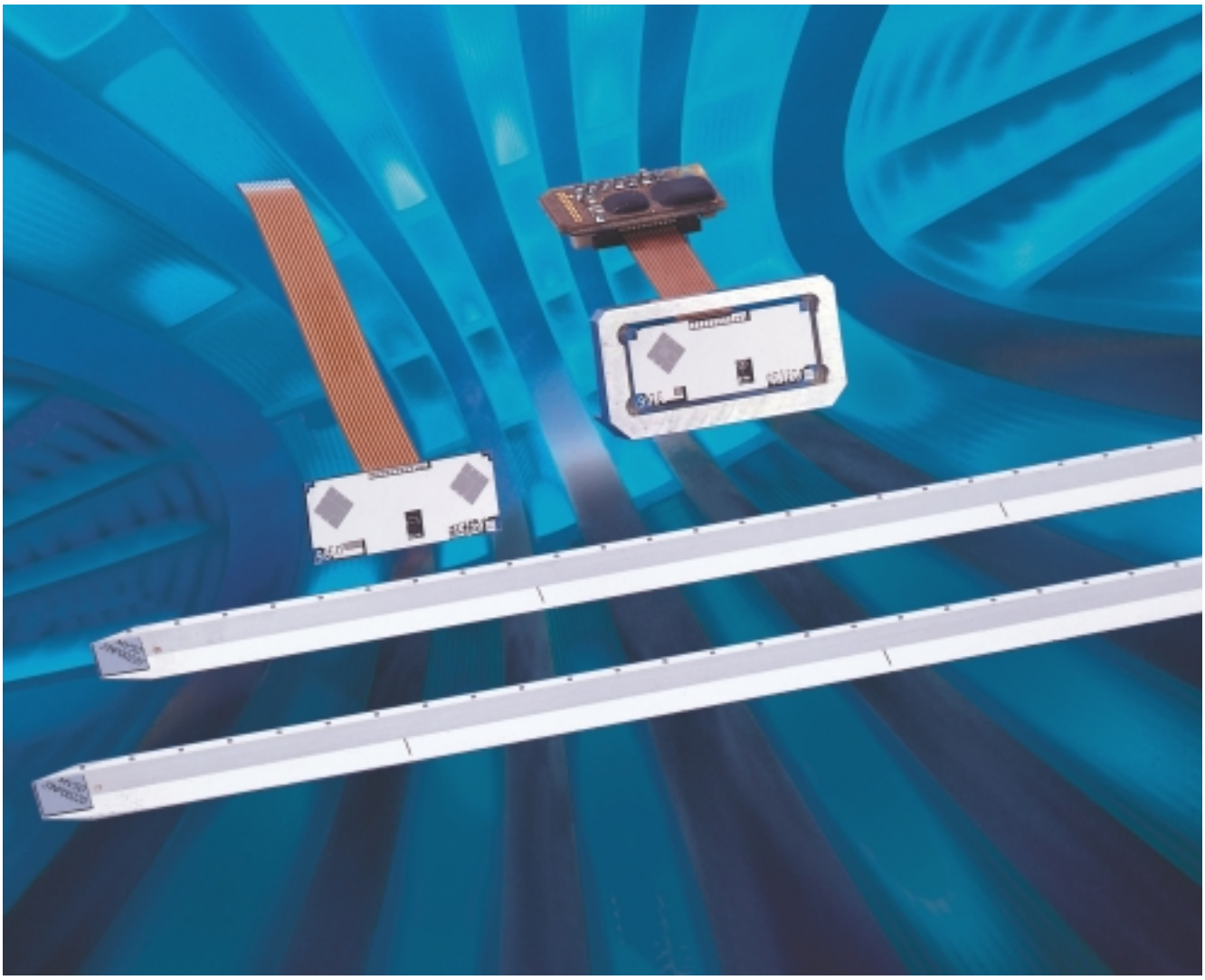
NUMERIK JENA

NUMERIK JENA



Encoder Kit L

Components for Linear Measurement

Encoder Kit L

The Encoder Kit L is a minimum configuration of a length-measuring system for use in situations where installation space is limited. The kit is based on the miniaturized and multifunctional EPIFLEX measuring module and on steel scale tapes.

The scale tapes are scanned in reflected light.

Features

- Compact, highly integrated design of the EPIFLEX measuring module; all functional components of a measuring system have been deposited on a glass substrate using microelectronic technologies
- Variable use due to modular design
- Minimum dimensions of the EPIFLEX measuring module
- Extremely flat design
- Allows rough installation tolerance limits; optional: user-friendly pre-alignment of the measuring module in a mechanical frame
- High resolution and accuracy
- Defined thermal behavior, no thermally and no mechanically induced warping of the DOUBLEFLEX scale tapes
- High measuring speed based on the high limit frequency of the EPIFLEX measuring module
- Variable signal interface
- With integrated switch sensor(s) on request

Fields of application

Fields of application where linear movements or lengths must be measured in confined installation conditions:

- Linear axes
- Instruments and machines used in the microelectronic industry
- Plotter
- Printer
- Instruments in reprographics
- Robots and handling technics
- Precision devices
- Probes
- X/Y-stages
- Medical systems

Modular Design

Installation of the EPIFLEX measuring module

In the standard versions, the EPIFLEX measuring modules are placed in steel or aluminum frames and adjusted to the mounting surface or reference surface of the frame.

The customer fastens the framed measuring module (Kit L ...) with screws.

The measuring module without frame (EML ...) is fastened by adhesive in the user's machine component.

Signal Adjustment

After mechanical installation, electronic signal adjustment is possible to optimize measuring module output signals.

This can result in

- a reduction of the interpolation error, and
- activation of functional reserves.

Signal adjustment can be performed with the aid of

- the adjustment kit together with an oscilloscope and PC, or
- the signal monitor.

Electronic adjustment is recommended for Encoder Kit L with 25-fold interpolation and higher.

Electronic adjustment is essential if the measuring module is used without frame, in a custom-designed frame, or with distance-coded reference marks.

Modular Design — Signal Processing on the Connector Board

ENCODER Kit L

consists of: Kit L, scale tape, connecting cable

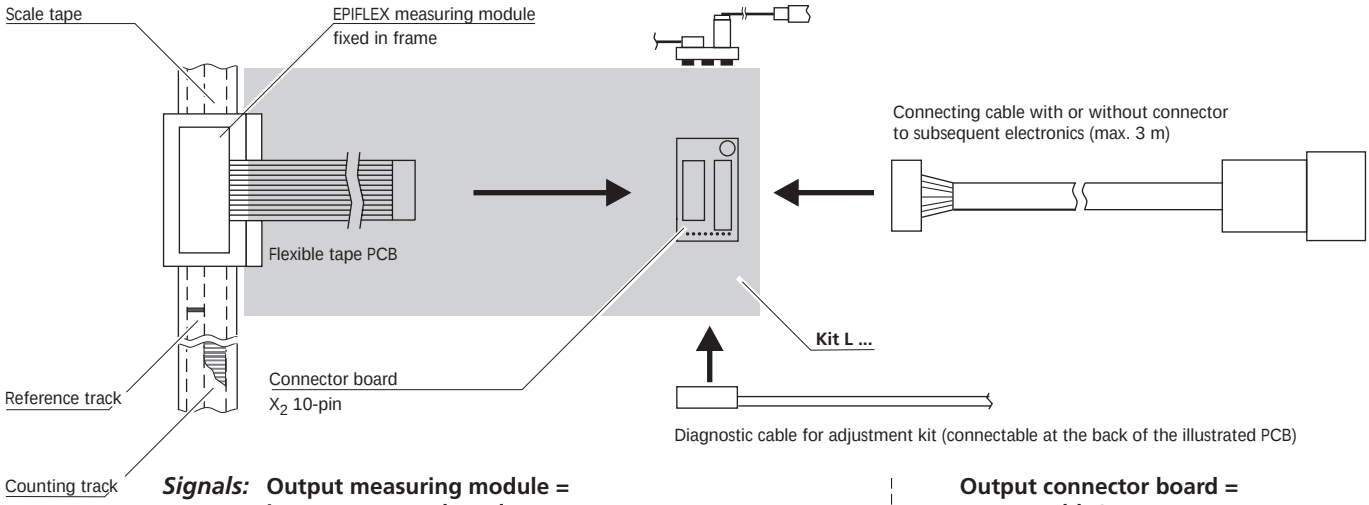
designation example: **Kit L 122 B S L4**
(measuring module fixed in the frame, connector board)

MV 5 1 – 4 0 B P 00100
Kab AA 1,0 O

Measuring module in standard frame (B)
Measuring module and connector board are interfaced and electronically adjusted.

Measuring module without frame (A) or in special frame
Measuring module is preadjusted and set to the signal interface of the electronic unit.

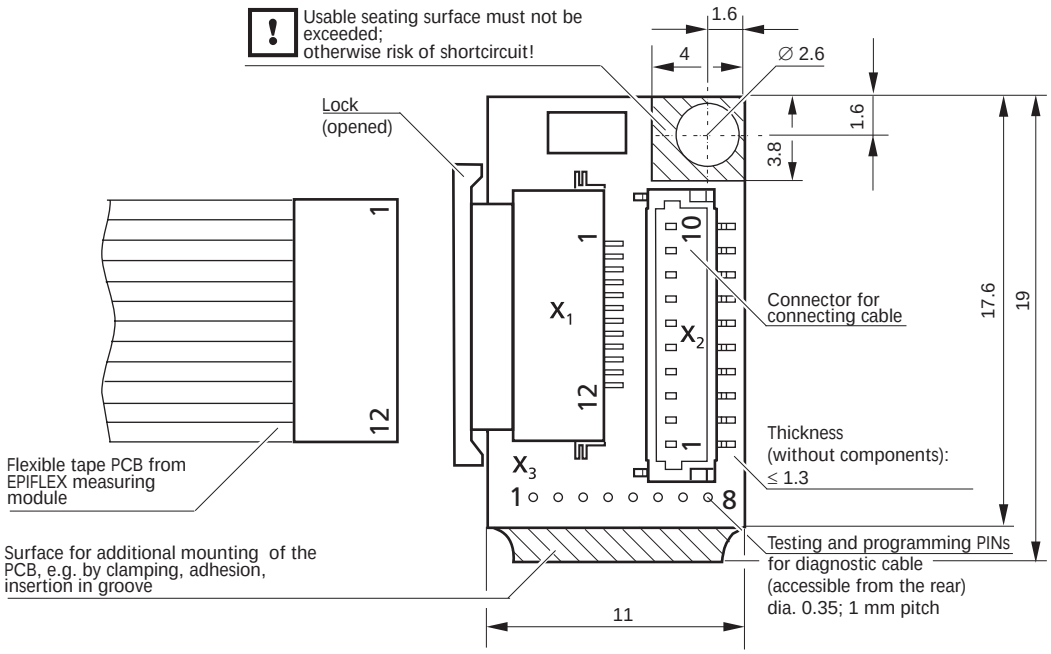
Measuring module is **not** interfaced with the connector board.



Signals:

Output measuring module = input connector board	Output connector board = output cable/connector
sin 1 V_{pp}	sin 1 V_{pp}
sin 1 V_{pp}	square-wave signal RS 422; **without** interpolation
sin 11 μA_{pp}	sin 11 μA_{pp}
sin 11 μA_{pp}	square-wave signal RS 422; **with** interpolation, interpolation faktor is fixed, max. output frequency (min.edge separation) is fixed

Connector board X_2 10-pin



Modular Design — Signal Processing in the Connector

ENCODER Kit L

consists of: Kit L, scale tape

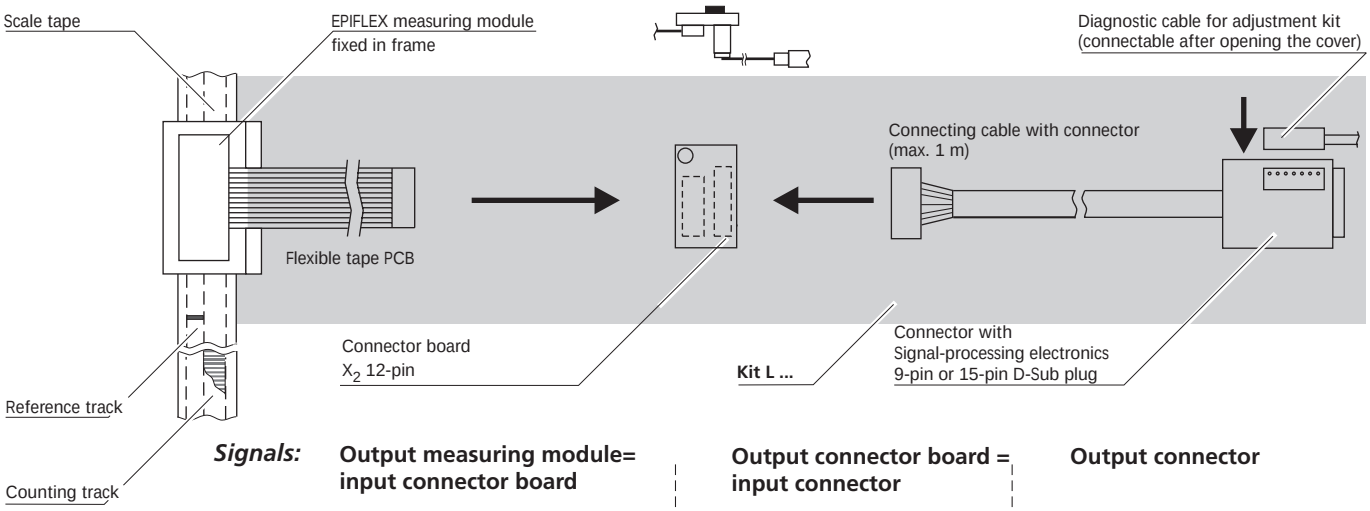
designation example: **Kit L 122 B S L4FZ**
(measuring module fixed in the frame, connector board, round cable with 15-pin D-Sub connector)

MV 5 1 – 4 0 B P 00100

A vacuum version is not available in this configuration.

Measuring module in standard frame (B)
Measuring module, connector board and cable with connector are interfaced and electronically adjusted.

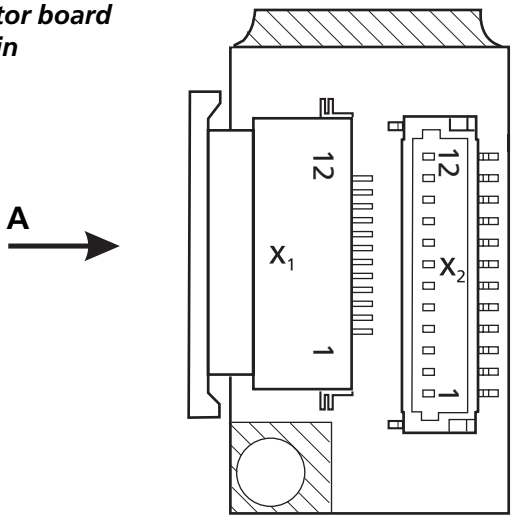
Measuring module without frame (A) or in special frame
Measuring module is preadjusted and set to the signal interface of the electronic unit.
Measuring module is **not** interfaced with connector board and cable.



Signals:

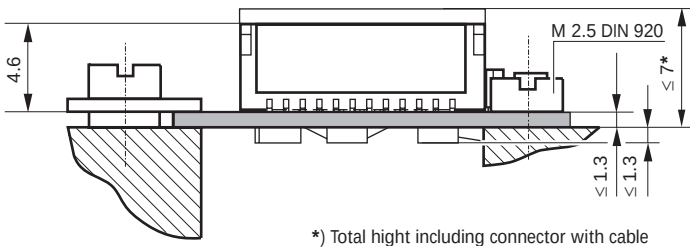
Output measuring module= input connector board	Output connector board = input connector	Output connector
sin 1 V_{pp}	sin 1 V_{pp}	sin 1 V_{pp} for 9-pin D-Sub plug
sin 1 V_{pp}	sin 1 V_{pp}	square wave signals RS 422 (for 15-pin D-Sub plug) **with** interpolation interpolation factor is fixed max. output frequency (min.edge separation) switchable

Connector board X_2 12-pin



For dimensions
see connector board page 4

Proposed Mounting of Connector Board
View A *(shown without connector X_1)*



*) Total hight including connector with cable

Modular Design — without Signal Processing

ENCODER Kit L

consists of: EPIFLEX measuring module
scale tape

designation example: **EML 122 B S L4**
(measuring module with frame)
MV 5 1 – 4 0 B P 00100

Driven square-wave signals

When using this interface, note that the reference pulse (in contrast to the versions with signal processing) is not gated with the counting pulses.

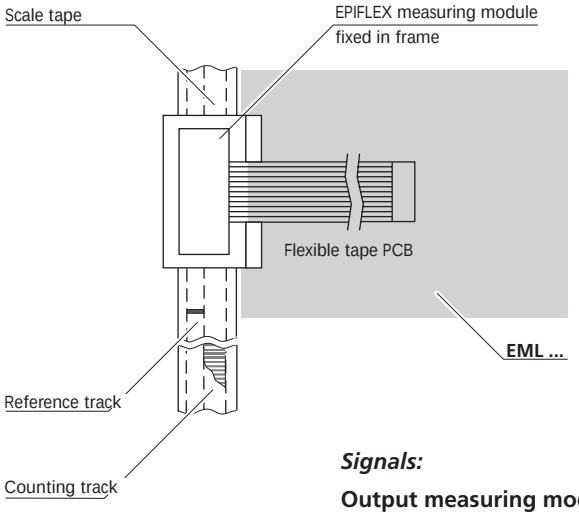
When approached from different directions, the hysteresis of the reference pulse can reach approx. one signal period (≈ 20 µm).

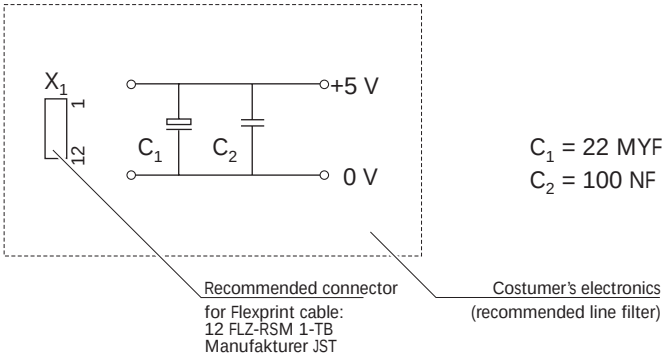
Measuring module in standard frame (B)

Measuring module is electronically adjusted.

Measuring module without frame (A) or in special frame

Measuring module is preadjusted and set to the signal output according to ordering key.





Signals:

Output measuring module

sin 1 V_{pp}

sin 11 μA_{pp}

square wave signals RS 422

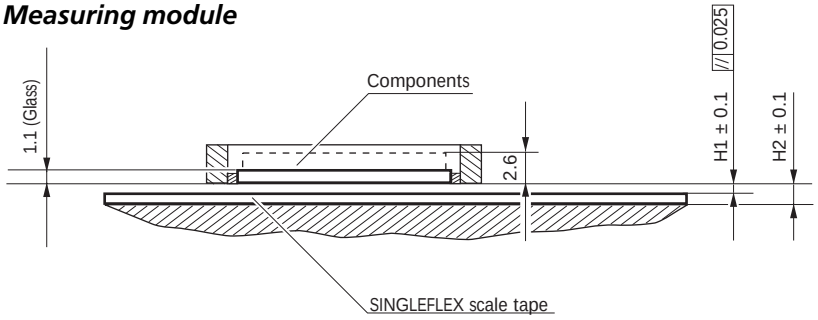
Pin assignment X_1

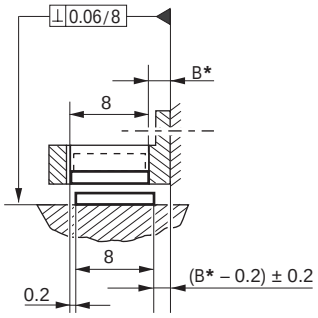
Pin	1	2	3	4	5	6	7	8	9	10	11	12
sin 11 μA_{pp}	SCL	SDA	GND	CS	I_{1+}	I_{1-}	NAS	I_{0-}	I_{0+}	I_{2+}	I_{2-}	U_B
sin 1 V_{pp}	SCL	SDA	GND	CS	U_{1-}	U_{1+}	NAS	U_{0+}	U_{0-}	U_{2-}	U_{2+}	U_B
RS 422	SCL	SDA	GND	CS	$\overline{Z_1}$	Z_1	NAS	R	$\overline{R}$	$\overline{Z_2}$	Z_2	U_B

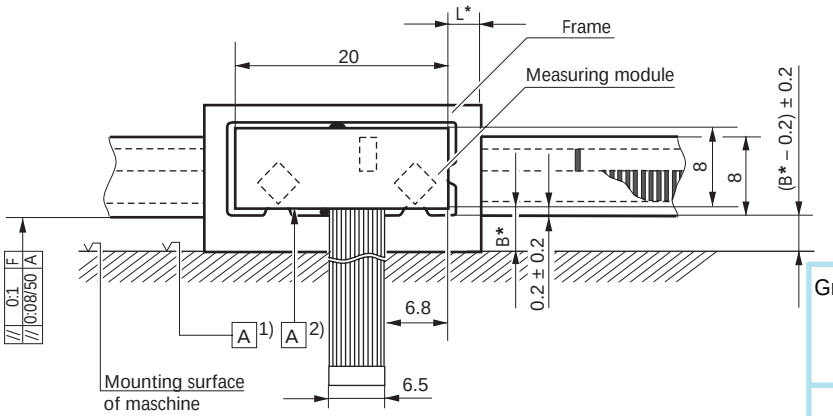
For legend see page 14

Installation Dimensions

Measuring module







F = machine guideway or unit guide

*) according to type of frame
For the available standard frames, please ask for special documents.

1) Measuring module with frame

2) Measuring module without frame

Graduation period	DOUBLEFLEX scale tape		SINGLEFLEX scale tape	
	H1	H2	H1	H2
20 µm	0.6 mm	1.3 mm	0.6 mm	1.1 mm

Permissible position deviation of the EPIFLEX measuring module from the scale tape

ΔZ (ΔH) = ± 0.1 mm

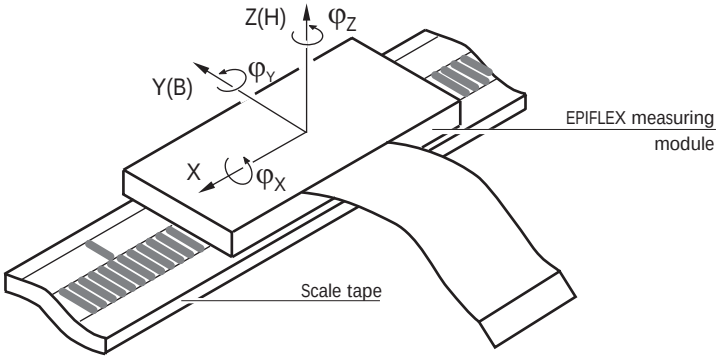
ΔY (ΔB) = ± 0.2 mm

φ_Z = ± 6' or ± 0.1° or 0.08/50

φ_Y = ± 3' or ± 0.05° or 0.04/50

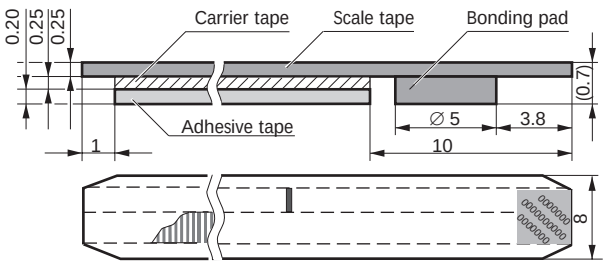
φ_X = ± 30' or ± 0.5° or 0.4/50

These cumulative tolerances include mounting tolerances and guideway error during operation.



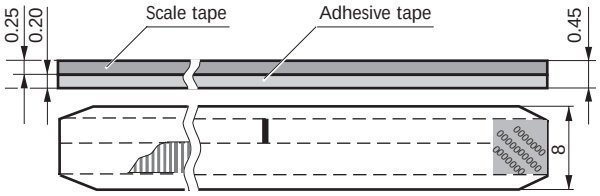
DOUBLEFLEX scale tape

only with bonding pad



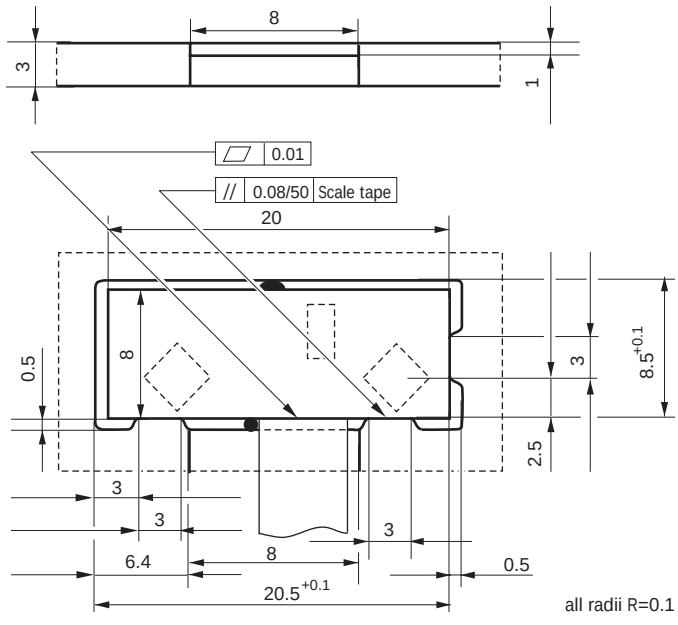
SINGLEFLEX scale tape

only without bonding pad

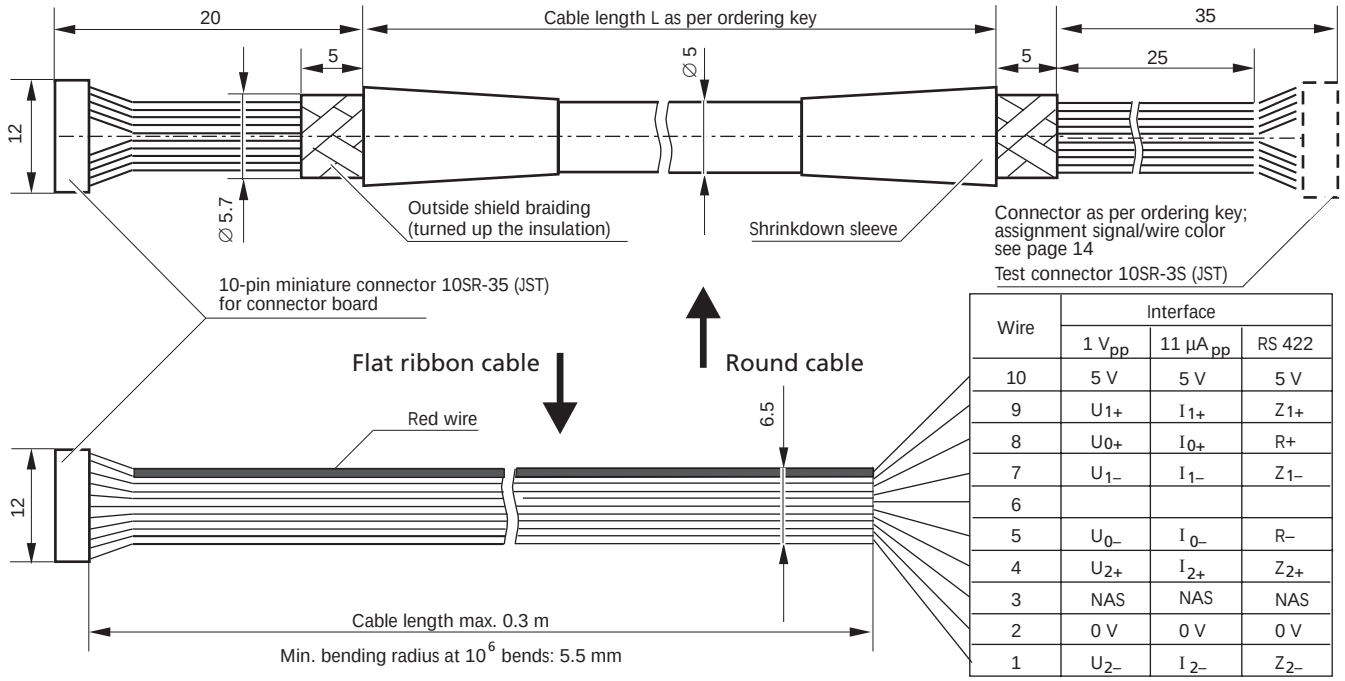


Machine contours for sensor frame

For available standard frames, please request special documents.



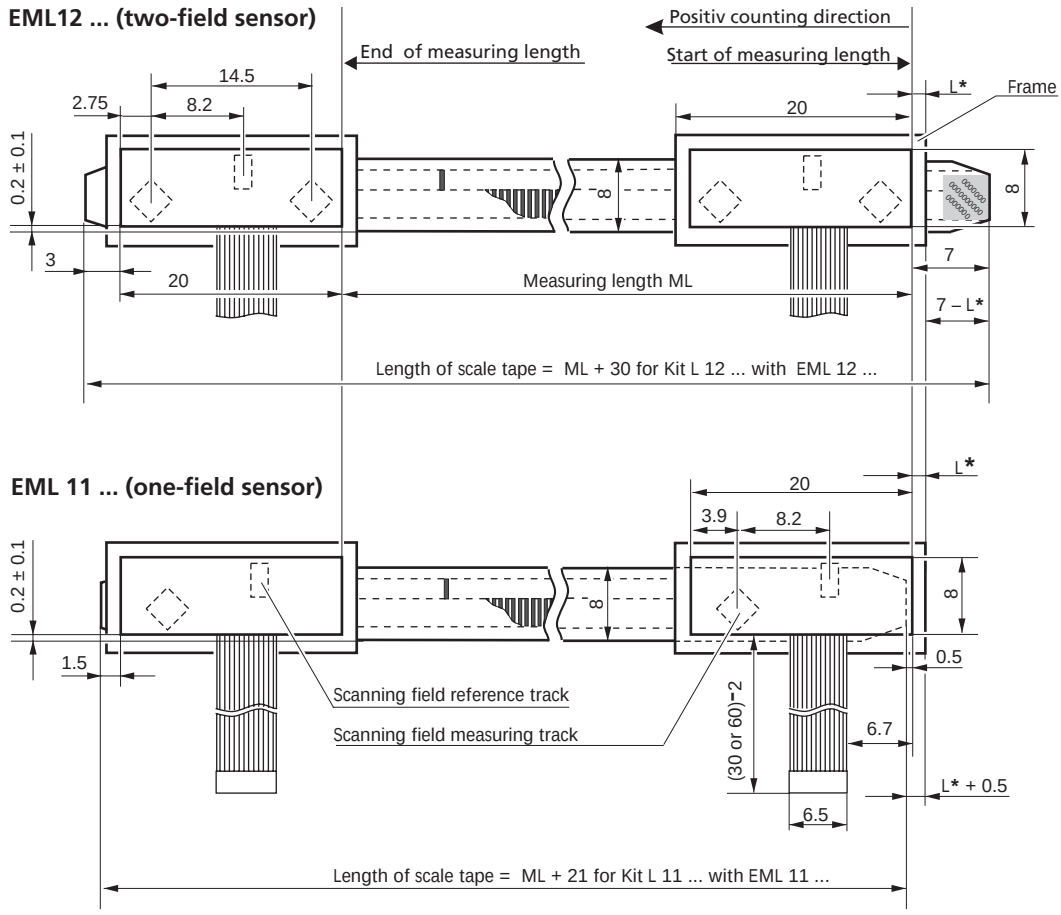
Connecting Cables



Wire	Interface		
	1 V_{pp}	11 μA_{pp}	RS 422
10	5 V	5 V	5 V
9	U_{1+}	I_{1+}	Z_{1+}
8	U_{0+}	I_{0+}	R+
7	U_{1-}	I_{1-}	Z_{1-}
6			
5	U_{0-}	I_{0-}	R–
4	U_{2+}	I_{2+}	Z_{2+}
3	NAS	NAS	NAS
2	0 V	0 V	0 V
1	U_{2-}	I_{2-}	Z_{2-}

Relationship Measuring Distance to Scale Tape

Applies to SINGLEFLEX and DOUBLEFLEX scale tapes

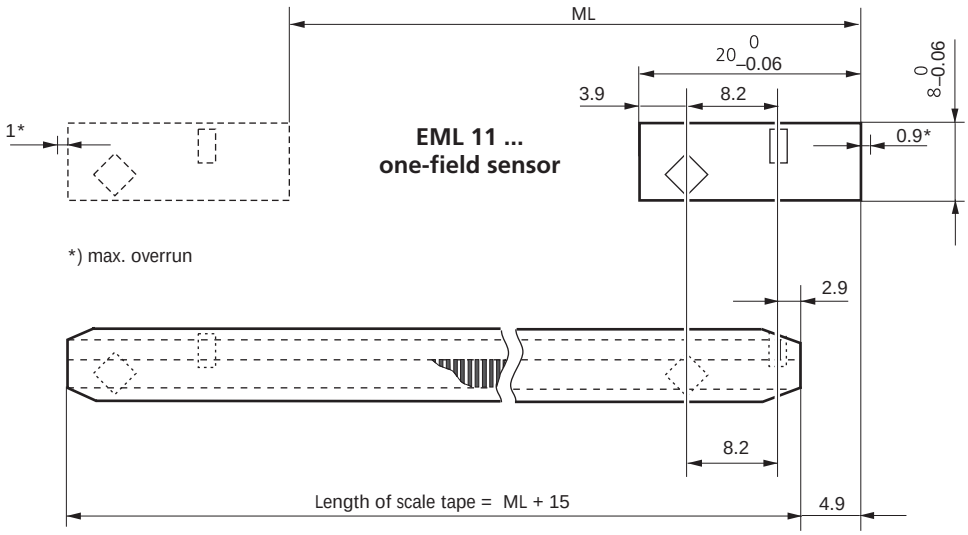


*) according to type of frame

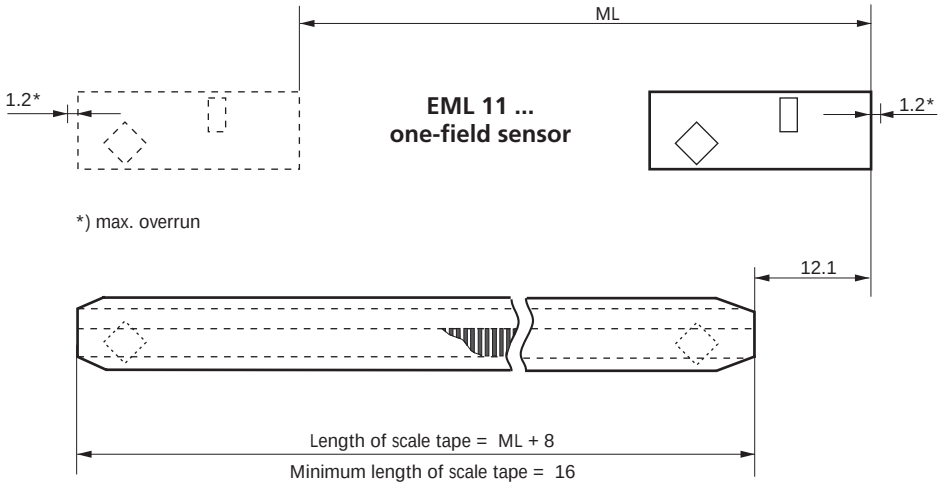
Standard

Relationship Measuring Distance to Scale Tape for Minimum Scale Tape Length

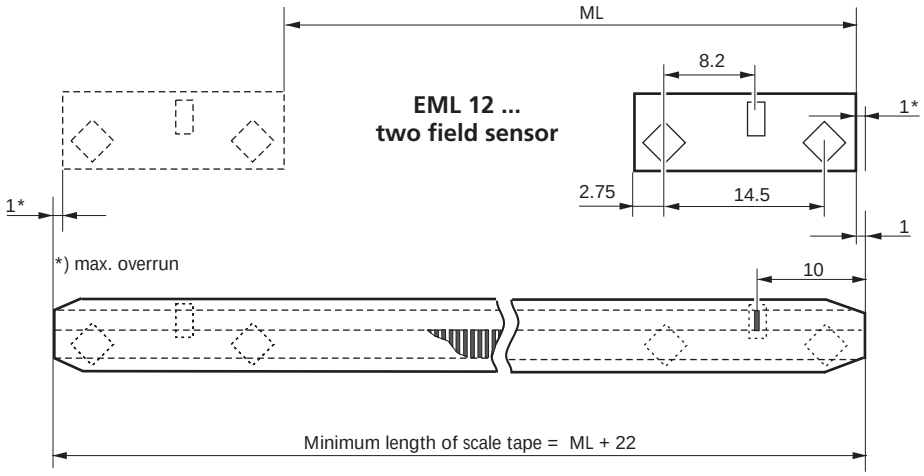
Applies only to SINGLEFLEX scale tapes



Measuring module EML 11 ...
scale tape MV 15
with evaluation of
reference mark



Measuring module EML 11 ...
scale tape MV 16
without evaluation of
reference mark



Measuring module EML 12 ...
scale tape MV 55
with evaluation of
reference mark

Technical Specification

Mechanical Data	Recommended increments (resolution)	0.1 µm; 0.2 µm; 0.5 µm; 1 µm; 5 µm
	Dimensions of – EPIFLEX measuring module without frame – EPIFLEX measuring module with frame	 8 x 20 x 2.6 mm^3 see page 15
	Mass – EPIFLEX measuring module without frame	 < 2 g
	Max. travel speed, depending on faktor of intrepolation and counting frequency of evaluation electronics	480 m/min für GP = 20 µm without interpolation
	Measuring lengths	up to 30 m (on request)
Scale tape	Material	steel
	Graduation period (GP)	20 µm
	Reference marks	periodically at intervals of 50 mm; distance coded at 1000 × GP; at the center of the measured length; others on request
	Linear expansion coefficient – DOUBLEFLEX scale tape – SINGLEFLEX scale tape	 $\approx 10.5 \times 10^{-6}$ grd^{-1} according to material of mounting surface
	Accuracy classes – DOUBLEFLEX scale tape – SINGLEFLEX scale tape	 ± 1µm, ± 2 µm; ± 3 µm; ± 5 µm ± 5 µm; others on request
Elektrical Data	Scanning frequency of the EPIFLEX measuring module	max. 400 kHz
	Output interfaces – voltage output – current output – square-wave output	 1 V_{PP} with integrated line driver 11 μA_{PP} RS 422 ; optionally with internal signal interpolation 5/10/25/50x
	Supply voltage	5 V ± 10%
	Power consumption – voltage output – current output – square-wave output (RS 422)	 < 60 mA < 30 mA < 180 mA
	Cable lengths – connecting cable (round cable) – permissible cable lengths (with extensions)	 up to 3 m with and without connector; other cables according to ordering key max. 18 m for current output 11 μA_{PP} max. 100 m for voltage output1 V_{PP} max. 100 m for square-wave output RS 422
Ambient conditions	Operating temperature range	0°C ... +55°C
	Storage temperature range	–20°C ... +70°C
	Vibration (50 Hz ... 2000 Hz)	≤ 200 ms^{-2}
	Shock (11 ms)	≤ 400 ms^{-2}

The way the EPIFLEX measuring module is designed – optoelectronic function elements on a glass substrate – it is alone not immune against electromagnetic radiation (EMC).

Ordering Key

Components for linear measurements

Kit L	–	1	2	2	B	S		L	4	F	Z

Designation example

Kit L	Version with signal processing
EML	Version without signal processing

Sensor type

1	dimensions 20 x 8 x 2.6

Graduation period – number of scanning fields

1	GP = 20 µm	1 scanning field
2	GP = 20 µm	2 scanning fields

Flexible tape PCB length

1	25 mm
2	55 mm

Frame

A	without frame
B [3]	with frame B
...	

Material of frame

S	steel / X12CrNi177 – passivated
A	aluminum – chromed

Signal processing in the connector

Y [1]	9-pin; D-Sub; electronic unit inside the connector/1 V_{PP}
Z [1]	15-pin; D-Sub; electronic unit inside the connector/RS 422

Cable Kit L for signal processing in the connector

A [1,2]	0.3 m
B [1,2]	0.5 m
F [1,2]	1.0 m

Frequency/flank distance

X	min. counting frequency of counter (min. flank distance of the counting signals): only for version with interpolation

Output signals

B	sinusoidal signal 11 μA_{PP}
C	sinusoidal signal 1 V_{PP}
K	square-wave signal RS 422 without interpolation
L	square-wave signal RS 422 with interpolation 5x
M	square-wave signal RS 422 with interpolation 10x
I	square-wave signal RS 422 with interpolation 25x
N	square-wave signal RS 422 with interpolation 50x

1 *Only necessary if the electronic unit is inside the connector*

2 *Length of cable max. 1 m , extension cable possible*

3 *For available standard frames, please request special documents.*

For available frames for measuring modules, see page 15

Ordering Key

Scale tape

MV	5	0	–	1	1	B	P	00770	(–)

Designation example

Material – scanning type

1	steel tape	one-field sensor
5	steel tape	two-field sensor

Deviation from standard

measuring length (ML) in mm

Design type

0	DOUBLEFLEX, standard [3]
1	SINGLEFLEX, standard
5	min. length of scale tape **with** reference mark [1,4]
6	min. length of scale tape **without** reference mark [1,5]

Graduation period (GP)

P	20 µm

Position of reference mark

0	none
B	in the center of measuring length
E	customized version [6]
F	distance coded at 1000 × GP [7]
N	at 50 mm spacings, starting at center of measuring length

Accuracy class

1	± 1 µm
2	± 2 µm
3	± 3 µm
4	± 5 µm

Bonding pad position

0	none [1]
1	start [2]

1 *Only for SINGLEFLEX scale tape*

2 *Only for DOUBLEFLEX scale tape*

3 *Min. measuring length with DOUBLEFLEX scale tape: 100 mm*
Max. measuring length with DOUBLEFLEX scale tape: 7300 mm

4 *For single-field scanning: measuring length + 15 mm*
For two-field scanning: measuring length + 22 mm

5 *For single-field scanning: measuring length + 8 mm*
For two-field scanning: measuring length + 22 mm

6 *Specified in XXXXX mm from start of mesauring length*

7 *Only for GP = 20 µm with max. measuring length 8000 mm*

Ordering Key

Connecting cables for ENCODER Kit L

Kab	A	A	0,0	A	

Designation example

Connector on output of connector board

A	JST connector 10-pin SR/SH

Pin assignment

	standard (analogous mounting instructions)
1	customized (serial numbering)
...	customized (serial numbering)

Cable type

A	round cable; d = 5.1
B	flat ribbon cable
F	round cable; d = 3.8; for vacuum

Connector on cable

A [3]	no connector
D	9-pin; D-Sub; PIN; straight
H	12-pin; plug; round; PIN; plastic-amored
I	9-pin; Stecker; round; PIN; plastic-amored
K [1]	12-pin; coupling; round; PIN; plastic-amored
O	15-pin; D-Sub; PIN; straight
S [1]	customized plug on request
V [1]	12-pin; DIN-plug

cable length [2] in X,X m

1 *No standard, supplied against surcharge*

2 *Standard lengths: 0.3 m; 0.5 m; 1.0 m; 1.5 m; 2.0 m; 3.0 m; greater lengths with extension cable; other lengths upon request*

3 *Supplied with test connector 10SR-3S (JST), only for cable type A*

For standard pin assignment see page 14

Standard Pin Assignment

15-pin D-sub plug

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
sin 1 V_{PP}	–	S1*	–	U_{0-}	U_{2-}	U_{1-}	–	+ 5 V	0 V	S2*	–	U_{0+}	U_{2+}	U_{1+}	–	Shield
RS 422	–	S1*	NAS	$\overline{Z_0}$	$\overline{Z_2}$	$\overline{Z_1}$	–	+ 5 V	0 V	S2*	AS	Z_0	Z_2	Z_1	–	Shield
Colour	–	–	violet	pink	red	yellow	–	brown	white	–	black	grey	blue	green	–	

*) in configuration with integrated switch sensor(s)

9-pin D-sub plug

Pin	1	2	3	4	5	6	7	8	9	Housing
sin 1 V_{PP}	U_{1-}	0 V	U_{2-}	–	U_{0-}	U_{1+}	+ 5 V	U_{2+}	U_{0+}	Shield
RS 422	$\overline{Z_1}$	0 V	$\overline{Z_2}$	NAS	$\overline{Z_0}$	Z_1	+ 5 V	Z_2	Z_0	Shield
sin 11µA_{PP}	I_{1-}	0 V	I_{2-}	–	I_{0-}	I_{1+}	+ 5 V	I_{2+}	I_{0+}	Shield
Colour	yellow	white	red	violet	pink	green	brown	blue	grey	

12-pin circular connector (Ø 28; M 23 x 1)

Pin	1	2	3	4	5	6	7	8	9	10	11	12	Housing
sin 1 V_{PP}	U_{2-}	+ 5 V	U_{0+}	U_{0-}	U_{1+}	U_{1-}	–	U_{2+}	–	0 V	0 V	+ 5 V	Shield
RS 422	$\overline{Z_2}$	+ 5 V	Z_0	$\overline{Z_0}$	Z_1	$\overline{Z_1}$	NAS	Z_2	–	0 V	0 V	+ 5 V	Shield
Colour	red	brown	grey	pink	green	yellow	violet	blue	–	white	white	brown	

9-pin circular connector (Ø 28; M 23 x 1)

Pin	1	2	3	4	5	6	7	8	9	Housing
sin 11µA_{PP}	I_{1+}	I_{1-}	+ 5 V	0 V	I_{2+}	I_{2-}	I_{0+}	I_{0-}	–	Shield
Colour	green	yellow	brown	white	blue	red	grey	pink	–	

12-pin DIN circular connector (Ø 18; M 18 x 0,75)

Pin	A	B	C	D	E	F	G	H	I	K	L	M	Housing
sin 1 V_{PP}	–	0 V	U_{1+}	U_{1-}	U_{2+}	0 V	U_{0+}	U_{0-}	0 V	+ 5 V	U_{2-}	+ 5 V	Shield
RS 422	–	0 V	Z_1	$\overline{Z_1}$	Z_2	0 V	Z_0	$\overline{Z_0}$	0 V	+ 5 V	$\overline{Z_2}$	+ 5 V	Shield
Colour	–	white	green	yellow	blue	white	grey	pink	white	brown	red	brown	

Legend

I_{1+}	U_{1+}	sin-signal (counting track)
I_{2+}	U_{2+}	cos-signal (counting track)
I_{1-}	U_{1-}	– sin-signal (counting track)
I_{2-}	U_{2-}	– sin-signal (counting track)
I_{0+}	U_{0+}	reference signal
I_{0-}	U_{0-}	– reference signal
Z_1		counting signal 0°
Z_2		counting signal 90°

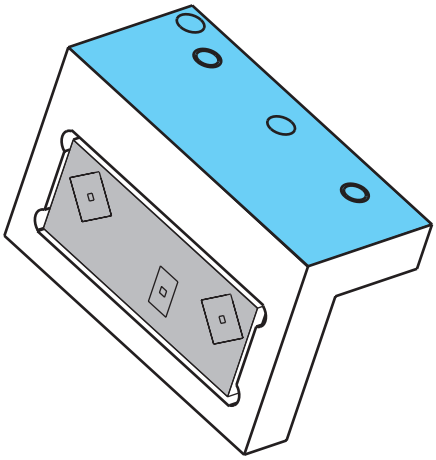
$\overline{Z_1}$	negated counting signal 0° (180°)
$\overline{Z_2}$	negated counting signal 90° (270°)
R	reference signal
$\overline{R}$	negated reference signal
U_B	supply voltage (+ 5 V)
GND	earth (0 V)
SCL,CS SDA	Adjustment pins (for electronic signal adjustment)

AS	monitoring signal
NAS	negated monitoring signal
	NAS high: *input signals within tolerance range;* *measuring system functioning* *NAS low:* *measuring system in disorder*

Available Frames for Measuring Modules

Frame design B for ***Kit L – 1xxB ...***

Dimensions:
length x width x heigth in mm **26 x 17 x 12**

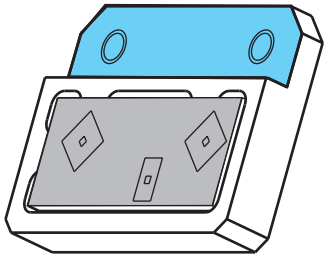


Frame design P for ***Kit L – 1xxP ...***

Dimensions:
length x width x heigth in mm **24 x 17.5 x 4**
thread M2.5

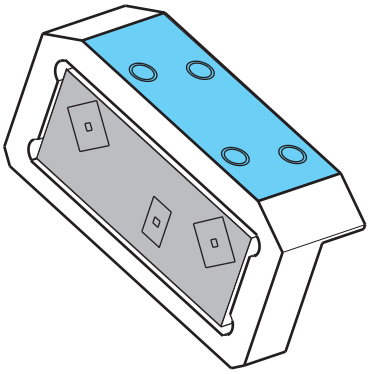
Frame design M for ***Kit L – 1xxM ...***

Dimensions:
length x width x heigth in mm **24 x 17.5 x 4**
bore Ø 2.4



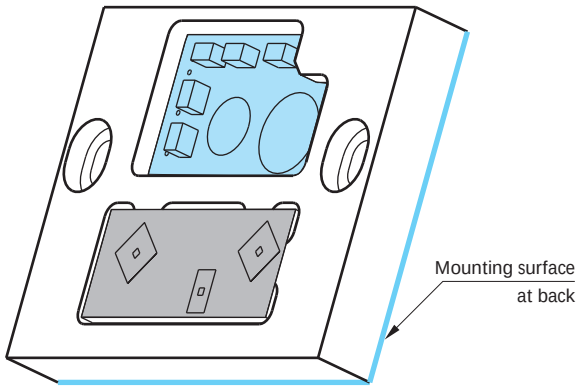
Frame design C for ***Kit L – 1xxC ...***

Dimensions:
length x width x heigth in mm **26 x 13.2 x 8**



Frame design S for ***Kit L – 1xxS ...***
(including holder for connector board)

Dimensions:
length x width x heigth in mm **33.8 x 26 x 5**
bore Ø 2.4

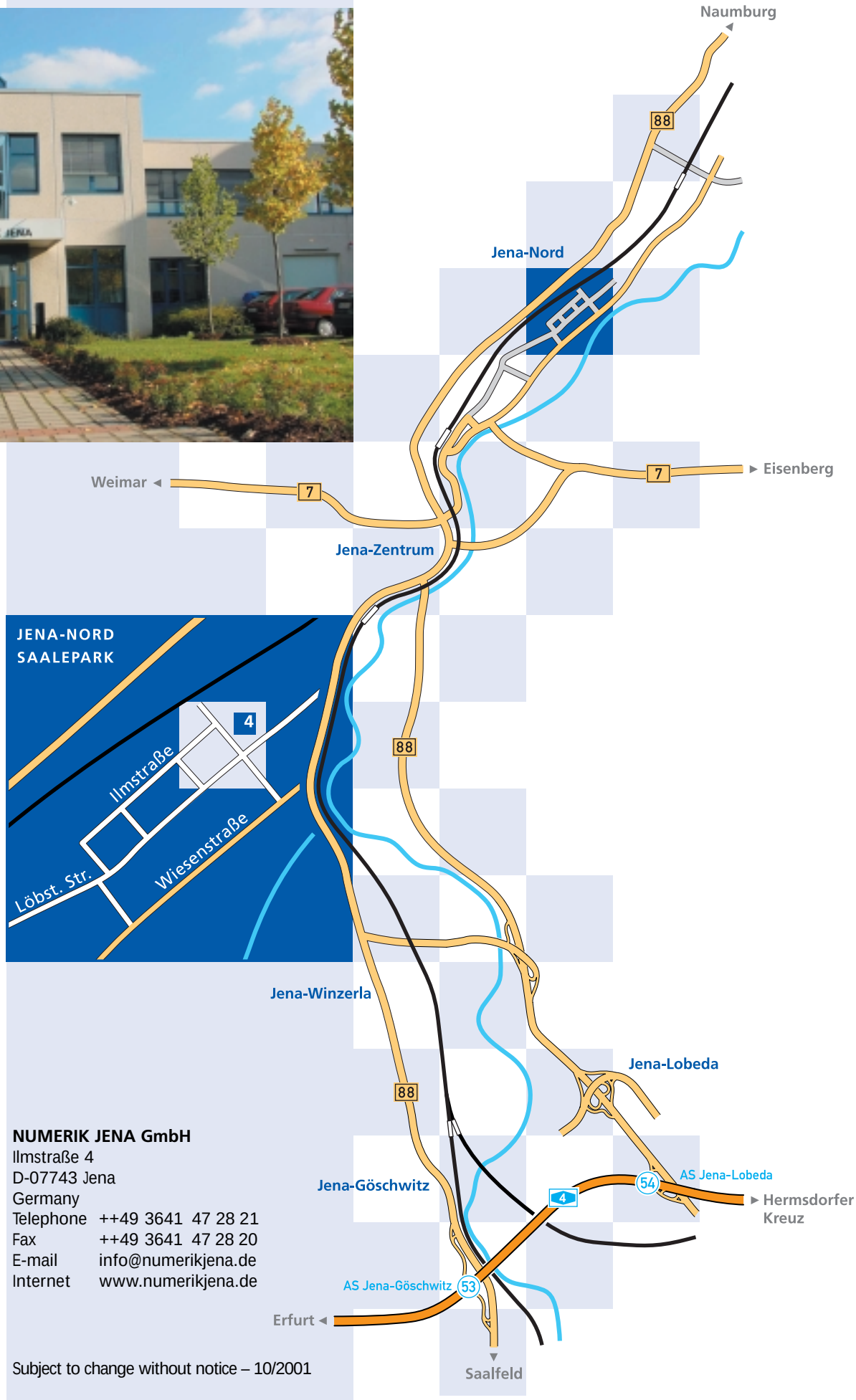


Mounting surfaces

EPIFLEX measuring module

Connector board

For more information, please request special documents



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Kit L-D-e-10/01