User manual

SMM-HD

SMM-XX

MULC

SMM-DR

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1 Content

2 General

- The Safety Measuring Module (SMM), described in this operating manual, is carefully designed and manufactered using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production.
- This operating manual includes important information on handling the device. Basis for safe workings is the observance of all given safety and work instructions. It is part of the product and must be kept in the immediate vicinity of the device and readily accessible to skilled personnel at any time.
- Observe the relevant local accident prevention regulations and general safety regulations for the device‘s range of use.
- The manual provides a full description of the Safety Measuring Module (SMM) and skilled personnel must have carefully read and understood the operating instructions, prior to beginning any work.
- The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorised modifications to the SMM.
- If the serial number gets illegible (e. g. by mechanical damage), the retraceability of the device is not possible any more.
- The general terms and conditions contained in the sales documentation shall apply.
- The Safety Measuring Module is subject to technical modifications.
- Further information: WEB: www.mueller-ie.com
  Data sheet: smm-hd_en.pdf, smm-de_en.pdf, mulc_en.pdf
  Mail: info@mueller-ie.com

3 Short description

- The Safety Measuring Module (SSM) is a safety-related measuring amplifier, which meets the requirements for the functional safety according the standards IEC 61508 / EN 62061 (SIL3) and the requirements of the standard EN ISO 13849-1, Performance Level „e“, Category 3. The Safety Measuring Module is suitable for load and force sensors with different bridge signals. For a safaty-related application (SIL3) is in addition a Safety PLC with an implemented diagnostic software necessary.

- The SMM is available in the product types load/force cell (SSM integrated), heavy duty enclosure and DIN-rail enclosure each with separate load/force cell. The complete safety-related system (SIL3) is always being composed of a sensor , a Safety Measuring Module and a connected safety diagnostic unit (Safety PLC).

Applications

Application fields of the Safety Measuring Module are all areas, where safety-related measuring systems are absolutely necessary.

Examples:

Picture 1: Airport

Picture 2: Crane systems

Picture 3: Theatre

4 Transport, Packaging, Storage

- **Transport:** Check the device for any damage that may have been caused during transportation. Obvious damage must be reported immediately.
- **Packaging:** Do not remove packaging until just before mounting. Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair).

- **Storage:** Avoid exposure to the following factors
  - Direct sunlight or closeness to hot objects
  - Mechanical vibration, mechanical shock (putting it down hard)
  - Soot, vapour, dust and corrosive gases
  - Moisture or wet environement

Store the device in its original packaging in a location that fulfils the conditions listed above.

5 Personnel qualification

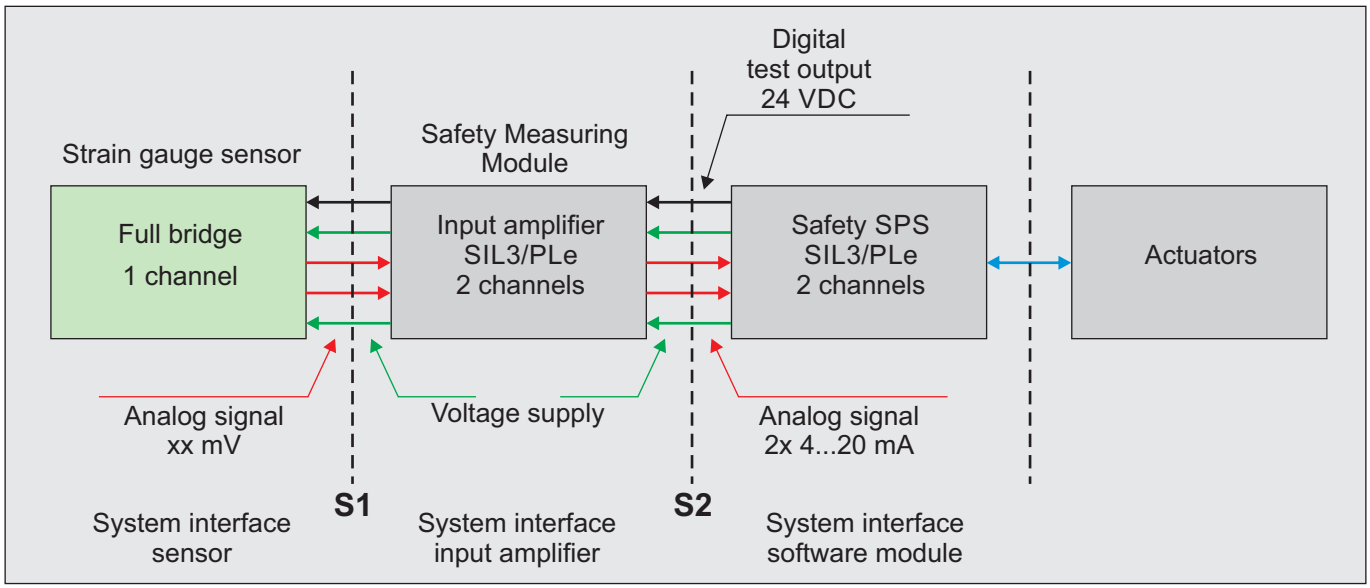
Warning

Risk of injury if qualification is insufficient

- For installation and starting of the devices the personnel has to be familiar with the relevant regulations and directives of the country and must have the qualification required.
- Particularly the qualified personnel has to undergo a briefing or training about the use and handling of safety-related products according the functinal safety (SIL3, PL „e“- Category 3).
- The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications. They have to be acquainted with electric circuits, are capable of carrying out the work described and can independently recognise potential hazards. Depending on the operation conditions of the application they have to have the corresponding knowledge.

6 Functional description

- The block diagram [Picture 4] shows the structure of the safety measuring system. The safety-related measurement chain is being composed of a sensor (full bridge), a SMM, a Safety PLC with a diagnostic software and connected actuators.



Picture 4: Block diagram of a SMM measurement chain

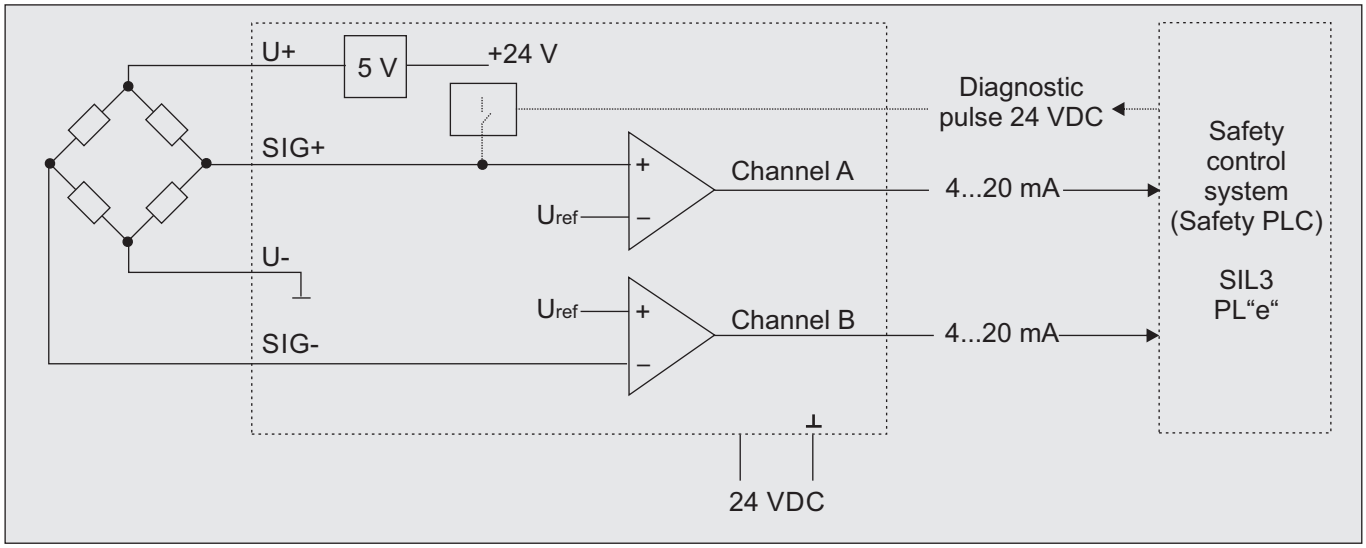
The safety concept of the Safety Measuring Module is based on a two-channel measurement system which converts the physical variable (force, pressure) to be measured in 2 proportional standard current values. The deviation of current of the two channels may not be more than 5% (ΔI= 0,8 mA) maximally when the measurement is propper.

For monitoring of overloads and faulty signals the diagnostic software of a Safety PLC or safety input and output unit is being used.

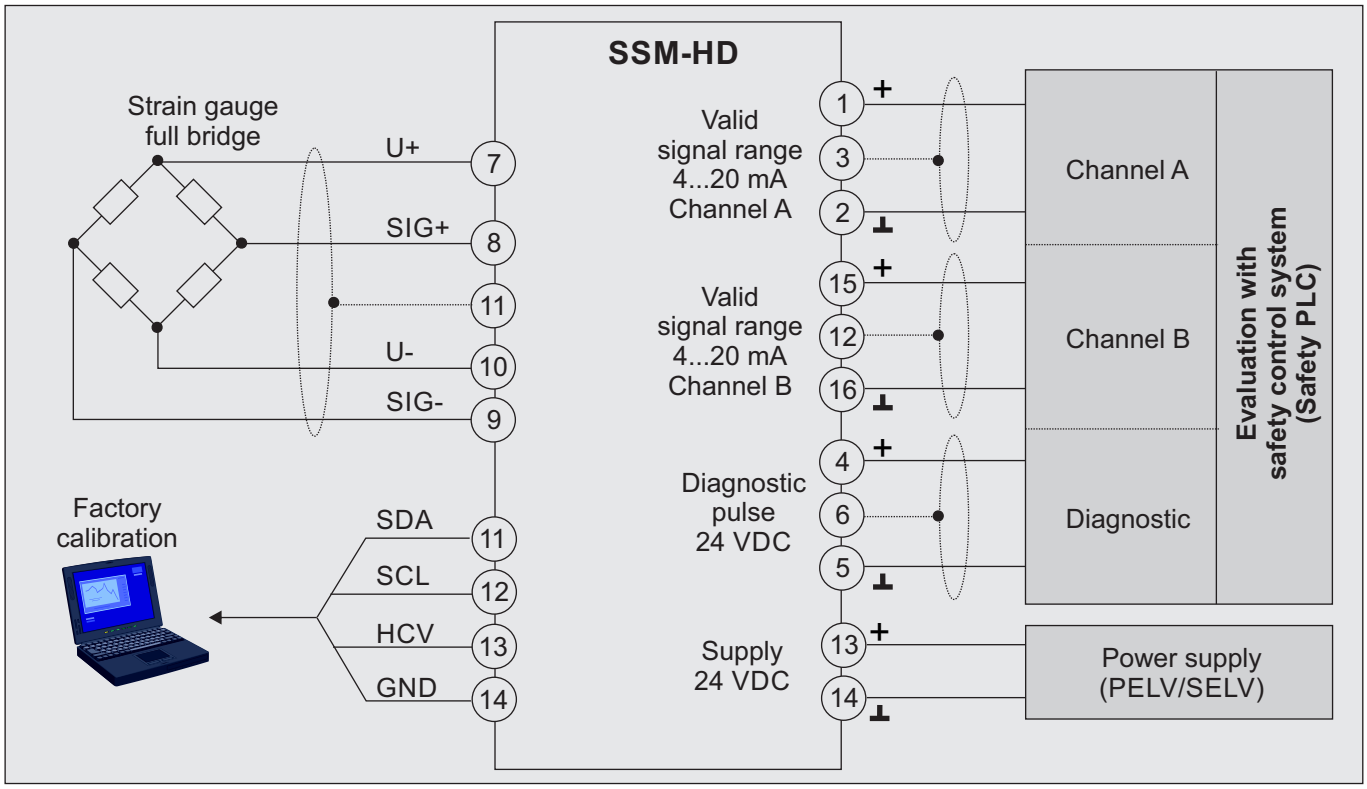
Each of the both measuring amplifiers has a preceding module for the supply of needed voltages and a cutoff on over- and undervoltage (36 V or 18 V) . The amplifiers are supplied with U=24 VDC ±10% using a PELV/SELV power unit.

6 Functional description (continued)

For the detection of faulty signals from the connected sensor (sensor break, sensor short circuit, sensor drift) and in both measuring amplifiers a Safety PLC has to generate a diagnostic pulse of U=24V ±20%. When all signals come right, the diagnostic pulse increases the current output value of channel B by ΔI_{out}=1mA. If the current value changes by more than ±5% of this value, the faulty signals can be identified by the diagnostic module of the Safety PLC .



Picture 5: Safety measure arrangement: SMM with sensor bridge circuit and Safety PLC according SIL3 / PL “e“, Category 3



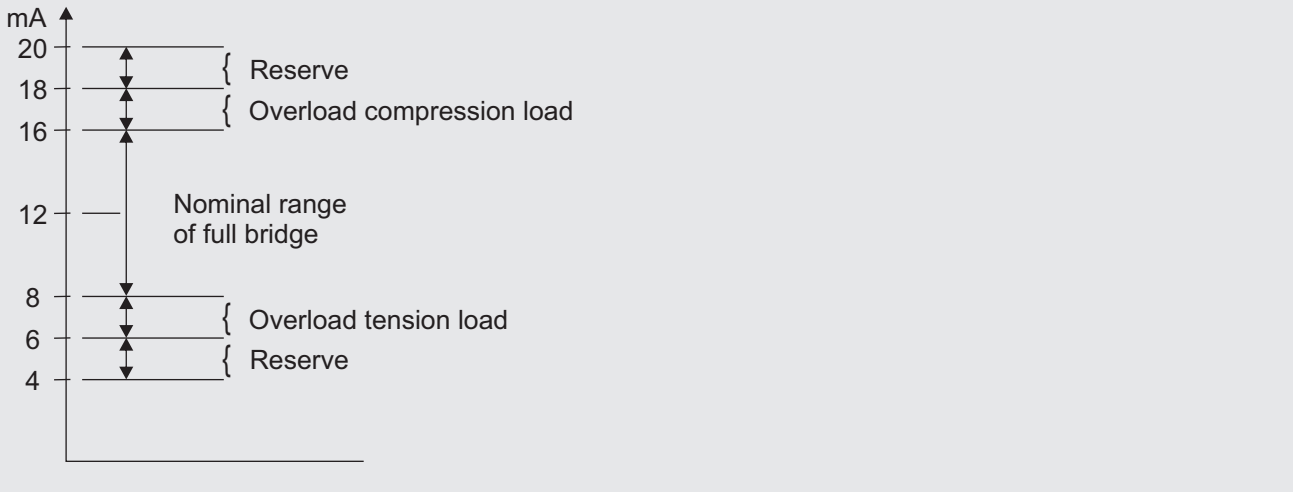
Picture 6: Measurement concept: SMM with sensor bridge circuit and Safety PLC according SIL3 / PL “e“, Category 3

7 General operational data

The operator has to ensure that the system is supplied by a PELV/SELV power unit and that the supply voltage is limited to 60 VDC on error.

Description	Output current I_a Channel A, Channel B	Comment
Current range	4...20 mA	Corresponds to value range of the signal
Measuring range -1: 0...100%	0...8 mA	Zero point at 8 mA abs (Measuring range abs.: 8...16 mA)
Measuring range -2: -50...+50%	±4 mA	Zero point at 12 mA abs (Measuring range abs.: 8...16 mA)
Extension of operating range	±2 mA	Reserve of calibration for application program
Operating range	0...12 mA	Relevant for safety evaluation unit (PLC) Measuring range ± reserve of calibration (8 mA ±2 mA) Operating range min = 6...14 mA abs Operating range max = 10...18 mA abs
Malfunction at minimum	<8 mA: -5%	Error analysis
Malfunction at maximum	>16 mA : +5%	Error analysis
Diagnostic pulse/detuning	1 mA	Detuning of output current of channel B
Maximal tolerance per channel	±5%	Measuring accuracy of the current valueper channel: ±0,4 mA referring to the measuring range 8 mA + zero point
Tolerance of the channel symmetry	5%	Measuring accuracy of the current symmetry (Channel A - Channel B) Maximal deviation of current: 0,8 mA abs

Table 1: Rating



Picture 7: Overview of operation modes

7 General operational data (continued)

In the following cases the PLC has to switch to a safe state:

1. The current output values of channel A and/or channel B are below the zero point of 7,2 mA (8mA -0,8 mA (-5%))
2. The current output values of channel A and/or channel B are above the maximal measuring range of 16,8 mA (16mA+0,8 mA (5%))
3. The difference of current (Symmetry of current) between channel A and channel B is more than 0,8mA (5%).
4. The response of detuning by the diagnostic pulse UPI=24 VDC is outside of the range 0,95 mA…1,05 mA (± 5 %)

Safety ratings SMM (without PLC)
HFT = 1; 1oo2 architecture structure (HTF (Hardware Failure Tolerance) = 1 means, that if there are appearing two failures simultaneously, the safe state of the system is lost)
SIL3 - Product safety SIL3 is only available when a Safety PLC with a diagnostic software is analysing the signals
PL „e“ / Category 3 - Product safety PL“e“ / Category 3 is only available when a Safety PLC with a diagnostic software is analysing the signals
DC_{avg} = 97,00% (Average of diagnostic coverage must be ≥97%)
PFH = 2,00 E-9 h^{-1} (Possibility of a dangerous failure per hour)
$MTTF_d$ = 100 years (Mean time to dangerous failure)
The frequency of the diagnostic pulse has to be specified in that way, that the complete system is switching to a safe state within the process safety time (dependent on application) when a dangerous failure appears.
The reaction time of the SMM: t = 3 ms

Table 2: Safety ratings

8 Requiremets for the mechanical load transmission of the load/force cell

Make sure, that the load/force cell meets the relevant mechanical requirements according EN ISO 13849 so that the mechanical load transmission generates a propper signal for the electronics. Therefore each sensor is mechanical routine-tested with a compression press in the workshop of Müller Industrie-Elektronik GmbH.

Take care that the application of force during first startup and normal operation uses always the direction of action of the load/force sensor, so that the effective force effect can be measured.

Once a year takes place an in situ inspection of the product where the mechanical load transmission is checked too. Corrosion or similar harmful influences on the load transmission are not to be expected between maintenance intervals.

For the measurement of the force effect all usual load/force sensors with one strain gauge full bridge and a sensitivity of 0,1...4 mV/V can be used.

9 Product types

9.1 General

The Safety Measuring Module is available in the following three product types:

- Load/force cell with integrated SSM (Product name: MULC)
- Heavy duty enclosure (Product name: SMM-HD)
- Din-rail enclosure (Product name: SMM-DR)

9.1.1 Technical data (all product types)

Physical quantity	Ratings
Maximal allowed supply voltage according PELV/SELV and DIN EN 60204-1 Nominal supply voltage Nominal supply voltage range Tolerance of nominal supply voltage maximal deviation of output current	U_{Bmax} = 60 VDC U_N = 24 VDC 21,6...26,4 VDC ±10% ±0,8 mA (±5%)
Diagnostic pulse Range of diagnostic pulse Tolerance of diagnostic pulse Increase of current output on diagnostic pulse Valid range of increase of current output on diagnostic pulse Frequency of diagnostic pulse	U_{PI} = 24 VDC 19,2...28,8 VDC ±20% Channel B: ΔI_{OUT} = 1 mA 0,95...1,05 mA (±5%) >(3/T_{PST}) PST: Process Safety Time
Maximal current consumption	100 mA
Ambient operation temperature	T = -25...+60 °C
Storing temperature	T = -25...+85 °C
Relative humidity without condensation	rH = 0...96%
Air pressure	p = 86...106 kPa
Vibration fatigue limit (wave)	Sine wave: f = 5...500 Hz U_{AMP} = 0,15 mm a_{max} = 20 m/s²
Impact strength (shock) maximal acceleration, half-sine Difference of velocity Time of nominal pulse	a_{max} = 150 m/s² Δv = 1,1 m/s T = 11 ms
Maximal altitude for application	H = 2000 m

Table 3: Technical data for the three product types

9.2 Product type 1: Load/force cell with integrated SMM (MULC)

9.2.1 Design

The [Picture 8] shows the load/force sensor with integrated SMM input amplifier.

Picture 8: Product type 1: Load/force sensor with 2 covers and one 4-pole and one 8-pole connection plug

9.2.2 Installation and set-up

Supplied items: Load/force cell (MULC), 2 connection cables with 1x M12x1 4-pole and 1x M12x1 8-pole

The electrical and mechanical connection between sensor and SMM is done during fabrication.

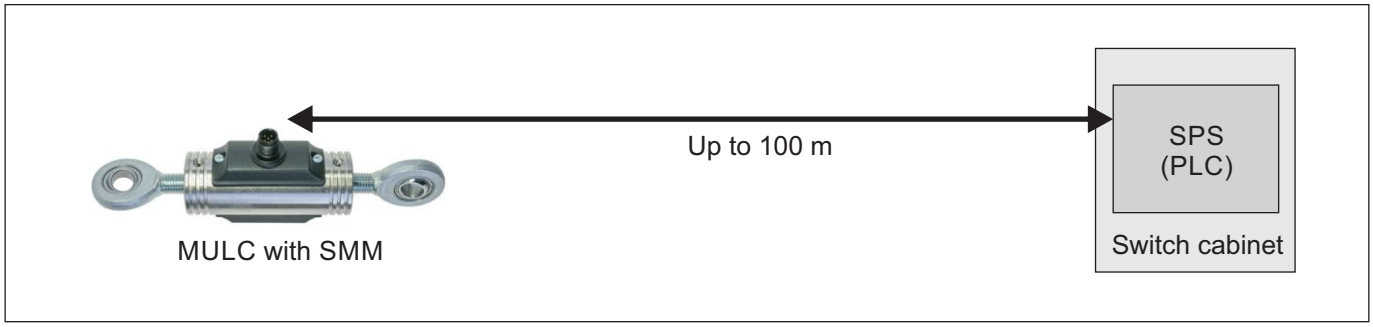
For the electrical connection a plug and socket system M12 x 1 is used and is supplied together with the signal cables of a length up to 100 m [Picture 9].

The signal cables are locally layed by the user.

The signal cables have a guaranteed elimination of errors according ISO EN 13849 .

Warning

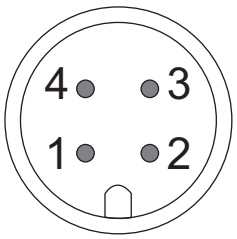
Electromagnetic parasitic inductions may impair the function and safety of the system. Therefore it is necessary to use at least single shielded cables for the connecting cables between MULC and PLC or supply unit.



Picture 9: Installation and set-up

9.2.3 Pin assignment

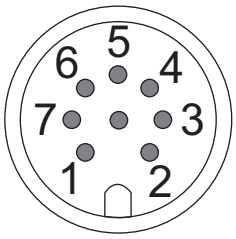
4-pole connector



PIN	Function	Description	Color
1	GND	Diagnostic pulse PLC - GND	brown
2	$+I_{A\_out}$ = 0...20 mA	Current output A	white
3	GND	Current output A - GND	blue
4	$+U_{Pulse}$ = 24 V ±20%	Diagnostic pulse PLC	black

Picture 10a: Pin assignment with 4-pole connector

9.2.3 Pin assignment

8-pole connector				
	PIN	Function	Description	Colour
	1	U_B = 24 V ±10%	Supply voltage	white
	2	$+I_{B\_out}$ = 0...20 mA	Current output B	brown
	3	GND	Supply voltage - GND	green
	4	GND	Current output B - GND	yellow
	Pins for factory configuration only			
	5	HVC U = 24 ±10% VDC	Activation protection commands of digital potentiometer	grey
	6	SCL U = 5 V ±5%	Clock pulse, I2C-bus	pink
	7	SDA U = 5 V ±5%	Serial data, I2C-bus	blue
	8	GND	I2C-bus - GND	red

Picture 10b: Pin assignment 8-pole connector

Warning Danger

The assignment of the pins 5...8 is only for information. The assignment of the other pins is for the connection of the supplied cables during the installation of the system by the user. Furthermore the user is not competent to apply unauthorized other signals to the pins or connection lines.

9.2.4 Technical data

Physical quantity	Ratings
Ingress protection	IP54
Dimensions (without rod ends and covers)	1000/1500 kg: L = 90,0 mm, d = 35 mm 3000 kg: L = 105,0 mm, d = 35 mm
Electrical connection	2x M12x1 (4-pole and 8-pole)
Weight	820 g

Table 4: Technical data MULC

9.3 Product type 2: Heavy duty enclosure (SMM-HD)

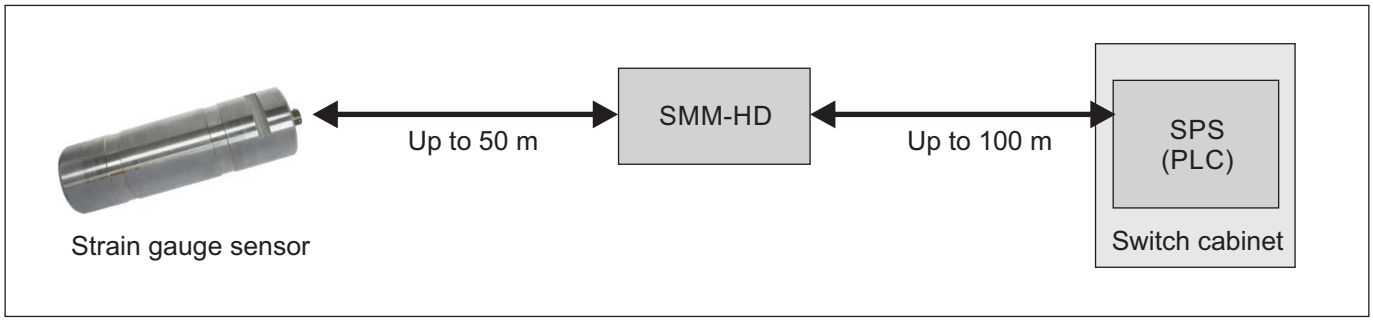
9.3.1 Product type

Picture 11: Product type 2: Heavy duty enclosure

9.3.2 Installation and set-up

Supplied items: Heavy duty enclosure (SMM-HD) with 1x or 2x SMM

The heavy duty enclosure (U-CASE2) is available with one or two Safety Measuring Modules, which are independently of each other, and is located locally between PLC and sensor [Picture 12].



Picture 12: Installation and set-up

The load/force sensor is made-up in factory with a single shielded cable with a length of maximal 50 m.

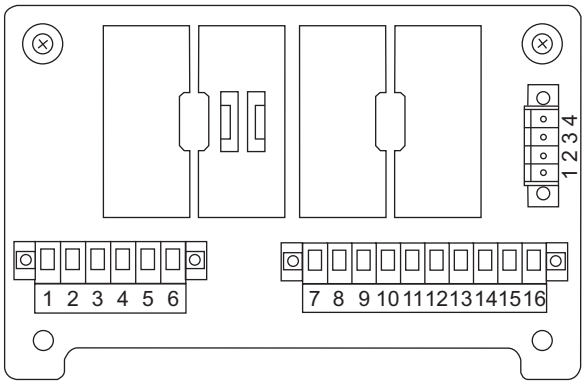
The single shielded cable between SMM-HD and PLC may have a maximal length of 100 m.

The signal cables are locally layed by the user.

Warning

Electromagnetic parasitic inductions may impair the function and safety of the system. Therefore it is necessary to use at least single shielded cables for the connecting cables between strain gauge sensor <> SSM-HD and SMM-HD <> PLC or supply unit.

9.3.3 Pin assignment



Picture 13: Pin assignment heavy duty enclosure

6-pole plug-in terminal strip		
Terminal	Function	Description
1	$+I_{A\_OUT}$ = 0...20 mA	Current output A
2	GND	Current output A - GND
3	Shield	
4	U_{PULSE}	Diagnostic pulse PLC
5	GND	Diagnostic pulse PLC - GND
6	Shield	

9.3.3 Pin assignment (continued)

10-pole plug-in terminal strip		
Terminal	Function	Description
7	U_{Br} = 5 V ±5%	Bridge supply
8	+S = 2,5 V ±5%	Sensor output +
9	-S = 2,5 V ±5%	Sensor output -
10	GND	Bridge supply - GND
11	Shield	
12	Shield	
13	U_B = 24 V ±10%	Supply voltage
14	GND	Supply voltage - GND
15	+IB_out= 0...20 mA	Current output B
16	GND	Current output B - GND

The following pin assignment is for factory configuration only

4-pole plug-in terminal strip		
Terminal	Function	Description
1	SDA U = 5 V ±5%	Clock pulse, I2C-bus
2	SCL U = 5 V ±5%	Serial data, I2C-bus
3	HCV U = 24 VDC ±10%	Activation protection commands of digital potentiometer
4	GND	I2C-bus - GND

The pin assignment of the 4-pole plug-in terminal strip is only for information. The assignment of the other terminal strips is for the connection of the supplied cable (Strain gauge sensor <> SMM-HD) and the cable (SMM-HD <> PLC/power supply), provided by the user, during the installation of the system by the user. Furthermore the user is not competent to apply unauthorized other signals to the pins or connection lines.

9.3.4 Technical data

Physical quantity	Ratings
Ingress protection	IP65
Dimensions	L = 162,2 mm B = 92,2 mm H = 60,2 mm
Electrical connection	Plug-in terminal strip (4-pole, 6-pole and 10-pole)
Weight	1x SMM: 450 g, 2x SMM: 590 g

Table 4: Technical data SMM-HD

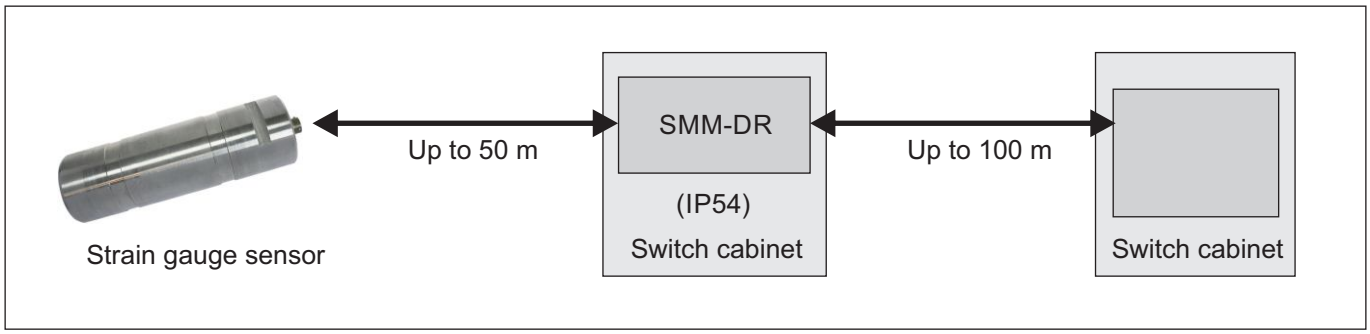
9.4 Product type 3: DIN rail enclosure (SMM-DR)

9.4.1 Product type

Picture 14: Product type 3: DIN rail enclosure

9.4.2 Installation and set-up

Supplied items: DIN rail enclosure (SMM-DR) with 1x SMM



Picture 15: Installation and set-up

The [Picture 15] shows the set-up with the DIN rail enclosure. This enclosure has to be built in in a switch cabinet with has an ingress protection of at least IP54

The load/force sensor is made-up in factory with a single shielded cable with a length of maximal 50 m.

The single shielded cable between SMM-DR and PLC may have a maximal length of 100 m.

The signal cables are locally layed by the user.

Warning

Electromagnetic parasitic inductions may impair the function and safety of the system. Therefore it is necessary to use at least single shielded cables for the connecting cables between strain gauge sensor <> SSM-DR and SMM-DR <> PLC or supply unit.

9.4.3 Pin assignment

The following pin assignment (Terminals 11 to 14) is for factory configuration only

4-pole plug-in terminal strip (Calibration / I2C-bus)		
Terminal	Function	Description
11	SDA U = 5 V ±5%	Clock pulse, I2C-bus
12	SCL U = 5 V ±5%	Serial data, I2C-bus
13	HCV U = 24 VDC ±10%	Activation protection commands of digital potentiometer
14	GND	I2C-bus - GND

4-pole plug-in terminal strip (Strain gauge sensor)		
Terminal	Function	Description
21	U_{Br} = 5 V ±5%	Bridge supply +
22	S+ = 2,5 V ±5%	Sensor output +
23	S- = 2,5 V ±5%	Sensor output -
24	GND	Bridge supply - GND

4-pole plug-in terminal strip (Power supply and current output - Channel B)		
Terminal	Function	Description
41	U_B = 24 V ±10%	Supply voltage
42	GND	Supply voltage - GND
43	$+I_{B\_out}$ = 0...20 mA	Current output - Channel B
44	GND	Current output channel B - GND

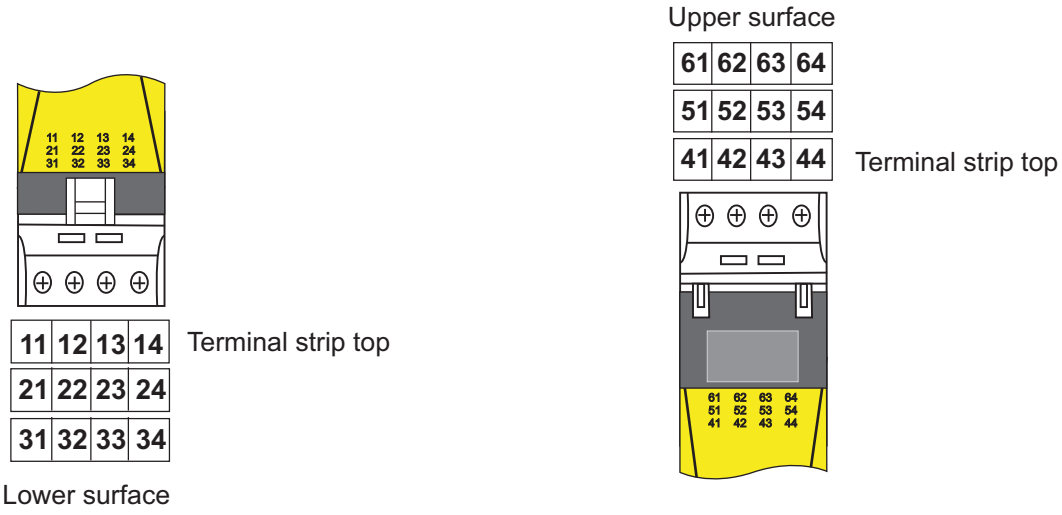
4-pole plug-in terminal strip (Diagnostic pulse and current output - Channel A)		
Terminal	Function	Description
51	$+I_{A\_out}$ = 0...20 mA	Current output - Channel A
52	GND	Current output chanel A - GND
53	U_{Pulse} = 24 V ±20%	Diagnostic pulse PLC
54	GND	Diagnostic pulse PLC - GND

4-pole plug-in terminal strip (Shield strain gauge)		
Terminal	Function	Description
31	Earth	Supply line
32	Shield	for stain gauge cable
33	Shield	for stain gauge cable
34	Shield	for stain gauge cable

4-pole plug-in terminal strip (Shield for powersupply, outputs, diagnostic pulse)		
Terminal	Function	Description
61	Earth	Supply line
62	Shield	for supply cable
63	Shield	for output cable
64	Shield	for diagnostic pulse cable

9.4.3 Pin assignment (continued)

The pin assignment of the 4-pole plug-in terminal strip (Terminals 11 to14) is only for information. The assignment of the other terminal strips is for the connection of the supplied cable (Strain gauge sensor <> SMM-DR) and the cables (SMM-DR <> PLC/power supply), provided by the user, during the installation of the system by the user. Furthermore the user is not competent to apply unauthorized other signals to the pins or connection lines.



Picture 16: Position of terminals at DIN rail enclosure

9.4.4 Technical data

Physical quantity	Ratings
Ingress protection	IP20
Dimensions	L = 117,2 mm B = 22,5 mm H = 113,6 mm
Electrical connection	Plug-in terminal strip (6x 4-pole)
Weight	240 g

Table 6: Technical data DIN rail enclosure

10 Putting into operation, maintenace and repair

10.1 Putting into operation

For the operator/user the putting into operation is limited to the laying of cables on location and the connecting of these cables to the devices. The calibration of the three product types is done by the manufacturer only in factory or in situ at the user‘s installation.

The devices are handed over sealed to the operator/user by the manufacturer. After the calibration of the system the valid running period and the serial number are recorded by the manufacturer.

The operator/user is disallowed to carry out manipulations or repairs on the product types.

10.2 Maintenance

Once a year a maintenance has to be carried out by the skilled personnel of the company Müller Industrie-Elektronik GmbH. Maintenance works, duration and date are recorded by Müller Industrie-Elektronik.

10.3 Repairs

Repair works on the three product types may only be carried out by the skilled personnel of the company Müller Industrie-Elektronik GmbH.

11 Disposal

Dispose devices, instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the sensor is supplied.

12 Safety specifications

The three product types (MULC, SMM-HD, SMM-DR) meet the specified safety requirements, which is certified by TÜV Rheinland. The examination of the Safety Measuring Module (SMM electronics) was done according the standards below. The integrated load/force sensor of MULC was not part of the examination.

IEC 61508:2010	(SIL3)
EN 62061:2005+AC:2010+A1:2013	(SIL3)
ISO 13849-1:2008+AC:2009	(PL „e“, Kat. 3)

Standards for EMC:

DIN EN 61326-1:2013	(CE conformity)
DIN EN 61326-2-1:2013	(CE conformity)
DIN EN 61326-3-1:2008	(SIL3)

Standards for environment:

DIN EN 60068-2-1:2008	Test procedure cold, Ae
DIN EN 60068-2-2:2008	Test procedure dry heat, Ae
DIN EN 60068-2-30:2005	Test procedure humid heat Db
DIN EN 60068-2-6:2008	Test procedure vibration (sinusoidal), Fc
DIN EN 60068-2-31:2009	Test procedure shocks for instruments, Ec
DIN EN 60529:	Test procedure degrees of protection provided by enclosures

13 Evaluation concept PLC

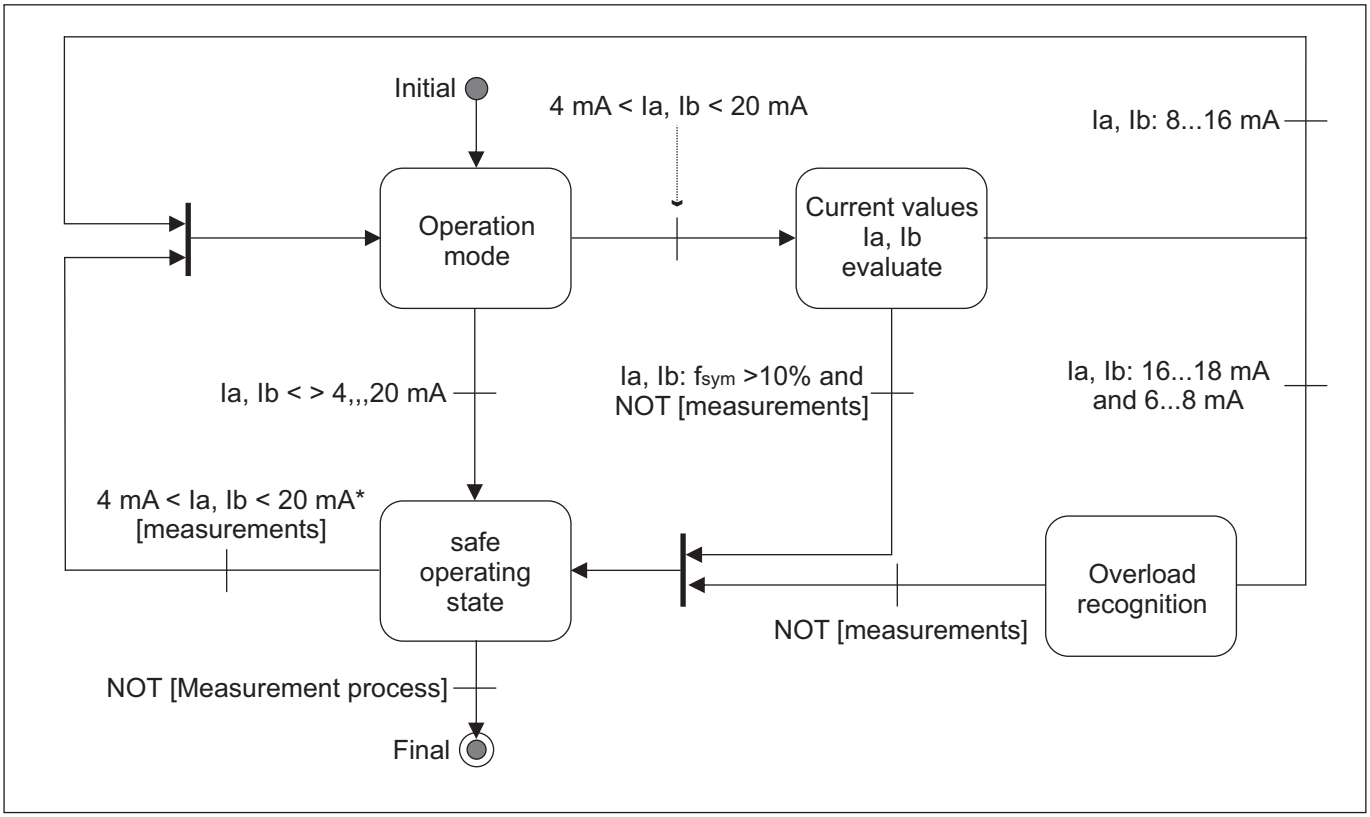
13.1 General

The following two diagrams are showing the scoring logic for the evaluation unit of the PLC. The first diagram presents the fundamental course of the software concept on the basis of a final state machine and the second diagram presents the program flow chart of the diagnostic unit.

Warning Danger

A safety related application according SIL3 with the Safety Measuring Module (SMM) requires in addition a Safety PLC or a safety related input/output unit, which meets the requirements according IEC 61508 (SIL 3) and PL „e“, Category 3. Only then the complete safety related system will cover the standards IEC 61508/ EN 62061/ ISO EN 13849. Particularly for the program creation the standard IEC 61508 – 3 has stringently to be observed.

13.2 Final state machine

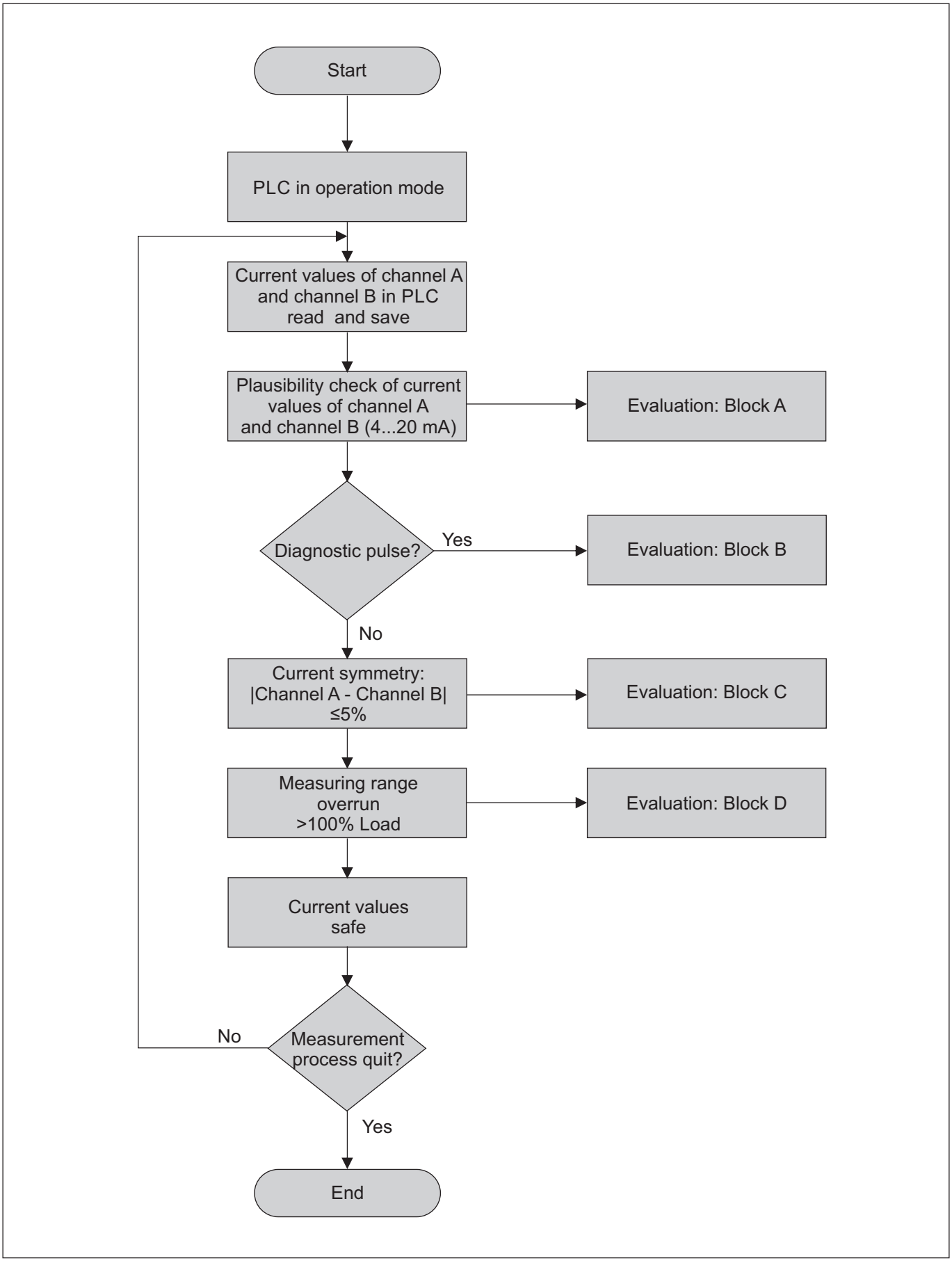


Picture 17: Final state machine diagnostic module

13.3 Flow Chart

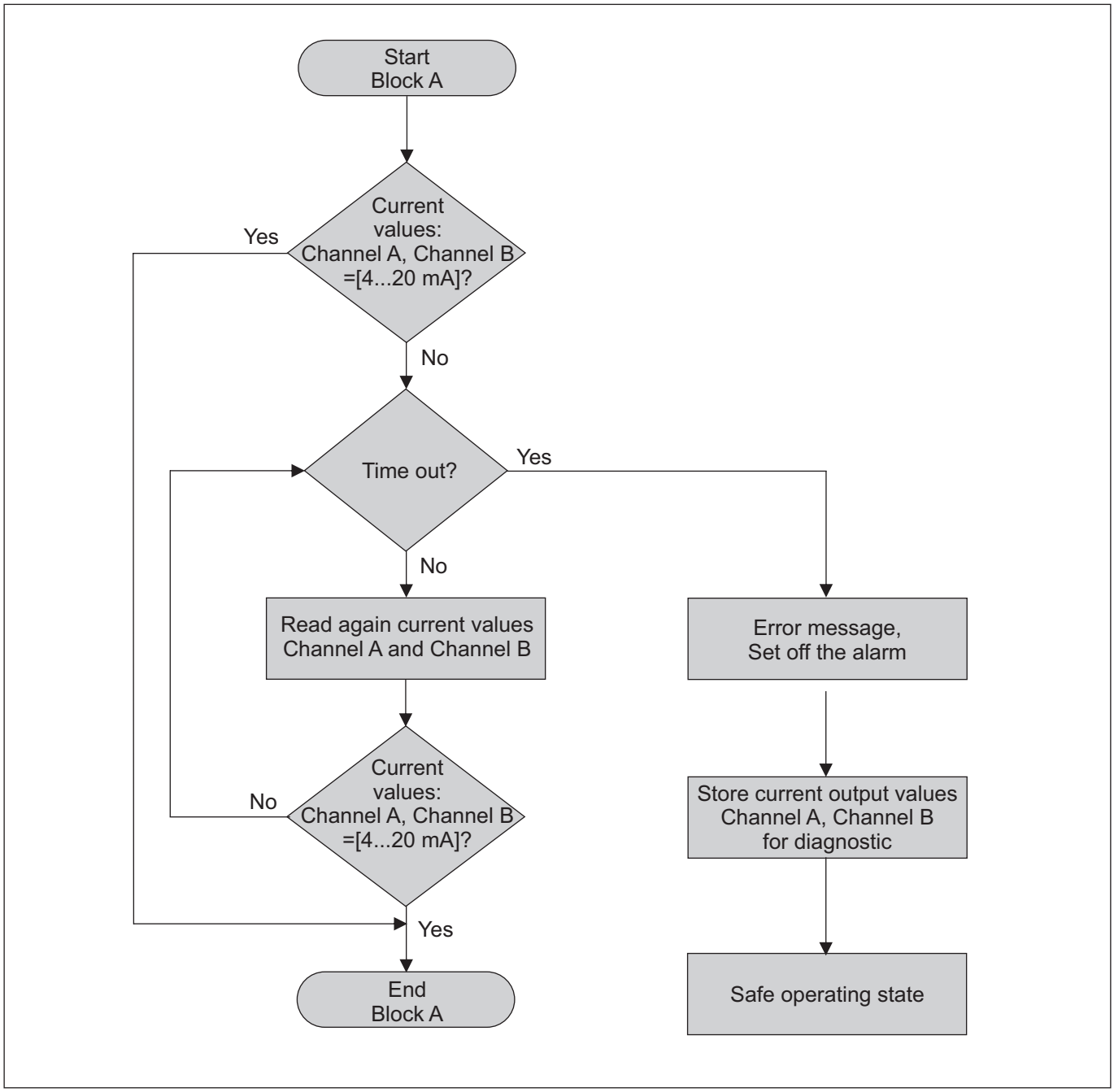
The flow charts of the [pictures 18a to 18 e] are showing the basic processing of the evaluation unit of a PLC for the current output values of the Safety Measuring Module SMM. In the main program the current output values are analysed with the polling method and processed further with plausibility check and a information request about their inspected values. On incorrect current output values the system switches to a safe state.

Overview of evaluation concept



Picture 18a: Flow chart (overview)

Evaluation concept Block A

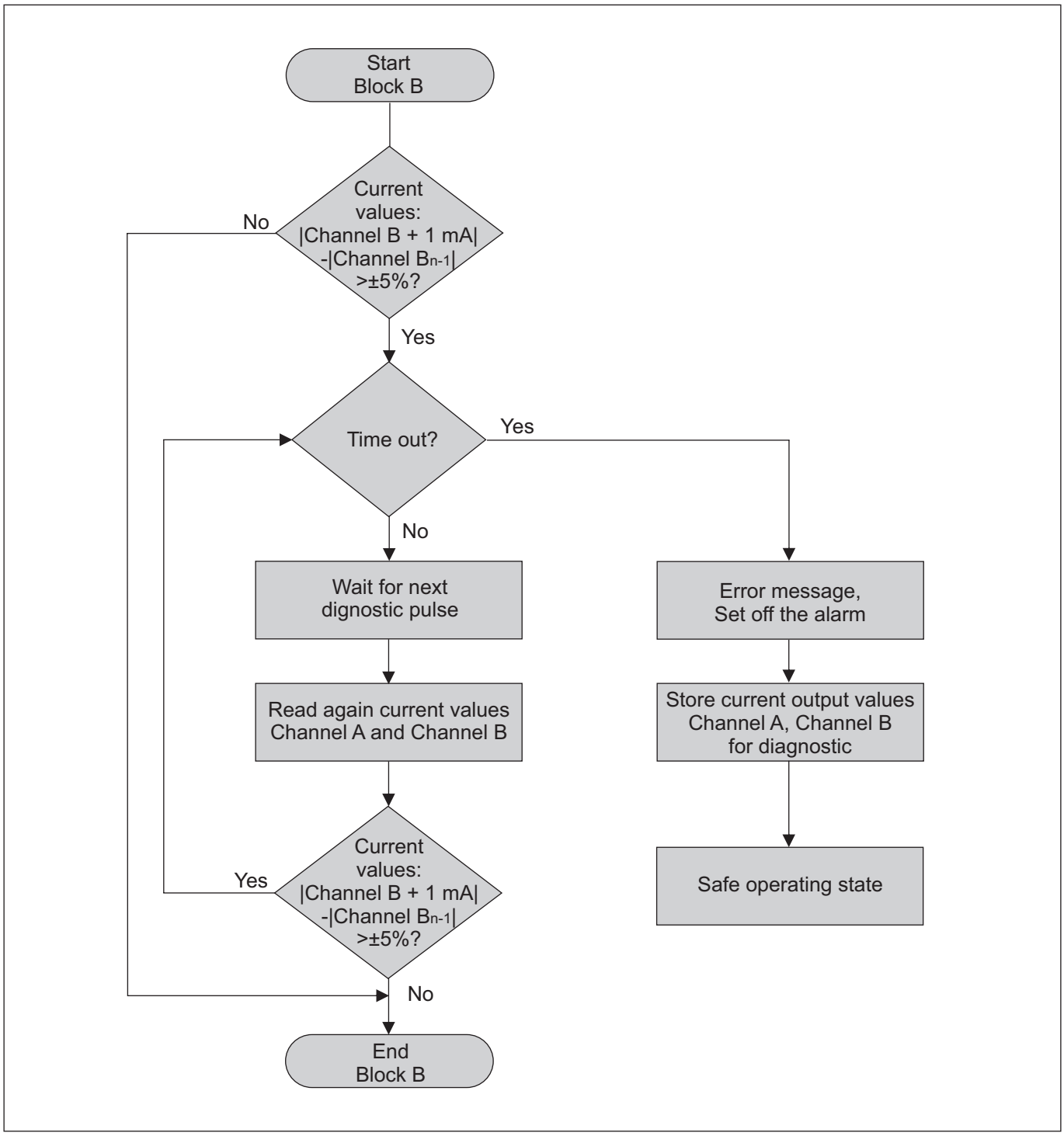


Picture 18b: Flow chart (Block A)

Warning

The period of Time out should be maximal one third of the Process Safety Time!

Evaluation concept Block B

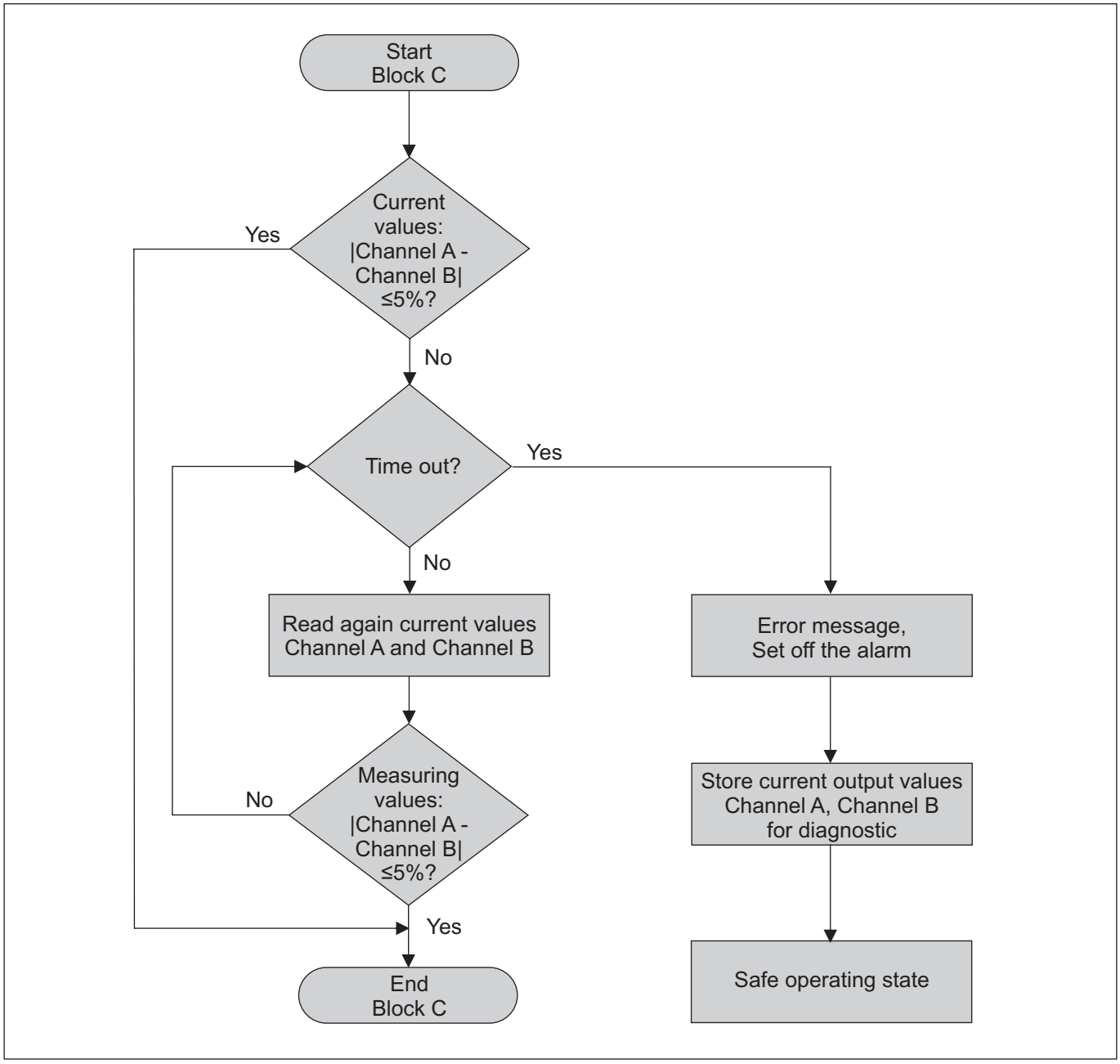


Picture 18c: Flow chart (Block B)

Warning

The period of Time out should be maximal one third of the Process Safety Time!

Evaluation concept Block C

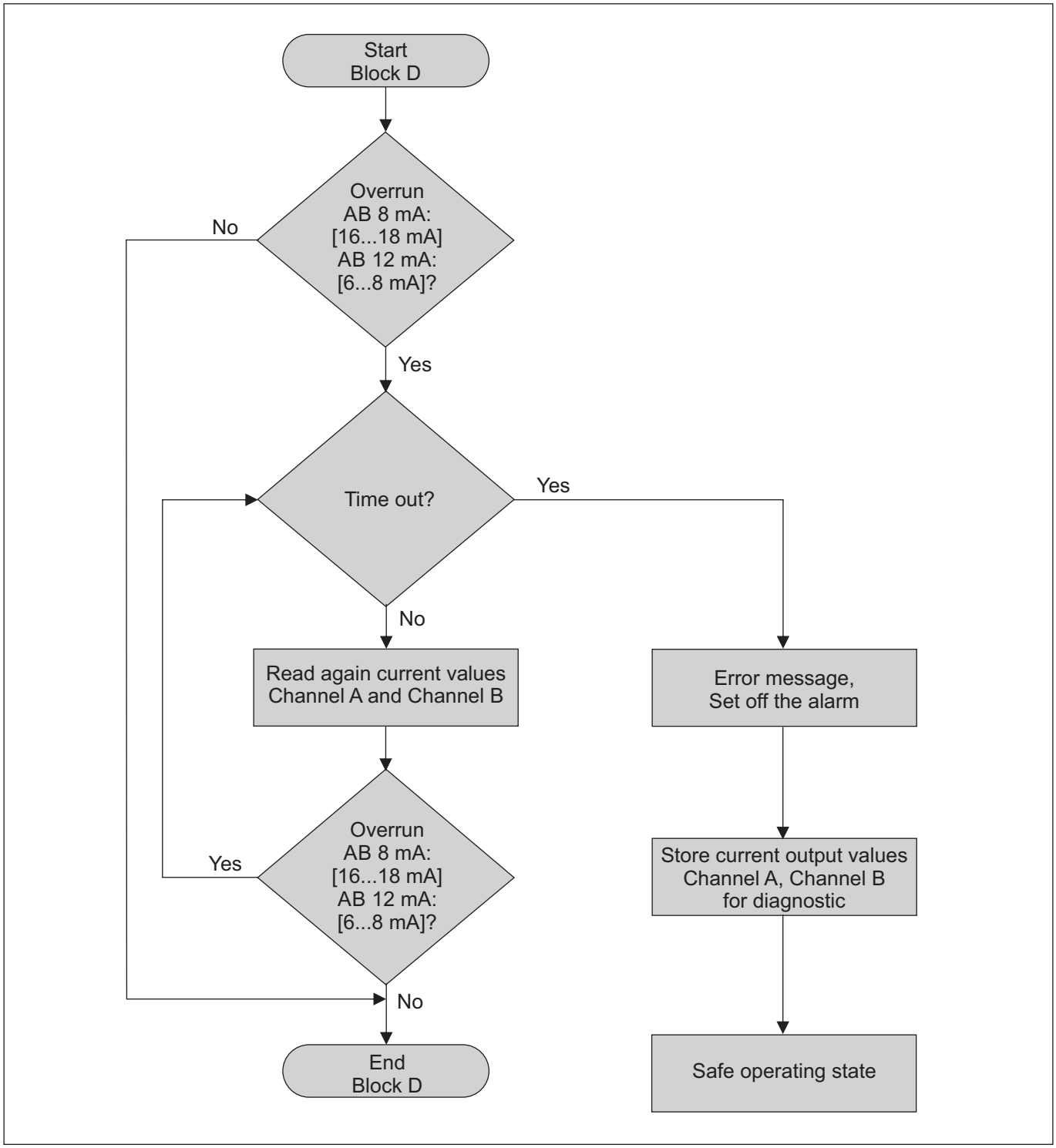


Picture 18d: Flow chart (Block C)

Warning

The period of Time out should be maximal one third of the Process Safety Time!

Evaluation concept Block D



Picture 18e: Flow chart (Block D)

Warning

The period of Time out should be maximal one third of the Process Safety Time!

14 Check list for putting into operation

The propper integration of the SMM in the complete system has to be validated. For this purpose all safety-relevant advices and warnings of this user manual have to be observed and the check list in [Table 7] with the instructions has to be processed to guarantee the functional safety of the SMM.

Check No.	Requirements	Mark OK / not OK
1	The SMM is supplied with a PELV/SELV power unit	
2	The operating voltage is within the specified range	
3	Ensure that the downstream PLC with diagnostic unit fulfils the safaty-related requirements according SIL3 (Cat.3) and PL „e“	
4	Ensure that the complete system being composed of sensor, measuring amplifier and PLC fulfils the safety-related requirements accoding SIL3 (Cat. 3) and PL „e“	
5	Ensure that the complete system changes into a safe state when the current output values of both channels A/B are below Fail Min (8 mA - 0,8 mA (5%))	
6	Ensure that the complete system changes into a safe state when the current output values of both channels A/B are above Fail Max (16 mA + 0,8 mA (5%))	
7	Ensure that an increase of current of ΔI = 1 mA is generated (5%) when the diagnostic pulse of U_{PI} = 24 VDC is started	
8	Ensure that the complete system changes into a safe state when the current pulse is different to the expected value (out of the range 1,05...0,95 mA)	
9	Ensure that the complete system changes into a safe state when the difference of current (Symmetry of current) between channel A and channel B is more than 0,8 mA (5%)	
10	Ensure, that the frequency of the diagnostic pulse together with the time of evaluation is within the Process Safety Time (PST) and that the detection of the error and the change of the application into a safe state is guaranteed within the PST	
11	Ensure that only suitable sensors with measuring bridges according SMM requirements are used	
12	Ensure that mechanical components, which transmit the load onto the measuring amplifier, meet the requirements according the standard EN ISO 13849 / Category 3	

Table 7: Check list with instructions to ensure the functional safety of the SMM

15 Contact

For questions about the products or faulty function in the application (a detailed description of the fault is necessary) use the following address:

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