Manual

MSK200ia-E, MSK200ib-E

WINSMART-Support from MSK200-Version 4.0
MODBUS-RTU Communication
HART Signal Connection

SIL
Safety Integrity Level DIN EN 61508 DIN EN 61511

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Classification of 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.

CE mark

This product meets the specifications according to the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC.

General remarks

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.

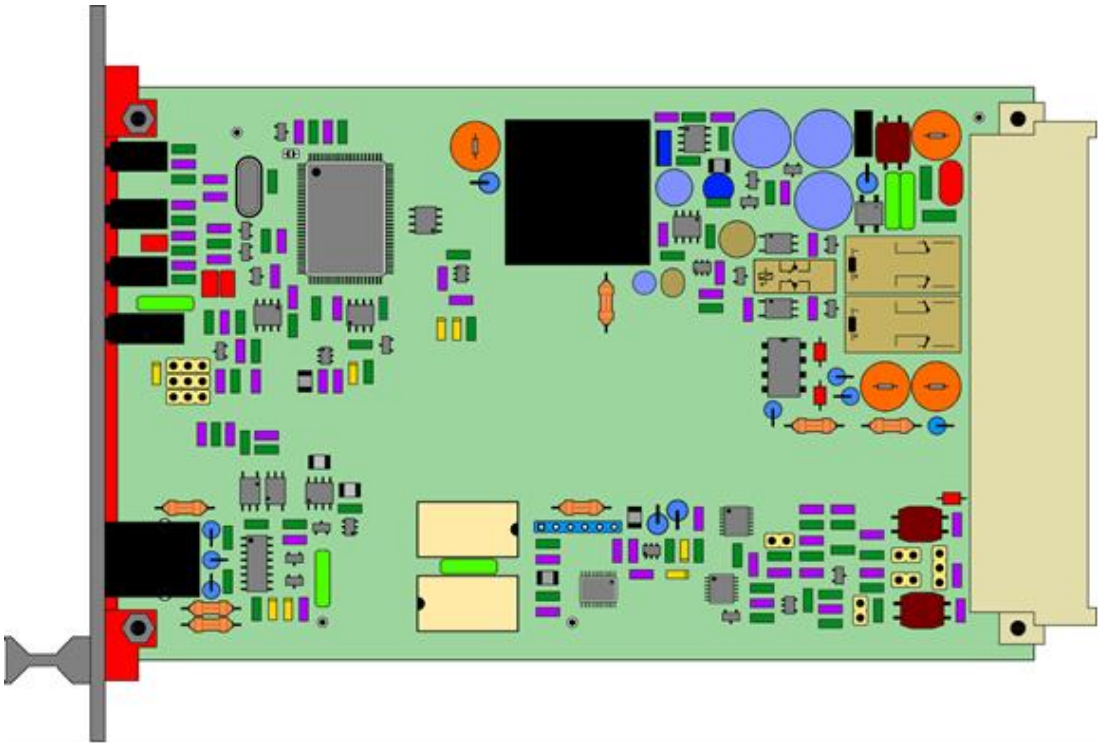
CAUTION

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.

Introduction

MSK200ia-E, MSK200ib-E

DIN-Rail Transmitter Supply Unit as per IEC/EN 61508 – SIL 2

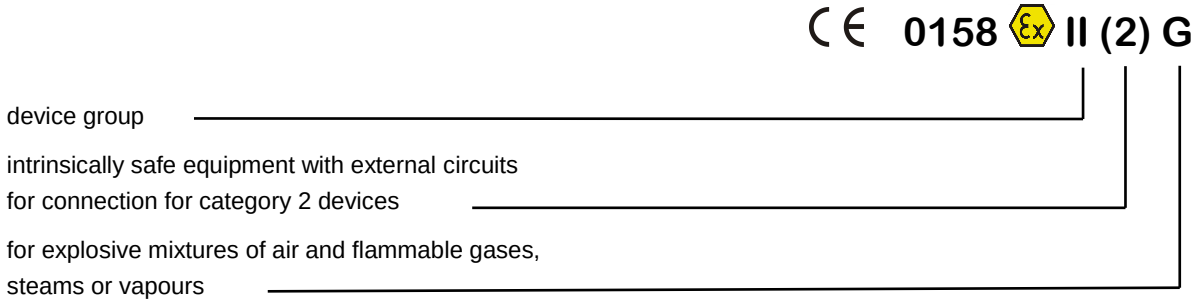


Features:

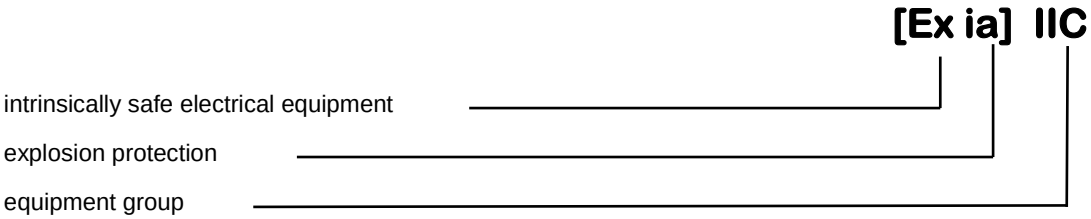
- DuoTec®-System (2 Controller with parallel monitoring)
- Failsafe-Technology for self-monitoring
- HART Signal Connection
- 4 A/D converters (16-bit, 12-bit, 10-bit)
- 1 D/A converter (15-Bit)
- 5 self-monitoring circuits
- 5 galvanically isolated alarm outputs (3x relay contact, 2x transistor)
- 1 intrinsically safe transmitter supply output [EEx ia/ib] IIC
- 1 intrinsically safe mA measurement signal input [EEx ia/ib] IIC
- 1 analogue output for constant current or constant voltage
- 1 galvanically isolated RS232 interface
- 1 galvanically isolated RS485 interface
- 24V AC/DC supply unit

1. General information for installation and operation

Identification in accordance with Guideline 94/9/EG:



Identification of explosion protection:



Safety instruction

If it is assumed that safe operation is not longer possible, the device must be taken out of service and secured against accidental operation.
Reasons for this can be:

- visible damage of the device
- failure of electrical function
- longer storage at temperatures over 85°C
- heavy transport stress

Before the device is put back into operation, a professional routine check must be performed in accordance with DIN EN 61010, Part 1. This examination should be made at manufacturers' side. Repair work at ex-devices may be accomplished only under attention by §9 of the ex regulation (Elex V).

Devices with intrinsically safe circuits may be never operated in not-intrinsically safe circuits. If ex devices in not-intrinsically safe circuits are operated, these need to be marked particularly and the ex labels must be removed absolutely, so these devices do not find use for intrinsically safe electric circuits later again. A later check of the devices on observance of the conditions for the explosion protection is possible with a disproportionately high expenditure only and is rejected therefore usually.

Proper use

The transmitter supply unit **MSK200ia/ib-E** delivers power to intrinsically safe 2-wire transmitters or can be used as an isolation amplifier for an intrinsically safe current signal of 0/4 - 20 mA.

The transmitter supply circuit on the contacts d/z28 + d/z30 and the mA input circuit on the contacts d/z30 + d/z32 are in accordance with explosion protection "intrinsic safety" category "ia" and "ib".

For operating the 19''-europecard needs to be assembled into a rack or a casing. Otherwise the required degree of protection IP20 according to IEC publication is not reached.

To connect an intrinsically safe HART terminal for parameterisation or testing the 2-wire transmitter there is a front socket used as link to the intrinsically safe circuit.

The maximum ambient temperature range of -20 °C to +60 °C may not be exceeded.

The transmitter supply unit MSK200i..-E is an associated electrical equipment of explosion protection (EEx ia) IIC or (EEx ib) IIC and must be operated outside potentially explosive areas always. Only the transmitter supply

circuit and the 0/4-20mA-measuring circuit can be directed into explosive areas. Only electrical circuits certified as intrinsically safe may be connected to both circuits.

Before operation, the intrinsically safety must be verified for both the supply circuit connection and the 0/4 - 20 mA signal circuit with the connected equipment, including wires.

The EG Examination Certificate and the regulations of EN 60079-14: 1996 ff must be observed

Installation and operation

The installation of the transmitter supply unit equipment has to take place in such a way that clearance of bright parts of intrinsically safe electric circuits amount to the metallic housing parts at least 3 mm and to the bright parts of the not-intrinsically safe electric circuits at least 6 mm.

According to the EN 60079-11 connecting units for the outside intrinsically safe electric circuits need to be arranged in such a way that bright parts are at least 50 mm away from connecting pieces or bright conductors of not-intrinsically safe electric circuits.

The terminal connections of the mounting rail housing to the intrinsically safe electric circuits and the not-intrinsically safe electric circuits are characterized on the type plate clearly. Additionally the 4-poled terminals of the intrinsically safe electric circuits are implemented in blue.

The assembly/disassembly, installation, operation, and maintenance may be only performed by qualified personnel in the automation industry under appropriate regulations and the MSK200i..-E operating instructions.

The technical data and power requirement information should be noted for the Installation.

2. Technical Features

A parallel monitoring of the dual processor system (DuoTec®-technology) in connection with further safeguards as per EN 61508 fulfils the guidelines for the SIL2-level.

Configuring, parameter setting and calibration are interface-controlled and are performed simply and quickly by the user with the user-friendly **WINSMART®** Windows program. Logging and reconstruct after programming of the selected configuration on the device allows the commands **Save/Print Configuration**.

The HART signal connection to the intrinsically safe power supply circuit can be done using the front socket.

Alarm monitoring takes place by two relay contact and two transistor outputs. Additional another relay contact output is available for signalizing the safety functions. All output circuits are galvanically isolated from each other and from the power supply.

The analogue output is designed for constant current of 0/4-20 mA. A voltage of 0/2-10 V at the output is also possible because of a resistive shunt of 500 Ω realized by a jumper.

The RS232 interface at the front socket and the RS485 interface at the multipole connector are galvanically isolated from other circuit elements and from the power supply.

3. ATEX (electrical maximum values)

Power supply circuit (contacts d/z2 and d/z4)				
Rated voltage		DC	19 ... 30	V
		AC	18 … 28	V
Max. voltage	Um	AC/DC	250	V
not intrinsically safe RS485-interface circuit (contacts b16 and b18)				
not intrinsically safe RS232-interface circuit (connection front socket)				
Rated voltage		DC	6	V
Rated current			100	mA
Max. voltage	Um	AC/DC	48	V
not intrinsically safe relay contact circuit 1 (contacts d8, d10 and z8/10)				
not intrinsically safe relay contact circuit 2 (contacts d12, d14 and z12/14)				
not intrinsically safe relay contact circuit 3 (cantacts d6 and z6)				
Switching voltage		DC	30	V
Switching current			1	A
Or				
Switching voltage			125	V
Switching current			0.5	A
Max. voltage	Um	AC/DC	125	V
not intrinsically safe digital output circuit 1 (contacts d16 and z16)				
not intrinsically safe digital output circuit 2 (contacts d18 and z18)				
Rated voltage		DC	28	V
Rated current			50	mA
Max. voltage	Um	AC/DC	125	V
not intrinsically safe analog output circuit (contacts d20 and z20)				
Rated voltage		DC	20	V
Rated current			50	mA
Max. voltage	Um	AC/DC	125	V
intrinsically safe power supply circuits (contacts d/z28 and d/z30)				
in the explosion protection Ex ia IIC **(MSK200ia-E)** or Ex ib IIC **(MSK200ib-E)**				
Voltage	Uo	DC	25.8	V
Current intensity	Io		65	mA
Power	Po		420	mW
Max. outer capacity	Co		83	nF
Max. outer inductivity	Lo		4	mH
intrinsically safe HART-current circuit (connection front socket)				
in the explosion protection Ex ia IIC **(MSK200ia-E)** or Ex ib IIC **(MSK200ib-E)**				
Voltage	Ui	DC	2	V
Current intensity	Ii		30	mA
Power	Pi		21	mW
Effective internal capacity	Ci		10	nF
Effective internal inductivity	Li		1	µH
intrinsically safe power supply circuits (contacts d/z28 and d/z30) with **HART-Terminal-hook up** (connection front socket)				
in the explosion protection Ex ia IIC **(MSK200ia-E)** or Ex ib IIC **(MSK200ib-E)**				
Voltage	Uo	DC	25.8	V
Current intensity	Io		95	mA
Power	Po		441	mW
max. outer capacity	Co		73	nF
max. outer inductivity	Lo		4	mH
intrinsically safe mA-input circuit (contacts d/z30 and d/z32)				
in the explosion protection Ex ia IIC **(MSK200ia-E)** or Ex ib IIC **(MSK200ib-E)**				
for the connection of an intrinsically safe circuit with following maximum values:				
Voltage	Ui	DC	30	V
Current intensity	Ii		110	mA
Power	Pi		700	mW
Effective internal capacity	Ci		Negligible	
Effective internal inductivity	Li		Negligible	
Ambient temperature area	Tamb		-20 to +70	°C

4. Fault conditions and fault signalling

No.	Fault source/ Fault cause	Alarm LED	Analogue output in fault event (programmable)	Alarms (programmable)	Restart after fault elimination	Remark
1	EEPROM: check sum incorrect	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	MSK200 must be reconfigured, parameterized, and calibrated	Parameter table in RAM loaded with default values
2	Master controller: RAM/EPROM memory incorrect	constant light	alarm value or fixed value	lim-prio, on, off, limit	automatic (after system reset)	Parameter set or program damaged
3	Slave controller: Communication, RAM or CPU defective	constant light	alarm value or fixed value	lim-prio, on, off, limit	automatic	
4	Slave controller: 5V supply incorrect	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	automatic	with ≥ 4 % deviation from the reference value
5	Master controller: 3V3 supply incorrect	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	automatic	with ≥ 4 % deviation from the reference value
6	analogue output: signal deviation	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	automatic	parameterizable: from ≥ 0.2 %
7	A/D converter signal deviation	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	automatic	parameterizable: from ≥ 0.2 %
8	mA measurement circuit or supply circuit: min signal shortfall	constant light	alarm value or fixed value	lim-prio, on, off, limit	automatic	parameterizable: from 0 mA
9	mA measurement circuit or supply circuit: max signal exceedance	constant light	alarm value or fixed value	lim-prio, on, off, limit	automatic	parameterizable: up to 22 mA
10	transmitter supply circuit incorrect	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	automatic	with ≥ 20 % deviation from reference value
11	alarm outputs: Relay pin Rel1, Rel2 or Rel3 defective	constant light	alarm value or instantaneous value	lim-prio, on, off, limit	automatic	Parallel contact of relay serves as reference!

In general an alarm only remains queued for maintenance requirement for the duration of the fault, signalled by Rel3 and the alarm LED. The fault source is shown in the Diagnostic Manager in the fields **Current Faults** and **Fault Memory.** A short fault occurring is represented by a blinking alarm LED and the diagnostic manager only indicated in the fault memory. Each case of faults is recorded and it is possible to distinguish between a present fault and a no longer fault by using the diagnostic manager.

5. Technical Data

ANALOGUE INPUT (AI)

A parameterizable filter of first order of (0.1 – 99.9)s!

mA-measuring input AE

mA-measurement range:	0 .... 22 mADC
measurement range:	free configurable
input resistance:	51 Ω + 2x U_D

SUPPLY CIRCUIT (SP)

A parameterizable filter of first order of (0.1 – 99.9)s!

Supply circuit SP

U_{max}:	22.4 V at 4 mA load
U_{min}:	17.3 V at 20 mA load
I_{max}:	24 mA
P_{max}:	360 mW

ANALOGUE OUTPUT (AO)

A parameterizable filter of first order of (0.1 – 9.9)s!
Galvanic isolation between input, analogue output 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 resistance:	max. 500 Ohm at 20 mA	min. 50 kΩ
Accuracy:	0.02 % of final value	0.02 % of final value
Load resistance influence:	< 0.005 %	0.5 % at R_L=100 kΩ
Rise time:	< 150 ms	< 150 ms

CONTACT OUTPUTS (REL1, REL2), TRANSISTOR OUTPUT (DO1, DO2)

Devices with intrinsically safe circuit may be connected over the contact and transistor output with devices with operating voltages under 250V only!

Alarm conditions are indicated with yellow front-side LED's!

Number:	4 independently adjustable limit values
Setting:	physically values with WINSMART®-Program
Accuracy:	like measured value accuracy
Alarm type:	free configurable
Alarm output:	2x relay contact and 2x transistor output
Alarm delay:	free configurable from 0 ... 9.9 s
Switching hysteresis:	free configurable from 0 ... 99.9 %
Mode of operation:	operating or zero current principle
Alarm function:	input signal monitoring and maintenance requirement report

Contact outputs REL1/REL2

Contact:	Opening or closing contact (corresponding to jumper adjustment)
Breaking capacity:	max. 62.5 VA resp. max. 30 W
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:	as per IEC 947-5-1 resp. EN60947

Transistor output DO1/DO2

Switching performance:	< 1.4 W
Switching Voltage:	< 28 VDC
Switching current:	< 50 mA

CONTACT OUTPUT (REL3) for MAINTENANCE REQUIREMENT

Devices with intrinsically safe circuit may be connected over the contact of the relay with devices with operating voltages under 250 V only!

Alarm conditions are indicated with a red front-side LED!

Mode of operation:	zero current principle
Alarm function:	maintenance requirement report
Contact position:	closed in good condition
Switching performance:	max. 62.5 VA resp. 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:	as per IEC 947-5-1 resp. EN60947

INTERFACES (COM, RS485, HART)

Galvanic separation of COM and RS485 to power supply and all other circuit elements!

RS232/COM:	via front socket for PC-connection with Mütec-interface cable
RS485:	Half-duplex, without scheduling
Baud rate:	9600 bps
Device address:	1-248
HART:	power supply circuit (0 … 3 kHz band width)

POWER SUPPLY

Power supply indicator:	green LED signal = good condition
Power supply range:	19 … 30 VDC or 18 … 28 VAC

Power consumption

Feed separator:	1.6 W (at 24VDC and 4 mA at analogue output)
	2.1 W (at 24VDC and 20 mA at analogue output)
Buffer amplifier:	1.1 W (at 24VDC and 4 mA at analogue output)
	1.4 W (at 24VDC and 20 mA at analogue output)

GENERAL DATA

Measuring value accuracy

Maximum:	< 0.05 % from final value
Typical:	< 0.025 % from final value

Temperature coefficient

Maximum:	< 0.01 %/K
Typical:	< 0.005 %/K

Galvanic separation

Input/output/supply:	300 V_{eff} (rated insulation voltage, overvoltage category II, Contamination level 2, safe separation as per EN 61010, EN 50178); 2.5 kV AC testing voltage (50 Hz, 1 min.);
Input/output:	375 V (peak value as per EN 60079-11)
Input/supply:	375 V (peak value as per EN 60079-11)

Environmental condition:

Acceptable temperature:	-20 °C ... +70 °C
Storage/transport:	-30 °C ... +80 °C
Acceptable humidity (at operating):	10 % … 95 % r.F. without condensation

Electric connection

Female multipoint connector:	48-core according to DIN 41612 – form of construction F

Proceeding of self-monitoring

Measuring input:	1 monitoring cycle with adjustable tolerance
Analogue output:	1 monitoring cycle with adjustable tolerance
Supply voltages:	2 monitoring cycles
Transmitter-feed circuit:	1 monitoring cycle
Relay (REL1 … REL3):	indirect contact monitoring
Maintenance requirement:	Constant light of red front-LED and REL3-contakt opened

A maintenance requirement report always occurs via the relay contact of the REL3, which is operated in zero signal current principle. The relay contact closed in the status offers the option of series connection with further REL-3 pins of other devices and thus common alarm monitoring. The relays REL-1 and REL-2 and the transistor outputs DO1 and DO2 can be involved in the alarm signalling.

Conformity

Ex-directive (ATEX):	EN 60079-0, EN 60079-11, EN 60079-26
EMV-directive 2004/108/EG:	EN 61000-6-2, EN 61000-6-4, EN 61326-1

ATEX: Maximum values of [Ex ia] IIC-circuits

Operation as separator

Maximum voltage U_o	25.8 V
Maximum current I_o	65 mA
Maximum power P_o	420 mW
Maximum capacity C_o	83 µF
Maximum inductivity L_o	4 mH

Operation as isolation amplifier

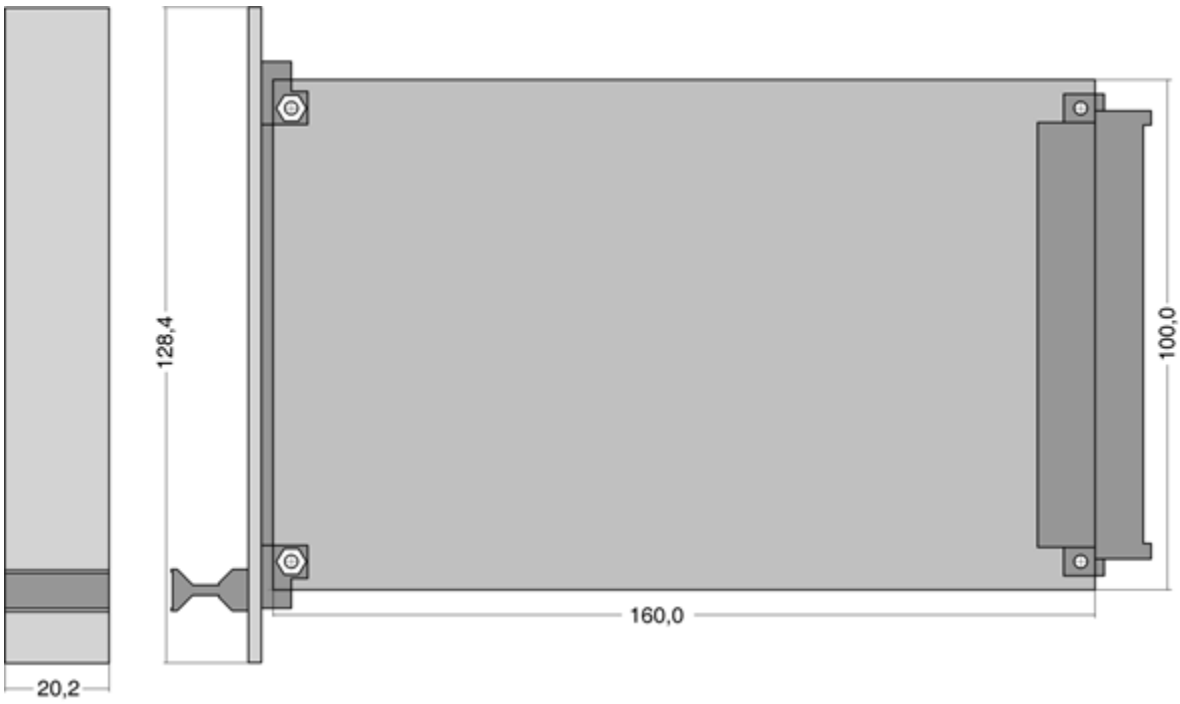
Maximum voltage U_i	30 V
Maximum current I_i	110 mA
Maximum power P_i	700 mW
Maximum capacity C_i	negligible
Maximum inductivity L_i	negligible

Mounting

The device can only be operated outside a potentially explosive area!

Form of construction:	19”-europecard with 4 TE front panel
Protection class:	IP20
Mounting:	for the required protection class the device has to be installed in a rack or in an appropriate housing
Mounting/Position	free
Weight	220 g

Dimensions of MSK200



5.1. Configuration protocol

A configuration dated protocol can be created for the MSK200 using the **WINSMART® program** with the command "Print configuration."

The TAG number, unit-specific device address, serial number and version number are logged as identification in the unit software.

The extensive comments saved in the device, with a maximum of 2000 ASCII characters, are printed out in a protocol with the first 60 characters.

All parameters for input, output and the alarm settings are listed in a table. In addition, the permissible tolerance deviations of the measuring input, analogue output and user for the

monitoring circuit are listed in a table.

MÜTEC GmbH **Configuration protocol for MSK200** **07-05-2012**

TAG No.: Software version: 4.01
Serial No.: Model Device address: 1

MEASURING VALUE		
Measuring range beginning	4.00	mA
Measuring range ending	20.00	mA
Filter time	0.5	s
MEASURING RANGE CONTROL		
MIN-value	3.50	mA
MAX-value	20.50	mA
PHYSICAL DESCRIPTION		
Measuring range beginning	4.00	mA
Measuring range ending	20.00	mA
OUTPUT		
Area beginning	4.00	mA
Area ending	20.00	mA
MIN-limit	3.60	mA
MAX-limit	21.00	mA
Alarm value	22.00	mA
Filter time	0.5	s
ALARM 1		
Alarm type	MIN-Alarm	
Function	zero signal current	
Alarm value	6.00	mA
Hysteresis	1.0	%
Alarm delay	0.5	s
ALARM 2		
Alarm type	MAX-Alarm	
Function	zero signal current	
Alarm value	18.00	mA
Hysteresis	1.0	%
Alarm delay	0.5	s
ALARM 3		
Alarm type	MIN-Alarm	
Function	zero signal current	
Alarm value	8.00	mA
Hysteresis	1.0	%
Alarm delay	0.5	s
Time window for rate of change alarm	20.0	s
MONITORING MEASURES		
mA-Input - maximum Tolerance	+/- 5.0	%
Analog Output - maximum Tolerance	+/- 5.0	%

OUTPUT

Fault sources:	Analogue Output	Relay 1	Relay 2	Logic 1
Analogue Output	Alarm value	limit	limit	on
mA-Input	Alarm value	lim-prio	lim-prio	out
Minimum mA-value	Alarm value	lim-prio	lim-prio	out
Maximum mA-value	Alarm value	lim-prio	lim-prio	out
Supply/16-Bit-uP	Alarm value	lim-prio	lim-prio	out
Transm.-Power supply	Alarm value	lim-prio	lim-prio	out
Relay 1, 2, 3	Current value	lim-prio	lim-prio	on
Internal device failure	Current value	lim-prio	lim-prio	lim-prio

5.2. Maximum line resistance for the analogue output

Analogue output circuit (AO) for constant current:

Max. range:	0…22 mA
Standard range:	0/4-20 mA
Load:	max. 500 Ω by 20 mA
Accuracy:	0.02 % of final value
Load influence:	<0.005 %

The maximum load for the analogue output circuit is the sum of the cable resistances and the input resistor (shunt) the following assembly:

$$\mathbf{R_{load} = 2 \times R_C + R_{Shunt} \leq 500\ \Omega}$$

Cable resistance:

$$\mathbf{R_C = l \times \varrho \times A^{-1}} \qquad \varrho = 0.0178 \quad [\Omega\ mm^2\ m^{-1}]$$

$$A = 0.25 \times d^2 \times \pi \quad [mm^2]$$

Calculation of cable length (distance):

$$\mathbf{l = 0.5\ (500\ \Omega - R_{Shunt}) \times \varrho^{-1} \times A\ [m]}$$

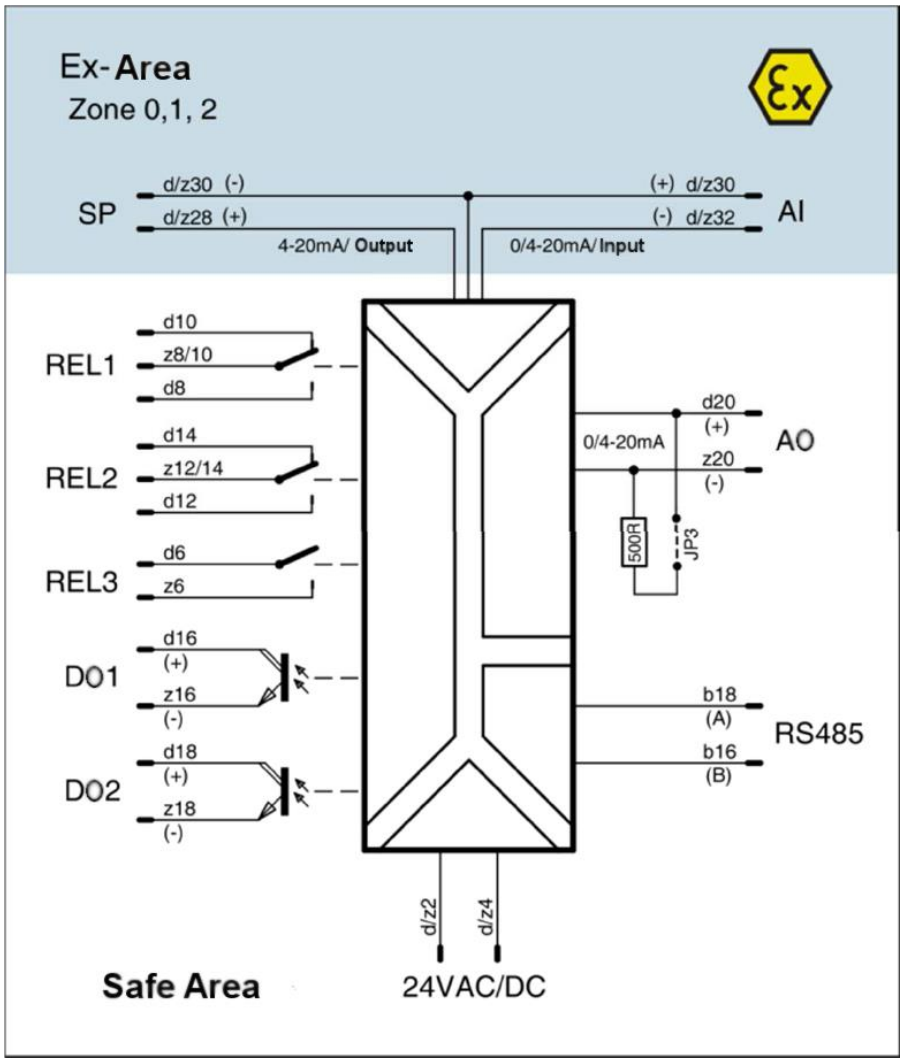
Cable length as a function of cable diameter and input resistance:

R_{Shunt} [Ω]	$C_{Diameter}$ [mm]	$C_{Cross\ section}$ [mm²]	C_{Length} [m]	C_{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

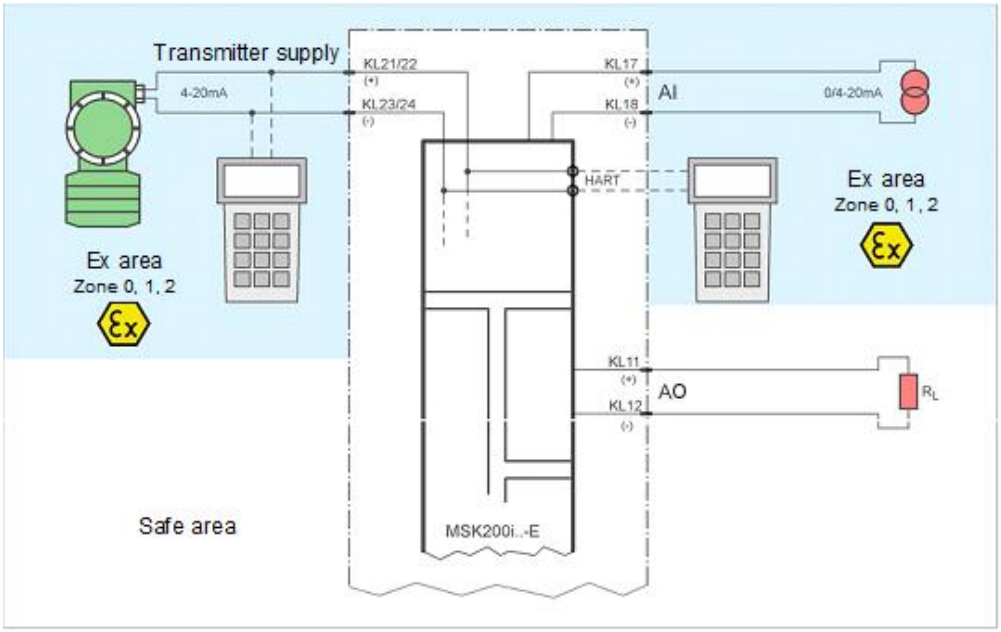
R_{Shunt} [Ω]	$C_{Diameter}$ [mm]	$C_{Cross\ section}$ [mm²]	C_{Length} [m]	C_{Length} [km]
200	0.6	0.283	2385	2.39
	0.7	0.385	3244	3.24
	0.8	0.502	4230	4.23
	0.9	0.636	5360	5.36
	1.0	0.785	6615	6.62

R_{Shunt} [Ω]	$C_{Diameter}$ [mm]	$C_{Cross\ section}$ [mm²]	C_{Length} [m]	C_{Length} [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

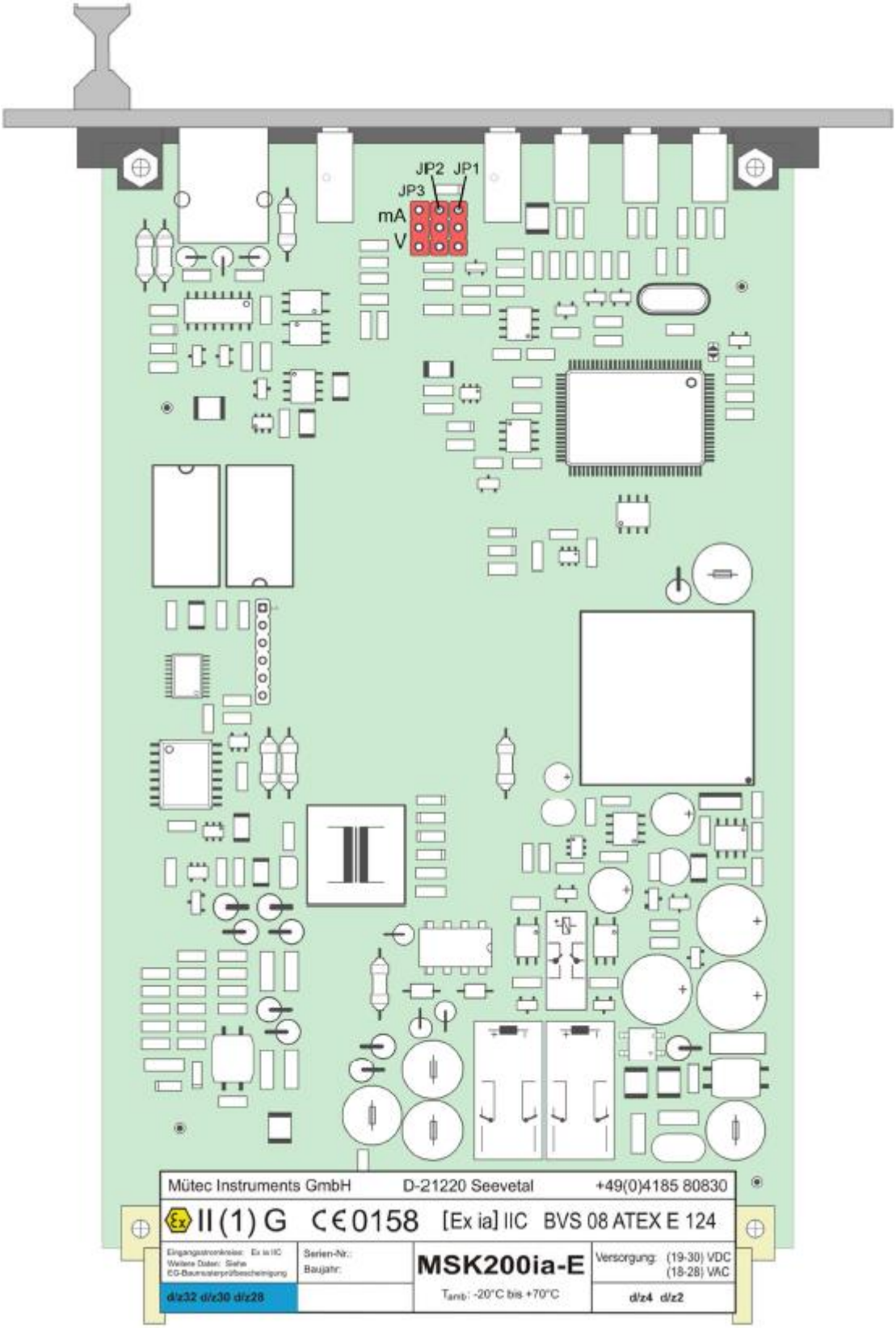
5.3. Basic Circuit Diagram



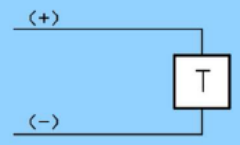
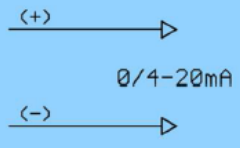
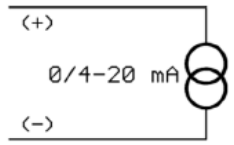
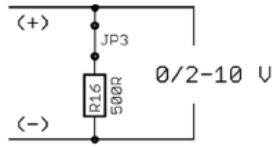
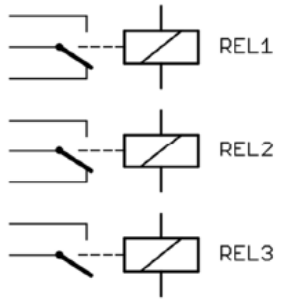
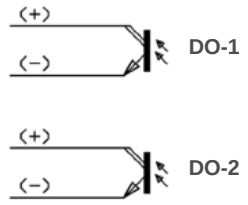
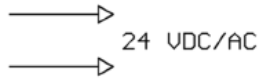
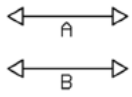
5.4. HART signal connection



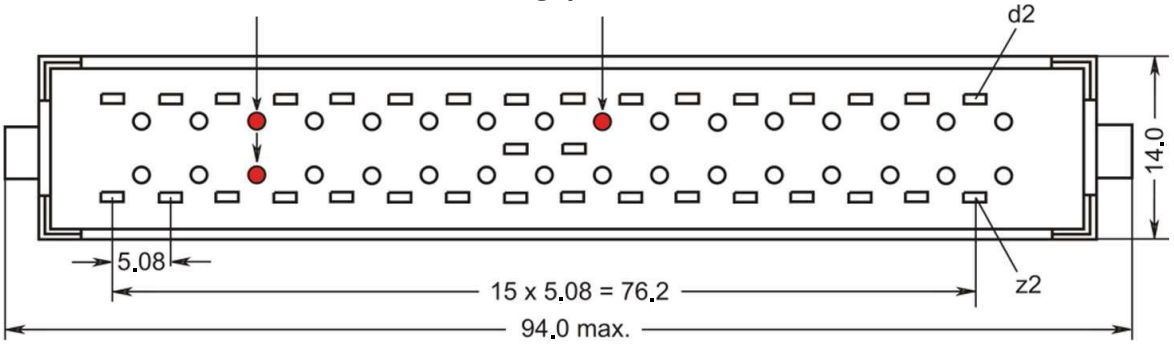
5.5. General View



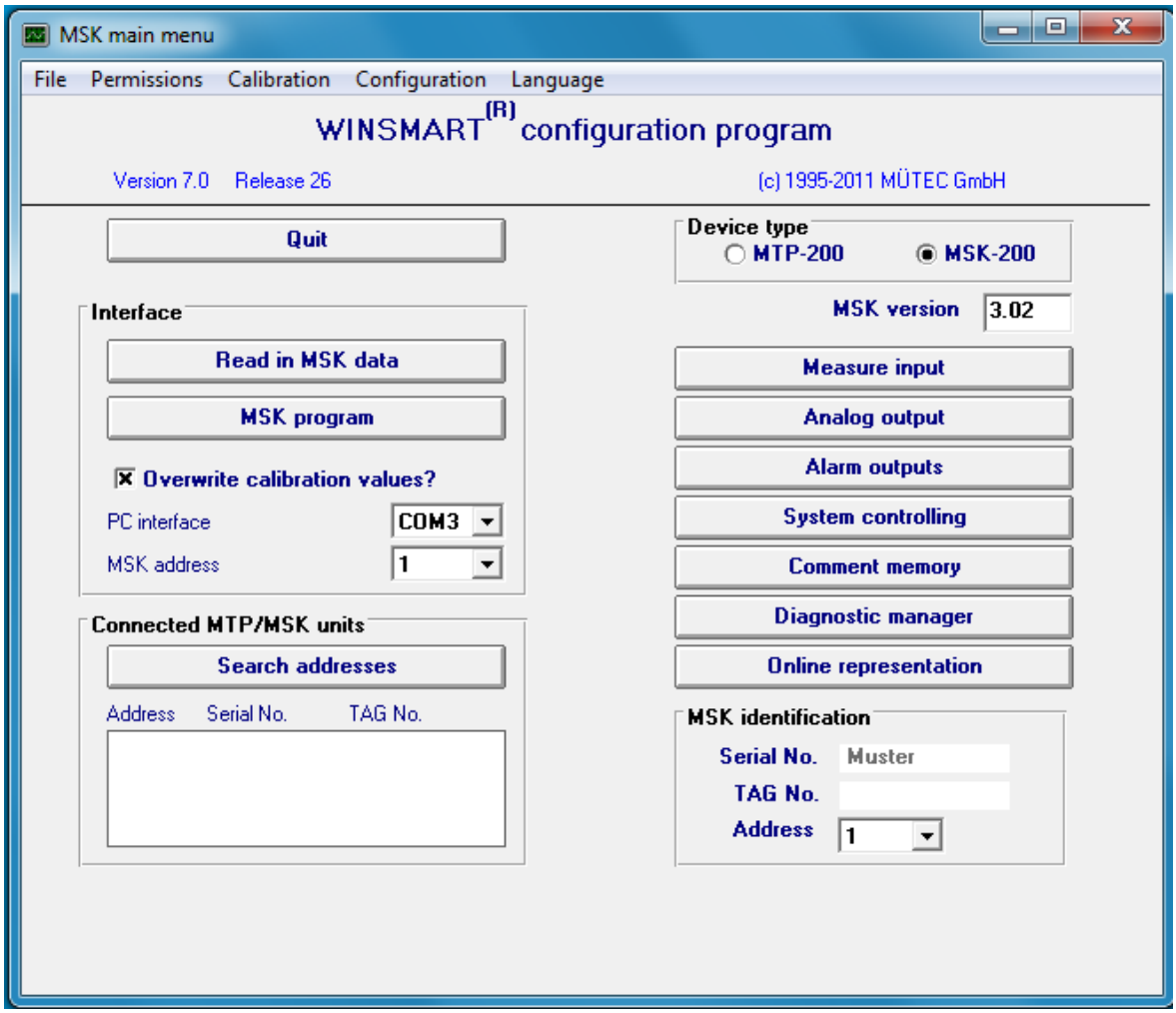
5.6. Terminal connection

Contact	T. supply circuit	Contact	mA-Input
d/z28 d/z30		d/z30 d/z32	
Contact	**Analog output/mA**	**Contact**	**Analog output/V** (no constant voltage)
d20 z20		d20 z20	
Contact	**Relay contact output**	**Contact**	**Digital output**
d8 z8/10 d10 d12 z12/14 d14 d6 z6		d16 z16 d18 z18	
Contact	**Auxiliary power**	**Contact**	**Interface RS485**
d/z2 d/z4		b18 b16	

Holes for 3 coding pins



6. Configuration program



The illustration above shows the opening screen of the WINSMART configuration program for the MSK200 and MTP200 with the corresponding version and release number of the program.

The command **File** in the menu bar is used to access existing configuration files and for saving and printing of the current configuration. Two of the three operating levels, which can be accessed by using the command **Permission**, are secured by passwords. The operating level for calibration of measure inputs and analogue outputs has a special importance. Only after password input and the command **Calibration** it is possible to access one of two masks.

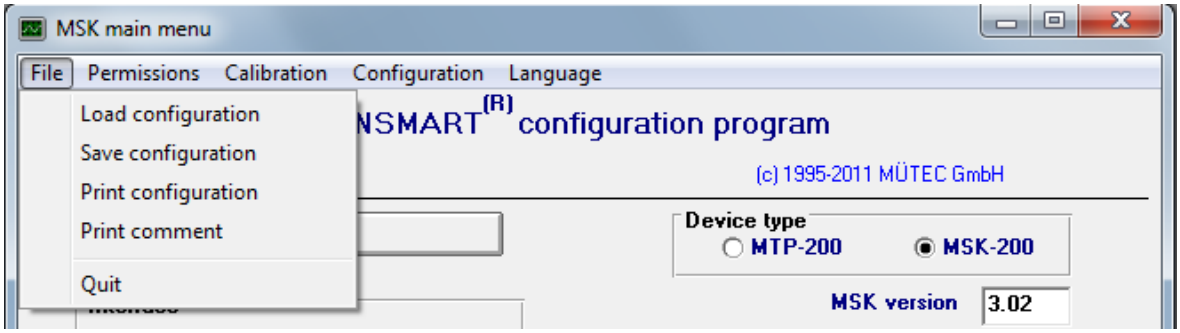
To communicate with the WINSMART program it is necessary to enter the COM address in the field **PC Interface** and **MSK address** (left area of the screen in the section **Interface**). A device with unknown address can be identified by using the function **Search address**. After finding the device address the **Serial-No.** and **TAG-No.** will be shown.

Administration of access rights for three operating levels secured by codes and calibration for the measuring input and analogue output. The WINSMART configuration program supports both MSK200 and MTP200.

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

The buttons arranged below offer access to configuration and parameter settings for the MSK200 input and output. The desired settings for the SIL2 monitoring circuit can be made in the relevant screen with the button **System Controlling**. The **Diagnostic Manager** reports the status of the device and also saves faults that arise even briefly. The **online display** offers the user a precise analogue and digital illustration of the measured input magnitudes and output signals.

6.1. Menu bar and commands



6.1.1. File → Load configuration

The MSK200 parameter set saved in a file with extension ***.MSK** on the hard drive is loaded into the Windows configuration program. Thus a parameter set already created and saved can be copied fast and reliably into other devices, if the same configuration is needed for these.

6.1.2. File → Save configuration

The MSK200 parameters of the configuration program are saved on the hard drive in a file with the extension ***.MSK** and archived. For later duplication into another MSK200, the file must only be loaded in the set-up program and transferred in the MSK200 with the command **MSK program**.

6.1.3. File → Print configuration

All MSK200 parameters of the configuration program and the first 60 characters of the comments are printed out as a dated protocol and the device characteristic data on a DIN-A4 page. The printer available under Windows is used. The character font and print format are fixed and cannot be changed by the user.

6.1.4. File → Print comment

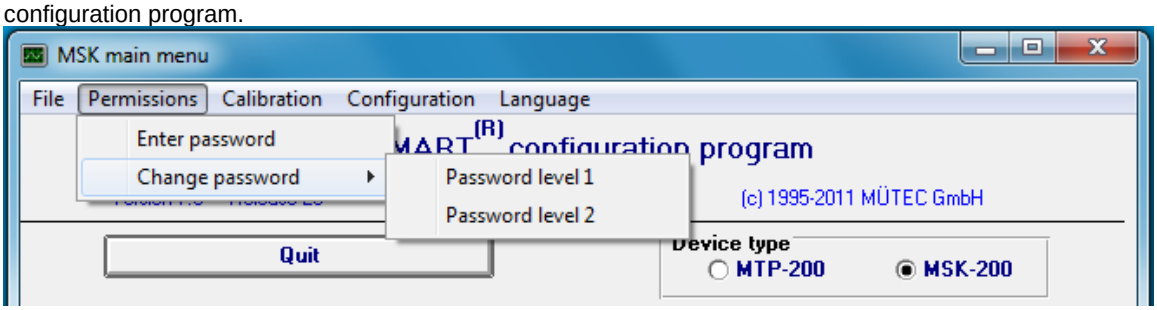
The extensive comments saved in the device as dated protocol with a maximum 2000 ASCII characters and the device characteristic data are printed out on a DIN-A4 page. The printer available under Windows is used. The character font and print format are fixed and cannot be changed by the user.

6.1.5. File → Quit program

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

6.1.6. Access rights → Enter password

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

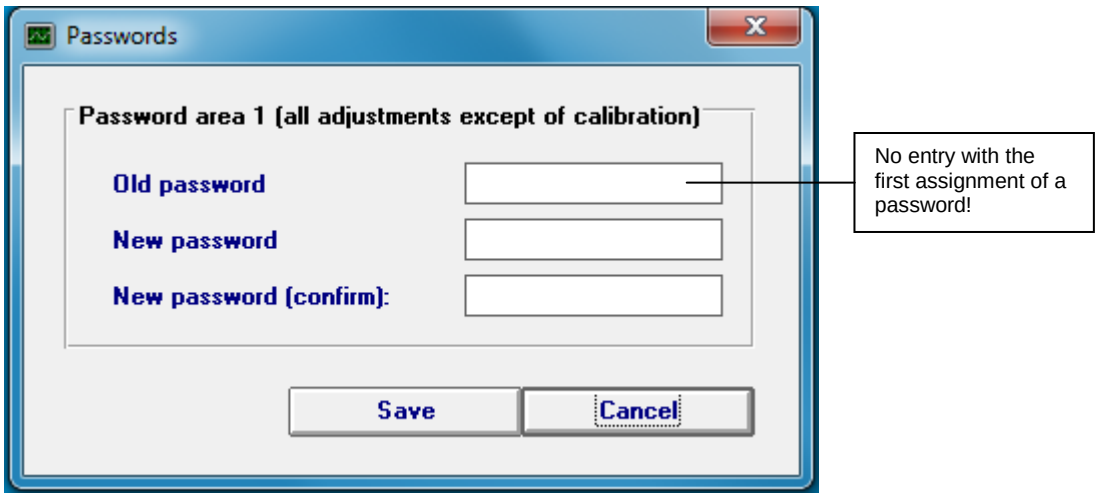


The configuration program is divided into 3 access areas:
The open program area contains no settings and so is always accessible.
Password level 1 contains all parameter settings.

Free input to this level is secured only after password assignment

Password level 2 contains calibration excluding configuration. This input is secured by a password assigned by the manufacturer (**5180**). Of course this password can be replaced with a new one by the user. Furthermore password 2 gives access to all parameters and functions of the device.

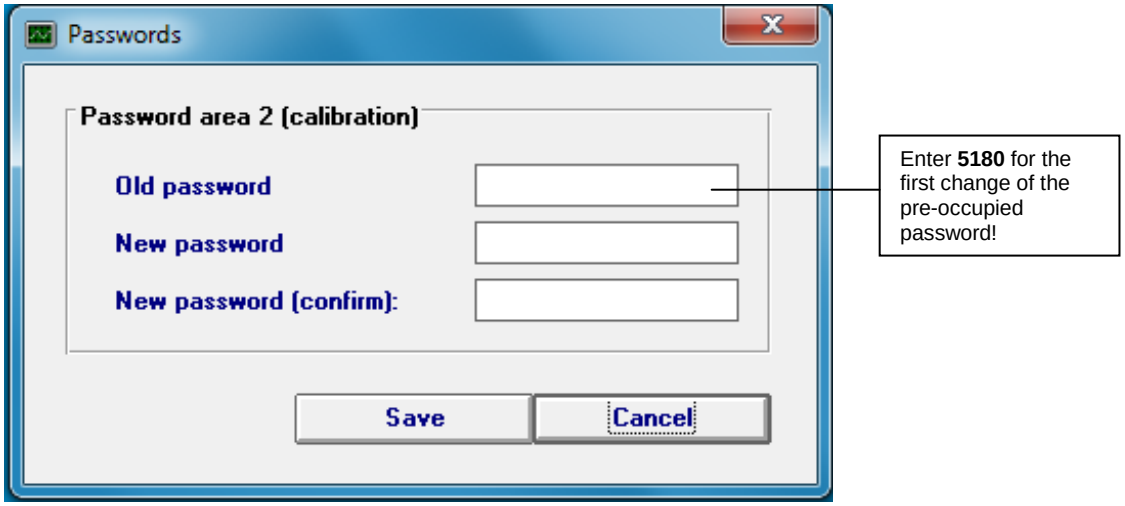
6.1.7. Access rights → Change password → Password level 1



Password level 1 covers all parameter settings of the MSK200 and is only enabled for authorised personnel (e.g. maintenance staff, service technician) to access all configurable settings.

The password may have a maximum of 20 alphanumeric characters and is entered and saved in the corresponding fields as in the screen.

6.1.8. Access rights → Change password → Password level 2

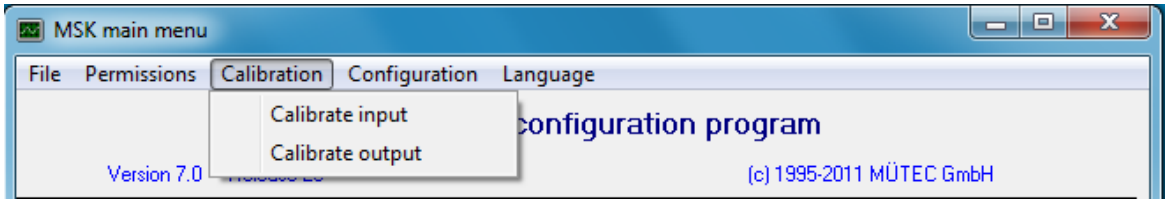


Password level 2 secures parameter settings for calibration and the function **Overwrite calibration values.** It is reserved exclusively for technicians with special knowledge of the device and its functions.

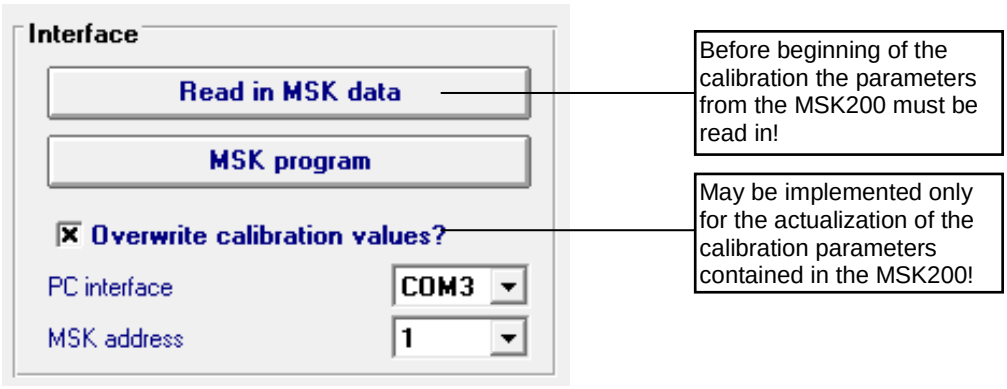
Password level 2 is secured by a password (**5180**) assigned by the manufacturer.

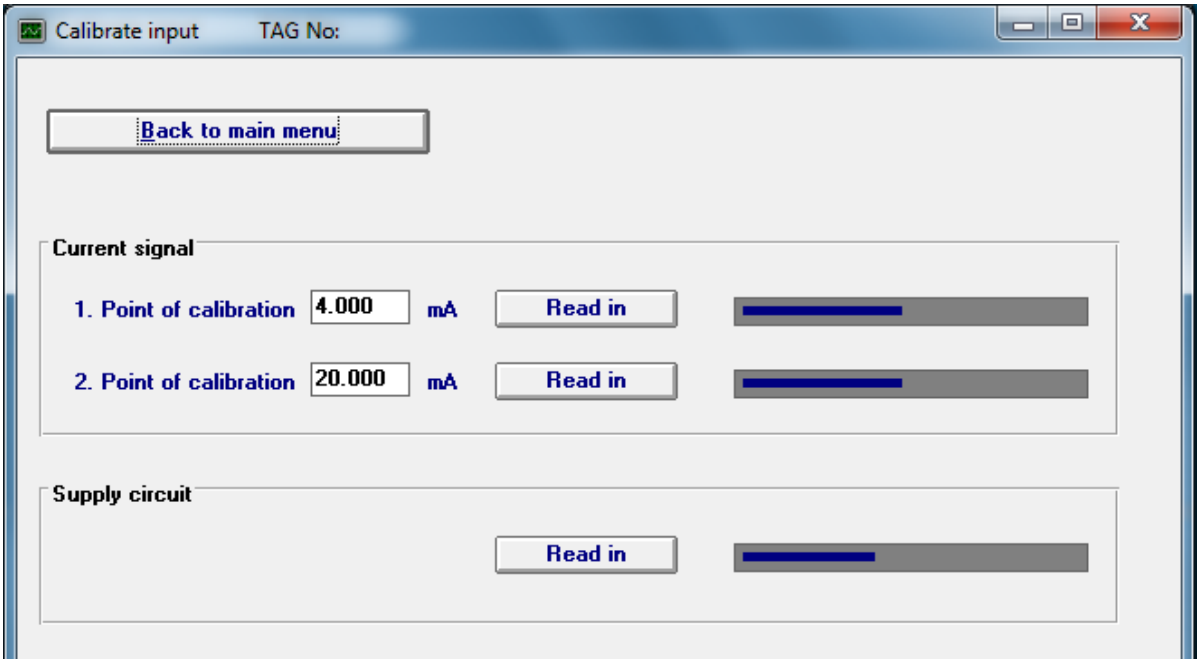
A newly assigned password may have a maximum of 20 alphanumeric characters and is entered and saved according to the indicated fields as in the screen

6.1.9. Calibration → Calibrate input



A calibration is only necessary for the analogue in- and output signal. Before calibration the parameter set must be read from MSK200 into WINSMART-program.





The calibration of the mA-Input at the contacts d/z30 and d/z32 takes place with a power supply in two steps. The calibration point can be freely selected, however an appropriate distance and the measuring range as calibration range is always recommended for high accuracy.

The calibration procedure begins with simulating the mA value in the MSK200 measuring input for the first calibration point and activating the command **Read**. The messages **Measuring...** and **Done** appear in the next screen. After confirmation with **OK,** the calibration value is transferred and displayed analogue in bar units on the screen. The proportional bar scale in the illustration serves for control and attends to calibration faults.

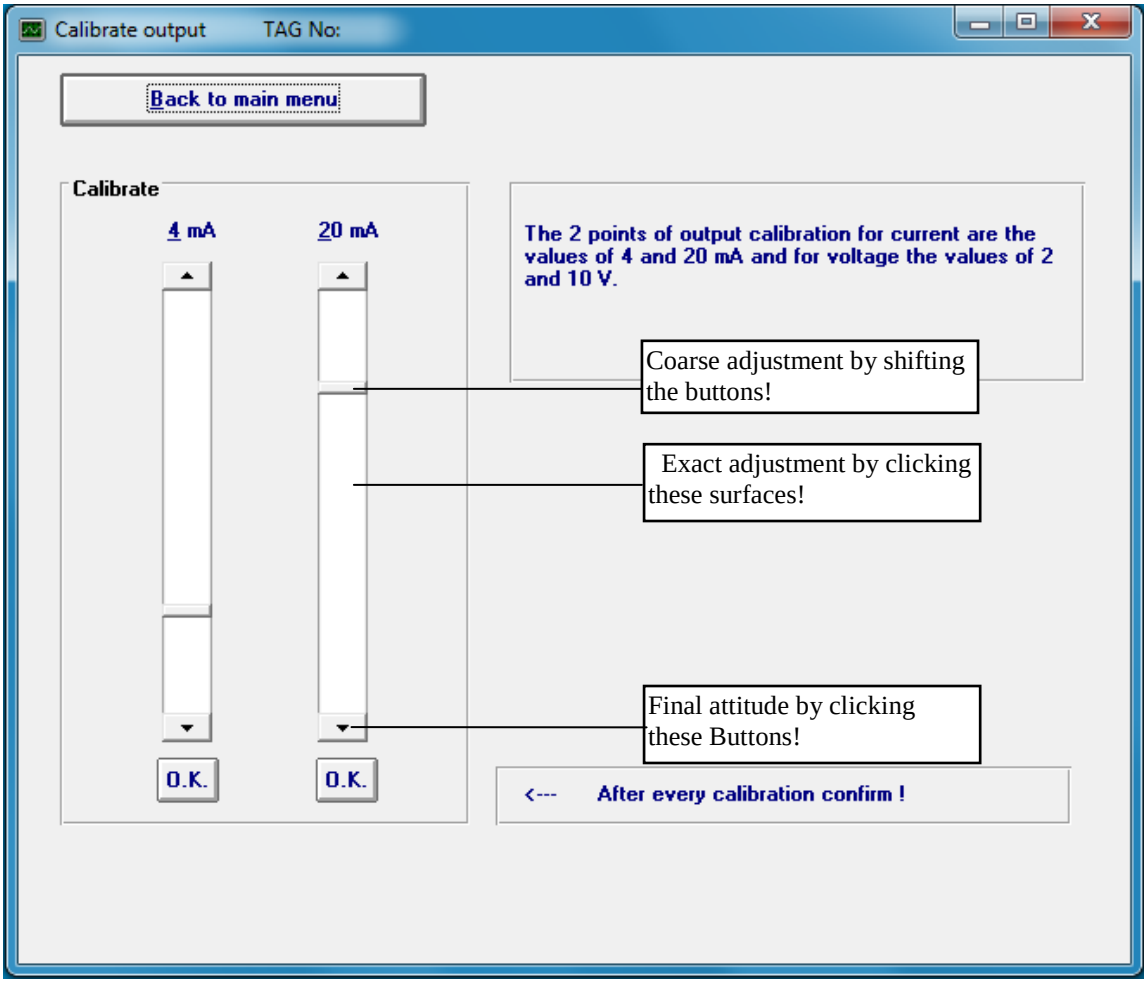
Same calibration values for the 1st and 2nd calibration point ⇒same bar lengths ⇒ no measured value illustration possible ⇒ output jumps!

Next, the second calibration point is simulated with the measuring input mA value, confirming calibration with **Read** and finalized with **OK**.

For monitoring the supply circuits at the contacts d/z30 and d/z32 a reference level at 20mA is needed, which can be simulated easily with a current sink. The voltage value is recorded by clicking the button **Read** and is figured in bar units for monitoring.

Finally the calibration values needs to be transferred to the MSK200. Therefor mark the box **Overwrite calibration values?** with a cross and click the button **MSK program**. The transfer starts and the question **Existing parameters will be overwritten. Continue anyway?** appears in the screen. This procedure is started with **OK** and the next message reads: **Transferring parameters**. A final OK completes the procedure and the calibration.

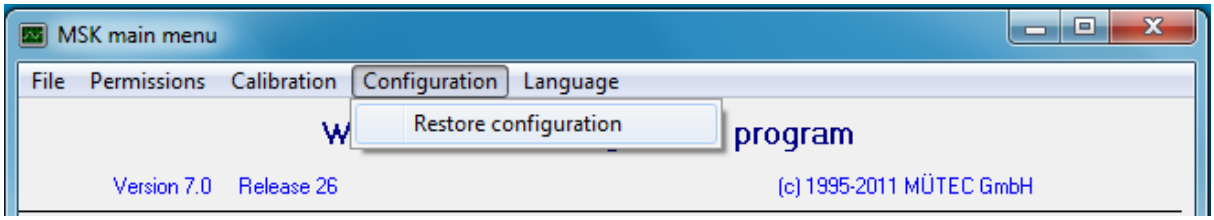
6.1.10. Calibration → Calibrate output



Before beginning each calibration, the parameter set must be read from the MSK200. A 4½-place digital circuit analyser is connected to the MSK200 output terminals and the output signal is adjusted with the jumpers JP1…JP3 for constant current or voltage.
The calibration screen contains 2 V and 10 V for voltage output or 4 mA and 20 mA for current output marked by sliding controls. The alignment procedure for the coarse, exact and final adjustment is free selectable and is confirmed with the **OK** button. After comparing the ZERO and SPAN value the determined calibration parameters need to be transferred to the MSK200 by clicking **MSK program** and **Overwrite calibration values**

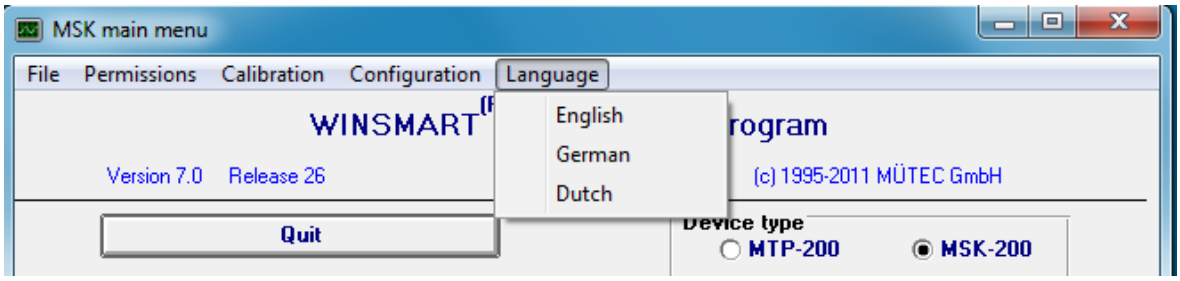
The output signal 0/2-10 V is generated by a constant current 0/4-20 mA, which runs over a resistive shunt of 500 Ω, assuming that JP1…JP3 is set on “V”.
Therefore a voltage results in a fault of 1 % in the case of a burden resistance of 50 kΩ, which is completely eliminated by recalibration.

6.1.11. Restore configuration



The **Configuration** of the device contains all MSK200 values and is automatically saved as an entry under Windows with **Read MSK data**. Thus each device can be reset to the original operating condition with the command **Restore configuration,** under the condition that both procedures are executed at the same PC. After the command **Restore configuration**, all values in the Windows screens and in the MSK200 are reset with the original data set. This procedure offers the convenient option to reset a device provided with erroneous calibration values or reset parameters with manufacturer values.

6.1.12. Language → English, German, Dutch



There are three language versions in the **WINSMART** program selectable

6.2. *Interface and connected devices*

Communication between the MSK 200 and the Windows PC is made by the front-side COM/RS232 or RS485 interface at the contacts b16 or b18.

By plugging on the COM-cable at the front socket, the change over from RS485- (offline) to COM-interface (online) is made automatically.

After disconnection of COM-connection, the RS485 interface is reactivated.

The RS232 interface and the RS485 interface are galvanic separated from all other circuit parts and auxiliary power.

6.2.1. Reading MSK data

The command **Read MSK data** starts a data transmission of the entire parameter set of the MSK200 to the configuration program. The interface connection will only work if the correct entries are made in the screen for the serial COM interface (COM1 to COM20)) and MSK address (1-255). Should the MSK address be unknown or not marked on the device, then the unknown address can be determined with the command **Search for addresses**. After conclusion of the correct transmission, the message **Reading parameters** appears and must be confirmed with OK.

6.2.2. Programming MSK data

The command **Program MSK** transfers the parameter set contained from WINSMART program to the MSK200. After command input the following message appears on the screen: **Existing parameters will be overwritten. Continue anyway?**

With **OK** the procedure is started, after which the confirmation appears **Transferring parameters** and is confirmed with **OK** to complete the transmission.

6.2.3. Overwriting calibration values

If the box for **Overwrite calibration values** is selected in the input screen, the calibration parameters for analogue input or analogue output can be transferred to the MSK200 with the command **Program MSK**, possibly updated in the configuration program.
The message then appears in the screen:
Existing parameters will be overwritten. Continue anyway?
The procedure is started with **OK** and the next message reads:
Transferring parameters. A final **OK** completes the transmission

6.2.4. PC interface

The addresses COM1 to COM20 are selectable.

6.2.5. MSK-address

The MSK address setting regulates communication over the interface with the receiver. The PC, as the master device, sends a transmission with the device address that is read with each MSK200 (slave) by using the COM interface in case of an individual compound or using the RS485 interface in case of a multidrop connection. Only the MSK device with the set address communicates to the master. Consequently, MSK devices with same address may not be connected.

6.2.6. 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**.

6.3. MSK identification

6.3.1. 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!

6.3.2. TAG No.

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

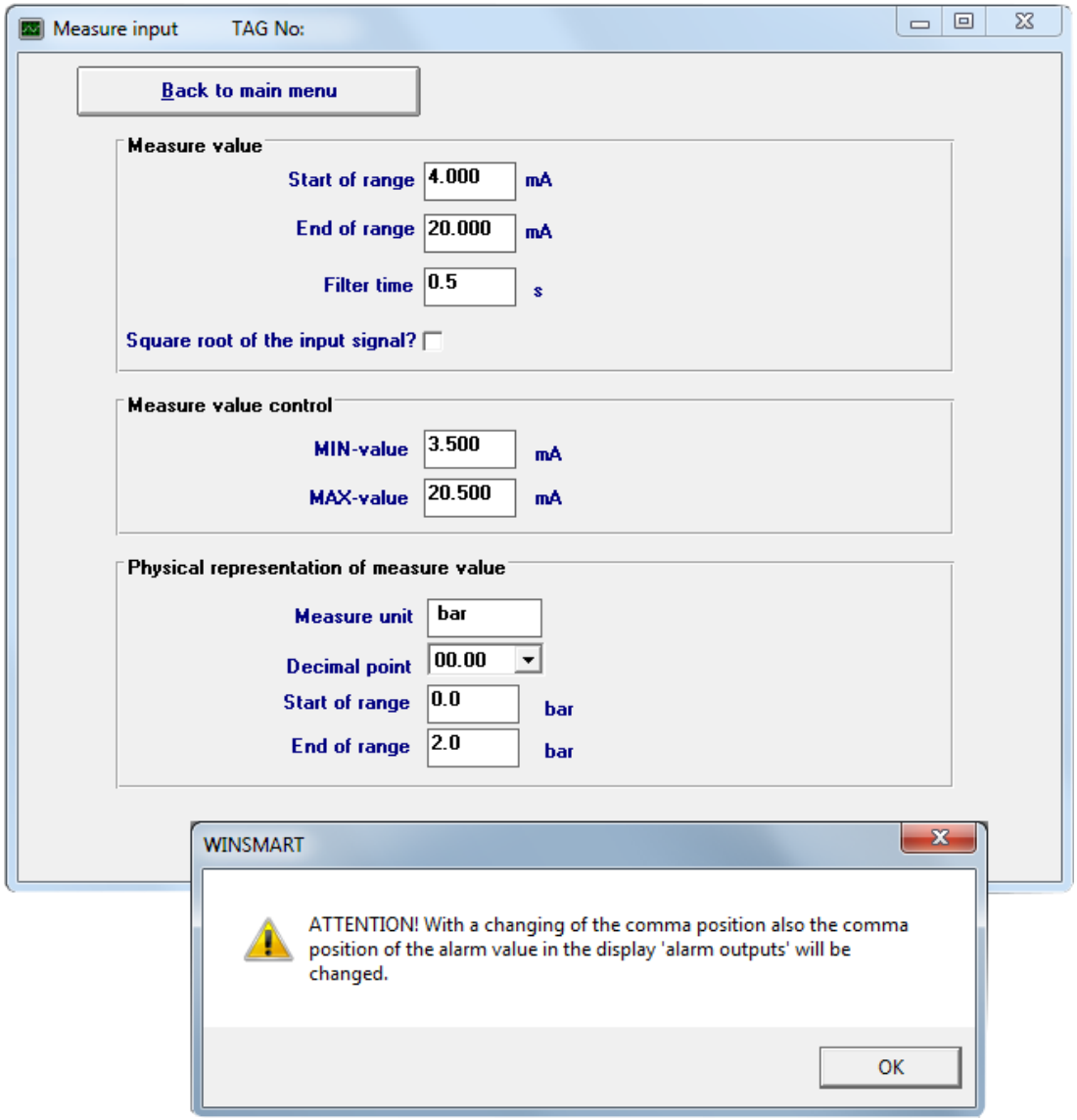
6.3.3. Address

For the device address**,** a maximum entry of 3 digits in the **address** field is set. 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. Read back the MSK data with the command Read MSK data (after finishing these actions, the new device address is indicated in the field MSK identification).

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

6.4. Measuring input



A **filter time** of minimum 0.1 to maximum 99.9 seconds defines a first order filter for the measure signal. With a larger filter time, the measured value is more damped.

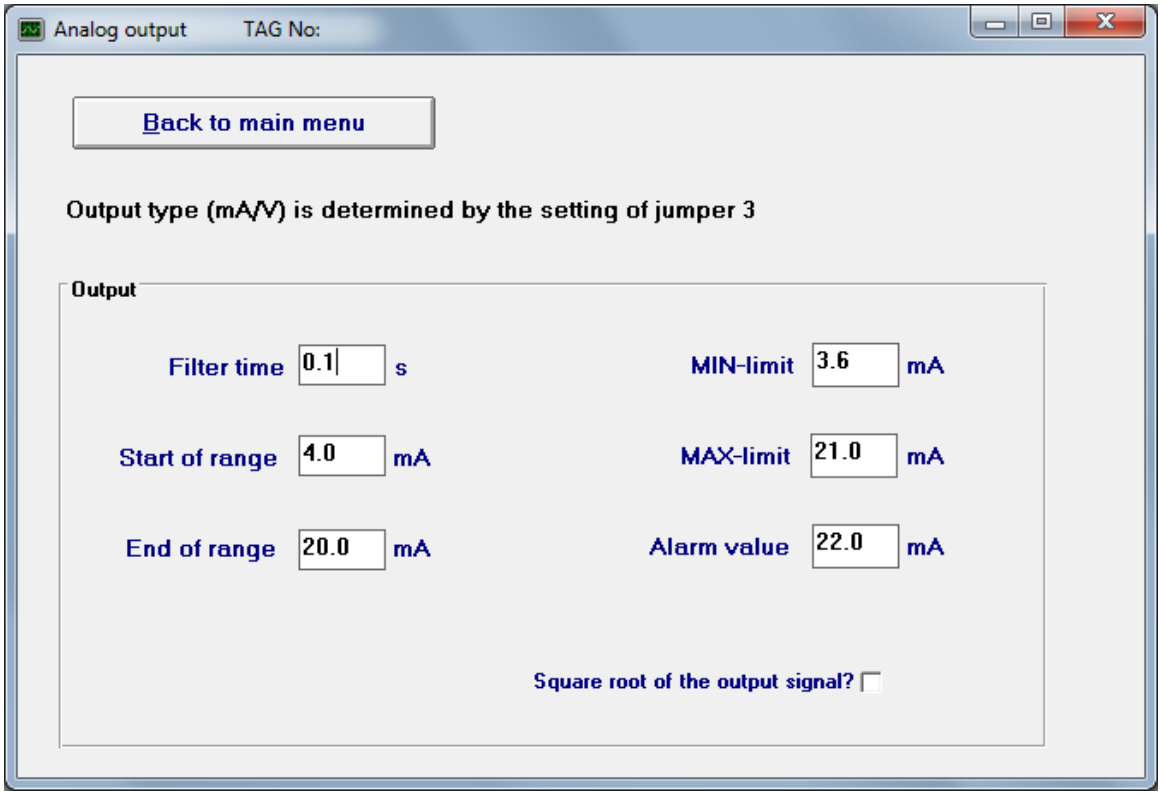
There in the mask measure input specified measuring range (e.g. 0.000 to 2.000 bar) complies 0 to 100 % of range for the limit value monitoring. The minimum adjustable limit value is 0.000 bar and the maximum 2.000 bar.
For a correct parameterization of MSK200 make adjust first the measuring range and 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 (bar, °C, K, etc.)
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
MIN value:	Minimal measure value for initiation of fault alarm
MAX value	Maximal measure value for initiation of fault alarm

For a correct limit value control must be placed the minimal measure value and the maximal measure value out of the range from the measured range because an exceedance of this limits triggers the maintenance alarm.

6.5. Analogue output



The **Filter time** of minimum 0.1 seconds up to maximum 9.9 seconds defines a first order filter for the output signal. The analogue value is more strongly dampened with increasing filter time.

For analogue output the illustration range is set by the definition of values for **Start of range** and **End of Range**.

This applies during voltage output amounting to a max. output range 0 - 11 V or with current output 0 - 22 mA. Exceedance can be reliably prevented within the illustrated range by the input **MIN limit** and **MAX limit** of the defined output range.

The **Alarm value** function defines a fixed value for analogue output. This is activated if a correct recording of the measured value is no longer possible in the input due to a fault and is programmed in the screen for **System controlling** with the function **Alarm value** for analogue output.

Square root extraction can be realized by activating the button **Square root of the output signal**.

All adjustments made in this mask are stored and activated by the command **Program MSK**.

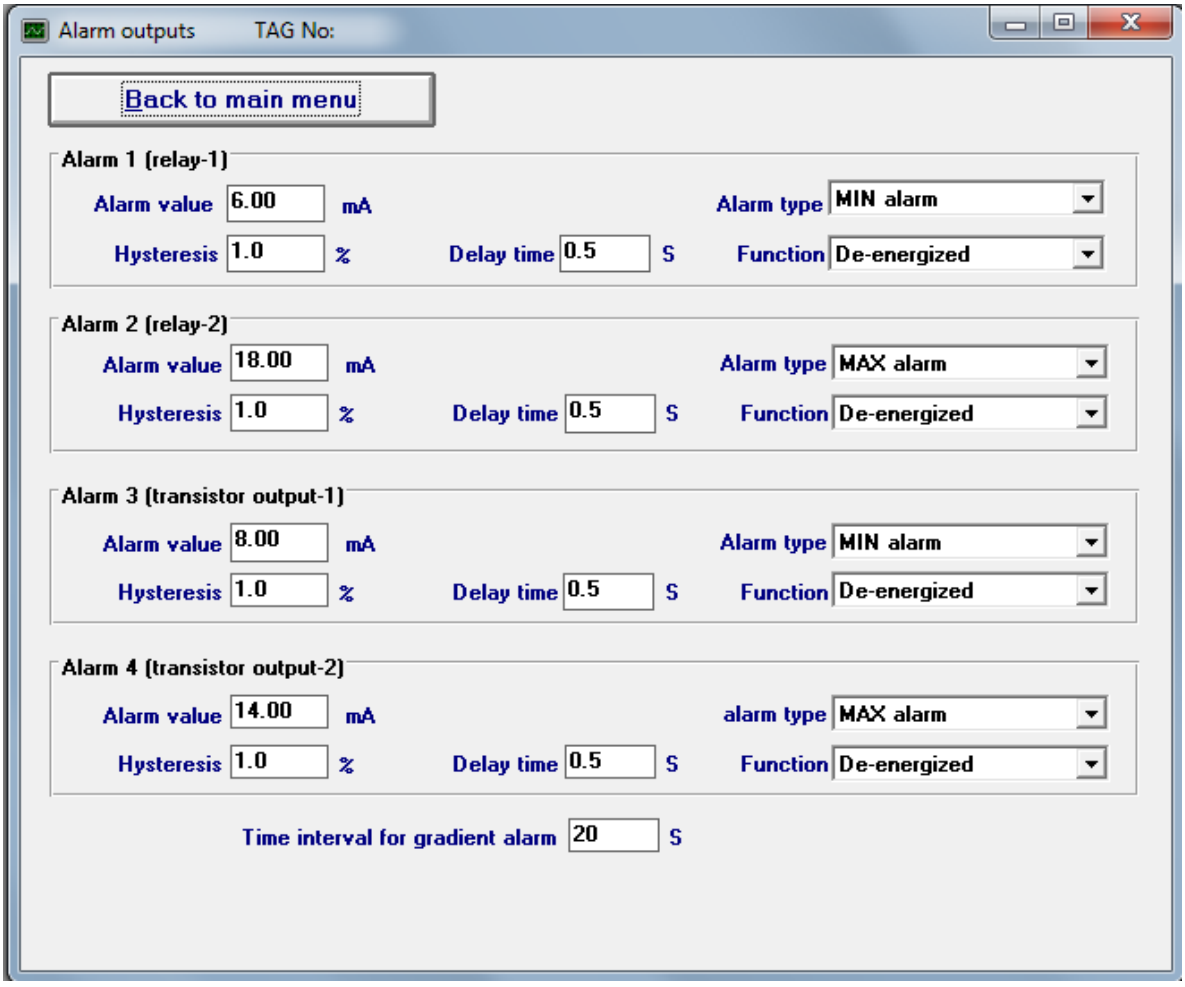
In principle it is possible to register an alarm value of 0. In this case the breakage monitoring at mA-output can not differentiate between alarm value and line break. The result is a constant switching of relay-3.

During voltage exit 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

6.6. Alarm outputs



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).

A value between 0 and 99.9% of the measuring range is assigned to each **alarm value hysteresis**. For a measuring range of 500°C a temperature level **hysteresis of** 2% corresponding to 10°C, with an activated **MAX alarm** of up to 400°C is only reverse with a temperature level of < 390 °C. An **alarm delay** up to a maximum of 9.9 seconds guarantees that briefly exceeded alarm values do not activate the alarm.

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

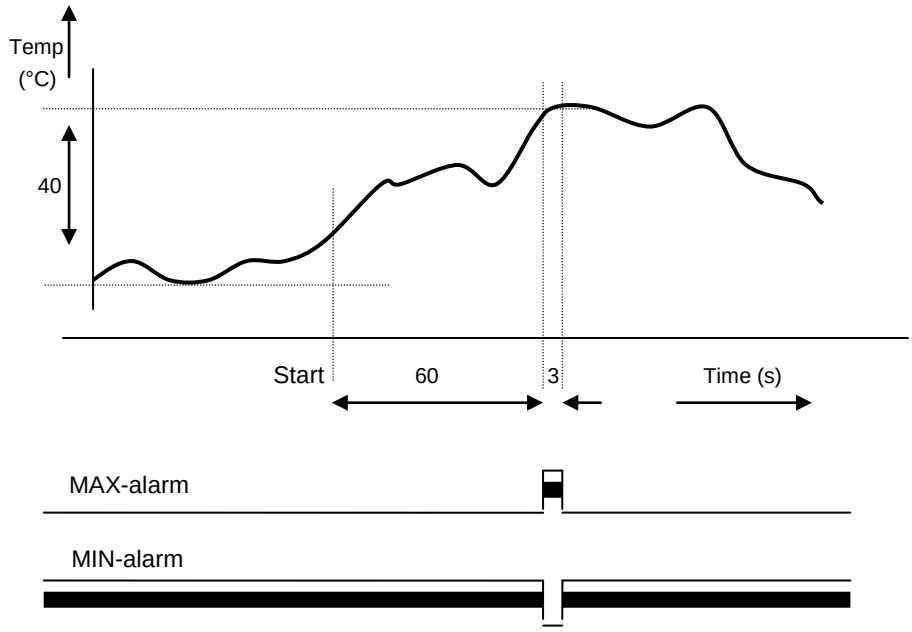
The gradient alarm needs a time interval as an additional parameter. It shows a time period between 0 and 9999 seconds, in which 20 samples are collected and used as the basic for the gradient alarm calculation.

Alarm value and alarm type are available in the online mask. Activated limiting value alarms are marked in red.

6.6.1. Differentiated gradient alarm and the parameter settings

1. Example:

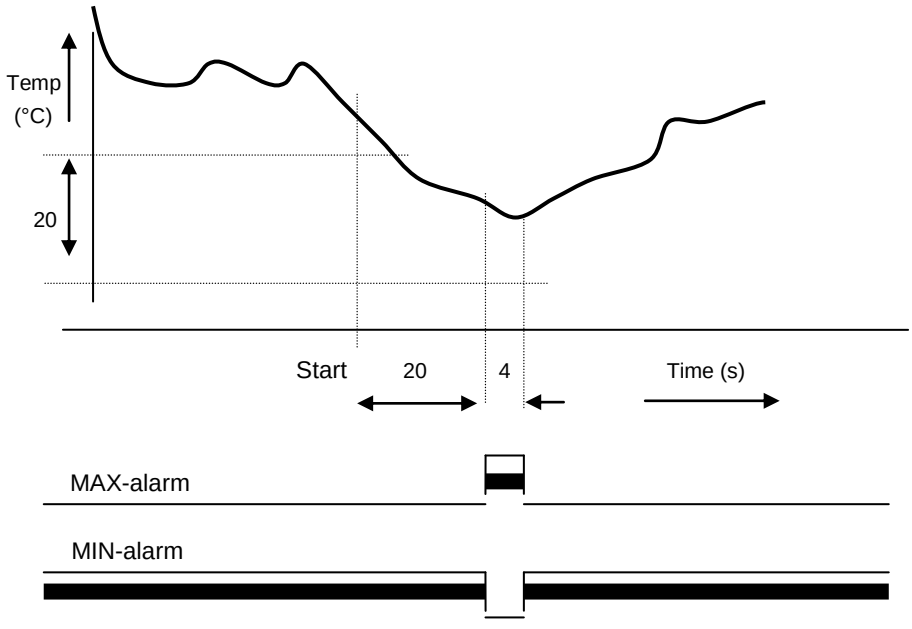
Alarm value = 40 °C
Alarm type = Gradient-MAX + MIN-alarm
Time interval = 60 s (20 samples in 60s)



Every time interval contains 20 samples. The minimum pulse duration at the alarm output is 0.05 x 60 s = 3 s!

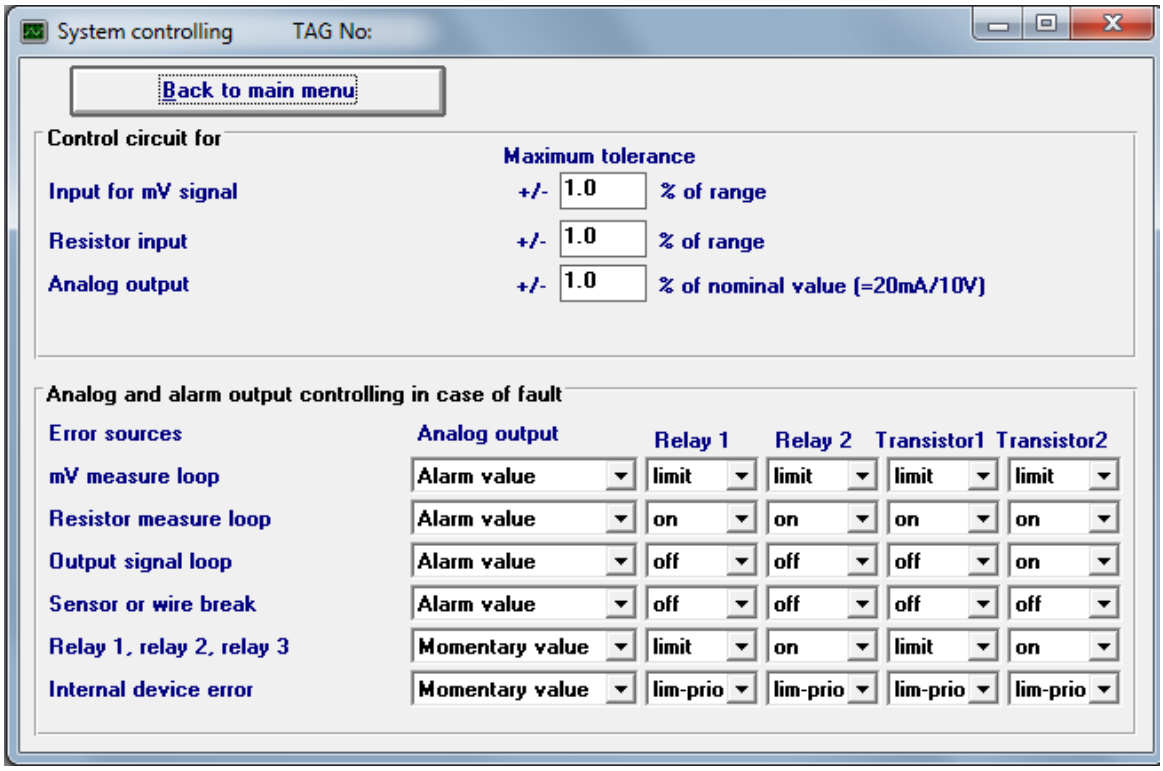
2. Example:

Alarm value = - 20 °C
Alarm type = Gradienten-MAX + MIN-Alarm
Time interval = 20 s (20 samples in 20s)



Every time interval contains 20 samples. The minimum pulse duration at the alarm output is 0.05 x 20 s = 1 s!

6.7. Monitoring conditions



A deviation fault between +/- (0.2 - 5.0) % is configured for mA measuring input and analogue output respectively.

A tolerance beyond that activates an alarm for maintenance requirement by the relay 3 and a constant light alarm LED on the front of the unit.

All faults in 6 fault sources, identifiable in the system, are summarized together in the screen. Each fault source has optionally different settings for analogue output and the alarm outputs are to be assigned determining behaviour in the fault event. The configuration for the alarm outputs (function, alarm type etc.) takes place exclusively in the **Alarm output** screen, where defined alarm outputs are dimmed out **no function** switched off and in the **System controlling** screen. In the fault event, the functions of analogue output and alarm outputs defined are overlaid in the **System controlling** screen to ensure controlled behaviour.

Alarm outputs can be switched off by **no function.** Therefore they are not available in the mask **System controlling** for maintenance requirement alarm.

No fault source is assigned to the 16-bit processor, because in the fault event for analogue output and alarm outputs, no safe condition can be guaranteed. It is of course possible with hardware operation, that a failure of the master processor could activate the SIL2 alarm for maintenance requirement.

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:

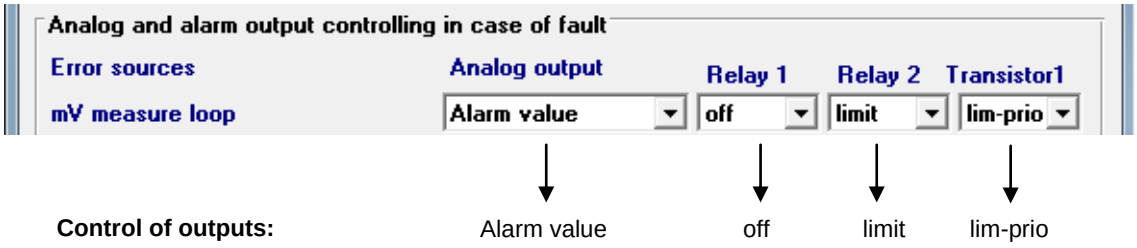
Function	Limit value alarm	Maintenance alarm	Alarm output	Notes
on	**x**	**on**	**on**	Only the fault alarm switched the alarm output!
off	**x**	**on**	**off**	The fault alarm switches off the limit value alarm!
lim-pro	**x**	**on**	**off**	The fault alarm switches off the limit value alarm, but not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

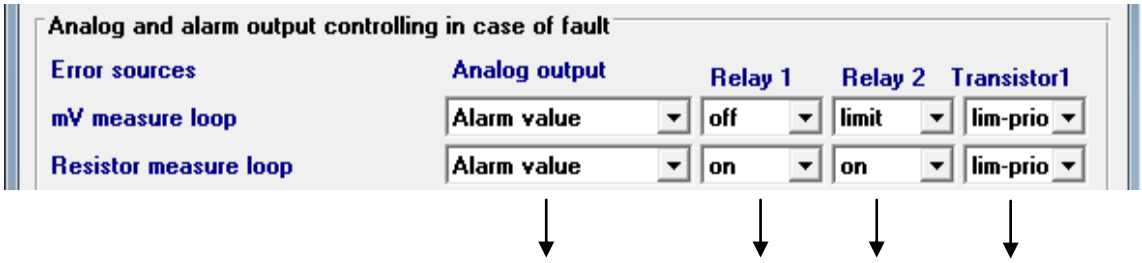
First example:

1. Fault: measure loop



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

2. Fault occurs later: mA-Input



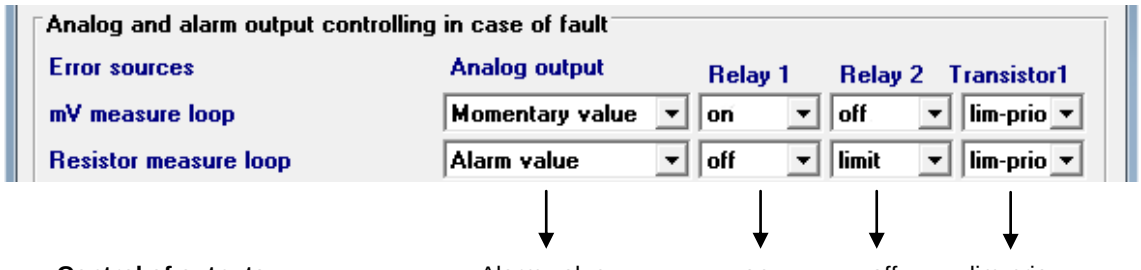
Control of outputs: Alarm value | on | on | on

The behaviour of the outputs determined by the ranking:

Analogue 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**

Second example:

2 fault occur parallel

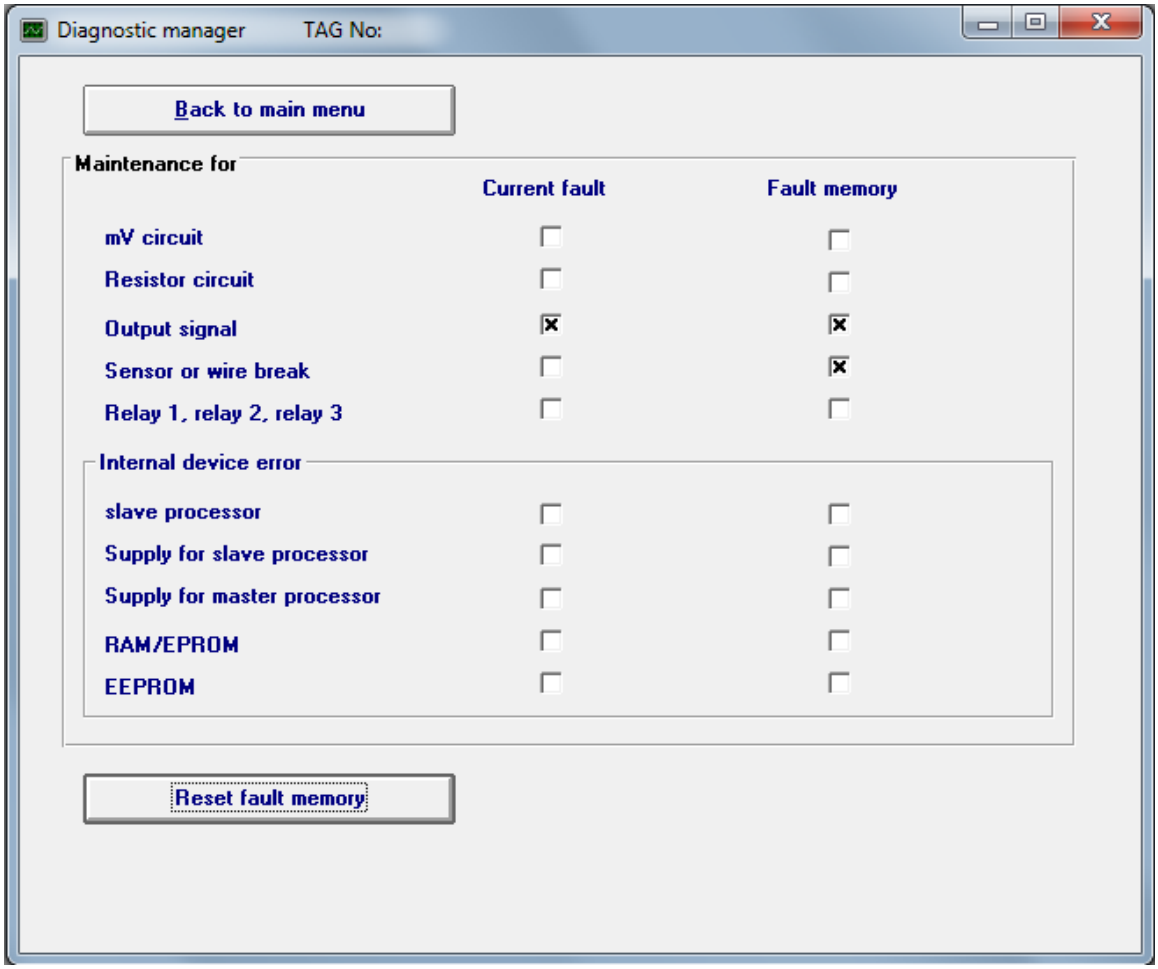


Control of outputs: Alarm value | on | off | lim-prio

The behaviour of the outputs determined by the ranking:

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

6.8. Diagnostic manager



The **Diagnostic Manager** records all occurred faults clearly inside and outside the MSK200. All 11 monitoring functions are listed in a table and provided with windows for **Current fault** and **Fault memory** respectively.

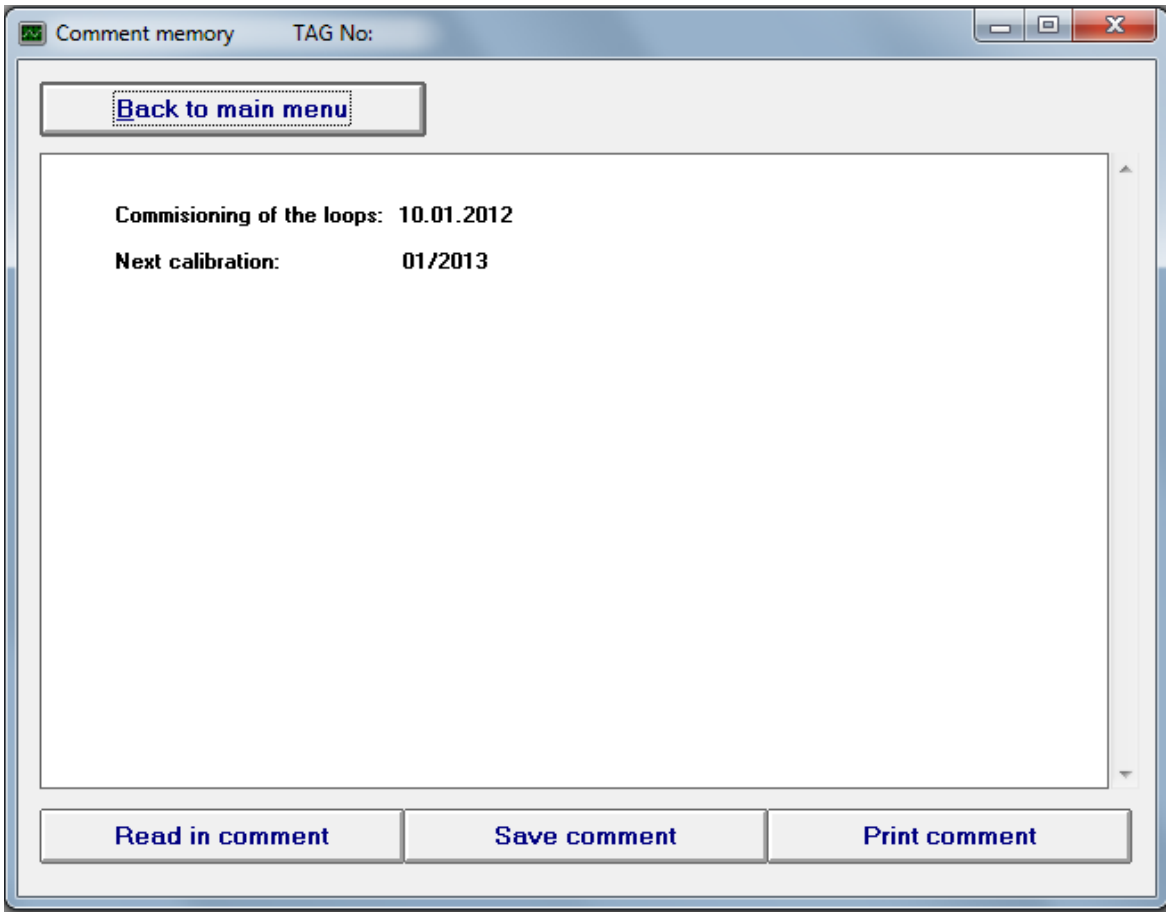
Each current fault is signalled as a maintenance alarm by the continuous red lighted alarm LED and relay 3. The diagnostic manager shows the source of these faults in the window **current faults** and **fault memory**. It is not possible to delete the **fault memory** for a current fault in case the fault is not solved.

The identification of the **fault memory** occurs with a cross, if the determined case of a fault is terminated independent of the duration. Thus the fault cause can be always seen with brief fault events.

By pressing the button **Reset fault memory**, all **fault memory** will be deleted under the condition that these faults are removed.

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

6.9. Comment memory

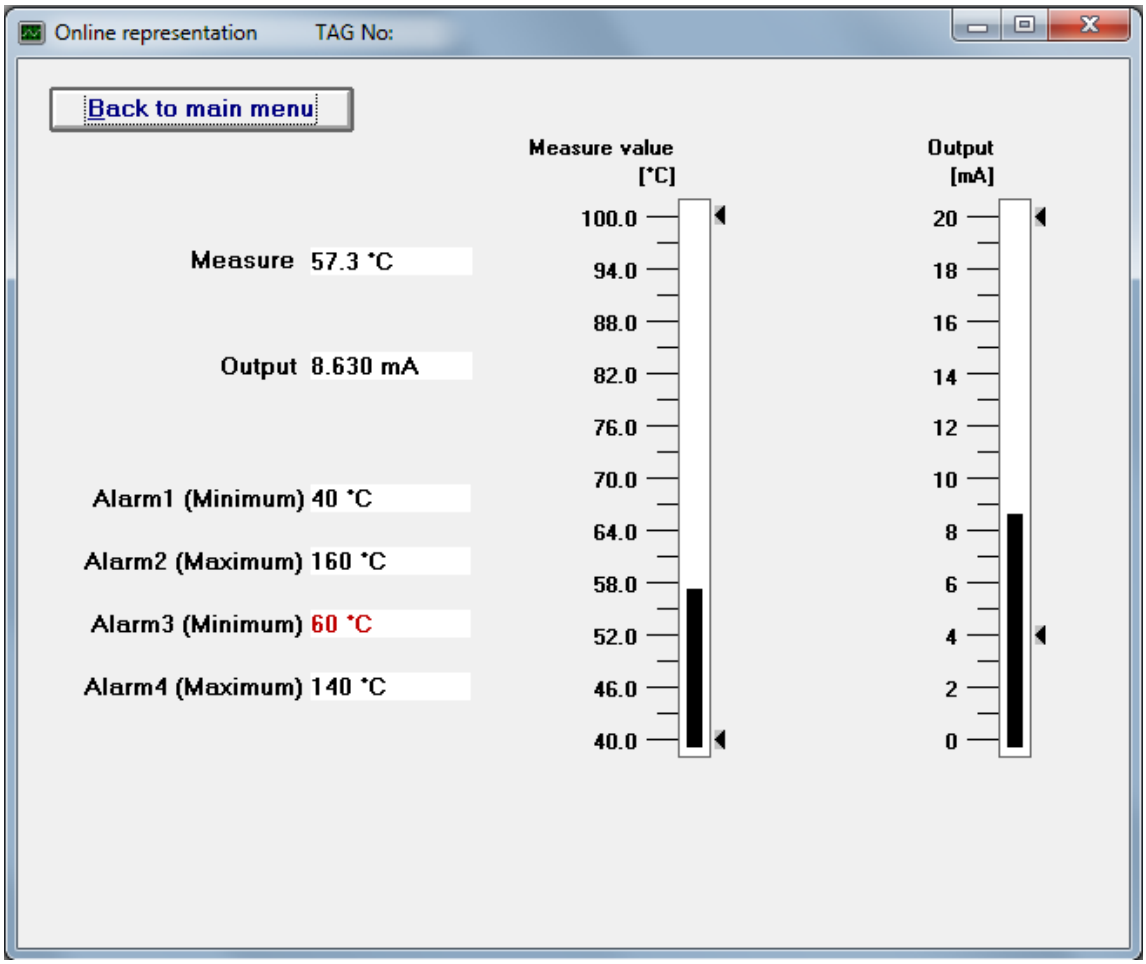


The **comment memory** offers the user a convenient option of saving comments or notes in the MSK200 device. The allowed capacity for comments is a maximum 2000 ASCII characters and may be sufficiently dimensioned for most applications. For protocols, this text can be printed out with the command **Print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

Read comment: text is loaded into the WINSMART program from the MSK200

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

6.10. Online representation



The **online representation** shows the input and output signal both analogue and digital. Additional the alarms with their limit values are figured. During exceeded limit value or alarm activation, the value is displayed in red. Unused alarms (**no function**) are not recorded in the **online display**.