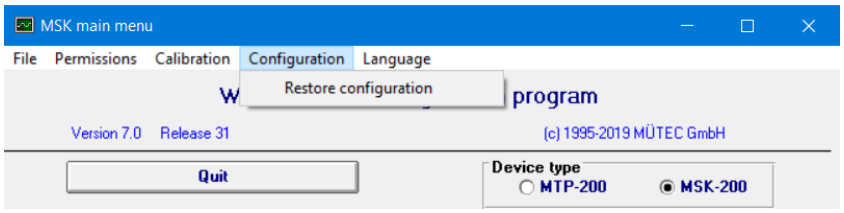


Fig. 18

The configuration contains all variables of the MSK200 and is automatically saved in the PC with the first process of **Read in MSK data**. With the **Restore configuration** command, each device can be reset to the factory settings. The prerequisite for this is that both processes are carried out on the same PC. After the **Restore configuration** command, all variables in the Windows masks and in the MSK200 are again provided with the original data. A device with falsified calibration values or settings can therefore be operated again at the push of a button.

12.1.12 Language → english, german, dutch

Fig. 19

There are three language versions in the WINSMART programm.

12.2 Interface and connected devices

Communication between the MSK200 and the PC is possible via the COM/RS232 on the front or RS485 interface on the DIN rail contacts T-B1 and T-B2. When the COM connector is plugged into the front socket, an existing RS485 connection is automatically disconnected and the COM connection is established.
After the COM connection has been disconnected, the RS485 interface is online again.
The RS232 and RS485 interfaces are galvanically isolated from all circuit parts and the auxiliary power (see block diagram of the MSK200).

Fig. 20

12.2.1 Reading MSK data

With the command **Read in MSK data** the parameter set of the MSK200 is loaded into the WINSMART program. The corresponding entries in the mask for the PC interface (COM1 to COM20) and the MSK address (1-255) are a prerequisite for establishing the interface connection. If the MSK address is not noted on the device, the unknown device address can be determined and entered with the **Search addresses** command. After the data transfer is complete, the **parameter read out** prompt appears and must be acknowledged with the **OK**.

12.2.2 Programming MSK data

The command **program MSK** transfers the parameter set from the WINSMART program to the MSK200. After entering the command, the message **Existing parameters will be overwritten** on the screen. **Proceed anyway?** The process is started with **OK**. After the successful transfer, the **parameter has been transferred** prompt is shown and is finally confirmed with **OK**.

12.2.3 Overwriting calibration values

If the **Overwrite calibration values** box is checked in the input mask, the calibration parameters of the mA input and the analog output can be transferred from the WINSMART program to the device using the **Program MSK** command. The text **Existing parameters will then be overwritten** is shown in the mask. **Proceed anyway?** The process is started with **OK** and the next printout reads **Parameters transmitted**. A final **OK** ends the transfer process.

12.2.4 PC interface

The addresses COM1 to COM20 are selectable.

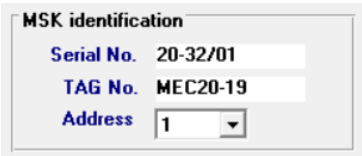
12.2.5 MSK address

The MSK address is a prerequisite for communication between the PC and MSK200. As the master, the PC sends a telegram with the desired device address, which is read by each MSK200 (slave) with a single connection via the COM interface and with a multi-point connection via the RS485 interface. Only the device with the called address establishes the connection to the master. For a trouble-free communication, no MSK200 devices with the same address may be connected to the RS485 bus.

12.2.6 Connected MSK devices → Search for addresses

A search function lists the connected and addressable MSK devices with their specific characteristic data such as address, serial number and TAG number.

12.3 MSK200 identification



For a successful connection, the 3 digits address in the **MSK identification** field and in the **Interface** field has to be correspond with the device address.

Fig. 21

12.3.1 Serial No.

The serial number is a 8-digit manufacturer-specific unit number ensuring clear identification for each MSK200. It consists of a date code (year + calendar week) and a sequential number. The serial number cannot be edited!

12.3.2 TAG No.

The TAG number can contain maximum 8 alphanumeric characters as user-defined device identification.

12.3.3 Address

A maximum 3-digit device address is selected in the Address field. Setting a device address involves:

1. Selection of device address with max. 3 digits in the MSK identification field;
2. Setting of the current device address in the Interface field;
3. Execute the **Program MSK** command and confirm;
4. Enter the new MSK address in the Interface field and check the changed connection data with the command **Read in MSK data**.

12.4 Analog input

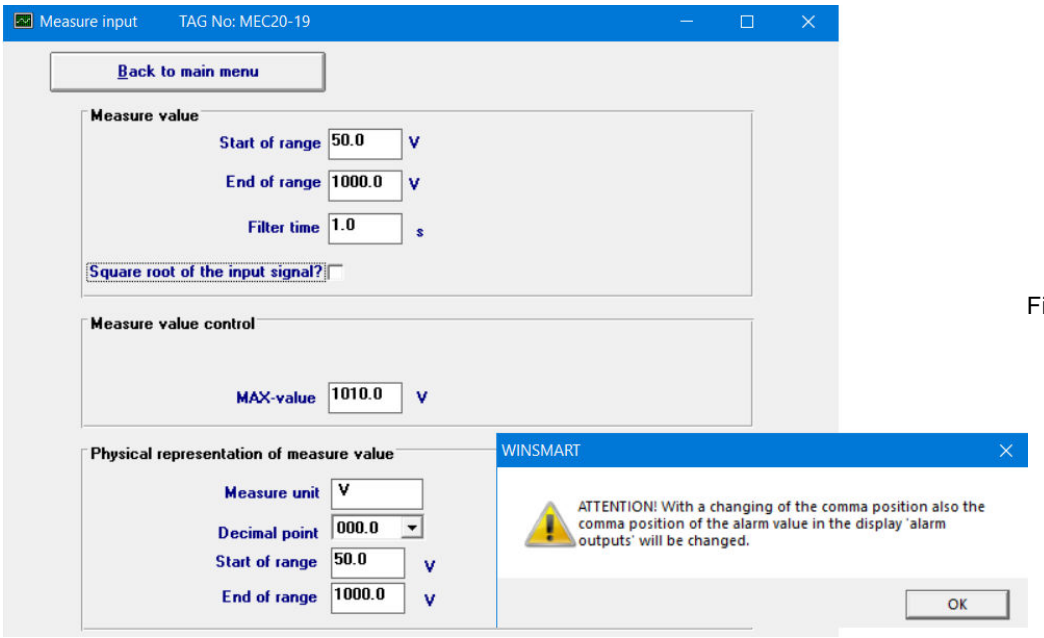


Fig. 22

A parameterizable 1st order filter from 0.1 to 99.9 seconds determines the arithmetic mean of the measured variable. The settling time changes in proportion to the filter time.

In the mask **Measure input** specified measuring range (e.g. 50 to 1000 V) complies 0 to 100 % of range for the limit value monitoring (**Measure value control**).
The maximum adjustable limit value is 1100 V.
For a correct parameterization of MSK200 make adjust first the measuring range and second the limit values. If you changed later the measuring range, always check the limit value alarms as well.

For standardized measurement signals further entries must be made in rubric **Physical representation** of measure value. They are needed for a representation in the online mask.

Unit:	Physical unit of measured variable (V)
Decimal point:	None, 1, 2 or 3 places after the decimal point
Start of range:	Physical measure value at start of range
End of range:	Physical measure value at end of range
MAX value:	Maximal measure value for initiation of fault alarm

For the correct limit value monitoring, the **range limit MAX** should always be outside the measuring range, otherwise exceeding these limits triggers the maintenance alarm.

12.5 Analog output

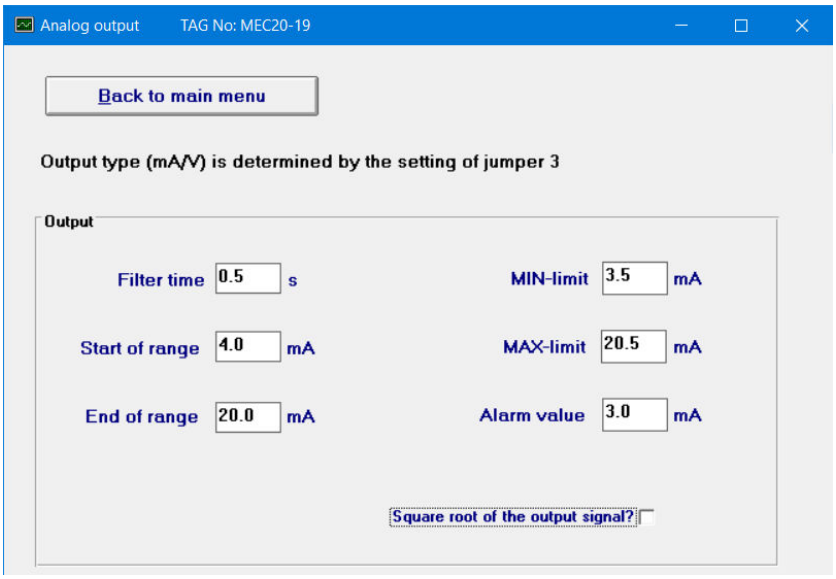


Fig. 23

A parameterizable 1st order filter is available for the analog output from a minimum of 0.1s to a maximum of 9.9s. The settling time changes in proportion to the **filter time**.
The setting range for the analog output is determined by the **start and end of the range**. For the current output, the max. Value 22 mA, for the voltage output 11 V. In addition, the setting range from 0-100% can be protected against falling below or exceeding by entering a **MIN or MAX limit**.
The **alarm value** for the analog output is a fixed value and is activated in the event of an error if the **alarm value function** for the analog output has been selected in the **System controlling** screen in the Error sources section.
To calculate the square root of the analog output signal, an "x" must be set in the **Square root output signal** window.
All settings made in the mask are only saved in the device with the command **programm MSK** (in the main mask) and are thereby actived.

If the value 0 mA was entered as the alarm value, the line break monitoring for the mA output cannot distinguish between the alarm value (0mA) and the line break (0mA) in the event of a fault. The result would be a constant switching of relay 3 + 4.

During voltage output neither a short circuit nor an interruption of the connection to the burden can be recognized!

mA-values for an output signal without and with square root extraction:

Input signal	**Output signal** without square root extraction	**Output signal** with square root extraction
0 %	4.00 mA	4.00 mA
25 %	8.00 mA	12.00 mA
50 %	12.00 mA	15.31 mA
75 %	16.00 mA	17.86 mA
100 %	20.00 mA	20.00 mA

12.6 Alarm outputs

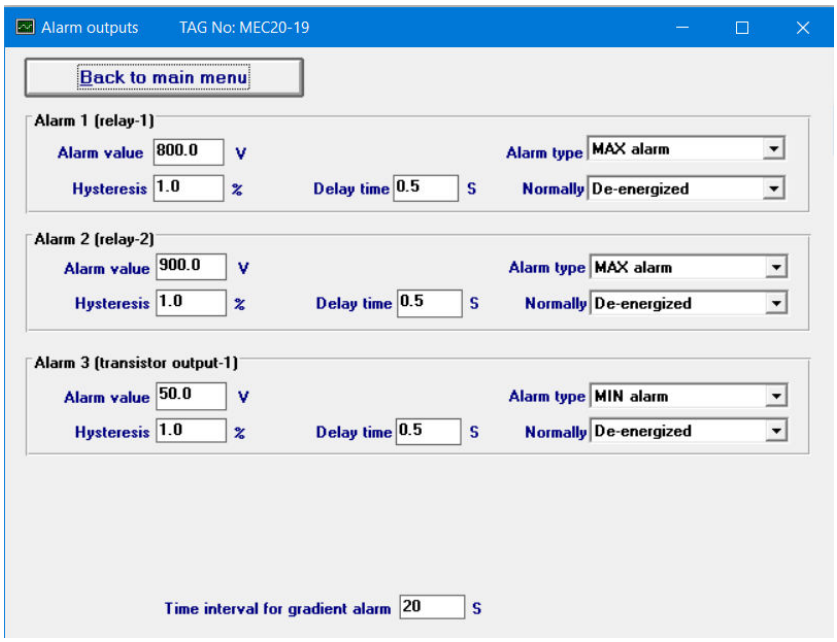


Fig. 24

The mask for the **Alarm outputs** enables quick setting of all parameters due to the clear display of the three alarms available (2x relay contact output, 1x transistor output).

For a voltage measuring range of 950 V, 1% hysteresis corresponds to a value of 9.5 V. A triggered MAX alarm at 900 V is therefore only canceled at a value of <890.5 V.

The alarm delay from a minimum of 0 to a maximum of 9.9 seconds ensures that brief alarm value violations do not lead to limit alarms.

Available alarm types:

MAX alarm	with rising measured value
MIN alarm	with falling measured value
Gradient MAX alarm	with rising and falling function line
Gradient MIN alarm	with rising and falling function line

Available alarm functions:

Open circuit principle:	in good status the relay is not under current
Closed circuit principle:	in good status the relay is under current
No function:	alarm output is switched off

With the gradient alarm, the **time interval for gradient alarm** is required as an additional parameter. It represents a time window between 0 and 9999 seconds, in which 20 samples are recorded and used for the calculation.

The alarm value and alarm type are also shown in the online display mask, whereby a triggered limit alarm is identified by a red text.

12.7 Differential gradient alarm

1. Example:

Alarm value variable	=	40 °C
Alarm type variable	=	Gradient/max
Time interval	=	60 s
Hysteresis variable	=	0
Sampling interval	=	60 s / 20 = 3 s

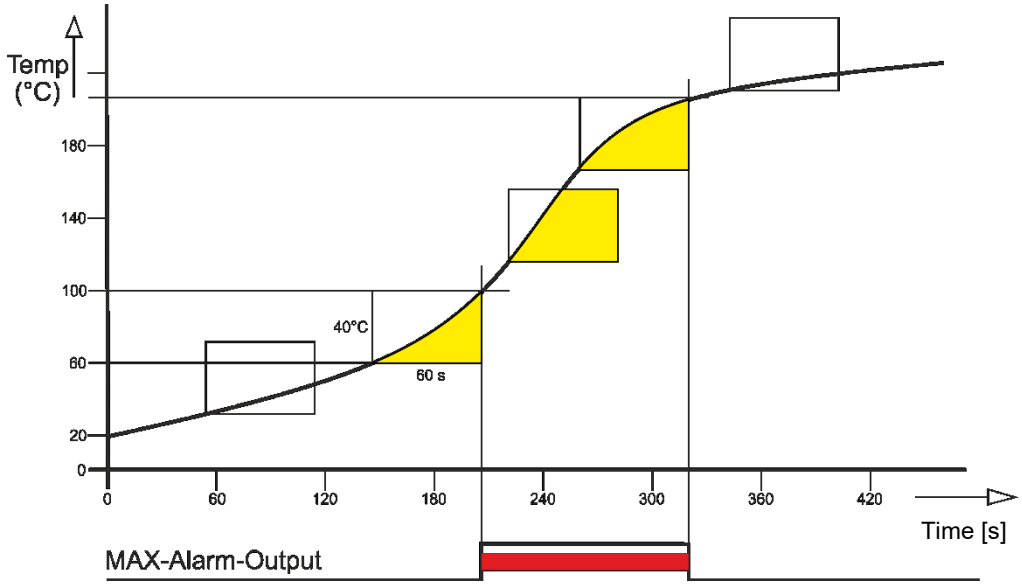


Fig. 25

2. example:

Alarm value variable	=	40 °C
Alarm type variable	=	Gradient/min
Time interval	=	60 s
Hysteresis variable	=	0
Sampling interval	=	60 s / 20 = 3 s

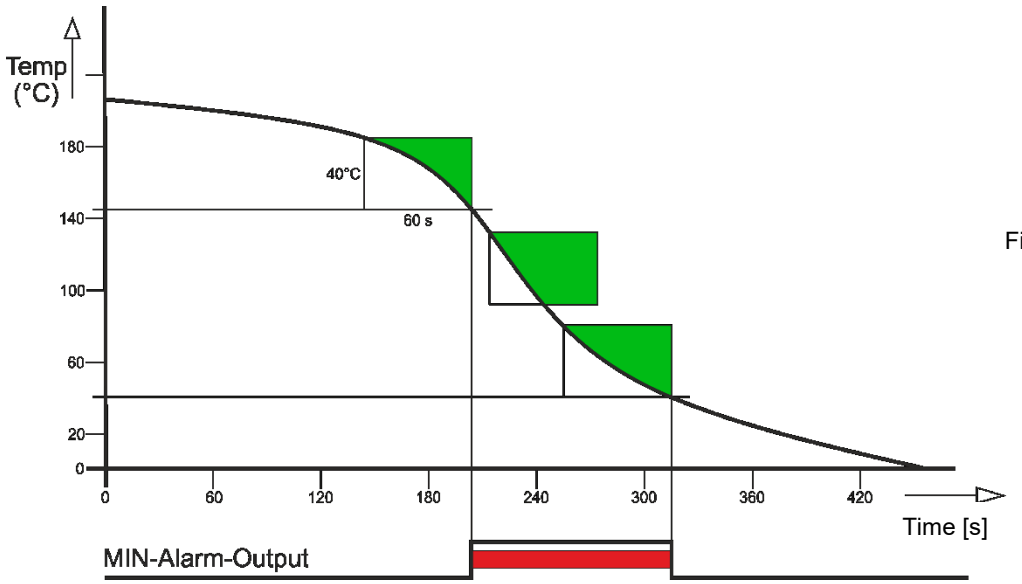


Fig. 26

12.8 Monitoring conditions

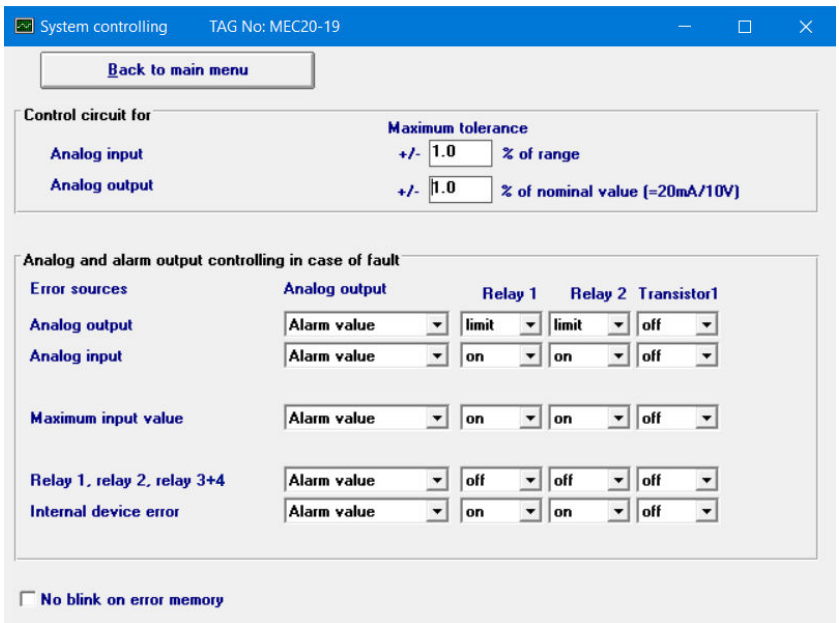


Fig. 27

A deviation fault between +/- (0.2 - 5.0) % is configured for mA measuring input and analog output respectively.
A tolerance beyond that activates an alarm for maintenance requirement by the relays 3+4 and a constant light alarm LED on the front of the device.
A total of five sources of error are distinguished in the MSK200. Depending on the source of the error, different functions can be assigned to the analog output and the alarm outputs. They determine the behavior of these outputs in the event of an error. If there is no error, the settings in the **Analog output** mask apply to the analog output and the parameterizations in the **Alarm outputs** mask apply to the alarm outputs. The functions selected in the **System controlling** mask are only superimposed on the outputs in the event of an error. If a second error occurs, the ranking of the functions involved determines the behavior of the output involved.

Alarm outputs can be switched off in the **Alarm outputs** mask with "**no function**". For this reason, they are no longer available in the **System controlling** mask for the maintenance alarm and are hidden.

Analog output and alarm outputs are only controlled by the master controller. The mutual monitoring of the two 16-bit controllers (DuoTec® system) in conjunction with further security measures ensures that the alarm for maintenance is triggered even if the master controller behaves incorrectly.

Analogue output in the event of fault:

Function	Ranking	Definition
alarm value	★★★	The output signal jumps to the alarm value defined in the **analogue output** mask!
frozen value	★★	The output signal remains at the value before fault occurrence and is in an offline mode!
instantaneous value	★	The output signal is updated and in online mode, but can be erroneous!

Relay and transistor outputs in the event of fault:

Function	Ranking	Definition
on	★★★★	The alarm output is switched on and the device required maintenance!
off	★★★	The alarm output is switched off!
lim-prio	★★	The alarm output is switched off, only there is no limit value alarm.
limit	★	The alarm function is only the limit value monitoring!

Truth table for limit values and maintenance alarm:

Function	Limit value alarm	Maintenance alarm	Alarm output	Notes
on	**x**	**on**	**on**	Only the fault alarm switched the alarm output!
off	**x**	**on**	**off**	The fault alarm switches off the limit value alarm!
lim-pro	**x**	**on**	**off**	The fault alarm switches off the limit value alarm, but not an existing limit value alarm!
	on (alarm exists!)	**on**	**on**	
limit	**off**	**x**	**on**	Only the limit value alarm switched the alarm output
	on	**x**	**off**	

x = optional (on or off)

With a fault occurrence, the behaviour of the analogue output and alarm outputs correspond to the parameterization in the mask System controlling without taking account of the ranking. After the occurrence of a second fault the highest rank of the functions involved determines the behaviour of the analogue output and alarm outputs.
(See some examples on next page)

First example

1. **Fault: analog output**

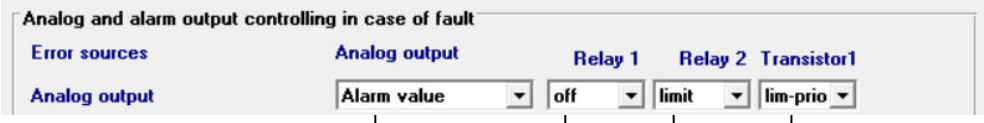


Fig. 28

Control of outputs: Alarm value | off | limit | lim-prio

2. **Fault occurs later: analog input**

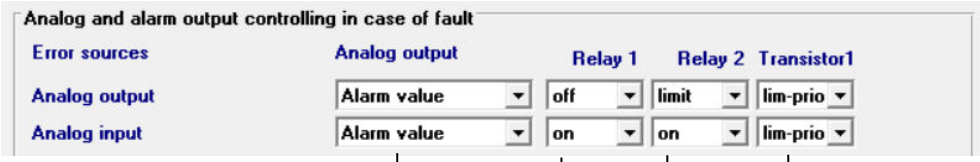


Fig. 29

Control of outputs: Alarm value | on | on | on

The behaviour of the outputs determined by the ranking:

Analog output	stays on **Alarm value**
Relay 1	changes from relay **off** to relay **on**
Relay 2	changes from relay **limit** to relay **on**
Logic 1*	stays on **lim-prio**

*transistor output

Second example

2 faults occur at the same time

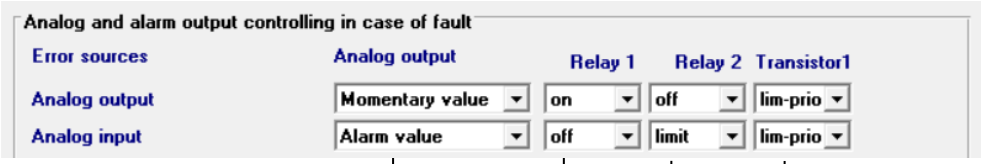


Fig. 30

Control of outputs: Alarm value | on | off | lim-prio

The behaviour of the outputs determined by the ranking:

Analog output	changes to **Alarm value**
Relay 1	is switched on
Relay 2	is switched off
Logic 1	stays on **lim-prio**

12.9 Diagnostic manager

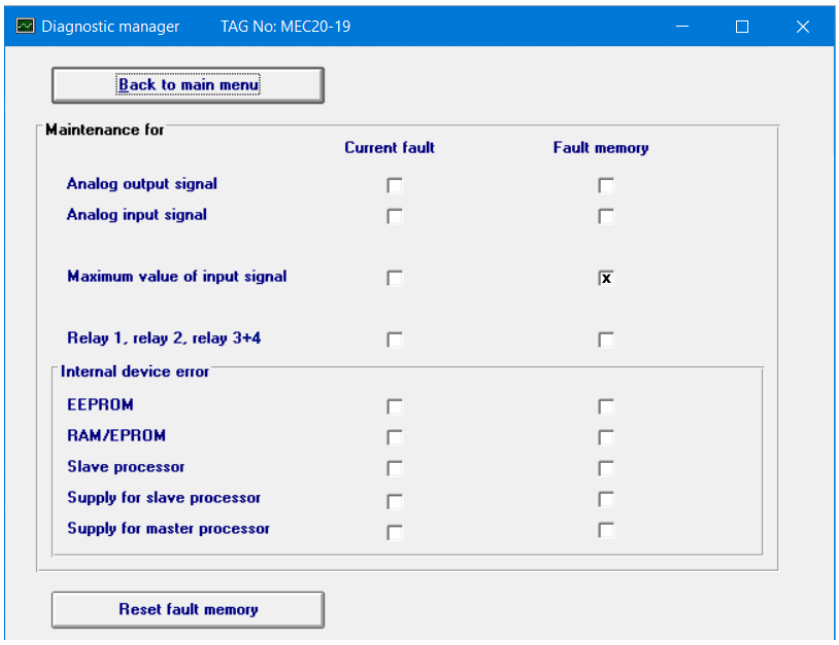


Fig. 31

The diagnostic manager clearly documents all errors that have occurred inside and outside the MSK200. All 10 monitoring functions with the 2 windows for **current fault** and **fault memory** are listed in a table.

Every existing error is reported as an alarm for maintenance needs with the steady light of the red alarm LED and relays 3 and 4. The source of the error is displayed in the **Diagnostic Manager** in the window **Current fault** and **error memory**. The **fault memory** for an existing fault cannot be deleted with the **Reset fault memory** command. After an error that has only occurred for a short time or is no longer present, the alarm LED changes from the steady light to the permanently flashing mode and relay 3 und relay 4 go back to the good state. In the **diagnostic manager**, the fault that is no longer present is only displayed in the **fault memory** window and can now also be deleted with the **Reset fault memory** button.

The **diagnostic manager** documents also short-time occurring faults. After a supply power break-down the fault memory will be deleted.

12.10 Comment memory

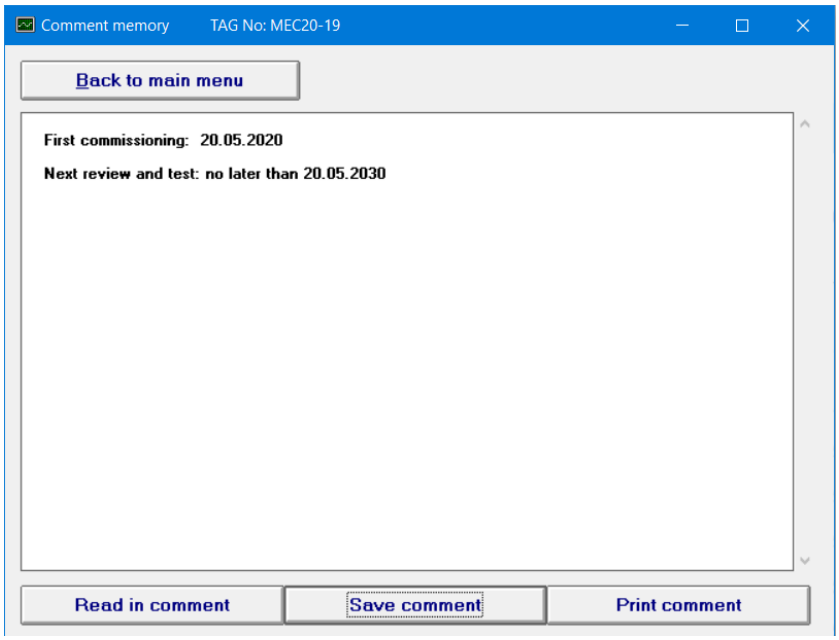


Fig. 32

The comment memory offers the user a convenient option of saving comments or notes in the MSK200 device. The allowed capacity for comments is a maximum 2000 ASCII characters and may be sufficiently dimensioned for most applications. For protocols, this text can be printed out with the command Print comment under Windows. The character font and print format are fixed and cannot be edited.

Read in comment: Text is loaded into the WINSMART program from the MSK200

Save comment: Text is written into the MSK200 from the WINSMART program

12.11 Online mask

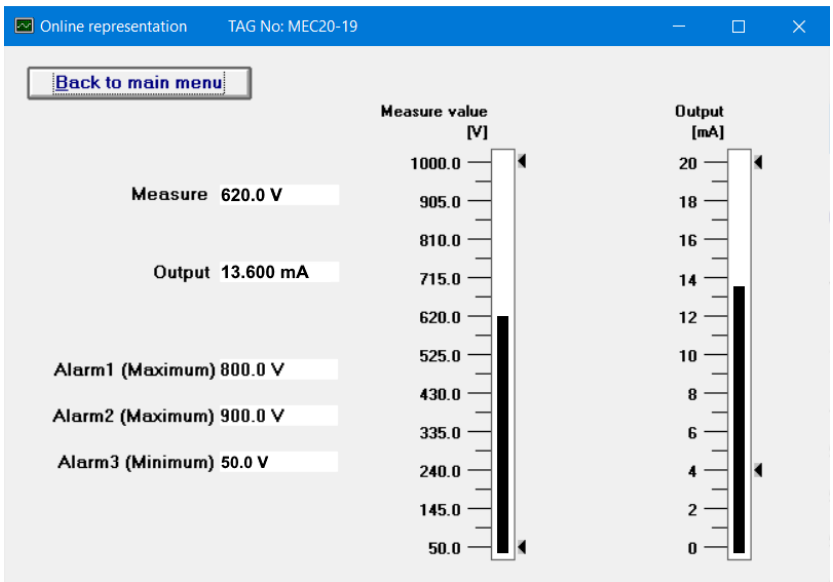


Fig. 33

The input and output signals are shown in analog and digital form in the online mask. In addition, the alarms are also displayed with their limit values. If the limit value is exceeded or an alarm is triggered, this is shown with red text. An alarm that is not used (**no function**) does not appear in the online mask.