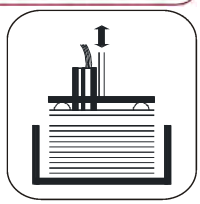
Double Sheet Detector E20
R1000 series

Electro magnetic principles – microcontroller based

NOW AVAILABLE:
- Front panel enclosure
- All common fieldbus standards



Single – sided contact double sheet control of ferrous materials

No force after measurement

Double sheet control of 0.1 to 6.5 mm (.004 to .255 in.) sheet thickness

6 exchangeable sensors for double sheet control

Optional version 4P allows connection of up to four identical sensors

- Programmable for 255 different sheet thicknesses and materials
- Digital display of sheet thickness and operational parameters
- Monitoring of over-gauge and under-gauge limits
- Monitoring of operating voltage and measuring time
- Opto-coupled 9-bit respectively 11-bit input interface
- Selectable interfaces:
  - Data communication and parameter backup via optional opto-coupled RS232 interface
  - Relay or opto-coupled outputs for under gauge, nominal gauge, over gauge and enable

Table of content

Declaration of conformity according to EC directives

Manufacturer:	Roland Electronic GmbH Otto-Maurer-Str. 17 DE 75210 Keltern
Product name:	**E20**
Product type:	**Double Sheet Detector** **R1000-series**

Roland Electronic GmbH declares that the product listed above complies with the requirements of the directives listed below.

Applied Directives:

2014/35/EU	Low Voltage Directive	
	EN 61010-1:2010	
2014/30/EU:	EMC Directive	
	EN 61000-6-2:2005/AC:2005	EN 61000-6-4:2007/A1-2011

Date of mark's apposition: 07.07.2017

Keltern, 07.07.2017		Managing Director
Place, Date	*Signature*	*Function of the signer*

The declaration confirms the compliance with the cited directives. However, it is not any implied warranty of fitness for a particular purpose especially as it may relate to product liability.

The safety instructions and warnings must be observed.

ISO 9001 : 2008
Reg.-no. 5152 QM08

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1 Safety advice

1.1 Safety instructions and warnings for user

This manual contains all information required for the correct operation of the Roland Electronic equipment. It has been written for technically qualified personnel.

Unauthorized tampering with the unit, especially ignoring the warnings in this handbook, can cause malfunction and damage to the unit. Only authorized personnel should be allowed to make changes to the unit and perform cable connections especially the power supply.

Should it be necessary, e.g. in case of service or repair, to make measurements within the unit, then all customary accidents prevention procedures should be observed. Only professional electrical tools should be used.

Note The factory pre-settings – especially the upper / lower limit values – have been chosen such that an optimal machine protection is ensured.

Diverging settings can impair the machine protection.

Safety advice for persons with cardiac pacemakers!

Persons with cardiac pacemakers are to stay away from the sensors!

The strong magnetic / electromagnetic fields of the sensors can cause malfunction of cardiac pacemakers and other such apparatus!

1.2 Declaration of icons

Warning - general dangers!

Reference to imminent hazards, which can result in severe bodily harm or death.

Attention - Damage of construction units!

Reference to a potential imminent situation, which can result in damage to the product or environs.

Note

Useful reference to an application or deepening information.

1.3 Intended use

Flexible Manufacturing Systems in the sheet processing industry require reliable Double Sheet Control systems in order to protect presses and other sheet processing machines against damage caused by feeding multiple sheets.

The Double Sheet Detector R1000 E20 was specifically developed for this technical environment. Depending on the application (type of material, thickness, sensor gap) the E20 can be used with up to four sensors. The reliable function of the Double Sheet Detector depends therefore markedly on the selection of the correct sensors and the mounting of the sensors.

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2 Technical data

2.1 Technical data control unit E20

Operating voltage:	24 VDC, +6 V / -2 V	
Power consumption:	Hardware Version 1…7 (till July 2007) P42AGS: 120 W; other sensors 45 W, in idle: <10 W Hardware Version 8 (since July 2007) P42AGS: 80 W; other sensors 45 W, in idle: <10 W	
Switch on current:	10 Amps for 1 ms	
External fuse:	5 Amps medium time lag	
Weight:	approx. 1.0 kg (2.21 lbs) Front panel enclosure approx. 1.6 kg (3.52 lbs) Wall mount enclosure	
Ambient temperature:	0 - 50 °C (30 - 122° F)	
Wall mount enclosure:		
Protection category:	IP65	
Dimensions (L x H x D):	E20 (without screw fittings):	approx. 140 × 140 × 76 mm (5.5 × 5.5 × 3 inch)
	E20 (with screw fittings):	approx. 140 × 163 × 76 mm (5.5 × 6.42 × 3 inch)
	E20-4P (without screw fittings):	approx. 180 × 140 × 76 mm (7.1 × 5.5 × 3 inch)
	E20-4P (with screw fittings):	approx. 180 × 163 × 76 mm (7.1 × 6.42 × 3 inch)
Front panel enclosure:		
Protection category:	IP40 (inside) IP65 (front cover)	
Dimensions (L x H x D):	approx. 180 × 180 × 70 mm (7.1 × 7.1 × 3 inch)	

Additional characteristics:

- 255 parameter sets memory
- Programming via pushbuttons
- 9 respectively 11 potential free optocoupler inputs 24 VDC with joint common; sinking inputs.
  Specification:
  - min. switching voltage HIGH: 18 VDC
  - max. switching voltage HIGH: 30 VDC
  - min. switching voltage LOW: 0 VDC
  - max. switching voltage LOW: 8 VDC
- 4 potential free outputs with positive external supply; sourcing outputs.
  Specification **relay version:**
  - Switching outputs: Dry relay opening contacts
  - max. switching voltage: 250 VAC
  - max. switching current: 1 A
  - max. switching power: 240 W / 200 VA

  Specification **opto coupler version:**
  - Switching outputs: unwired Emitter and Collector
  - max. switching voltage: 50 VDC
  - max. switching current: 150 mA
  - max. switching power: 100 mW

Attention In case of inductive load a coil protection diode should be used. Otherwise the signal output could be destroyed by the excess voltage generated by switching the inductive load off.

- RS232 interface

  Specification:
  - Baud rate: 4800 - 19200 baud
  - Data Bits: 8
  - Parity-Bit: None
  - Stop-Bit: 1
  - Hardware Handshake: None

The selection of the interface parameters with the exception of the baud rate is made via the software and cannot be changed by user.

2.2 Versions of the control unit E20

The control unit article key is coded as follows:

1. Control unit E20 for connection of one sensor	
E20-x-x-FP A B C D	A: = Control unit B: = Version B C C: = Outputs O: Opto coupler R: Relay D: = Control unit in front panel enclosure

2. Control unit E20 for connection of up to four sensors, all sensors are plug connected directly at the unit.	
E20-4P-x-x-FP A B C D E	A: = Control unit B: = Connection of up to 4 sensors C: = Version B C D: = Outputs O: Opto coupler R: Relay E: = Control unit in front panel enclosure

Version B	Memory for 255 parameter sets (Nominal thickness and upper and lower limits). Set up and addressing by push buttons or via 9 respectively 11 opto coupled data inputs 24 VDC with joint common.
Version C	Same as Version B but in addition: 1 opto coupled RS232 interface for bi-directional data communication with a PLC or PC.

Basing on the article key shown above the following versions are available:

Variants of the E20 control unit (examples)			
With one sensor		With up to four sensors	
For wall mounting	For front panel mounting	For wall mounting	For front panel mounting
E20-B-R	E20-B-R-FP	E20-4P-B-R	E20-4P-B-R-FP
E20-B-O	E20-B-O-FP	E20-4P-B-O	E20-4P-B-O-FP
E20-C-O	E20-C-O-FP	E20-4P-C-O	E20-4P-C-O-FP

2.3 Sensors

The sensor description has the following code:

P42AGS

A B C D E

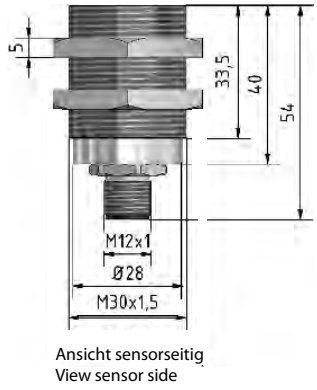
A = Electro magnet
B = Diameter
C = Model*
D = Thread
E = Quick disconnect

*Model: V: extended thickness measuring range
A: stands for a larger air gap

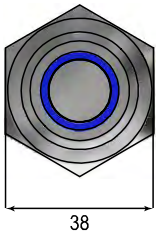
Fig. 1: Designation of sensors

2.3.1 Sensor P30GS

P30GS

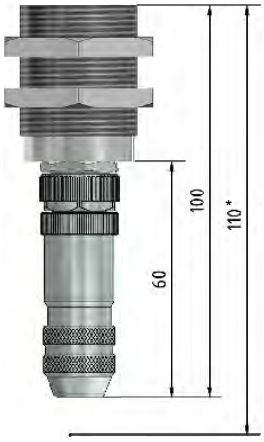


Ansicht sensorseitig
View sensor side



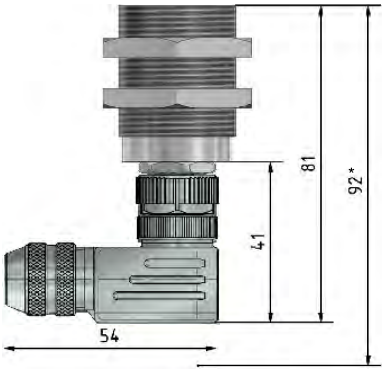
P30GS

with straight cable plug



P30GS

with 90° angled cable plug



* Maß mit Freiraum zur Sensor-Stecker-Verbindung

* Dimension with clearance to sensor plug connection

Sensor Kabel / Sensor cable
Biegeradius fest, minimum 31 mm - Biegeradius flexibel, minimum 58 mm
Bending radius fixed, minimal 31 mm - Bending radius flexible, minimal 58 mm

Alle Maße sind in mm. Baulängentoleranz: ± 0,8 mm, alle anderen Maße ± 0,2 mm
All dimensions are in mm. Length tolerance: ± 0.8 mm, all other dimensions are ± 0.2 mm

Fig. 2: Sensor P30GS

Technical data		
Measuring range [1]:	0.1 – 2.5 mm	.004 – .1 inch
Ambient temperature:	0 – 60 °C	30 – 140 °F
Class of protection:	IP65	
Weight:	approx. 0.21 kg	0.46 lbs
Sensor cable:	pluggable	
Measurable ohmic resistances [2]:		
Pin 1-2:	Approx.15 Ω	
Pin 4-3:		
Pin 1-4:	0 Ω	
Pin 2-3:		

1) Related to single sheet thickness

2) Pins are not connected to the sensor housing

2.3.2 Sensor P42AGS

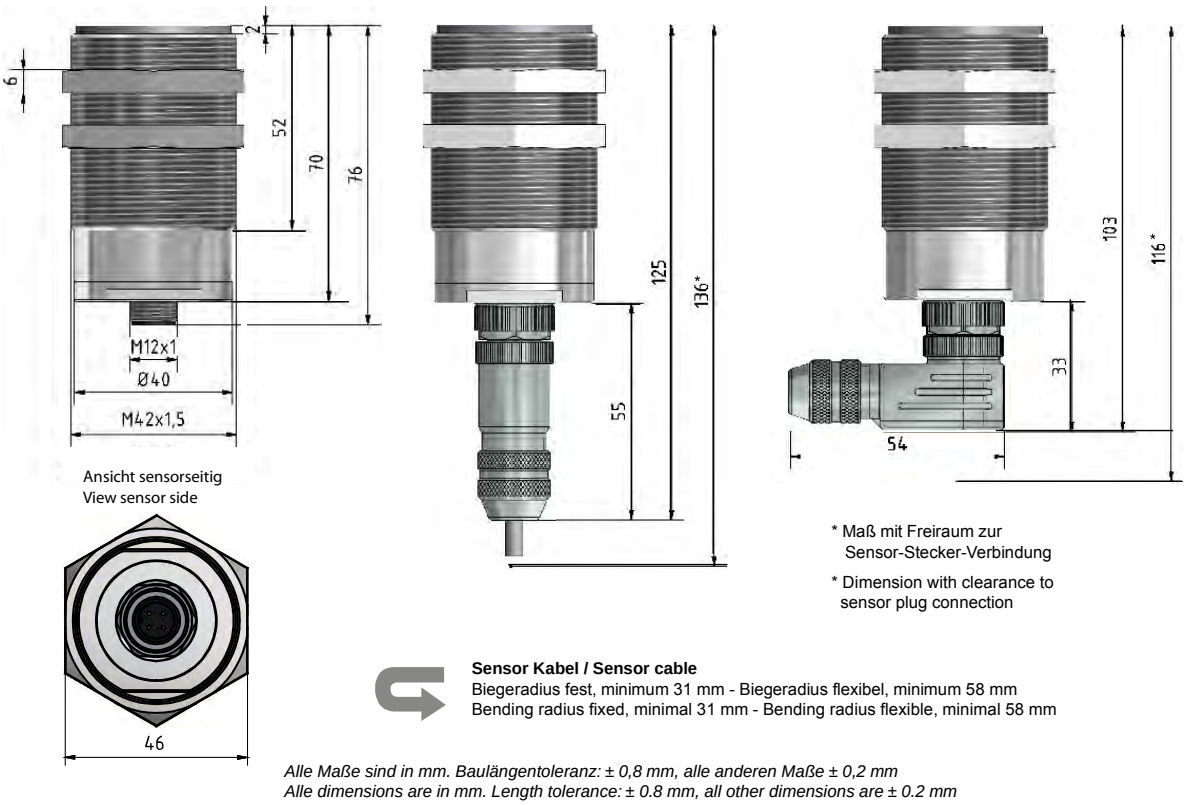


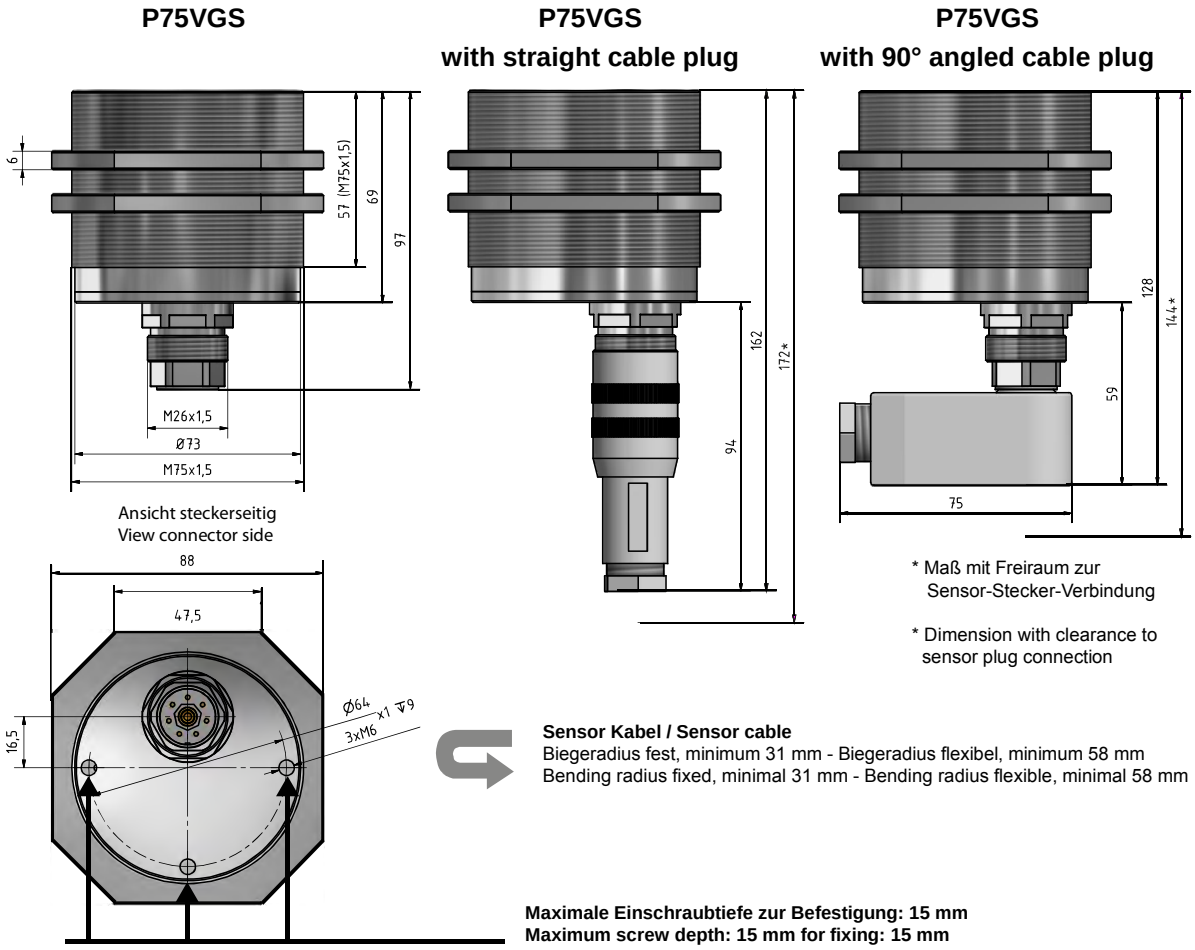
Fig. 3: Sensor P42AGS

Technical data		
Measuring range [2]:	0.2 – 4.0 mm	.008 - .16 inch
Ambient temperature:	0 – 60 °C	30 – 140 °F
Class of protection:	IP65	
Weight:	approx. 0.42 kg	0.93 lbs
Sensor cable:	pluggable	
Measurable ohmic resistances [2]:		
Pin 1-2:	Approx. 20 Ω	
Pin 4-3:		
Pin 1-4:	0 Ω	
Pin 2-3:		

1) Related to single sheet thickness

2) Pins are not connected to the sensor housing

2.3.3 Sensor P75VGS



Alle Maße sind in mm. Baulängentoleranz: ± 0,8 mm, alle anderen Maße ± 0,2 mm
Alle dimensions are in mm. Length tolerance: ± 0.8 mm, all other dimensions are ± 0.2 mm

Fig. 4: Sensor P75VGS

Technical data		
Measuring range [1]:	0.2 – 6.5 mm (0.2 – 8.0 mm) [2]	.008 - .25 inch (.008 - .31 inch)[2]
Ambient temperature:	0 – 60 °C	30 – 140 °F
Class of protection:	IP65	
Weight:	approx. 1.65 kg	3.64 lbs
Sensor cable:	pluggable	
Measurable ohmic resistances [3]:		
Pin 5-6:	Approx.15 Ω	

1) Related to single sheet thickness
2) with restriction
3) Pins are not connected to the sensor housing

2.4 Sensor performance data (Measuring time)

In the following diagram the response time of the control unit for measurement is shown depending in sensor type and number of sensors activated by the program. In addition the response time depends on the selected system parameter “measure”, the actual sheet thickness, the nominal sheet thickness and the upper limit (up).

System parameter „measure“

- **„fast“**
  The **actual** response time depends on the measured sheet thickness, the nominal thickness and the upper limit (up).
  The **maximum** response time is limited by the nominal thickness and the upper limit (see diagram and example).

  Advantage: maximum response time is low.

  Disadvantage: In case of measuring results larger than the double sheet threshold, the text “2-sheet” is issued instead of the actual measurement value.
- **„normal“**
  The **actual** response time depends on the measured sheet thickness.
  The **maximum** response time corresponds to the maximum sheet thickness.

Example 1:

- System parameter “Measure: **fast**”
- P75VGS sensor
- Measurement with one sensor
- Nominal thickness 1.0 mm = 100%
- upper limit (UP) 120% (=1.2 mm)

Actual sheet thickness = 1 mm	**actual** response time = 120 ms
Actual sheet thickness = 2 x 1 mm	**actual** response time = 130 ms
Actual sheet thickness = 7 x 1 mm (sensor on stack)	**actual** response time = 130 ms
The **maximum** response time is 130 ms (with “up“ = 120%). This means that after the signal "measurement start" was issued (max. 30ms), it will take 130 ms until the result of the measurement is available as output signal (with “up“ =120%).	

Example 2:

- System parameter “Measure: **normal**”
- P75VGS sensor
- Measurement with one sensor
- Nominal thickness 1.0 mm = 100%
- upper limit (UP) 120% (=1.2 mm)

Actual sheet thickness = 1 mm	**actual** response time = 120 ms
Actual sheet thickness = 2 x 1 mm	**actual** response time = 160 ms
Actual sheet thickness = 7 x 1 mm (sensor on stack)	**actual** response time = 400 ms
The **maximum** response time is 400 ms (with “up“ = 120%). This means that after the signal "measurement start" was issued (max. 30ms), it will take 400 ms until the result of the measurement is available as output signal (with “up“ =120%).	

Note The advantage in measuring time is significant, if the thickness of material is considerably lower than the measuring range of the sensor.

Note The sensor diagrams shown here are valid for systems with Hardware Version 5 and higher (from system no. 103237, from date 27.02.2006).

Having the “old” sensor diagrams (before HW version 5) available could be useful, e.g. for exchanging control units with “old” / “new” Hardware versions).

For this reason the “old” sensor diagrams are shown in the appendix.

Measuring time P30GS (Device-Hardware-Version 5 and higher)

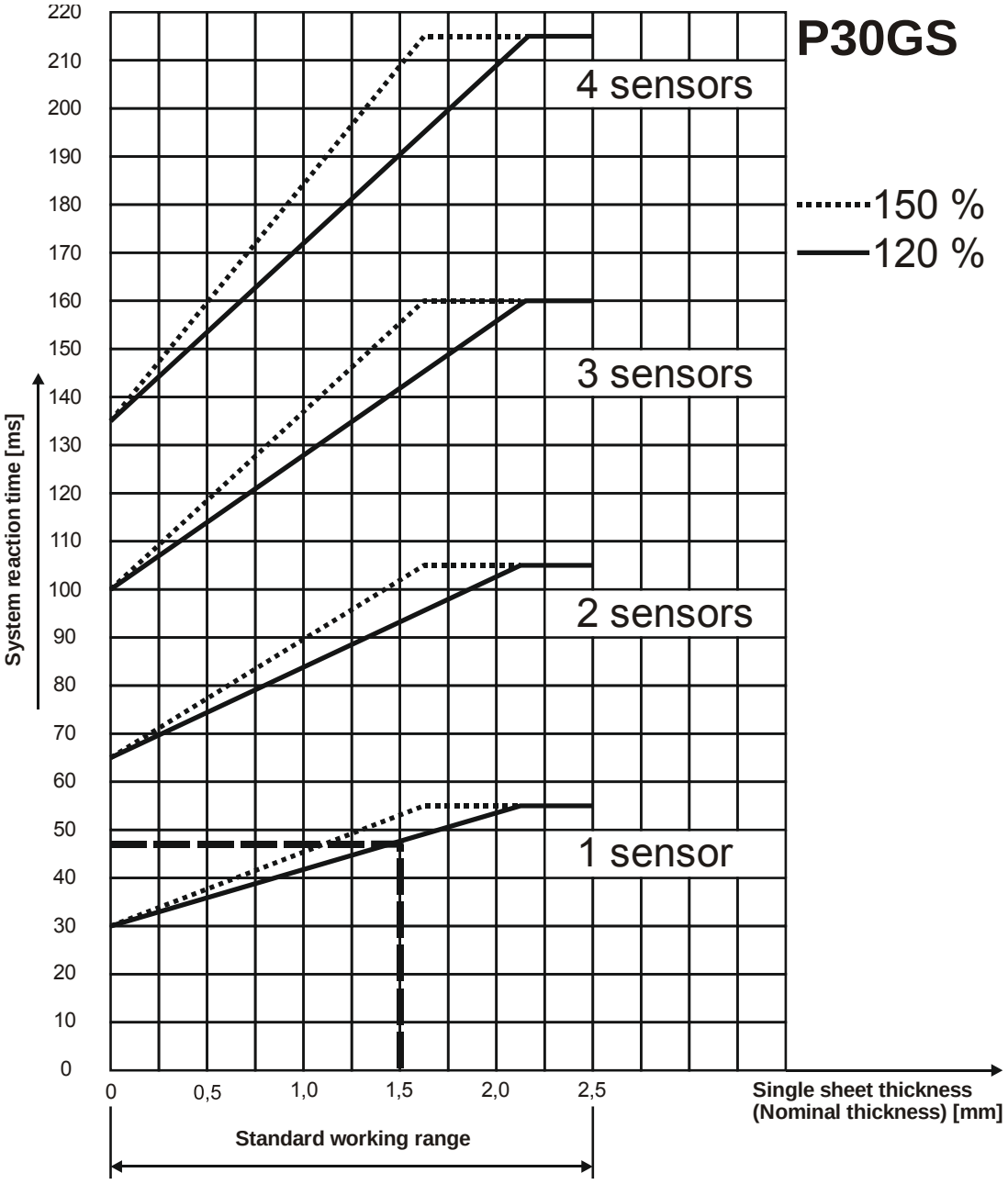


Fig. 5: System reaction time P30GS

Measuring time P42AGS (Device-Hardware-Version 5 and higher)

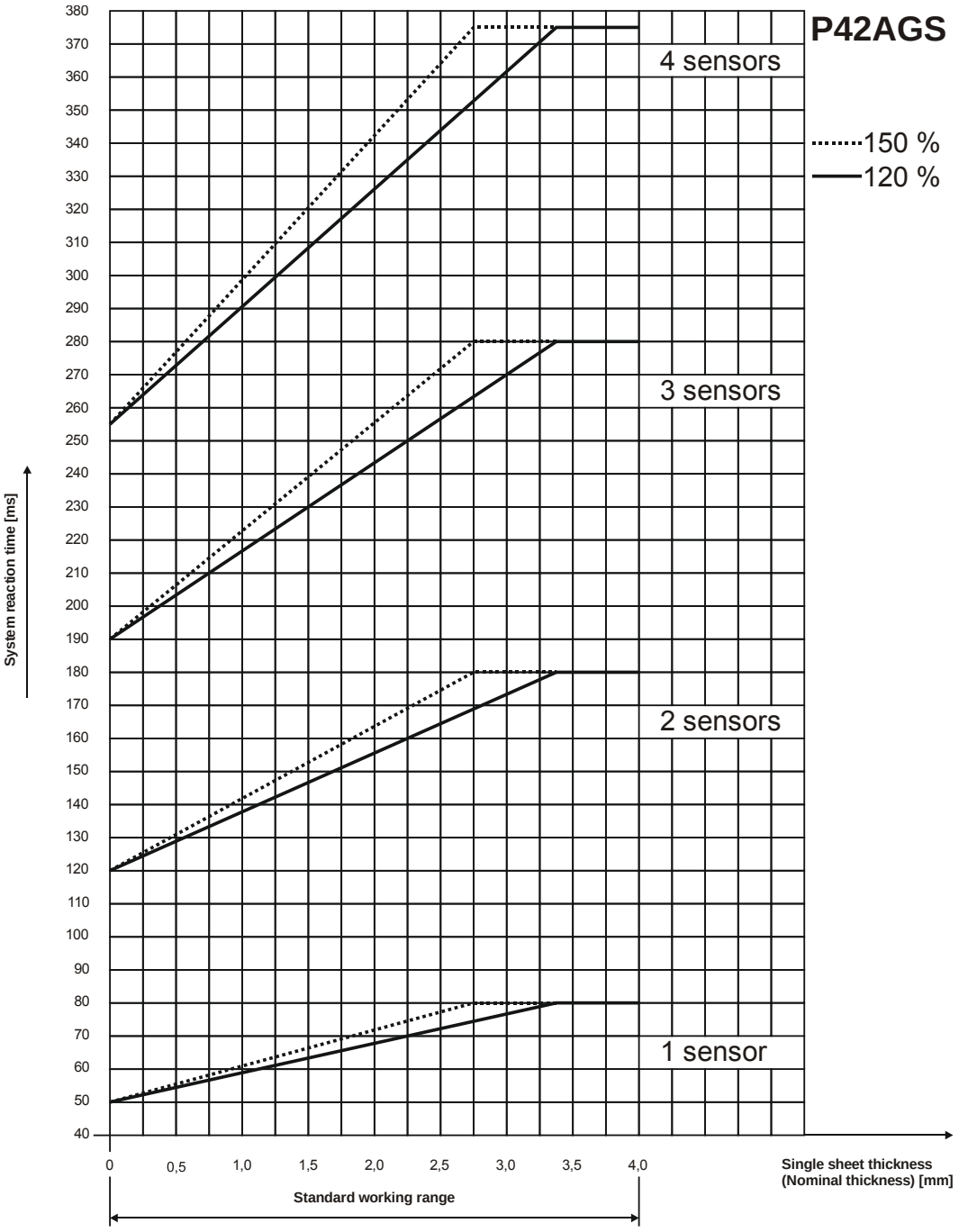


Fig. 6: System reaction time P42AGS

Measuring time P75VGS (Device-Hardware-Version 5 and higher)

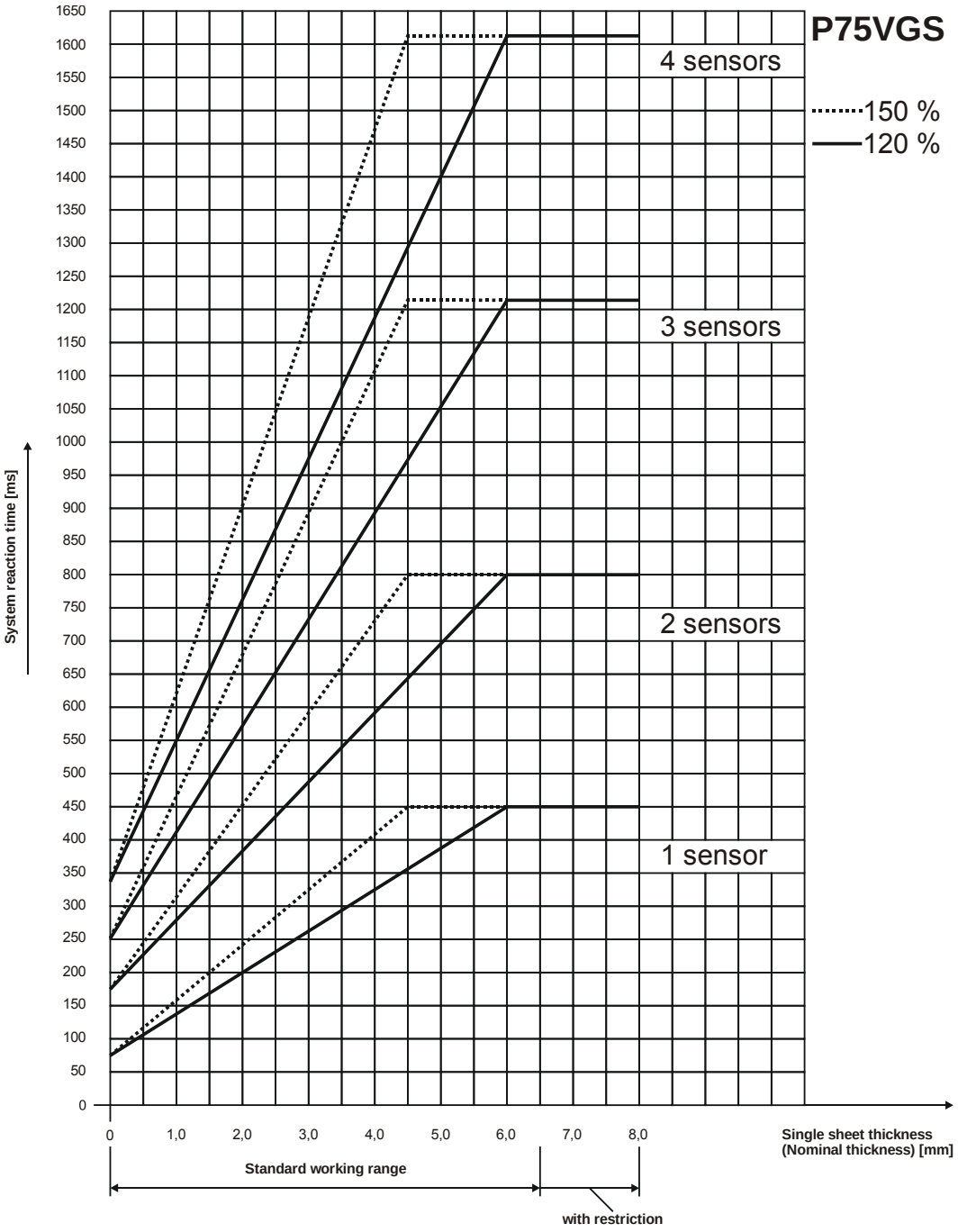


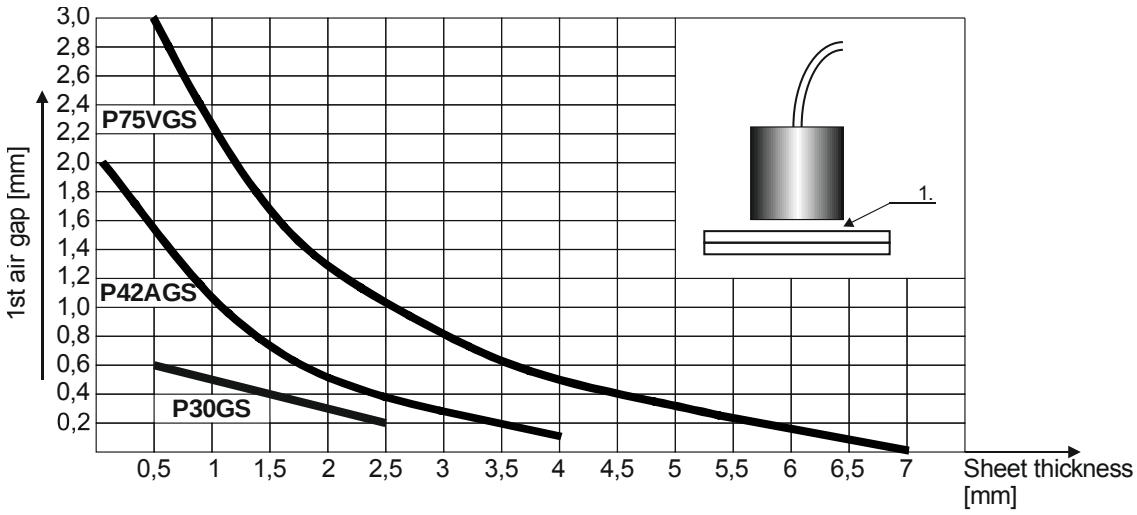
Fig. 7: System reaction time P75VGS

Double sheet thresholds above 120% reduce the performance of the system with regard to air gaps between the sheets and increase the systems reaction time according to the diagram.

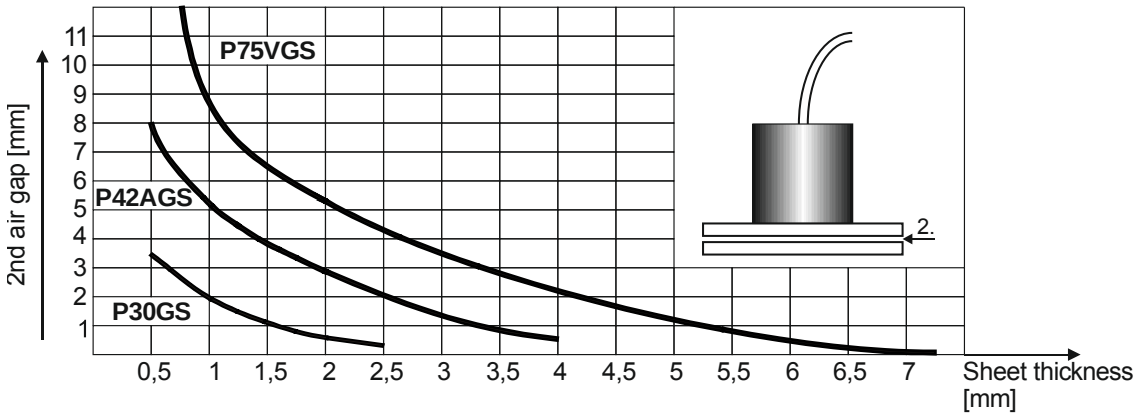
Air gaps influence the performance negatively because air has - in contrast to steel - a high resistance to the magnetic flux. Therefore, air gaps reduce the performance of the system considerably.
For reliable double sheet monitoring there should be no air gap between sheet and sensor and also between the sheets. The most reliable double sheet recognition results, if no air gaps exists. These aspects should be specifically observed when mounting the sensors. The influence of air gaps are described in the following diagrams.

Attention The performance data of both diagrams **cannot** be combined.

Max. air gap between sensor and first sheet (1st air gap)



Max. air gap between first and second sheet (2nd air gap)



The data apply for a set upper limit of 120%.

2.5 Sensor cables

Suitable cable types:

- Oilflex FD810CY 2 x 1mm^2
- Unitronic FDCP (TP) plus 1 x 2 x 1mm^2 (UL / CSA)

ROLAND ELECTRONIC uses according to standard the Oilflex FD810CY 2 x 1mm^2 cable.

- Both cables are oil-proof and suitable for drag chains
  - Bending radius fix use 31 mm
  - Bending radius flexible use 58 mm

Cable marking:

- for P30GS and P42AGS:
  - CPM12S-G (straight receptacle at the sensor)
  - CPM12S-W (right angle receptacle at the sensor)

- for P36GS, P42GS, P75GS, P75VGS,
  - CPS-GOIL (straight receptacle at the sensor)
  - CPS-WOIL (right angle receptacle at the sensor)

The cables are equipped with quick disconnect plug at the sensor side and with bootlace ferrules at the control unit side.

Note The sensor cable is an active component of the sensor technology. The technical data of the sensors is valid only if the cable specification is met. A shielded 2 x 1 mm² cable must be used. The cable length can be to up to 50 m. Following the rule "the shorter the better" generally leads to better measuring results.

Cable shields must be connected according to the wiring diagram (For details refer to chapter 5.4) and should have **no additional connections.**

Note Damaged cable insulation can cause further (unwanted) electrical connections.

Instruction: Leading a cable through EMC gland

- Remove the screw cap and slide it over the cable.
- Remove cable sleeve by 20 mm length (see figure below, step A).
- Guide the cable through the gland until the shield reaches the inner edge of the gland (see figure below, step B + C and figure below right).
- After initial opening, screw the cap back into place and fasten with a 20 mm spanner until a noticeable resistance is felt. Do not force. (see figure below, step D).

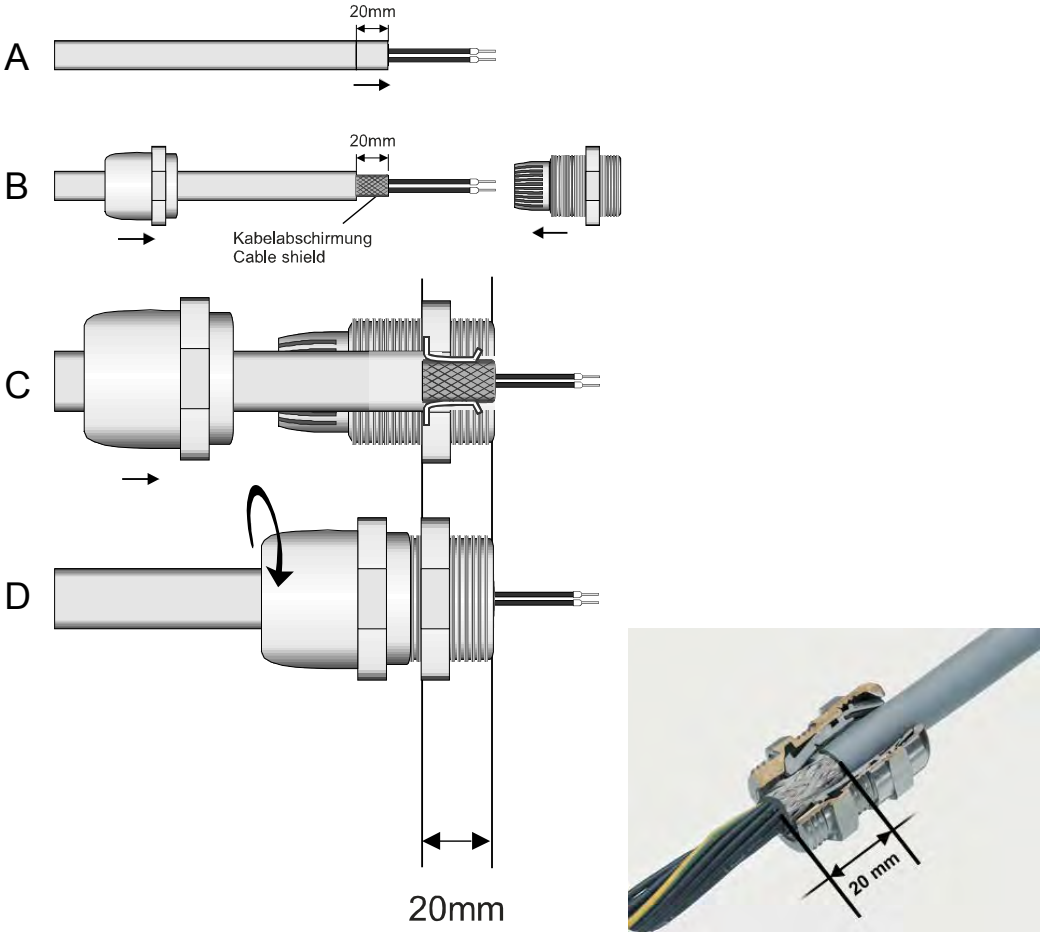
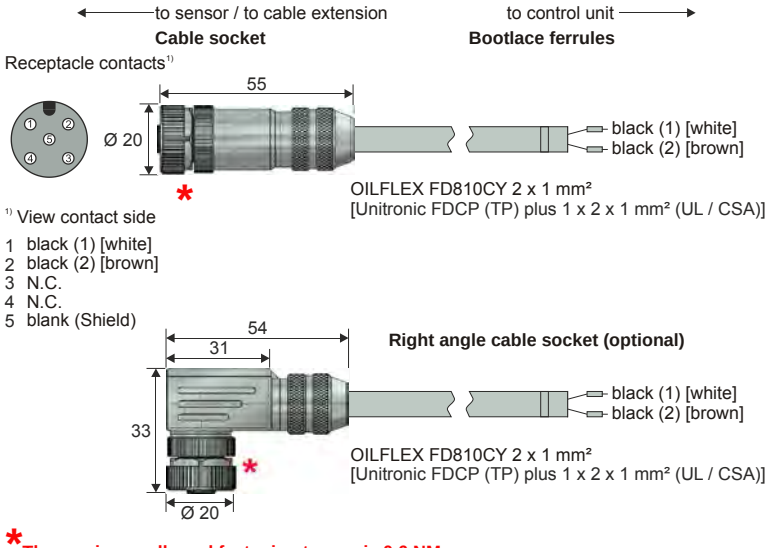


Fig. 8: Connecting cable to PC-gland

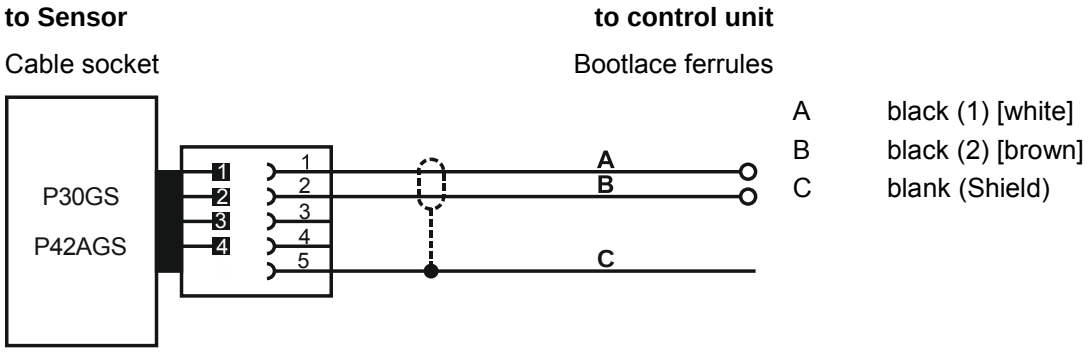
2.5.1 Sensor cables for direct connection of sensor

2.5.1.1 Cable CPM12S for sensors P30GS and P42AGS



* **The maximum allowed fastening torque is 0.6 NM**
- It is not allowed to fasten the locking screw with pliers, pipe wrenches or similar!
- We request to tighten the locking screw by hand or to use a fastening tool with torque control e.g. Binder Tool 713-825, Binder Order no. 07 0079 000
http://www.binder-connector.de/de/zubehoer/82149

Fig. 9: Sensor cable CPM12S



Cable types for sensors P30GS and P42AGS (order data):

- CPM12S-G (straight receptacle at the sensor)
- CPM12S-W (right angle receptacle at the sensor)

The standard length is 5 meter. Cable length up to 50 meter made to order, longer cables please enquire.

Note In particular with larger lengths the sensor cable should not be placed directly adjacent to cables with large noise potential.

The cable is drag cable suitable and oil resistant.
Cable type:

- Oilflex FD810CY 2 x 1mm^2
- Unitronic FDCP (TP) plus 1 x 2 x 1mm^2 (UL / CSA)

2.5.1.2 Sensor cable CPS for sensors P36GS, P42GS, P75GS and P75VGS

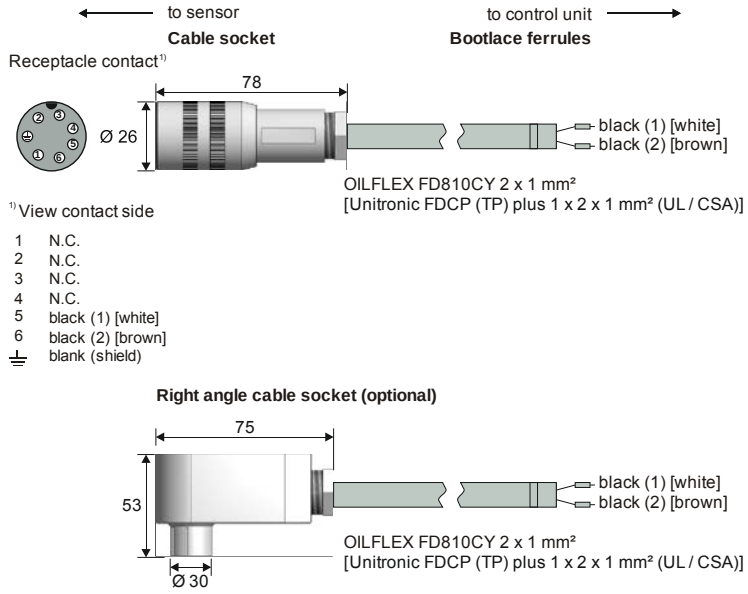
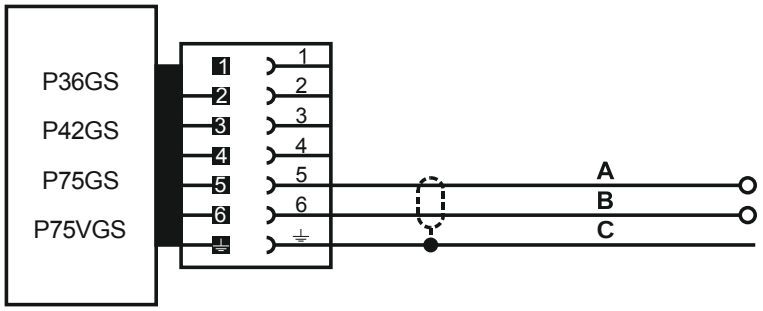


Fig. 10: Sensor cable CPS

to Sensor **to control unit**

Cable socket Bootlace ferrules



A	black (1) [white]
B	black (2) [brown]
C	blank (Shield)

Cable types for the P36GS, P42GS, P75GS and P75VGS sensor (order data):

- CPS-GOIL (straight receptacle at the sensor)
- CPS-WOIL (right angle receptacle at the sensor)

The standard length is 5 meter. Cable length up to 50 meter made to order, longer cables please enquire.

Note In particular with larger lengths the sensor cable should not be placed directly adjacent to cables with large noise potential.

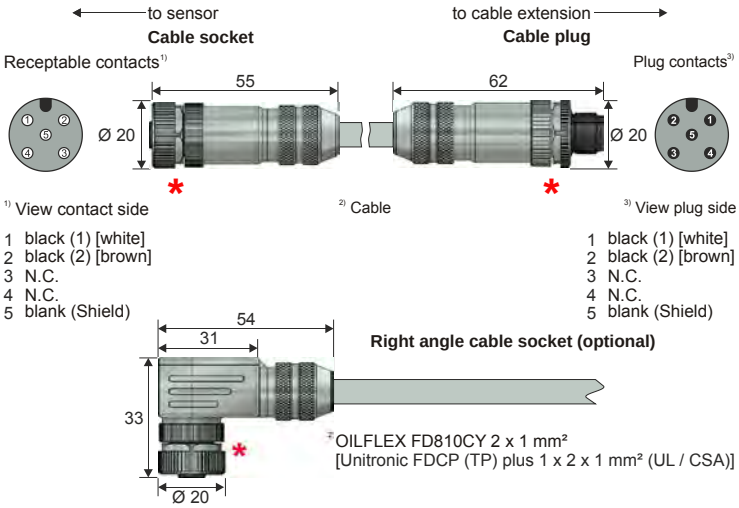
The cable is drag cable suitable and oil resistant.
Cable type:

- Oilflex FD810CY 2 x 1mm^2
- Unitronic FDCP (TP) plus 1 x 2 x 1mm^2 (UL / CSA)

2.5.2 Sensor cable extensions

A sensor cable extension can be made easily. For this a CPM12S-G cable is always needed. In addition, depending on the sensor, either the following cables SM12CPM12S-GG/SM12CPM12S-GW for P30GS and P42AGS or SM12CPS-GG/SM12CPS-GW for P36GS, P42GS, P75GS and P75VGS

2.5.2.1 Sensor cable extension SM12CPM12S for sensors P30GS and P42AGS



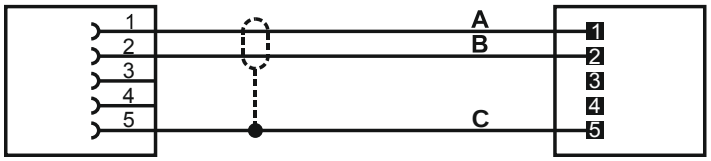
The maximum allowed fastening torque is 0.6 NM

- It is not allowed to fasten the locking screw with pliers, pipe wrenches or similar!
- We request to tighten the locking screw by hand or to use a fastening tool with torque control e.g. Binder Tool 713-825, Binder Order no. 07 0079 000
  http://www.binder-connector.de/de/zubehoer/82149

Fig. 11:Cable extension SM12CPM12S

to Sensor **to cable extension**

Cable socket Cable plug



A black (1) [white]
B black (2) [brown]
C blank (Shield)

Cable types for the P30GS and P42AGS sensor (order data):

- SM12CPM12S-GG (straight receptacle at the sensor)
- SM12CPM12S-GW (right angle receptacle at the sensor)

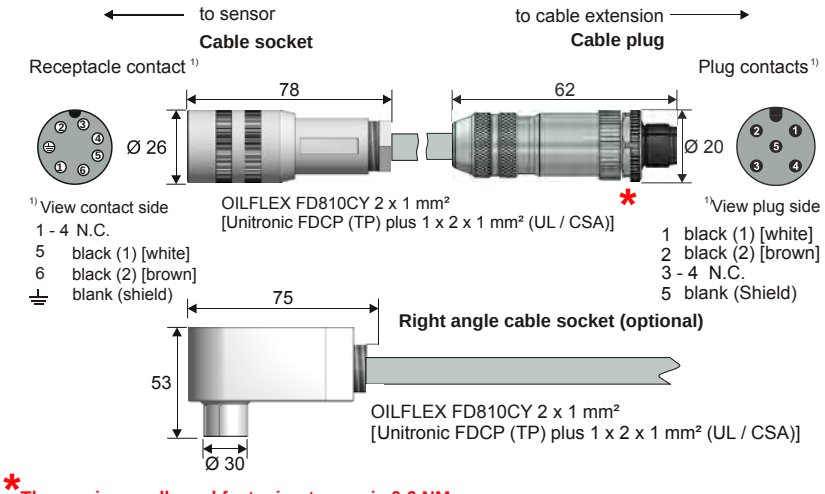
The standard length is 5 meter. Cable length up to 50 meter made to order, longer cables please enquire.

Note In particular with larger lengths the sensor cable should not be placed directly adjacent to cables with large noise potential.

The cable is drag cable suitable and oil resistant.
Cable type:

- Oilflex FD810CY 2 x 1mm^2
- Unitronic FDCP (TP) plus 1 x 2 x 1mm^2 (UL / CSA)

2.5.2.2 Sensor cable extension SM12CPS for P36GS, P42GS, P75GS and P75VGS



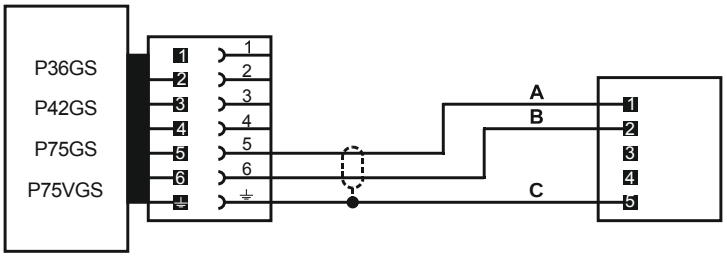
***The maximum allowed fastening torque is 0.6 NM**

- It is not allowed to fasten the locking screw with pliers, pipe wrenches or similar!
- We request to tighten the locking screw by hand or to use a fastening tool with torque control e.g. Binder Tool 713-825, Binder Order no. 07 0079 000
http://www.binder-connector.de/de/zubehoer/82149

Fig. 12: Cable extension SM12 CPS

to Sensor **to cable extension**

Cable socket Cable plug



A	black (1) [white]
B	black (2) [brown]
C	blank (Shield)

Cable types for the P36GS, P42GS, P75GS and P75VGS sensor (order data):

- SM12CPS-GG (straight receptacle at the sensor)
- SM12CPS-GW (right angle receptacle at the sensor)

The standard length is 5 meter. Cable length up to 50 meter made to order, longer cables please enquire.

Note In particular with larger lengths the sensor cable should not be placed directly adjacent to cables with large noise potential.

The cable is drag cable suitable and oil resistant.
Cable type:

- Oilflex FD810CY 2 x 1mm^2
- Unitronic FDCP (TP) plus 1 x 2 x 1mm^2 (UL / CSA)

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3 System description

Flexible production systems in the sheet processing industry require automated, reliable double sheet detection in order to protect presses and other processing machinery from damage by multiple sheets. The E20 was specifically developed for this technical environment.

The E20 is based on the product platform R1000 and consists in the standard version of three components:

- Control unit
- One sensor for ferrous materials
- Sensor cable

3.1 Measurement principle

The double sheet detector is based on the electromagnetic principle. It monitors ferromagnetic sheets with single sided sensors and exerts forces during the monitoring process only. A change of the sheet thickness results in a change of induction. The system calculates the sheet thickness from this change. Corresponding to the pre-set limits 0-sheet, 1-sheet or 2-sheets signals are generated.

3.2 General hints for process security

The process security of the system is influenced by the following factors:

- the stability of the measuring values
- the setting of under-gauge threshold and over-gauge threshold
- the evaluation of the status signals

Stable measuring conditions will result in stable measuring results. For measuring procedures with single-sided contacting sensors the **air gap** between sensor and material surface is a decisive criterion.

Air gaps varying from measurement to measurement will cause varying measuring results. Basically, such situations are bad, since in such cases the user is inclined to decrease the under-gauge threshold and to increase the over-gauge threshold. On doing so, the user puts up with the drastically increasing risk of not detecting a double sheet.

The following external factors decisively influence the stability of measuring results and need to be considered for operation of a double sheet detector:

- the air gap between sensor and material surface
- the magnetical characteristics of the material
- the tolerance in material thickness

From this some simple rules derive, which enable a large degree of process security when abided by:

- **Always care for good contact of the sensor with the material!**
- **Use separate programs to measure different sheet thickness (and alloy)!**
- **Adjust the switching thresholds as tight as possible!**

Furthermore it is necessary that the control checks all status signals of the E20, also the 0-sheet signal. While measuring, only the 1-sheet signal may occur. If 0-sheet or 2-sheet occurs, the measured sheet may not be transported on. In such cases, the sheet will usually be deposited, re-picked and measured again.

- **The control needs to evaluate all status signals !**

Checking-up through the 0-sheet signal is to assure that a sheet really is in front of the sensor during measuring. If 0-sheet occurs while measuring, the measurement is not correct. For example, a defective sensor holder might prevent the sensor from contacting the sheet. Monitoring the sheet thickness would then only be performed apparently.

In case of double sheet fatal consequences could then result.

3.3 Control unit

The E20 is based on the product platform R1000.

Major features of the control unit:

- Programmable for 255 different sheet thicknesses and materials
- Calibration by a Teach-In procedure
- Digital display of sheet thickness and operating parameters
- Monitoring of over gauge and under gauge limits
- Monitoring of operating voltage and cable break as well as shortcut at sensor cable
- Optocoupler for direct I/O control via the PLC for fast measurement operations
- Data backup via serial interface

3.4 Parameters of the control unit

The E20 provides for extensive configuration. So, different customer requirements can be served. Configuration is performed by setting system parameters and program parameters. System parameters are set only once on commissioning, and will then remain unchanged. Program parameters contain items which are material and job depending, and enable individual adaptation to the measuring task.

3.4.1 System parameters

“Language“
System languages available for operating the unit via display and keyboard:

- German
- English
- Spanish
- Italian
- French

“Sensor type“
At the time of editing the sensor types P30, P36, P42, P42A, P75 and P75V, are available. For those sensors characteristic curves for linearization purposes exist.

“Dimension“
Switches the indication of the thickness values on the display between mm ⇔ inch.

"Measurement operation"
Sets how the measuring is to be triggered. The following modes are available:

- Demo
  This mode of operation is intended for equipment demonstrations, but not for normal process operation. The system executes measurements continuously. The repetition rate of the measurement depends on the type of sensor:
  1 second for P42, P30, P42A, P75V; 2 seconds for P36; 4 seconds for P75.
- Ext. Single (default setting)
  Here a single measuring is performed. For doing so, the signal "Measuring start" must be externally fed. Another measuring requires a new flank of the "Measuring start" signal.
- Ext. Permanently
  The system executes measurements, as long as the "Measurement start" signal is applied via the external PLC input.
  The repetition rate of the measurement depends on the type of sensor:
  0.5 seconds for P42, P30, P42A, P75V; 1 second for P36; 2 seconds for P75.

"Baud rate"
Baud rate of the RS232 interface for data communication.

"CLR parameter (Clear Program Parameter)"
Deletes all program parameters. For doing so, the parameter needs to be set to "yes". Executing the command requires several minutes, since the program memory will completely cleared. All program parameters will be reset to the default values and existing teach-in data will be deleted. Using this function only makes sense if a unit is to be newly used for another machine.

"Password yes/no"
Switches the password request on/off. If the password request is set "on", the system / program parameters can only be changed after the password has been entered.

"Output level"
Sets the output voltages for outputs 0-,1-,2-sheet. Default setting is 24 VDC.

"External Alignment"
Sets whether an external teach-in / zero adjust is to be possible. If "yes" is set, the PLC can trigger the procedure via the inputs "Teach-In 0-, 1-sheet". Default setting is "no".

- **The external alignment may only be performed under supervision of an operator**.

"Version"
Indication of the version of the unit.

- **Factory setting, do not change !**

"Number of sensors"
Defines the number of connected sensors. Those sensors are then available for measuring.

"Sensor selection"
Selection of the sensor by program or via the inputs A and B.

“Measuring fast/normal“
For time-critical applications the measuring time can be slightly shortened. If “fast“ is selected and double sheet occurs, the measuring is terminated on reaching the upper switch limit, and the information “2-sheet“ is released. If “normal“ is selected, the measuring will be executed to the end and the measured thickness will be displayed.

“E20-x-x(1)“ or E20-4P-x-x(x)
“SW:xx HW:xx“
Identification of unit. Needs to be at hand for telephone support.

3.4.2 Program parameters

The sensor is operated with an electro magnetical method – called “P“ measurement. For the P measurement a compensation curve for linearization exists. The compensation curve fits to ST37 steel. Other steel alloys respectively magnetical materials deviate from this curve. This causes measuring results which can deviate for more than 5% from the real sheet thickness. In such cases it is useful to calibrate the unit (later merely called “Teach-In“).

In order to avoid frequent Teach-In procedures for different materials and thicknesses, the unit provides for 255 program memories. Every such memory consists of a data set with the following parameters.

“Sensor number“
Entry of the selected sensor (/sensor sequence) for multi-channel systems (e.g. E20-4P…).

“Nominal measure“
Changes the nominal measure. It can be shown in mm or inch.
Default setting either 0.03mm or 0.001 inch.

“TO“ ***and*** *“TU“*
Changes the limit values for the lower and upper switching threshold. The values can be entered either in % or in mm/inch. On these thresholds the status signals depend. In a window comparator the three signals will be generated from the measuring signal.

The signal “0-sheet“ is generated when the measuring signal falls short of the lower switching threshold. The lower switching threshold TU can be set from 1...99%. The signal “2-sheet“ is generated when the upper switching threshold is exceeded. The upper switching threshold TO can be set from 100...150%. If the measuring value is within both limits, the signal “1-sheet“ is generated.

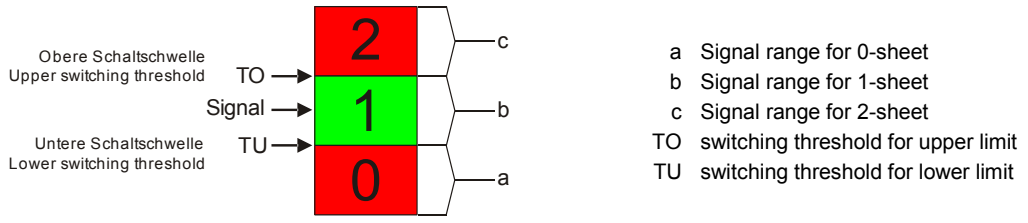


Fig. 13: Visualisation of switching thresholds

The preset values (TO=120% respectively TU=80%) should only be changed under the following aspects:

1. the 1-sheet range becomes restricted, since the measuring values are very stable. Thus the process security increases. The restriction can be done by decreasing the TO value, by increasing the TU value, or both.
2. the 1-sheet range becomes extended for a time. Thus the process security decreases. Such an action should only be performed in exceptional cases; the user has to decide about that. Extending the 1-sheet range is commonly considered due to mechanical problems (air gap, uneven sheets). This measure prevents the machine from standstill, until the mechanical problem is solved.

“Zero adjust“
Before commissioning a new system, after having exchanged a sensor or a sensor cable or a control unit, a zero adjust must be performed. This zero adjust eliminates the variation of the sensors. The sensors can be zero adjusted “separately“ or “all in one stroke“.

- **The zero adjustment is valid for all programs!**

“Teach-In“
Because of the linearization of the sensor it is possible to measure with factory calibration in many applications. However, the prerequisite for such measurement are:

- Use of the preset thresholds „low“ (lower limit = 80%) and „up“ (upper limit = 120%)
- Correctly executed zero adjustment

It is, however, possible that the measurement is not satisfactory: Then the measured thickness values under normal operating conditions deviate sufficiently to generate nuisance trips. If, for example among the measured value is too low or too high, the control unit generates an under gauge signal (0-sheet) or an over gauge signal (2-sheet). As a consequence the transportation of the sheet is stopped by the PLC - even though no obvious fault has occurred.

Such a deviation of the measured value can have different causes, for example:

a) the measured sheet actually has an under gauge or over gauge thickness

b) there is air gap present between the sensor and the sheet surface

c) the measured material differs in its magnetic properties from the reference material ST37 (regular low carbon steel), the linearization curve does not fit the material

In the cases of a) and b):

The causes have to be eliminated; otherwise the measurement will not be satisfactory.

In the case of c):

Here the Teach-In calibration has to be executed with the material to be processed. After the Teach-In procedure the measurements will be more precise with the processed material. The calibration applies only to the selected program.

3.5 Application samples

The following are two typical application examples for the use of the E20.

If more than one sensor is required, then the E20-4P is a good choice. Four sensors of the same type can be connected to this control unit.

These sensors cannot be operated simultaneously, but only sequentially. The switching (sequencing) can be made as follows:

a) by program switching
b) by external sensor selection A/B
c) with the so-called sequencer mode

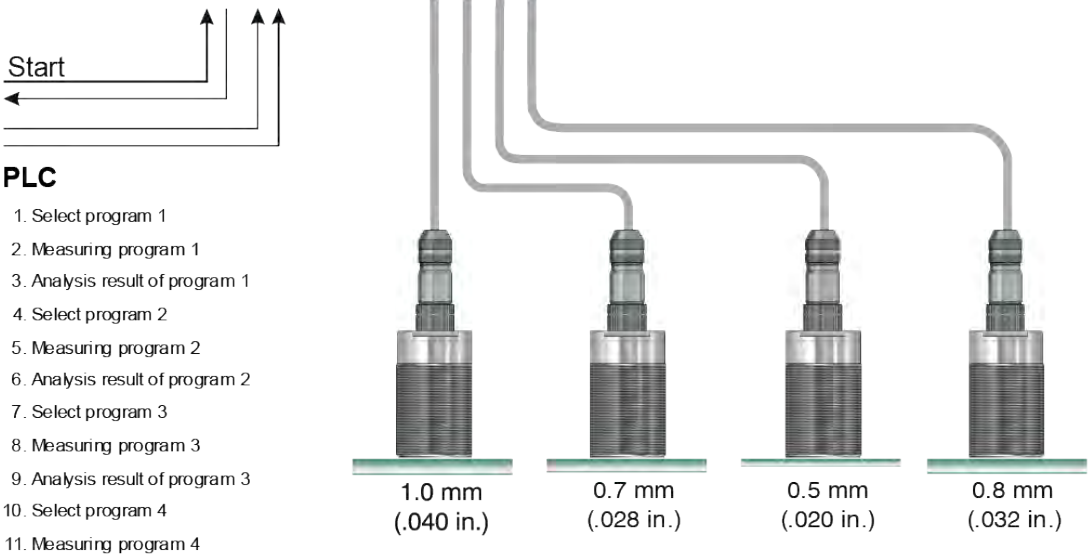
Method a)

Meaningful, if the sheets to be monitored by the various sensors have different sheet thicknesses. Also suitable if the nominal thickness changes from cycle to cycle.

For this procedure the respective parameter set (program) must contain nominal thickness and sensor number. The selection of the program is then performed by the PLC.

Disadvantage: Relative long time required for switching the program via the parallel interface.

Program	Thickness	Sensor
1	1.0 mm	1
2	0.7 mm	2
3	0.5 mm	3
4	0.8 mm	4



PLC

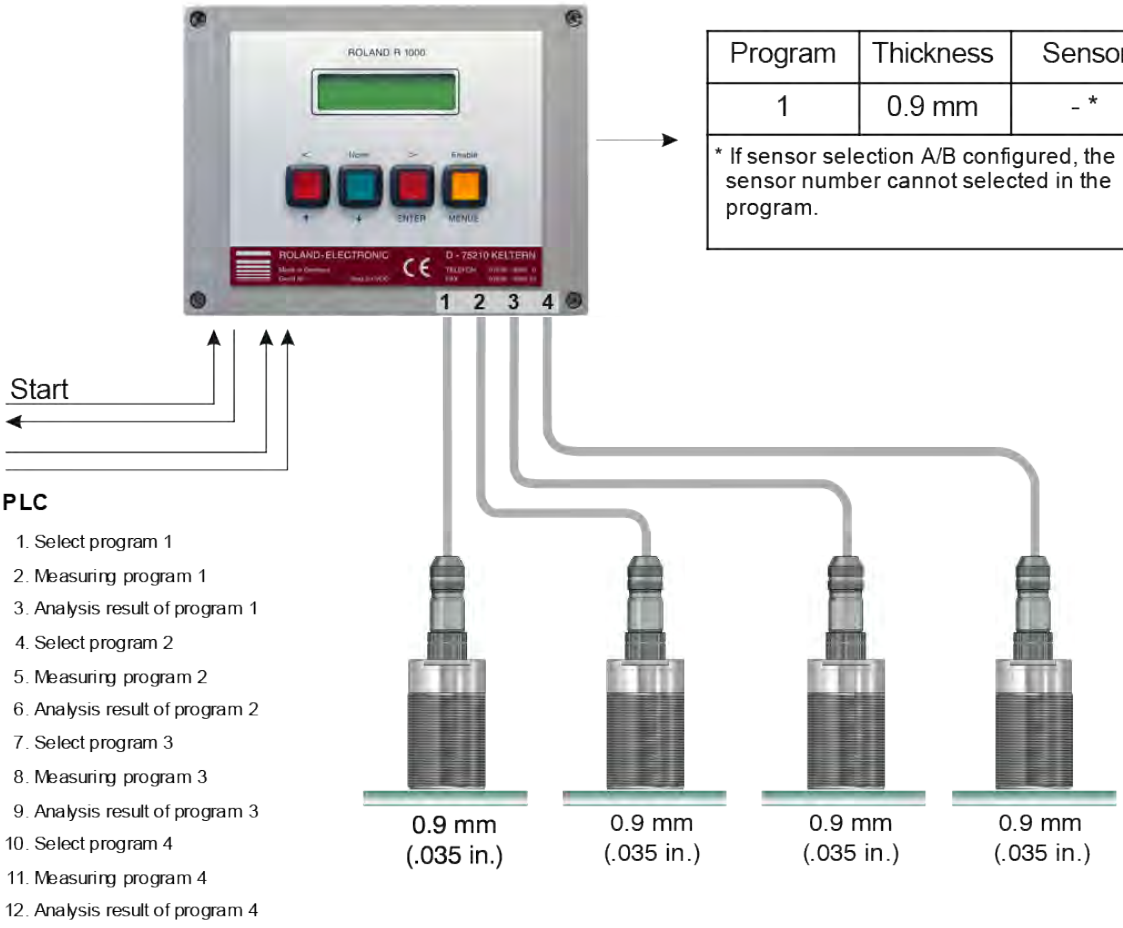
1. Select program 1
2. Measuring program 1
3. Analysis result of program 1
4. Select program 2
5. Measuring program 2
6. Analysis result of program 2
7. Select program 3
8. Measuring program 3
9. Analysis result of program 3
10. Select program 4
11. Measuring program 4
12. Analysis result of program 4

Note Sensor selection via "program" must be selected in the system configuration.

Method b)

Advantageous when measuring the same sheet thickness with each sensor. Each measurement sensor is addressed via the inputs A/B of the control unit. In addition, the result of each measurement is available as output.

Note Advantage: Substantial time saving compared to program switching.



Program	Thickness	Sensor
1	0.9 mm	- *

* If sensor selection A/B configured, the sensor number cannot selected in the program.

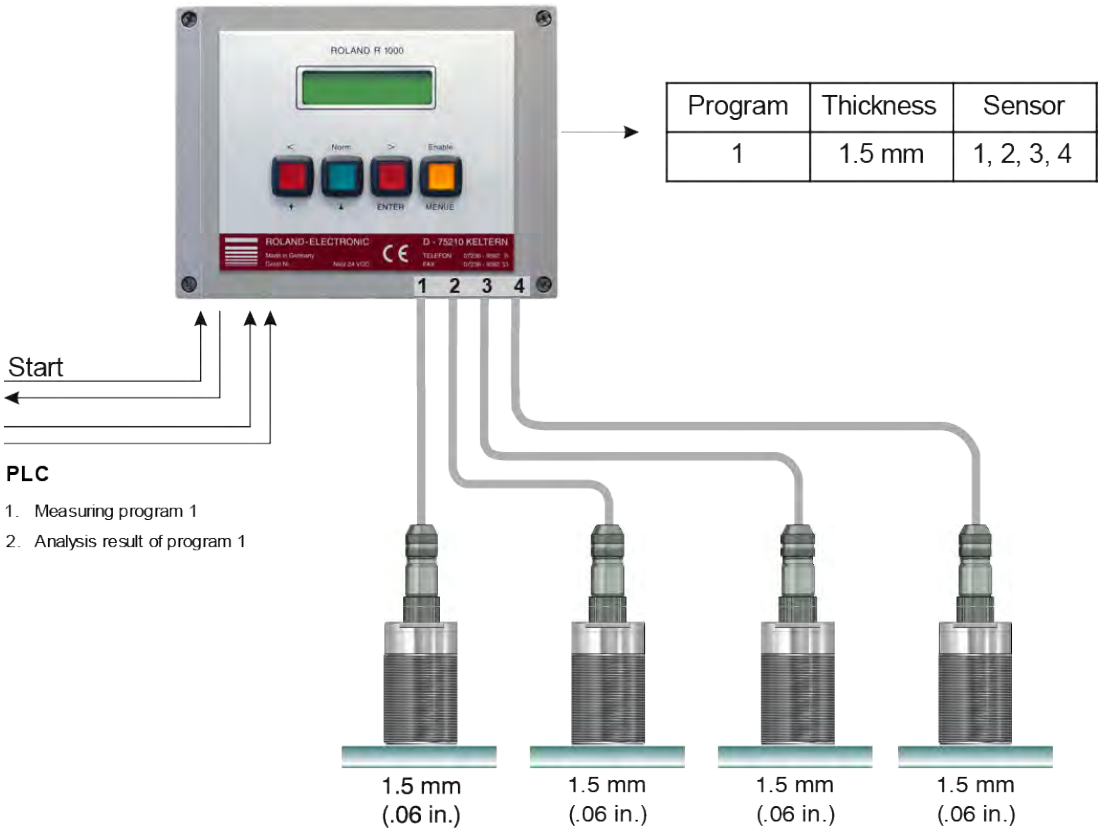
Note Sensor selection via "external (inputs A and B)" must be selected in the system configuration.

Method c)

Advantageous when measuring the same sheet thickness with each sensor. In contrast to the method b) addressing of each sensor is done automatically by the E20. The sequence of the sensors is predetermined in the program.

Note Advantage: Very fast measurements are possible, smaller software effort on the PLC side.

Only one output is generated for connected sensors. The summary output is formed with the following priorities: 2-sheet before 0-sheet, 0-sheet before 1-sheet.



Program	Thickness	Sensor
1	1.5 mm	1, 2, 3, 4

Note To activate this method sensor selection has to be done via "program" in the system configuration. A separate selection of the "sequencer mode" is not required.

The sequence of addressing the sensors is done in the program parameters section under "sensor number".

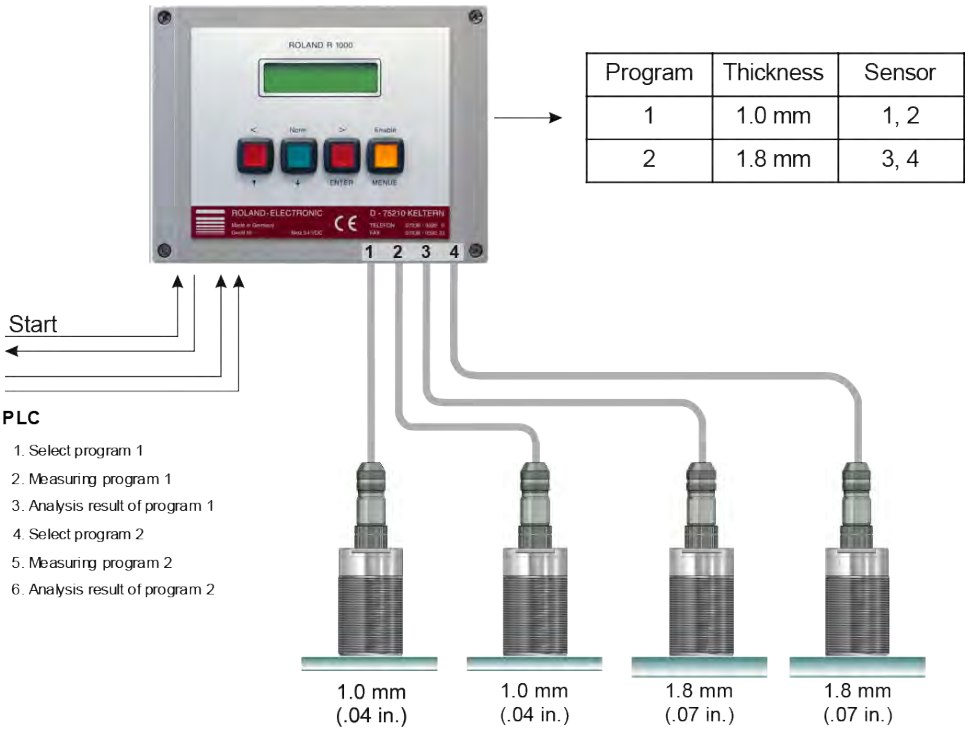
In addition to the selection by sensor number (see “11.3 System Configuration - number of sensors"), the following sequences for the selection are available:

Sequence
Sensor 1 + sensor 2
Sensor 1 + sensor 3
Sensor 2 + sensor 3
Sensor 1 + sensor 2 + sensor 3
Sensor 1 + sensor 4
Sensor 2 + sensor 4
Sensor 3 + sensor 4
Sensor 1 + sensor 2 + sensor 4
Sensor 1 + sensor 3 + sensor 4
Sensor 2 + sensor 3 + sensor 4
Sensor 1 + sensor 2 + sensor 3 + sensor 4

Note If all four sensors are activated, each possible sequence with only 2 or 3 sensors can be selected. On the other hand the sequences for example for the sensor number 4 cannot be selected, if only 3 sensors are activated.

The following rule applies: The highest sensor number in the sequence determines the minimum number of activated sensors.

Note The sequence is a program parameter, therefore methods a) and c) can form a practical combination, for example, two stacks of sheet for instance left and right blanks with different thicknesses can thus be checked for double sheet.



Program	Thickness	Sensor
1	1.0 mm	1, 2
2	1.8 mm	3, 4

4 Mounting

The mounting of the Double Sheet Detector R1000 E20 determines the measurement accuracy and the reliability of operation. The system was designed for operating in rough industrial environments. However, the following mounting instructions should be observed in order to minimize mechanical, thermal, and electromagnetic influences on the operation.

4.1 General mounting instructions

The enclosure for wall mounting meets IP65 and is designed for mounting the enclosure close to the sensor location. This results in the use of shorter sensor cables with a corresponding lower exposure to electromagnetic noise and could therefore result in better measurements.

The control unit should be installed in locations where no vibration exists and no additional heat is transferred into the system (even better reduce the heat in the control unit). In addition the control unit should be installed in such a fashion that it can be easily opened for service purposes. During the operation the control unit and the sensors should be under visual control of the operating personnel.

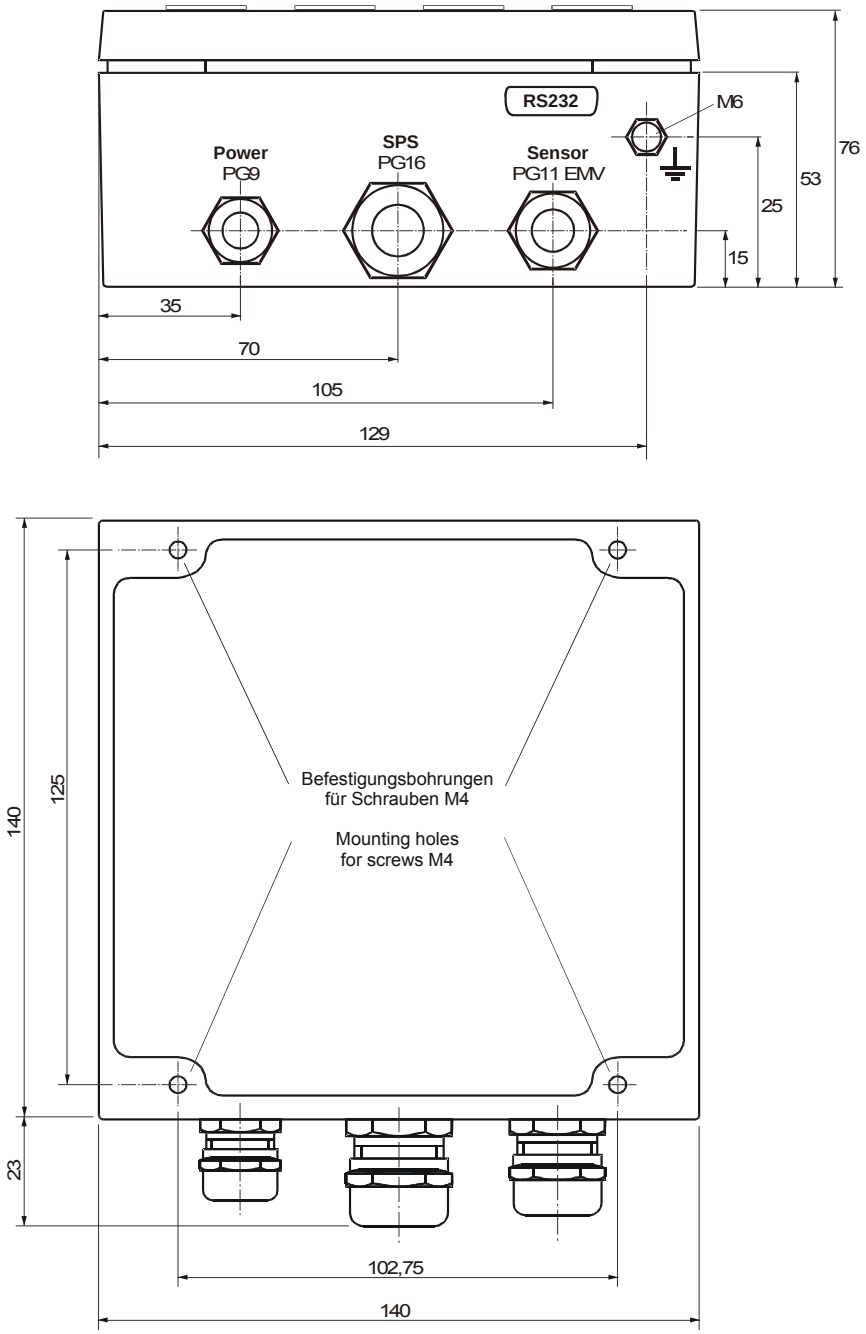
Attention Strong vibrations and additional heat can damage the control unit.

In case of panel or operator consoles the front panel version should be used.

4.2 Dimensions of the system

4.2.1 System in industrial enclosure

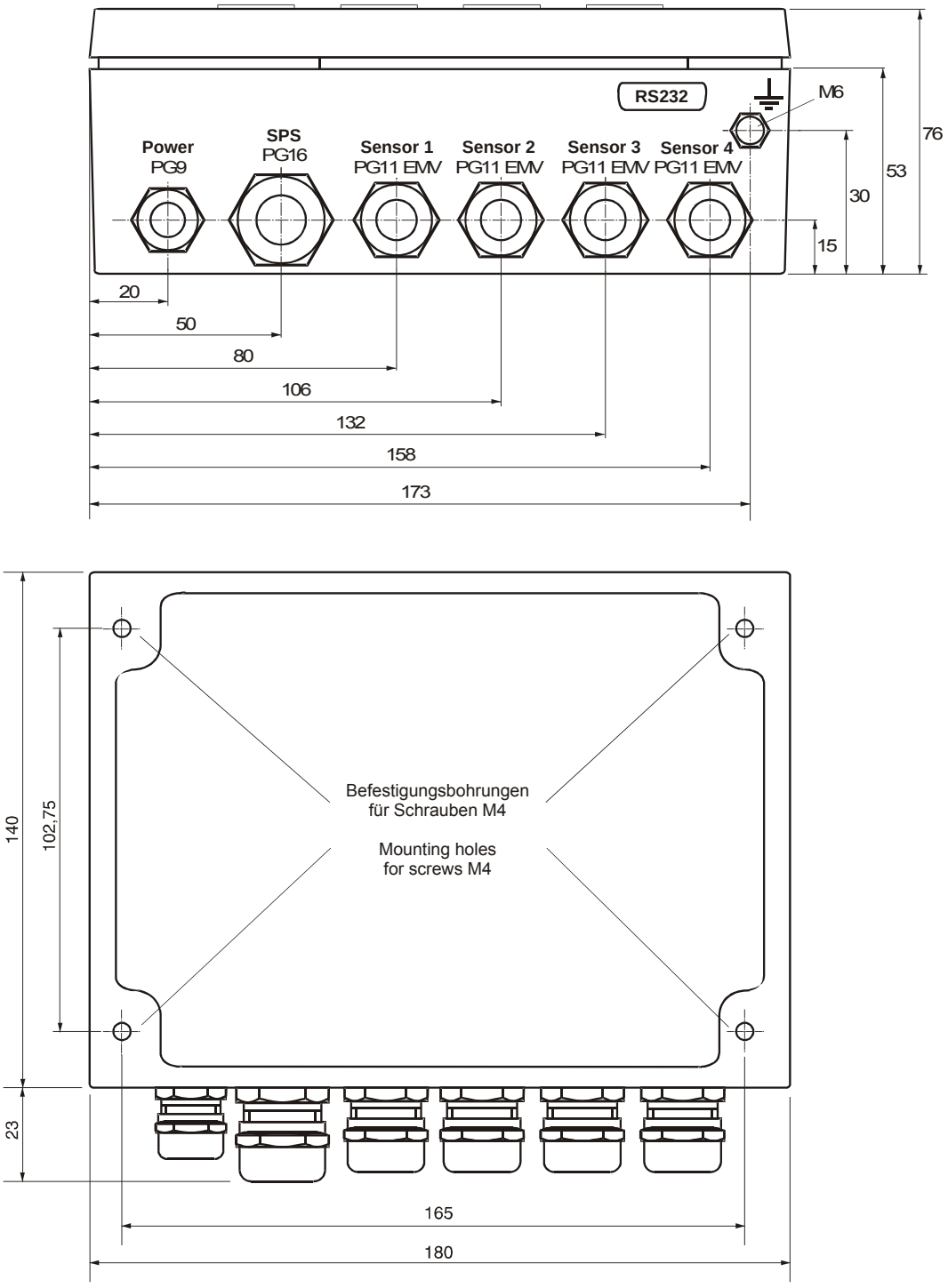
Version E20 for one sensor (standard version)



All dimensions are in mm. Tolerance: ±0.2 mm

Fig. 14: Dimensions of the wall mount enclosure - connection view

Version E20-4P for up to four sensors

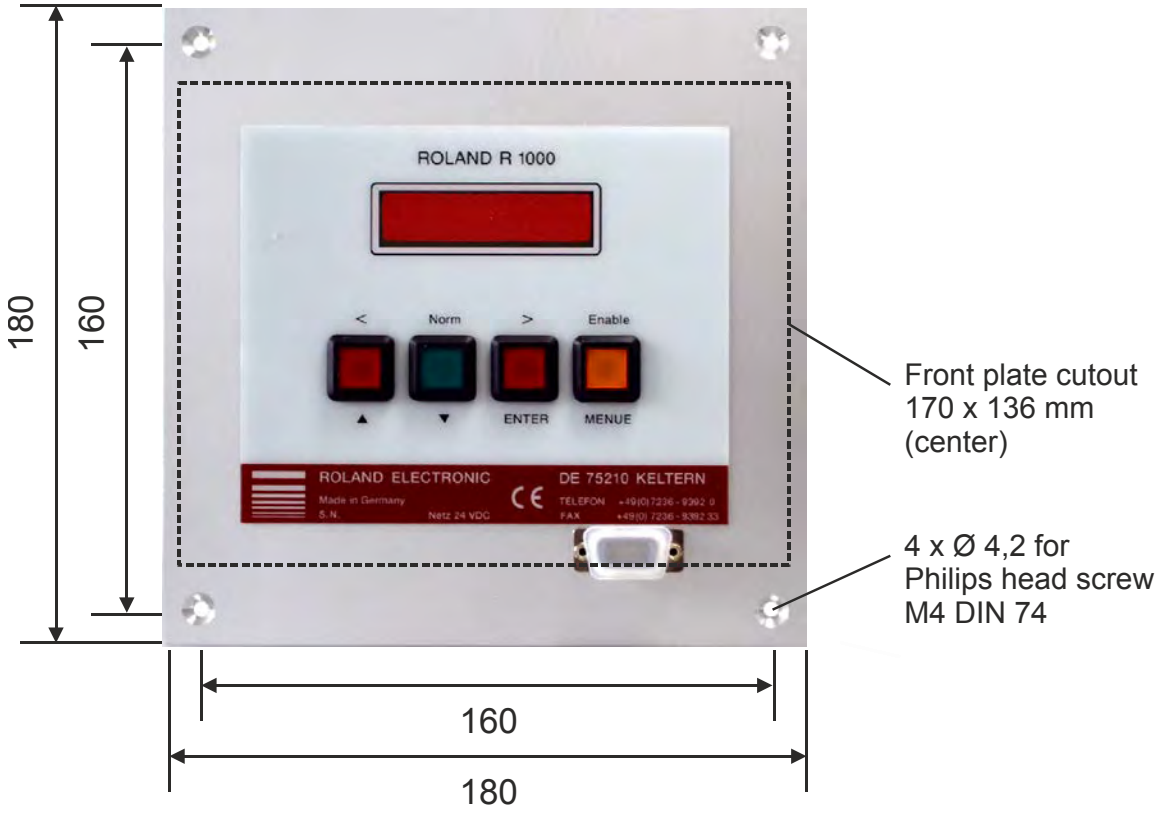


All dimensions are in mm. Tolerance: ±0.2 mm

Fig. 15: Dimensions of the wall mount enclosure - front view

4.2.2 System with enclosure for front panel mounting

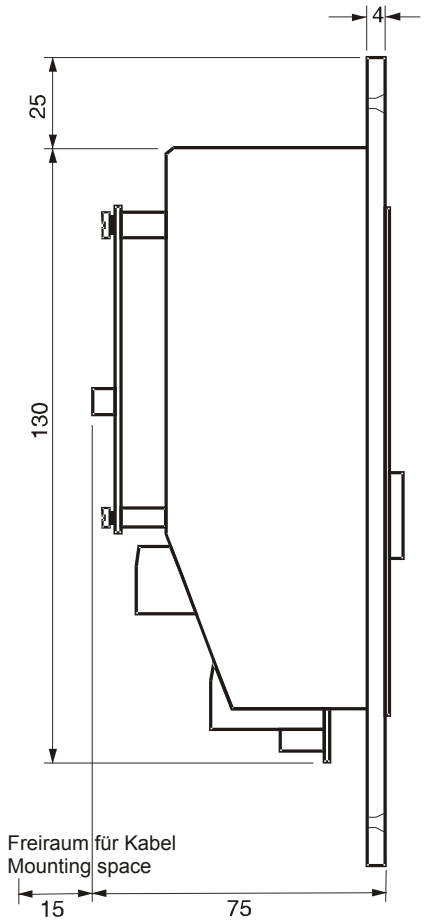
(identic for one and four sensors)



All dimensions are in mm. Tolerance: ±0.2 mm

Fig. 16: Dimensions of the front panel enclosure -front view

Lateral view



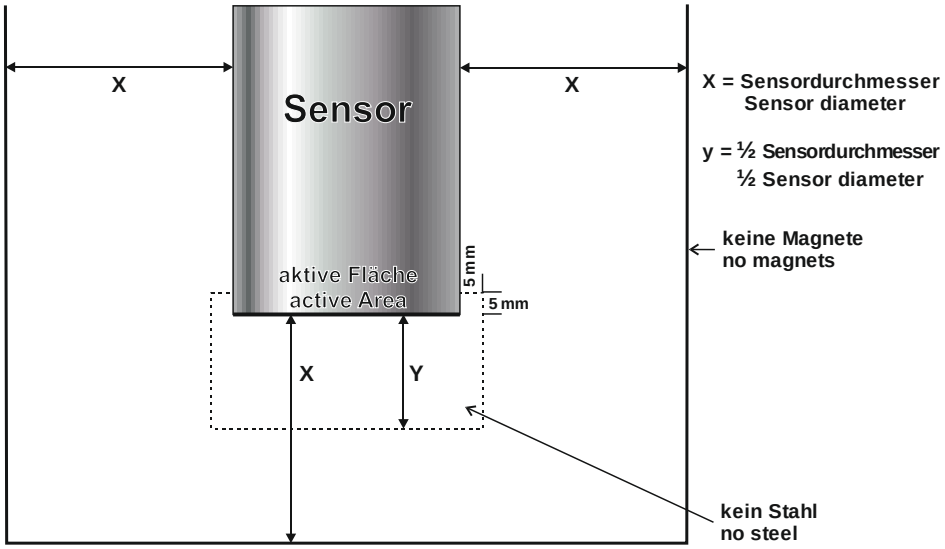
All dimensions are in mm. Tolerance: ±0.2 mm

Fig. 17: Dimensions of the front panel enclosure -lateral view

4.3 Mounting of sensors

The reliable function of the Double Sheet Detector depends to a great degree on the correct mounting of the sensors. The following mounting rules should be followed:

- The sensor must be mounted perpendicular to the sheet and fully contact the sheet surface. Foreign matter should not obstruct the contact.
- Tilting or air gaps between the sensor and the sheet surface can result in faulty measurements.
- It is possible to cover the sensor surface with thin Teflon in order to avoid damage to the sheet metal surface. However, this will reduce the performance and is, therefore, not recommended.
- Mounting in steel / distance to magnets



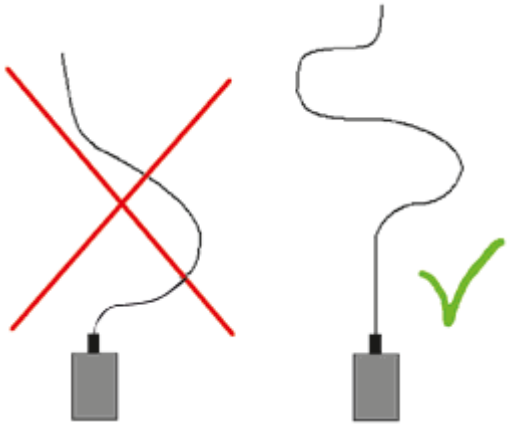
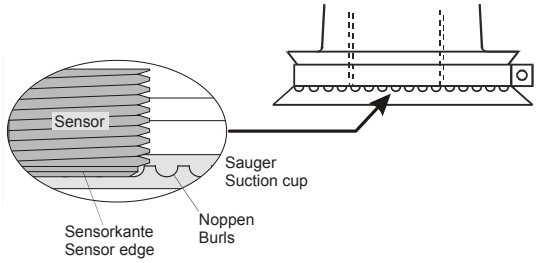
- It is important to set the under gauge threshold of the control unit and analyze the under gauge signal at the 0-sheet output.
- It is important to set the upper gauge threshold of the control unit and analyze the upper gauge signal at the 2-sheet output.
- A spring loaded mounting bracket or the installation directly into the vacuum cup is recommended (see the following sections).

Attention Air gaps can result in faulty measured values. This applies also to tilting or partial gaps or bowed sheets. Ignoring these factors can result in unreliable operations.

The E20 can detect unintentional air gaps. The lower limit (“low“) should be used for this purpose. The lower limit should be adjusted to more than 80%. An air gap causes a decrease of the measured value. As soon as the measured value falls below the under gauge threshold, then under gauge is signalled at the 0-sheet output. It is absolutely necessary that the control unit stops the current operation and issue is a fault signal. Only if this fault condition is eliminated should sheet processing be allowed to continue.

4.3.1 Checklist for Mounting of contacting Sensors

In the interest of longest lifetime and operational security the following items should be observed when mounting contacting sensors and checked in regular intervals.

Point of attention		Possible influences	Checked
Cable type	1	Use only the recommended cable with highest flexibility and durability.	
Cable routing 	2	Avoid any tension of the cable. Route the cable with enough clearance.	
	3	Special care has to be taken to the route of cable in front of sensor plug, if a flexible sensor bracket is used. The cable should never have a bend close to the plug. Also the meander of the cable has to be symmetrically to the axis of the plug, see enclosed sketch.	
Plug	4	Correctly tighten the arresting ring of the plug. This avoids too strong wear of contacts. If possible choose a sensor with fixed cable instead.	
Sensor mounting in the destacking tool 	5	Use a sensor bracket which is flexible enough to let the sensor align also to tilted sheets. This avoids unnecessary wear of sensor contact surface.	
	6	Properly adjust sensor edge so that it aligns with the rubber burls of the suction cup. Do not allow excess end. See enclosed sketch. This avoids unnecessary wear of sensor contact surface.	
	7	Properly adjust sensor mounting in regard to the lifting suction cups of tooling. Mount sensor suction cup on same height as lifting suction cups. Do not use sensor suction cup for sheet lifting.	

4.3.2 Spring loaded sensor brackets

P-sensors should always be fitted into spring mounted sensor bracket rather than rigid mounting arrangements.

A substantial advantage is in the fact that the sensor presents itself perpendicular to the sheet metal surface even though sensor bracket and sheet surface may not be completely aligned at a right angle.

It is important to observe that lateral cable pull does not tilt the sensor. In addition it must be ensured that the springs do not get stuck. If the springs get stuck tilting of the sensor may result or stuck springs can actually provoke tilting. Ideally the spring mounted bracket should be pre-loaded in order to ensure that the sensor is presented perpendicular to the sheet even under dynamic conditions.

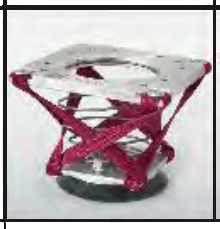
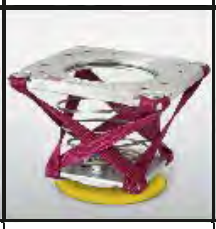
Type	SHX42	SHX42-85	SHX42-DL	SHS42G-FB	SHS42G-FB80
					
Description	Spring loaded sensor bracket with rubber lip		Spring loaded sensor bracket with double-lip	Spring loaded sensor bracket with bellow suction cup (red)	
	Optimal flexibility			SHS42G-FB_SW (black) SHS42G-FB_GE (yellow)	SHS42G-FB80_SW (black) SHS42G-FB80_GE (yellow)
Suited for	P42GS P42AGS PW42GS PW42AGS				
Sensor mounting	Thread M42 x 1.5				
Total height (unloaded)	120 mm	141 mm	120 mm	128 mm	128 mm
Spring travel (+ suction cup compression)	approx. 70 mm	approx. 70 mm	approx. 70 mm	approx. 34 mm (plus approx. 20 mm)	approx. 34 mm (plus approx. 17 mm)
Weight	approx. 0.85 kg	approx. 1.1 kg	approx. 0.85 kg	approx. 1.2 kg	approx. 0.75 kg
Pressure force at 1/2 of spring travel	approx. 25 N	approx. 25 N	approx. 25 N	approx. 60 N	approx. 60 N
Suction cup diameter (while applying vacuum)	115 mm	85 mm	105 mm	105 mm	80 mm
Vacuum feed	Hose 8 mm OD	Hose 8 mm OD	Hose 8 mm OD	Hose 8 mm OD	Hose 8 mm OD
Spare parts	Strap set SHX42-STRAP-80			Bellow suction cup 2395045 (red) Hardness: 45 shore	Bellow suction cup 2395100 (red) Hardness: 45 shore
	Sealing ring 2395126				
	Rubber lip 2395110 (black)	Rubber lip 2395168 (black)	Bellow suction cup 2395218 (yellow)	Bellow suction cup 2395046 (black) Hardness: 60 shore	Bellow suction cup 2395217 (black) Hardness: 60 shore
	Rubber pressure pad 2395109	Rubber pressure pad 2395167		Bellow suction cup 2395133 (yellow) Hardness: 55 shore	Bellow suction cup 2395216 (yellow) Hardness: 55 shore
Accessories	SHX-AZ2-25 Shank / Adapter for 25 mm clamp collar / swivel arm  SHX-AZ-BILSING Adapter for Bilsing quick-change coupling			SHK Bracket clamp for mounting with crossing over clamp 25 mm 	

Fig. 18: Overview of sensor brackets 1/2

Type	SH42GS	SHS42GS	SHS42GS-85	SH75GS	SHS75GS
					
Description	Spring loaded sensor bracket	Spring loaded sensor bracket with flat suction cup		Spring loaded sensor bracket	Spring loaded sensor bracket with flat suction cup
Suited for	P42GS P42AGS PW42GS PW42AGS			P75VGS P75GS	
Sensor mounting	Ø 43 mm	Thread M42 x 1.5		Ø 76 mm	Thread M75 x 1.5
Total height (unloaded)	98 mm sensor excess length	141 mm	141 mm	98 mm sensor excess length	128 mm
Spring travel (+ suction cup compression)	approx. 26 mm	approx. 26 mm	approx. 26 mm	approx. 26 mm	approx. 26 mm
Weight	approx. 0.75 kg	approx. 1.25 kg	approx. 1.2 kg	approx. 0.7 kg	approx. 1.5 kg
Pressure force at 1/2 of spring travel	approx. 48 N	approx. 48 N	approx. 48 N	approx. 48 N	approx. 48 N
Suction cup diameter (while applying vacuum)	n.a.	115 mm	85 mm	n.a.	155 mm
Vacuum feed	n.a.	Hose 8 mm OD	Hose 8 mm OD	n.a.	Hose 10 mm OD
Spare parts	Spring Kit 2395117				
		Rubber lip 2395110 (black)	Rubber lip 2395168 (black)		Foam rubber ring 2395038
		Rubber pressure pad 2395109	Rubber pressure pad 2395167		Rubber pressure pad 2995039
Accessories	SHK Bracket clamp for mounting with crossing over clamp 25 mm 				

Fig. 19: Overview of sensor brackets 2/2

4.3.3 Application properties of sensor brackets

The suction delay time is strongly dependent on vacuum strength, tube resistance, contact angle and contact pressure to the sheet.

Never use the sensor brackets as a lifting device!

Exception: The sheet is smaller than the area of 3 suction cups.

Suited for	Vertical destacker	Robot loader	Inclinated sheet stacks	Notes
		High-speed destackers		
SH42GS No suction delay time	+	- -	-	For narrow sheets and applications where weight is critical
SHS42GS Suction delay time approx. 0.1 s	+	-	o	Strong hold on even sheets due to suction cup
SHS42GS-85 Suction delay time approx. 0.1 s	+	-	o	
SHS42G-FB Suction delay time approx. 0.5 s	+	o	+	Various rubber hardnesses for different surface requirements
SHS42G-FB80 Suction delay time approx 0.5 s	+	o	+	
SHX42 Suction delay time approx. 0.1 s	+	+	++	Highest tilt flexibility, highest spring travel, very lightweight, for high lateral acceleration (up to 2g). Minimal wear, durable designed, low lifecycle costs
SHX42-DL Suction delay time approx. 0.1 s	+	+	++	
SHX42-85 Suction delay time approx. 0.1 s	+	+	++	
SH75GS No suction delay time	+	- -	-	Well-suited for big sheet thicknesses.
SHS75GS Suction delay time approx.0.1 s	+	-	o	

(Legend: „- -“ = absolutely not suited / „-“ = not suited / „o“ = applicable / „+“ = well suited / „++“ = best suited)

Fig. 20: Application properties of sensor brackets

4.3.3.1 Spring loaded sensor bracket SH42GS

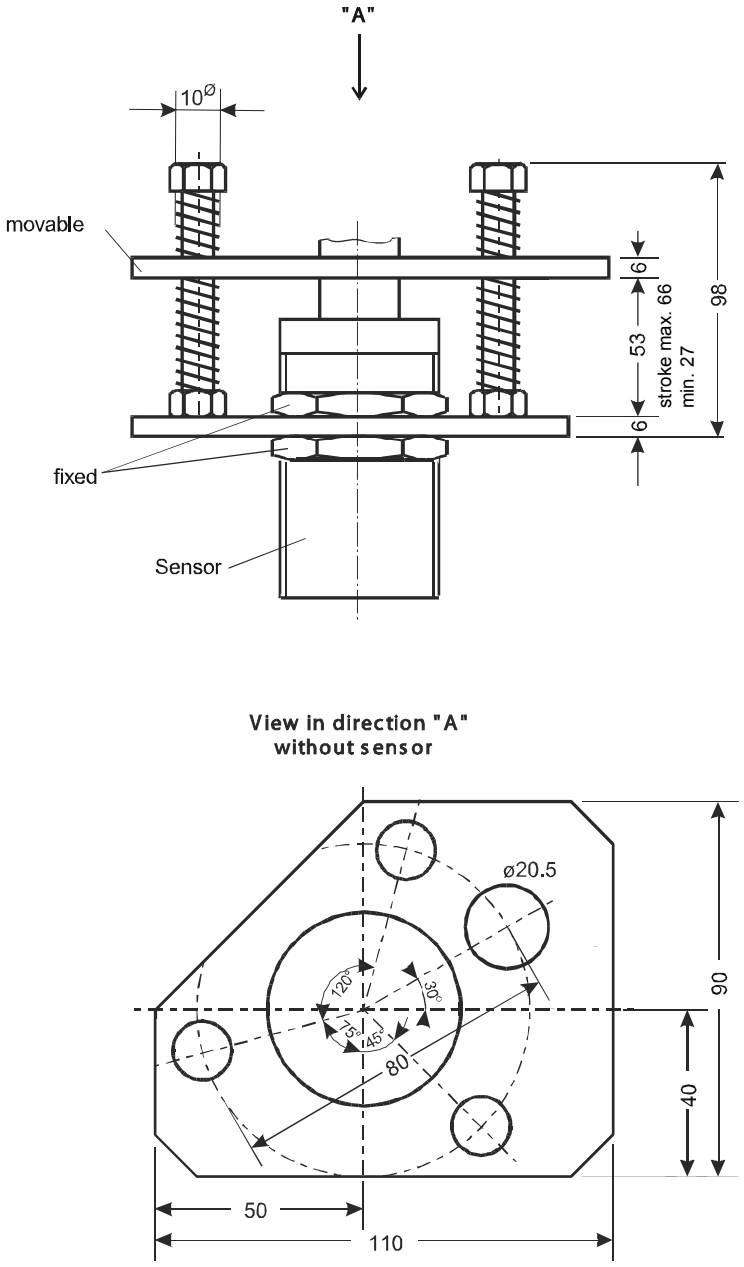
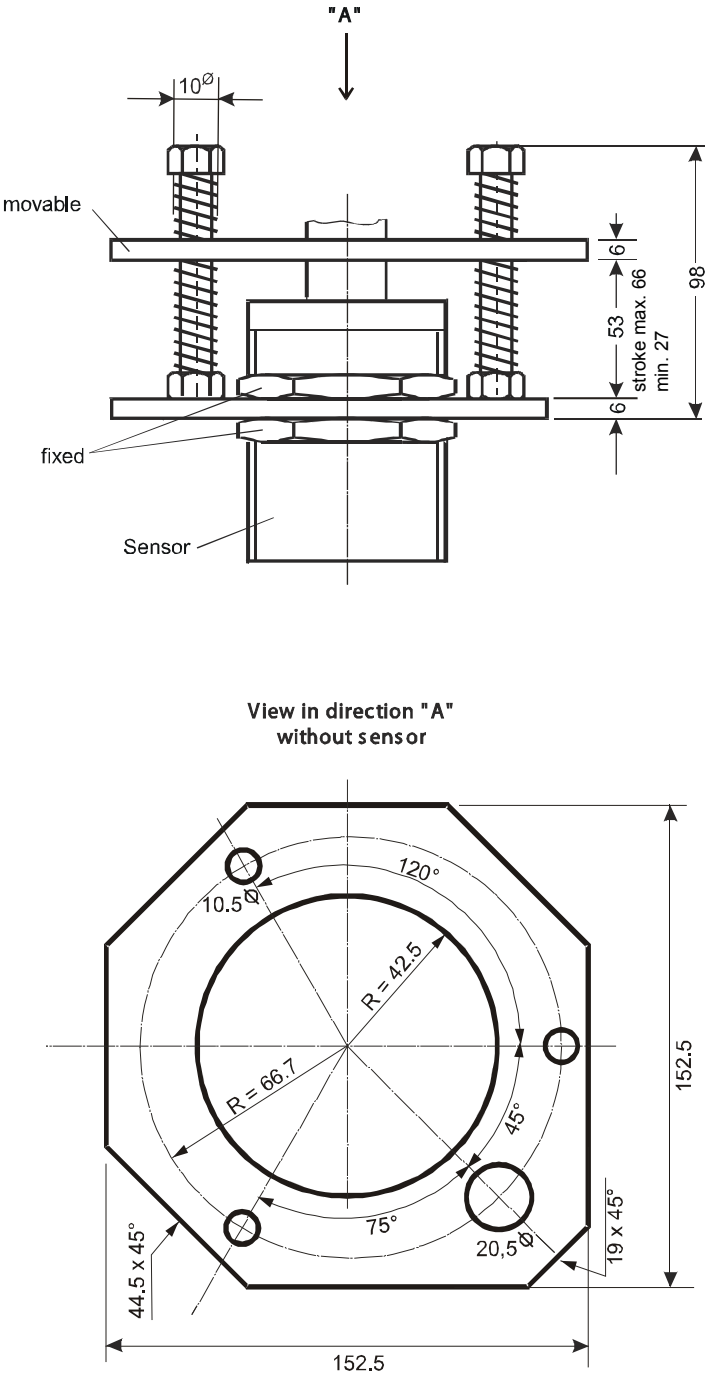


Fig. 21: Spring loaded sensor bracket SH42GS

4.3.3.2 Spring loaded sensor bracket SH75GS



All Dimensions are in mm. Tolerance: ±0.4 mm.

Fig. 22: Spring loaded sensor bracket SH75GS

4.3.4 Spring loaded sensor bracket with flat suction cup

Destacking of blanks is done mostly with the vacuum suction cups. For the measurement of the sheet thickness the sensors should rest vertically and flat on the sheet. The best contact to the sheet surface is made by mounting the sensor into a vacuum suction cup.

That suction cups present the sensor vertically to the sheet surface and function fast because of the low volume of air required. Deviations from the right angle have to be compensated by the spring-loaded Sensor brackets, otherwise no vacuum can be generated. Bellow style vacuum suction cups can themselves compensate deviations from the right angle but they can also pull an inclined sensor to the sheet surface or in inclined sheet to the sensor leading to instability of measurement. The forces acting in this process can lead to wear and tear to the bracket and lips of the suction cups. Generating and releasing vacuum requires considerably longer time.

The suction cups are not designed to lift and carry the sheet. In order to prevent inadvertently the sensor losing touch to the sheet it is necessary to maintain a certain degree of spring load between sensor and sheet. Sensor cable and vacuum hoses should be mounted in such a fashion that low angular forces act on the sensor bracket. If necessary the sensor thread can be sealed with a permanently elastic sealant (Hylomar, Loctite) or a narrow Teflon web.

The spring-loaded sensor bracket contains fixing holes to attach the bracket to the carrying tooling. In special cases (on request) is an operation without the vacuum cup or the lifting/carrying of the sheet with the sensor bracket possible.

4.3.4.1 Spring travel of SHS42GS and SHS75GS

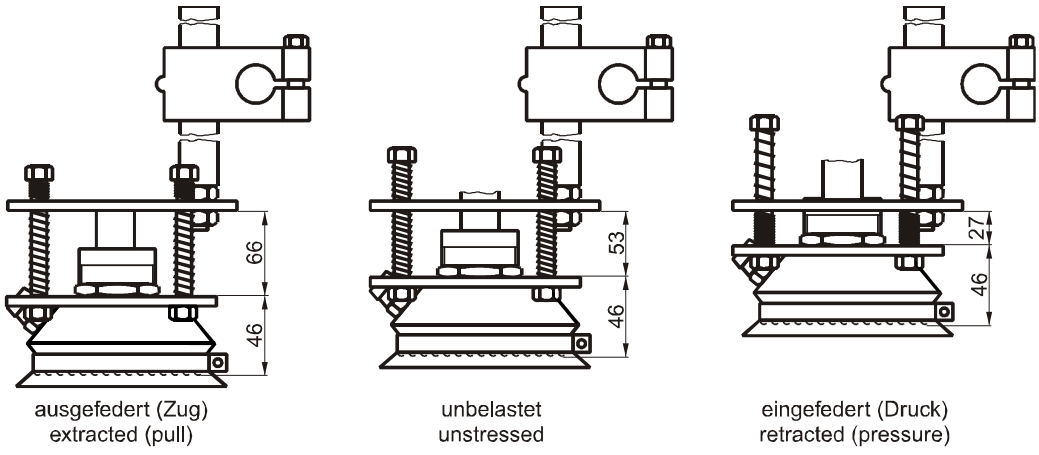
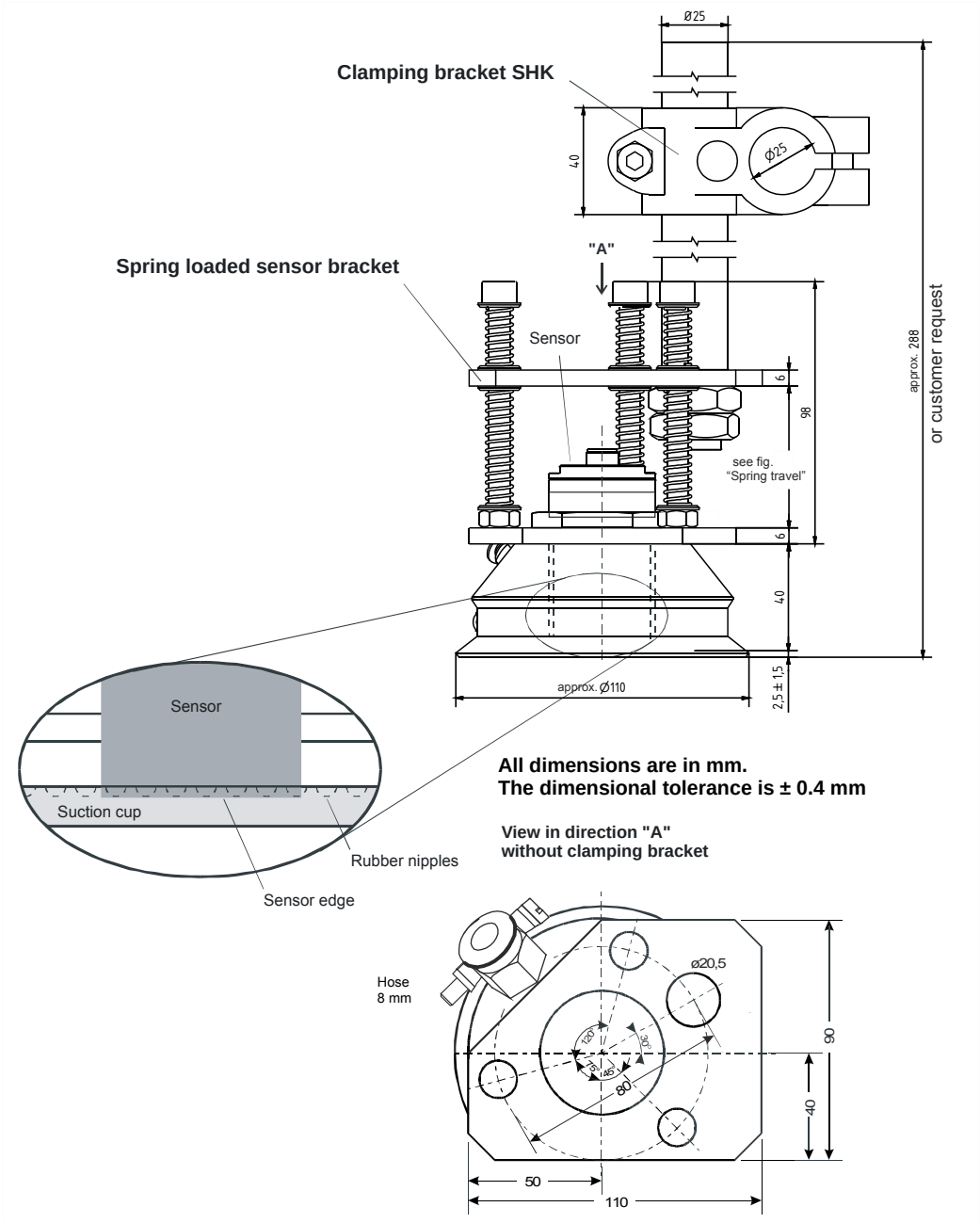


Fig. 23: Spring travel for SHS42GS and SHS75GS

4.3.4.2 Spring loaded sensor bracket SHS42GS with flat suction cup

The spring loaded sensor bracket SHS42GS with flat suction cup is intended for accommodating the sensors. It is well suitable for use in feeder destacking applications (only vertical motions, no turning motions). For usage with robotic destackers the sensor bracket SHS42G-FB (with bellow suction cup) is to be preferred.

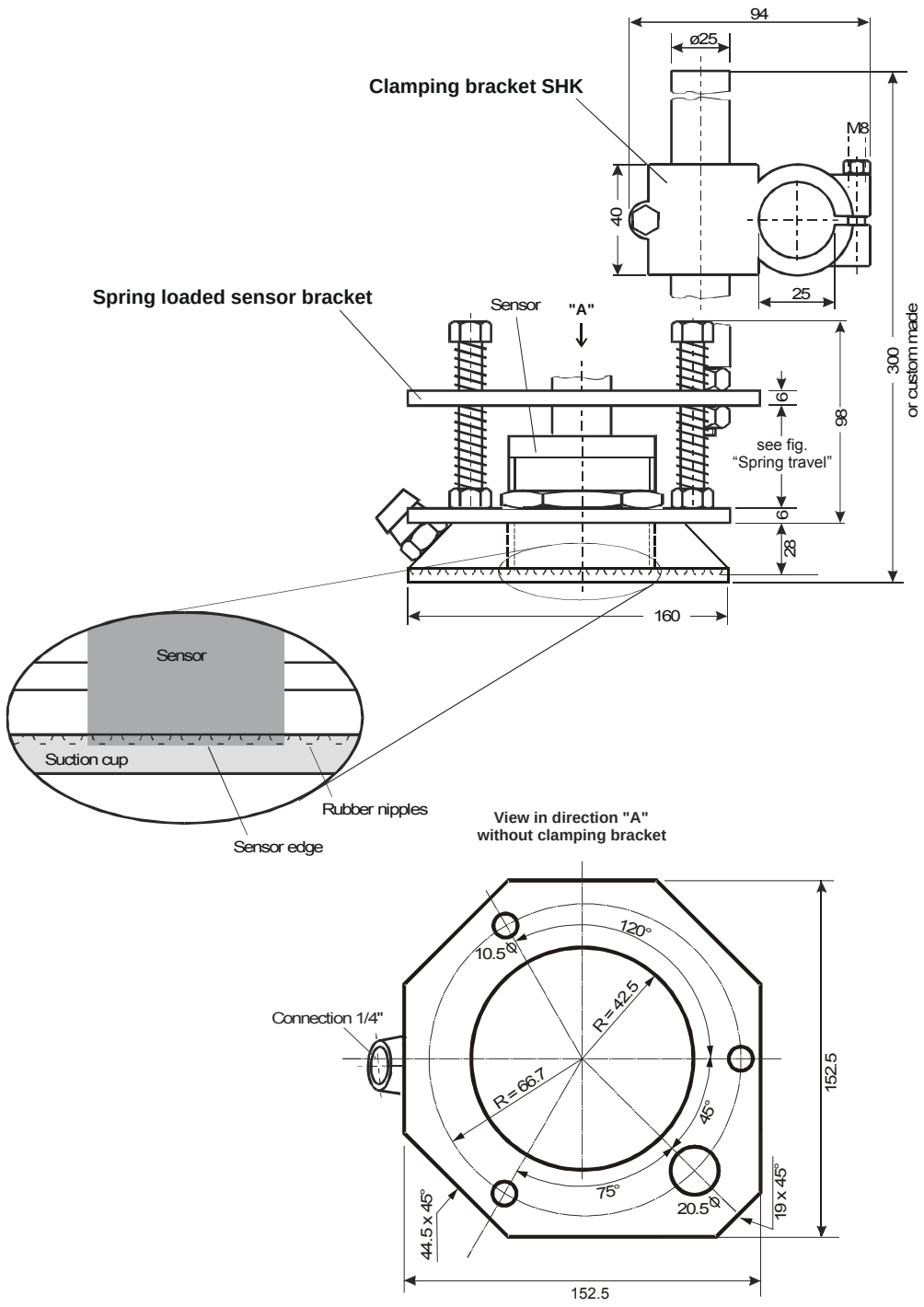


All dimensions are in mm. The dimensional tolerance is ± 0.4 mm

Fig. 24: Spring loaded sensor bracket SHS42GS with flat suction cup

4.3.4.3 Spring loaded sensor bracket SHS75GS with flat suction cup

The spring loaded sensor bracket SHS75GS with flat suction cup is intended for accommodating the sensors. It is well suitable for use in feeder destacking applications (only vertical motions, no turning motions).



All dimensions are in mm. The dimensional tolerance is ± 0.4 mm

Fig. 25: Spring loaded sensor bracket SHS75GS with flat suction cup

4.3.5 Spring mounted sensor bracket SHX42

Features:

- Very stiff in extended condition, for lateral acceleration up to 2g. Thus precise putting on the sheet without canting, also on splayed sheets or bevelled TWB stacks.
- Very elastic in pressed condition and movable into all directions. Lateral motions of the sheet being transported can thereby also be compensated up to approx. ±1 centimetre.
- No appearance of lateral forces, thus only minimal wear.
- Fast suction and releasing of the sheets due to small air volume under the suction hood, compared to bellows suction cups.
- Same sealing gasket and burled plate as used with the Roland SHS42GS.
- Good access to the sensor from above, no counter-nut required.
- Fixing of sensor by lateral headless screw with plastic pressure pad.

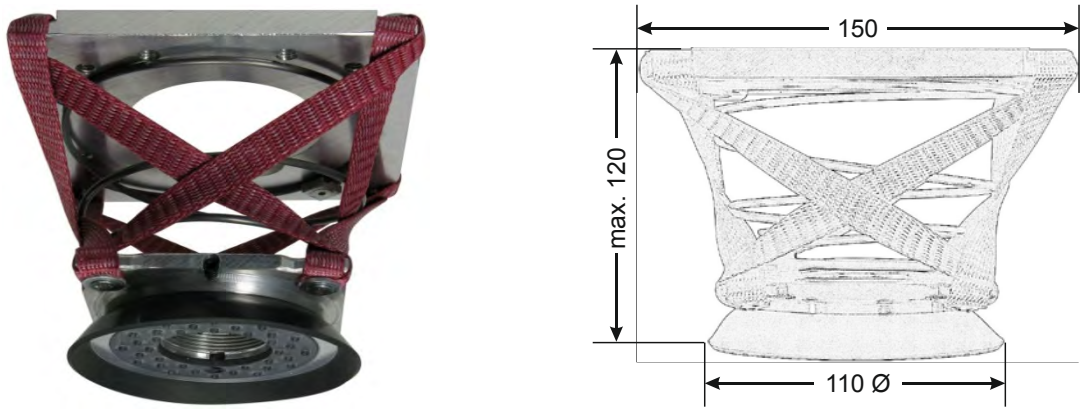


Fig. 26: Sensor bracket SHX42

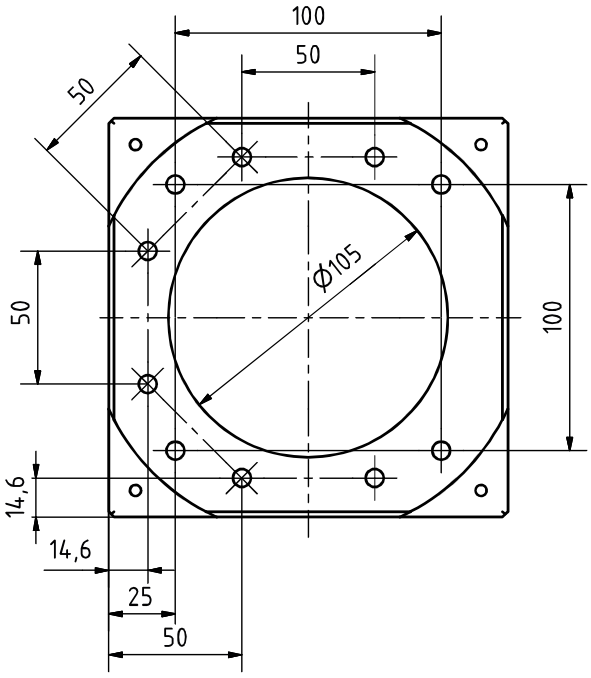


Fig. 27: Base plate for sensor bracket SHX42

Mounting of the sensor bracket

The mounting plate has a total of 10 M8 tap holes at distances of 50 and 100 mm. At least 2 of them must be used for mounting. An adapter with 25 mm shank for swivel arm is available. Other adapters may be ordered by request. Item 1 - 4 describes the mounting of the sensor into the sensor bracket and item 5 - 8 describes the mounting of the sensor bracket.

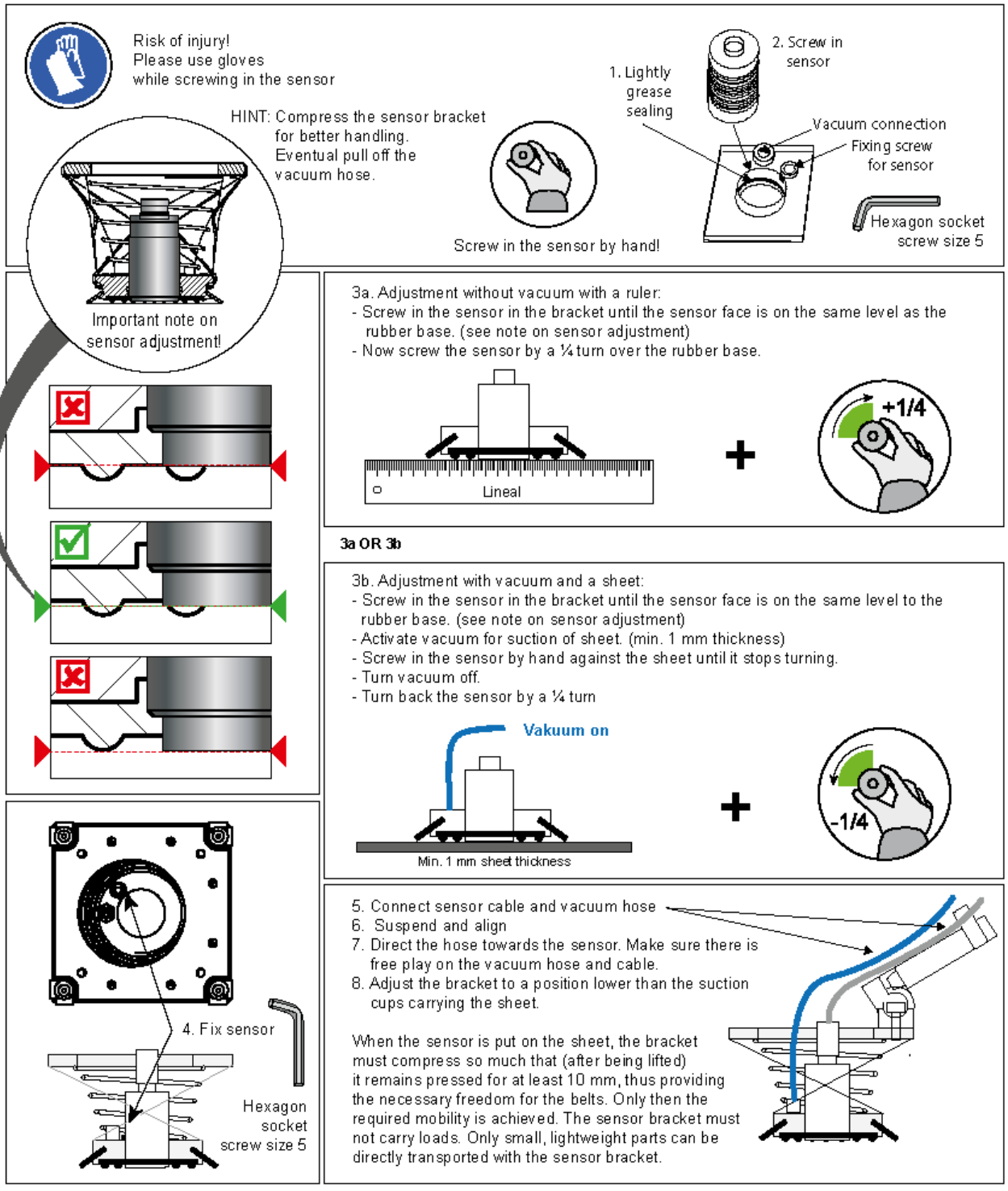


Fig. 28: Mounting of the sensor bracket SHX42

Replacing the gasket

Pull the rubber disc over the lower edge. Pay attention for undamaged sealing lips at the inner and outer edge as well as for uniform projection of the sealing edge.

The gasket can be bilaterally used.

4.3.5.1 Clamping bracket SHX-AZ2-25

For fixing the sensor bracket SHX42 to swivel arms with 25 mm clamp collar.

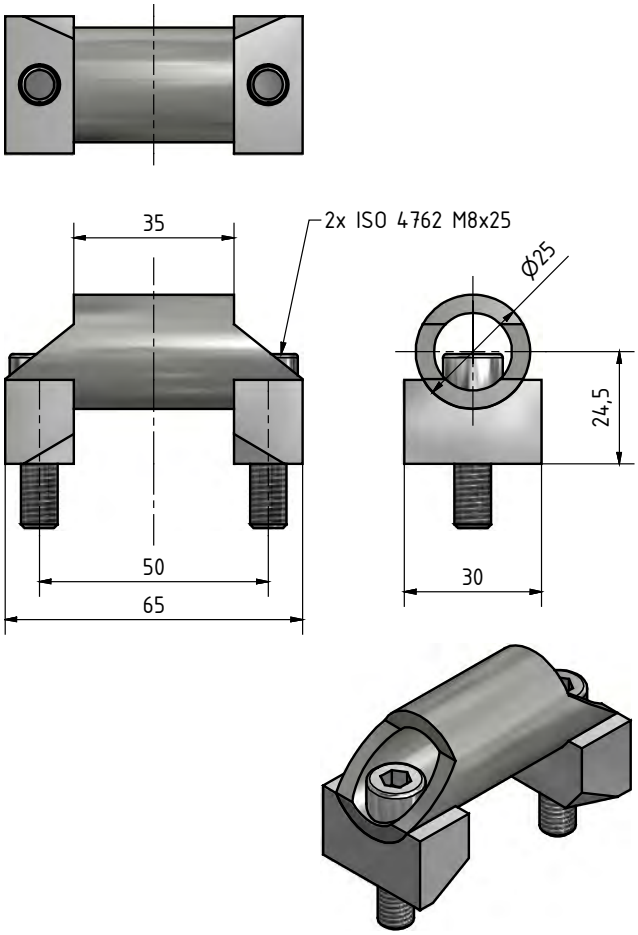


Fig. 29: Clamping bracket SHX-AZ2-25

4.3.6 Spring mounted sensor bracket SHX42-DL

Features:

- Very stiff in extended condition, for lateral acceleration up to 2g. Thus precise putting on the sheet without canting, also on splayed sheets or bevelled TWB stacks.
- Very elastic in pressed condition and movable into all directions. Lateral motions of the sheet being transported can thereby also be compensated up to approx. ±1 centimetre.
- No appearance of lateral forces, thus only minimal wear.
- Fast suction and releasing of the sheets due to small air volume under the suction hood, compared to bellows suction cups.
- Bellows suction cup with a shore grade of 55
- Good access to the sensor from above, no counter-nut required.
- Fixing of sensor by lateral headless screw with plastic pressure pad.

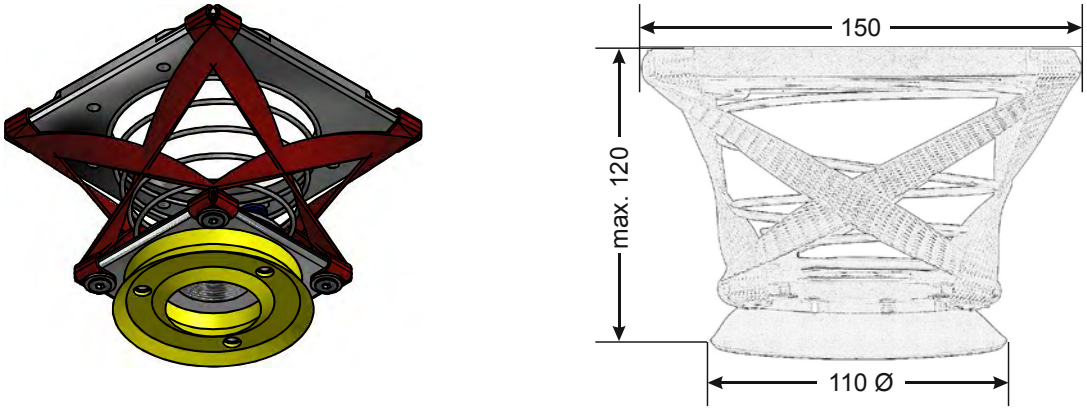


Fig. 30: Sensor bracket SHX42-DL

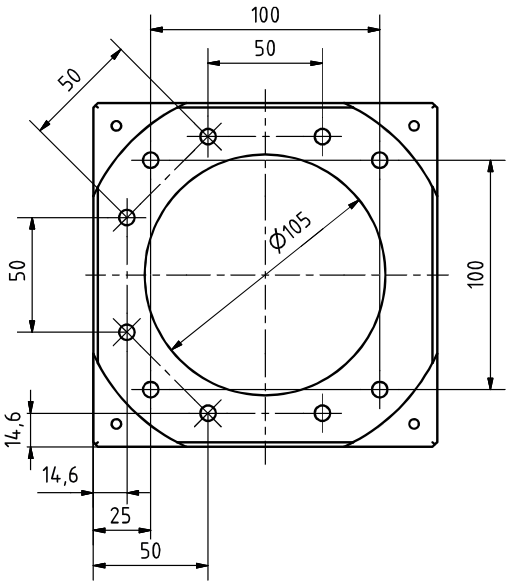


Fig. 31: Base plate for sensor bracket SHX42-DL

4.3.7 Spring loaded sensor bracket SHS42G-FB (with bellow suction cup)

The spring loaded sensor bracket SHS42G-FB with bellow suction cup is intended for the installation of the P sensor. It is well suitable for use in robotic destackers, since transversal forces (appearing on fast turning motions) are well compensated.

The suction vacuum and the integrated nap ring assure a full-area pressure contact of sensor and sheet.

The suction cup has a Shore hardness of 45 (red), harder suction cups with a Shore hardness of 60 (black) are available (see chapter 12 „Order data - sensors and accessories).

On installing, attention must be paid that the sensor is thoroughly sealed (e.g. with Teflon tape) in the thread seating.

Considerations:

- The sensor face must align with the nubs.
- The vacuum must adequately effect.
- The suction facility must be kept free from loading, i.e. the springs may only be low pre-tensioned.
- **The suction facility must not be used as load-lifting device.**

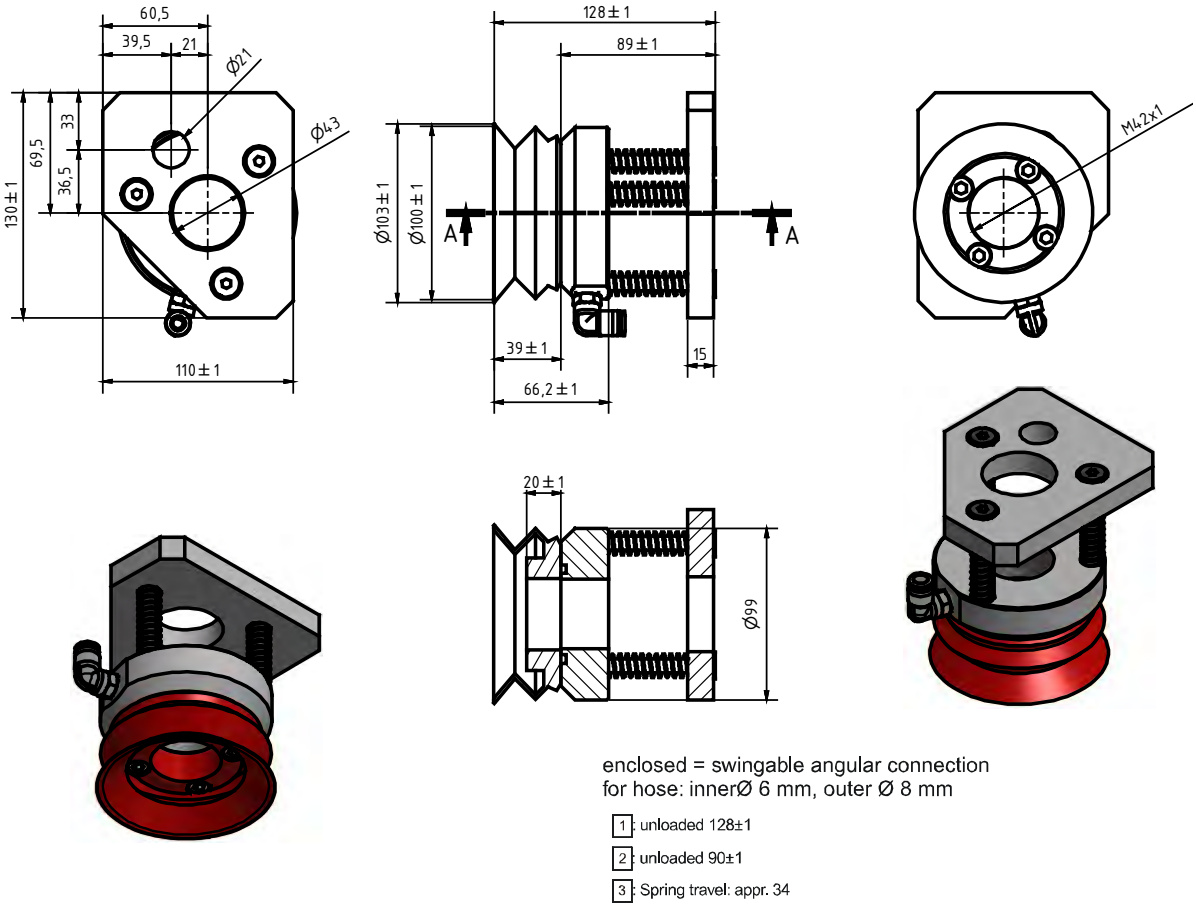
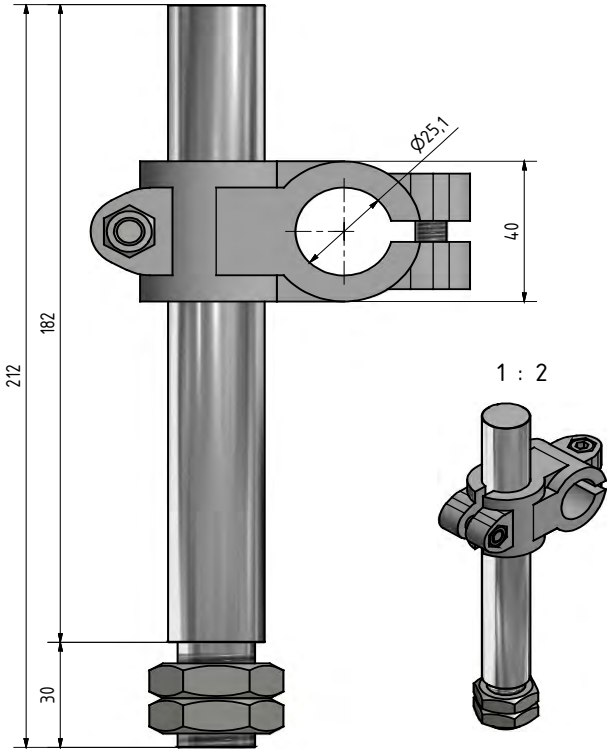


Fig. 32: Sensor bracket SHS42G-FB

4.3.8 Clamping bracket SHK

The clamping bracket SHK can be used for the mounting of the spring loaded sensor brackets SHS...GS or SH...GS.



All Dimensions are in mm. Tolerance: ± 0.2 mm.

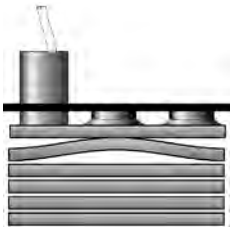
Fig. 33: Clamping bracket SHK

4.3.9 Incorrect mounting of the P sensors

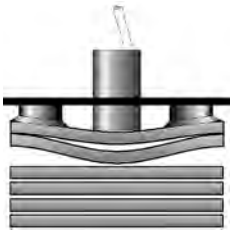
The following illustration shows examples of incorrect installations of P-sensors.

Faulty!
The sensor does not touch the sheet.

Faulty!
The sensor does not sit perpendicular on the sheet, the sensor bracket is apparently not suitable.



Faulty!
An air gap exists between the first and the second sheet.
The sensor is mounted in an unfavourable position.



Faulty!
An air gap exists between the first and the second sheet.
The second sheet clings to the first sheet, perhaps by stamping residuals.

Faulty!
Fault prone control in a bucket. An air gap exists between bended sheets.

Fig. 34: Incorrect mounting of the p sensors

4.3.10 Electromagnetic interference

Electromagnetic interference can affect the measuring accuracy of the sensor. Therefore the sensors should not be installed close to devices which cause electromagnetic interference. Such devices are e.g. frequency converters, servo motors or proximity switches on inductive basis. In case of switching magnets a minimum distance of 20 mm should be observed in order to avoid feedback.

The sensor cables should not be placed directly adjacent to cables with large interference potential, e.g. power supply cable. This applies especially to longer cable lengths.

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5 Electrical installation

5.1 General instructions

The sensor cables should be kept as short as possible in order to minimize the influence of electromagnetic noise. Cable shields must be connected according to the connection diagrams only and should not have any additional connections.

Attention Damaged cable installations can result in additional electrical connections. This can disturb the measured values.

The voltage supply cable should be kept short. Up to 20 m length use cable leads with 2 x 1 mm^2 cross-section. For larger lengths the cross section should be increased.

5.2 Allocation of connectors

5.2.1 Allocation of connectors at the E20

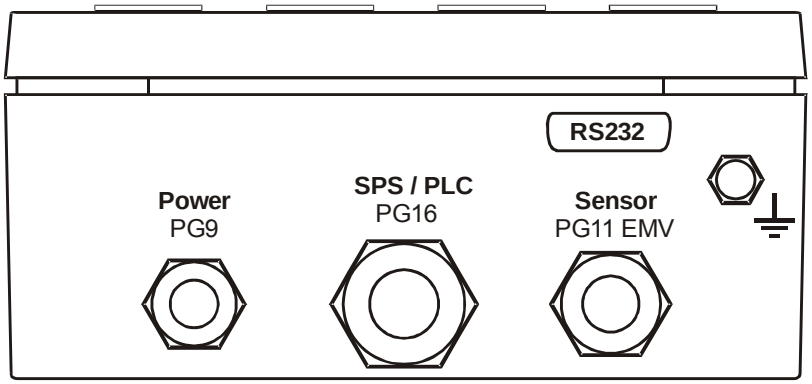


Fig. 35: Allocation of connectors at the E20

5.2.2 Allocation of connectors at the E20-4P

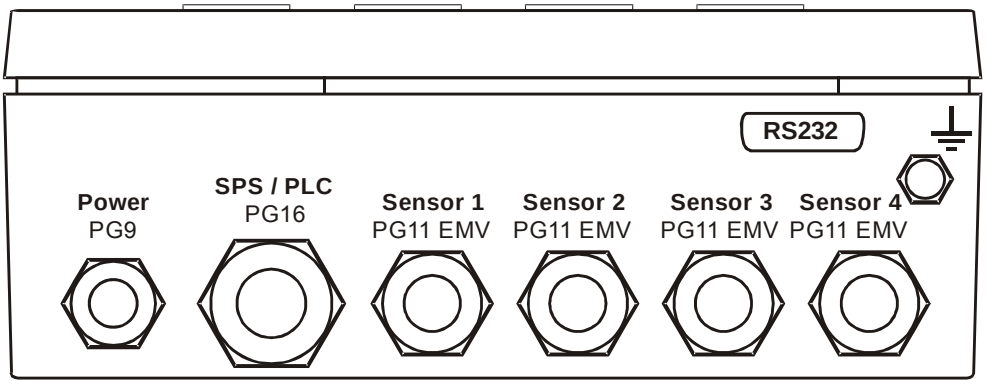


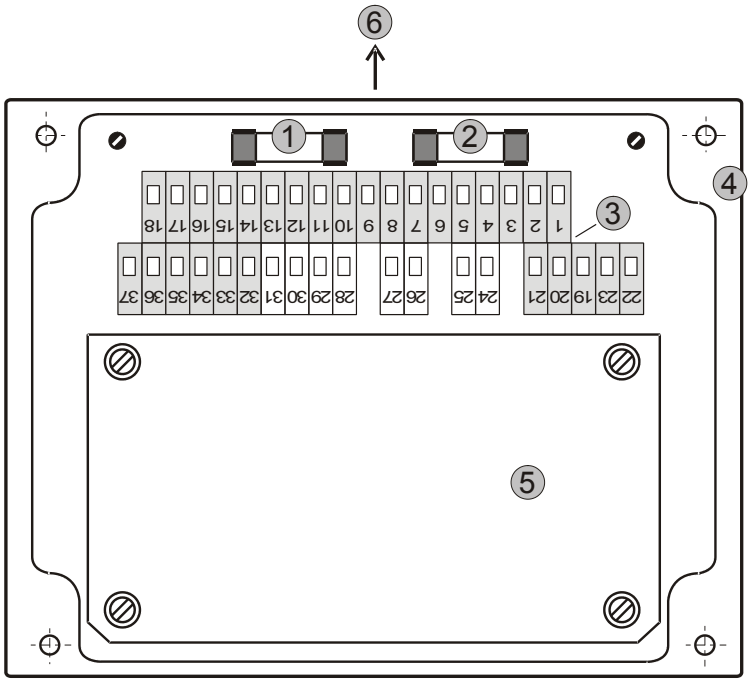
Fig. 36: Allocation of connectors at the E20-4P

5.3 Connection to the grounding of the machine

The enclosure of the R1000 has an M6 threaded screw as grounding connection. This screw must be connected to the earth ground of the equipment with a copper wire gauge of at least 1.5 mm² cross section.

Attention The positive supply voltage +24 VDC should not be connected to machine ground.

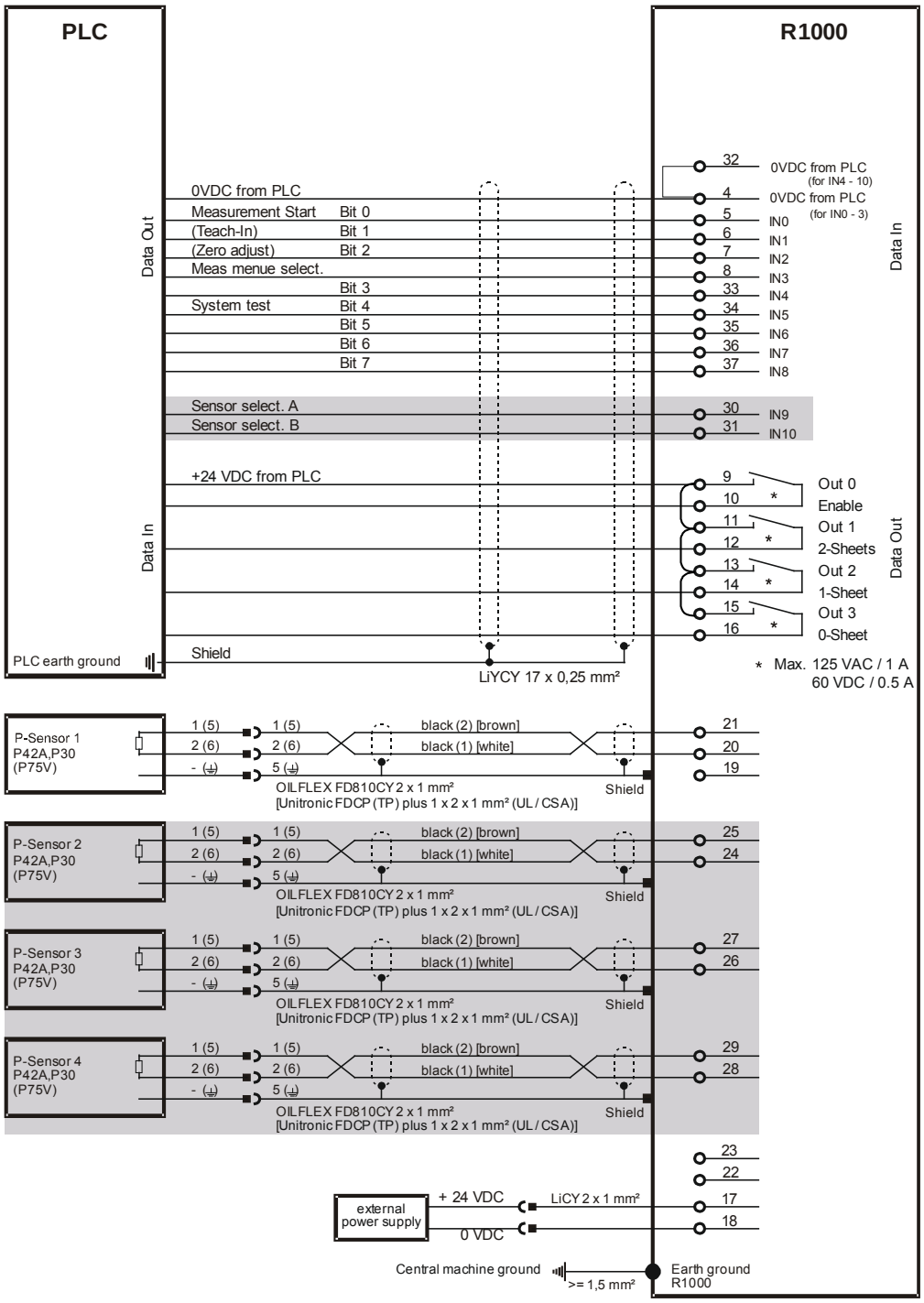
5.4 Wiring diagrams and pin configurations



1 Fuse
2 Spare fuse (5 A medium-blow)
3 Terminal blocks
4 Enclosure lid
5 Cover
6 View: upper part flipped downside

Fig. 37: Position of connectors

5.4.1 Wiring diagram Version B, Relay outputs



Complete wiring is required only if all options are to be used.
The highlighted areas are relevant only for the 4P versions.

Attention The positive supply voltage +24 VDC should not be connected to machine ground.

5.4.2 Pin configuration E20 – Version B, Relay outputs

Data inputs PLC – E20 (galvanically isolated)

PLC		E20		
Function		Terminal no.	Inputs	Specification
Meas. menu selection = 0	Meas. menu selection = 1	8	IN3	Sinking inputs LOW: 0-8 V; HIGH: 18-30 V
Measurement start	Bit 0	5	IN0	
Teach-In	Bit 1	6	IN1	
Zero adjust	Bit 2	7	IN2	
-	Bit 3	33	IN4	
System test	Bit 4	34	IN5	
-	Bit 5	35	IN6	
-	Bit 6	36	IN7	
-	Bit 7	37	IN8	
Sensor select A		30	IN9	
Sensor select B		31	IN10	
0VDC from PLC		4		0 V DC
		32		jumped with terminal 4

Data outputs PLC – E20 (Relay)

PLC	E20		
Function	Terminal no.	Outputs	Specification
Relay contact is closed if ENABLE is active (unit is o.k.)	9 10	OUT0 OUT0	max. 125 V AC / 1 A max. 60 V DC / 0.5 A
Relay contact is closed if 2-sheet is detected	11 12	OUT1 OUT1	max. 125 V AC / 1 A max. 60 V DC / 0.5 A
Relay contact is closed if 1-sheet is detected	13 14	OUT2 OUT2	max. 125 V AC / 1 A max. 60 V DC / 0.5 A
Relay contact is closed if 1-sheet is detected	15 16	OUT3 OUT3	max. 125 V AC / 1 A max. 60 V DC / 0.5 A
The terminals 9, 11, 13, 15 are jumped with each other			

External power supply – E20

External power supply	E20	
Power supply	Terminal no.	Specification
24 V DC	17	24 V DC, +6 V / -2 V / 5A
0 V DC	18	min. 1mm² (up to 20 m length)
Central machine grounding	GND	min. 1.5 mm²

Attention The positive supply voltage +24 V DC should not be connected to machine ground.

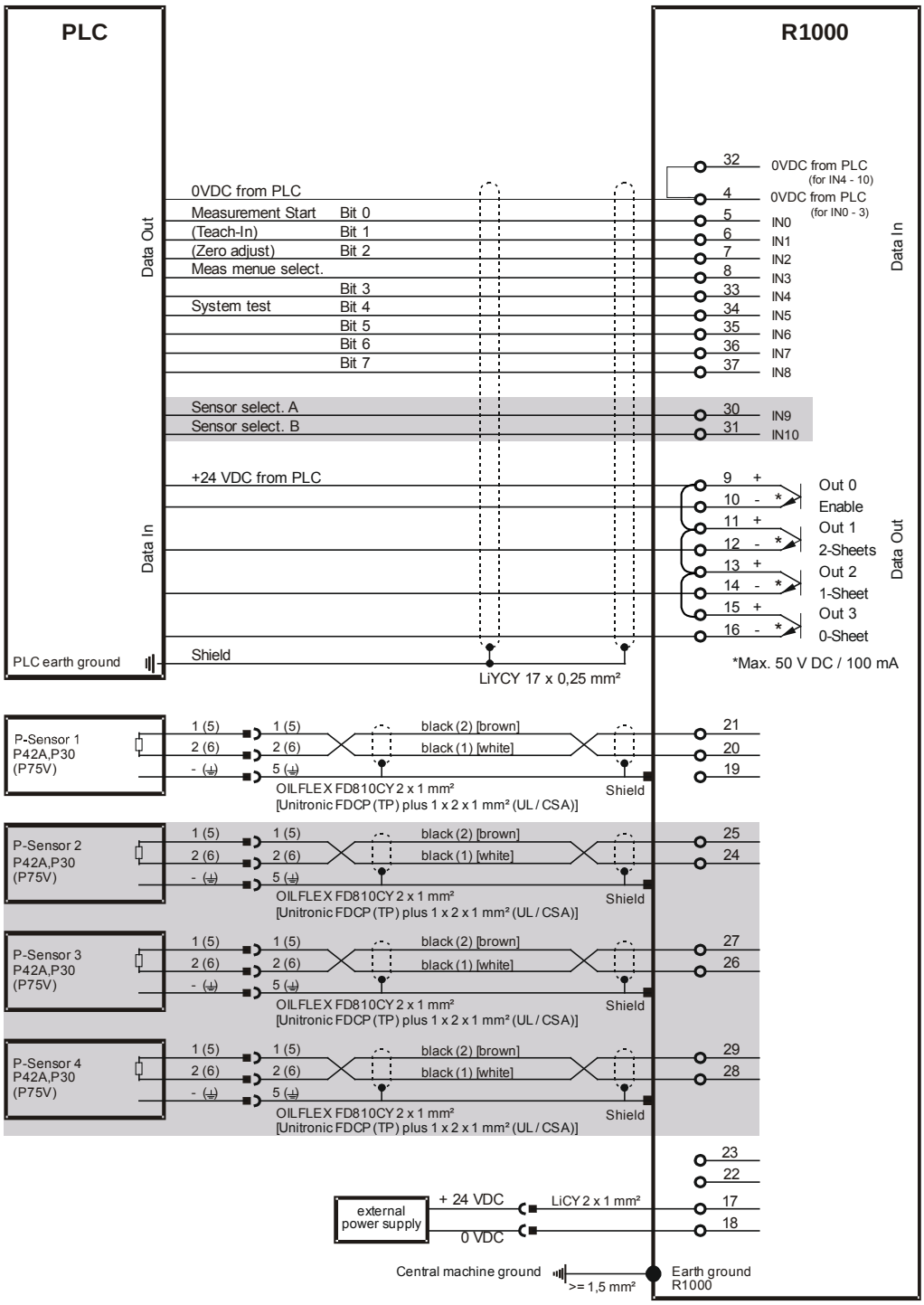
Connection sensors 1 to 4 – E20

(Sensor 2-4 only for 4P version)

	Sensor			E20	
	Pin-Nr.		Function	Terminal no.	Specification
	P42A / P30	P75V			
Sensor 1	2	6	P-Sensor	20	black (2) [brown]
	1	5	P-Sensor	21	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 2	2	6	P-Sensor	24	black (2) [brown]
	1	5	P-Sensor	25	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 3	2	6	P-Sensor	26	black (2) [brown]
	1	5	P-Sensor	27	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 4	2	6	P-Sensor	28	black (2) [brown]
	1	5	P-Sensor	29	black (1) [white]
	5 [1)]	Pin-⏚	Cable shield	PG screw fitting	
The terminal 19 can be used for connecting the cable shield, if this unit replaces an existing unit without EMC PG screw fitting.					
For cable FD810CY wire color: black (1) / black (2) For cable FDCP (TP) plus wire color: white / brown					

[1)] The pin 5 is only present at the cable connector of the sensor cable.
The sensor has no pin 5

5.4.3 Wiring diagram Version B, opto coupler outputs



Complete wiring is required only if all options are to be used.
The highlighted areas are relevant only for the 4P versions.

Attention The positive supply voltage +24 VDC should not be connected to machine ground.

5.4.4 Pin configuration E20 – Version B, opto coupler outputs

Data inputs PLC – E20 (galvanically isolated)

PLC		E20		
Function		Terminal no.	Inputs	Specification
Meas. menu selection = 0	Meas. menu selection = 1	8	IN3	Sinking inputs LOW: 0-8 V; HIGH: 18-30 V
Measurement start	Bit 0	5	IN0	
Teach-In	Bit 1	6	IN1	
Zero adjust	Bit 2	7	IN2	
-	Bit 3	33	IN4	
System test	Bit 4	34	IN5	
-	Bit 5	35	IN6	
-	Bit 6	36	IN7	
-	Bit 7	37	IN8	
Sensor selection A		30	IN9	
Sensor selection B		31	IN10	
0VDC from PLC		4		0 V DC
		32		jumped with terminal 4

Data outputs PLC – E20 (opto coupler)

PLC	E20		
Function	Terminal no.	Outputs	Specification
Opto coupler low resistive if ENABLE is active (Unit o.k.)	9 10	OUT0 OUT0	Sourcing outputs Output current: absolute max. 150 mA continuously max. 100 mA max. 50 V DC
Opto coupler low resistive if 2-sheet is detected	11 12	OUT1 OUT1	
Opto coupler low resistive if 1-sheet is detected	13 14	OUT2 OUT2	
Opto coupler low resistive if 0-sheet is detected	15 16	OUT3 OUT3	
The terminals 9, 11, 13, 15 are jumped with each other			

External power supply – E20

External power supply	E20	
Power supply	Terminal no.	Specification
24 V DC	17	24 V DC, +6 V / -2 V / 5A
0 V DC	18	min. 1mm² (up to 20 m length)
Central machine grounding	GND	min. 1.5 mm²

Attention The positive supply voltage +24 VDC should not be connected to machine ground.

Connection sensors 1 to 4 – E20

(Sensor 2-4 only for 4P version)

	Sensor			E20	
	Pin-Nr.		Function	Terminal no.	Specification
	P42A / P30	P75V			
Sensor 1	2	6	P-Sensor	20	black (2) [brown]
	1	5	P-Sensor	21	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 2	2	6	P-Sensor	24	black (2) [brown]
	1	5	P-Sensor	25	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 3	2	6	P-Sensor	26	black (2) [brown]
	1	5	P-Sensor	27	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 4	2	6	P-Sensor	28	black (2) [brown]
	1	5	P-Sensor	29	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
The terminal 19 can be used for connecting the cable shield, if this unit replaces an existing unit without EMC PG screw fitting.					
For cable FD810CY wire color: black (1) / black (2) For cable FDCP (TP) plus wire color: white / brown					

[1)] The pin 5 is only present at the cable connector of the sensor cable.
The sensor has no pin 5

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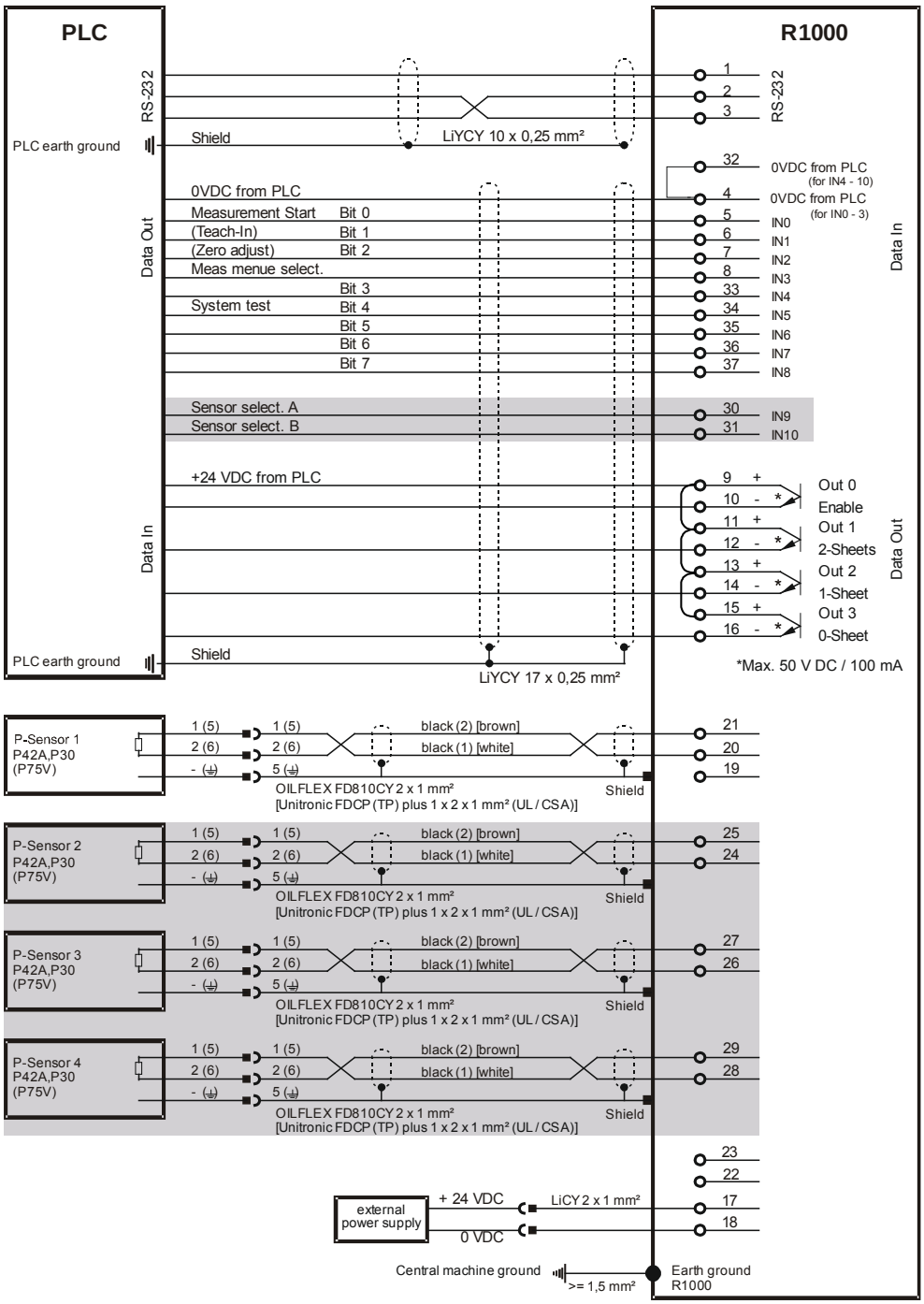
5.4.5 Wiring diagram Version C, opto coupler outputs



Complete wiring is required only if all options are to be used.
The highlighted areas are relevant only for the 4P versions.

Attention The positive supply voltage +24 VDC should not be connected to machine ground.

5.4.6 Pin configuration E20 – Version C, opto coupler outputs

Data inputs PLC – E20 (galvanically isolated)

PLC		E20		
Function		Terminal no.	Inputs	Specification
Meas. menu selection = 0	Meas. menu selection = 1	8	IN3	Sinking inputs LOW: 0-8 V; HIGH: 18-30 V
Measurement start	Bit 0	5	IN0	
Teach-In	Bit 1	6	IN1	
Zero adjust	Bit 2	7	IN2	
-	Bit 3	33	IN4	
System test	Bit 4	34	IN5	
-	Bit 5	35	IN6	
-	Bit 6	36	IN7	
-	Bit 7	37	IN8	
Sensor selection A		30	IN9	
Sensor selection B		31	IN10	
0VDC from PLC		4		0 V DC
		32		jumpered with terminal 4

Data outputs PLC – E20 (opto coupler)

PLC	E20		
Function	Terminal no.	Outputs	Specification
Opto coupler low resistive if ENABLE is active (Unit o.k.)	9 10	OUT0 OUT0	Sourcing outputs Output current: absolute max. 150 mA continuously max. 100 mA max. 50 V DC
Opto coupler low resistive if 2-sheet is detected	11 12	OUT1 OUT1	
Opto coupler low resistive if 1-sheet is detected	13 14	OUT2 OUT2	
Opto coupler low resistive if 0-sheet is detected	15 16	OUT3 OUT3	
The terminals 9, 11, 13, 15 are jumpered with each other			

External power supply – E20

External power supply	E20	
Power supply	Terminal no.	Specification
24 V DC	17	24 V DC, +6 V / -2 V / 5A
0 V DC	18	min. 1mm² (up to 20 m length)
Central machine grounding	GND	min. 1.5 mm²

Attention The positive supply voltage +24 VDC should not be connected to machine ground.

Serial interface RS232 PLC – E20 (opto coupler)

PLC	E20		
Function	Terminal no.	Input	Output
Receiver / Transmitter GND RS232	1	GND	GND
Receiver Input RxD RS232	2	RxD	
Transmitter Output TxD RS232	3		TxD

Connection sensors 1 to 4 – E20

(Sensor 2-4 only for 4P version)

	Sensor			E20	
	Pin-Nr.		Function	Terminal no.	Specification
	P42A / P30	P75V			
Sensor 1	2	6	P-Sensor	20	black (2) [brown]
	1	5	P-Sensor	21	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 2	2	6	P-Sensor	24	black (2) [brown]
	1	5	P-Sensor	25	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 3	2	6	P-Sensor	26	black (2) [brown]
	1	5	P-Sensor	27	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
Sensor 4	2	6	P-Sensor	28	black (2) [brown]
	1	5	P-Sensor	29	black (1) [white]
	5 [1)]	Pin- ⏚	Cable shield	PG screw fitting	
The terminal 19 can be used for connecting the cable shield, if this unit replaces an existing unit without EMC PG screw fitting.					
For cable FD810CY wire color: black (1) / black (2) For cable FDCP (TP) plus wire color: white / brown					

[1)] The pin 5 is only present at the cable connector of the sensor cable.
The sensor has no pin 5

5.5 Cable connections

The cable is connected via PG-glands (in case of the sensor cable special EMI PG-glands) and internal plug-in terminals inside the control unit. The front cover with the complete electronics can be removed after loosening the plug terminal blocks inside. This enables the exchange of control units without disconnecting the cables.

5.5.1 PLC cable

The connection of the cable shield should be one sided at the systems common of the PLC only (compare connection diagram PLC cable, see chapter “5.4 Wiring diagrams and pin configurations“).

5.5.2 Voltage supply cable

The voltage supply cable should be kept short. Up to 20 m length use cable leads with 2 x 1 mm² cross-section. For larger lengths the cross section should be increased.

5.6 Connectors of the P-sensors and the sensor cable

For the connection of the P-sensors are used as in the following picture.

Attention The sensor cable is an active part of the sensor. The performance data is therefore based on the compliance with cable specification.

5.6.1 Mounting instruction for M12 connectors with arresting ring

These connectors have a positioning key at the plug and a positioning slot at the receptacle. These items are designed to prevent incorrect connecting positions.

For this reason if plug and receptacle are connected together then these positioning features should fit to each other.

Only then it is possible to connect plug and receptacle without force and with proper pin configuration.

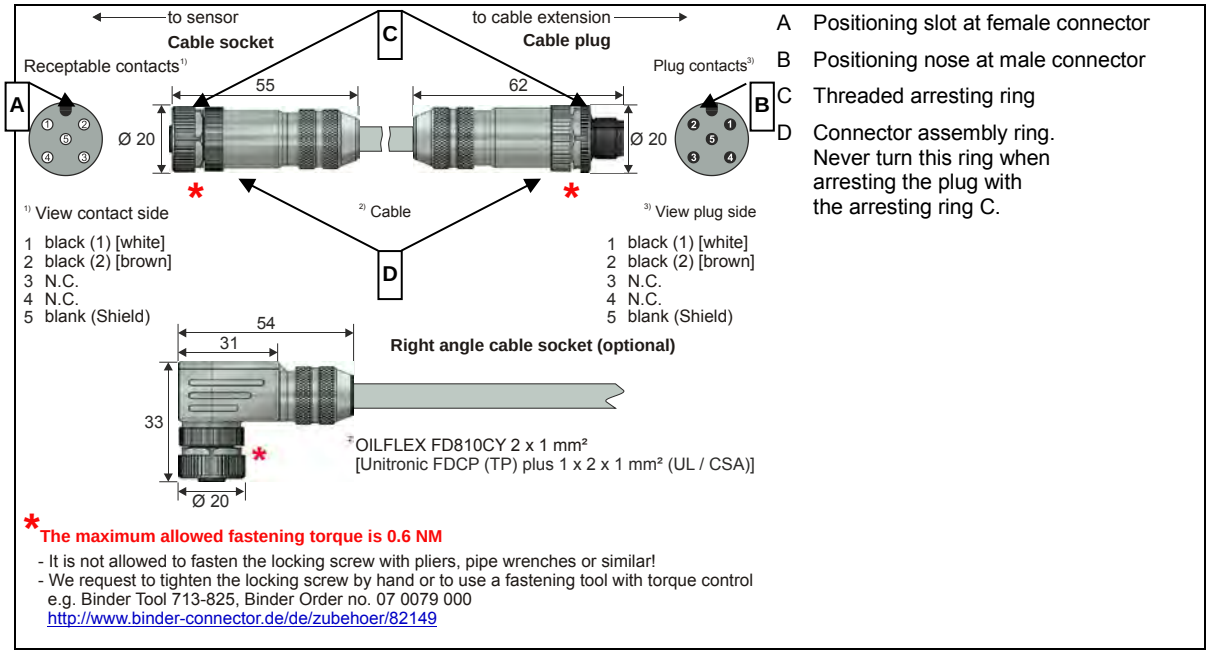


Fig. 38: Positioning facility and arresting ring

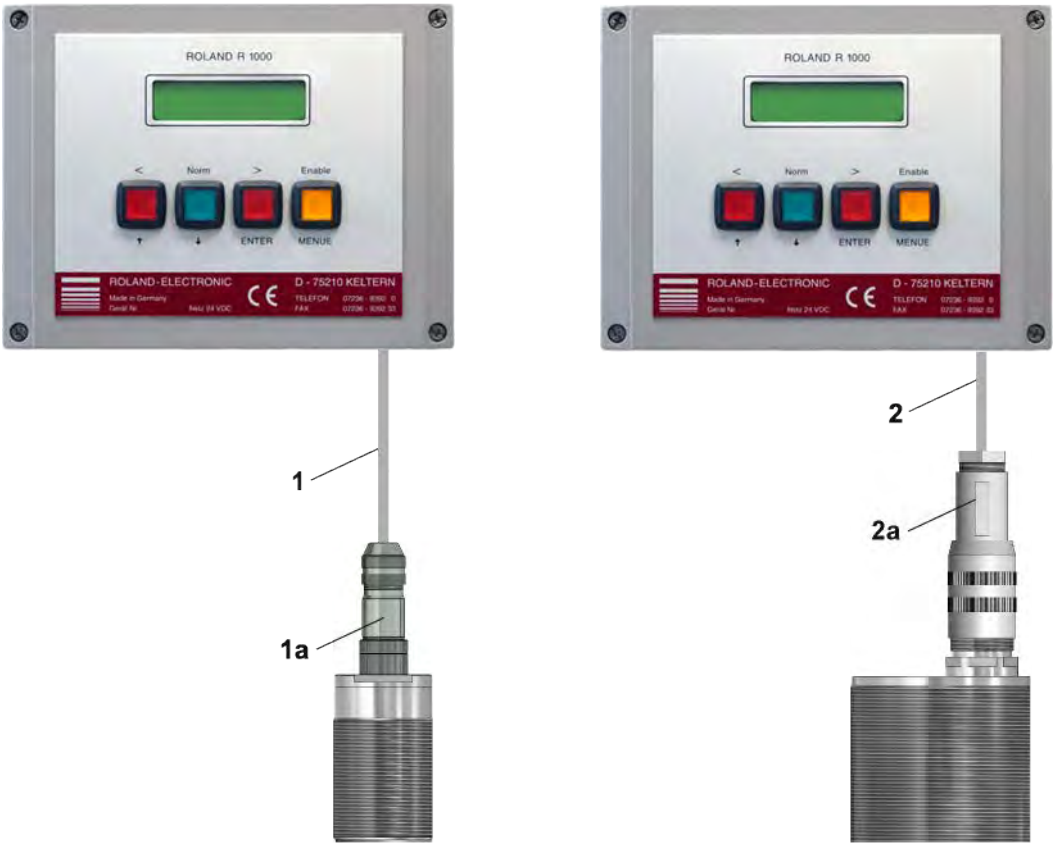
Important

1) **Turn only the threaded arresting ring C.**
If the whole plug becomes turned, the locking facility and the contact pins will break and the connector will become useless.

2) **Never mis-use parts of a connector as holder for mounting the counterpart.**

5.7 Connecting diagram - examples

5.7.1 Connecting diagram E20 with one sensor without cable extension



for P30GS and P42AGS

1 Cable	
Order no.:	CPM12S-G
Order no.:	CPM12S-W (90° angle socket at sensor)
Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)	

1a Cable socket (5 contacts)	
Order no.:	2276116 (straight) 2276117 (90° angle)
Pin 1	black (1) [white]
Pin 2	black (2) [brown]
Pin 3	N.C.
Pin 4	N.C.
Pin 5	blank (shield)

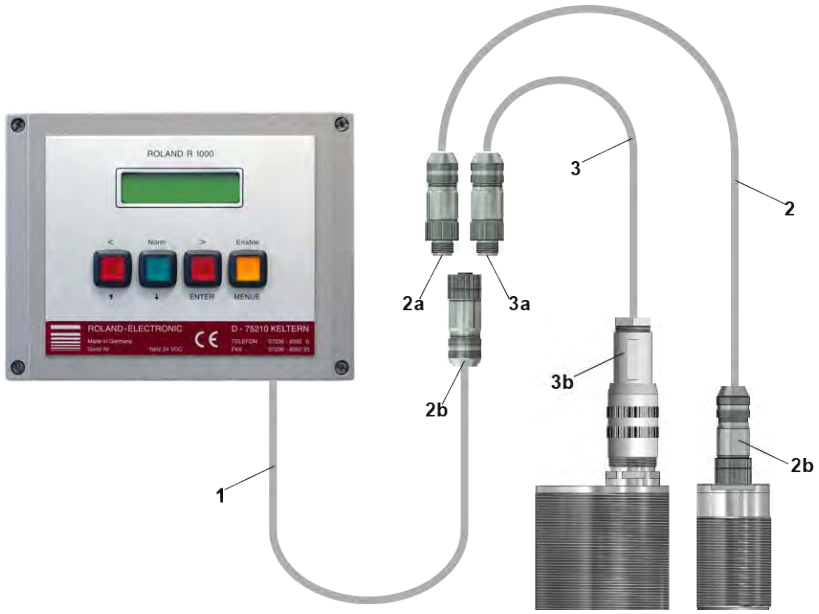
for P36GS, P42GS, P75GS and P75VGS

2 Cable	
Order no.:	CPS-GOIL
Order no.:	CPS-WOIL (90° angle socket at sensor)
Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)	

2a Cable socket (7 contacts)	
Order no.:	2276637 (straight) 2277639 (90° angle)
Pin 1	N.C.
Pin 2	N.C.
Pin 3	N.C.
Pin 4	N.C.
Pin 5	black (1) [white]
Pin 6	black (2) [brown]
Pin ⏚	blank (shield)

Fig. 39: Connecting diagram E20 with 1 sensor

5.7.2 Connecting diagram E20 with one sensor and cable extension



1 Cable
Order no.: CPM12S-G Order no.: CPM12S-W (90° angle socket at sensor)
Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)

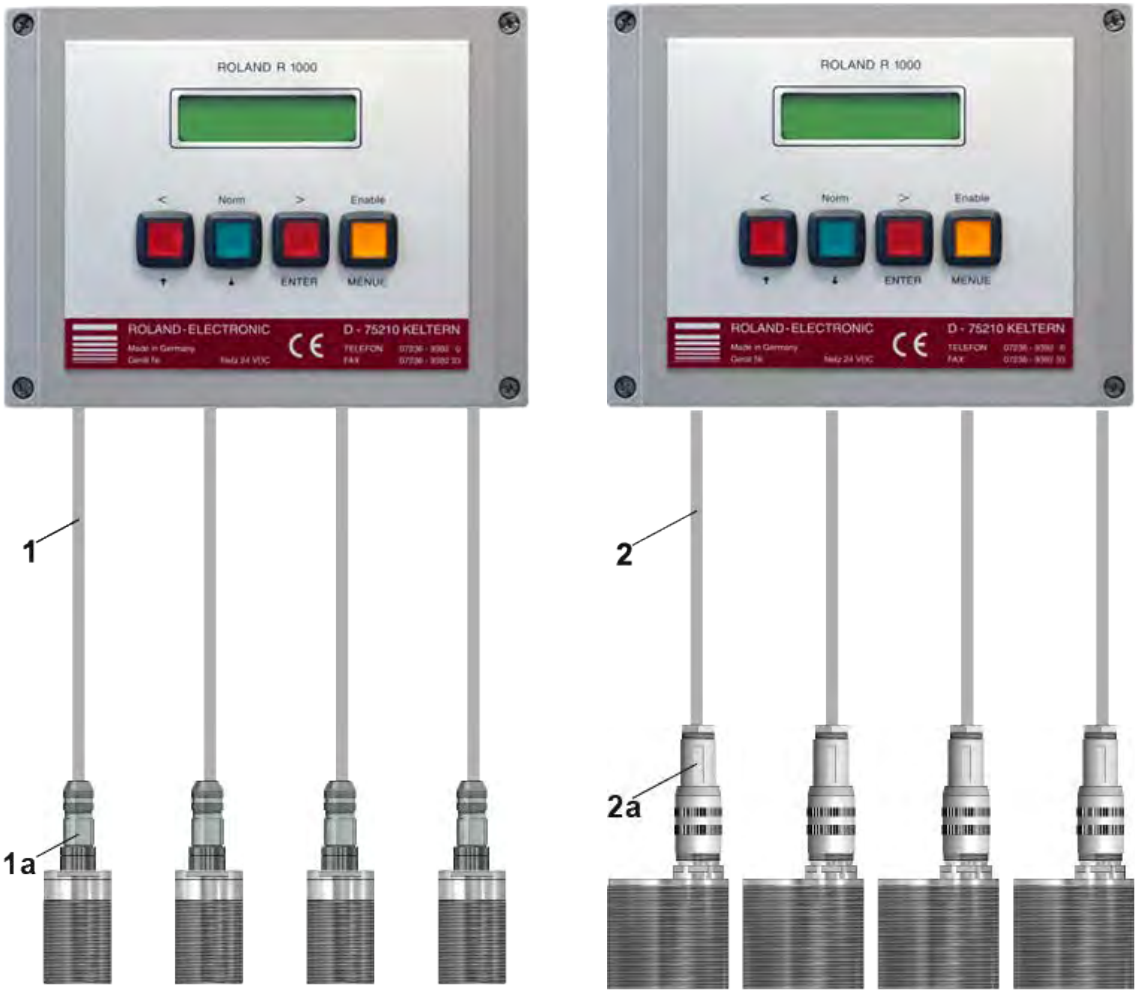
for P30GS and P42AGS	for P36GS, P42GS, P75GS and P75VGS
2 Cable	**3 Cable**
Order no.: SM12CPM12S-GG Order no.: SM12CPM12S-GW (90° angle socket at sensor)	Order no.: SM12CPS-GG Order no.: SM12CPS-GW (90° angle socket at sensor)
Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)	Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)

2a Cable plug (5 contacts)	3a Cable plug (5 contacts)
Order no.: 2277704	Order no.: 2277704
Pin 1 black (1) [white] Pin 2 black (2) [brown] Pin 3 N.C. Pin 4 N.C. Pin 5 blank (shield)	Pin 1 black (1) [white] Pin 2 black (2) [brown] Pin 3 N.C. Pin 4 N.C. Pin 5 blank (shield)

2b Cable socket (5 contacts)	3b Cable socket (7 contacts)
Order no.: 2276116 (straight) 2276117 (90° angle)	Order no.: 2276637 (straight) 2277639 (90° angle)
Pin 1 black (1) [white] Pin 2 black (2) [brown] Pin 3 N.C. Pin 4 N.C. Pin 5 blank (shield)	Pin 1 N.C. Pin 2 N.C. Pin 3 N.C. Pin 4 N.C. Pin 5 black (1) [white] Pin 6 black (2) [brown] Pin ⏚ blank (shield)

Fig. 40: Connecting diagram E20 with one sensor and cable extension

5.7.3 Connecting diagram E20-4P with 4 sensors



for P30GS and P42AGS	for P36GS, P42GS, P75GS and P75VGS
1 Cable	**2 Cable**
Order no.: CPM12S-G Order no.: CPM12S-W (90° angle socket at sensor)	Order no.: CPS-GOIL Order no.: CPS-WOIL (90° angle socket at sensor)
Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)	Oilflex FD810CY 2 x 1mm² or Unitronic FDCP (TP) plus 1 x 2 x 1 mm² (UL / CSA)
1a Cable socket (5 contacts)	**2a Cable socket (7 contacts)**
Order no.: 2276116 (straight) 2276117 (90° angle)	Order no.: 2276637 (straight) 2277639 (90° angle)
Pin 1 black (1) [white] Pin 2 black (2) [brown] Pin 3 N.C. Pin 4 N.C. Pin 5 blank (shield)	Pin 1 N.C. Pin 2 N.C. Pin 3 N.C. Pin 4 N.C. Pin 5 black (1) [white] Pin 6 black (2) [brown] Pin ⏚ blank (shield)

Fig. 41: Connecting diagram E20 with 4 sensors

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6 Communication with the PLC

The E20 has 9 (in case of 1P-control unit) or 11 (in case of a 4P-control unit) galvanically isolated (opto coupled) inputs. For the 4 outputs there are relays or opto couplers available as alternatives. The inputs are sinking inputs and the outputs are sourcing outputs.

6.1 PLC inputs

For external control parallel PLC inputs are available. These inputs can be operated via a PLC. If several functions are executed at the same time, then the unit issues an fault message. The following functions are possible:

- Measurement Start / Stop
- System test
- Menu selection
- Teach-in (not active as factory adjustment)
- Zero adjust (not active as factory adjustment)

6.2 PLC output signals

The following signals are available as outputs:

Opto coupler outputs		
Signal	Meaning	Note
OUT3	0-sheet output	Standard 24 V active (selectable in system configuration)
OUT2	1-sheet output	Standard 24 V active (selectable in system configuration)
OUT1	2-sheet output	Standard 24 V active (selectable in system configuration)
OUT0	ENABLE output	Standard 24 V active (not selectable, for safety reasons)

6.2.1 Explanation of summary output 0-sheet, 1-sheet and 2-sheet:

If the unit is used in sequencer-mode (more than 1 sensor in a program e.g. 1+3+4), the measurement result is formed as summary output. The priorities are:

2-sheet is issued if at least one sensor detects 2-sheet.

1-sheet is issued if all sensors detect 1-sheet.

0-sheet is issued if no 2-sheet is detected but at least one sensor detects 0-sheet.

Truth table for summary output

Sensor 1	Sensor 2	Sensor 3	Sensor 4
2-sheet is issued if:			
2-sheet	any condition		
any condition	2-sheet	any condition	
any condition		2-sheet	any condition
any condition			2-sheet
1-sheet is issued if:			
1-sheet	1-sheet	1-sheet	1-sheet
0-sheet is issued if:			
0-sheet	0-sheet / 1-sheet		
0-sheet / 1-sheet	0-sheet	0-sheet / 1-sheet	
0-sheet / 1-sheet		0-sheet	0-sheet / 1-sheet
0-sheet / 1-sheet			0-sheet

The results of the separate sensors are available in the bytes 12-23 and can be used as required.

6.2.2 Signal „Enable“

The signal ENABLE is always 24V active

The signal is LOW (0V)

- during system operation via keyboard
- in case of system fault
- during a system test

The signal is HIGH (24V)

- when the system is operational

6.3 Timing diagrams

Notes for the following diagrams and descriptions:

For all the following diagrams and explanations the output signal level of OUT1 to OUT3 has been set to "+24 V" in config item 9: "Level 0-1-2".

In case of OUT 1 to OUT3 equal to "0 V" the outputs are inverted. “Level 0-1-2“ does not affect the signal ENABLE OUT0.

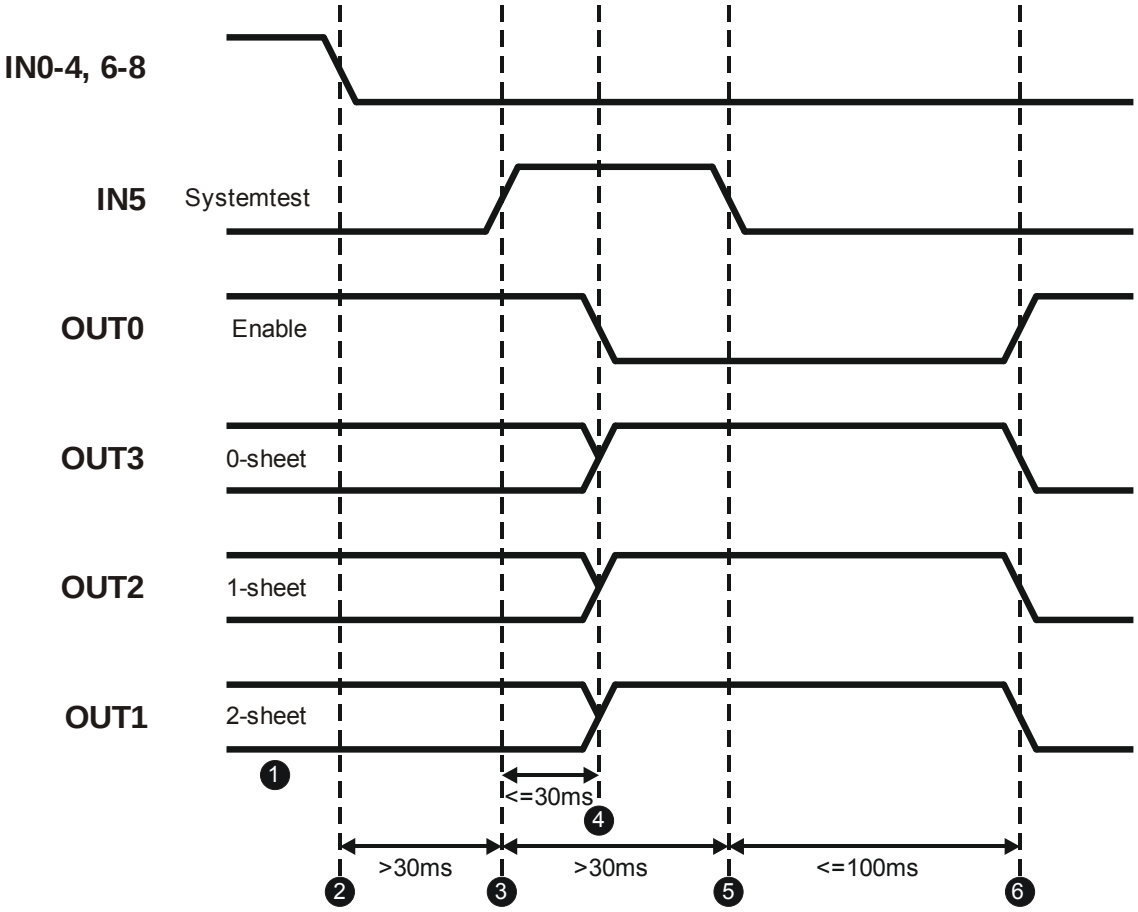
HIGH Level at the outputs means relay is closed respectively opto coupler is low resistant.

LOW Level at the outputs means relay is open respectively opto coupler is high resistant.

6.3.1 System test

The System test should be performed before each measuring cycle.

All outputs (also the Enable) are activated for the duration of the systems test. After the test all activated signals are reversed again.



❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before performing a System test all inputs must be switched to LOW for >30 milliseconds.

❸ Switch the input IN5 “System test“ to HIGH.

❹ Within 30 milliseconds switch the output OUT0 “Enable“ to LOW and outputs OUT1-3 to HIGH.

❺ Switch Input IN5 “System test“ to LOW.

❻ Now the unit performs an internal Systems test. After <= 100 ms output OUT0 “Enable“ is switched to HIGH, outputs OUT1-3 are switched to LOW. The interrogation of the status is not possible under the systems configuration “Measurement internal“ because measurement starts automatically after the completion of the tests. For this reason the control unit has be configured for “Measurement external“.

Example:

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH.

❷ All inputs should be on LOW for more than 30 milliseconds.

❸ Then switch input IN5 to HIGH.

❹ After >30 milliseconds output OUT0 “Enable“ has to been switched to LOW, outputs OUT1-3 to HIGH.

❺ Then switch input IN5 “System test“ to LOW.

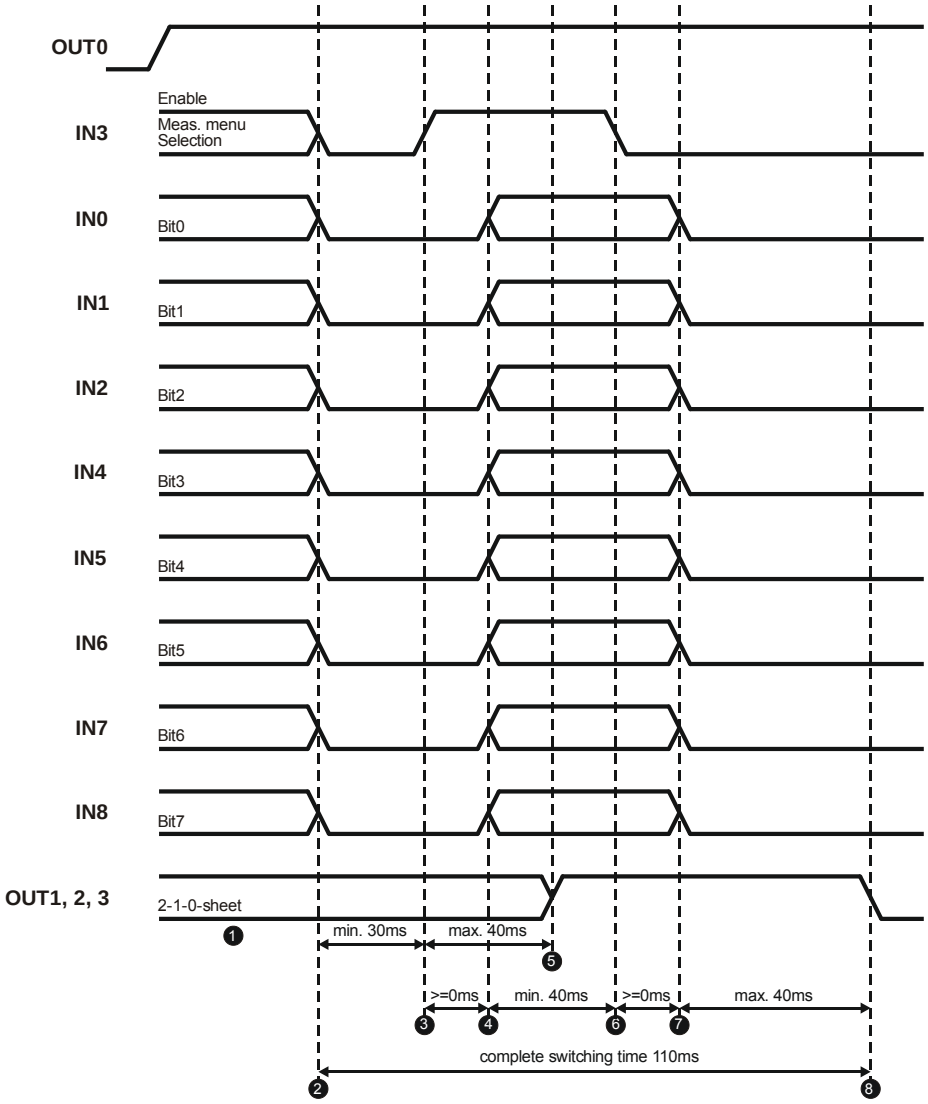
❻ After >100 milliseconds output OUT0 “Enable“ has to been switched to HIGH, outputs OUT1-3 to LOW.

6.3.2 Measurement menu selection

All 255 measuring programs can be selected via the PLC inputs.

For this the inputs IN0 to IN8 are used.

Note The inputs IN0-2 and IN5 are used also for functions other then the selection of the measuring programs. This means that the sequence in the timing diagram has to be followed exactly.



❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before selecting a measurement program all inputs must be switched to LOW for 30 milliseconds.

❸ Switch the input IN3 “Menu selection“ to HIGH

❹ Simultaneously with ❸ or delayed switch the binary values to IN0-2 and IN4-7.

❺ Within 40 milliseconds of switching IN3 “Menu selection“ the outputs OUT1-3 are switched to HIGH.

❻ After the binary value has been present for a minimum of 40 milliseconds, then switch the input IN3 “Menu selection“ to LOW.

❼ Simultaneously with ❻ or delayed switch back the binary values at IN0-2 and IN4-7 (switch to LOW).

❽ After a maximum amount of 40 ms all outputs OUT1-3 are switched to LOW. If the configuration “Measurement internal“ has been selected measurement will start automatically again (provided a valid program has been selected). If the configuration “Measurement external“ has been selected then the operation of the unit it is performed via the PLC.

Example:

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH.

❷ All inputs should be on LOW for more than 30 milliseconds.

❸ Switch input IN3 “Menu selection“

❹ and simultaneously the binary values to IN0-2 and IN4-7.

❺ Check after more than 40 milliseconds whether the outputs OUT1-3 have been switched to HIGH.

❻ Switched the input IN3

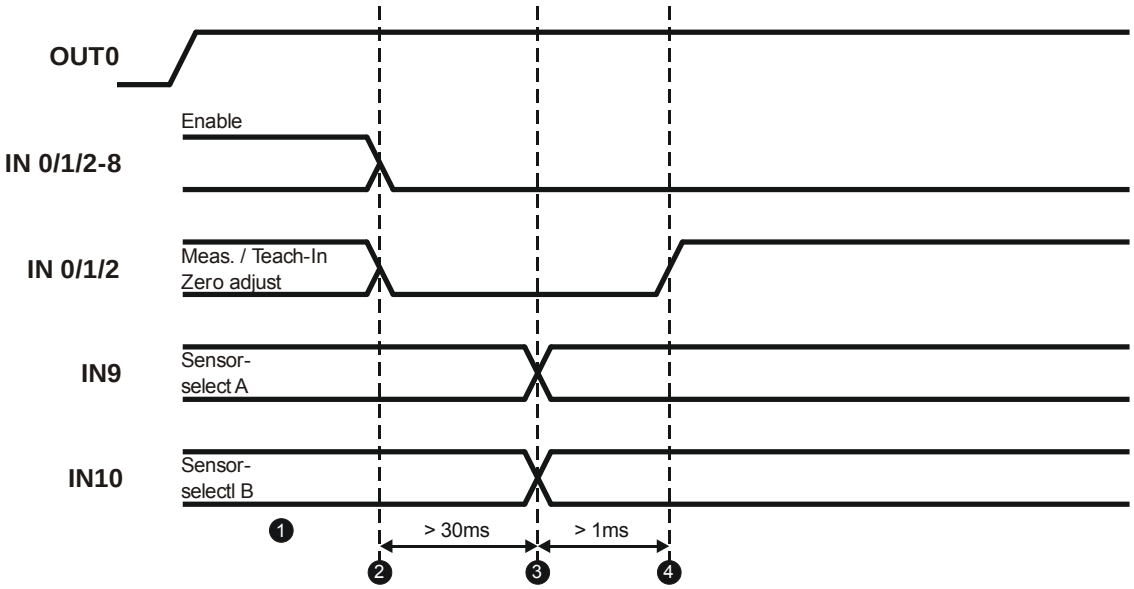
❼ and the binary value (IN0-2 and IN4-7) to LOW.

❽ Wait the necessary time (refer to the diagram) until the outputs OUT1-3 have switched back to LOW.

Program no.	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	1
…	…	…	…	…	…	…	…	…
255	1	1	1	1	1	1	1	0
Not used	1	1	1	1	1	1	1	1

6.3.3 Sensor selection via external inputs (4P version only)

If system parameter “sensor selection“ has been configured to “external“, then the sensor selection functions according to the following timing diagram. This applies to single measurement, continuous measurement, zero adjust and Teach-In.



❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before selecting a sensor all inputs must be switched to LOW for 30 milliseconds.

❸ Switch the inputs IN9 and IN10 for selecting the sensor according to the table.

❹ After >1 milliseconds the measurement can be started. (See timing diagram: Measurement Start/Stop)

Example:

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH.

❷ All inputs should be on LOW for more than 30 milliseconds.

❸ For selecting sensor 2 switch IN9 to HIGH and IN10 to LOW.

❹ After >1 milliseconds the measurement can be started.

Sensor selection B (IN10)	Sensor selection A (IN9)	Selected sensor
0	0	S 1
0	1	S 2
1	0	S 3
1	1	S 4

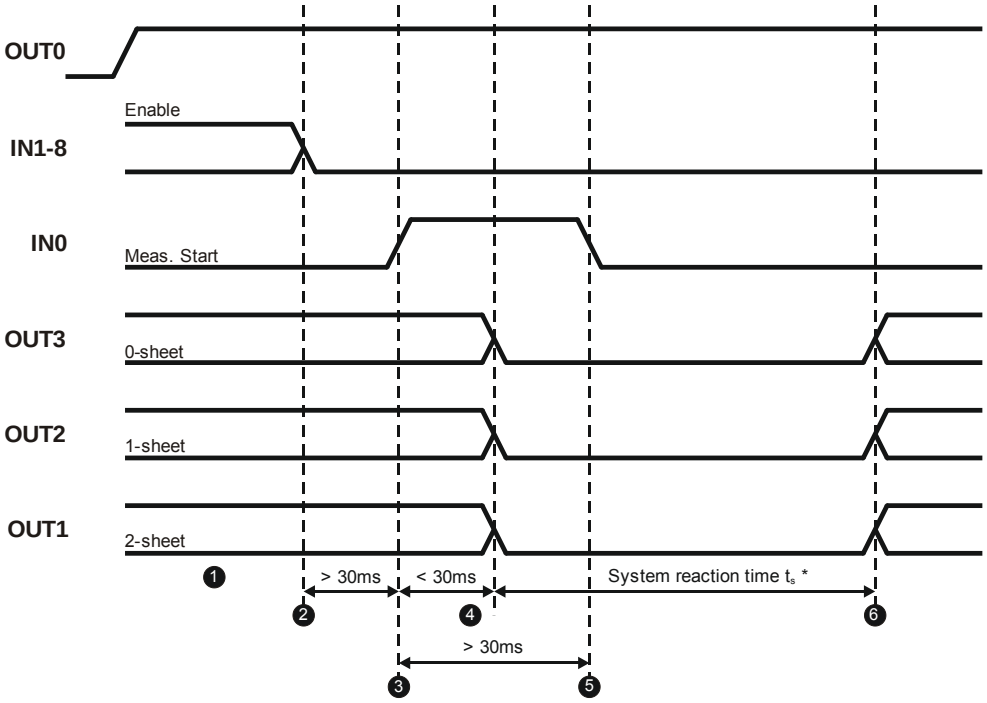
▶ **Note** High Level at the outputs means relay closed respectively opto coupler low resistant. Low Level at the outputs means relay open respectively opto coupler high resistance.

6.3.4 Measurement Start / Stop

External control is different for single measurement and continuous measurement. If the sequencer mode is used, the signals 0-1-2-sheet will be formed as summary output (For details refer to chapter „3.5 Applications examples“).

6.3.4.1 Single measurement

The measurement result remains frozen until a new action is initiated.



*t_s: The system reaction time is the time required by the unit in order to issue the result to the output after the signal "Measurement Start" has been recognized (For details refer to chapter 2.4).

Note **In the relay output version the status of the outputs appears delayed (<10 ms) due to the switching time of the relays.**

Note High Level at the outputs means relay closed respectively opto coupler low resistant. Low Level at the outputs means relay open respectively opto coupler high resistant.

Note If several measurements are executed consecutively, the measuring operation time should not exceed 10 seconds. It is advisable to keep a recovery time of at least twice the measuring operation time. Example: 10 measurements within 1 second, then 2 seconds of recovering time. If the recovery time is less than twice the measuring time, the sensor will warm up and the measuring value will drift.

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before starting a measurement all inputs must be switched to LOW for 30 milliseconds.

❸ Switch the input IN0 “Measurement Start“ to HIGH.

❹ After 30 milliseconds the outputs OUT1-3 are switched to LOW for the duration of the measurement (systems reaction time see chapter 2.2).

❺ After point ❹ or 30 milliseconds after point ❸ switch the input IN0 “Measurement Start“ to LOW.

❻ The measurement result is available (after the systems reaction time t_s) at the outputs OUT1-3 and remains frozen until the new action is initiated.

Example with “fast“ PLC/BUS cycle time (smaller 20 milliseconds):

❶ Check whether the output OUT0 “Enable“ is switched to HIGH.

❷ All the inputs must be in the LOW status for more then 30 milliseconds.

❸ After that switch input IN0 “Measurement Start“ to HIGH.

❹ Check whether all outputs OUT1-3 switch within 30 milliseconds to LOW.

❺ After that switch input IN0 to LOW.

❻ Continue to interrogate the outputs OUT1-3 until (after the systems reaction time t_s) the measurement result is available.

Example with “slow“ PLC/BUS cycle time (larger 20 milliseconds):

❶ Check whether the output OUT0 “Enable“ is switched to HIGH.

❷ All the inputs must be in the LOW status for more then 30 milliseconds.

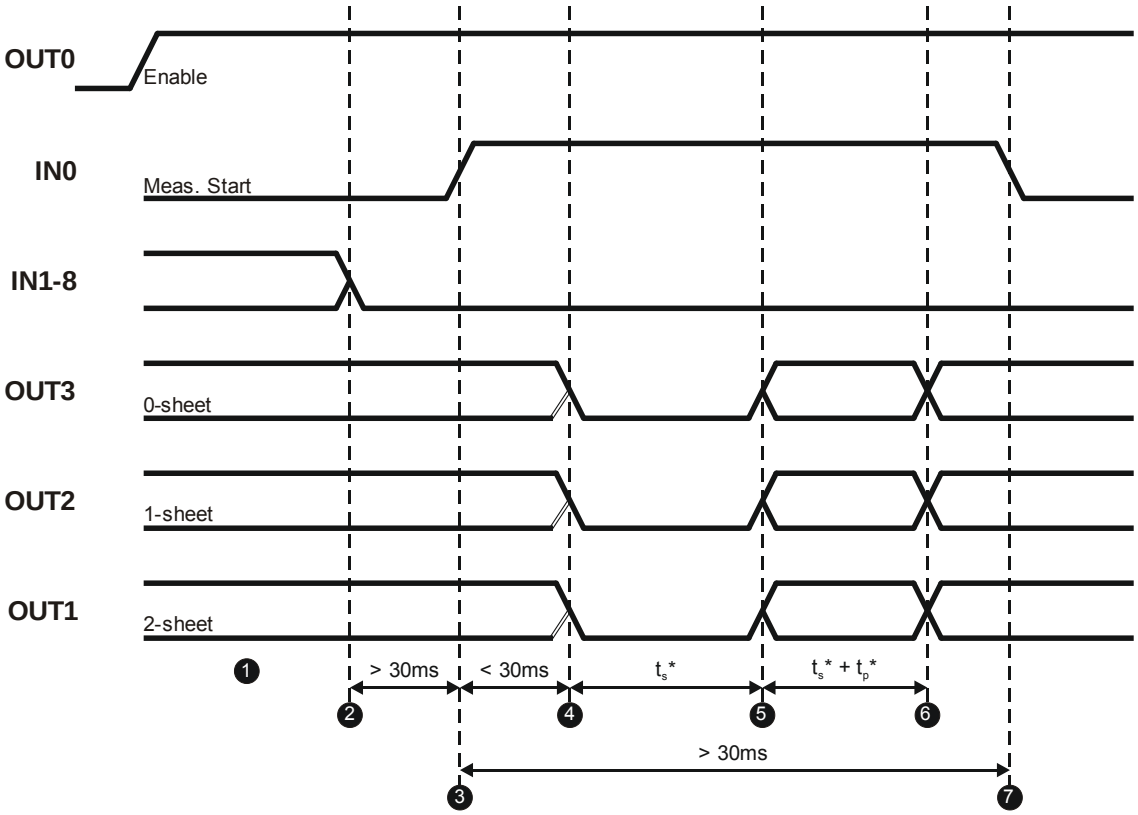
❸ After that switch input IN0 “Measurement Start“ to HIGH.

❺ After more than 30 milliseconds switch input IN0 “Measurement Start“ to LOW.

❻ Continue to interrogate the outputs OUT1-3 until (after the systems reaction time t_s) the measurement result is available.

6.3.5 Continuous measurement

The control unit measures continuously as long as the signal “Measurement Start“ is switched to HIGH. If the signal “Measurement Start“ is switched to LOW, the measurement is aborted and the last measuring result is frozen until a new cycle is initiated.



Note In the relay output version the status of the outputs appears delayed (<10 ms) due to the switching time of the relays.

Note High Level at the outputs means relay closed respectively opto coupler low resistant. Low Level at the outputs means relay open respectively opto coupler high resistant.

*t_S: The system reaction time is the time required by the unit in order to issue the result to the output after the signal "Measurement Start" has been recognized (For details refer to chapter 2.4).

*t_p: additional breaks

- P30, P42, P42A, P75V 0.5 Seconds
- P36 1.0 Second
- P75 2.0 Seconds

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before starting a measurement all inputs must be switched to LOW for 30 milliseconds.

❸ Switch the input IN0 “Measurement Start“ to HIGH.

❹ After 30 milliseconds the outputs OUT1-3 are switched to LOW for the duration of the measurement (systems reaction time see chapter 2.6).

❺ The measurement result is available after the systems reaction time t_s at the outputs OUT1-3 and measurement starts again.

❻ The measurement result of the second measurement is available at the outputs. The measurement starts again.

❼ Switch the input IN1 “Measurement Start“ to LOW. The measurement is aborted, the last measurement result is now available at the outputs OUT1-3. The measurement result is frozen until a new cycle is initiated.

Example with “fast“ PLC/BUS cycle time (smaller 20 milliseconds):

❶ Check whether the output OUT0 “Enable“ is switched to HIGH.

❷ All the inputs must be in the LOW status for more then 30 milliseconds.

❸ After that switch input IN0 “Measurement Start“ to HIGH.

❹ Check whether all outputs OUT1-3 switch within 30 milliseconds to LOW.

❺ Continue to interrogate the outputs OUT1-3 until (after the systems reaction time t_s) the measurement result is available.

❻ If required interrogate several measurements.

❼ Afterwards switch input IN0 to LOW.

The measurement is aborted, the last measurement result is now available at the outputs OUT1-3.

The measurement result is frozen until a new cycle is initiated.

Example with “slow“ PLC/BUS cycle time (larger 20 milliseconds):

❶ Check whether the output OUT0 “Enable“ is switched to HIGH.

❷ All the inputs must be in the LOW status for more then 30 milliseconds.

❸ After that switch input IN0 “Measurement Start“ to HIGH.

❺ Continue to interrogate the outputs OUT1-3 until (after the systems reaction time t_s) the measurement result is available.

❻ If required interrogate several measurements.

❼ Afterwards switch input IN0 to LOW.

The measurement is aborted, the last measurement result is now available at the outputs OUT1-3.

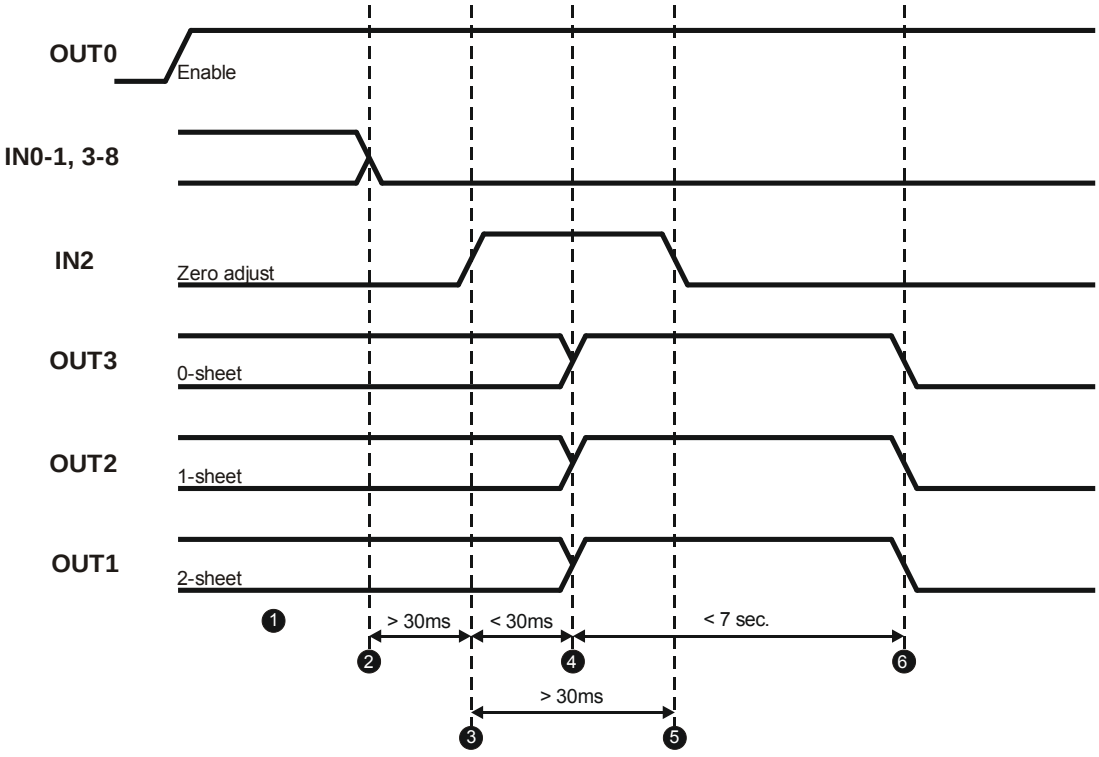
The measurement result is frozen until a new cycle is initiated.

6.3.6 External zero adjust (via PLC inputs)

This function may be required for special applications. It is, however, switched off in the standard factory adjustment. If required it can be activated according chapter “7. Start-up“.

Note According to the setting in the configuration menu, item 13 "Sensor selection" the Zero adjust causes following:
- External:
  a zero adjust is performed at the selected sensor by signal "selection A/B". (see chapter 3.3)
- Program:
  a zero adjust is performed at selected sensors in the active program.

Note During zero adjust no sheet must be in front of the sensor.



❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before initiating zero adjust all inputs must be switched to LOW for 30 milliseconds. There should be no sheet in front of the sensor.

❸ Switch the input IN2 “Zero adjust“ to HIGH.

❹ Within 30 milliseconds the outputs OUT1-3 are switched to HIGH.

❺ After point ❹ or 30 milliseconds after point ❸ switch the input IN2 “Zero adjust“ to LOW.

❻ Now the unit performs a zero adjust. The zero adjust is completed within 7s and the outputs OUT1-3 switch to LOW.

Example:

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH.

❷ No sheet should be in front of the sensor. All inputs should be on LOW for more than 30 milliseconds.

❸ Now switch input IN2 to HIGH.

❹ After 30 milliseconds check whether outputs 1-3 have been switched to HIGH.

❺ Now switch input IN2 to LOW.

❻ After >7 seconds check whether the outputs 1-3 have been switched to LOW.

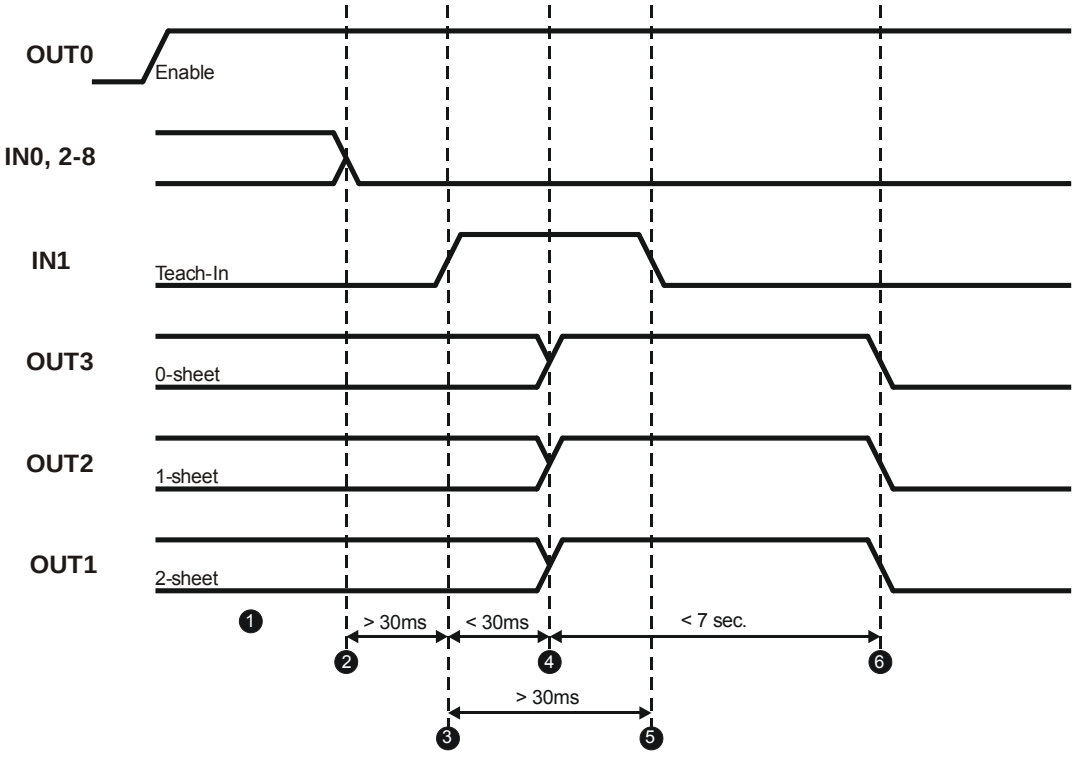
6.3.7 External Teach-In (via PLC inputs)

This function may be required for special applications. It is, however, switched off in the standard factory adjustment. If required it can be activated according chapter “7. Start-up“.

Note According to the setting in the configuration menu, item 13 "Sensor selection" the Teach-In causes following:
- external:
  the selected sensor in "selection A/B" is teached. (see chapter 3.3)
- Program:
  the selected sensors in the active program are teached.

Note During Teach-In one sheet of nominal thickness must be placed in front of the sensor.

Note A zero adjust procedure must be executed immediately before the Teach-in procedure.



❶ Check whether the output OUT0 “Enable“ has been switched to HIGH (ready for operation), otherwise there is a fault condition.

❷ Before initiating the Teach-in all inputs must be switched to LOW for 30 milliseconds. One sheet of nominal thickness must be placed in front of the sensor.

❸ Switch the input IN1 “teach-in“ to HIGH.

❹ Within 30 milliseconds the outputs OUT1-3 are switched to HIGH.

❺ After point ❹ or 30 milliseconds after point ❸ switch the input IN1 “teach-in“ to LOW.

❻ Now the unit performs a “teach-in“ procedure. The teach-in is completed within 7s and the outputs OUT1-3 switch to LOW.

Example:

❶ Check whether the output OUT0 “Enable“ has been switched to HIGH.

❷ One sheet should be in front of the sensor. All inputs should be on LOW for more than 30 milliseconds.

❸ Now switch input IN1 to HIGH.

❹ After 30 milliseconds check whether outputs 1-3 have been switched to HIGH.

❺ Now switch input IN1 “teach-in“ to LOW.

❻ After >7 seconds check whether the outputs OUT1-3 have been switched to LOW.

6.3.8 Typical measurement cycle for unit in destacking application

In order to warrant reliable functioning of the system the following operating cycle is recommended.
It is recommended to perform step 2 at each cycle.

1. Selection of the desired measuring program.
2. System test (This test **should** be performed).
   See timing diagram chapter “6.3.1 System test“
3. The sensor is lowered onto the stack (this stack contains 1 or more sheets).
4. Measurement in order to detect last sheet in the stack (1-sheet signal = only one sheet in the stack) **provided** there is no other metal under the stack.
5. Destack a sheet and move into monitoring position - at least 2 cm (.8 inch) away from stack.
6. Monitor and initiate action depending on measurement result:
   - 0-sheet: Repeat destacking operation.
   - 2-sheet: Initiate actions to remove double sheet or several sheets from destacker.

   After the measure again.

   Attention: During the removal operation measurement should be switched off because of potentially undefined conditions, air gaps between sensor and sheet etc.
   - 1-sheet: continue with point 7.
7. Transport sheet into the proper loading position.
8. Measurement to verify that the sensor is still on the sheet.
9. Release the sheet.
10. After de-stacking a sheet perform security check - Is the sheet de-stacked ?
11. Before de-stacking a new sheet perform point 1 “Selection of the desired measuring program“ or point 2 “System test“.

6.4 Internal control (Demo mode)

In this operating mode the system continuously executes measurements and activates OUT0 … OUT3.

In general, this operating mode is suitable for demonstration purposes only.

Prerequisite:
- Supply voltage applied
- System parameter 4 set to demo mode
- Teach-In has been executed

The external sensor switching via the A/B outputs does not function in this mode.

The refresh rate of the measurement is dependent on the sensor type:

- P30, P42, P42A, P75V 1 Second
- P36 2 Seconds
- P75 4 Seconds

6.5 Serial interface RS232 (version C only)

The serial interface provides all functions necessary for the remote control of the unit. Measuring programs can be selected and measurement can be started but also changes can be made to measured values and limits. The following functions are available:

Function	Description
“Select program number“	adjusts the desire measurement program
“Measurement Start“	starts the measurement
“Measurement Stop“	switches the measurement off
“Measurement request“	supplies the value of the last measurement
“Adjust nominal thickness“	adjusts the nominal thickness for selected program
“Select sensor no. / sequence“	adjusts the desired sensor number / sequence
“Adjust lower limit in %“	adjusts the relative value of the lower limit (threshold) “low“
“Adjust upper limit in %“	adjusts the relative value of the upper limit (threshold) “up“
“Adjust teach-in factor Sensor 1“	adjusts the teach-in for sensor 1 (only the value transferred by the control unit should be re-entered)
“Adjust teach-in factor Sensor 2“	adjusts the teach-in for sensor 2 (only the value transferred by the control unit should be re-entered)
“Adjust teach-in factor Sensor 3“	adjusts the teach-in for sensor 3 (only the value transferred by the control unit should be re-entered)
“Adjust teach-in factor Sensor 4“	adjusts the teach-in for sensor 4 (only the value transferred by the control unit should be re-entered)
“Issue zero adjust command“	starts a zero adjust
“Issue teach-in command“	starts a teach-in
“Request fault message and delete“	supplies the fault status of the control unit and acknowledges the fault
“Request download“	supplies the download data
“Request current program	supplies the parameters of the current program (same data format as in the download)
“Request program no. XXX	supplies the parameters of the program no. XXX (same data format as in the download)

6.5.1 Transmission parameters

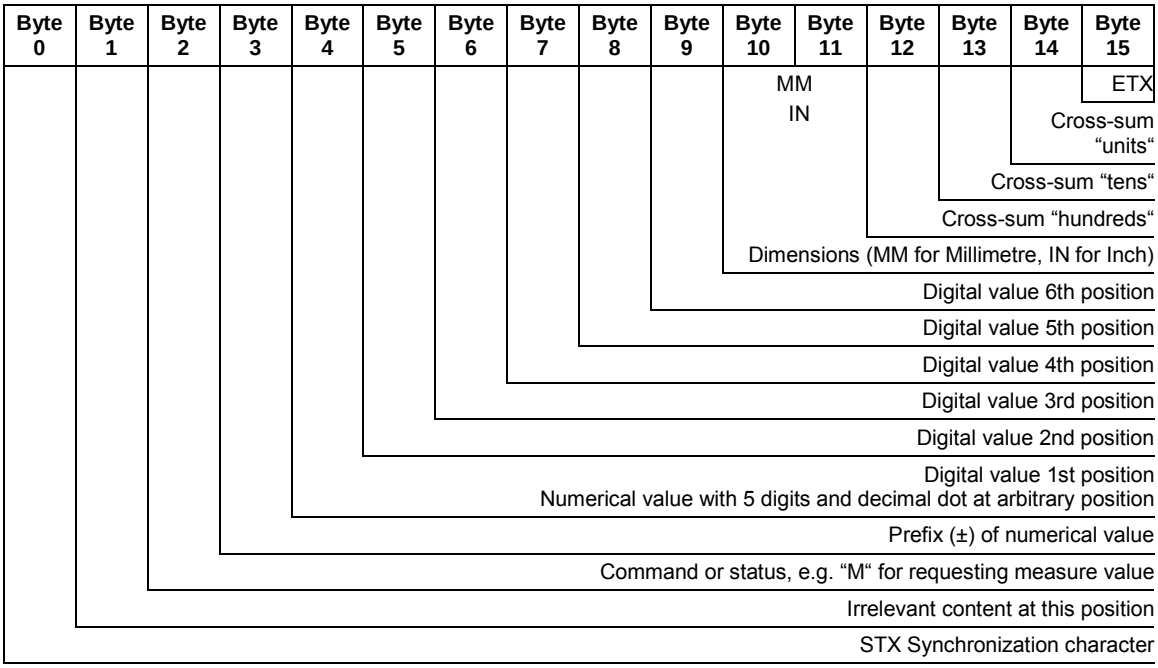
The RS232 interface of the R1000 uses the following transmission parameters:

- asynchronous transmission
- 1 Start bit (Low)
- 8 Data bits (LSB first)
- 1 Stop bit (High)
- 300 - 19200 Baud

A parity bit as well as software and hardware handshakes are not available.

6.5.2 Data format and commands (version C only)

The data format is as follows:



The cross-sum calculates from the sum of Byte 1 to Byte 11.

Commands via the RS232 interface towards the R1000 (C versions only)

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
Select prog. no.	STX	-	P	+	0	0	0	ZH	ZZ	ZE	-	-	QH	QZ	QE	ETX
Measurement start	STX	-	S	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Measurement stop	STX	-	H	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Request measurement*	STX	-	M	+	0	0	0	0	0	ZE	-	-	QH	QZ	QE	ETX
Adjust nominal value	STX	-	N	+	X	•	X	X	X	X	Dimension		QH	QZ	QE	ETX
Select sensor no. / sequence**	STX	-	J	+	0	0	0	0	ZZ	ZE	-	-	QH	QZ	QE	ETX
Lower limit %	STX	-	u	+	0	0	0	0	ZZ	ZE	-	-	QH	QZ	QE	ETX
Upper limit %	STX	-	o	+	0	0	0	ZH	ZZ	ZE	-	-	QH	QZ	QE	ETX
Adjust Teach factor S1	STX	-	t	+	X	•	X	X	X	X	X	X	QH	QZ	QE	ETX
Adjust Teach factor S2	STX	-	Q	+	X	•	X	X	X	X	X	X	QH	QZ	QE	ETX
Adjust Teach factor S3	STX	-	G	+	X	•	X	X	X	X	X	X	QH	QZ	QE	ETX
Adjust Teach factor S4	STX	-	E	+	X	•	X	X	X	X	X	X	QH	QZ	QE	ETX
Zero adjust start	STX	-	Z	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Teach-In start	STX	-	T	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Request error message	STX	-	F	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Delete error message	STX	-	f	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Request download	STX	-	D	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Request current program***	STX	-	A	+	0	0	0	0	0	0	-	-	QH	QZ	QE	ETX
Request program number***	STX	-	A	+	0	0	0	ZH	ZZ	ZE	-	-	QH	QZ	QE	ETX

* Sensor sequence: 1=S1; 2=S2, 3=S3; 4=S4; 5=S1+S2; 6=S1+S3; 7=S1+S4; 8=S2+S3; 9=S2+S4; 10=S3+S4; 11=S1+S2+S3; 12=S1+S2+S4; 13=S1+S3+S4; 14=S2+S3+S4; 15=S1+S2+S3+S4

** request sensor no. X

*** The data written back from the R1000 have the same data format as for download.

Meaning of the characters in the table:

0 = a 0 (zero) must be in this position
– = the characters in this position are immaterial
X = represents a digital value
E = single digit (least significant value)
Z = Number and Ten´s position of a number (e.g. ZZ)
H = Hundred´s position of a number
Q = Cross sum
• = Decimal point

The program interrogates only those bytes which are relevant for the function under consideration.

Example:
Byte 10 and 11 (dimension) have no meaning for the function select "Program n umber". The program therefore ignores these bytes. The digits in Byte 11 and 12 have only a meaning for the cross sum.

The following order of entries is mandatory when entering a parameter-program via the serial interface:

1. Select program number
2. Sensor number / sequence
3. Communicate nominal thickness
4. Communicate limit threshold

Every command issued to the R1000 is acknowledged with a error status message. Exceptions are requests for measurement values, down load and programs.

If the error status message contains an error code in Byte 8/9 which is different from zero, then it is necessary to eliminate the cause of the fault.

In order to proceed working with the unit it is necessary to acknowledge the error with the command ”Request error message/delete“.

The fault cannot be acknowledged or deleted if the cause is not eliminated.

Commands issued from the R1000 (Version C only)

The R1000 responds to a request for measurement value or error code as follows:

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
Measurement value	STX	-	M	+	X	•	X	X	X	X	Dimension		QH	QZ	QE	ETX
Error status	STX	-	F	+	0	0	0	0	ZZ	ZE	-	-	QH	QZ	QE	ETX

If no measured value is present, then it supplies:

at mm: **STX,0,M,+,-,-,.,-,-,-,-,M,M,QH,QZ,QE,ETX**
at inch: **STX,0,M,+,-,.,-,-,-,-,-,I,N,QH,QZ,QE,ETX**

The fault message ”30” means teach-in fault. This means that a teach-in has been attempted with a sheet which is 25% thinner or 34% thicker than the nominal value of the selected measuring program. This could mean that the selected measuring program is not intended for the sheet presently in front of the sensor or that an incorrect sheet is being used for the teach-in process.

The described data formats above must be followed exactly for data transmission otherwise the R1000 will issue an fault message.

All available fault messages and their meaning are described in chapter ”9. Fault messages”.

For downloading, the R1000 sends the data of **all measuring programs complete as one block**. The format of the table below applies. If the data is requested for the currently selected program or one specific program then the R1000 sends the data in the format described below but for **one program** only.

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
Program no.	STX	-	P	+	0	0	0	**0**	**0**	**1**	-	-	QH	QZ	QE	ETX
Sensor no.	STX	-	J	+	0	0	0	0	ZZ	ZE	-	-	QH	QZ	QE	ETX
Nominal value	STX	-	N	+	X	•	X	X	X	X	Dimension		QH	QZ	QE	ETX
Lower limit %	STX	-	u	+	0	0	0	0	ZZ	ZE	%	-	QH	QZ	QE	ETX
Upper limit %	STX	-	o	+	0	0	0	ZH	ZZ	ZE	%	-	QH	QZ	QE	ETX
Teach factor S1	STX	-	t	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S2	STX	-	Q	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S3	STX	-	G	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S4	STX	-	E	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Program no.	STX	-	P	+	0	0	0	**0**	**0**	**2**	-	-	QH	QZ	QE	ETX
Sensor no.	STX	-	J	+	0	0	0	0	ZZ	ZE	-	-	QH	QZ	QE	ETX
Nominal value	STX	-	N	+	X	•	X	X	X	X	Dimension		QH	QZ	QE	ETX
Lower limit %	STX	-	u	+	0	0	0	0	ZZ	ZE	%	-	QH	QZ	QE	ETX
Upper limit %	STX	-	o	+	0	0	0	ZH	ZZ	ZE	%	-	QH	QZ	QE	ETX
Teach factor S1	STX	-	t	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S2	STX	-	Q	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S3	STX	-	G	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S4	STX	-	E	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Program no.	03 - 254															
Program no.	STX	-	P	+	0	0	0	**2**	**5**	**5**	-	-	QH	QZ	QE	ETX
Sensor no.	STX	-	J	+	0	0	0	0	ZZ	ZE	-	-	QH	QZ	QE	ETX
Nominal value	STX	-	N	+	X	•	X	X	X	X	Dimension		QH	QZ	QE	ETX
Lower limit %	STX	-	u	+	0	0	0	0	ZZ	ZE	%	-	QH	QZ	QE	ETX
Upper limit %	STX	-	o	+	0	0	0	ZH	ZZ	ZE	%	-	QH	QZ	QE	ETX
Teach factor S1	STX	-	t	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S2	STX	-	Q	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S3	STX	-	G	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX
Teach factor S4	STX	-	E	+	1	•	0	0	0	0	0	0	QH	QZ	QE	ETX

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7 Start-up

7.1 Initially applying power to the system

The R1000 UDK20 is designed for an operating voltage of 24 VDC (+ 6 V / - 2 V). This voltage is to be checked before applying power. The control unit is automatically switched on by applying the power. After applying power, the type of system, the version number and the bus system message are briefly displayed. Then the system switches into that measurement menu, which was active before the unit was switched off.

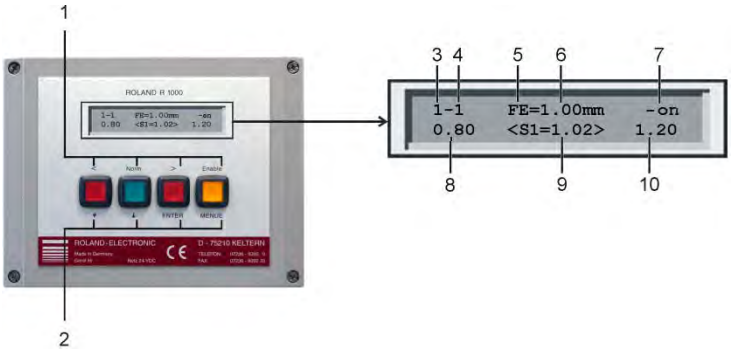
After installation, the system configuration must be adapted if necessary.
Thereafter, a zero adjust must be performed with all connected sensors.

Note Exchanging of sensors, cables and unit require to perform a zero adjust.

7.2 Operation

Note The system is factory adjusted for “single measurement“. Therefore the system functions only if the signal “measurement start“ is activated. The modification of the configuration is described in the following sections.

After applying power to the system, the system type and the version number are briefly displayed. Afterwards the system switches into that measurement menu which was active before the unit was switched off.



1 LED functions
2 Pushbutton functions
3 Program number
4 Selected sensor
5 Type of material
6 Nominal thickness
7 Measurement status
8 Lower limit value
9 Sensor number with measured value
10 Upper limit value

Fig. 42: Frontal view of the R1000 with enlarged display detail

LED functions (symbols above the keys)	
<	ON, if the measured value reaches (or falls short of) the lower limit value.
Norm	ON, if the measured value is within the lower and upper limit values.
>	ON, if the measured value reaches (or exceeds) the upper limit value.
Enable	- blinks, if a fault is present - ON, if the equipment is in measurement mode - OFF, during parameter programming with the keyboard

Key functions (symbols below the keys)	
↑	Changes the parameters (forward)
↓	Changes the parameters (backwards)
Enter	Selects a parameter for changing and confirming the change
Menu	Activates the menu level, for deleting a fault message and exiting the menu level.

7.3 Configuration menu

7.3.1 Main menu structure

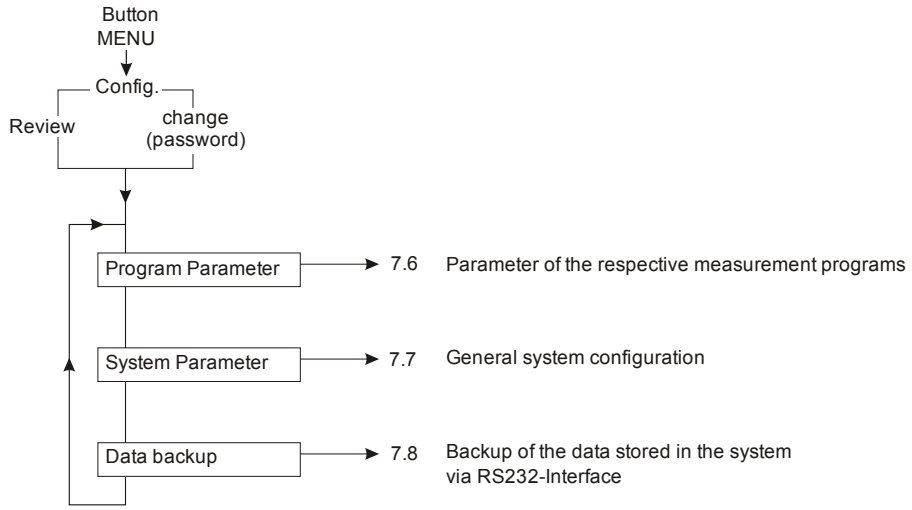


Fig. 43: Main structure of configuration menu

7.3.2 Sub structure “Program parameter”

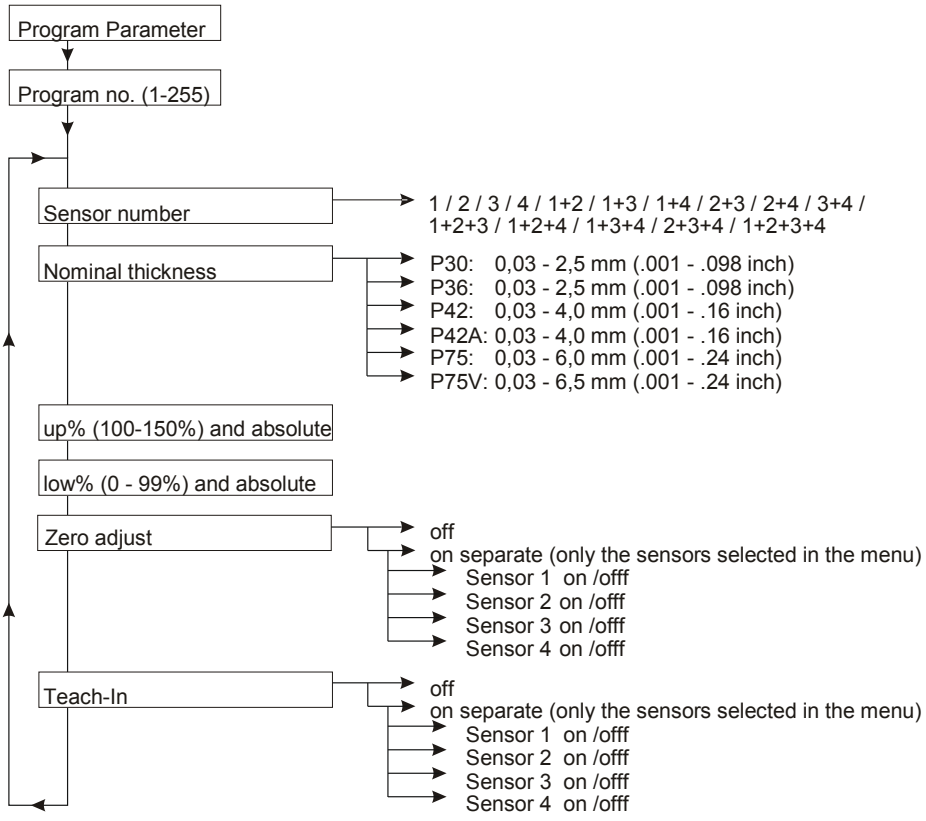


Fig. 44: Sub structure „Program parameter“

7.3.3 Sub structure “System parameter”

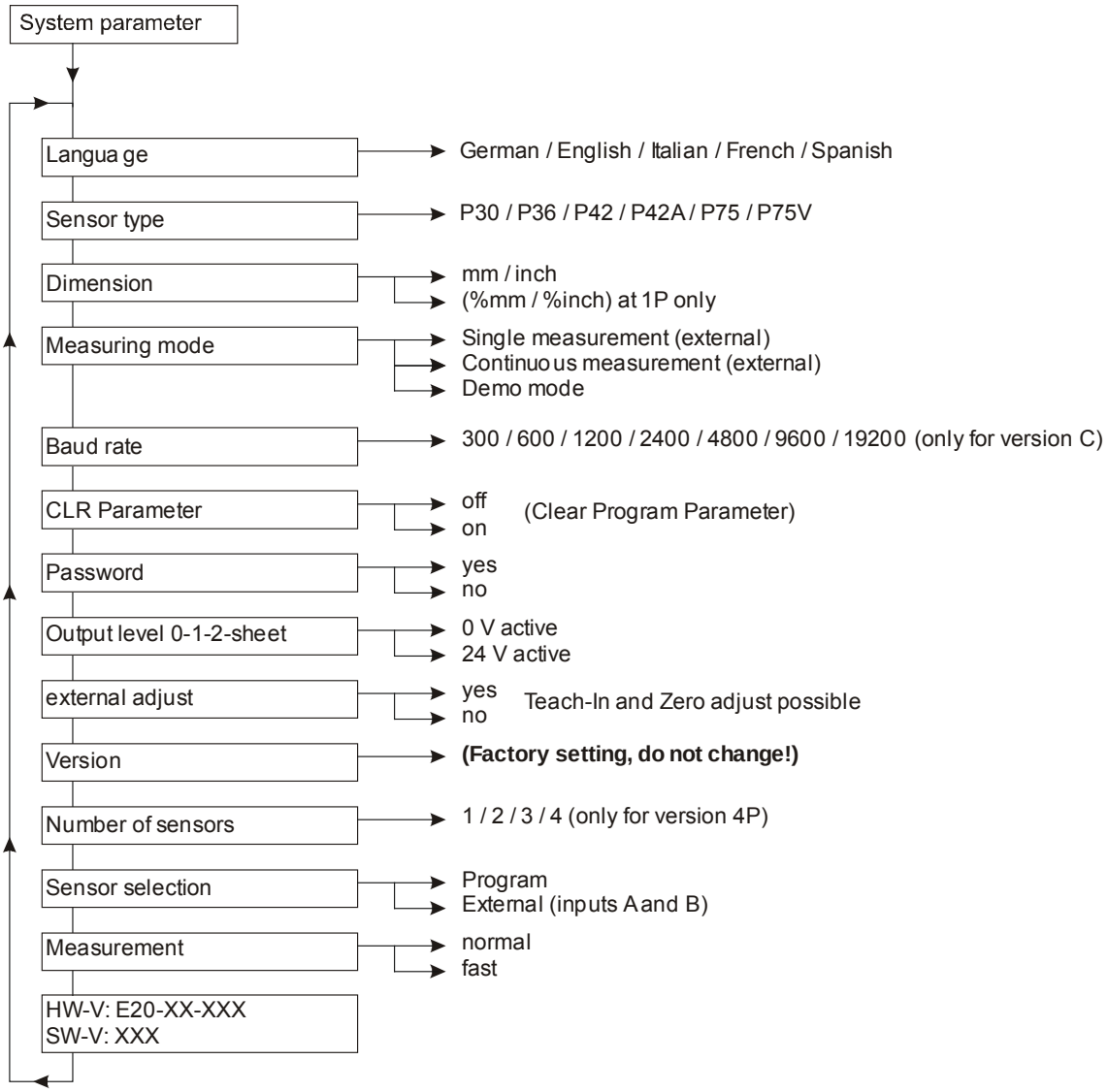


Fig. 45: Sub structure „System parameter“

7.4 General information regarding the configuration

Note The correct configuration depends on the communication with the PLC, on the measurement task and the connected components.

The following rules apply to the operation in the configuration mode:

- The configuration mode is activated (while in measurement mode) by pressing the *MENU* key.
- The configuration mode is terminated or cancelled by pressing the *MENU* key.
- The selected / set parameters can be changed when the items are blinking in the display.
- The selected / set parameters are activated by pressing the *ENTER* key.

7.5 Changing, setting-up or checking the configuration

In order to select, set-up or check the system / program parameters, press the *MENU* key.

The following menu is shown.

Fig. 46: Indication after calling-up the menu

This menu option permits either reviewing or changing the configuration.

Configuration review: The system / program parameters cannot be changed. The measurement mode is not interrupted.

Configuration change: All system / program parameters can be changed after entering the password.

The following menu option is shown.

Fig. 47: Password request

Each blinking digit can be changed with the arrow keys and confirmed with *ENTER*. After having entered the correct password, the following menu appears for the adjustment of the configuration mode.

If the entered password is incorrect then the cursor returns to the first digit of the password and the input must be repeated. The input of the password can be aborted by pressing the *MENU* button.

Note: A fault is generated if PLC commands are executed while entering the password or changing parameters.

Fig. 48: Selecting the configuration mode

Available configuration modes:

- Configuration system parameter
- Configuration program parameter
- Data backup

System parameters are general adjustments (e.g. language).
Program parameters are application specific adjustments (e.g. input of nominal sheet thickness).

Note After exiting the configuration mode the password remains active for five minutes. Thus other configuration adjustments can be made, without re-entering the password. If no key is pressed (while in the menu level), then the program changes to the measurement mode

7.6 Program parameters

The program parameters contain the information required for the various measurement programs. For accessing the program parameters, select the mode “configuration program parameter“ and confirm with *ENTER*.

Program parameter 1: Selecting the measuring program to be configured.

Fig. 49: Selecting the program to be configured

Here the measuring program (1-255) to be configured is selected. All following adjustments apply to the selected program (here: program no. 1).

Program parameter 2: Selecting the sensor to be used for measurement (only for 4P version).

Fig. 50: Selecting the sensor

Here the sensor (1 - 4) must be selected, which is to be used for measurement (4P version only). For this purpose the item "program" must be selected under “sensor selection“ in the system configuration.

If the sensor selection is made via "program" the sequence measurements are also available. Thus the following combinations are available:

- 1 / 2 / 3 / 4 / 1+2 / 1+3 / 1+4 / 2+3 / 2+4 / 3+4 / 1+2+3 / 1+2+4 / 1+3+4 / 2+3+4 / 1+2+3+4

Program parameter 3: Specifying the nominal thickness of the sheet to be measured.

Fig. 51: Adjusting the nominal thickness

Here the nominal thickness of the sheet to be measured is specified. Normally, the nominal thickness is the sheet thickness used for teach-in.

Note A change of the nominal thickness deletes the values determined during teach-in. A new teach-in is required.

Program parameter 4: Setting the percentage threshold of the upper limit value.

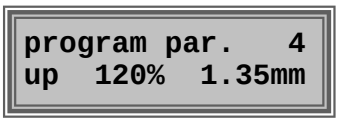


Fig. 52: Adjusting the upper limit

Value range: between 100% and 150%, with simultaneously displaying the absolute limit value.

The maximal settable absolute limit depends on the sensor:

- P42, P42A: 5 mm (.197in.)
- P30, P36: 3 mm (.118in.)
- P75: 6.8 mm (.268in.)
- P75V: 9.2 mm (.362in.)

Program parameter 5: Setting the percentage threshold of the lower limit value.

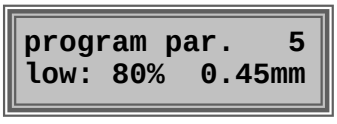


Fig. 53: Adjusting the lower limit

Value range: between 0% and 99%, with simultaneously displaying the absolute limit value.

Program parameter 6: Zero adjust

Attention Before performing a Zero adjust procedure, verify in any case that no sheet is in front of the sensor (the sensors).

Fig. 54: Status of Zero adjust

For performing a zero adjust press the ENTER key (if no zero adjust is present or for repeating)

Possible choices (only for 4P versions):

- separate: All connected sensors must be zero adjusted individually (each sensor is addressed individually for *"on"* or *"off"*).
- common: All sensors are zero adjusted at the same time.

Note the choices *"separate"* and *"common"* are available only for 4P versions with more than one sensor connected.

During the zero adjust the following message is shown:

Fig. 55: Display during zero adjust

Note Fault messages are described in the chapter "9 Fault messages".

When the zero adjust is completed, the following message appears:

Fig. 56: Zero adjust successfully completed

The zero adjust is now completed.

Program parameter 7: Teach-in

Fig. 57: Status of Teach-in

Possible choices:

- off: A Teach-In has not been executed
- on: A Teach-In will now be performed

For performing a Teach-In, select “on“ and press the *ENTER* key (if no teach-in was done or if a Teach-In has to be repeated).

Then the operator is requested to attach a sheet with nominal thickness:

Fig. 58: Request for attaching a sheet

Attach a sheet with nominal thickness.

Attention A sheet must be attached to the sensor without air gap. The position of the sheet during teach-in must be the same as for normal operation. Otherwise the measurement result could be faulty.

Then press the ENTER key.

The Teach-In measurement value is then displayed:

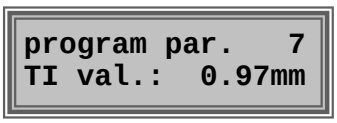


Fig. 59: Teach-in measurement value

This measured value can be accepted or changed, e.g. to calibrate the control unit.

The teach-in procedure is now completed (for a 1P system).

Attention For a 4P system with sequential measurement the entire teach-in procedure for all sensors is performed in the selected sequence. For sensor selection A/B the Teach-In for the selected sensor is then competed. However, if all sensors should be taught, then the teach-in of the other sensors must be repeated separately.

Description of the Teach-In procedure:

	Locally at the control unit		**With PLC (parallel or fieldbus)**	
With system parameter 3:	mm or inch	%mm or inch	mm or inch	%mm or inch
Step 1: attach sheet to sensor and initiate teach-in	measured value is displayed	measured value is displayed	– –	– –
Step 2: Calibration	change displayed value to actual value (e.g. as measured with a micrometer) Max. possible correction see I.	displayed value is transferred as nominal thickness (100%) to the program Max. possible correction see II.	measured thickness is changed to nominal thickness Max. possible correction see III.	measured thickness is transferred as nominal thickness (100%) to the program Max. possible correction see II.

I. Maximum possible correction is double the displayed value, however, not more than 133% of the nominal thickness and not more than the max. measurable thickness (depends on sensor size), under gauge correction is max. 75% of the displayed value, however not less than 50% of the nominal dimension

II. Unlimited, displayed value must be larger than 0.05 mm and smaller than the max. measurable thickness (depends on sensor size)

III. +100% / -25% related to the measured thickness. If this correction range is not sufficient, in order to reach the nominal dimension, an error message is generated

The Teach-In affects only the selected program.

7.7 System parameters

Note The selected system configuration should be documented in the form “System configuration“ in the chapter 13.2. This information is required in case a system needs to be exchanged.

The general adjustments are specified in the system parameters.
For accessing, select the “system parameter configuration“ mode and confirm with *ENTER*.

System parameter 1: Setting the dialogue language.

Fig. 60: Selecting the dialogue language

System parameter 2: Specifying the type of sensor.

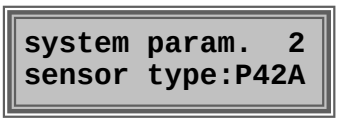


Fig.. 61: Specifying the type of sensor

Currently available sensors:

- P30
- P36
- P42
- P42A
- P75
- P75V

Attention Changing the adjusted configuration will delete all stored program parameters. Then the nominal thicknesses must be re-entered and Teach-In must be performed for all sheet types!

System parameter 3: Selecting the dimensions for the display (mm / inch).

By changing the dimensions for the display to mm or inch, the sheet metal thicknesses of the program parameters are converted into the new dimension. In addition % mm and % inch are available (not for 4P version).

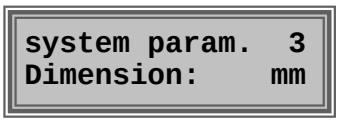


Fig.. 62: Selecting the dimension for the display

System parameter 4: Adjusting the measuring mode.

Fig.. 63: Adjusting the measuring mode

Possible measurement modes:

- **External continuous measurement:** The system executes measurements, as long as the "Measurement start" signal is applied via the external PLC input. The repetition rate of the measurement depends on the type of sensor: 0.5 seconds for P42, P30, P42A, P75V; 1 second for P36; 2 seconds for P75.
- **External single measuring:** The system measures once if the "Measurement start" signal is applied via the external PLC input. Each measurement must initiated separately. The hints in chapter 6.1.4.1 „timing diagram single measurement" must be abided by.
- **Demo mode:** This mode of operation is intended for equipment demonstrations, but not for normal process operation. The system executes measurements continuously. The repetition rate of the measurement depends on the type of sensor: 1 second for P42, P30, P42A, P75V; 2 seconds for P36; 4 seconds for P75.

System parameter 5: Adjusting the baud rate of the serial RS232 interface (for C version only).

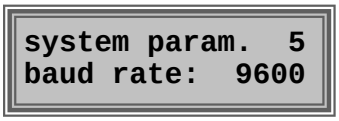


Fig.. 64: Adjusting the baud rate

According to the requirements of the super-ordinated system, values from 300 – 19200 can be set.

System parameter 6: Deleting all measuring programs.

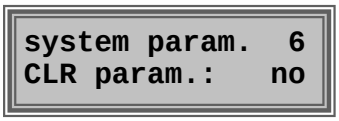


Fig.. 65: Deleting of measuring programs

Attention The deletion cannot be undone.

System parameter 7: Switching the password function on / off.

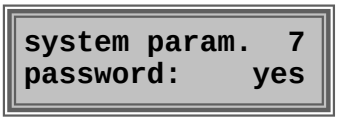


Fig.. 66: Switching the password on / off

Attention If no password is activated, then all parameters can be accessed at any time. We recommend this only during starting-up the system. For daily operation the password function should be activated.

System parameter 8: Setting the output logic (0-sheet, 1-sheet, 2-sheet outputs).

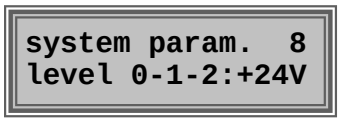


Fig.. 67: Setting the output logic

Possible choices:

- 0 V: The outputs 0-sheet, 1-sheet and 2-sheet are inverted, i.e. the respective signals in the timing diagrams must be seen inverted.
- +24 V: As shown in the timing diagrams.

Note The output “Enable“ is not affected thereby.

System parameter 9: Deactivating / activating the external calibration via fieldbus.

Fig.. 68: Deactivating / activating the external calibration

Here the external calibration, which is possible via PLC with the signals “teach-in“ and “zero adjust“, can be deactivated / activated.

System parameter 10: Indication of system version.

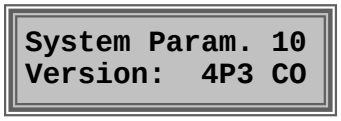


Fig.. 69: Indication of system version, here 4P with 3 sensors, Version C, Opto coupler

This factory setting **must not be changed!**

System parameter 11: Specifying the number of connected sensors (only for 4P unit).

Fig.. 70: Specifying the number of sensors

Possible choices:

- 1 sensor
- 2 sensors
- 3 sensors
- 4 sensors

Attention Changing the adjusted configuration will delete all stored program parameters. Then the nominal thicknesses must be re-entered and Teach-in must be performed for all sheet types!

System parameter 12: Specifying the type of actuating the sensors (only for 4P control unit).

Fig.. 71: Sensor selection

Possible choices:

- External: Switching of sensor is accomplished via the external PLC cables „Sensor selection“ A and B.
  Advantage: faster sensor switching procedure.
- Program: Switching of sensor is accomplished via program selection.
  A sensor is assigned to each program.
  Advantage: less programming effort.

System parameter 13: Selecting the speed of measurement.

Fig.. 72: Selecting the speed of measurement

Possible choices:

- normal: Here the system reaction time depends on the measured sheet thickness. The maximum can be inferred from the diagrams in chapter "2.4"
- fast: Here the system is enabled to detect double sheets before the "normal" end of the measurement.
  Advantage: The system reaction time is shorter and depending on the adjusted nominal thickness as well as the upper limit value.
  Disadvantage: In case of measuring results larger than the double sheet threshold, a double sheet signal is issued but not the actual measurement values.

System parameter: Indication of versions of Hardware and Software.

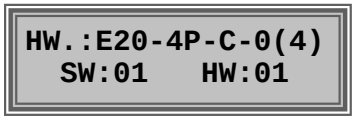


Fig.. 73: Indication of versions

Meaning:

E20	Type of system	(4)	4 sensors connected
4P	Version with 4 Sensors	SW	Software version
C	Version C	HW	Hardware version
O	Version Opto coupler		

7.8 Data storage via serial RS232-interface

For better prevention from loss of data, a data backup procedure is available for the system configuration and the parameter sets. This is made via the RS232-interface (not in B- versions). The secured data can be transferred to spare units in case of exchange after a failure.

The data backup is accomplished with the RPP1000 software available from ROLAND.

The data backup procedure can be selected in the menu configuration. The following menu is displayed during the data backup.

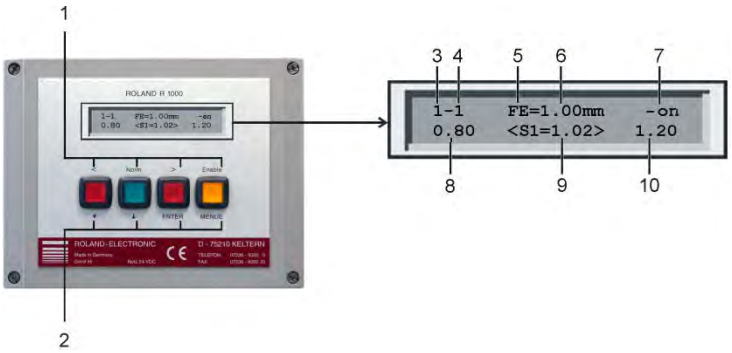
Fig. 74: Status of data backup

8 Operation

8.1 Abbreviated operating instructions

Note The system is factory adjusted for “single measurement“. Therefore the system functions only if the signal “measurement start“ is activated. The modification of the configuration is described in the following sections.

After applying power to the system, the system type and the version number are briefly displayed. Afterwards the system switches into that measurement menu which was active before the unit was switched off.



1 LED functions
2 Pushbutton functions
3 Program number
4 Selected sensor
5 Type of material
6 Nominal thickness
7 Measurement status
8 Lower limit value
9 Sensor number with measured value
10 Upper limit value

Fig. 75: Frontal view of the R1000 with enlarged display detail

LED functions (symbols above the keys)	
<	ON, if the measured value reaches (or falls short of) the lower limit value.
Norm	ON, if the measured value is within the lower and upper limit values.
>	ON, if the measured value reaches (or exceeds) the upper limit value.
Enable	- blinks, if a fault is present - ON, if the equipment is in measurement mode - OFF, during parameter programming with the keyboard

Key functions (symbols below the keys)	
↑	Changes the parameters (forward)
↓	Changes the parameters (backwards)
Enter	Selects a parameter for changing and confirming the change
Menu	Activates the menu level, for deleting a fault message and exiting the menu level.

In the measuring mode the measured value can be read in the display. The control unit automatically compares the measured value with the adjusted thresholds. The result is transmitted via the interface to the PLC and also to the front panel LED's.

During the normal measurement process no further actions on the control units are necessary with the following few exceptions. The following situations require action directly at the control unit or an action via the field bus interface:

- Clear fault and error messages (see to chapter “9. Error messages, causes and remedies“)
- Teaching of new types of metal and sheet metal thicknesses (see section “7.6 Configuration of the program parameters“)

The following notes for the measuring operations should be observed:

Note If the measured value fluctuates and deviates substantially from nominal value during normal operation then an air gap between sensor and sheet surface is the most likely cause. A renewed Teach in cannot overcome this problem.

Note Do not adjust the upper limit (“up“) above 120 %.

8.2 Entering a measurement program

1 Push the *MENU* key, switch to "change" with the ↑ ↓ keys and confirm with *ENTER* key
2 Enter the password
3 Switch to "program parameter" and confirm with *ENTER* key
4 Select the desired program number at the control unit
5 In of case of a 4P control unit is, select the appropriate sensor
6 Enter the nominal dimension (nominal thickness of the sheet to be processed)
7 Adjust lower limit (“low“) to 80% (default setting)
8 Adjust upper limit (“up“) to 120% (default setting)
9 Return into the measurement mode with the *MENU* key

8.3 Zero adjust

1 Push the *MENU* key, switch to "change" with the ↑ ↓ key and confirm with the *ENTER* key
2 Enter the password
3 Switch to "program parameter" and confirm with *ENTER* key
4 Select the desired program number at the control unit
5 Switch to zero adjust (parameter 6)
6 Select "zero adjust" and confirm with *ENTER* key
7 The message "remove sheet" appears, then confirm with *ENTER* key
8 After the message "zero adjust active" the message "zero adjust completed" is shown. Then confirm with *ENTER* key
9 Return into the measurement mode with the *MENU* key

8.4 Teach-In

1 Push the *MENU* key, switch to "change" with the ↑ ↓ key and confirm with the *ENTER* key
2 Enter the password
3 Switch to "program parameter" and confirm with *ENTER* key
4 Select the desired program number at the control unit
5 Switch to Teach-In (parameter 7)
6 Select "Teach-In" and confirm with *ENTER* key
7 The message "attach sheet" appears, then confirm with *ENTER* key
8 After " Teach-In active" the message "Teach-In value: x.xx" is shown – the value can be corrected with the ↑ ↓ keys (the adjustment is not possible if "%mm" or "%inch" were selected in the configuration menu option 2)
9 Return to the measurement mode with the *MENU* key

Attention The actual measured value cannot deviate too far from the nominal dimension, otherwise the fault message " Teach-In fault" appears. (this restriction is not valid if in the configuration option 2 "%mm" or "%inch" were selected).

The exact teach-in procedure is described in the chapter “7.6 Program parameter 7: teach-in".

Note High-alloy steels (e.g. TRIP steel) generate a significantly lower measurement signal than normal steel. Deviations of up to 30% are possible. To prevent this, the nominal thickness should be set to a smaller value if necessary. This can be necessary for thin sheets less than 0.5 mm thickness.

Example: Nominal thickness 2.00 mm – manual Teach-In

- The micrometer measures actual value to be: 1.92 mm.
- The teaching shows a value of: 1.89 mm.
- The display value is now corrected to 1.92 mm.

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9 Fault messages, causes and remedies

In case of malfunction a message containing the fault number and the associated error text is displayed

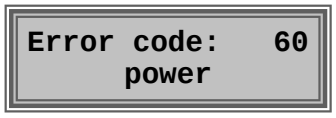


Fig. 76: Example of a fault message

The fault number indicates the fault and the probable cause. The fault description and the suitable measures to remedy the fault condition are found in the following tables. The cause of malfunction must be eliminated before the equipment can continue operation.

The fault can be cleared by pressing the *MENU* key on the control unit.

Note As long as the cause of the fault is not eliminated, the fault cannot be cleared.

The fault messages are summarized into the following classes:

- Memory faults
- Teach-In faults
- Transmission faults (RS232)
- Measuring operating faults
- Keyboard faults
- Operating voltage faults
- PLC input faults
- Other faults

9.1 Faults concerning memory

No.	Reason	Remedy
1	Error while writing to the EEPROM. The acknowledge signal does not arrive in the expected time.	The EEPROM is defective
2	Error while writing to the EEPROM. No storage in memory possible.	
3	System parameter “program number” is out of range >255	Store correct parameter.
4	System parameter “Unit” is neither mm nor inch.	Store correct parameter.
5	System parameter “measuring mode” is neither single measurement nor continuous measurement respectively keyboard or PLC.	Store correct parameter.
6	System parameter “Language” is not realistic.	Store correct parameter.
7	System parameter “Baud rate” is not defined.	Store correct parameter.
8	System parameter “Zero adjust” is not realistic.	Perform zero adjust.
12	System parameter “Measuring” (normal/fast) is not defined.	Exchange EEPROM.
16	System parameter “Sensor type” is not defined.	Select sensor type again and store.
17	System parameter “Output 0-1-2” is out of range.	Store correct parameter. Recycle power. If error code appears again, change EEPROM.
18	System parameter “External adjustment” is out of range.	Store correct parameter. Recycle power. If error code appears again, change EEPROM.
19	System parameter “Version” or “Number of sensors” is not defined.	Store correct parameter.
20	Memory error XX. The program no. XX is not realistic. The program has been deleted.	Create a new program and store it. Recycle power. If error code appears again, change EEPROM.
21	Memory error XX. The program no. XX is not realistic. Several programs have been deleted.	The numbers of the deleted programs cannot be indicated. Check all programs. Recycle power. If error code appears again, change EEPROM.
22	System parameter “Sensor selection” is not defined.	Store correct parameter.

9.2 Faults concerning Zero adjust

No.	Cause	Remedy
25	The zero adjust value is not realistic	Perform new zero adjust. Perhaps there was material in front of the sensor.

9.3 Faults concerning Teach-In

No.	Cause	Remedy
30	The sheet cannot be taught because there is no sheet in front of the sensor or the sheet thickness is wrong.	1. Perform zero adjust, was not performed. 2. Avoid air gap between sensor and sheet. 3. In the case of special material (e.g. nickel plate), measure without Teach-In and use the measured thickness as nominal thickness.

9.4 Faults concerning RS232 Transmission

No.	Cause	Remedy
40	Checksum does not correspond to transmitted information	Check program and data transmission connection
41	Dimension is incorrect (mm instead of in. or in. instead of mm) or no numerical character at the position expected (e.g. --.00MM instead of 00.001MM).	Compare transmitted dimension and dimension in the parameter set at E20. Numerical characters in the data format require a number. (e.g. 00.011MM or 01.0000MM)
42	The requested serial function is not possible, because the unit was configured to “internal control”.	Configure the control unit to “external control”. For “internal control” only the following commands are permissible: - Send measurement data - Delete error code
44	The requested function is not possible, because of an active parallel input (parallel function).	Deactivate the parallel input and await completion of the parallel function, then restart the serial transmission.
45	The transmitted value is out of the defined range (e.g. Program no. > 255)	Repeat data transmission with correct values.
46	The function is not operational because the menu is open.	Close the menu and repeat data transmission.
47	The serial commands are following too fast.	Include a small pause between the individual serial values.
48	A serial function was started although another serial function was still active.	Await completion of the active serial function, then restart the serial transmission.
49	The command is not known.	Check command.

9.5 Faults concerning measuring operation

No.	Cause	Remedy
51	a) Measuring time is not realistic (too short) b) Wrong sensor selected c) The zero adjust was done with sheet	a) Exchange sensor. b) Set sensor on sheet >2.5 mm and select correct sensor. c) Perform zero adjust without sheet
52	Internal DC/DC converter is defective.	Exchange hardware.
53	The selected sensor at the inputs „sensor selection A and B“ is not valid. Example: Sensor no. 4 is selected but only two sensors are configured.	Select the correct sensor.
54	a) The current between sensor and unit was short circuited during measurement. b) A wrong sensor type was connected or configured. S1 = Sensor 1, S2 = Sensor 2 S3 = Sensor 3, S4 = Sensor 4	a) Check cable and connectors, exchange sensor b) Check whether connected and set sensor type do match.
55	The current between sensor and unit was interrupted during measurement. S1 = Sensor 1 S2 = Sensor 2 S3 = Sensor 3 S4 = Sensor 4	Check cable and connectors, exchange sensor. Check whether the sensor was removed during measurement (counter induction).
For Demo mode only: If the faults 51 to 55 appear due to wrongly set values for sensor type / number of sensors / sensor sequence, then the correct configuration can only be established by directly entering the configuration menu (by simultaneously pressing all 4 operation keys) and setting the correct values. Only then the fault condition will be redressed.		

9.6 Faults concerning keyboard

No.	Cause	Remedy
56	The change of system or program parameter is not possible because a serial function is active (e.g. Teach-In or Measurement start).	Await completion of active serial function or stop it.
57	The change of system or program parameter is not possible because a parallel function is active (e.g. Teach-In or Measurement start).	Await completion of active parallel function or stop it.

9.7 Faults concerning supply voltage

No.	Cause	Remedy
60	Operating voltage was below 20 VDC.	Check power supply.
62	Sensor voltage too low.	Check external power supply (insufficient power ?). Contact Roland Electronic Service Department.

9.8 Faults concerning PLC parallel inputs

No.	Cause	Remedy
70	Operation of PLC inputs is incorrect.	Check timing of PLC inputs.
71	The parallel function is not possible, because another parallel function is active (e.g. measurement start and in addition teach-in 1-sheet).	See timing diagrams.
72	Selected program number >255.	Select the new program number.
76	The parallel function is not possible, because the system was configured to “internal control”.	In case of “internal control” it is only possible to select the measuring program. If required, change configuration to “external control”.
77	The parallel function is not possible, because the menu is open.	Close the menu.
78	The parallel function is not possible, because a serial function is active (e.g. measurement was started serially).	Await completion of the serial function or finish it, then repeat the parallel function.

9.9 Other faults

No.	Cause	Remedy
80	An error has occurred which cannot be unequivocally identified to one of the above error codes.	Contact Roland Electronic Service Department.

10 Maintenance

Generally the Double Sheet Detector R1000 E20 requires no special or regular maintenance.

If new types of sheet metal and dimensions are to be processed, then a new Teach-In for new programs to be stored is necessary, see also section “7.6 Program parameter 7: Teach-In“.

In the following cases a new Teach-In for all programs becomes required:

- If a sensor exchange was not done according to the instructions in the following section “10.1 Sensor exchange“

10.1 Replacement of sensors

In order to further use the taught programs, the following must be observed:

- Before the sensor is removed, its installation position must be exactly documented. This applies especially to the installation position with regard to the measuring axis.
- The original installation position in all directions has to be restored. This applies especially to the gaps between the sheets.

Attention If the original sensor positions cannot be restored, then the teach-in has to be repeated for all programs.

After having exchanged a sensor, the zero adjust must be performed again.

Proceed as follows:

For a standard control unit 1P with one sensor:

1 Ensure that no sheet is in front of the sensor
2 Press the *MENU* key, select *“change“* and confirm with the *ENTER* key
3 Enter the password
4 Change to *“program parameter“* and confirm with the *ENTER* key
5 Ensure that no sheet is in front of the sensor
6 Change to *“zero adjust“* and select *“on“*
7 Control unit shows *“remove sheet”*. Confirm with the *ENTER* key
8 Control unit shows *“zero adjust: active“*, then *“zero adjust: off“*
9 Exit the programming with the *MENU* key

For a 4P control unit with 2-4 sensors:

1 Verify that no sheet is in front of the sensor respectively the sensors
2 Press the *MENU* key, switch to *“change“* and confirm with the *ENTER* key
3 Enter the password
4 Switch to *“program parameter“* and confirm with the *ENTER* key
5 Verify that no sheet is in front of the sensor respectively the sensors
6 Switch to *“zero adjust“* and confirm with the *ENTER* key

7 Select *"zero adjust: separate"* or *"zero adjust: common"*

7.1 If *"zero adjust: separate"*, then confirm with the *ENTER* key

7.1.1 The display shows: *"zero adjust S1: on"* or *"zero adjust S1: off"*

If zero adjust is desired, then select *„on"* and confirm with the *ENTER* key.

if zero adjust is not desired (or sensor is not used in program), then select *"off"* and confirm with the *ENTER* key.

7.1.2 The display shows: *"zero adjust S2: on"* or *"zero adjust S2: off"*

If zero adjust is desired, then select *„on"* and confirm with the *ENTER* key.

if zero adjust is not desired (or sensor is not used in program), then select *"off"* and confirm with the *ENTER* key.

Step 7.1.2 repeats for sensor 3 (S3) and sensor 4 (S4) if they were selected.

7.2 If *"zero adjust: common"*, then confirm with the *ENTER* key, all connected sensors will become zero adjusted.

8 The display will show *"zero adjust: active"*, and then *"zero adjust: off"*

9 Exit the programming with the *MENU* key.

10.2 Exchange of control unit

Exchange with help of the RPP-software (only with C-versions):

The UDK20 provides for backup and re-writing the equipment parameters via the RS232 interface, with help of the provided RPP-software.

Exchange without help of the RPP-software:

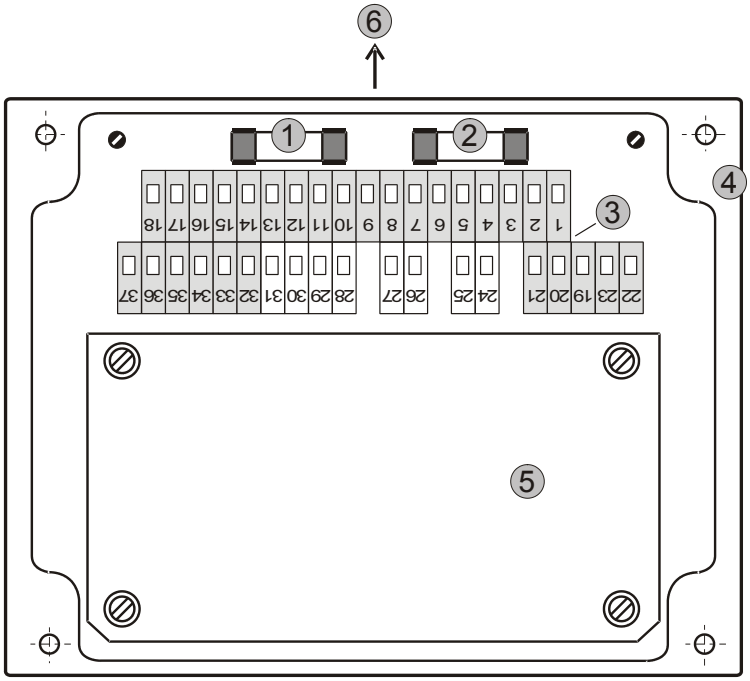
After exchanging the equipment, the original system configuration must be restored. Therefore, the form „System Configuration" in chapter „Technical Documents" (which had been filled out during set-up) can be used. If this form is not available or filled out, the information on the system configuration must be retrieved from the equipment documentation.

After exchanging the control unit it is necessary to perform a zero adjust.

10.3 Replacement of fuses

Attention The fuse should be checked only by trained personnel, since it is necessary to open the control unit.

The power supply fuse is 5 x 20 mm,5 Amp slow blow. A spare fuse is accommodated in the control unit. The position of the spare fuse is shown in the picture below.



1 Fuse
2 Spare fuse (5 A medium-blow)
3 Terminal blocks
4 Enclosure lid
5 Cover
6 View: upper part flipped downside

Fig. 77: Position of fuses in the E20

10.4 Exchange of sensor cable

When exchanging the sensor cable and thereby changing the cable length a zero adjust must be performed.

10.5 Data backup via the serial interface

The R1000 offers the possibility of data exchange with a PC. The system and program parameter can be stored via the serial interface. In addition, stored or modified data can be written back again into the control unit. The data backup runs via the RS232 interface (only for C version units).

10.6 Short description RPP 1000 software

The RPP 1000 software serves the purpose of creating a data backup onto an external PC and rewriting it back onto a ROLAND system.

In case of a defective control unit this backup can be transferred to another control unit.

The instructions of the programs can be accessed via the help function after installation (pdf).

Hardware requirements

- C-version of a ROLAND unit series R1000, such as E10, E20, I10, I20, L20, UDK10, UDK20 or Fieldbus units
- PC with Windows® 7 / 8.1 / 10 installed and a free serial interface or USB, set at COM1 ... COM9
- Null modem cable for the serial interface, or USB-serial adapter
- Switch the device to backup mode (For details refer to chapter 7.8).

10.7 Spare parts

ROLAND ELECTRONIC recommends to inventory the following spare parts (minimum):

- One sensor
- A set of cables

Whether a spare control unit should be kept in inventory has to be decided on individual basis.

11 Technical records

11.1 Exchange of equipment

11.1.1 Exchange of a R1000 E10 against a R1000 E20

A R1000 E10 can be fully replaced by a R1000 E20.

Prerequisite: The E20 has the same suffixes as the E10,
e.g.: E10-B-R ⇔ E-20-B-R or E10-4P-C-O ⇔ E20-4P-C-O.

For exchanging, the following must be considered.

1. **Enclosure**
   The enclosure with the connections, mounting fixtures and terminal blocks is fully compatible.
2. **Power consumption**
   The power consumption of the E20 can amount up to 100W (vs. E10 with only 10W). Therefore, the cross-section of the cable leads of the power supply should be selected accordingly.
3. **External I/O control**
   The external I/O control of the E20 corresponds to that of the E10 system.
4. **Measurement functions**
   The E20 fieldbus has a shorter measuring time. With that new so-called sequencer mode several sensors can be more efficiently interrogated.
5. **Sensors**
   All presently available sensors can be connected to the E20 fieldbus equipment. However, the use of the new sensor P42AGS (not for the E10) is recommended instead of the P42GS.
6. **Sensor cables**
   The sensor cables are fully compatible.
7. **Modes of operation**
   The dimensions %mm and %inch are not available for E20-4P control unit (if used with separated sensors).
8. **Sensor selection**
   When “sensor selection A/B” is set, the selection will be taken over only when a new signal “measurement start” is applied. In the demo mode the selection will not be performed.
9. **Sensor-Switch-Box**

   The connection of a SSBE10 is not possible on E20. Alternatively, the "E20-4P device" is used.
10. **A-Version**

    The A-versions of the E10 (e.g. E10-A-R) were taken out of our delivery program, these versions are replaced by the B-versions of the E20 (e.g. E20-B-R).

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12 Order data

12.1 Versions of control unit E20

Order data	Description	
E20-B-R	control unit with up to **one** sensor	Control unit in wall mount enclosure, memory for 255 parameter sets, programming via push keys, 9 respectively 11 opto coupled data inputs 24 VDC with joint common, relay outputs
E20-B-R-FP		Same as E20-B-R, but control unit in front panel enclosure
E20-B-O		Same as E20-B-R, but with opto coupler outputs
E20-B-O-FP		Same as E20-B-O, but control unit in front panel enclosure
E20-C-R		Control unit in wall mount enclosure, memory for 255 parameter sets, programming via push keys, 9 resp. 11 opto coupled data inputs 24 VDC with joint common, 1 opto coupled RS232 interface for bi-directional data communication with a PLC or PC, relay outputs
E20-C-R-FP		Same as E20-C-R, but control unit in front panel enclosure
E20-C-O		Same as E20-C-R, but with opto coupler outputs
E20-C-O-FP		Same as E20-C-O, but control unit in front panel enclosure

E20-4P-B-R	control unit with up to **four** sensors	Control unit in wall mount enclosure, memory for 255 parameter sets, programming and operation via push keys only, 9 respectively 11 opto coupled data inputs 24 VDC with joint common, relay outputs
E20-4P-B-R-FP		Same as E20-4P-B-R, but control unit in front panel enclosure
E20-4P-B-O		Same as E20-4P-B-R, but with opto coupled outputs
E20-4P-B-O-FP		Same as E20-4P-B-O, but control unit in front panel enclosure
E20-4P-C-R		Control unit in wall mount enclosure, memory for 255 parameter sets, programming via push keys, 9 respectively 11 opto coupled data inputs 24 VDC with joint common, 1 opto coupled RS232 interface for bi-directional data communication with a PLC or PC, relay outputs
E20-4P-C-R-FP		Same as E20-4P-C-R, but control unit in front panel enclosure
E20-4P-C-O		Same as E20-4P-C-R, but with opto coupled outputs
E20-4P-C-O-FP		Same as E20-4P-C-O, control unit in front panel enclosure

12.2 Sensors and accessories

Order information	Description
P30GS	Sensor 30 mm Ø, without cable, with M12 sensor plug for sensor cable connection, sensor with threaded body M30 x 1.5 mm, 2 flat nuts
P42AGS	Sensor 42 mm Ø, without cable, but with sensor plug for sensor cable connection, sensor with threaded body M42 x 1.5 mm, 2 flat nuts
P75VGS	Sensor 75 mm Ø, without cable, but with sensor plug for sensor cable connection, sensor with threaded body M75 x 1.5 mm, 2 flat nuts
SH42GS	Spring loaded sensor bracket, for direct installation of sensors with threaded body M42 x 1.5 mm
SH75GS	Spring loaded sensor bracket, for direct installation of sensors with threaded body M75 x 1.5 mm
SHS42G-FB	Spring loaded sensor bracket, for direct installation of sensors with threaded body M42 x 1.5 mm with bellow-shaped vacuum cup, without clamping bracket, suction cup diameter 100 mm
SHS42G-FB85	Spring loaded sensor bracket, for direct installation of sensors with threaded body M42 x 1.5 mm with bellow-shaped vacuum cup, without clamping bracket, suction cup diameter 85mm
SHS42GS	Spring loaded sensor bracket, for direct installation of sensors with threaded body M42 x 1.5 mm with vacuum cup, without clamping bracket, suction cup diameter 110 mm
SHS42GS-85	Spring loaded sensor bracket, for direct installation of sensors with threaded body M42 x 1.5 mm with vacuum cup, without clamping bracket, suction cup diameter 85 mm
SHS75GS	Spring loaded sensor bracket, for direct installation of sensors with threaded body M75 x 1.5 mm with vacuum cup, without clamping bracket, suction cup diameter 110 mm
SHX42	Spring loaded sensor bracket, for direct installation of sensors with threaded body M42 x 1.5 mm with vacuum cup, suction cup diameter 110 mm
SHX42-DL	
SHX42-STRAP-80	Set of belt strap for SHX42, for spring travel 70 mm
SHX-AZ2-25	Adaptor 25mm for SHX42, for 25mm clamping collar
SP42GS	Suction cup, for direct installation of sensors with threaded body M42 x 1.5 mm
SP75GS	Suction cup, for direct installation of sensors with threaded body M75 x 1.5 mm
SHK	Clamping bracket, for SH42GS, SHS42GS, SH75GS, SHS75GS, for mounting the sensor brackets to the customer specific destacking systems
2395038	Gasket, made of rubber, for suction cup SP75GS and for sensor bracket SHS75GS
2395039	Spare rubber pad, for suction cup SP75GS and for sensor bracket SHS75GS
2395045	Spare rubber pad, red, for sensor bracket SHS42G-FB
2395046	Spare rubber pad, black, for sensor bracket SHS42G-FB
2395109	Spare rubber pad, for suction cup SP42GS and for sensor bracket SHS42GS and SHX42
2395110	Spare rubber lips, for sensor bracket SHS42 and SHX42 or suction cup SP42
2395168	Spare rubber lips, for sensor bracket SHS42GS-85 or SHX 42-85
2395218	Bellows suction cup, for sensor bracket SHX42-DL

12.3 Cables

The standard length of the cables is 5 meters. Other lengths up to 50 meters made to order, larger lengths upon request.

Order information	Specification	Description
CPM12S-G	OILFLEX FD 810 CY 2 x 1 mm²	Cable for connecting sensor P30GS, P42AGS to E20. Wire-end ferrules for connecting the control unit and straight cable socket for connecting the sensor.
CPM12S-W	OILFLEX FD 810 CY 2 x 1 mm²	Cable for connecting sensor P30GS, P42AGS to E20. Wire-end ferrules for connecting the control unit and angled cable socket for connecting the sensor.
CPS-GOIL	OILFLEX FD 810 CY 2 x 1 mm²	Cable for connecting sensor P36GS, P42GS, P75GS, P75VGS to E20. Wire-end ferrules for connecting the control unit and straight cable socket for connecting the sensor.
CPS-WOIL	OILFLEX FD 810 CY 2 x 1 mm²	Cable for connecting sensor P36GS, P42GS, P75GS, P75VGS to E20. Wire-end ferrules for connecting the control unit and angled cable socket for connecting the sensor.
SM12CPM12S-GG	OILFLEX FD 810 CY 2 x 1 mm²	Cable for inserting a quick disconnect between E20 and sensor P30GS, P42AGS in conjunction with cable CPM12S-G. Straight cable plug for connecting the sensor.
SM12CPM12S-GW	OILFLEX FD 810 CY 2 x 1 mm²	Cable for inserting a quick disconnect between E20 and sensor P30GS, P42AGS in conjunction with cable CPM12S-G. Angled cable plug for connecting the sensor.
SM12CPS-GG	OILFLEX FD 810 CY 2 x 1 mm²	Cable for inserting a quick disconnect between E20 and P36GS, P42GS, P75GS, P75VGS in conjunction with cable CPM12S-G. Straight cable plug for connecting the sensor.
SM12CPS-GW	OILFLEX FD 810 CY 2 x 1 mm²	Cable for inserting a quick disconnect between E20 and P36GS, P42GS, P75GS, P75VGS in conjunction with cable CPM12S-G. Angled cable plug for connecting the sensor.

12.4 Sensors and accessories – only for changing over from R1000 E10 to R1000 E20

Order information	Description
P34S	Sensor 34 mm Ø, without cable, with sensor plug for sensor cable connection, sensor without threaded body
P36GS	Sensor 36 mm Ø, without cable, with sensor plug for sensor cable connection, sensor with threaded body M36 x 1.5, 2 flat nuts
P42G	Sensor 42 mm Ø, with fixed sensor cable, sensor with threaded body M42 x 1.5, 2 flat nuts
P42GS	Sensor 42 mm Ø, without cable, with sensor plug for sensor cable connection, sensor with threaded body M42 x 1.5, 2 flat nuts
P75GS	Sensor 75 mm Ø, without cable, with sensor plug for sensor cable connection, sensor with threaded body M75 x 1.5, 2 flat nuts
P75S	Sensor 75 mm Ø, without cable, with sensor plug for sensor cable connection, sensor without threaded body
P75VGS	Sensor 75 mm Ø, without cable, with sensor plug for sensor cable connection, sensor without threaded body
SH36GS	Spring loaded sensor bracket for direct installation of sensors with threaded body M36 x 1.5 mm
SHS36GS	Spring loaded sensor bracket for direct installation of sensors with threaded body M36 x 1.5 mm, with vacuum cup, with clamping bracket
SP36GS	Suction cup for direct installation of sensors with threaded body M36 x 1.5 mm
SHK	Clamping bracket for SHS36GS and SH36GS, for mounting the sensor brackets to the customer specific destacking systems
2395109	Spare rubber pad for sensor bracket SHS36GS and suction cup SP36GS
2395110	Spare rubber gasket for sensor bracket SHS36GS and suction cup SP36GS

12.5 Cable plugs and cable sockets

Order information	Description
2276116	Cable socket, 5 pin, M12, Binder series 713, for P30GS and P42AGS
2276117	Cable socket 90°, 5 pin, M12, Binder series 713, for P30GS and P42AGS
2276637	Cable socket, 7 pin, Tuchel-Amphenol C164-637M-7S, for P36GS, P42GS, P75GS, P75VGS
2277639	Cable socket 90°, 7 pin, Tuchel-Amphenol C164-639F-7S, for P36GS, P42GS, P75GS, P75VGS
2277704	Cable plug, 5 pin, M12, Binder series 713, for extension cable (quick disconnect)

12.6 Other accessories

Order information	Description
RPP 1000	Software for data backup
2277013	Cable for RS232 connection to PC, 3 m length
PWSE10	Program selector switch for manual selection of 10 programs

13 Appendix

13.1 Sensor data (Measuring time) of older hardware versions 1…4

With introducing the Hardware version 5 (from system no. 103227, from date 27.02.2006) the measurement times have been remarkably reduced. The current sensor diagrams are shown under section 2.4 “Sensor data”.

Anyhow, having the “old” sensor diagrams available could be useful (e.g. for exchanging control units with “old” / “new” Hardware version).

For this reason the “old” sensor diagrams are shown here.

Measuring time P30GS (of old Device-Hardware-Versions 1 – 4)

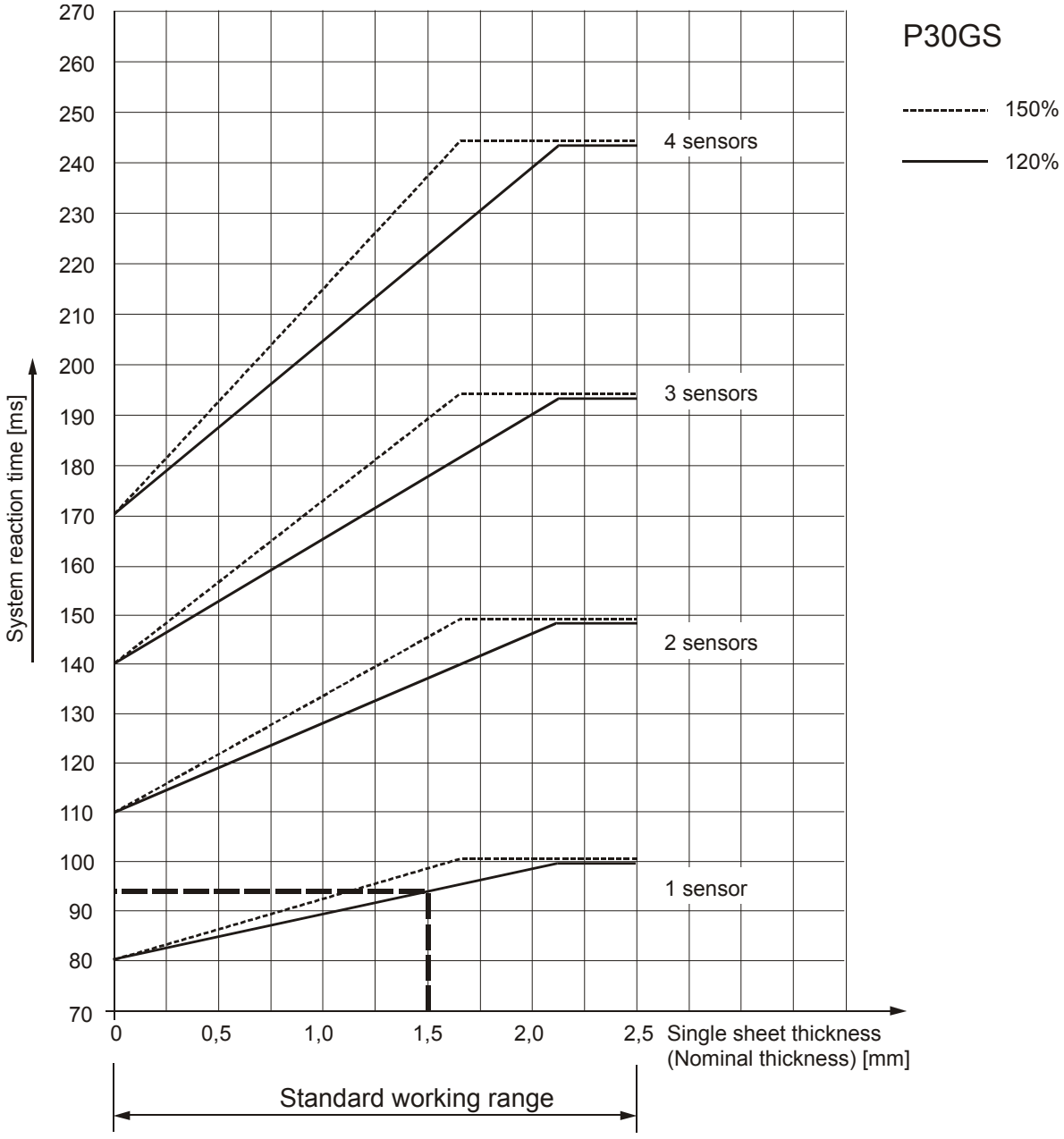

Fig. 78: System reaction time P30GS

Measuring time P42AGS (of old Device-Hardware-Versions 1 – 4)

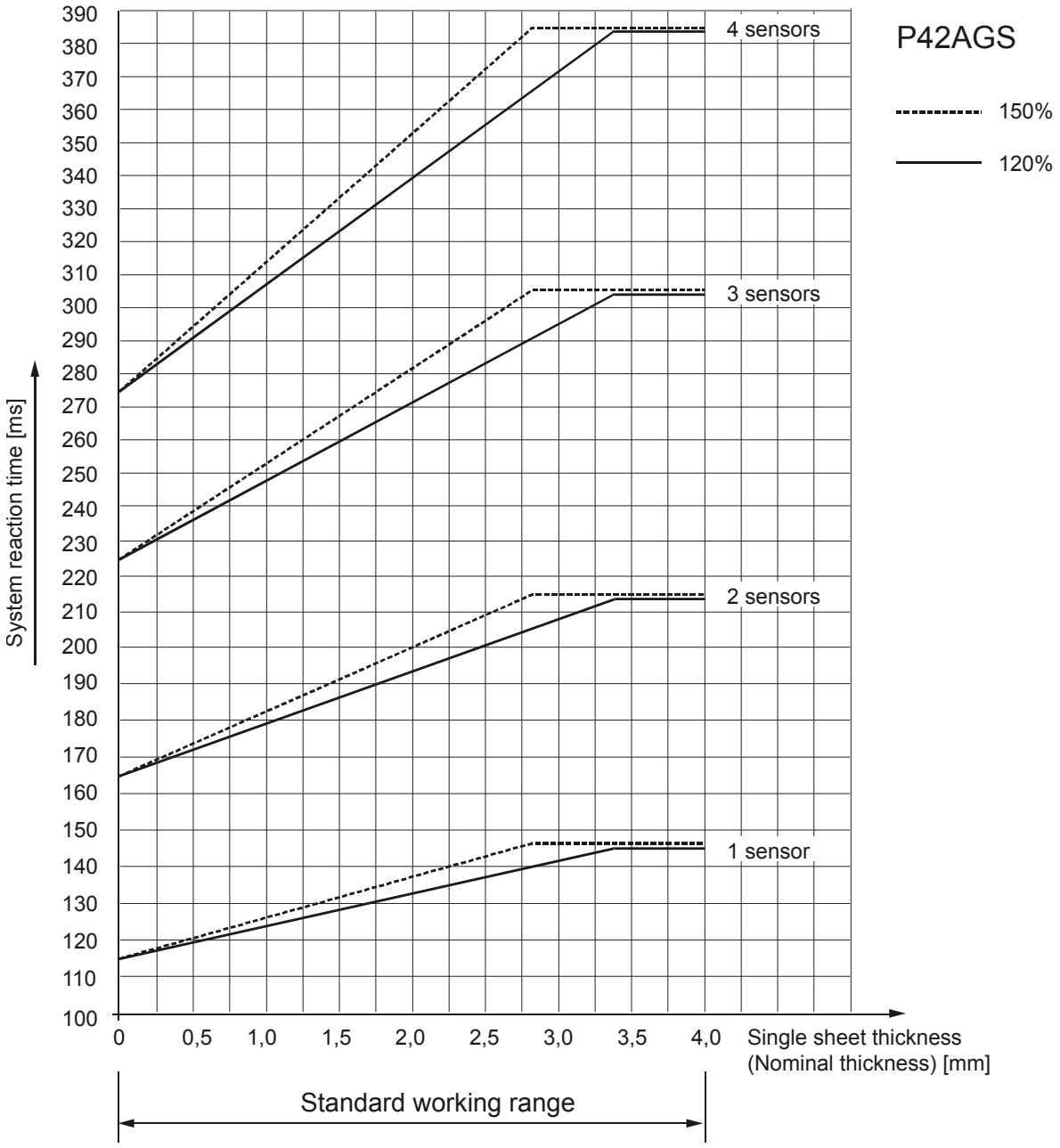

Fig. 79: System reaction time P42AGS

Measuring time P75VGS (of old Device-Hardware-Versions 1 – 4)

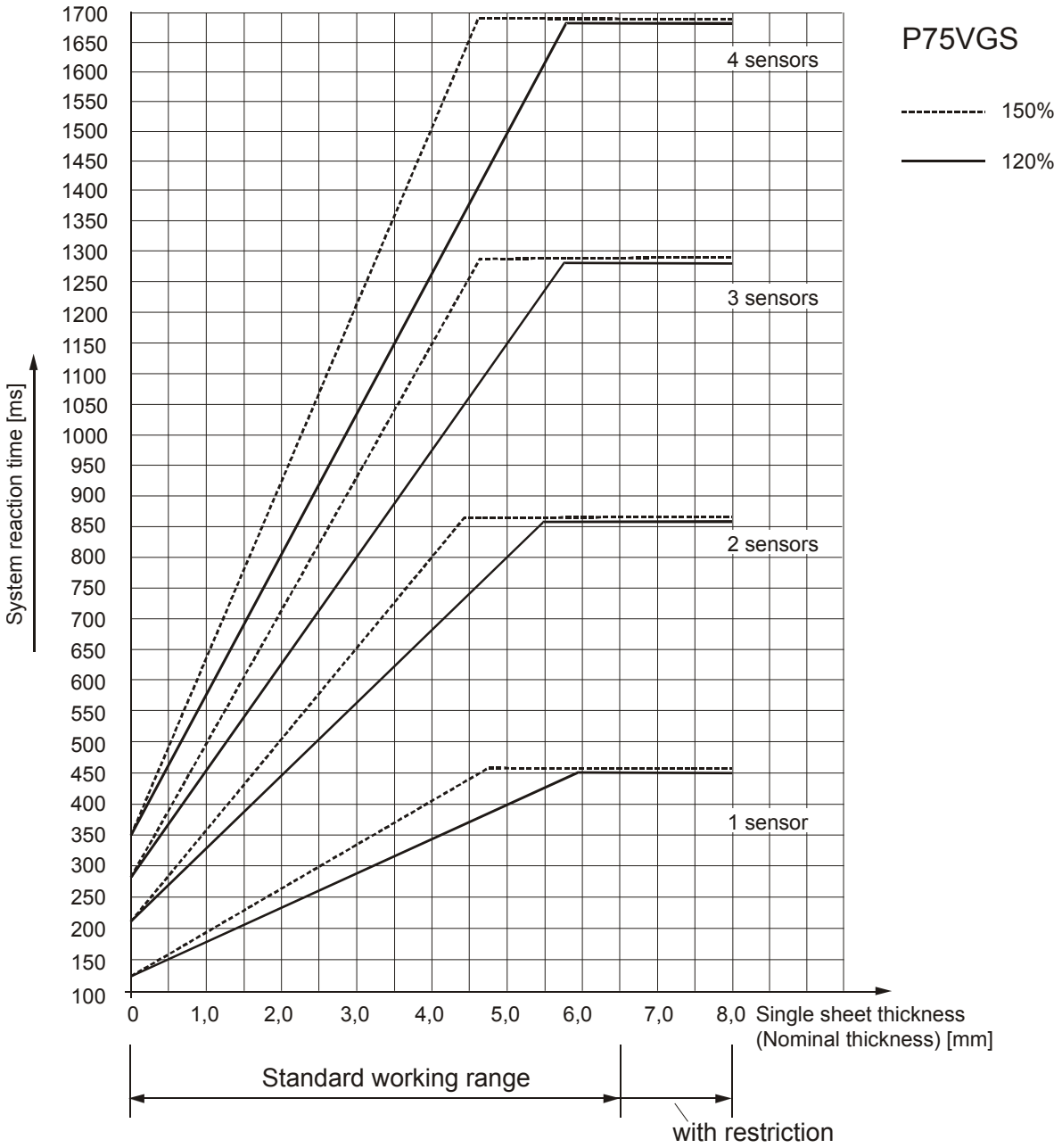

Fig. 80: System reaction time P75VGS

13.2 System configuration form

Standard settings are printed bold, deviations are marked.

Language:	( ) **D** ( ) E ( ) I ( ) S ( ) F
Sensor type:	( ) P30GS ( ) P42AGS ( ) P75VGS
Dimensions:	( ) **mm** ( ) inch ( ) %mm[1)] ( ) %inch[1)]
Meas. mode:	( ) ext. continuous meas. ( ) **ext. single meas.** ( ) demo
Baud rate:	( ) _____
CLR Parameter	( ) on ( ) **off**
Password:	( ) **yes** ( ) no
Level 0-1-2:	( ) 0 VDC ( ) **+24 VDC**
External adjust:	( ) yes ( ) **no**
Unit version:	( ) x[2)] _____
Number of sensors (4P only):	( ) **1** ( ) 2 ( ) 3 ( ) 4
Sensor selection (4P only):	( ) **external** ( ) program
Measurement	( ) **fast** ( ) normal

[1)] for 1P version only
[2)] matches with the number of sensors

---------- **End of Document** ----------