



## 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; 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
- High accuracy of interpolation by introducing an internal electronic compensation of amplitude and offset deviations
- 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

# Dynamic Offset and Amplitude Control, Signal Adjustment

## *Dynamic offset and amplitude control*

Contamination and mounting errors lead to interferences in the optical scanning of the scale by the scanning head, and so to periodic deformations of the sinusoidal counting track signals.

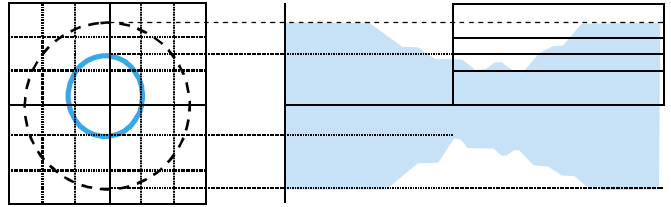
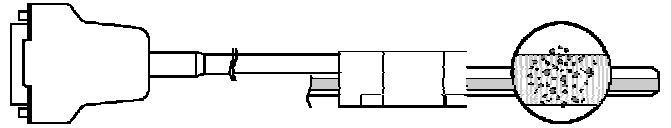
These deformations manifest themselves as

- n offset deviations and
- n amplitude deviations, as well as
- n amplitude differences between the sine and cosine channel

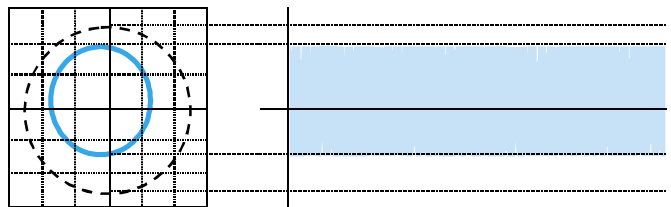
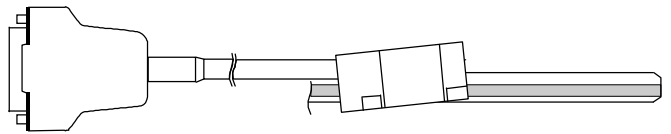
and lead to interpolation errors.

The signals generated by the measuring module are automatically corrected within the sensor without following error over the entire velocity range.

This measure not only increases the accuracy, but also the reliability of the encoder.



*Scanning signal of contaminated scale before offset and amplitude correction*



*Scanning signal at incorrect mounting conditions before offset and amplitude correction*

## *Signal adjustment*

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

This can result in

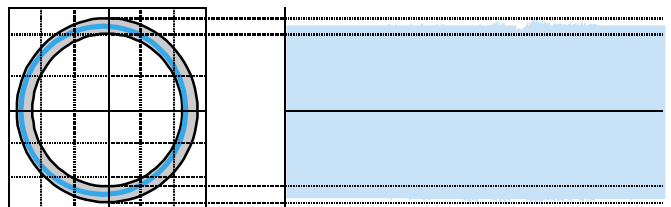
- a reduction of the interpolation error, and
- activation of functional reserves.

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.

**An electronic adjustment is essential if the measuring module is used without frame, in a custom-designed frame, or with distance-coded reference marks!**



*Scanning signal of contaminated scale and/or incorrect mounting conditions after offset and amplitude correction*

# Modular Design – Components

## Modular design – general

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.

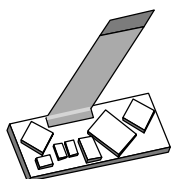
The customer fastens the framed measuring module (Kit L ...) with screws.

For extremely crowded installing conditions the EPIFLEX measuring module can be used without frame.

The measuring module is pre-adjusted and needs to be adjusted electronically by the user after the mounting process.

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

### EPIFLEX measuring module with flexible tape PCB



Output interfaces:

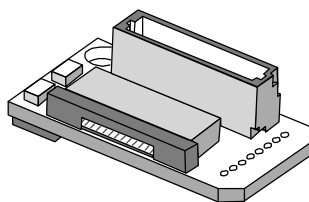
- voltage output 1 V<sub>pp</sub>
- square wave output RS 422 without interpolation

Signal period:

- 20 μm (standard), 100 μm

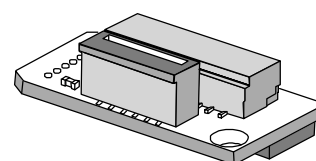
Line filters and diagnostic connectors have to be implemented by the customer if necessary.  
The EPIFLEX measuring module will be glued in a frame.

### Connector board type 1



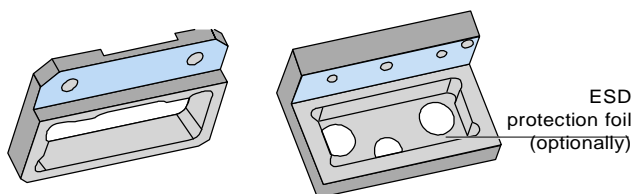
Horizontal input connector for measuring module;  
vertical connector for connecting cable

### Connector board type 2



Vertical input connector for measuring module;  
horizontal connector for connecting cable

## Frames



ESD protection foil (optionally)

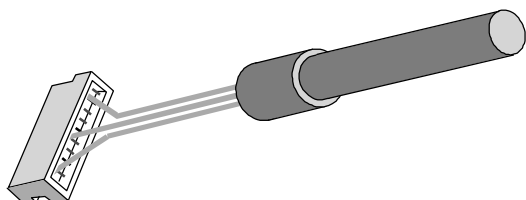
Mechanical frames for the EPIFLEX measuring module are available in different versions. The frames will be fixed with screws. Customized frames and a protection foil to enhance the ESD performance are available on request.

On the connector board there are located:

- the connectors for measuring module and connecting cable
- line filters
- diagnostic and setup connector pins for signal adjustment
- optionally signal interpolation electronics and RS 422 line driver

According to the integration situation either version can be used.

### Round cable with connector to the connector board



Alternative versions with or without connector to evaluation electronics.

## Scale tapes

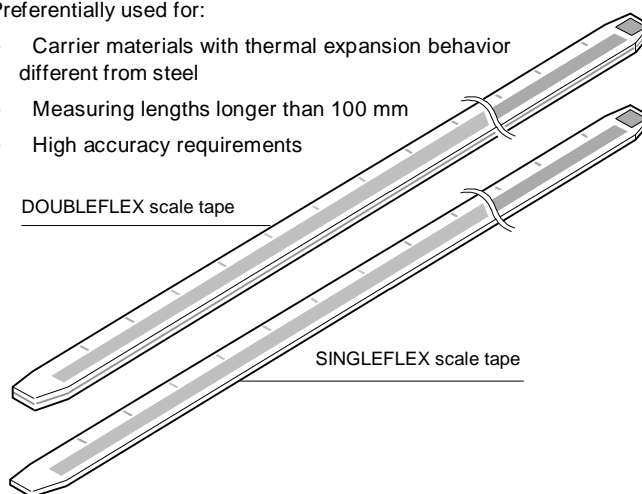
### DOUBLEFLEX scale tape

Mechanical isolation of the scale tape from the scale tape carrier; this results in defined thermal behavior.

Preferentially used for:

- Carrier materials with thermal expansion behavior different from steel
- Measuring lengths longer than 100 mm
- High accuracy requirements

DOUBLEFLEX scale tape



SINGLEFLEX scale tape

### SINGLEFLEX scale tape

Preferentially used for:

- Scale tape carrier with thermal expansion behavior same as steel ( $\alpha \approx 10.5 \times 10^{-6} \text{ grd}^{-1}$ )
- Low accuracy requirements

# Modular Design without Signal Processing

## Encoder Kit L

consists of: EPIFLEX measuring module and scale tape

designation example: **EML 2220-B1SL4**  
(measuring module in frame)

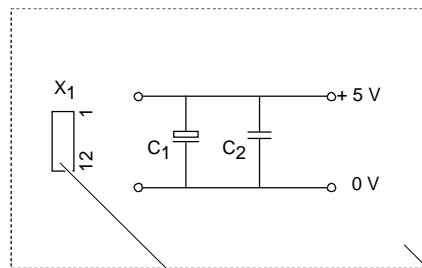
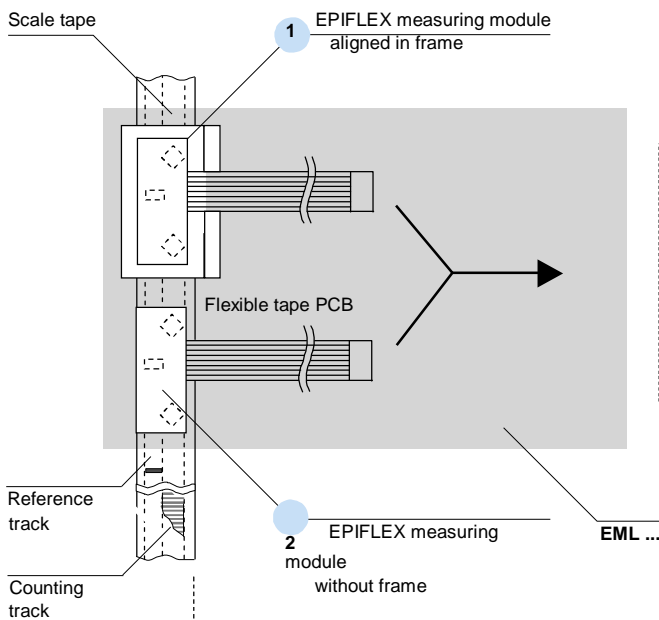
**MV 51-40BP00100**

- 1 **EPIFLEX measuring module in standard frame (B; C; ...)**  
Measuring module is electronically adjusted.
- 2 **EPIFLEX measuring module without frame (A) or in special frame**  
Measuring module is pre-adjusted and set to the signal output according to ordering key.  
An electronic adjustment by the customer is essential (adjustment kit or signal monitor).

### Driven square wave signals

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

When approached from different directions, the hysteresis of the reference pulse can reach approximately one signal period ( $\approx 20 \mu\text{m}$ ).



Recommended connector for flexprint cable: 12 FLZ-RSM 1-TB; manufacturer: JST ([www.jst.com](http://www.jst.com))

Customer's electronics (recommended line filter)  
 $C_1 = 22 \mu\text{F}$   
 $C_2 = 100 \text{ nF}$

### Signals:

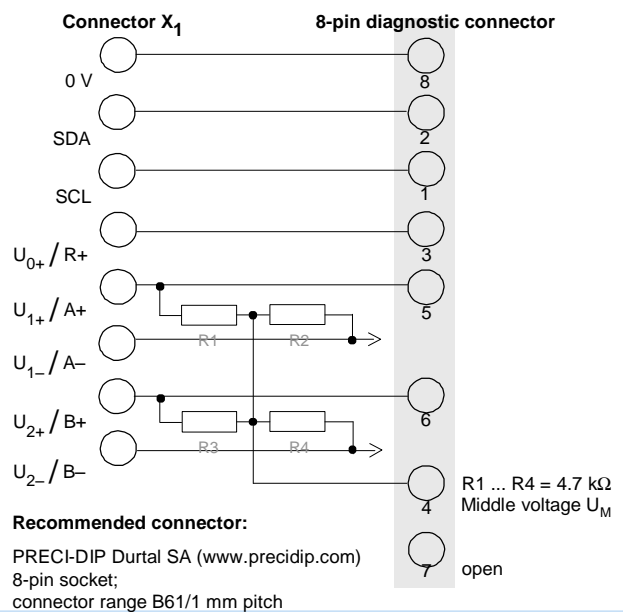
#### Output measuring module

Sinusoidal signal  $1 \text{ V}_{pp}$   
Square wave signal RS 422

### Note

To adjust the Encoder Kit L electronically it is necessary to integrate the adjacent circuitry.

The connection between the adjusting device and the PCB is done with an 8-pin plug connector, which is included with the adjusting device.

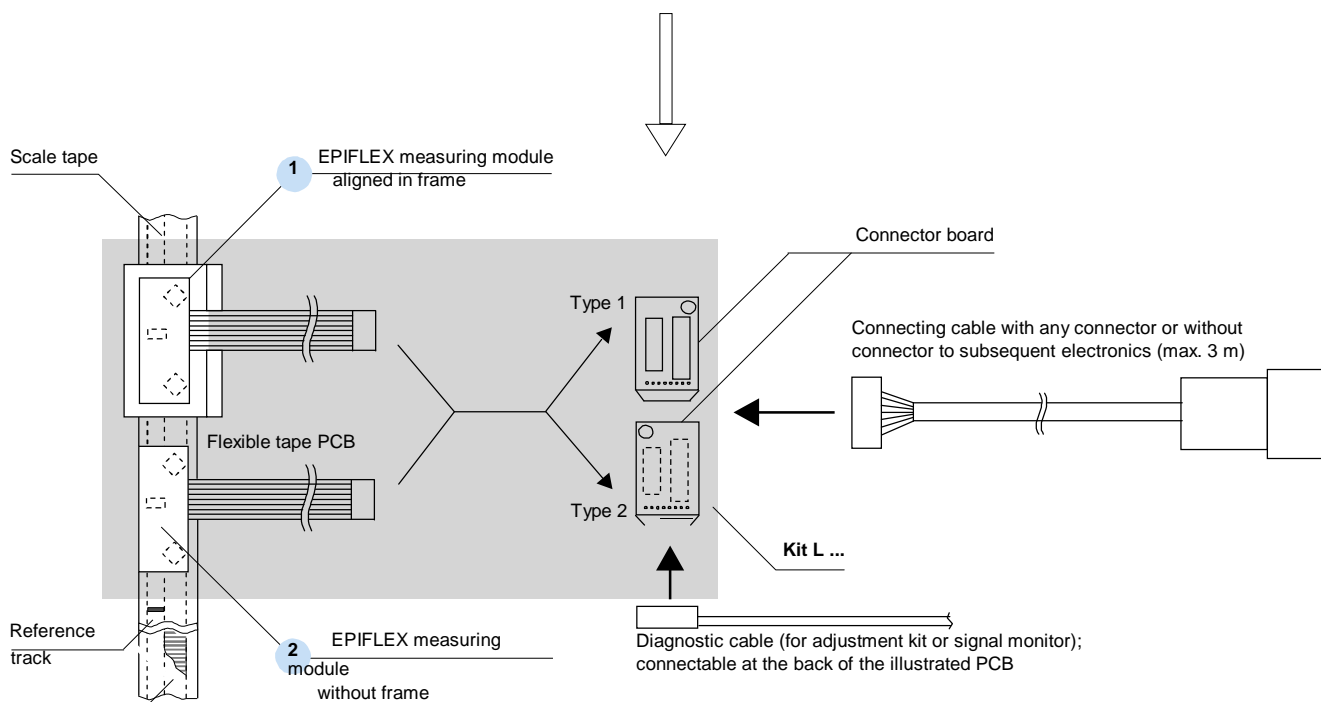
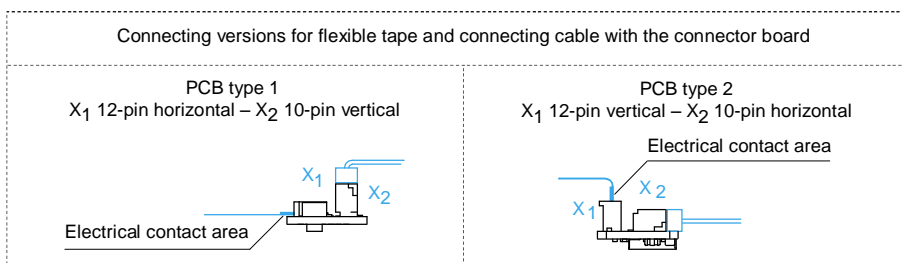


# Modular Design – Signal Processing on the Connector Board

## Encoder Kit L

consists of: Kit L, scale tape, connecting cable  
 designation example: **Kit L 2220–B1SL42–FA**  
 (measuring module fixed in the frame, connector board)  
**MV 51–40BP00100**

- 1 **EPIFLEX measuring module in standard frame (B; C; ...)**  
 Measuring module and connector board are interfaced and electronically adjusted.
- 2 **EPIFLEX measuring module without frame (A) or in special frame**  
 Measuring module is pre-adjusted and set to the signal interface of the electronic unit.  
 Measuring module is **not** interfaced with the connector board.  
 An electronic adjustment by the customer is essential (adjustment kit or signal monitor).



**Signals:**

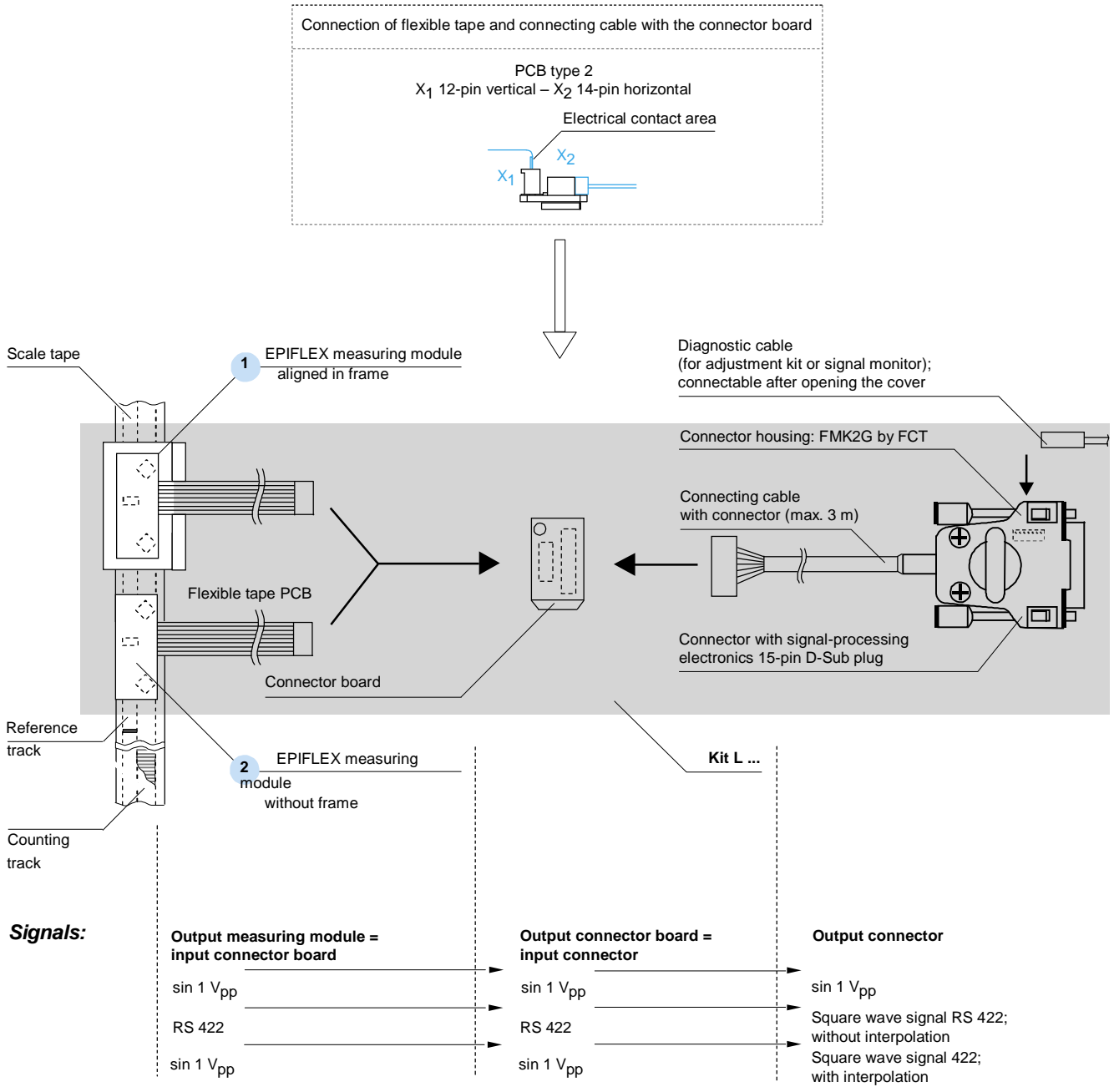
<b>Output measuring module = input connector board</b>		<b>Output connector board = Output cable/connector</b>
sin 1 V <sub>pp</sub>	→	sin 1 V <sub>pp</sub>
sin 1 V <sub>pp</sub>	→	Square wave signal RS 422; with interpolation
sin 1 V <sub>pp</sub>	→	sin 11 μA <sub>pp</sub>
RS 422	→	Square wave signal RS 422; without interpolation

# Modular Design – Signal Processing in the Connector

## Encoder Kit L

consists of: Kit L, scale tape  
 designation example: **Kit L 2220-B1SL42-FZ**  
 (measuring module fixed in the frame, connector board, round cable with 15-pin D-Sub connector)  
**MV 5 1 – 4 0 B P 00100**

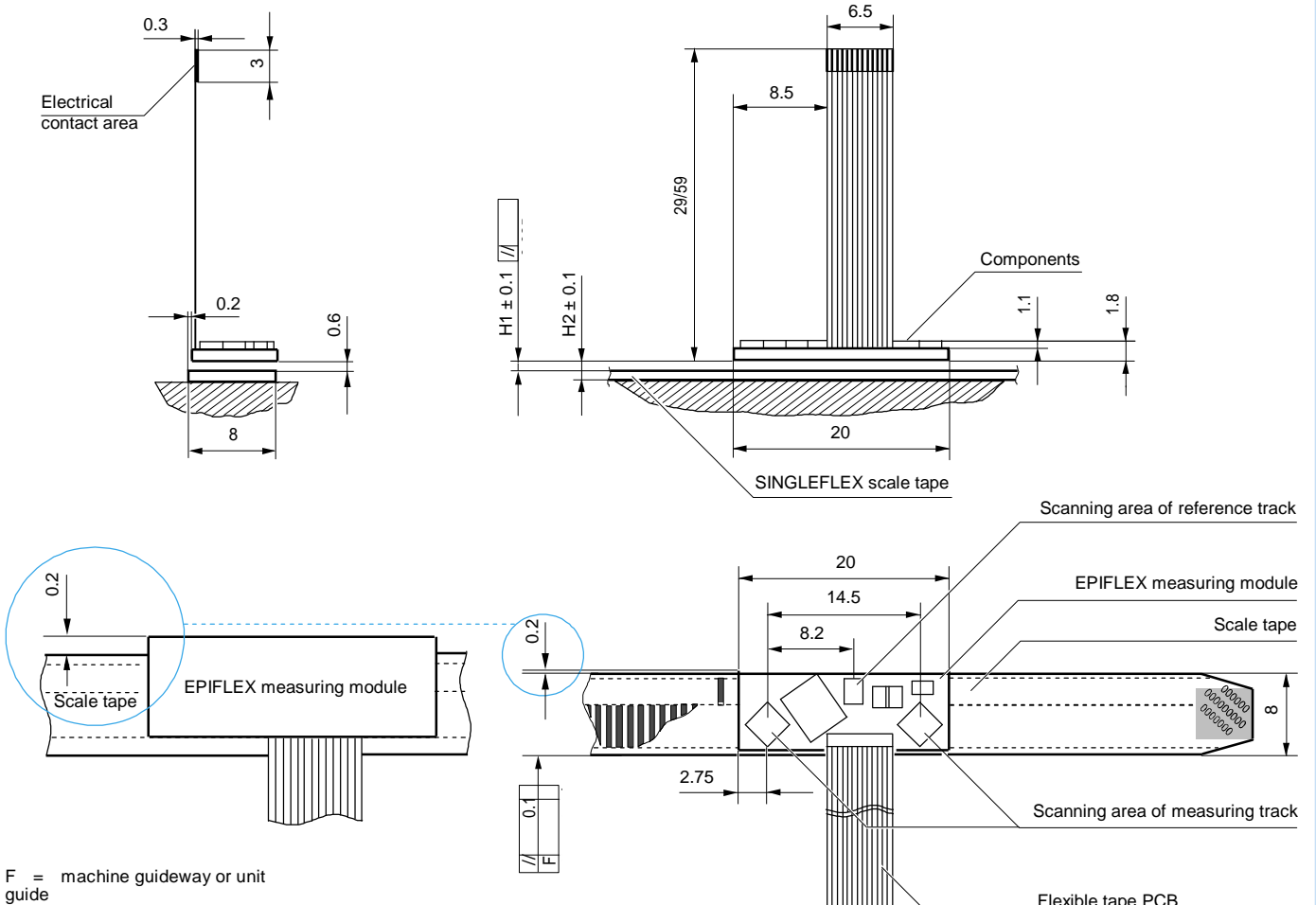
- 1 **EPIFLEX measuring module in standard frame (B; C; ...)**  
 Measuring module, connector board and cable with connector are interfaced and electronically adjusted.
- 2 **EPIFLEX measuring module without frame (A) or in special frame**  
 Measuring module is pre-adjusted and set to the signal interface of the electronic unit.  
 Measuring module is **not** interfaced with the connector board.  
 An electronic adjustment by the customer is essential (adjustment kit or signal monitor).





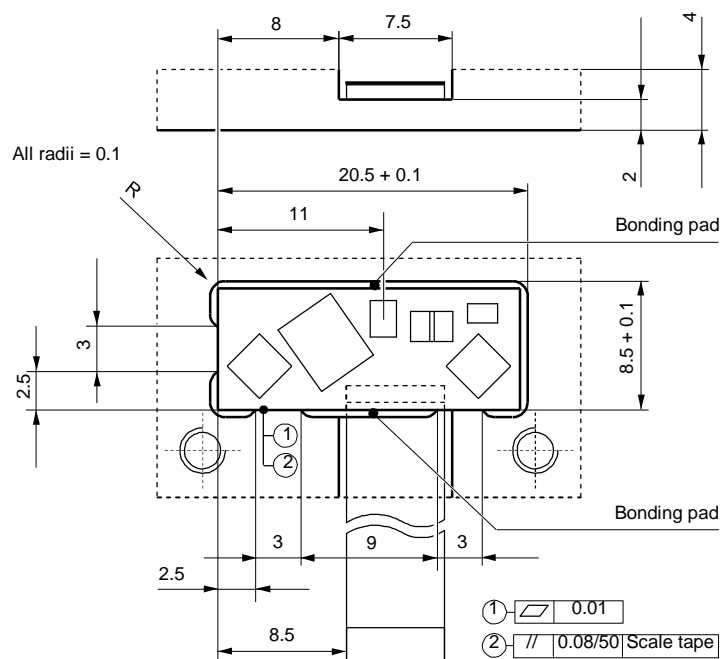
# Installation Dimensions – EPIFLEX Measuring Module

## Assignment of EPIFLEX measuring module and scale tape



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

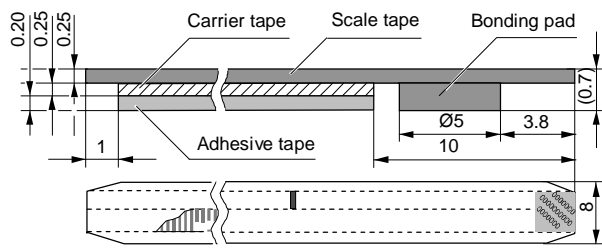
## Machine outline for sensor frame



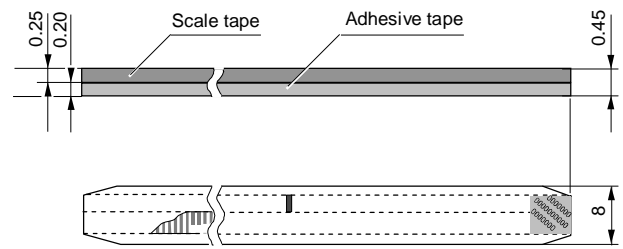
For available standard frames, please request special documents.

# Installation Dimensions – Scale Tape

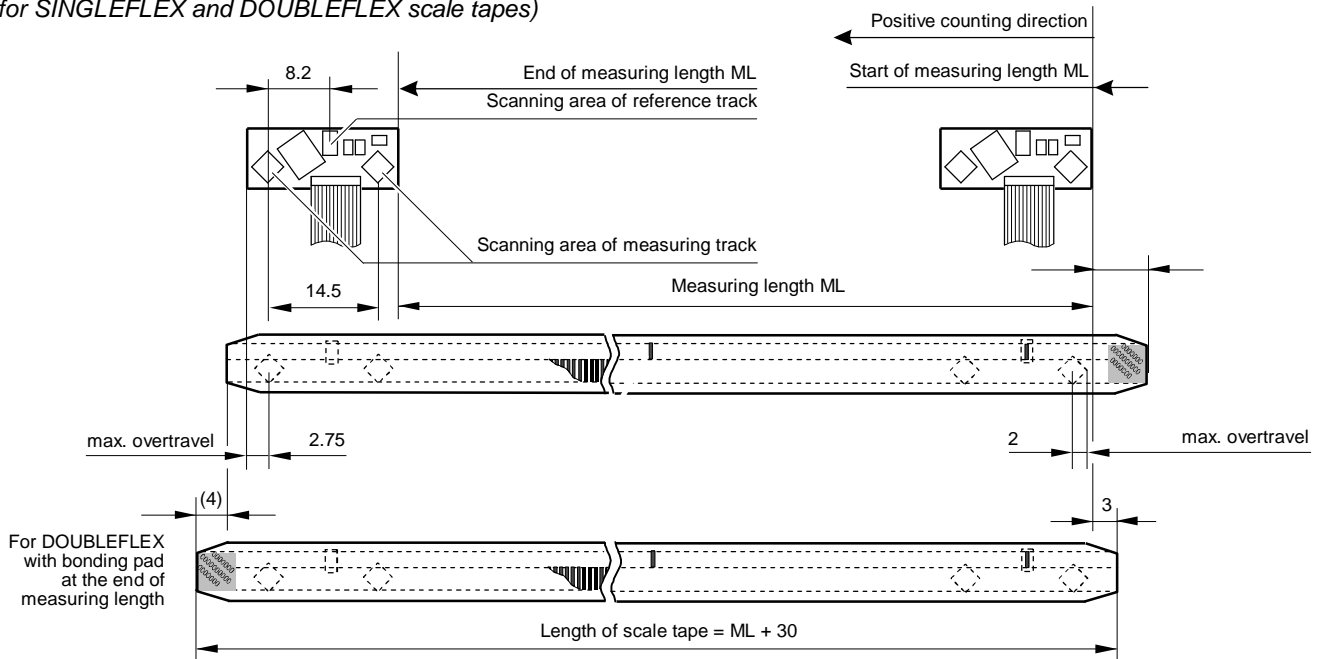
## DOUBLEFLEX scale tape (always with bonding pad)



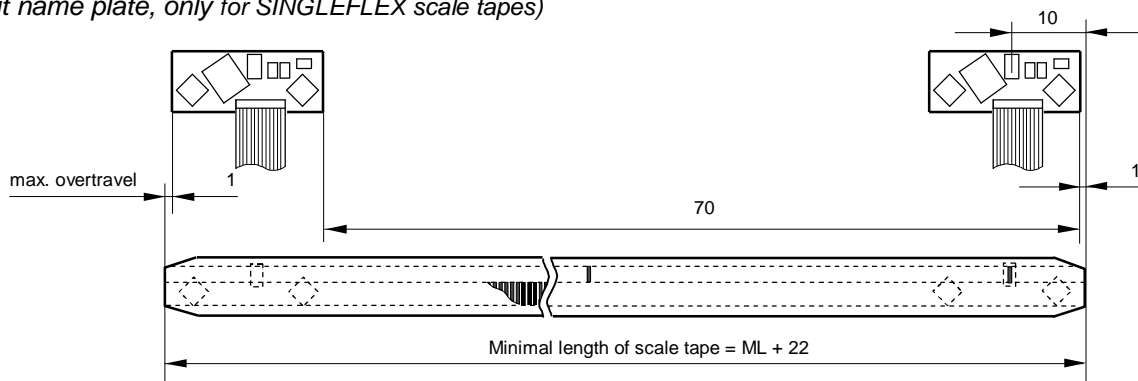
## SINGLEFLEX scale tape (always without bonding pad)



## Assignment of measuring length and scale tape (for SINGLEFLEX and DOUBLEFLEX scale tapes)



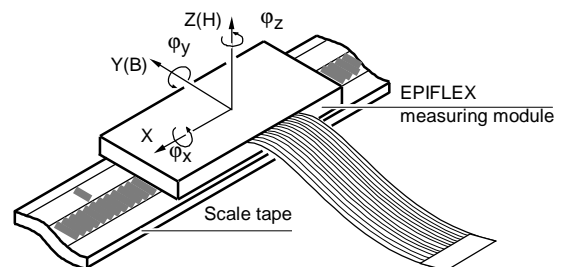
## Assignment of measuring length and scale tape for shorted scale tape length (without name plate, only for SINGLEFLEX scale tapes)



## Permissible position deviation of the EPIFLEX measuring module to the scale tape

- $\Delta Z (\Delta H) = \pm 0.1 \text{ mm}$
- $\Delta Y (\Delta B) = \pm 0.2 \text{ mm}$
- $\varphi_Z = \pm 6' \text{ or } \pm 0.1^\circ \text{ or } 0.08/50$
- $\varphi_Y = \pm 3' \text{ or } \pm 0.05^\circ$
- $0.04/50 \varphi_X = \pm 30' \text{ or } \pm 0.5^\circ$
- or  $0.4/50$

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



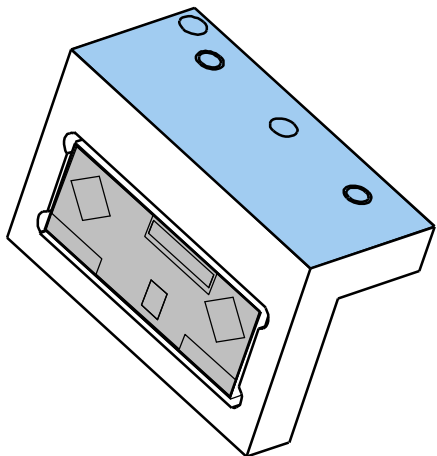


# Installation Dimensions – Frames

Frame design B for Kit L 22x0–B...

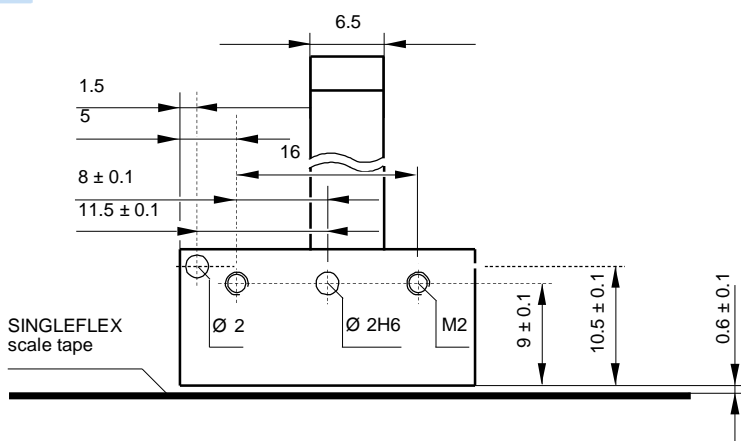
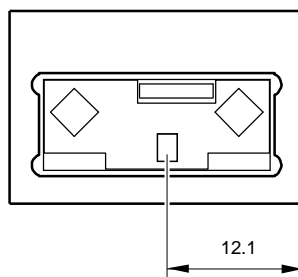
Dimensions:

length x width x height in mm 26 x 17 x 12

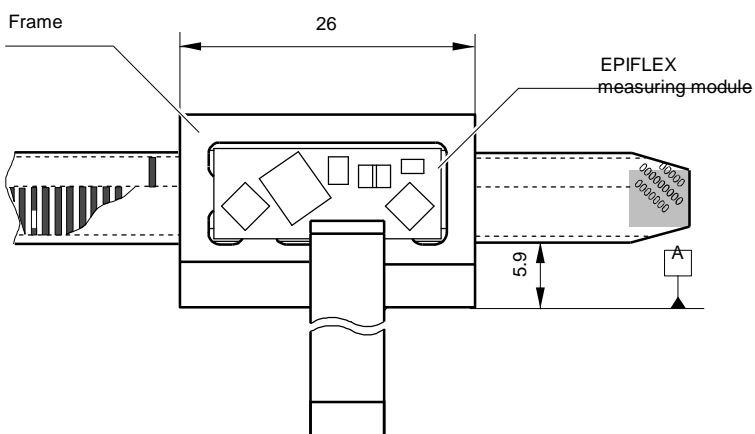
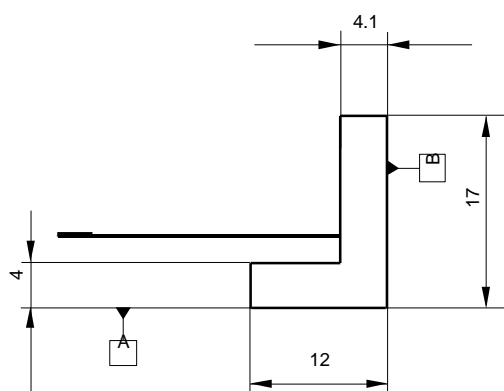


Mounting and contact surface

EPIFLEX measuring module



A Mounting surface  
B Level of scanning areas



More frames on request.  
For more information, please request special documents.



# Installation Dimensions – Frames

*Frame Design P0 for Kit L 22x0–P0 ...*

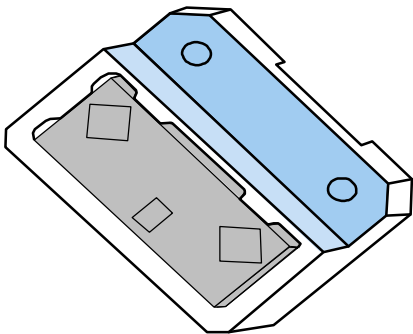
Dimensions:  
length x width x height in mm 24 x 17.5 x 4  
thread M2.5

*Frame Design M0 for Kit L 22x0–M0 ...*

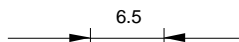
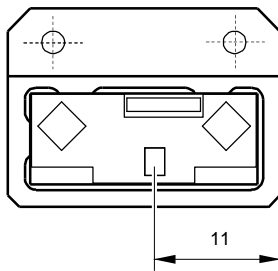
Dimensions:  
length x width x height in mm 24 x 17.5 x 4  
bore Ø 2.4

*Frame design P1 for Kit L 22x0–P1 ...*

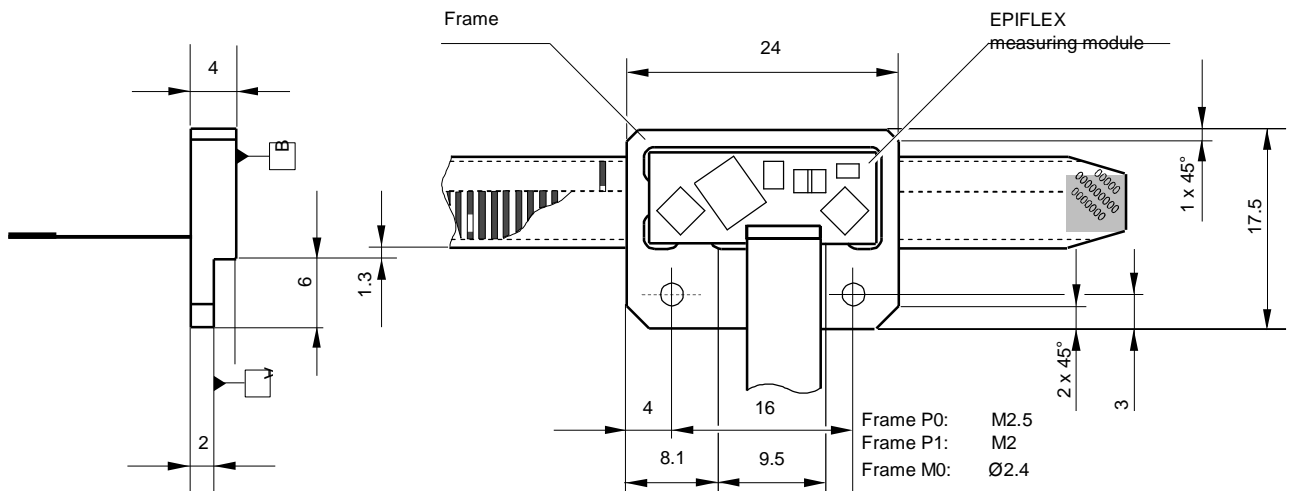
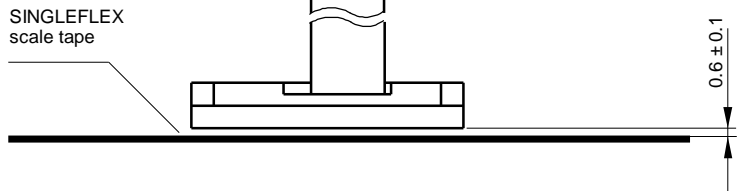
Dimensions:  
length x width x height in mm 24 x 17.5 x 4  
thread M2



- Contact surface
- Mounting surface
- EPIFLEX measuring module



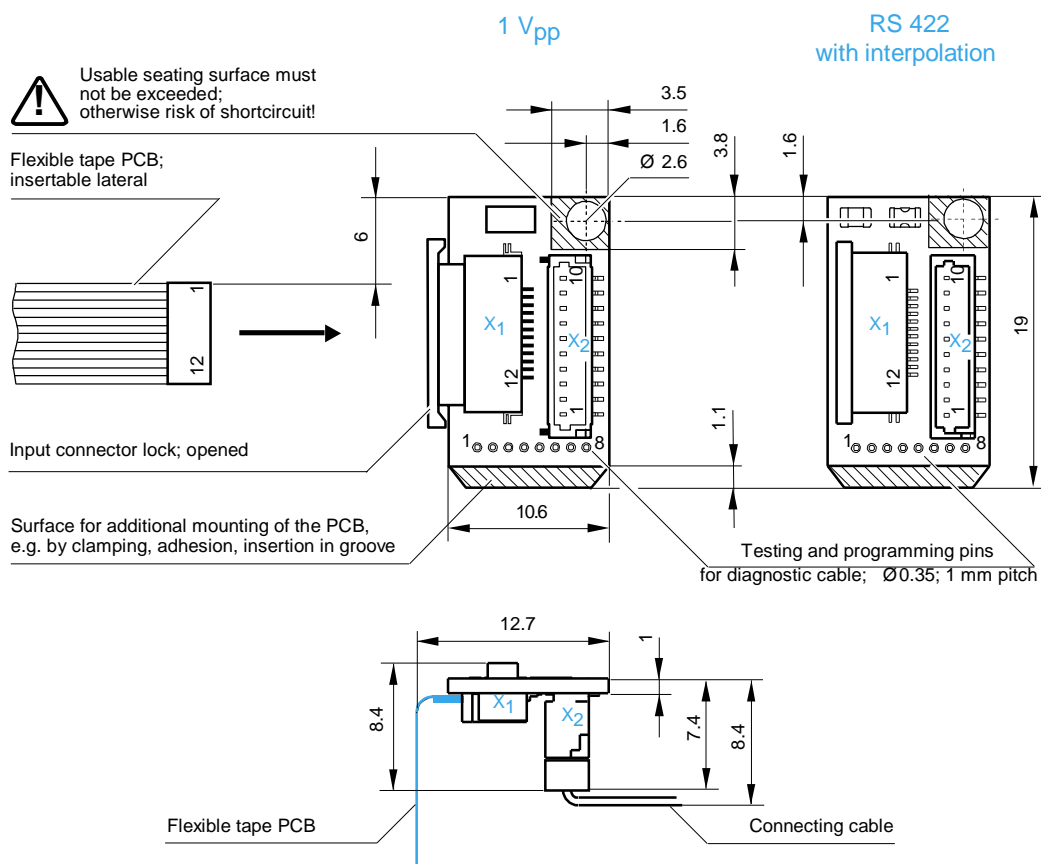
- A Mounting surface
- B Level of scanning areas



*More frames on request.  
For more information, please request special documents.*

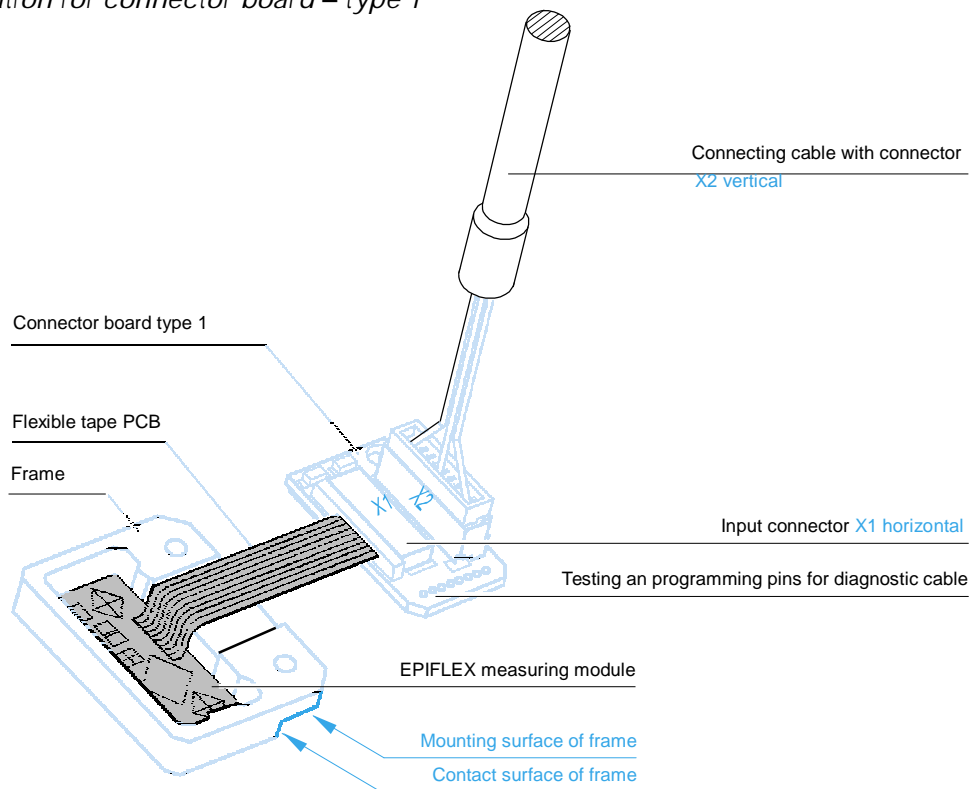
# Installation Dimensions – Connector Boards

PCB type 1 – horizontal input connector ; for signal processing on the connector board



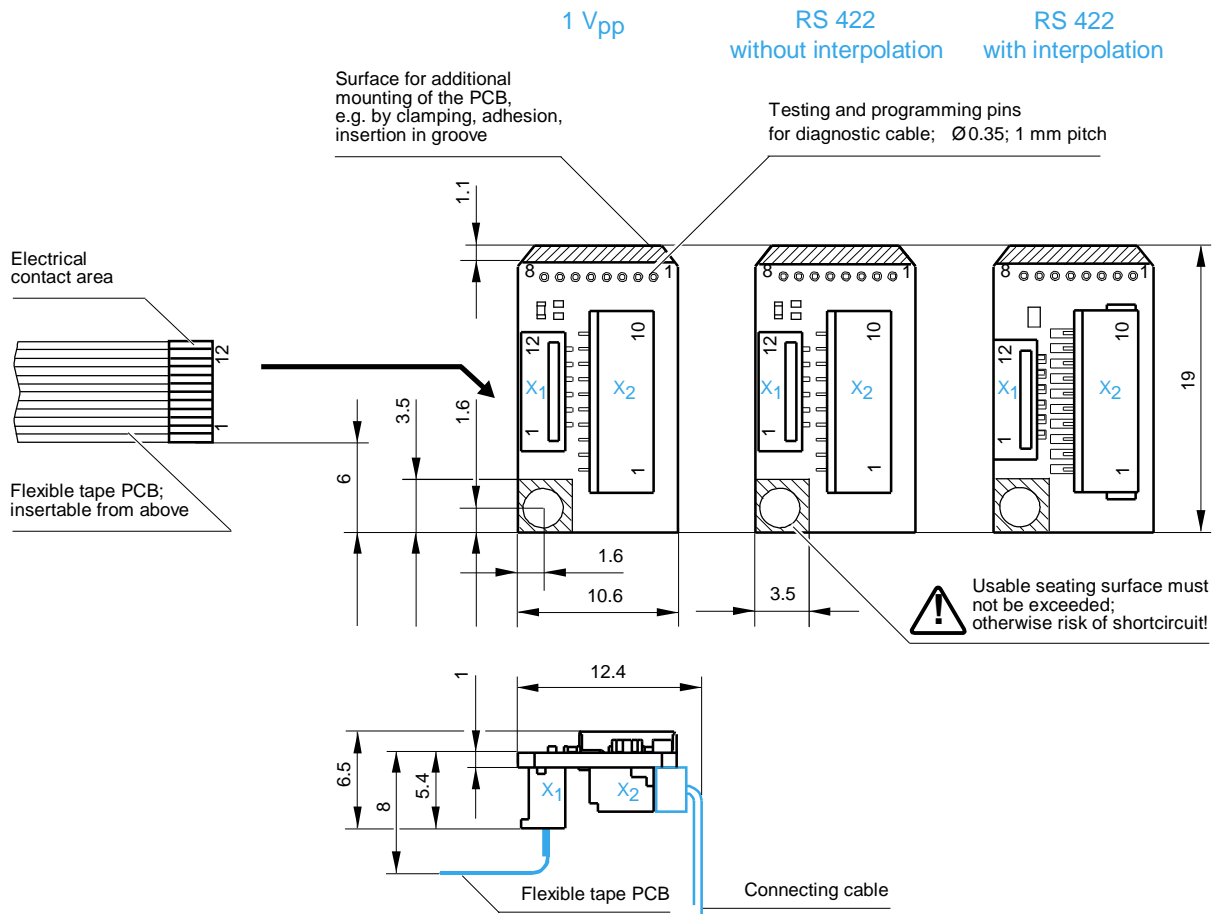
- X<sub>1</sub>: Horizontal input connector for flexible tape PCB; 12-pin
- X<sub>2</sub>: Vertical connector for connecting cable; 10-pin

System illustration for connector board – type 1



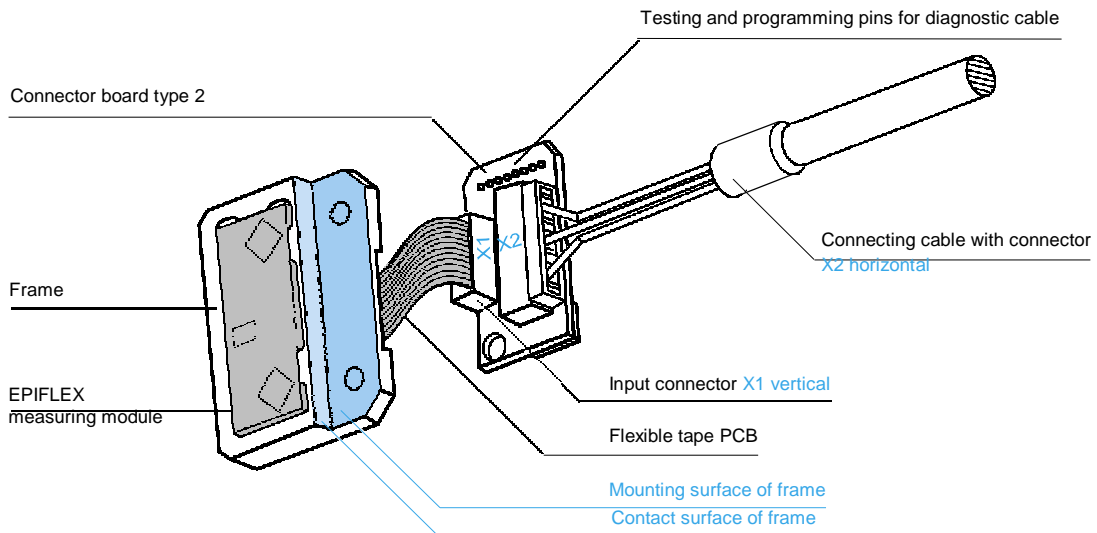
# Installation Dimensions – Connector Boards

PCB type 2 – vertical input connector ; for signal processing on the connector board



- X<sub>1</sub>: Vertical input connector for flexible tape PCB; 12-pin
- X<sub>2</sub>: Horizontal connector for connecting cable; 10-pin

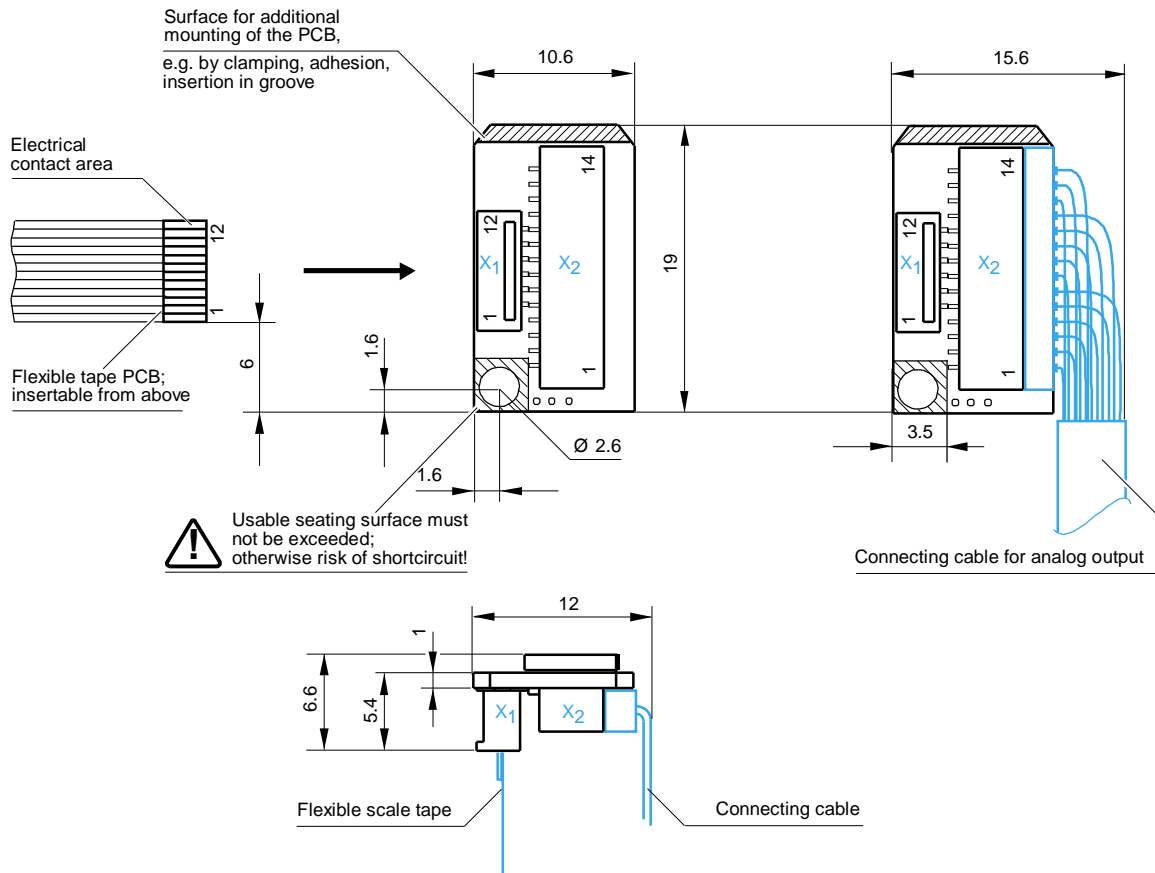
## System illustration for connector board – type 2





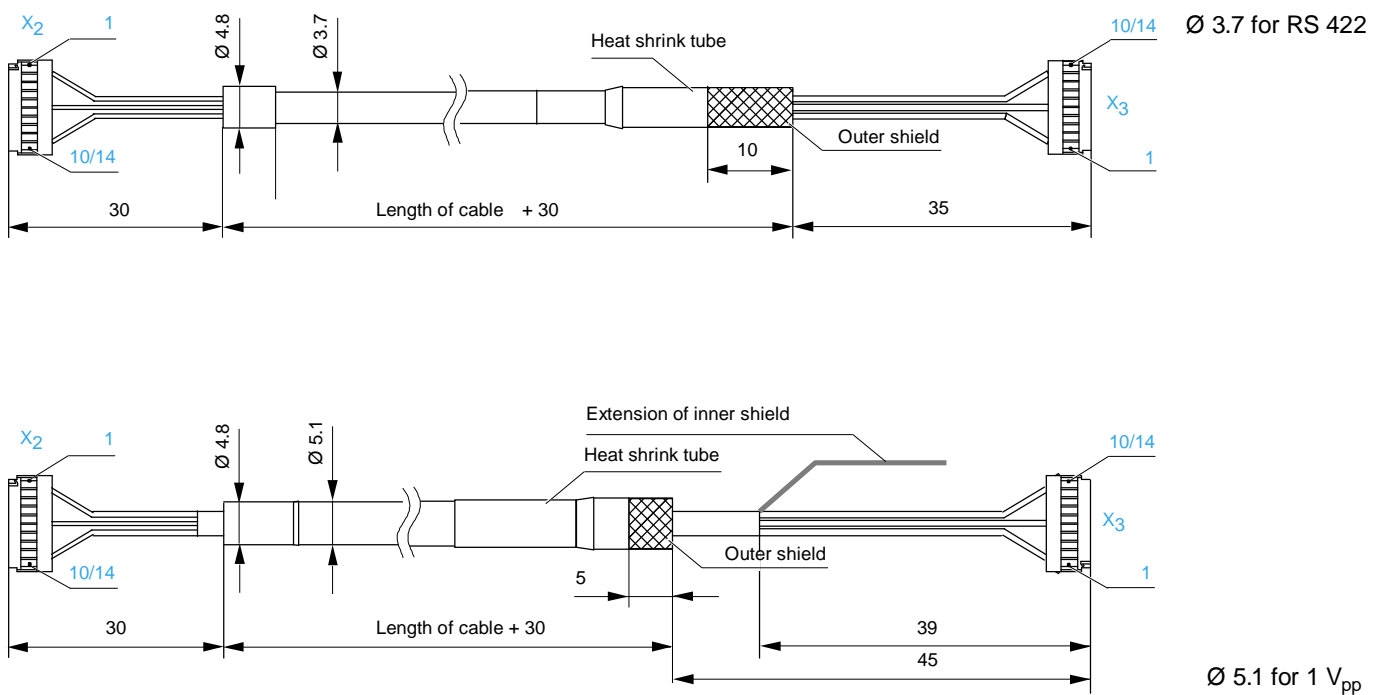
# Installation Dimensions – Connector Boards

PCB type 2 – vertical input connector ; for signal processing in the connector



- X<sub>1</sub>: Vertical input connector for flexible tape; 12-pin
- X<sub>2</sub>: Vertical connector for connecting cable; 14-pin

# Installation Dimensions – Cable with Open Output



# Connectors and PIN Assignment

## Legend

U <sub>1+</sub>	sine signal; counting track	Sine signals	A <sub>+</sub>	Counting signal 0°	Square wave signals	U <sub>B</sub>	Operating voltage (5 V)
U <sub>2+</sub>	cosine signal; counting track		B <sub>+</sub>	Counting signal 90°		G <sub>N</sub>	Ground (0 V)
U <sub>1-</sub>	- sine signal; counting track		A <sub>-</sub>	Inverse counting signal 0° (180°)		SCL SDA	Programming wires for electronic signal adjustment
U <sub>2-</sub>	- cosine signal; counting track		B <sub>-</sub>	Inverse counting signal 90° (270°)			
U <sub>0+</sub>	Reference signal		R <sub>+</sub>	Reference signal			
U <sub>0-</sub>	- Reference signal		R <sub>-</sub>	Inverse reference signal			

AS	Monitoring signal	<i>AS low/NAS high:</i> <i>Input signal within the tolerance range, encoder functioning properly.</i> <i>AS high/NAS low:</i> <i>Input signal out of tolerance range, check the encoder!</i>
NAS	Inverse monitoring signal	

## PIN assignment for X<sub>1</sub> on the connector board

PIN	1	2	3	4	5	6	7	8	9	10	11	12
1 V <sub>pp</sub>	SCL	SDA	GND	-	U <sub>1-</sub>	U <sub>1+</sub>	NAS	U <sub>0+</sub>	U <sub>0-</sub>	U <sub>2-</sub>	U <sub>2+</sub>	5 V
RS 422	SCL	SDA	GND	-	A-	A+	NAS	R+	R-	B-	B+	5 V

## 10pin JST miniature connector X<sub>2</sub> and X<sub>3</sub> (only for open output and signal processing on the connector board)

PIN	1	2	3	4	5	6	7	8	9	10	
1 V <sub>pp</sub>	U <sub>2-</sub>	0 V	-	U <sub>2+</sub>	U <sub>0-</sub>	-	U <sub>1-</sub>	U <sub>0+</sub>	U <sub>1+</sub>	5 V	Inner shield
RS 422	B-	0 V	NAS	B+	R-	AS	A-	R+	A+	5 V	-
Cable Ø 5.1 mm	red	white	-	blue	pink	-	yellow	gray	green	brown	white/green
Cable Ø 3.7 mm single shielded	red	white	violet	black	pink	yellow	brown	gray	green	blue	-

## 14pin JST miniature connector X<sub>2</sub> and X<sub>3</sub> (only for open output and signal processing in the connector respectively)

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1 V <sub>pp</sub>	0 V	U <sub>1-</sub>	-	SCL	SDA	-	U <sub>1+</sub>	U <sub>0+</sub>	U <sub>2-</sub>	5 V	U <sub>2+</sub>	U <sub>0-</sub>	-	-	Inner shield
RS 422	0 V	A-	NAS	SCL	SDA	-	A+	R+	B-	5 V	B+	R-	-	-	-
Cable Ø 5.1 mm	white	yellow	violet	black	brown/green	-	green	gray	red	brown	blue	pink	-	-	white/green

SCL programming wire for clock  
 SDA programming wire for data

# Connectors and PIN Assignment

## 9-pin D-sub connector

PIN	1	2	3	4	5	6	7	8	9	Housing
1 V <sub>pp</sub>	U <sub>1-</sub>	0 V	U <sub>2-</sub>	Inner shield *	U <sub>0-</sub>	U <sub>1+</sub>	5 V	U <sub>2+</sub>	U <sub>0+</sub>	Outer shield
RS 422	A-	0 V	B-	NAS	R-	A+	5 V	B+	R+	Outer shield
11 μA <sub>pp</sub>	I <sub>1-</sub>	0 V	I <sub>2-</sub>	-	I <sub>0-</sub>	I <sub>1+</sub>	5 V	I <sub>2+</sub>	I <sub>0+</sub>	Outer shield
Cable Ø 5.1 mm	yellow	white	red	violet	pink	green	brown	blue	gray	-
Cable Ø 3.7 mm single shielded	brown	white	red	violet	pink	green	blue	black	gray	-

\*) wire colour: white/green

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

PIN	1	2	3	4	5	6	7	8	9	10	11	12	Housing
1 V <sub>pp</sub>	U <sub>2-</sub>	5 V	U <sub>0+</sub>	U <sub>0-</sub>	U <sub>1+</sub>	U <sub>1-</sub>	-	U <sub>2+</sub>	Inner shield	0 V	0 V	5 V	Outer shield
RS 422	B-	5 V	R+	R-	A+	A-	NAS	B+	-	0 V	0 V	5 V	Outer shield
Cable Ø 5.1 mm	red	brown	gray	pink	green	yellow	violet	blue	-	white	white	brown	-
Cable Ø 3.7 mm single shielded	red	blue	gray	pink	green	brown	violet	black	white/green	white	white	blue	-

Pins 2 and 12 bridged, pins 10 and 11 bridged

## 15-pin D-sub connector

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Housing
1 V <sub>pp</sub>	-	-	-	U <sub>0-</sub>	U <sub>2-</sub>	U <sub>1-</sub>	-	5 V	0 V	-	-	U <sub>0+</sub>	U <sub>2+</sub>	U <sub>1+</sub>	Inner shield	Outer shield
RS 422	-	-	NAS	R-	B-	A-	-	5 V	0 V	-	AS	R+	B+	A+	Inner shield *	Outer shield
Cable Ø 5.1 mm	-	-	violet	pink	red	yellow brown	-	white	-	black	gray	blue	green	white/ green	-	-
Cable Ø 3.7 mm single shielded	-	-	violet	pink	red	brown	-	blue	white	-	yellow	gray	black	green	-	-

\*) for signal processing in the 15-pin D-sub connector

# Ordering Key – Components for Linear Measurements

(Designation example)

**KIT L 2 2 2 0 - B 1 S P 4 1 - F Z**

KIT L	version with signal processing
EML	version without signal processing

Model type	
2	dimensions 20 x 8 – SV 3 – R

Grating period; type of sensor	
2	GP = 20 µm; two-field

Flexible type PCB – length and direction	
1	25 mm, vertical output (90°)
2	55 mm, vertical output (90°)
3	25 mm, horizontal output
4	55 mm, horizontal output

Frame	
A	without frame
B	standard frame
...	continuous
...	
Z	

Type of frame and installation position for the EPIFLEX measuring module	
0 ... 9	versions of frame

Material of frame	
A	aluminum chromated
B	aluminum without surface treatment
S	steel/X12CrNi177 passivated

Output signals	
B	sinusoidal 11 µA <sub>pp</sub>
C	sinusoidal 1 V <sub>pp</sub>
K	RS 422 square wave signal without interpolation
L	RS 422 square wave signal with interpolation 5x
M	RS 422 square wave signal with interpolation 10x
I	RS 422 square wave signal with interpolation 25x
N	RS 422 square wave signal with interpolation 50x
P	RS 422 square wave signal with interpolation 100x

Speed factor	
X	Customer-specific value, depending on the max. speed and max. input frequency of the evaluation electronics; consult NUMERIK JENA

Type of connector

A <sup>2</sup>	Open
D	with 10/14-pin JST miniature connector
H	9-pin; D-sub; PIN; straight
O	12-pin; circular; PIN; plastic-coated
Z	15-pin; D-sub; PIN; straight
Z	15-pin; D-sub; signal processing in the connector

Type of cable

Cable Ø 5.1 mm double shielded for 1 V <sub>pp</sub> and 11 µA <sub>pp</sub>		Cable Ø 3.7 mm single shielded for RS 422	
A	0.3 m	R	0.3 m
B	0.5 m	S	0.5 m
F	1.0 m	T	1.0 m
E	1.5 m	P	1.5 m
G	2.0 m	V	2.0 m
K	3.0 m	W	3.0 m
O <sup>1</sup>	others on request	U <sup>1</sup>	others on request

Version

-	standard
1	vacuum suitable up to 10 <sup>-6</sup>

Type of connector board

1	horizontal input connector
2	vertical input connector

- 1) no standard, supplied for a surcharge
- 2) outer shield fold back on coating, protected with heat shrink tube, with 10/14-pin JST connector

# Ordering Key – Scale Tape

MV 5 0 - 1 1 B P 00770 (-)

(Designation example)

Material of tape; scanning type

5	steel tape; two-field
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deviation from standard

Design type

0	DOUBLEFLEX, standard <sup>3</sup>
1	SINGLEFLEX, standard
5	min. length of scale tape <b>with</b> reference mark <sup>1,4</sup>

measuring length (ML) in mm

Grating period GP

P	20 $\mu$ m
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Accuracy class

1	$\pm 1 \mu$ m
2	$\pm 2 \mu$ m
3	$\pm 3 \mu$ m
4	$\pm 5 \mu$ m

Position of reference mark

0	without reference mark
B	in the center of measuring length
E	customized version <sup>5</sup>
F	distance coded at $1000 \times GP$ <sup>6</sup>
N	at 50 mm spacings, starting at center of measuring length

Bonding pad position

0	without bonding pad <sup>1</sup>
1	at start of measuring length <sup>2</sup>
5	at end of measuring length <sup>2</sup>

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) measuring length (ML) + 22 mm

5) specified in XXXXX mm from start of measuring length

6) only for GP = 20  $\mu$ m with max. measuring length 7300 mm

# Technical Specifications

## *Mechanical data - EPIFLEX measuring module*

Recommended measuring increments (resolution)		0.05 $\mu\text{m}$ 0.1 $\mu\text{m}$ 0.2 $\mu\text{m}$ 0.50 $\mu\text{m}$ 1.0 $\mu\text{m}$ 5.0 $\mu\text{m}$
Dimensions	EPIFLEX measuring module without frame	8 × 20 × 2.6 mm <sup>3</sup>
	EPIFLEX measuring module with frame	see frames
Weight	EPIFLEX measuring module without frame	< 2 g
Max. travel speed (depending on auxiliary electronic units)		600 m/min for GP = 20 $\mu\text{m}$ without interpolation; 48 m/min for GP = 20 $\mu\text{m}$ with interpolation 100x
Measuring length		up to 30 m (on request)

## *Mechanical data – scale tape*

Material		steel
Grating period (GP)		20 $\mu\text{m}$ ; standard
Reference marks		<ul style="list-style-type: none"> <li>● periodically at 50 mm spacings</li> <li>● distance coded at 1000 × GP</li> <li>● in the center of measuring length</li> <li>● others on request</li> </ul>
Linear expansion coefficient	DOUBLEFLEX scale tape	$\approx 10.5 \times 10^{-6} \text{ grad}^{-1}$
	SINGLEFLEX scale tape	at function of material of the mounting surface
Accuracy classes	DOUBLEFLEX scale tape	$\pm 1 \mu\text{m}$ $\pm 2 \mu\text{m}$ $\pm 3 \mu\text{m}$ $\pm 5 \mu\text{m}$
	SINGLEFLEX scale tape	$\pm 5 \mu\text{m}$ others on request

## *Elektrical data*

Scanning frequency		max. 500 kHz
Output interfaces for counting signals	voltage output	1 V <sub>pp</sub> with integrated line driver
	current output	11 $\mu\text{A}_{pp}$
	square wave output	RS 422; optionally with internal signal interpolation 5x, 10x, 25x, 50x, 100x
Supply voltage		5 V $\pm$ 10%
Power consumption	voltage output	< 60 mA
	current output	< 60 mA
	square wave output (RS 422)	< 200 mA
Cable lengths	connecting cable (round cable)	up to 3 m with and without connector standard: 0.3 m; 0.5 m; 1.0 m; 2.0 m; 3.0 m
	Permissible total cable lengths with extension cable	<ul style="list-style-type: none"> <li>● max. 18 m for current output 11 <math>\mu\text{A}_{pp}</math></li> <li>● max. 100 m for voltage output 1 V<sub>pp</sub></li> <li>● max. 100 m for square wave output RS 422</li> </ul>

## *Ambient conditions*

Operating temperature range		0°C ... + 55°C
Storage temperature range		- 20°C ... + 70°C
Vibration (50 Hz ... 2000 Hz)		$\leq 200 \text{ ms}^{-2}$
Shock (11 ms)		$\leq 400 \text{ ms}^{-2}$
Humidity		93% RH (no condensing)

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

