

BDK-1.3 Double Sheet Metal Monitor

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1. Application

Double Sheet Metal Monitors are applied in situations where pieces of ferrous (Fe) or non-ferrous (NE) metal sheets must be monitored in order to ensure that their thickness is between upper and lower limits. When pieces of sheet metal, such as blanks, are removed from a stack, occasionally two or more pieces adhere to each other. This must be recognised immediately; otherwise, a double sheet could be inserted into the press, resulting in damage to the tool or the press itself.

The use of Double Sheet Metal Monitors ensures proper insertion of the workpieces, by preventing insertion of double sheets.

The BDK Double Sheet Metal Monitor is suitable for operation with various sheet metal thickness sensors for monitoring ferrous and non-ferrous sheet metals. Depending on the sensor and/or measuring method, a thickness up to 6,5 mm can be detected.

2. Configuration

A lockable cover protects the evaluation device against unauthorised access. Sensor and evaluation device are characterised by a sturdy construction and a high protection class. The ready-made connecting leads with plugs and sockets on both sensor and device sides permit quick and easy mounting and commissioning of these devices.

Four operator keys and a four-line illuminated text display permit the convenient entry of device and measuring parameters. There are 256 program memory locations, which allow the storage of the measuring programs. They allow quick changes of material or tool during operation, and the programs remain stored even when the device is switched off.

The PROPAR / BDK-1 software allows the data backup and the down- and uploading of all program parameters.

3. Mode of Operation

There are various methods of measurement for double sheet monitoring and measuring their thickness. Measuring methods can be subdivided into two groups: contact and non-contact.

A BDK-1.3 evaluation unit is necessary for all measuring methods. The selection between ferrous sheet measurement using the magnetic flux method and the non-ferrous sheet measurement based on the eddy current principle takes place automatically when selecting the sensor type. This procedure requires that the sensor rests on the sheet metal during the measurement.

With the double surface non-contact measurement method of ferrous and non-ferrous workpieces, the generated alternating magnetic field is attenuated by the workpiece (sheet metal) placed between the two sensors, transmitter and receiver (transmission measurement).

A single surface non-contact measurement detects the distance between sensor and workpiece. Based on this distance, the evaluation device evaluates the thickness of the workpiece (distance measurement).

With all methods, after making the measurement, the microprocessor-controlled monitoring device uses the sensor signal to determine the thickness of the sheet metal and compares the result to the current threshold values.

On the LC display, sensor type, upper and lower threshold value, sensor connection right/left, measurement internal/external, and the calibration selection are presented in dependence of the selected program number. After each measurement the reading is updated and displayed.

The display and operator panel are equipped with signal lamps, which optically present the active status of a measurement, the proximity switch (initiator) and the 0-, 1- and 2-sheet detection.

In connection with these messages the press controller allows an individual evaluation via three potential-free relay outputs K0 ... K2.

The current status of operation can be taken from the actual signal behaviour. The details of the signal behaviour are described from page 9.

Parameters and similar are entered using the four keys and their possible combinations (detailed description under pos. 5).

Devices with a fieldbus interface, for example Profinet, transmit via this interface instead of the relay outputs the measured value, the 0-, 1- and 2-sheet metal messages, the memory location number of the current program and the current threshold value.

The selection of the measuring program and initiation of the measurement can take place via either a parallel PLC interface or the fieldbus interface.

When being operated without PLC (stand-alone operation), the measurement program can be selected on the device itself and the measuring operation can be initiated by a proximity switch inside the sensor.

4. Versions

4.1. Single Surface Contact Measurement

For single surface contact measurement, the DSP Sheet Metal Thickness Sensor can be used for monitoring ferrous sheets with thicknesses ranging from 0.2 to 5.5 mm. The BDWF sensor is suitable for non-ferrous sheets from 0.2 to 5.5 mm thickness.

With the DSPW sensor ferrous sheets in the range of 0.2 and 4 mm and non-ferrous sheets between 0.2 and 3 mm can be monitored.

The DSP Sheet Metal Thickness Sensors for ferrous workpieces have an exciter coil which generates a strong magnetic field. The workpiece is temporarily pulled onto the sensor head and brought to magnetic saturation by the high flux density. A sensor coil measures the saturation flux density, which is approximately proportional to the thickness.

In the BDWF Sheet Metal Thickness Sensor for non-ferrous workpieces, an exciter coil induces an eddy current in the non-ferrous workpiece to be measured. The sensor coil measures the field caused by the eddy current, which is approximately proportional to the thickness. Since the workpiece is not pulled onto the sensor head, no essential air gap between workpiece and sensor head is permissible during measurement. In both types of measurement, the accuracy is about 0.1 mm at the calibration point or about 5 % of the end-of-scale value across the measurement range.

The DSPW Sheet Metal Sensor combines the two measuring methods of DSP and BDWF.



Note:

On the display, the indication of the sensor type (DSPW/FE for ferrous, DSPW/NE for non-ferrous sheets) allows to select the material being used.

A general statement about the permissible air gap for single surface contact measurement is not possible because it is influenced by the thickness, the type of sheet metal, and the sensor being used. Basically, there should be no air gap, neither between the sensor and the workpiece nor between the workpieces in the case of a double sheet. See diagrams in the chapter "Sheet Metal Thickness Sensors".

4.2. Double Surface Non-contact Measurement

The double surface non-contact measurement is realised by the Sheet Metal Thickness Sensors BDWD/S (transmitter) and BDWD/E (receiver) for ferrous magnetic sheets with thicknesses ranging from 0.2 to 3 mm and for non-ferrous magnetic sheets with thicknesses ranging from 0.2 to 20 mm.



Note:

On the display, the indication of the sensor type (BDWD/FE for ferrous, BDWD/NE for non-ferrous sheets) allows to select the material being used. Via the parameterisation of the sensor connection in the menu Parameter, the transmitter BDWD/S and receiver BDWD/E can be assigned to the according connection (XS1 or XS2).

A transmitter coil in the (BDWD/S) transmitter generates an alternating magnetic field. A receiver coil in the (BDWD/E) receiver measures the field, which is attenuated approximately proportionally to the thickness of the workpiece.

The accuracy is about 0.2 mm at the calibration point or about 5 % of the end-of-scale sensor value across the measurement range. This measurement procedure is insensitive to the relative position workpiece – sensor heads and to air gaps between workpieces, which may move during measurement. Between sensor and sheet metal, however, a minimum distance of 10 mm must be kept.

Strong sources of magnetic interference can influence the measurement results.

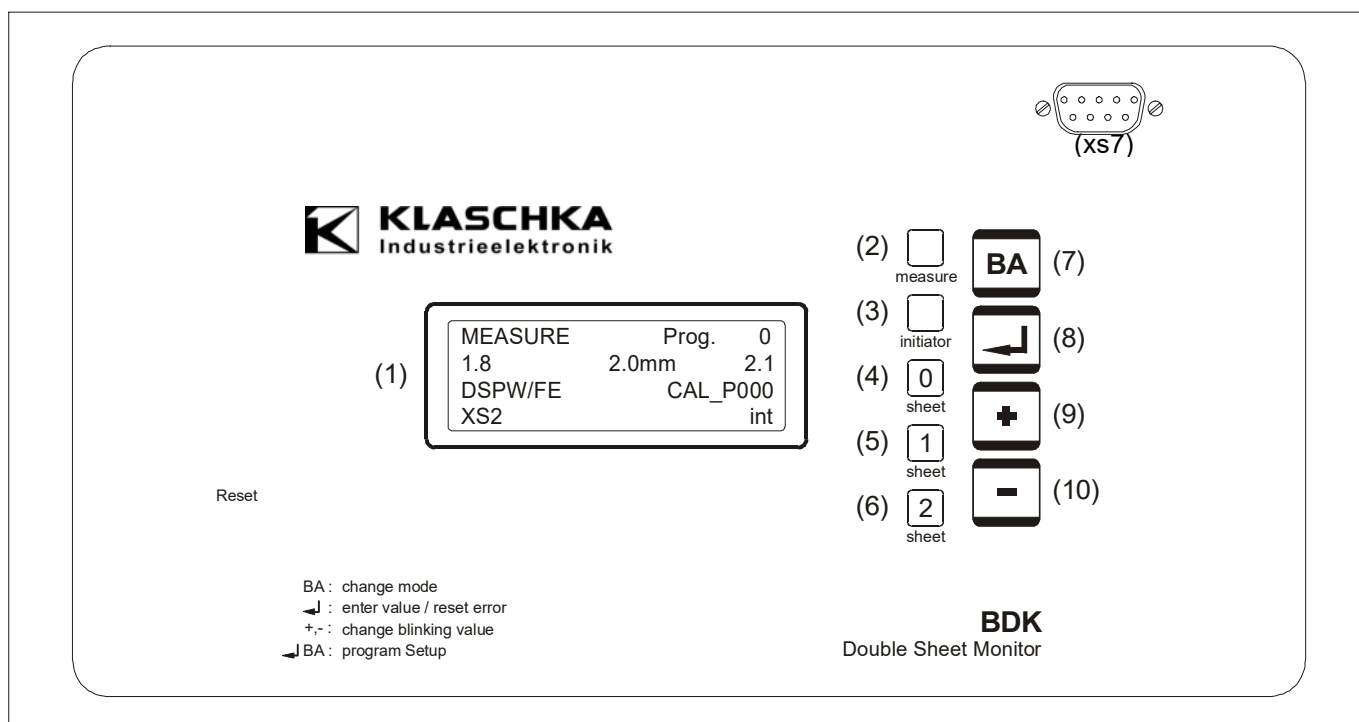
4.3. Single Surface Non-contact Measurement

The DSD Sheet Metal Sensor is suitable for monitoring pieces of ferromagnetic sheet metal (other materials on request) with a thickness range from 0.5 to 6,5 mm. The workpieces, however, must be placed on a solid reference plate, for example, a conveyor belt.

The distance between the sensor and workpiece is detected by the DSD sensor. Since the distance between the sensor and the supporting plate is fixed, the thickness of the workpiece can be calculated as the difference between the two distances. The measured thickness can be compared with the nominal value in order to detect the presence of a double sheet.

The accuracy at the calibration point is 0.2 mm with DSD-18 and 0.3 mm with DSD-30 or 5 % of the end-of-scale sensor value across the entire measurement range.

Measurement can be taken as the metal sheet moves along the sensor. With the single surface non-contact measurement, an air gap between the workpieces and between the workpiece and the supporting plate can directly influence the measured thickness (The measured thickness will appear to be greater than the actual thickness).



5. Operation

Use the four operator keys on the front panel of the device for operating:

Mode Change operating mode (7)

Enter Acknowledge entry (8)

+ Increment value (9)

- Decrement value (10)

5.1. Indicators

In order to guide the operator, the device is equipped with an illuminated text display (1) with 4 lines of 20 characters each. This allows to check the current operating status at any time. 5 LED indicators: (2) ... (6) provide additional information about the measurement result.

The illuminated fields have the following meanings:

Measurement: (2)	Lights up during measurement
Proximity switch (initiator): (3)	Lights up when the sensor recognises a sheet
0-Sheet: (4)	Lights up when no workpiece is present at sensor or thickness is less than lower threshold
1-Sheet: (5)	Lights up to indicate detection of one sheet metal piece
2-Sheets: (6)	Lights up to indicate detection of double sheet or general error

5.2. Basic Settings in "Setup" Menu

When the device is used for the first time, the first step is to enter the basic settings. To do this, press and hold down the BA ("Mode") key (7) and the "Enter" (8) key simultaneously. This opens the "Setup" Menu. Press "Enter" (8) to go to the next setting. The parameters hereto are changed by pressing the "+" (9) and "-" (10) keys (see picture in chapter 5.5).

The following settings can be made:

- Select language to be displayed,
- Internal start of measurement (using integral proximity switch in sensor) or external start (using STA input or via fieldbus interface),
- Switch on or off the recognition of STA lead breakage,
- Program memory selection "manual" (by selecting program number on evaluation device) or "external" (via PLC or fieldbus interface),
- Allow remote operation (acknowledge error, perform calibration, switch on and off via PLC interface),
- Behaviour of relay outputs (switchover between standard and alternative modes),
- Behaviour of relays reset input (high or low active),
- Repetition time (time interval after which subsequent measurement is initiated with continuous start signal). If repetition time is set to 0 seconds, the device will perform only one measurement per start signal,
- Setting aid for the distance between BDWD sensors (for double surface measurement). The setting takes place without any sheet, as long as the LC-Display signals „ok“,
- Scaling of DSPW/NE, without sheet, for calibration of the frequency response.

After the last available setting point, the settings are started again at the first point.

Press the BA key (7) to exit the Setup Menu and return to the Main Menu. Press the "Enter"- and "Mode" keys (7 and 8) simultaneously to change the setup settings whenever you want.



Note:

When entering parameters in the "Program"- and "Calibrate" operating modes, as well as in the "Setup" Menu, the relays output will signal a double sheet message.

5.3. Operating Modes in Main Menu

Operating modes are selected in the Main Menu. You can cycle from one mode to another by pressing the BA key:

- **Program:**

Used to program the program memory location with the sensor type and its calibration as well as the upper and lower limit values (thresholds).

- **Calibrate:**

For calibrating the sensor last selected in the "Program" operating mode.

- **Measure:**

Main operating mode, measures the current thickness and indicates the presence of sheet metal.

5.3.1. "Program" Mode

In order to monitor the sheet metal thickness, the device compares the measurement result with an upper threshold to check for a double sheet and a lower threshold to check for nominal thickness and presence of a workpiece. The device is provided with 256 program memory locations for storing the type of sensor with its calibration, and the threshold values. In the "Measure" mode, the appropriate set of parameters can thus be called up from the memory (see figure in chapter 5.6).

Programming

Perform the following steps for programming:

- Press repeatedly the BA key (7) to select the "Program" operating mode.
- Use the "+" (9) and "-" (10) keys to select the program memory location (blinking value) and use the "Enter" key (8) to confirm. Subsequently the sensor selection will blink.
- Press the "+" and "-" keys to select the sensor type to be used. Press the "Enter" key (8) to change to the next setting parameter.
- Select the upper threshold, which, when exceeded, will result in a double sheet message.
The upper threshold should be some value between the thickness of a single and a double sheet. The closer this threshold is to the thickness of a single sheet, the greater the certainty that a double sheet will be detected. However, if this threshold is too close to a single sheet thickness, small variations in sheet metal thickness will occasionally result in a double sheet message when only one sheet is present.
Press the "Enter" key (8) to enter the next parameter.
- Select the lower threshold, which will result in a "too thin" message if the measured thickness is less than this value.
Press the "Enter" key (8) to enter the next parameter.
- Press the $\pm$ (8/9) keys to select the required calibration (CAL 0 up to CAL 7 or CAL _PXXX).
Press the "Enter" key (8) to enter the next parameter.
- Use the $\pm$ (8/9) keys to select the required connection (XS1 / XS2).
Press the "Enter" key (8) again to select the measuring program memory.
- Further measuring programs can be installed in the same way.



Note:

The numbers in () refer to the diagram of the display and operator panel on page 3.

Selection of the program memory location

Use one of the following two methods to select the program memory used during measurement:

Internal Selection

To allow internal selection of the program memory, the memory selection must be set to manual in the Setup Menu. Use the "Program" operating mode and the "+" (9) and "-" keys (10) to select now the required memory location. Use the "Enter" key to confirm it.

External Selection

Use either the PLC interface or the fieldbus interface (selection via fieldbus interface, page 12) for external selection.

To permit this, memory location selection must be set to external in the Setup Menu.

The required program memory location can be selected by placing the appropriate binary code on inputs A1 ... A8. The moment at which the binary code is acknowledged depends on whether or not the remote control for error acknowledgement, calibration, and memory location has been switched on in the Setup Menu.

For external memory selection without extended remote control (standard) the binary A1 ... A8 is interrogated and acknowledged once every program cycle.

For external memory selection with a switched-on extended remote control first bit A8 must be set high; then the binary code must be placed onto A1 ... A7. Acknowledgement occurs with the falling edge of A8.

Table for Selection of Program Memory Location

Setup mem. Location selection	Selection bit A8 ... A1	Program memory	Remarks
manual	-----	0 ... 255	Manual entry via keys on operator panel
external remote control standard	0 0 0 0 0 0 0 0 0 0 0 0 0 1 ... 1 1 1 1 1 1 1	0 1 . 255	External entry via binary code A1 ... A8
external remote control extended	0 0 0 0 0 0 0 0 0 0 0 0 0 1 ... 1 1 1 1 1 1 1	0 1 . 128	External entry via binary code on A1 ... A7 and falling edge of A8

5.3.2. "Calibrate" Mode

In order to obtain optimum measurement results whenever any of the following factors are altered, the sensor should be recalibrated (see figure 5.6):

- Type of sheet metal or its magnetic and electrical characteristics.
- Sensor, type of sensor and its environment.
- Lead length and cross section (at DSP, DSPW).
- Air gap between sensor and workpiece (single surface measurement only).

Calibration can be accomplished by either of two methods: manually on the evaluation device or with the switched-on extended remote control via the PLC interface. Calibration on the device can be performed at any time; in remote operation via the PLC it can be performed only if enabled in the Setup Menu (select remote control "extended").

Calibration on evaluation device

- Press the BA key (7) to select the "Calibrate" operating mode. The calibration graph of the sensor last selected in the "Program" operating mode is calibrated.

- *Only for double surface non-contact measurement using the BDWD sensor:*

Use the "+" and "-" keys (9) and (10) to set the measuring time for the selected sensor ranging from 25 to 200 ms. A measuring time of 25 ms has been preset at the factory. For thick ferrous workpieces and in order to achieve a constant measurement result, the measuring time can be increased. The selected measuring time is then entered by pressing the "Enter" key (7). If only the measuring time is to be changed, the calibration procedure can be terminated by pressing the "Mode" key, in which case the calibration for thickness will not be affected.

- Use the "+" and "-" keys (9) and (10) to set the thickness of the workpieces to be processed. At this point, the thickness most recently selected for this calibration will be displayed. The selected thickness is entered by pressing the "Enter" key (8).
- Subsequently, the device will request that a workpiece is placed in position and will wait for the operator to start the measurement by pressing the "Enter" key (8).
- After completion of the measurement, the device will signal either a double sheet or a no sheet message. The device requests each step that the operator must perform and waits for the operator to acknowledge by pressing the "Enter" key (8).

Press the BA key (7) to leave the calibration mode whenever you want. The previously entered calibration values will remain stored and the new ones deleted.

Calibration via the PLC-interface

The calibration graph of the sensor stored in the most recently used memory location and its selected calibration sheet will be calibrated.

Calibration will be performed as follows:

- Before beginning calibration, the selection bit A8 must be switched off.
- Place the calibration sheet into position. Apply a positive pulse for longer than 20 ms to bit A2 in order to start calibration for "1 sheet".
- Remove the calibration sheet or place 2 calibration sheets on DSD sensor. Start calibration for 0 sheets (or for 2 sheets) by applying a positive pulse to bit A3.

After completion of the 0 sheet (or 2 sheet) measurement, the measurement results will be stored.

The timing diagram for the signals is illustrated in the chart "External Calibration" on pages 10 or 11.

5.3.3. "Measure" Mode

A measurement is initiated either via the proximity switch in the sensor or via an external "STA" signal on the PLC interface, depending on the start method set during the setup (control via bus interface, see page 10). A continuous "STA" signal causes periodic measurement with a repetition rate between 0.3 and 10 seconds depending on the time interval selected during setup. In addition, a measurement can be initiated at any time by pressing the "Enter" key (8).

Evaluation of the measurement occurs with the calibration curve and the threshold values stored in the currently selected memory location (programming and selection of program memory location, see "Program" operating mode). When the measurement is initiated, the workpiece must completely cover the sensor head or, in the case of double surface measurement with the BDWD, the workpiece must extend over the edges of the sensor head by at least 90 mm. If, during measurement, the workpiece has not reached or has already left this position, a smaller thickness will be measured, perhaps resulting in a 1 sheet message when, in fact, a double sheet is present.

In external start operation, either the PLC or an additional proximity switch can initiate the measurement (STA) at a definite point in time.

Both the leads to the sensor and for the external start signal are monitored for line breaks so that, in case of an error, measurement operation can be halted while the relays K0, K1, and K2 drop out, causing an error message.

5.4. Acknowledge Error Message

When the cause of a general error message has been rectified, the device must be reset into operating condition. This is accomplished either on the device by pressing the "Enter" key (8) or by placing an error code onto the interface.

After an error has been acknowledged, the relay K0 pulls in again. The relay K2 remains dropped out until the next measurement.



Important note:

An incorrectly performed calibration will result in incorrect calculation of the thickness and, thus, to incorrect "1 sheet" and "2 sheet" messages. Therefore only authorised operating staff is allowed to perform the calibration and the setting of the thresholds.

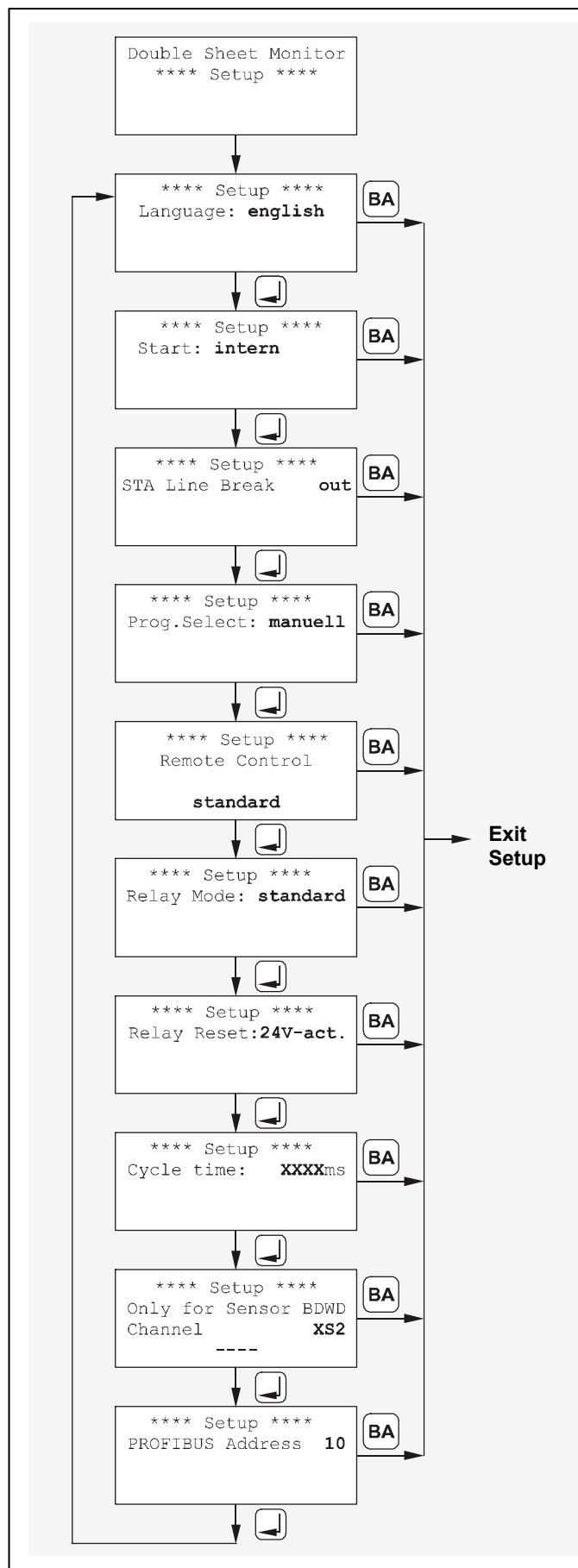
Before calibrating the BDWD Sensor, make sure that the sensor spacing and orientation are correctly adjusted. These settings are performed during setup.



Important note:

After a measuring program is programmed or the sensor or the metal type is calibrated, insert first one and then two metal sheets to check the proper functioning of the device.

5.5. Setup Menu



Press "BA" and "Enter" at the same time to call the Setup Menu. Press "Enter" to go to the following Setup point and press "BA" to leave the Setup Menu.

The following functions and parameters can be set in the setup menu:

Language of display text:

The following languages can be displayed: German, English, French or Spanish.

Start measurement:

Select "intern" for internal start of measurement via integral proximity switch, or "extern" for external start of measurement via start contact "STA" or via bus interface.

STA lead breakage recognition:

The STA start contact lead can be checked for breakage. Select "on" to activate the detection of lead breakage.

Select memory:

Use the program memory number in the "Program" operating mode to select "manual" memory and the PLC or bus interface to select "extern" (external) memory.

Remote control

Setting of the remote control to the operation mode "standard" or "extended".

Relay mode:

Switch over between two different relay modes, "standard" and "alternative".

Relay reset:

Determine whether the relays are to drop out at 24 V level ("24V active") or at 0 V level ("0V active").

Repetition time:

Set time between subsequent measurements when start signal is on continuously. Setting repetition time to 0 seconds causes device to perform 1 measurement per start signal.

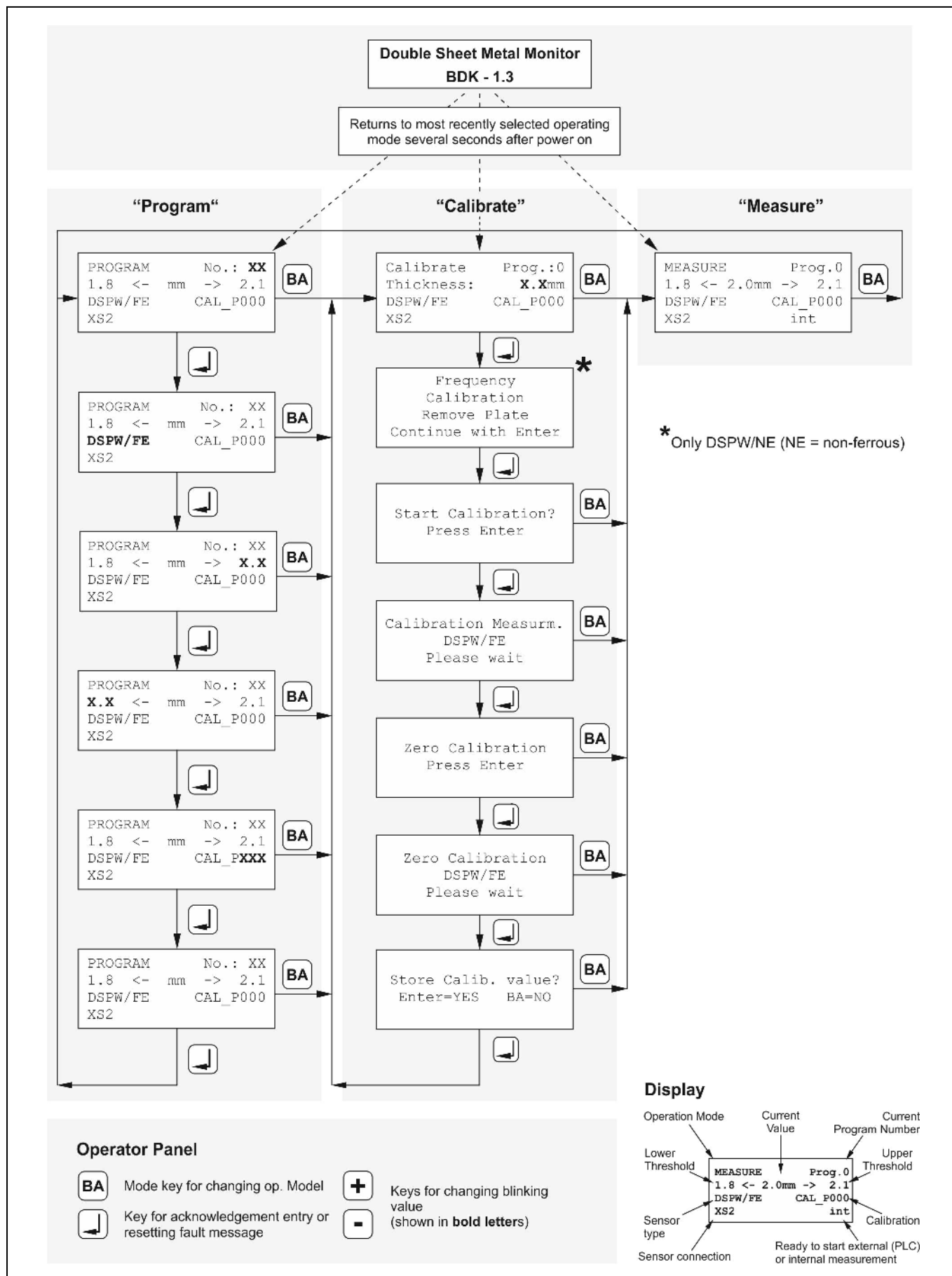
Sensor settings:

Even though the measurement procedure is relatively tolerant towards the changes in spacing ($\pm 0.5\text{mm}$), it is mandatory that the spacing setting is performed.

>> <<	when sensor distance is far too large
> <	when sensor distance is too large
OK	when sensor distance is correct
< >	when sensor distance is too small
<< >>	when sensor distance is far too small

* only for Profibus connection at BDK/FP

5.6. Main Menu



6. Interfaces

The double sheet metal monitoring devices are available with two different interface versions. The standard version is equipped with a parallel PLC interface for connection to the I/O level of the controller.

The version with the fieldbus interface is available with various fieldbus standards.

6.1. Parallel interface

6.1.1. Outputs

The sheet metal thickness monitors without the bus interface are equipped with three electrically isolated relay outputs. The outputs of BDK-1.3 are equipped with electromechanical relays, those of BDK/OB-1.3 with contactless semi-conductor relays. K1 and K2 are equipped with one reversing switch each. K0 is equipped with one NO and one NC. Depending on the relay mode, the following signals can be generated:

Standard Mode

K0: Result of the most recent thickness measurement (output of result after completion of the measurement).

Pulled in: A thickness greater than the current lower threshold has been measured (1 or 2 sheets).

Dropped out: A thickness less than the current lower threshold has been measured.

K1: 0 sheet message negated

Thickness measurement initiated by the integrated proximity switch (drops out immediately on detection of a workpiece)

Pulled in: No workpiece has been detected

Dropped out: Workpiece has been detected.

K2: Result of most recent measurement (output of result after completion of measurement).

Pulled in: A thickness less than the current upper threshold has been measured (0 or 1 sheet).

Dropped out: A thickness greater than the current upper threshold has been measured (2 sheets) or general error message.

In the case of a general error message, the cause of the error will be specified more precisely on the display of the operator panel.

Standard Mode			
Sheets	K0	K1	K2
0	0	1	1
Undersize	0	0	1
1	1	0	1
2	1	0	0
Error	0	0	0

Alternative Mode

At the beginning of the measurement, all the relays pull in. At completion of the measurement, the following message is generated:

K0: 0 sheet message negated

Pulled in: A thickness greater than the current lower threshold has been measured (1 sheet or 2 sheets).

Dropped out: Thickness less than the current lower threshold has been measured (0 sheet or too thin).

K1: 1 sheet message negated

Pulled in: A thickness less than the current lower or greater than the current upper threshold has been measured (0 or 2 sheets).

Dropped out: A thickness less than the current upper and greater than the current lower threshold has been measured (1 sheet).

K2: 2 sheet message negated

Pulled in: A thickness less than the upper threshold has been measured (0 or 1 sheet).

Dropped out: A thickness greater than the current upper threshold has been measured (2 sheets).

In the case of a general error message, the cause of the error will be more precisely specified on the display of the operator panel.

Alternative Mode			
Sheet	K0	K1	K2
0	0	1	1
Undersize	0	1	1
1	1	0	1
2	1	1	0
Error	0	0	0

6.1.2. Inputs

STA Input

The measurement can be initiated by an external signal on the "STA" input. This can be an external mechanical switch, a proximity switch, or a PLC.

For the lead break monitoring a resistor must be connected in parallel with the switch.

Relay Reset

In order to ensure reliable operation, the relay outputs must be reset before or after each measurement and dynamically interrogated via the press controller.

While the relays are reset, K0, K1, and K2 are in the dropped out condition. After relays reset, depending on the selected relays mode, the relays take on the following conditions:

Standard Mode

After the test, K1 pulls in if no workpiece is present. The relays K0 and K2 do not pull in until completion of a measurement. After an error and following error clearance including acknowledgement, 2 sheet message will be signalled (K2 is in dropped out condition).

Alternative Mode

The relays K0, K1, and K2 do not pull in until the beginning of the next measurement. After the measurement, K0, K1, or K2 drop out again, corresponding to the result. These are also the results after an error acknowledgement.

Control Inputs

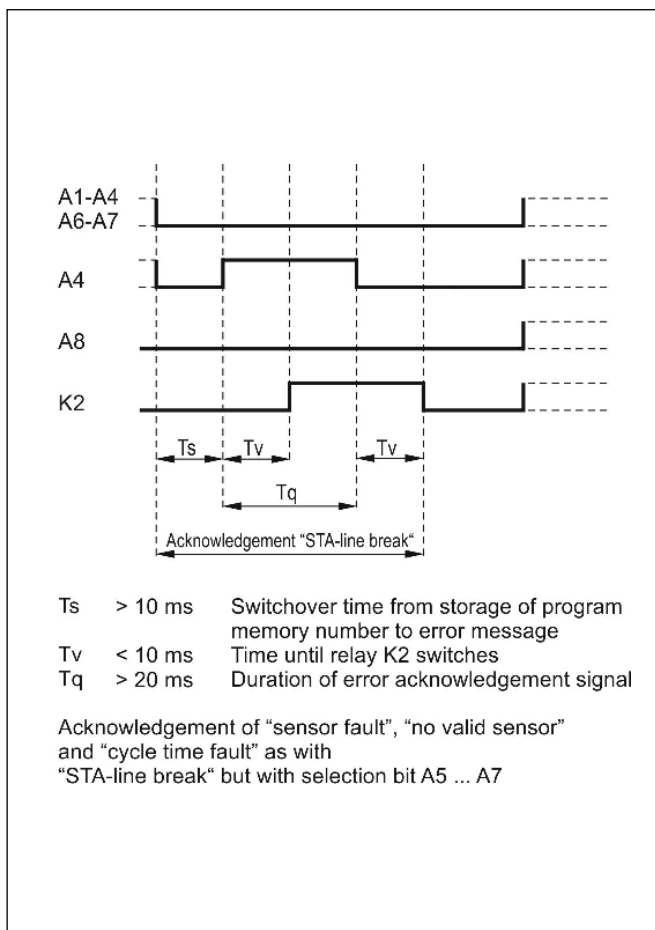
The program memory locations and the enabling of the remote control operation are selected via 8 electrically isolated inputs. In addition, with extended remote operation, the error acknowledgement, calibration, and system test can be performed (see also the timing diagram "External Error Acknowledgement" and "External Calibration"), pages 9 + 10.

6.1.3. Charts and Timing Diagram

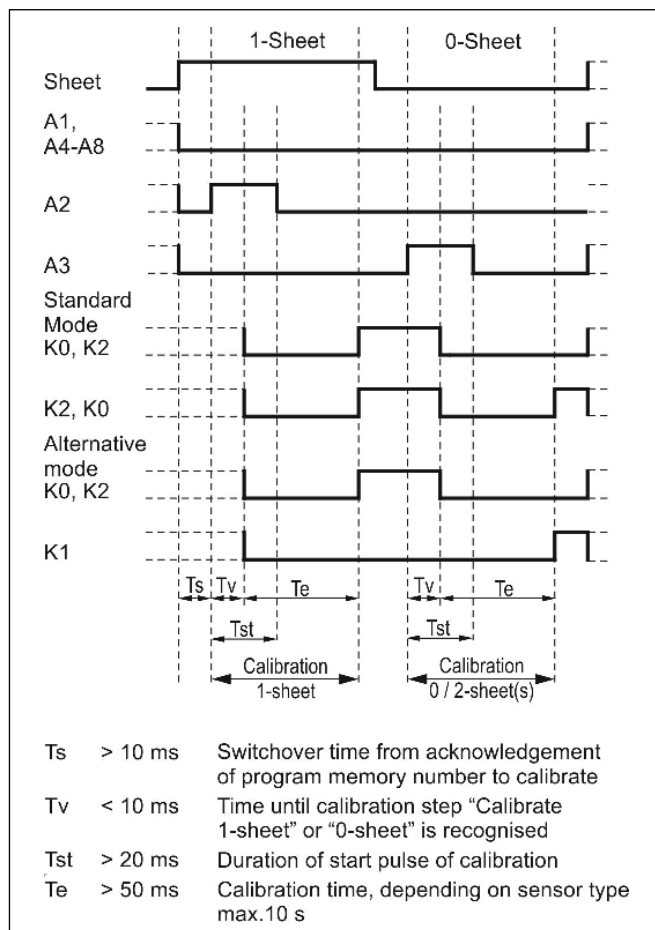
Chart for Remote Control Functions

Setup setting Remote control	Selection bit								Remarks
	A8	A7	A6	A5	A4	A3	A2	A1	
Standard	X	X	X	X	X	X	X	X	Program memory select without remote control function
Extended		X	X	X	X	X	X	X	Storage of the program memory number with remote control function
	0	0	0	0	0	0		0	Calibrate 1 sheet
	0	0	0	0	0		0	0	Calibrate 0 sheet / 2 sheets
	0	0	0	0		0	0	0	Error acknowledgement, STA line break
	0	0	0		0	0	0	0	Error acknowledgement, no valid sensor
	0	0		0	0	0	0	0	Error acknowledgement, sensor fault / OAS line break
	0		0	0	0	0	0	0	Error acknowledgement, cycle time fault
	0	0	0	0	0	0	0		Frequency calibration DSPW/NE

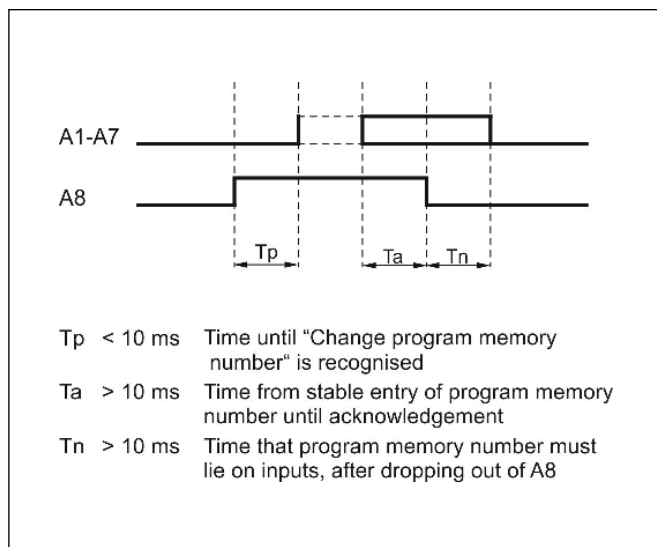
Timing Diagram: Acknowledge Error Messages Externally



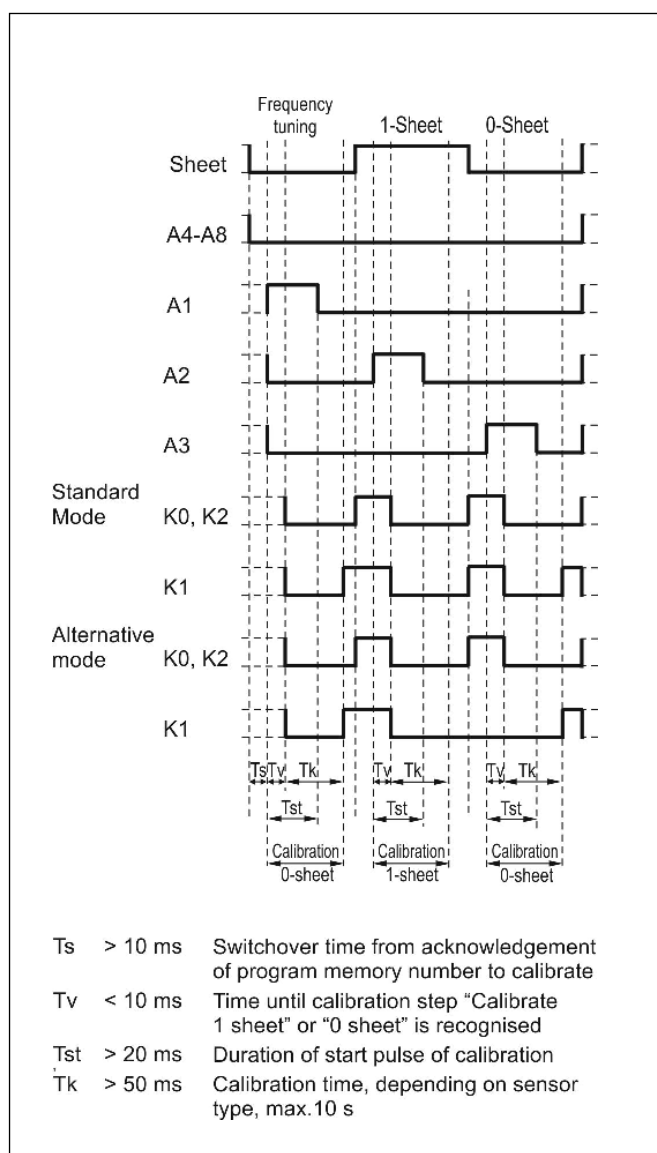
Timing Diagram: External Calibration DSP, BDWF, BDWD, DSD, DSPW/FE



Timing Diagram: Change Program Memory Number



Timing Diagram: External Calibration DSPW/NE (non-ferrous)



6.2. InterBus-S Interface, PROFIBUS DP, and PROFINET IO

Machine control systems often communicate with their decentralised field devices via fieldbuses. The standard versions of the BDK Double Sheet Metal Monitors are available with an InterBus-S fieldbus interface, a PROFIBUS DP, or a PROFINET IO. All important measurement and control data can be transmitted from and to the controller via these interfaces. Other fieldbus interfaces are available on request.

The InterBus-S interface is equipped with ordinary cylindrical plug-in IBS connectors, making the double sheet metal monitor directly connectable to the IBS fieldbus. It appears as an I/O module with 2 words corresponding to 32 binary in- and outputs on the InterBus-S.

For devices with PROFIBUS DP interface the relevant GSD file is enclosed in delivery.

Fitted with the PROFINET IO interface, the BDK-1.3 operates as PROFINET IO device. When starting the BDK-1.3, the PROFINET controller assigns automatically the IP address using the relevant GSDML file enclosed in delivery.

The data transfer within the network takes place via 4 Byte inputs and 4 Byte outputs having the following meaning:

6.2.1 Outputs (Inputs)

Byte 0

- Bit 0 on: Measurement in progress
- Bit 1: Workpiece recognition via integrated proximity switch (asynchronous to measuring clock pulse)
 - off: Workpiece recognised
 - on: No workpiece recognised
- Bit 2: Result of most recent measurement (synchronous to measuring clock pulse, updated when measurement is completed).
 - on: Measured thickness between current lower and upper threshold (1 sheet)
 - off: Status after resetting measurement result, or measured thickness less than current lower or greater than current upper threshold.
- Bit 3: on: Measured thickness greater than current upper threshold (2 sheets).
 - off: Status after resetting measurement result, or measured thickness less than current upper threshold.
- Bit 4: on: Measurement result available.
 - off: Status after resetting measurement result.
- Bits 5 ... 7: Result of error messages. In the case of a general error message, the error is more precisely specified on the display (1).
- Bit 5 on: Cycle time fault.
- Bit 6 on: Sensor fault.
- Bit 7 on: Selected sensor not calibrated or not valid.

Byte 1:

Bit 0 ... 7: The internally or externally selected memory location number is returned (asynchronous to clock pulse).

Byte 2:

Bit 0 ... 7: Output of the most recent measurement result in mm/10 (synchronous with clock pulse).

Byte 3:

Bit 0 ... 7: Current upper threshold value in most recently selected memory location number is output in mm/10 (asynchronous to clock pulse).

6.2.2 Inputs (Outputs)

Byte 0:

Bit 0 on: Begin of measurement.

Bit 1 3: Not used.

Bit 4 on: Reset 0, 1, or 2 sheet message and thickness measurement.

Bit 5 ... 7: Acknowledge error message.

1 0 0: Cycle time fault

0 1 0: Sensor fault

0 0 1: Sensor invalid or not calibrated

Byte 1:

Bit 0 7: Selected memory location number 0 ... 255 (binary coded).

Byte 2 ... 3: Not used.

6.3. Serial Interface for Data Backup

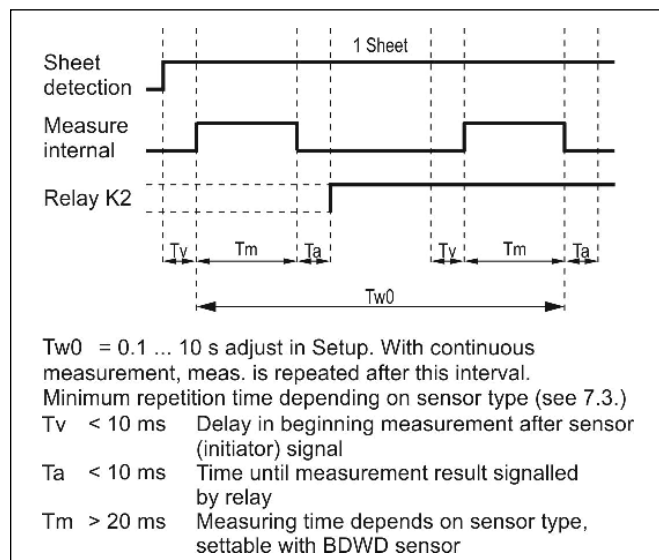
For data backup, the front panel of the BDK is equipped with a standard RS232 interface with 9-pole SUB-Min-D version.

7. Pulse Diagram for Interrogation of Measured Value

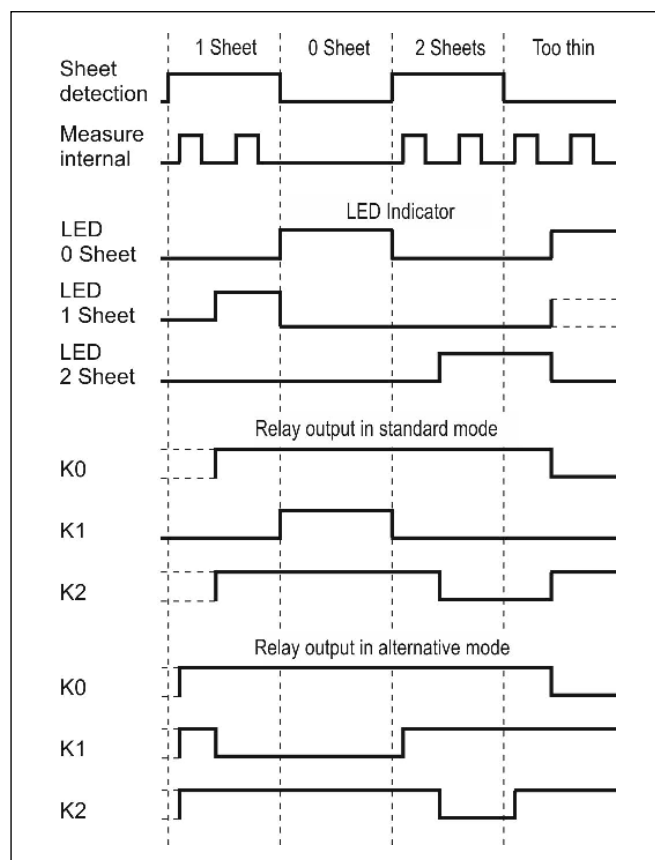
7.1. BDK with PLC-Interface

7.1.1. Internal Start of Measurement

Timing Diagram of Measurement

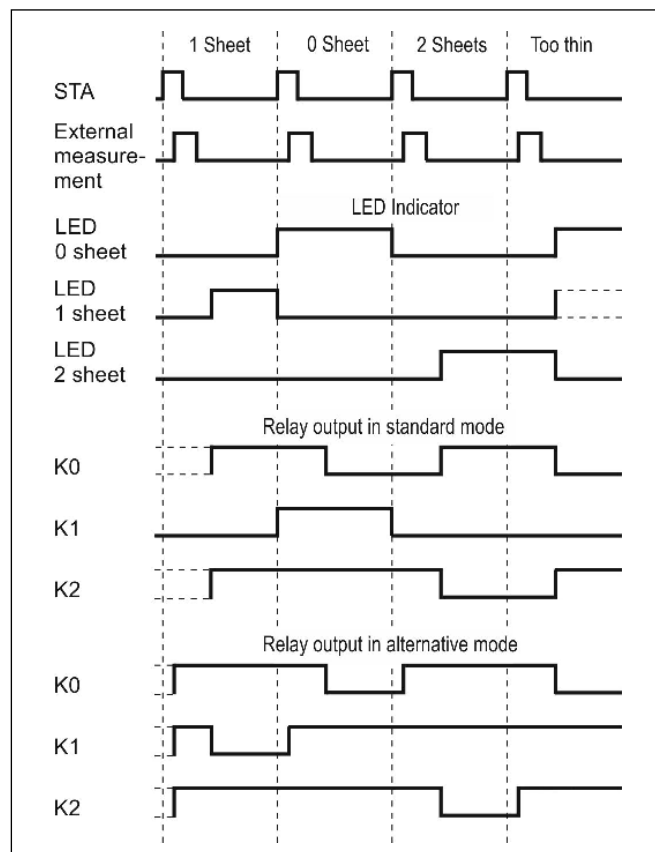


Overview of Measurement Sequences

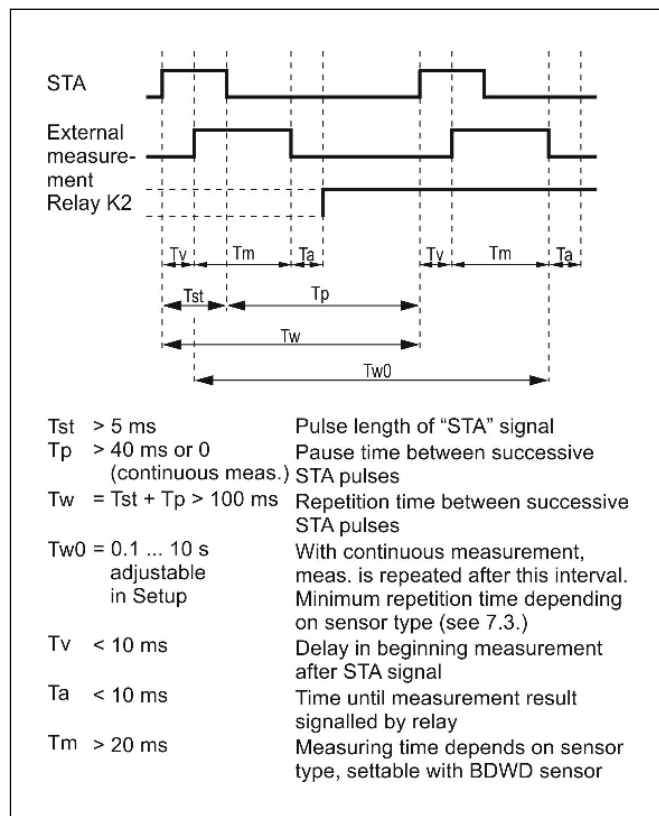


7.1.2. External Start of Measurement

Overview of Measurement Sequences



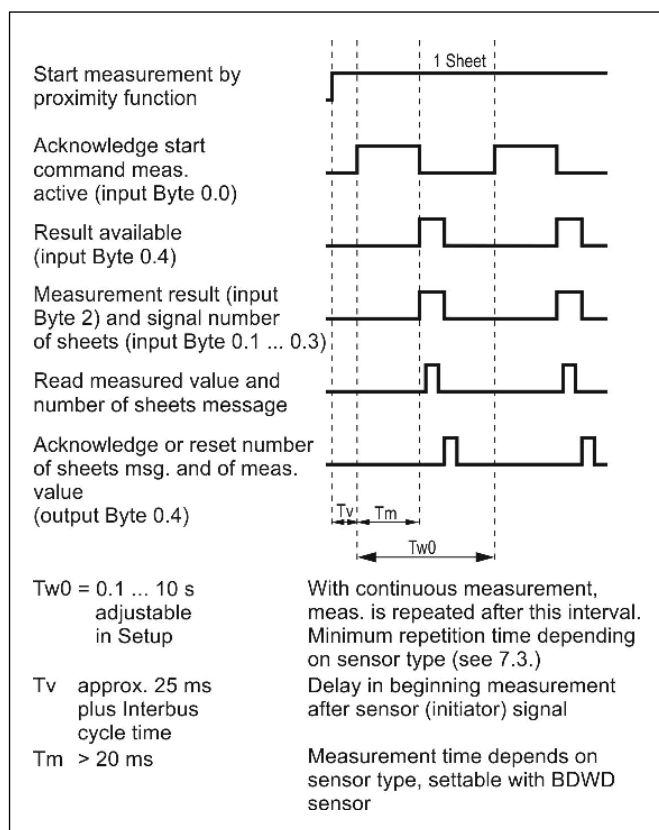
Timing Diagram of Measurement



7.2. With InterBus Interface

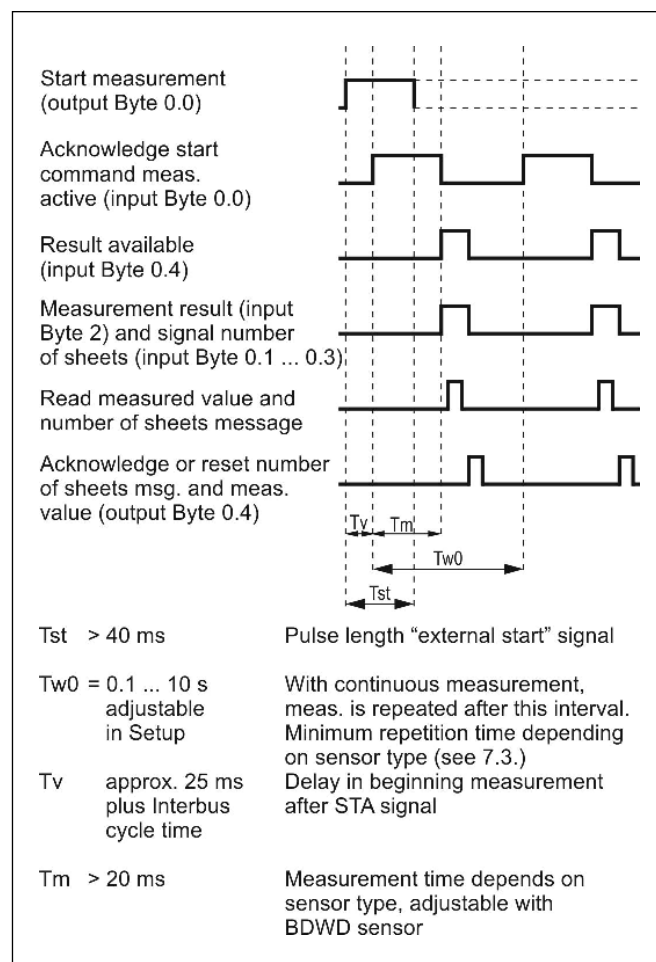
7.2.1. Internal Start of Measurement

Timing Diagram of Measurement (Handshake)



7.2.2. External Start of Measurement

Timing Diagram of Measurement (Handshake)



7.3. Repetition Time

The setting of the smallest repetition time interval T_{w0} (time distance between measurement beginnings with a permanent active start signal) has to be individually fitted to the different sensors and measuring principles. This has to be preset with the Setup-Menu. 100 ms can be set as the smallest repetition time. But when DSP and DSPW sensors are used for measuring ferrous workpieces, the repetition time is to be limited to 150 ms or 300 ms.



Important Note:

To prevent the DSP and DSPW sensors (measuring mode for ferrous workpieces) from heating up they may operate at the smallest possible repetition time only with a maximum start-up time of 50%.

This leads to a higher degree of measuring inaccuracy and to the destruction of the sensor during long periods of operation.

That means that for e.g. with a whole measuring time of 1 s a break of min. 1 s has to take place at the smallest possible repetition time.

Type	Ref. no.	Repetition Time
DSP-36sg	13.05-86	150 ms ... 10 s
DSP-42sg	13.05-87	150 ms ... 10 s
DSP-54sg	13.05-89	150 ms ... 10 s
DSP-75sg	13.05-90	300 ms ... 10 s
DSPW-54sg	13.05-67	150 ms ... 10 s
		100 ms ... 10 s
BDWF-m54rg-2s	13.05-73	100 ms ... 10 s
BDWD/S-m36rg-1s	13.05-74	100 ms ... 10 s
BDWD/E-m36rg-1s	13.05-75	100 ms ... 10 s
BDWD/S-60aq30-1Y1	13.05-76	100 ms ... 10 s
BDWD/E-60aq30-1Y1	13.05-77	100 ms ... 10 s
DSD-18mg61n0,5/3-1Sd1	13.05-91	100 ms ... 10 s
DSD-30mg74n3/6,5-1Sd1	13.05-94	100 ms ... 10 s

8. Interconnection with Press Controller

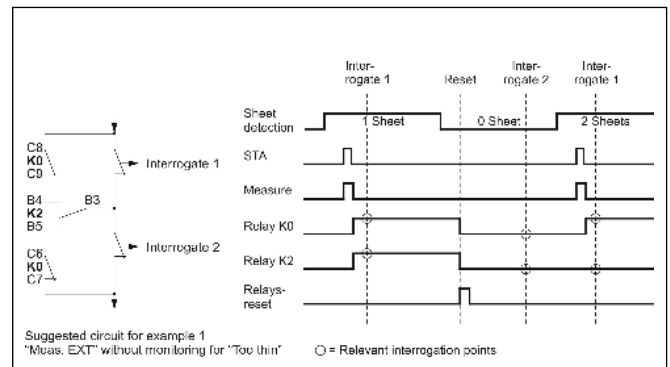
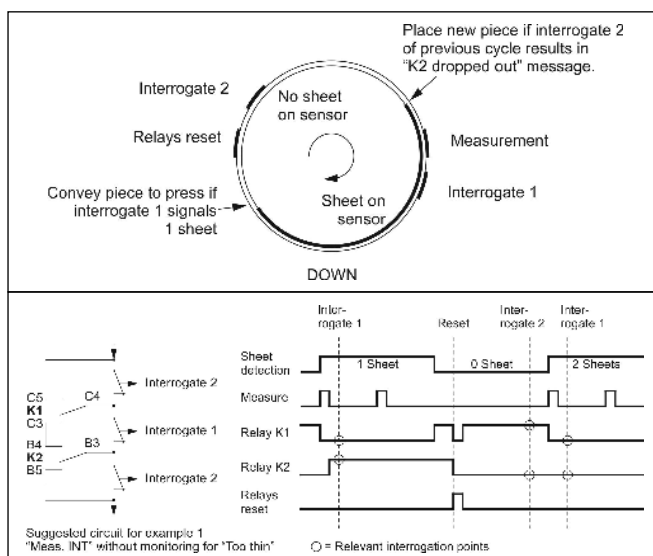
Appropriate interconnection of this device with the press controller appreciably improves the safety of the machinery. In order to ensure the best reliability of the machinery, the outputs should be interrogated at various instants during the operating cycle of the press.

Interrogation should take place in such a manner that the relays have to change the status every cycle.

Example 1:

Operation with relay reset, measuring on an intermediate depositing station or with workpiece being transported (standard mode).

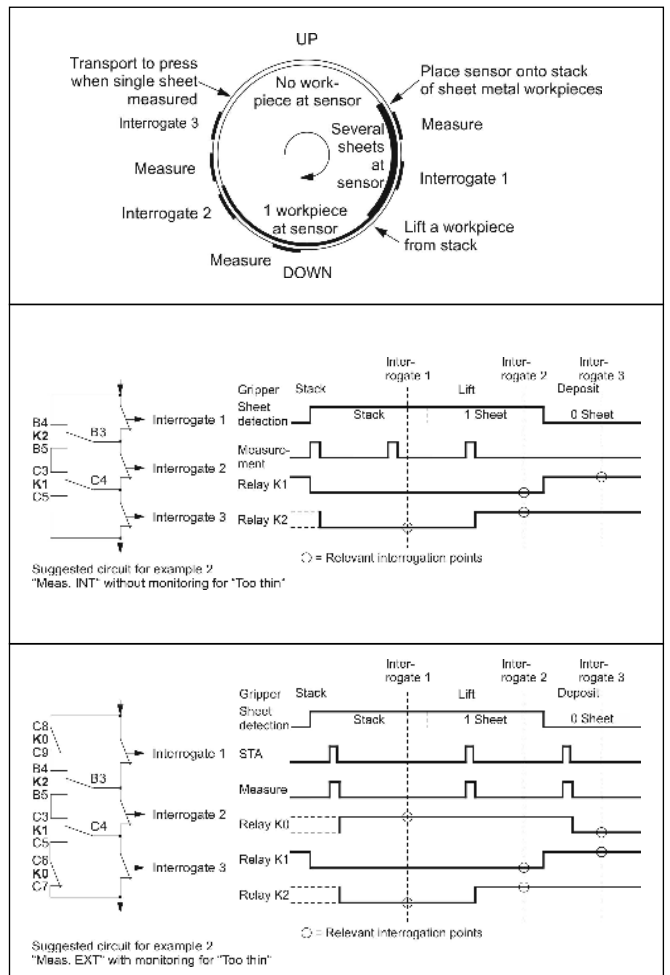
1. Start measurement with proximity switch or external start after sensor has been placed onto workpiece.
2. Interrogation 1, if single sheet has been measured (K1 dropped out, K0 and K2 pulled in).
3. Relays released by relay reset.
4. Interrogation 2, if K1 is pulled in or K0 and K2 have dropped out.



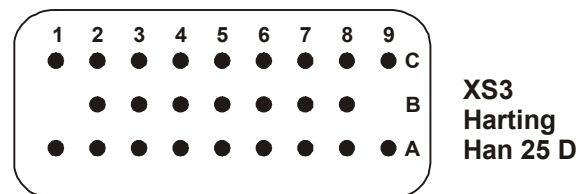
Example 2:

Operation without relays reset, workpiece being lifted from stack (standard mode).

1. Measurement start with proximity switch or external start when sensor has been placed on stack.
2. Interrogation 1, if multiple sheets have been measured (K0 pulled in, K1 and K2 dropped out).
3. Further measurements after metal sheet has been lifted from stack.
4. Interrogation 2, if single sheet has been measured (K1 dropped out, K0 and K2 pulled in).
5. Workpiece deposit.
6. Measurement after workpiece has been deposited.
7. Interrogation 3, if workpiece has been deposited (K0 dropped out, K1 and K2 pulled in).



9. Wiring

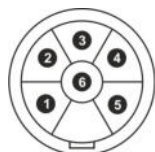


9.1. Contact Assignment XS3 PLC Interface

A1	Memory selection BIT 0
A2	Memory selection BIT 1
A3	Memory selection BIT 2
A4	Memory selection BIT 3
A5	Memory selection BIT 4
A6	Memory selection BIT 5
A7	Memory selection BIT 6
A8	Operation "standard": Memory selection BIT 7 Operation "extended": Take over of selection
A9	STA (External start)
B2	M ext. (0 VDC ground for electrically isolated inputs A1 - A9 B6)
B3	Relay output K2 (center contact)
B4	Relay output K2 (NO)
B5	Relay output K2 (NC)
B6	Relay reset input
B7	0 VDC } aux. Voltage e.g. for
B8	+ 24 VDC } 24 V inputs, 400 mA load capacity

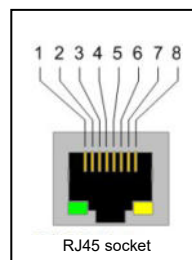
	PE
C1	+ 24 VDC
C2	0 VDC
C3	Relay output K1 (NC)
C4	Relay output K1 (center contact)
C5	Relay output K1 (NO)
C6	Relay output K0 (NC)
C7	Relay output K0 (NC)
C8	Relay output K0 (NO)
C9	Relay output K0 (NO)

9.2. XS6 Power Supply Connection for Bus Interface



PIN	Signal
1	+24 VDC
2	not used
3	0 VDC
4	not used
5	PE
6	not used

9.3. XS4 PROFINET IO Interface



PIN	Signal	Meaning
1	Tx+	Transmission data +
2	Tx-	Transmission data -
3	Rx+	Receive data +
4	-	-
5	-	-
6	Rx-	Receive data -
7	-	-
8	-	-

- Ethernet interface with electrical isolation (inductive) in auto crossover mode
 - Possibility of wiring to PROFINET via patch lead or Ethernet crossover lead

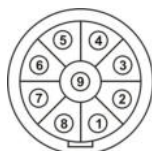
9.4. InterBus-S Connection

XS4 InterBus-S input



PIN	Signal	Core colour
1	DO	(ye)
2	$\overline{\text{DO}}$	(gn)
3	DI	(gy)
4	$\overline{\text{DI}}$	(pk)
5	Ground	(bn)
6	not used	-
7	not used	-
8	not used	-
9	not used	-
Housing	Shielding	Shield braid

XS5 InterBus-S output



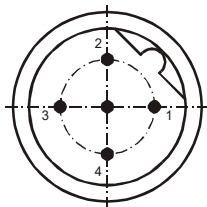
PIN	Signal	Core colour
1	DO	(ye)
2	$\overline{\text{DO}}$	(gn)
3	DI	(gy)
4	$\overline{\text{DI}}$	(pk)
5	Ground	(bn)
6	not used	bridge here
7	not used	
8	not used	
9	RBST	-
Housing	Shielding	Shield braid

9.5. PROFIBUS DP Connection

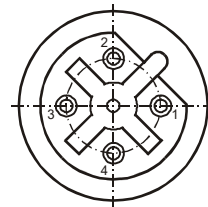
The used connectors correspond to the IEC 947-5-2, but with invertal mechanical coding (Reserve Key Coding). Internally the BDK contains a decoupling network, therefore a non-interacting use for 3 - 12 Mbaud is possible.

M12 bus connector:

XS4 Input

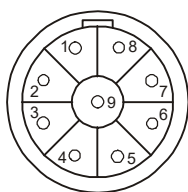


XS5 Output



Pin	Signal	Meaning
1	VP	Power supply - plus, (P5V)
2	RxD/TxD-N	Receive- / transmission data - N, A - lead
3	DGND	Potential of data transmission (reference potential to VP)
4	RxD/TxD-P	Receive- / transmission data - plus, B - lead
5	Shield	Shield or protective ground
Thread	Shield	Shield or protective ground

9.6. BDWF, DSP, DSPW, BDWD and DSD Connections XS1 and XS2

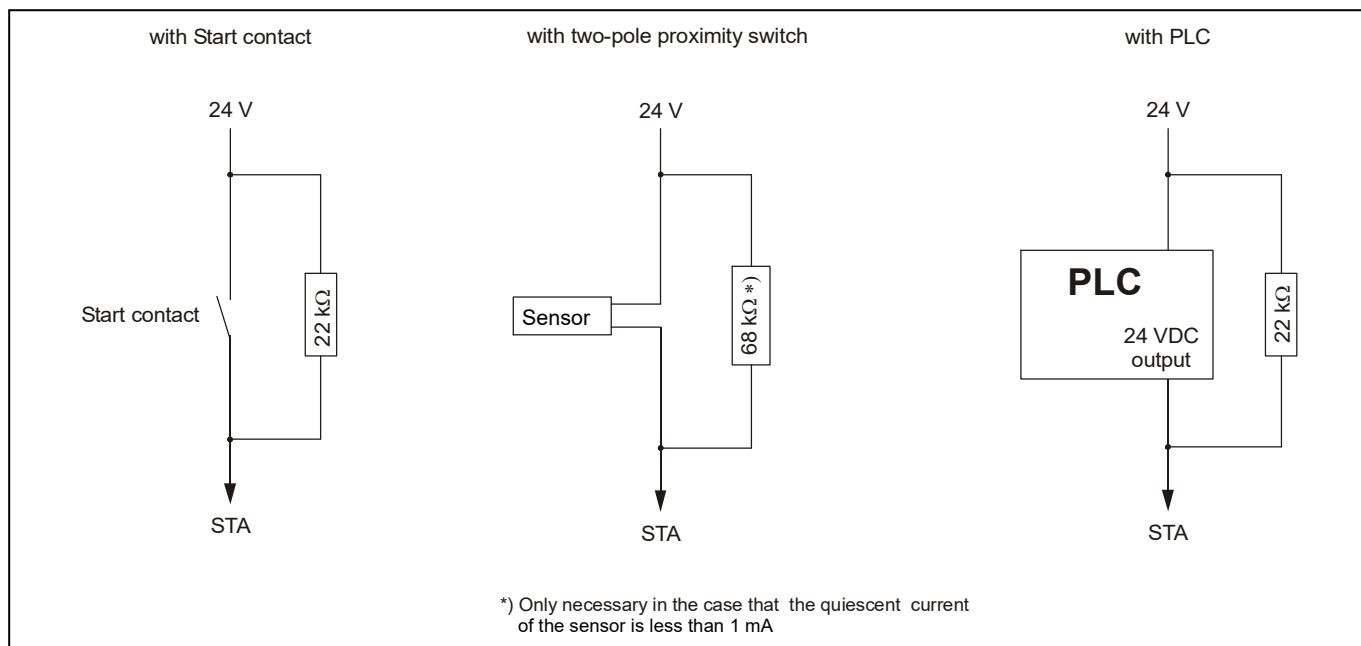


	BDWF / BDWD	DSD	DSP	DSPW	
1	+24 VDC	+24 VDC	+24 VDC	+24 VDC	(rd)
2	OUT	not used	not used	OUT	(bl)
3	M	M	M	M	(vo/ bn/gy)
4	IN	not used	not used	IN1	(pk)
5	not used	IN	Proximity switch	not used	(gn)
6	not used	not used	IN	IN2	(bu)
7	not used	not used	S-OUT1	S-OUT1	(bn)*
8	not used	not used	S-OUT2	S-OUT2	(wt)*
9	not used	not used	not used	not used	-
Housing	Shielding	Shielding	Shielding	Shielding	Shielding

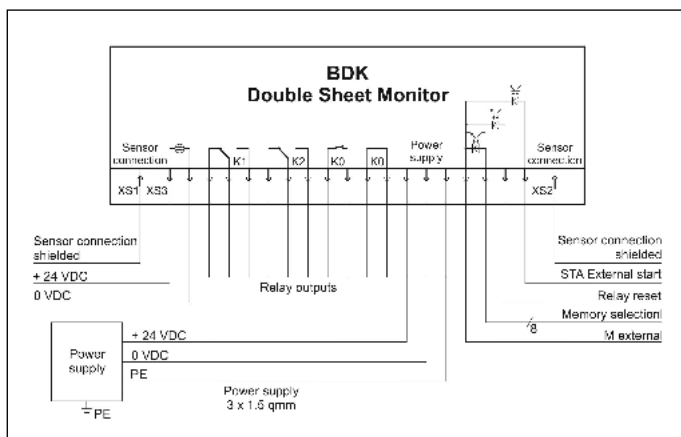
* 1.00mm

10. Wiring Diagrams

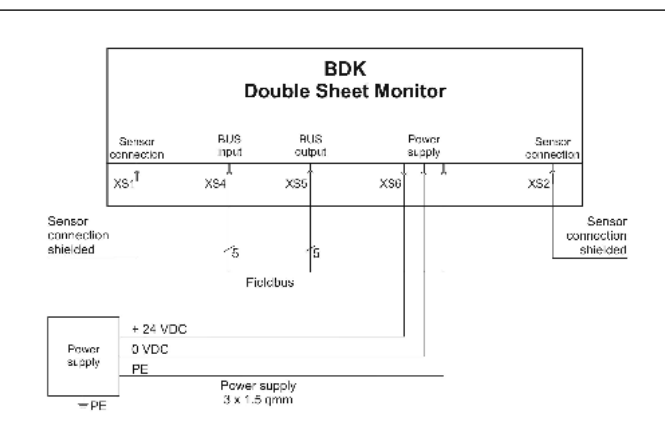
Wiring STA – lead with lead breakage monitor



Wiring Diagram BDK with PLC Interface

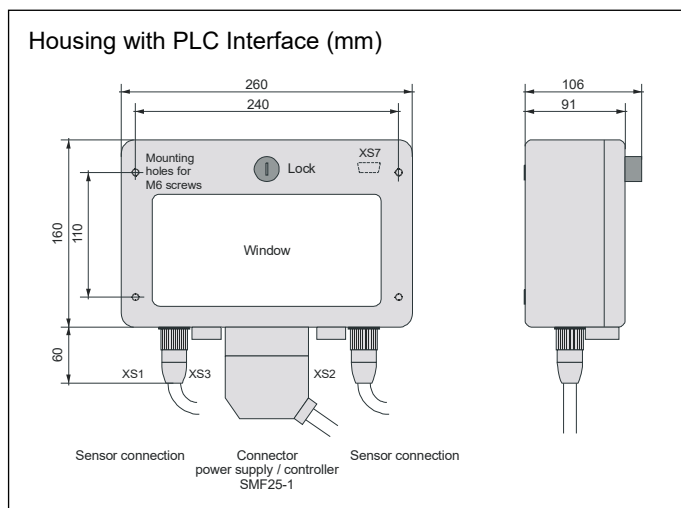


Wiring Diagram BDK with Fieldbus Interface

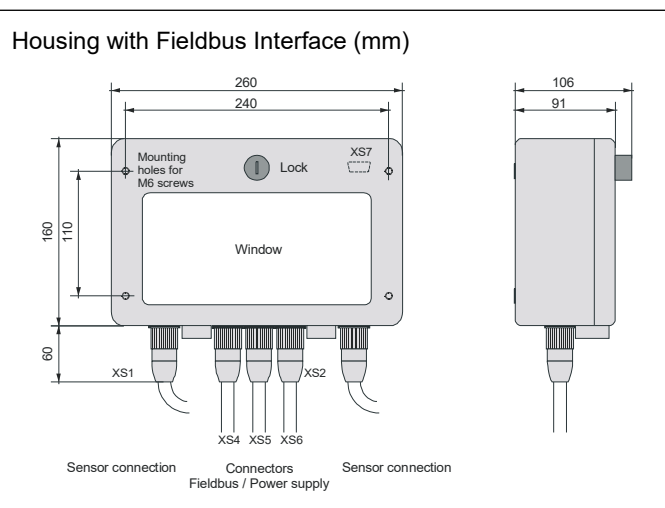


11. Housing Dimensions

Housing with PLC Interface (mm)



Housing with Fieldbus Interface (mm)



12. Sheet Metal Thickness Sensors

12.1. DSP, DSPW and BDWF for Single-Surface Contact Measurement

12.1.1. Mounting

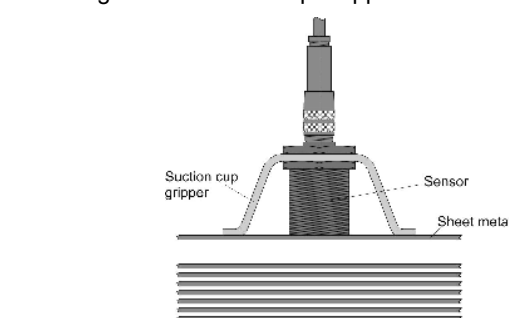
Preferably, the sensor should be built into an appropriately designed suction cup on the gripper.

The suction cup lifts the workpiece from the stack, bringing it near the proximity switch in the sensor. Just before the sensor touches the workpiece, the proximity switch recognises the sheet metal and initiates the measurement.

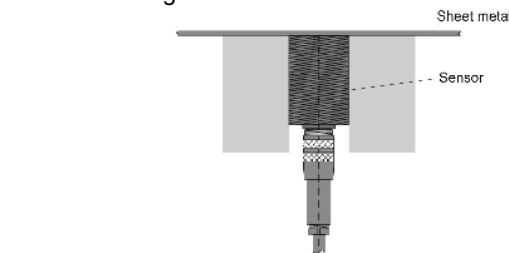
In the case of ferrous metals, the workpiece is held onto the sensor during the brief measuring time (≤ 110 ms). Instead of having a sensor in the suction cup gripper, it can be mounted also single-sided in a measuring station. In such case, however, the workpieces must remain motionless relative to the sensor during measurement. Mounting the sensor directly under and flush with the surface supporting the workpiece avoids accumulation of dirt and filings around the sensor (avoid air gap between sensor and workpiece).

A spring-mounted sensor is a suitable expedient if workpieces which are not flat and/or are very stiff (more than 1.5 mm thick) are to be processed. The workpieces must be large enough to completely cover the sensing face of the sensor during measurement.

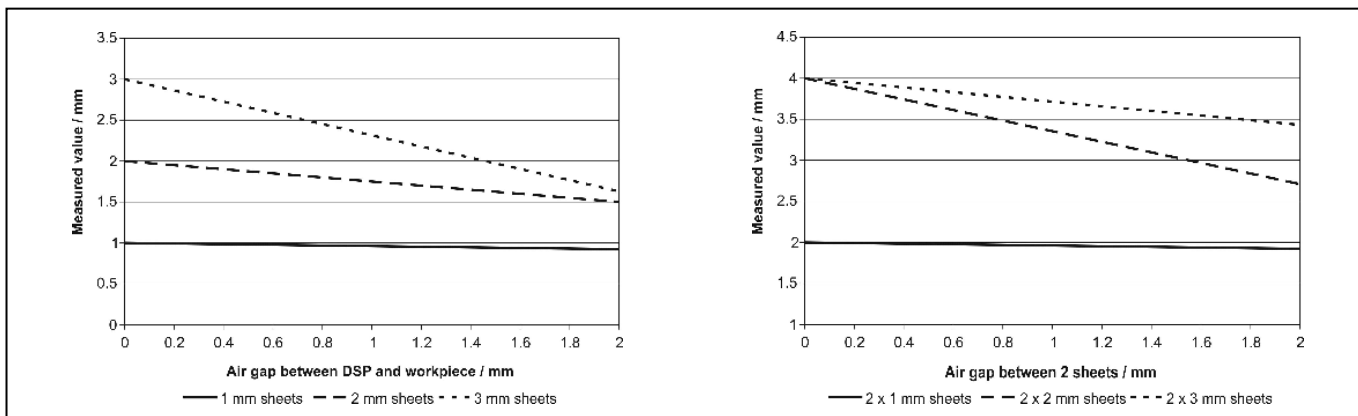
Mounting in the Suction Cup Gripper



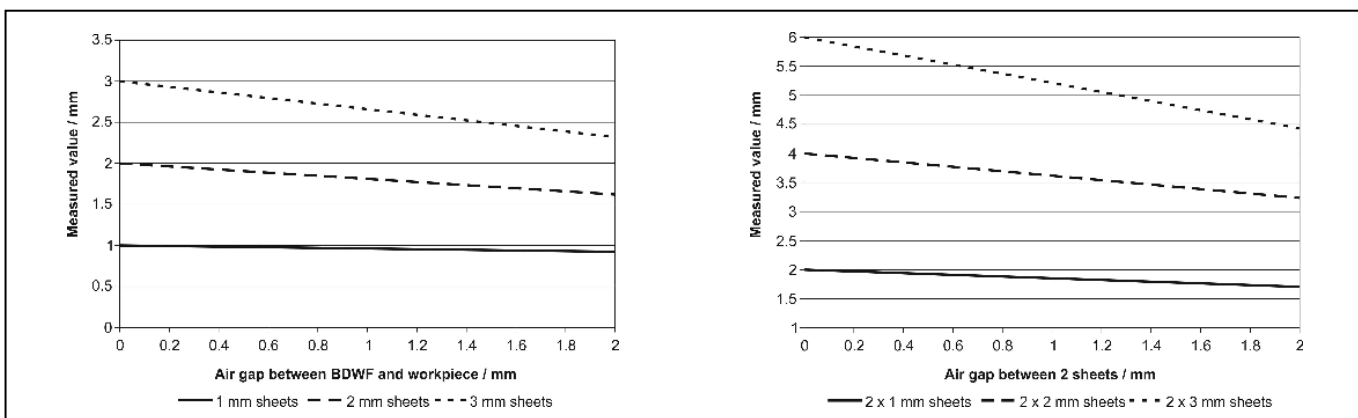
Flush Mounting



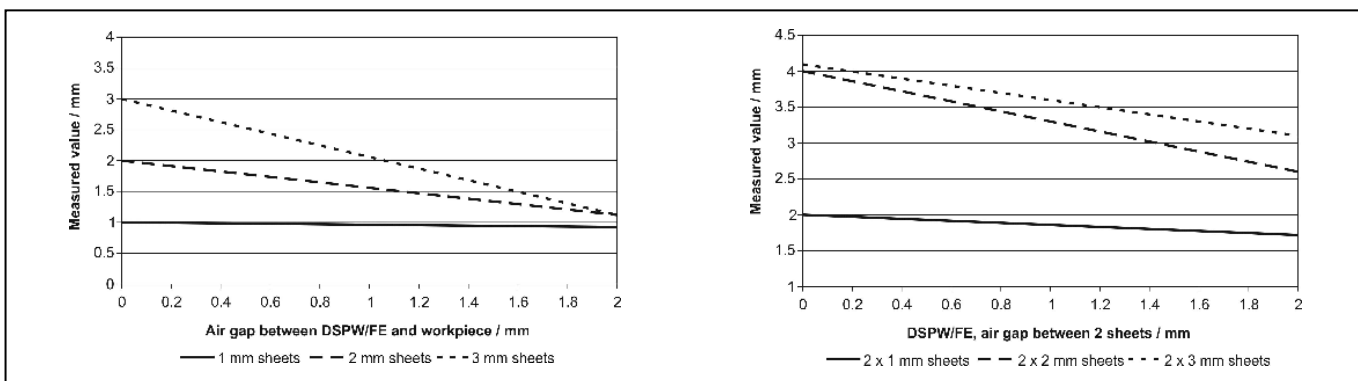
12.1.2. Air Gap Sensitivity with DSP-54sg-1s (Fe sheets)



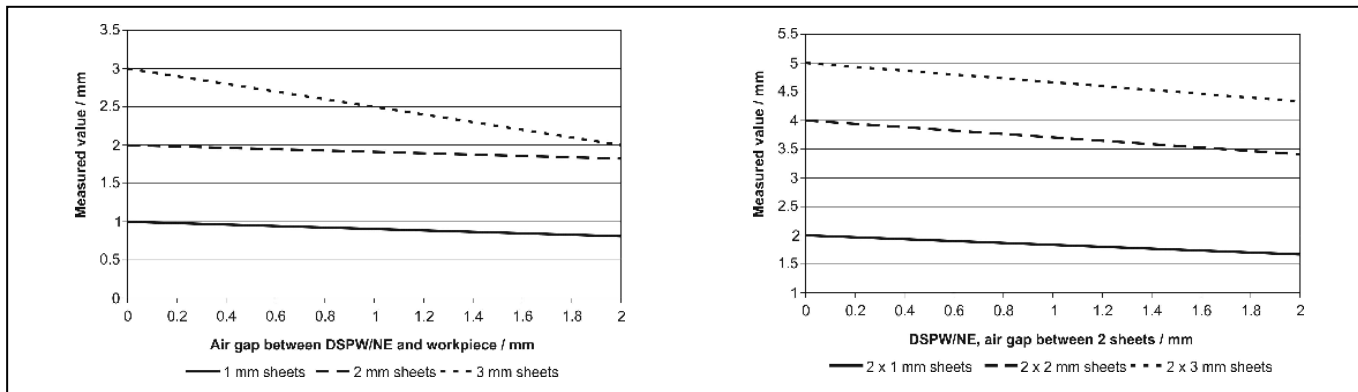
12.1.3. Air Gap Sensitivity with BDWF-54rg-2s (NE sheets)



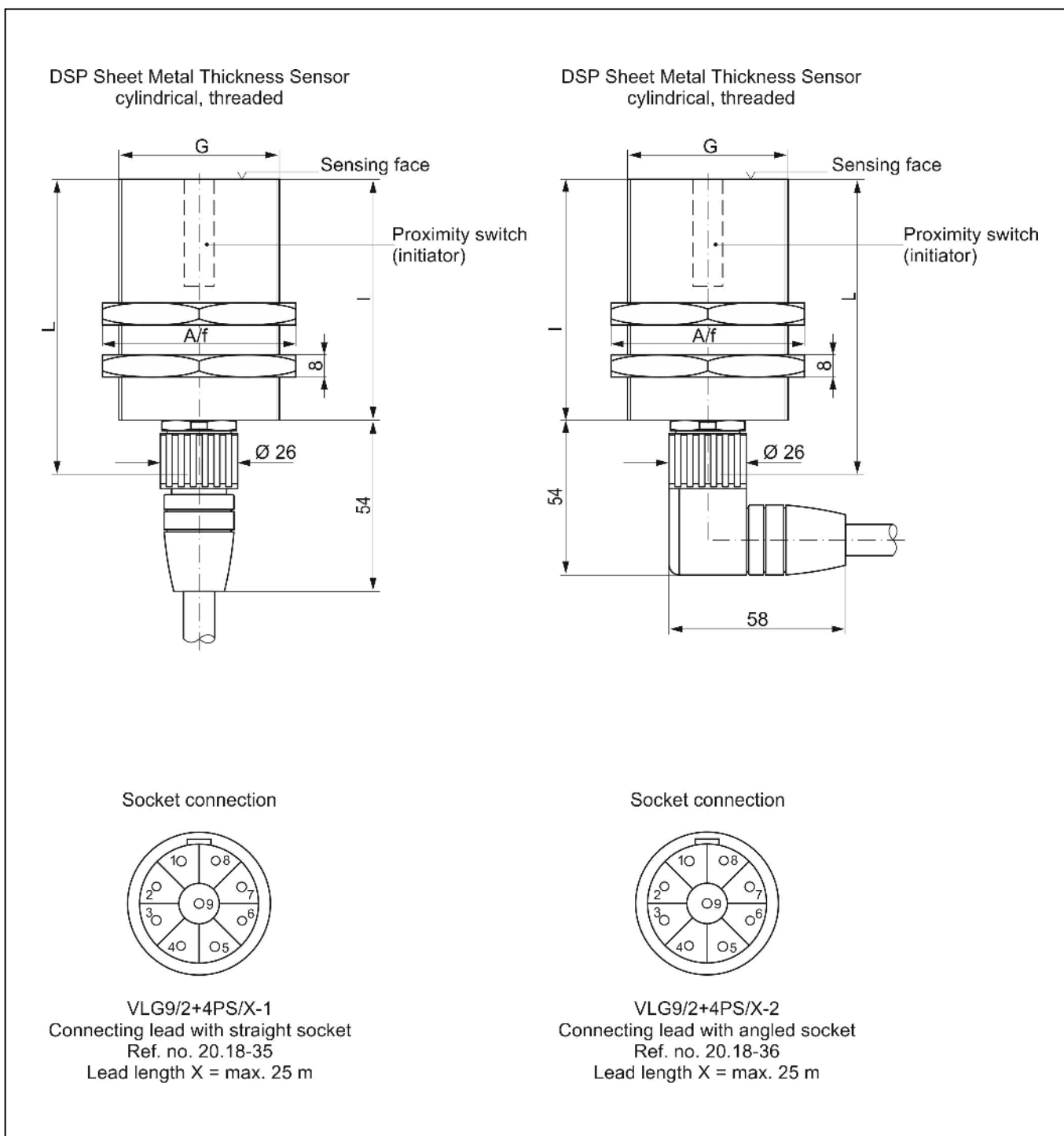
12.1.4. Air Gap Sensitivity with DSPW-54sg-1s (Fe sheets)



12.1.5. Air Gap Sensitivity with DSPW-54sg-1s (NE sheets)

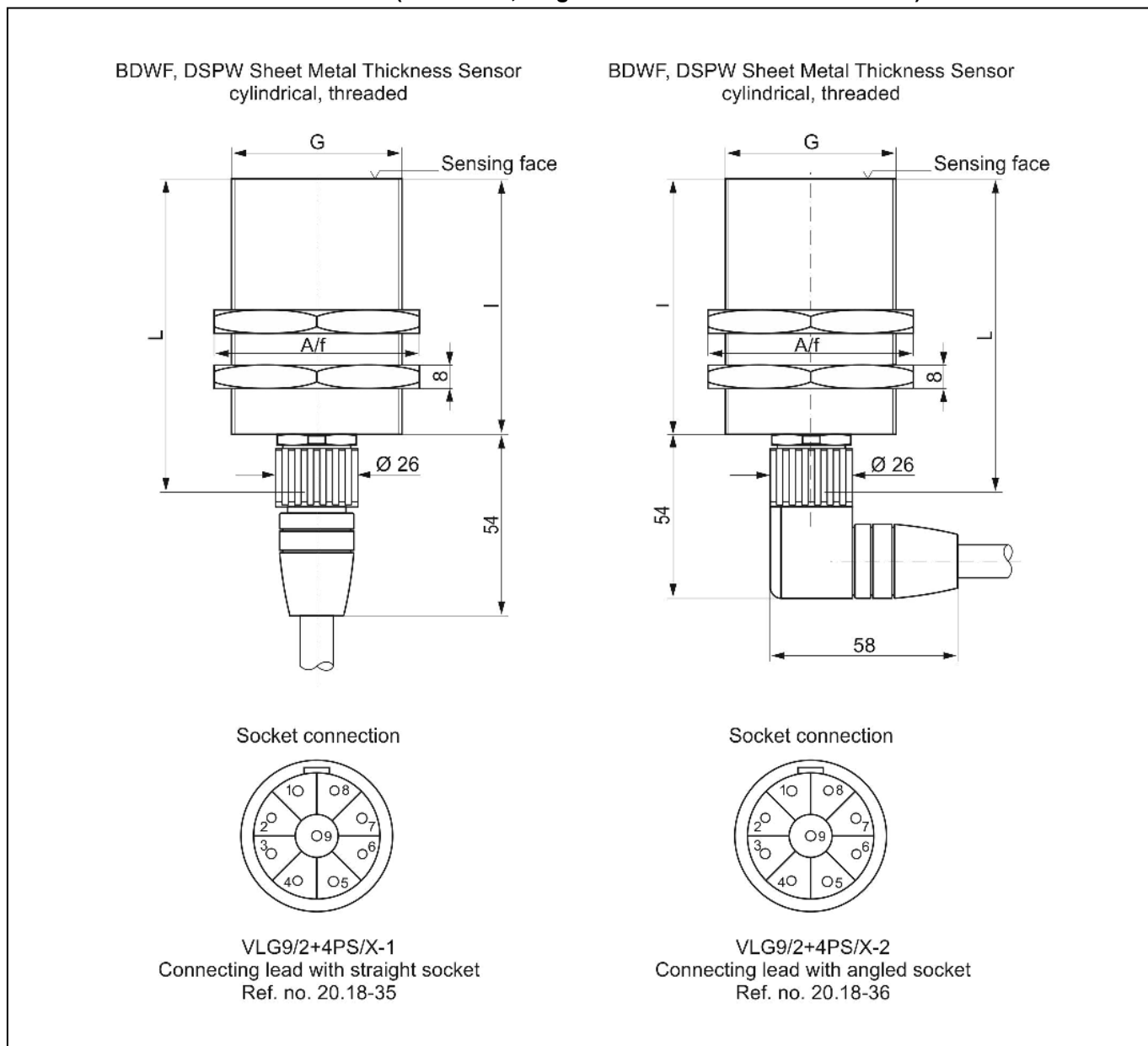


12.1.6. Housing Dimensions DSP (Fe sheets, single-surface contact measurement)



Type	Ref. no.	Meas. Range mm	Fe sheets up to mm	Meas. time ms	L mm	I mm	G Thread	A/f	Weight g
DSP-36sg-1s	13.05-86	0.2 ... 2.0	1.5	< 20	90	65	M36 x 1.5	55	380
DSP-42sg-1s	13.05-87	0.2 ... 3.0	2.5	< 30	100	75	M42 x 1.5	65	910
DSP-54sg-1s	13.05-89	0.2 ... 4.0	3.5	< 50	107	81	M54 x 0.75	65	1200
DSP-75sg-1s	13.05-90	0.2 ... 6.0	5.5	< 110	126	100	M75 x 1.5	90	3010

**12.1.7. Housing Dimensions DSPW (Fe and NE sheets, single-surface contact measurement)
 BDWF (NE sheets, single-surface contact measurement)**



Type	Ref. no.	Meas. range mm	Max. thickn. mm	Meas. time ms	L mm	I mm	G Thread	A/f	D mm	Weight g	Max. lead length m
DSPW-42sg-1s **)	13.05-66	Fe: 0.2 ... 3.5 NE: 0.2 ... 2.5 NE: 0.2 ... 4.0*)	3.0 2.0 3.0	< 70	117	96	M42 x 1.5	55	42	900	25
DSPW-54sg-1s	13.05-67	Fe: 0.2 ... 4.0 NE: 0.2 ... 3.0 NE: 0.2 ... 5.0*)	3.5 2.5 4.0	< 70	117	96	M54 x 0.75	65	54	1200	25
BDWF-m54rg-2s	13.05-73	NE: 0.2 ... 6.0	5.5	< 100	101	81	M54 x 0.75	65	54	650	50

*) The measuring range for non-ferrous (NE) sheets can be extended to **4 mm** or **5 mm** by use of a special adapter.

When using an unsuitable adapter, the accuracy and linearity of the sensor may deteriorate.

We like to provide you our support to work out the best solution.

**) For using the DSPW-42sg-1s sensor, the evaluation device has to be equipped with software version E118 (January 2014) or higher.

12.2. BDWD/S and BDWD/E for Double Surface Measurement

12.2.1. Mounting

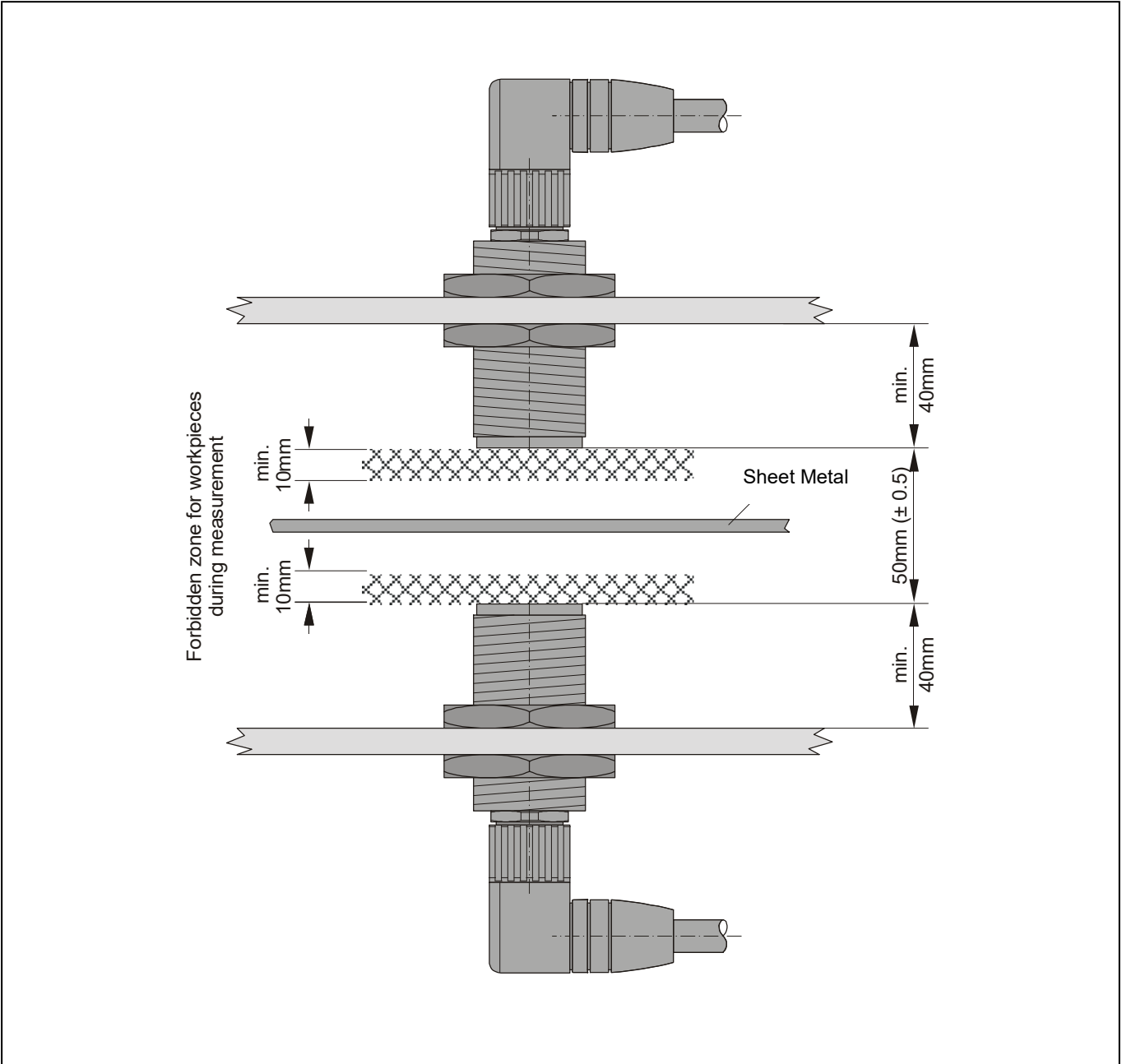
The BDWE/S and BDWD/E sensor pair is to be mounted with a distance of 50 mm between their sensing faces. Mounting must be accomplished so that the workpieces maintain a distance of at least 10 mm from the sensing faces during measurement.

In order to provide maximum measurement accuracy, mounting must be accomplished in such manner that the workpieces will be transported precisely between the transmitter and receiver.

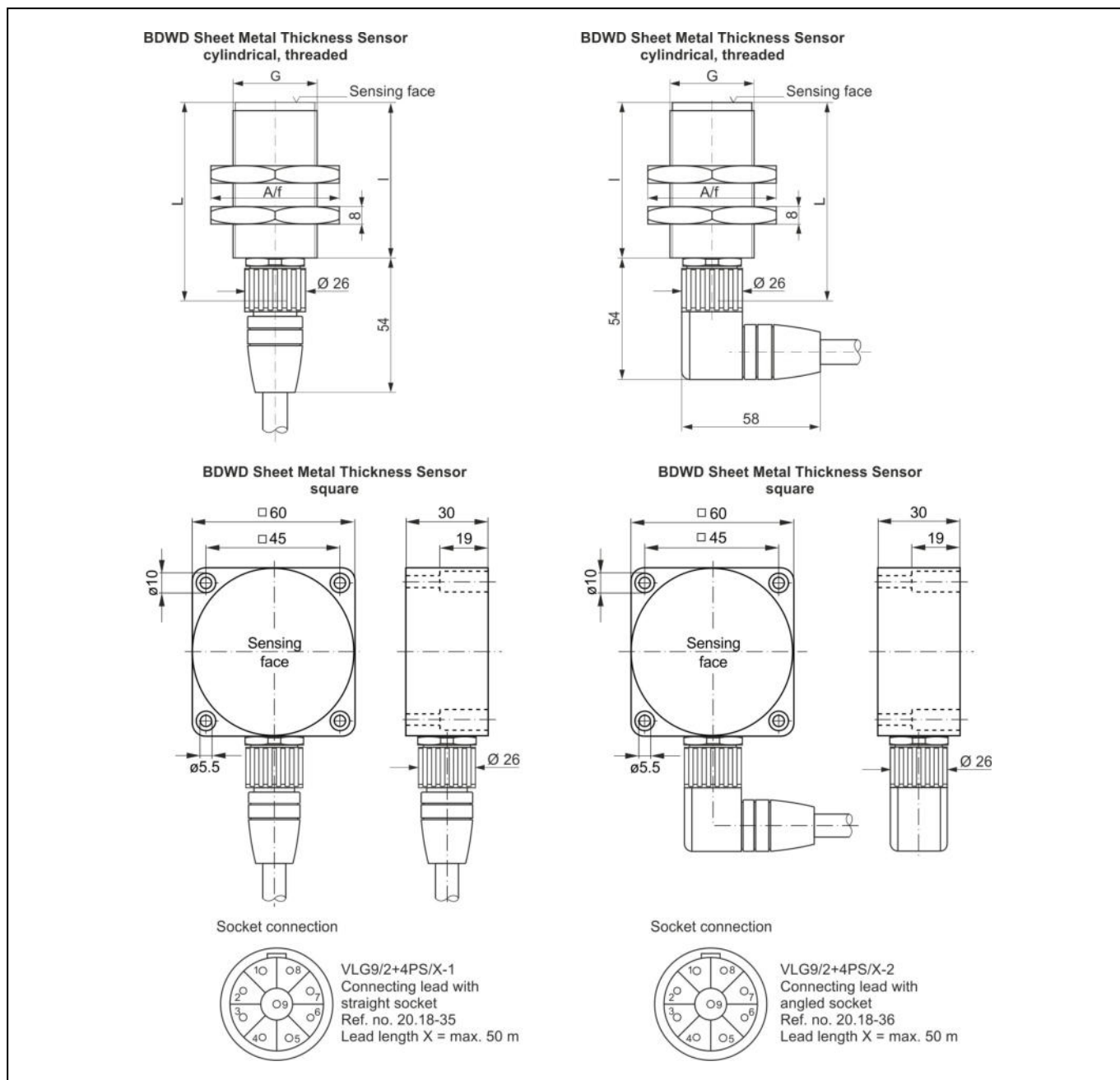
The workpieces must be large enough to exceed at least 90 mm over the edges of the sensing faces during the entire measuring interval; otherwise, especially the measurement of thick ferrous workpieces can lead to wrong results or to a reduced measuring range.

>> <<	Indicates that sensor distance is far too large
> <	Indicates that sensor distance is too large
OK	Indicates that sensor distance is correct
<>	Indicates that sensor distance is too small
<< >>	Indicates that sensor distance is far too small

Visual support for the precise mounting procedure is provided in the sensor distance submenu of the Setup Menu. The LC-display informs the operator about the distance between the transmitter and receiver.



12.2.2. Housing Dimensions BDWD (Fe and NE sheets, double-surface non-contact measurement)



Type	Ref. no.	Meas. range mm		Max. thickness mm		Meas. time ms	L mm	I mm	G Thread	A/f	Weight g
		Ferrous	Non-ferrous	Ferrous	Non-ferrous						
Transmitter BDWD/S-m36rg-1s	13.05-74	0.2 ... 3.5	0.2 ... 20	3.0	6.0	25 ... 200	85	65	M36x1.5	55	250
Receiver BDWD/E-m36rg-1s	13.05-75	0.2 ... 3.5	0.2 ... 20	3.0	6.0	25 ... 200	85	65	M36x1.5	55	250
Transmitter BDWD/S-60aq30-1Y1	13.05-76	0.2 ... 3.5	0.2 ... 20	3.0	6.0	25 ... 200	-	-	-	-	500
Receiver BDWD/E-60aq30-1Y1	13.05-77	0.2 ... 3.5	0.2 ... 20	3.0	6.0	25 ... 200	-	-	-	-	500

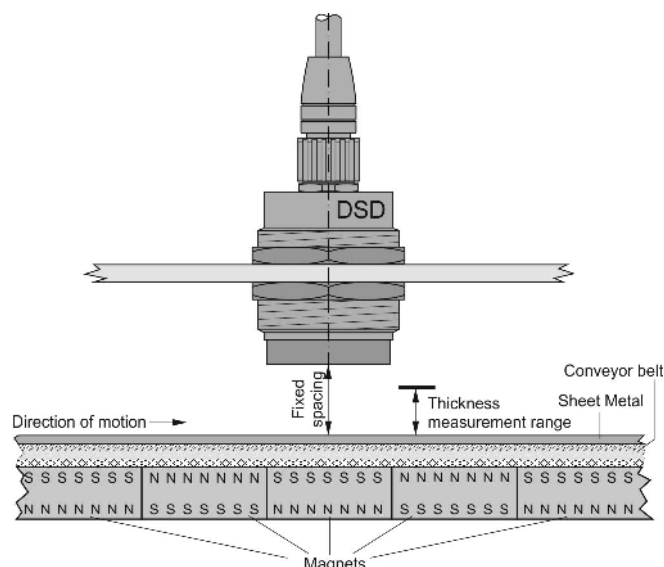
12.3. DSD Sensor for Single-Surface non-contact Measurement

12.3.1. Mounting

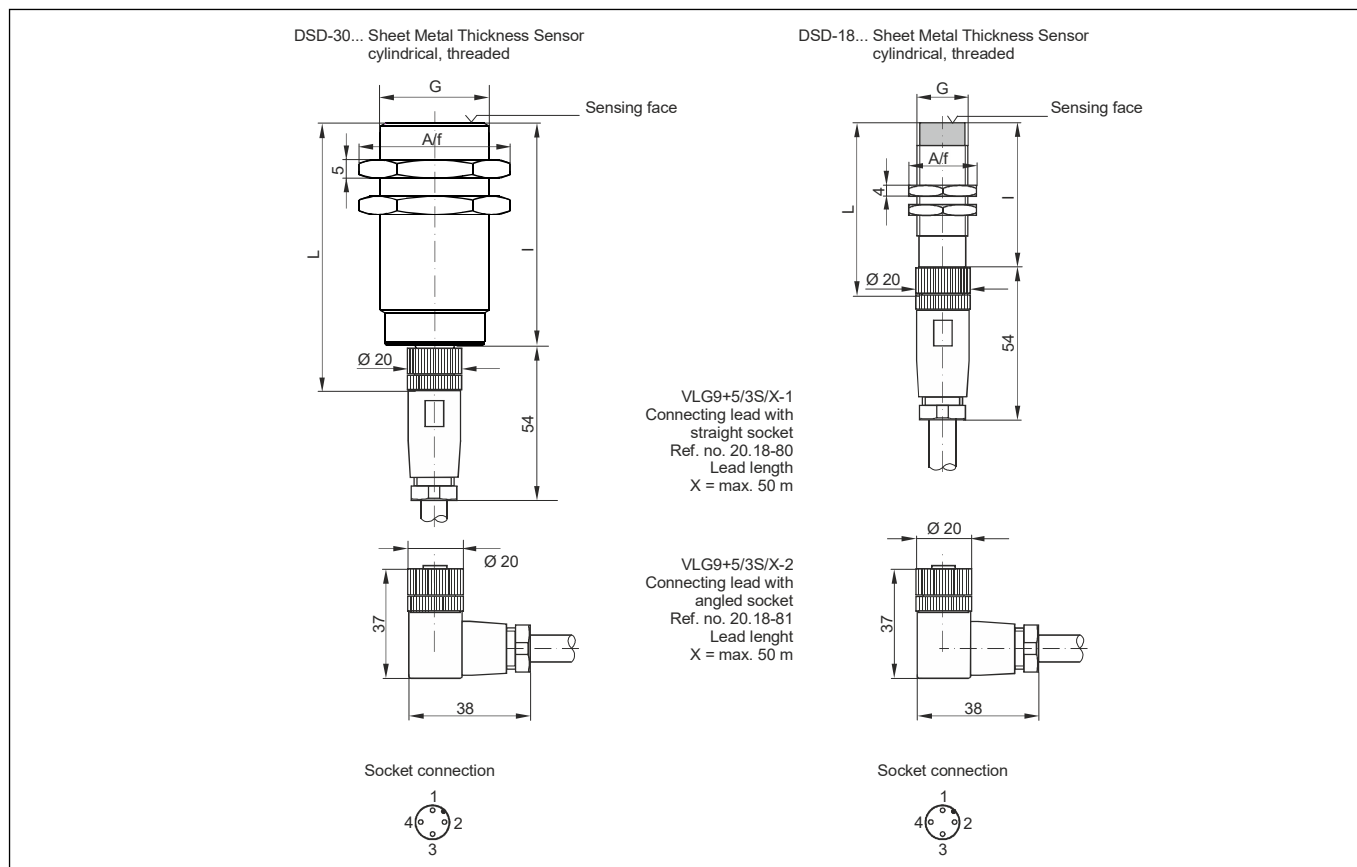
The distance between the sensing face and the surface supporting the workpiece (conveyor belt) must correspond to the distance specified for the sensor to be used. The workpieces must lie on the supporting surface without any air gap.

Strong magnetic fields, resulting from magnets which are used on conveyor belts, may influence the measurements when the workpiece moves along the sensor. This influence can be minimised by mounting the sensor symmetrically to the magnetic poles, and hence to the respective magnetic field.

The workpieces must be large enough to completely cover the sensing face during the entire measuring operation.



12.3.2. Housing Dimensions DSD (Fe sheets, single-surface non-contact measurement)



Type	Ref. no.	Dist. mm	Ferrous materials		Meas. time ms	L mm	I mm	G Thread	A/f	Weight g
			Meas. range mm	Double sheet moni- tor mm						
DSD-18mg 61n0.5/3-1Sd1	13.05-91	8	0.5 ... 6.0 0.5 ... 7.0 *)	0.5 ... 3.0 0.5 ... 3.5 *)	10	61	51	M18x1	24	50
DSD-30mg 74n3/6,5-1Sd1	13.05-94	16	3.0 ... 13 **)	3.0 ... 6.5 **)	10	74	61	M30x1.5	36	112

*) from software version F119 or higher (August 2015). **) from software version F120 or higher (April 2022).

13. VLG Connecting Leads

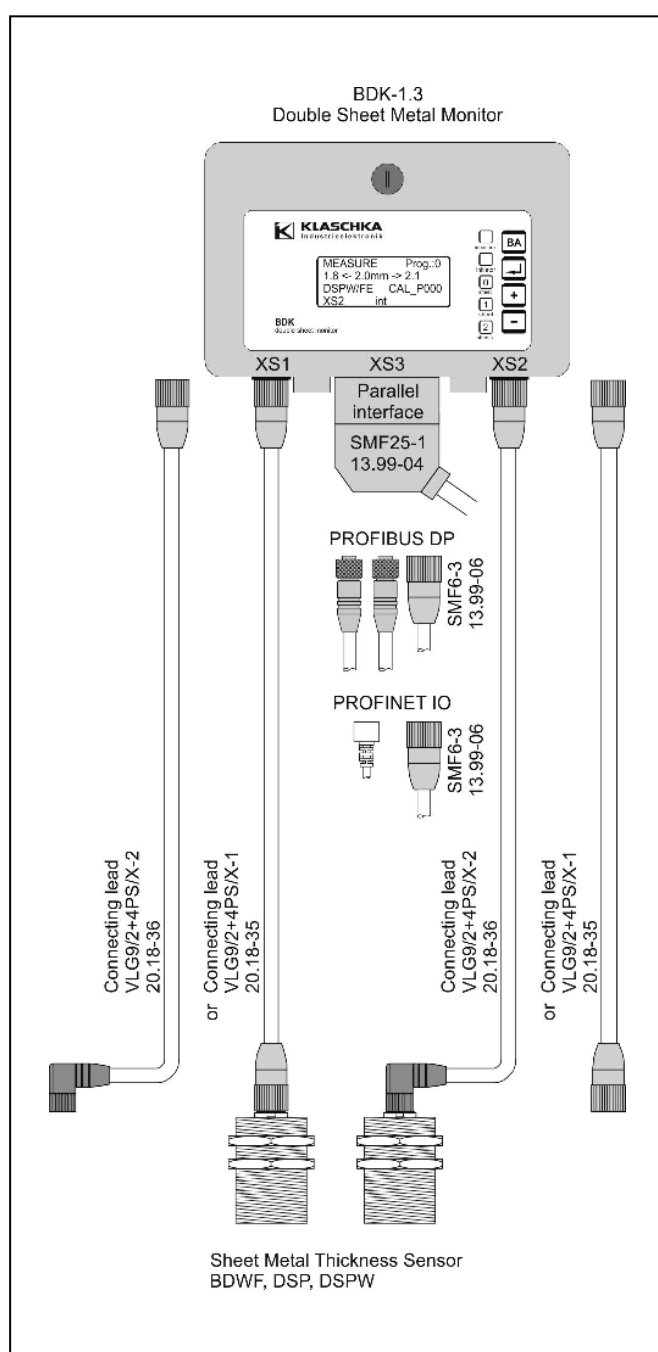
All connecting leads for the connection of the sensors to the evaluation unit are oil-resistant and suitable for drag chains.

The maximum lead length depends on the sensor type.

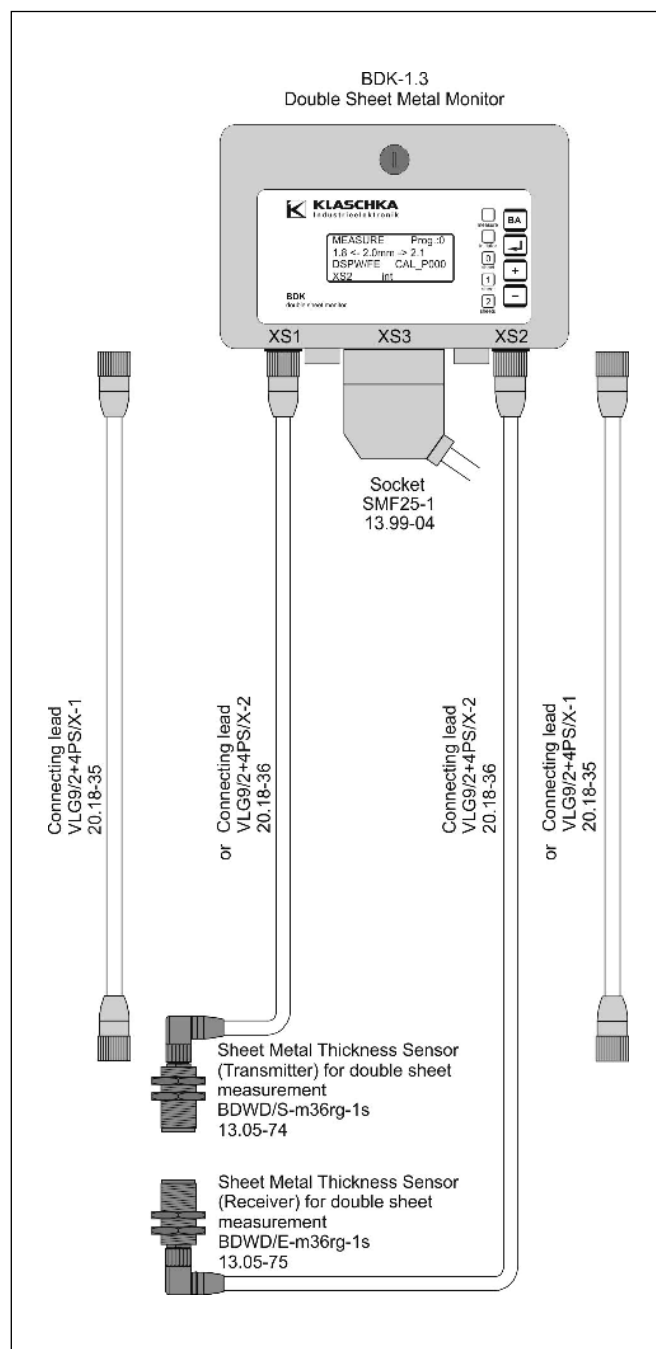
The connectors are mounted straight on the monitoring device side and can be straight or angled on the sensor side, as required.

Depending on the installation situations, the lead with the straight connector VLG9/2+4PS/X-1 (Ref. no. 20.18-35) can be used instead of the lead with the angled connector VLG9/2+4PS/X-2 (Ref. no. 20.18-36).

13.1. Configuration Example for Sheet Metal Thickness Sensors for Single Surface Monitoring



13.2. Configuration Example for Sheet Metal Thickness Sensors for Double Surface Non-contact Monitoring



14. ADD1/2-1.3 T-Coupler

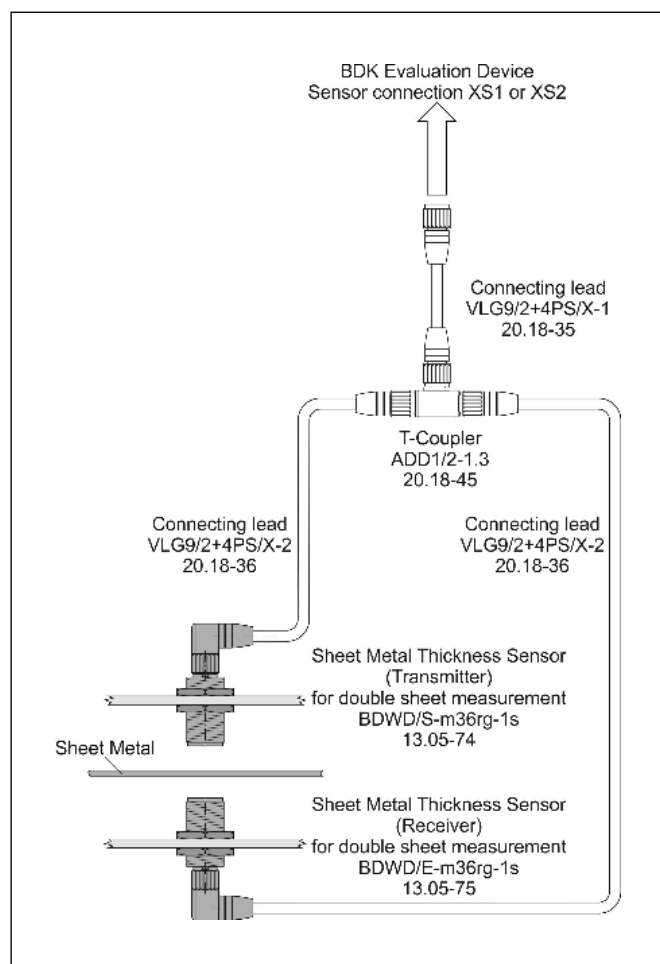
When using the ADD1/2-1.3 T-coupler, two different sensor types can be employed on each (XS1 and XS2) sensor connection of the BDK-1.3 monitoring device.

The selection of the desired sensor or sensor pair on the corresponding connection takes place via default of the accordingly specified program number.

Depending on the installation situations the lead with the straight connector VLG9/2+4PS/X-1 (Ref. no. 20.18-35) can be used instead of the lead with the angled connector VLG9/2+4PS/X-2 (Ref. no. 20.18-36).

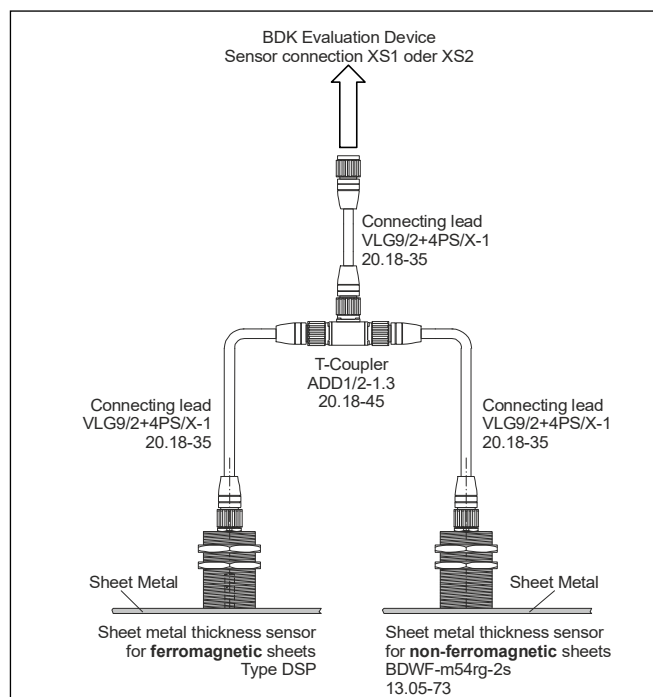
14.1. Double Surface Non-contact Monitoring via One Sensor Connection

The ADD1/2-1.3 T-coupling enables the connection of the BDWD/S-m36rg-1s and BDWD/E-m36rg-1s sensor pair to the (XS1 or XS2) sensor connection of the BDK-1.3 monitoring device.



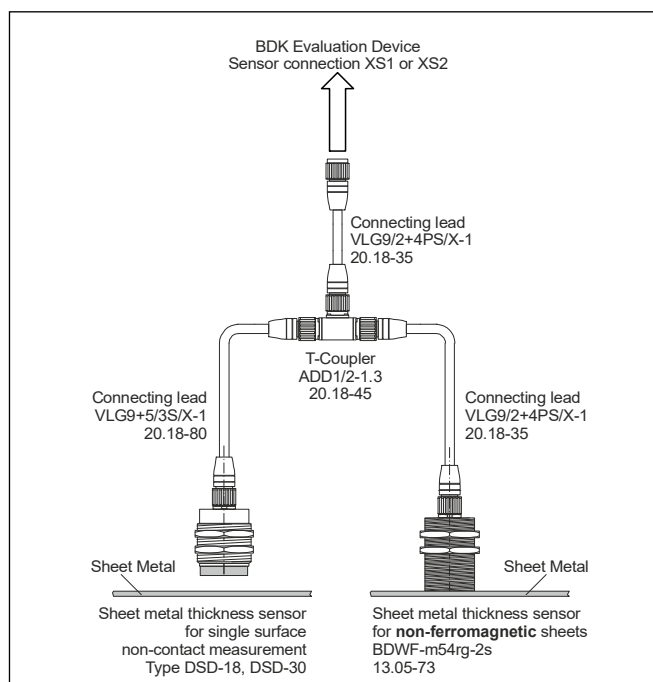
14.2. Single Surface Contact Monitoring of Ferrous (Fe) and Non-ferrous (NE) Sheet Metals via One Sensor Connection.

The application of the ADD1/2-1.3 T-coupler enables the operation of one sheet metal thickness sensor of the type series DSP for ferrous magnetic sheets and of one BDWF-m54rg-2s sheet metal thickness sensor for non-ferrous magnetic sheets on one (XS1 or XS2) sensor connection.



14.3. Single Surface Non-contact Monitoring of Ferrous Sheets (Fe) and Contact Monitoring of Non-ferrous Sheets (NE) via One Sensor Connection

The application of the ADD1/2-1.3 T-Coupler enables the operation of one sheet metal thickness sensor of the type series DSD for non-contact measurement of ferrous magnetic sheets and one BDWF-m54rg-2s sheet metal thickness sensor for contact measurement of non-ferrous magnetic sheets on one (XS1 or XS2) sensor connection.



(regarding 14.2 and 14.3) Instead of the BDWF-m54rg-2s sensor, either a DSPW-42sg-1s or a DSPW-54sg-1s can be connected. (contact monitoring of Fe- and NE-sheets).

15. BDIW Sensor Switch

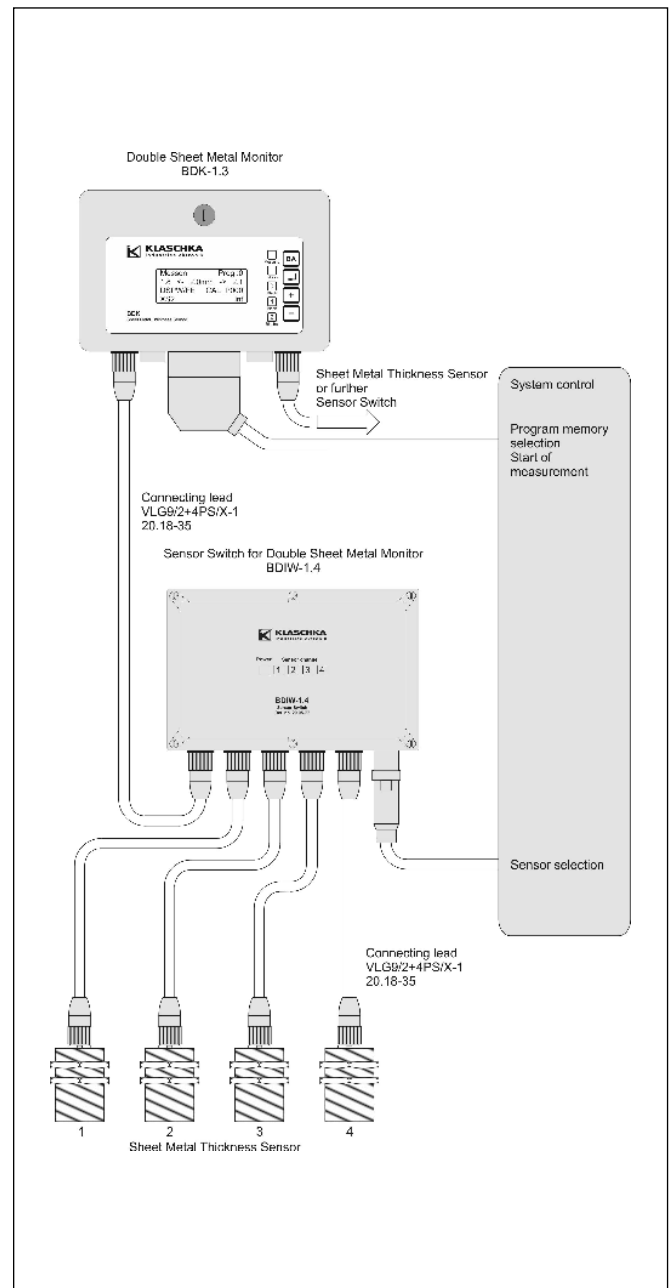
With the operation of BDK Double Sheet Metal Monitors it often occurs that one monitor has to be connected to different sheet metal thickness sensors. This is, for example, the case when working with very different sheet thicknesses and materials at one press or when measuring at different points of material supply.

With the two equivalent sensor connections XS1 and XS2 as well as the use of the ADD1/2-1.3 T-coupler, the monitoring device disposes of a lot of possibilities for the connection of further sensors. The BDIW sensor switch allows to operate up to 4 additional sensors via each of the XS1 or XS2 sensor connections of the BDK-1.3 monitoring device.

Please find more details in description KB 20.05-77.

15.1. Example

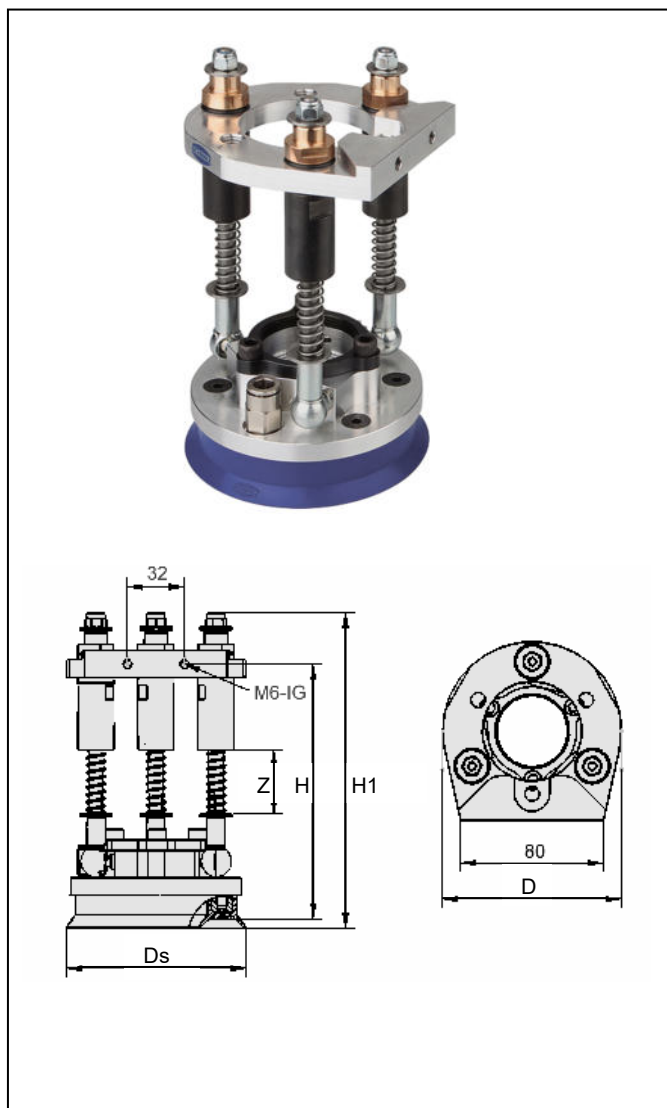
Application of max. 2 Sensor-Switches BDIW with each max. 4 Sensors



16. Bracket with suction cup for mounting Sheet Thickness Sensor

For single surface contact monitoring (e.g. for destacking equipment), sheet thickness sensors are often built into the suction cup of the gripper. For the DSP, DSPW, and BDWF thickness sensors with (M42, M54) design there are different versions of sensor brackets available.

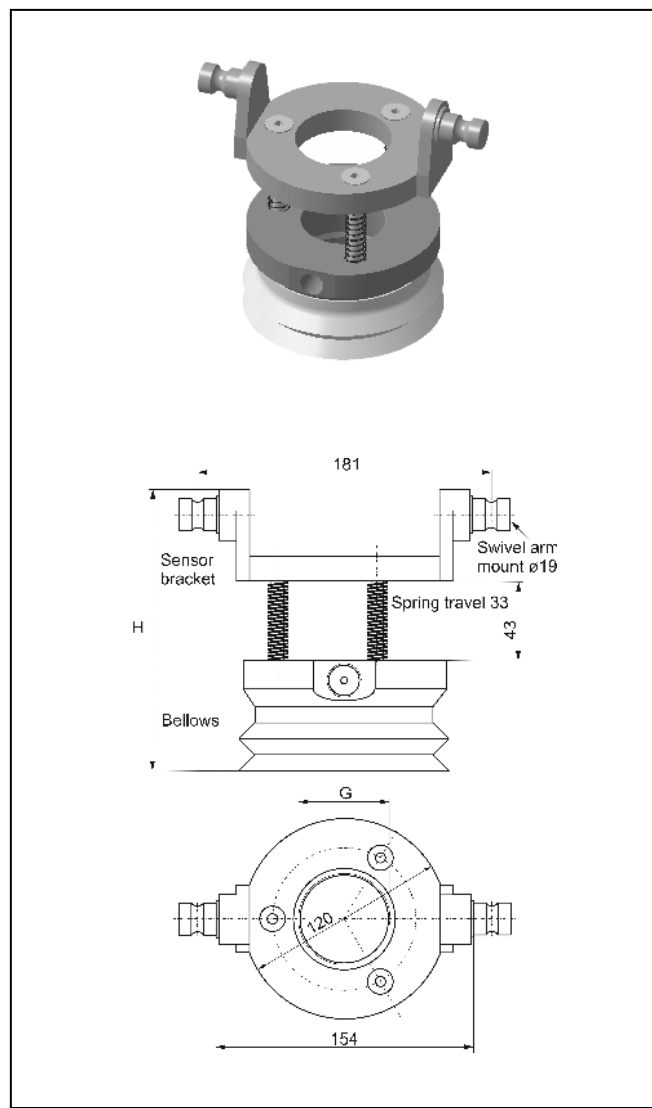
16.1. For Sensors with M42 x 1.5 and M54 x 0.75 thread - spring-mounted, with suction ring, with flexible spherical bearing



Type Ref. no.	D	Ds	H	H1	Z	Weight (g)
ZBF/BBF42-1 13.99-77	100	100	143	178	36	1070
ZBF/BBF54-2 13.99-87	130	128.8	187	221	80	1300

Spare Parts for Sensor Brackets		
Type	Ref. no.	
ZBF/BB42-1	13.99-78	Suction cup for sensor bracket M42
ZBF/BB54-2	13.99-88	Suction cup for sensor bracket M54

16.2. For Sensors with M42 x 1.5 and M54 x 0.75 thread - spring-mounted, with bellows



Type Ref. no.	H	G	Weight (g)
ZBF/BBF42-2 13.99-84	165.2	M42 x 1.5	1300
ZBF/BBF54-1 13.99-69	162.0	M54 x 0.75	1500

Spare Parts for Sensor Brackets		
Type	Ref. no.	
ZBF/BB42-2	13.99-85	Bellows for sensor bracket M42
ZBF/BB54-1	13.99-68	Bellows for sensor bracket M54

17. Technical Data

17.1. Evaluation Devices

Inputs

Start external (STA)

- lo-level	1 ... 8 VDC
- hi-level	12 ... 30 VDC
- Lead break detection	0 ... 1 VDC (external resistor necessary, see page 19)
- Input current	approx. 10 mA
- Electrical isolation	yes (to power supply)

Threshold select external

(A1 ... A8 and Relays reset)

- lo-level	0 ... 4 VDC
- hi-level	12 ... 30 VDC
- Input current	approx. 10 mA
- Electrical isolation	yes (to power supply)

Outputs

Elektromechanical relays

- Relay output K0	1 NC, 1 NO
- Relay outputs K1, K2	1 rev. switch each 6 A, 250 VAC

Semi-conductor relays *)

- Relay output K0	1 NC, 1 NO
- Relay outputs K1, K2	1 rev. switch each 0.5 A, 30 V

Measurement accuracy

- At calibration point	± 0.1 or. 0.2 mm
- Across measurement range value	± 5% end-of-scale
- Permissible air gap	see page 22

Power supply

<u>DC voltage</u>	24 VDC
- Tolerance	± 15%
- Residual ripple	max. 10%

Power consumption

- During measurement	max. 100 VA (when measured with DSP and DSPW sensors, otherw. 20 VA)
- Idle state	approx. 12 VA

Overload protection

- At 24 VDC	via fuses t 3.15 A
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Housing

	sturdy metal housing, lockable cover with window
- Protection rating	IP 65
- Mounting	screw mounting (4 x M6)

Weight

approx. 3.5 kg

Ambient temperature

0 ... 55 °C

*) When connecting inductive loads to the semi-conductor relays, an appropriate cut-off protection has to be used.

17.2. DSP Sheet Metal Thickness Sensor

Workpiece

ferromagnetic sheets

Field coil

- Nominal voltage	approx. 38 VDC
- Coil current	max. 2.2 A

Proximity switch

- Type	IAD-m8rg-2k
- Switching distance	approx. 1.2 mm
Housing material	nickel-plated steel
Protection rating	IP 65
Ambient temperature	0 ... 60 °C

17.3. BDWF Sheet Metal Thickness Sensor

Workpiece

non-ferrous sheets

Power supply	24 VDC
Input current	10 Vpp
<u>Sheet detection</u>	
- Switching distance	1 ... 5 mm (dep. on sheet)
Housing material	nickel-plated steel
Protection rating	IP 65
Ambient temperature	0 ... 60 °C

17.4. BDWD/S, BDWD/E T Sheet Thickness Sensors

Workpiece

ferrous and non-ferrous sheets

Power supply	24 VDC
Input current	10 Vpp
Housing material	nickel-plated steel
Protection rating	IP 65
Ambient temperature	0 ... 60 °C

17.5. DSD Sheet Metal Thickness Sensor

Workpiece

ferromagnetic sheets

Power supply	24 VDC
Housing material	nickel-plated brass
Protection rating	IP 65
Ambient temperature	0 ... 60 °C

17.6 DSPW Sheet Metal Thickness Sensor

Workpiece

ferromagnetic sheets, non-ferrous sheet

Power supply	24 VDC
<u>Sheet detection</u>	
- Switching distance	1 ... 5 mm
Housing material	nickel-plated steel
Protection rating	IP 65
Ambient temperature	0 ... 60 °C

17.7 Standards Applied

Measuring relays and protection equipment	EN 60255-1
EMC emission	EN 61000-6-4
EMC immunity	EN 61000-6-2

18. Order Data (designation / ref. no.)

18.1. Evaluation Devices

BDK-1.3 (Relay outputs)	20.05-80
BDK/OB-1.3 (Semi-conductor relay outputs)	20.21-01
BDK/FS-1.3 (InterBus – S)	20.05-81
BDK/FP-1.3 (PROFIBUS DP)	20.05-82
BDK/PN-1.3 (PROFINET IO)	20.05-93

18.2 Sheet Metal Thickness Sensors for single-surface contact measurement

DSPW-42sg-1s for Fe sheets up to 3.0 mm / NE sheets up to 2.0 mm, thread M42 x 1.5 - For using the DSPW-42sg-1s sensor, the evaluation device has to be equipped with software version E118 (January 2014) or higher.	13.05-66
DSPW-54sg-1s for Fe sheets up to 3.5 mm / NE sheets up to 2.5 mm, thread M54 x 0.75	13.05-67
BDWF-m54rg-2s for NE sheets up to 5.5 mm, thread M54 x 0.75	13.05-73
DSP-36sg-1s for Fe sheets up to 1.5 mm, thread M36 x 1.5	13.05-86
DSP-42sg-1s for Fe sheets up to 2.5 mm, thread M42 x 1.5	13.05-87
DSP-54sg-1s for Fe sheets up to 3.5 mm, thread M54 x 0.75	13.05-89
DSP-75sg-1s for Fe sheets up to 5.5 mm, thread M75 x 1.5	13.05-90

18.3 Sheet Metal Thickness Sensors for double-surface non-contact measurement

BDWD/S-m36rg-1s (transmitter) for Fe sheets up to 3.0 mm / NE sheets up to 6.0 mm, thread M36 x 1.5	13.05-74
BDWD/E-m36rg-1s (receiver) for Fe sheets up to 3.0 / NE sheets up to 6.0 mm, thread M36 x 1.5	13.05-75
BDWD/S-60aq30-1Y1 (transmitter) for Fe sheets up to 3.0 / NE sheets up to 6.0 mm, rectangular housing 60x60 mm	13.05-76
BDWD/E-60aq30-1Y1 (receiver) for Fe sheets up to 3.0 / NE sheets up to 6.0 mm, rectangular housing 60x60 mm	13.05-77

18.4 Sheet Metal Thickness Sensors for single-surface non-contact measurement

DSD-18mg61n0,5/3-1Sd1 for Fe sheets up to 3.0 mm for Fe sheets up to 3.5 mm with software version F119 (Au- gust 2014) or higher for NE sheets (depends on sheet type, on demand), thread M18 x 1	13.05-91
DSD-30mg74n3/6.5-1Sd1 for Fe sheets up to 6.5 mm for NE sheets (depends on sheet type, on demand), thread M30 x 1.5 from software version F120 (April 2022).	13.05-94

18.5 Connecting Leads and Accessories

All connecting leads are oil-resistant and suitable for drag chains. Please indicate the lead length X when ordering (standard length X = 5 m). The connectors are device-sided straight and sensor-sided optionally straight or angled.

VLG9/2+4PS/X-1 Connecting lead BDK <---> sensor, lead socket sensor-sided straight	20.18-35
VLG9/2+4PS/X-2 Connecting lead BDK <---> sensor, lead socket sensor-sided angled	20.18-36
VLG9/2+4PS/X-3 Extension lead: BDK-lead (VLG) <---> sensor, lead socket sensor-sided straight	20.18-37
VLG9/2+4PS/X-4 Extension lead: BDK-lead (VLG) <---> sensor, lead socket sensor-sided angled	20.18-38
VLG9E/2+4PS/X-1 Connecting lead BDK and multiple coupling	20.18-39
VLG9E/2+4PS/X-2 Connecting lead multiple coupling and sensor, lead socket straight	20.18-40
VLG9E/2+4PS/X-3 Connecting lead multiple coupling and sensor, lead socket angled	20.18-41
VLG9+5/3S/X-1 Connecting lead BDK <---> DSD-18/DSD-30, lead socket sensor-sided straight	20.18-80
VLG9+5/3S/X-2 Connecting lead BDK <---> DSD-18/DSD-30, lead socket sensor-sided angled	20.18-81
ADD1/2-1.3 T-Coupler for connecting additional sensors, 1 x pin, 2 x socket	20.18-45
SMF25-1 Lead socket for connection of power supply and control leads for devices with parallel interface.	13.99-04
SMF6-3 Lead socket for connection of power supply leads for InterBus, PROFIBUS and Profinet devices.	13.99-06

18.6 Switch for connecting additional Sensors

BDIW-1.4

20.05-77

Sensor switch for selecting one out of four sensors (BDWF, BDWD, DSP, DSPW, or DSD), Power supply 24 VDC.

Connecting leads for BDIW-1.4

Connecting Leads

All connecting leads are oil-resistant and suitable for drag chains. Please indicate the lead length X when ordering (standard length X = 5 m).

The connectors are device-sided straight and sensor-sided optionally straight or angled.

VLG9/2+4PS/X-1

20.18-35

Connecting lead BDK <---> BDIW and BDIW <---> Sensor connection BDWF, BDWD, DSP, or DSPW, plug sensor-sided straight.

VLG9/2+4PS/X-2

20.18-36

Connecting lead BDIW <---> Sensor connection BDWF, BDWD, DSP, or DSPW, plug sensor-sided angled.

VLG9+5/3S/X-1

20.18-80

Connecting lead BDK <---> DSD-18/DSD-30, lead socket sensor-sided straight

VLG9+5/3S/X-2

20.18-81

Connecting lead BDK <---> DSD-18/DSD-30, lead socket sensor-sided angled

SPF8-1

13.99-05

Lead socket for connecting supply and control leads.

18.7 Sensor Bracket for installing Thickness Sensor

Sensor bracket M42 x 1.5, spring-mounted, with suction ring, flexible spherical bearing
 ZBF/FBF42-1

13.99-77

Sensor bracket M42 x 1.5, spring-mounted, with bellows
 ZBF/FBF42-2

13.99-84

Sensor bracket M54 x 0.75, spring-mounted, with bellows
 ZBF/FBF54-1

13.99-69

Sensor bracket M54 x 0.75, spring-mounted, with suction ring, flexible spherical bearing
 ZBF/FBF54-2

13.99-87

Spare Parts for Sensor Brackets

Suction cup for sensor bracket M42

ZBF/FB42-1 13.99-78

Bellows for sensor bracket M42

ZBF/FB42-2

13.99-85

Bellows for sensor bracket M54

ZBF/FB54-1

13.99-68

Suction cup for sensor bracket M54

ZBF/FB54-2

13.99-88

19. Data Backup

PROPAR/BDK-1

40.43-33

The software for data storage of the complete parameter set of the evaluation device BDK-1.3 on a PC via the serial interface is available on CD-ROM.

Operating system: MS Win9x, NT4, 2000, XP, WIN7, WIN10.

19.1. Connecting lead BDK to PC

VLG9/4S/X-1

30.13-25

Connecting lead BDK <---> data backup PC (RS232, 9 pol. SUBmin D)

We are certified according to DIN EN ISO 9001.

Subject to changes!