

Features

Compact Double Sheet Metal Monitor for the connection of one sensor for single-surface contact measurement of ferrous (Fe) sheets. Easy handling and teach-in-programming.

Application

Double Sheet Metal Monitor BDK/I-1.4 (BDK Compact) can be used wherever you need to be sure that ferrous metal sheets do not exceed a specified thickness (double sheet). Measured sheet thickness can be provided for processing in a control system (PLC) with semiconductor relays for "0, 1, or 2 sheet(s)" message or as an analogue value.

Configuration

The Double Sheet Metal Monitor has a sturdy plastic housing. The ready-made connecting leads permit quick and easy connection of the metal thickness sensor. A 9-pole M23 connector allows to connect the power supply, the controlling signals and the analogue output.

Mounting instructions

The sensor can be mounted into the suction cup of the gripper or into a monitoring station. For measurement, the complete sensing face of the sensor must be covered by the sheet.

Operating principle

The metal thickness sensor DSP for single-surface, contact measurement is used to monitor sheets for double thicknesses in the range 0.15 to 4 mm. During measurement, an excitation coil generates a strong magnetic field. The sheet is briefly drawn towards the coil and magnetised to saturation. A sensor coil measures the magnetic flux, the evaluation device linearises the measured value and transforms it into an analogue signal. Measurement can be started by an external signal or pressing "Start" on the control panel. When a continuous start signal is applied, measurement is carried out every 500 ms.

Teaching the thickness of the current reference sheet is carried out using the control panel or by an external Teach-in signal. During this procedure three measurements are taken automatically. The resulting sheet thickness is stored as reference value. If a thickness more than 1.3 times that of the reference sheet is measured, "Double sheet" is signalled. If the measured thickness is less than 0.5 times that of the reference sheet, "No sheet" is signalled. If a double sheet is detected, the switching output for 1 sheet changes from Hi to Lo.

Operation

For the operation there are four operator keys on the control panel:

Start	Manual start of a measurement
-	Decrement limit value or calibrate zero value
+	Increment limit value or calibrate end value
Teach	Teaching of the reference sheet



Display

In addition, 5 LEDs indicate the result of the current measurement.

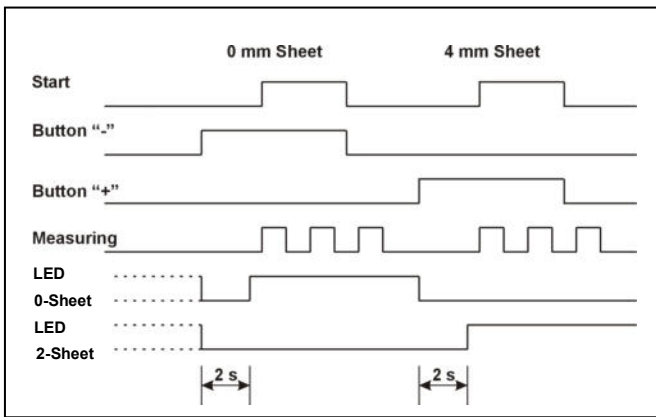
Light Fields:	
Measurement	Lights up during the measurement
Sensor	Lights up when sheet is detected by the sensor
0-sheet	Lights up if no sheet is in front of the sensor or the measured value is below the lower limit value.
1-sheet	Lights up on output of 1-sheet message
2-sheets	Lights up on output of 2-sheet message

Commissioning

When the device is used for the first time or after changing any component in the system, the system, and thus the measuring range, must be recalibrated. When using the DSP-54sg-2s sensor, this is done by teaching the zero setting (measurement without a sheet) and the end value with a 4 mm calibration sheet. When using the DSP-36sg-2s sensor, teaching is performed with a 2 mm calibration sheet.

Calibration will be performed as follows:

Remove the sheet from the sensor and press the “-“ key for 2 seconds until the LED “0 sheet” lights up. Keep “-“ pressed and press “Start”. The device will now automatically perform three measurements and calculate the zero value. Place then the 4 mm or 2 mm sheet on the sensor and press the “+“ key for 2 seconds until the LED “2 sheets” lights up. Press then simultaneously the “+“ and “Start” keys. Again, three measurements will be performed and the end value be calculated. The calibration sheet is delivered together with the sensor.



Timing diagram: commissioning

Teach-In

Teaching the sheet to be measured can be either by an external signal, such as a PLC signal, or by pressing the “Teach” key on the control panel of the device. For this function the appropriate sheet must be placed on the sensor.

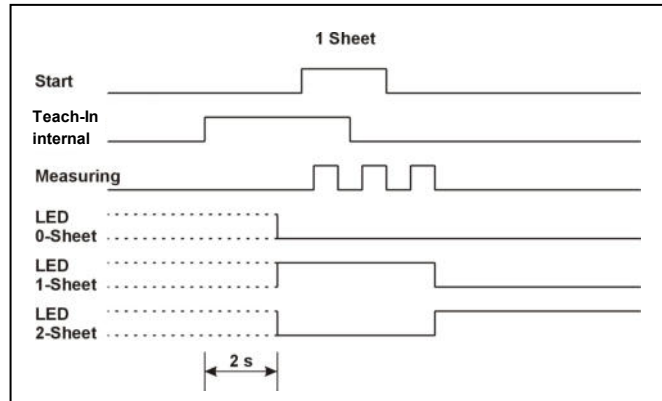
Internal teaching of the sheet using the control panel:

Place the sheet on the sensor and push the “Teach” key for 2 seconds until the LED “1 sheet” is the only one to light up. Press then simultaneously the “Teach” and “Start” keys. Three measurements take place automatically for the calculation of the threshold value.

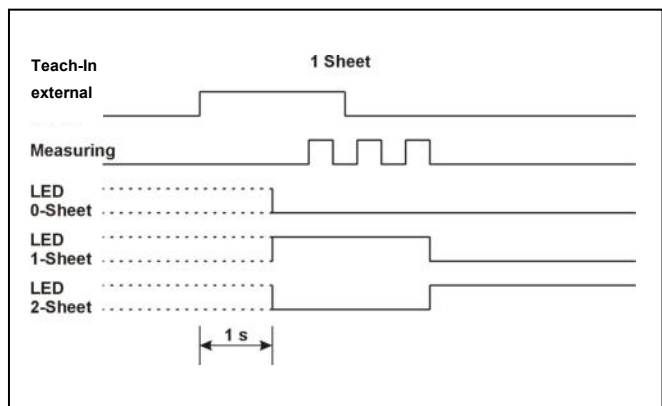
External teaching of the sheet using the controller:

Place the sheet on the sensor and apply a 24 V signal to the input for Teach-in for more than 1 second. After one second the LED “1 sheet” lights up and the device will take three measurements and calculate the threshold value as described above for internal teaching.

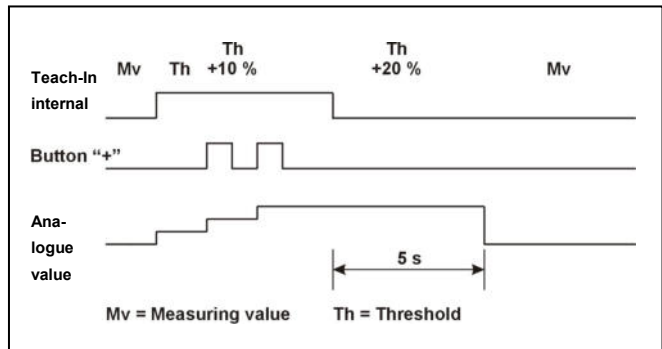
The threshold value for double sheet detection is 1.3 times the thickness of the reference sheet. Use “Teach” and the two “+“ and “-“ keys to change the threshold manually in 10 % steps. The selected threshold value for double sheet detection is indicated by the three LEDs “0, 1 and 2 sheet(s)”. In addition, the analogue output delivers the selected threshold for approx. 5 s when entering the threshold settings or pressing the “Teach” key for a few seconds.



Timing diagram: Teach-in - internal



Timing diagram: Teach-in - external



Timing diagram: manually changed threshold value

Threshold value:	LED		
Reference sheet x	0 sheet	1 sheet	2 sheets
1.1	ON	OFF	OFF
1.2	ON	ON	OFF
1.3	ON	ON	ON
1.4	OFF	ON	ON
1.5	OFF	flashes	ON
1.6	OFF	OFF	ON
1.7	OFF	OFF	flashes

Outputs

After each measurement the instantaneous result for “0, 1, and 2 sheet(s)” message will be provided via two semiconductor outputs to a PLC for further processing.

Outputs:		
Sheets	0- sheet message	1- sheet message
undersize	1	0
1	0	1
2	0	0

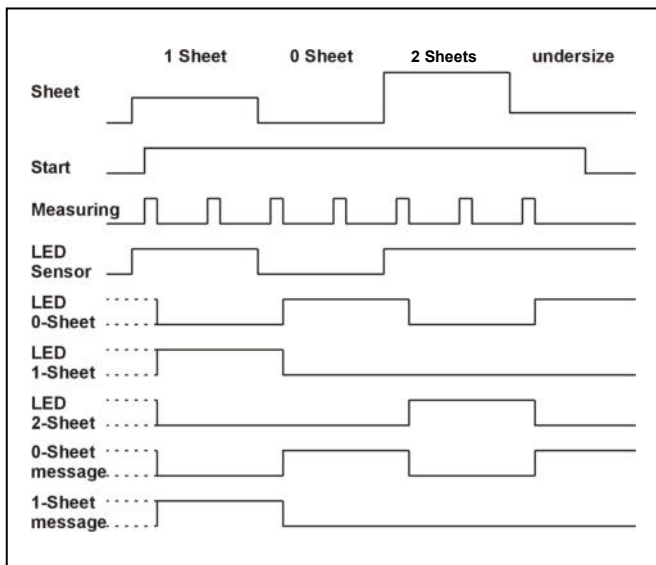
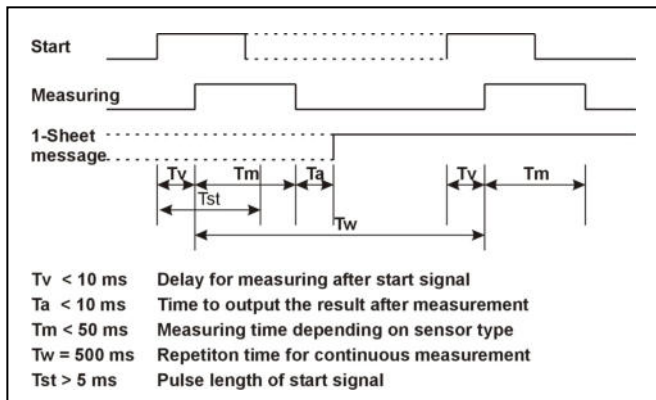


Diagram: Measurement procedure



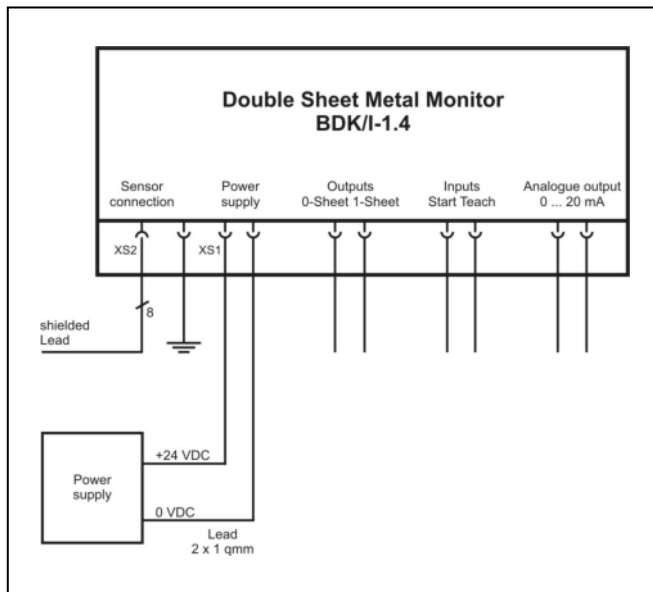
Timing diagram: Measurement

Error analysis

Double Sheet Metal Monitor performs after each sheet thickness measurement a plausibility check of the detected measurement values. By doing so, it checks if the sheet metal thickness sensor and the connection leads function correctly. In case of an occurring error, the LEDs are blinking. After troubleshooting, press the “Start” key to reset the device to the operating mode.

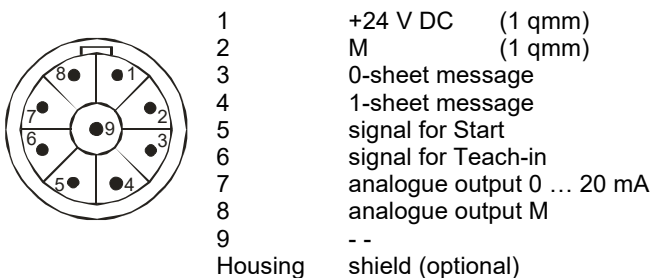
Error messages concerning sensor/ sensor connection	LED			
	Sensor	0 sheet	1 sheet	2 sheets
Temperature sensor	flashes	flashes		
Exciter coil	flashes		flashes	
Receiver coil	flashes			flashes

Connection diagram

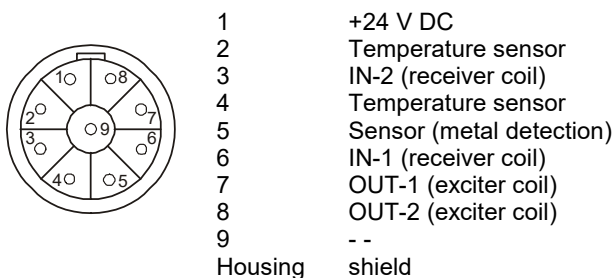


Connections

XS1: Pin assignment for PLC connection

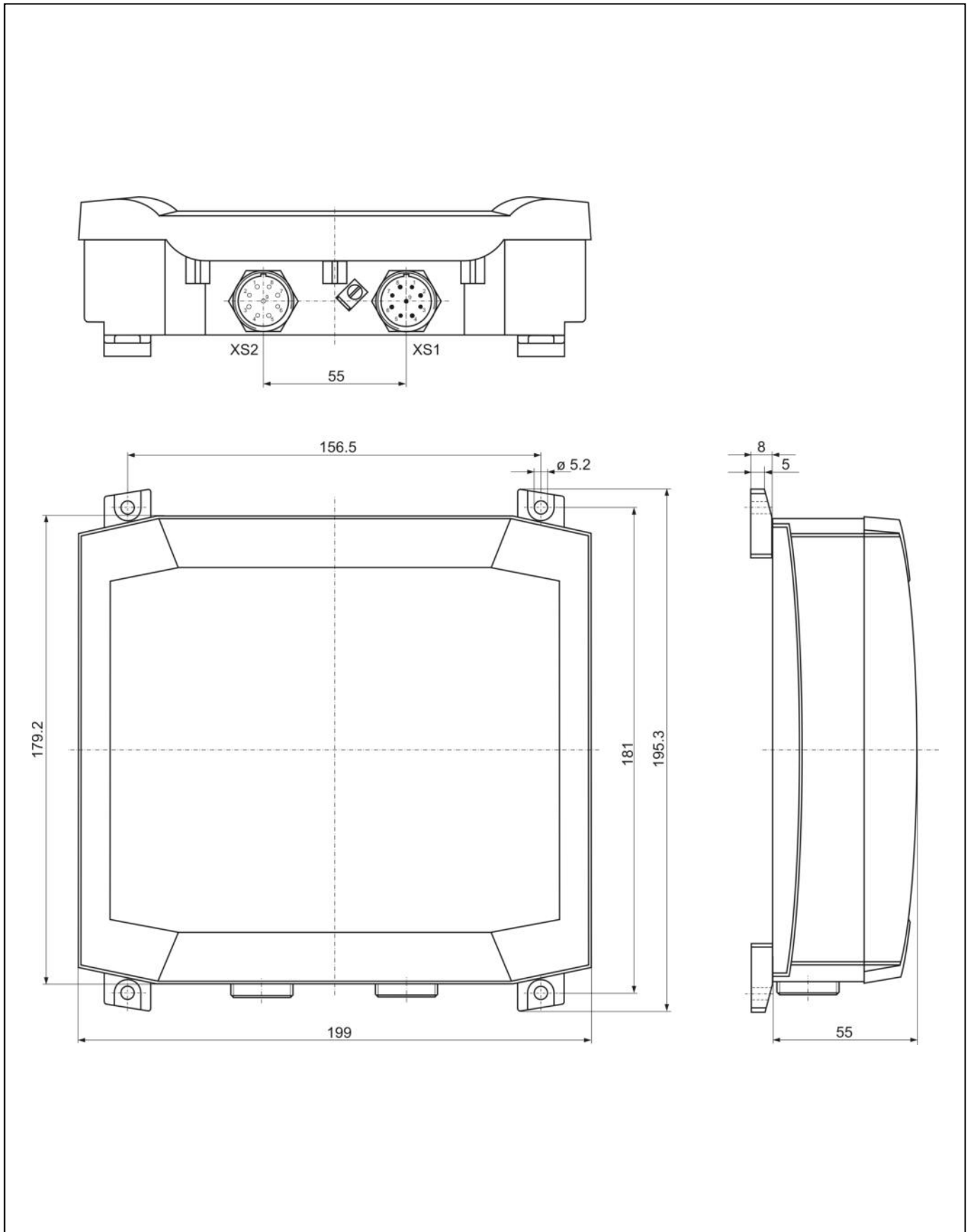


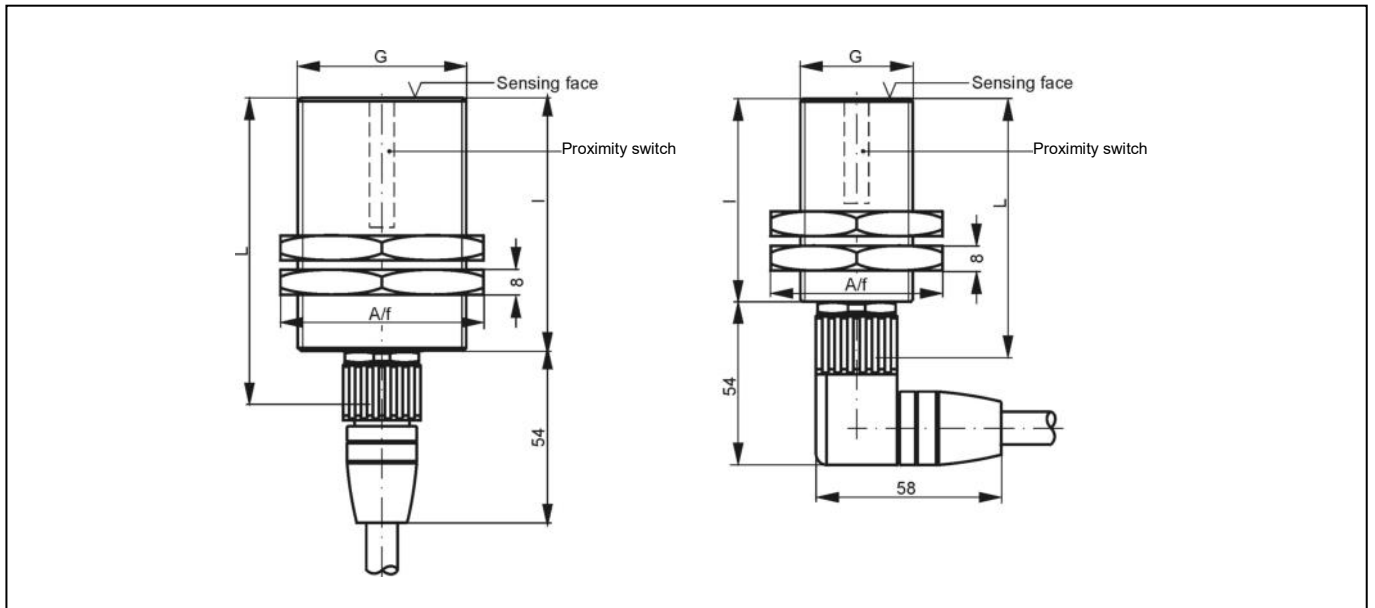
XS2: Pin assignment for sheet metal thickness sensor



Maximum interference immunity is achieved by earthing the housing. Use a short lead to join the flat connector on the narrow side of the housing (next to the external connections) to earth potential.

Dimensions of the housing

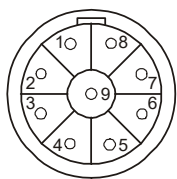




Type	Ref. no.	Meas. range mm	Max. thickness mm	Meas. time ms	L mm	l mm	G Thread	A/f	Weight g
DSP-36sg-2s	13.05-96	0.15 ... 2	1.5	< 30	90	65	M36 x 1.5	55	380
DSP-54sg-2s	13.05-95	0.15 ... 4	3.5	< 50	107	81	M54 x 0.75	65	1200

Power supply connection lead for BDK/I-1.4) (Pin XS1)

Power supply and control lead with socket SPF9-1 (VLG9E/2+4PS/x-4)



1	+24 V DC	brown	(1 qmm)
2	M	white	(1 qmm)
3	0-sheet message	green	(0.25 qmm)
4	1-sheet message	brown	(0.25 qmm)
5	signal for Start	grey	(0.25 qmm)
6	signal for Teach-in	pink	(0.25 qmm)
7	analogue output 0 ... 20 mA	blue	(0.25 qmm)
8	analogue output M	violet	(0.25 qmm)
9	--	black	(0.25 qmm)
Housing	shield (optional)	green/yellow	(0.75 qmm)

Technical data
**Double Sheet Metal Monitor BDK/I-1.4
for ferromagnetic metals**

Operating voltage U_B 19 ... **24** ... 30 V DC
 Current consumption max. 3.5 A
 Operating temperature 0 ... + 55 °C

Inputs

Start signal Hi = 12 ... **24** ... 30 V DC
 Lo = 0 ... 5 V DC
 Input current C 5 mA (for 24 V DC)
 Electrical isolation no
 Teach-In Hi = 12 ... **24** ... 30 V DC
 Lo = 0 ... 5 V DC
 Input current approx. 5 mA (for 24 V DC)
 Electrical isolation no

Outputs

Switching output Semiconductor output, plus switching, resistant to short circuit
 Output current $U_B - 1.75$ V
 Analogue output max. 100 mA
 Electrical isolation no
 Analogue output Current
 Output current 0 ... 20 mA
 Load resistance $\leq 500 \Omega$
 Electrical isolation no
 Linearity / Resolution 5 % / 256 steps
 Measuring time < 50 ms
 Repetition time 500 ms
 Housing, B / H / T 200 / 180 / 60 mm
 Weight approx. 700 g

Sheet Metal Thickness Sensor

Measurement method saturation induction

DSP-54sg-2s

Measurement range 0.15 ... 4 mm
 Sheets until max. 3.5 mm
 Diameter 54 mm
 Total length 120 mm
 Thread M54 x 0.75
 Weight approx. 1200 g

DSP-36sg-2s

Measurement range 0.15 ... 2 mm
 Sheets until max. 1.5 mm
 Diameter 36 mm
 Total length 135 mm
 Thread M36 x 1.5
 Weight approx. 380 g

Order data

BDK/I-1.4 Ref. no. 20.21-03
 Double Sheet Metal Monitor Compact

DSP-54sg-2s Ref. no. 13.05-95
 Sheet Metal Thickness Sensor for BDK/I-1.4
 (Sheet thickness max. 3.5 mm)

DSP-36sg-2s Ref. no. 13.05-96
 Sheet Metal Thickness Sensor for BDK/I-1.4
 (Sheet thickness max. 1.5 mm)

Connection leads for Sensor (Pin XS2)

All connection leads are oil-resistant and suitable for drag chains. Maximum length is stated to 20 m. Please indicate length when ordering. (standard length = 5 m, 10 m)

VLG9/2+4PS/5-5 5 m Ref. no. 20.18-93-050
 Connection lead BDK <--> Sensor,
 Straight plug on sensor end.

VLG9/2+4PS/10-5 10 m Ref. no. 20.18-93-100
 Connection lead BDK <--> Sensor,
 Straight plug on sensor end.

VLG9/2+4PS/5-6 5 m Ref. no. 20.18-94-050
 Connection lead BDK <--> Sensor,
 Angled plug on sensor end.

VLG9/2+4PS/10-6 10 m Ref. no. 20.18-94-100
 Connection lead BDK <--> Sensor,
 Angled plug on sensor end.

Power supply (Pin XS1)

SPF9-1 Ref. no. 13.99-08
 Lead box (socket) for connecting
 power supply and control leads

Optional: (Pin XS1)

VLG9E/2+4PS/5-4 5 m Ref. no. 20.18-95-050
 Power supply and control lead
 with socket SPF9-1

VLG9E/2+4PS/10-4 10 m Ref. no. 20.18-95-100
 Power supply and control lead
 with socket SPF9-1

We are certified according to DIN EN ISO 9001.

Subject to changes!