Datasheet

General Features

Absolute optical scale with glass measuring support.

- Absolute optical scale with glass measuring support, SSI - BiSS C (unidirectional) interface.
- Resolutions up to 0.01 µm.
- Accuracy grade up to ± 2 µm.
- Central fixed expansion point (**FEP**). On request positioned on the right (**RT**) or on the left (**LT**), for a linear expansion consistent with the type of application.
- Direct reading of absolute measure.
- Small size, to allow installation in narrow spaces.
- Connector on the transducer.
- Pressurization from both sides of the scale or from the transducer.
- Option: 1 Vpp analog signal.

Technical Characteristics

Measuring support Grating pitch Linear thermal expansion coefficient	Glass scale 20 µm 8 x 10^{-6} °C^{-1}
Incremental signal	sine wave 1 Vpp (optional)
Resolution 1 Vpp	Up to 0.01 µm *
Serial interface	SSI-BiSS C (unidirectional)
Resolution absolute measure	1 - 0.1 – 0.05 - 0.01 µm
Accuracy grade	±5 µm ** standard version ±3 µm ** high-accuracy version; ±2 µm for measuring length up to 670 mm
Interpolation error (SDE)	± 0.05 µm ***
Hysteresis	0.09 µm ***
Measuring length ML in mm	70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 770, 820, 920, 1.020, 1.140, 1.240, 1.340, 1.440, 1.540, 1.640, 1.740, 1.840, 2.040 (max. measuring length)****
Max. traversing speed	180 m/min
Max. acceleration	50 m/s^2 in measuring direction
Required moving force	≤ 2.5 N
Vibration resistance (EN60068-2-6)	100 m/s^2 [55 ÷ 2000 Hz]
Shock resistance (EN60068-2-27)	150 m/s^2 [11 ms]
Protection class (EN 60529)	IP 54 standard IP 64 pressurized
Operating temperature	0 °C ÷ 50 °C
Storage temperature	-20 °C ÷ 70 °C
Relative humidity	20 % ÷ 80 % (not condensed)
Reading block sliding	by ball bearings ◎
Power supply	5 VDC ±10 %
Current consumption	250 mA max. (mit R = 120 Ω)
Max. cable length	50 m (serial + analog output) 70 m (serial output)*****
Electrical connections	see related table
Connector	inside the transducer
Electrical protections	inversion of polarity and short circuits
Weight	225 g + 610 g/m (per m measuring length)

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

* Depending on CNC division factor.
** The declared accuracy grade of ±X µm is referred to a measuring length of 1 m.
*** The error declared is subject to the respect of the alignment tolerances.
**** For measuring lengths higher than 1.340 mm it is necessary to use the supporting bar (optional for lower measuring lengths).
***** Ensuring a minimum power supply voltage of 5 V to the transducer.

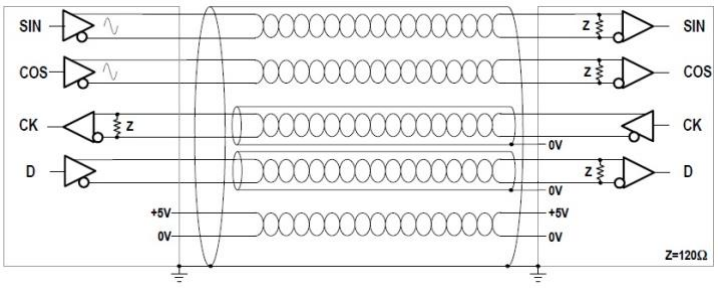
Electrical Characteristics

Analog Output + Serial Output
GVS 508 T absolute optical scale is supplied with a 10-wire shielded cable, ∅ = 6,2 mm, PUR external sheath, with low friction coefficient, oil-resistant and suitable for continuous movements.
Inside the cable, a further shield for the twisted pair of the digital signals (SSI-BiSS) is present.
Conductors section:
- power supply: 0.30 mm²
- signals: 0.10 mm²
-

Notice
The cable's bending radius should not be lower than 80 mm.

Analog Output + Serial Output 10-wire cable

The following output signals are available:



Signal	Conductor Color
+V	red
0V	blue
A	green
$\overline{A}$	orange
B	white
$\overline{B}$	Light-blue
CK	brown
$\overline{CK}$	yellow
D	pink
$\overline{D}$	grey
SCH	shield

Serial Output
GVS 508 T absolute optical scale is supplied with a 6-wire shielded cable, ∅ = 6,2 mm, PUR external sheath, with low friction coefficient, oil-resistant and suitable for continuous movements.

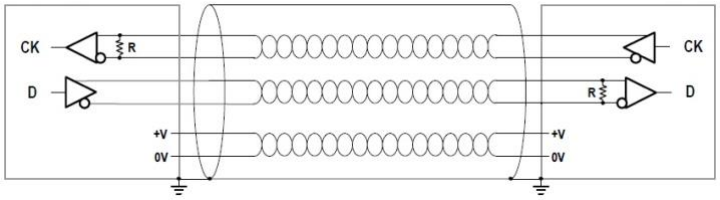
Conductors section:
- power supply: 0.35 mm²
- signals: 0.25 mm²

Notice
The cable's bending radius should not be lower than 70 mm.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

Serial Output 6-wire cable

The following output signals are available:



Signal	Conductor Color
+V	brown
0V	white
CK	green
$\overline{CK}$	yellow
D	pink
$\overline{D}$	grey
SCH	shield

Complying to DIN 47100.
Avoid locating the cable next to any device that may cause electromagnetic interferences (motors, solenoid valves, inverters).
If interferences are detected, act directly on the source of disturb using EMC filters.
If cable extensions are needed, it is necessary to use shielded cables with a section of at least 0.5 mm^2 for power supply and 0.25 mm^2 for signals.

The cable capacity should be: C ≤90 – 100 pF/m.

SSI

Cable length	≤10 m	≤20 m	≤50 m	
Clock frequency	1.2 MHz	0.4 MHz	0.2 MHz	

BiSS

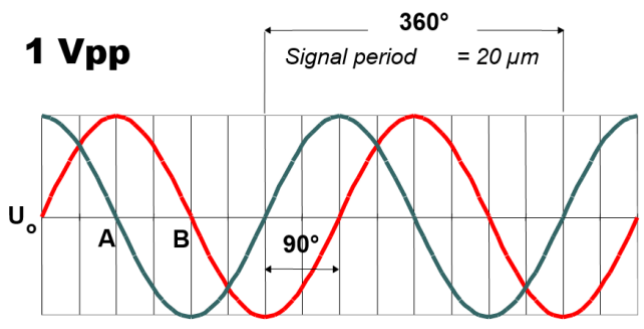
Cable length	≤6 m	≤10 m	≤20 m	≤50 m
Clock frequency	5 MHz	4 MHz	1 MHz	0.5 MHz

The scale is supplied with a standard 4-m long cable, suitable for continuous movements, but longer lengths can be required. Ensuring a minimum power supply of 5 V to the transducer, the maximum cable length can be extended to 70 m.

Notice
In case of cable extension, it is necessary to guarantee:
- the electrical connection between the body of the connectors and the cables shield
- a minimum power supply voltage of 5 V to the transducer

Output Signals

1 Vpp Inkremental signals version:

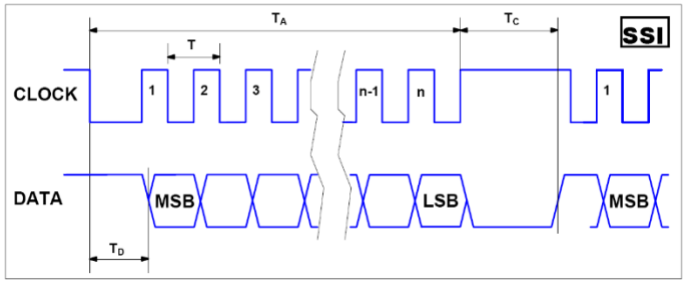


Signals	A, $\overline{A}$, B, $\overline{B}$
Signals amplitude	0.8 Vpp ÷ 1.2 Vpp typical 1 Vpp
Reference voltage U_0	≈ 2.3 V
A und B phase displacement	90° ± 10° electrical

Signals amplitude is referred to differential measurement on 120 Ω impedance with power supply voltage to the transducer of 5 V ± 10%.

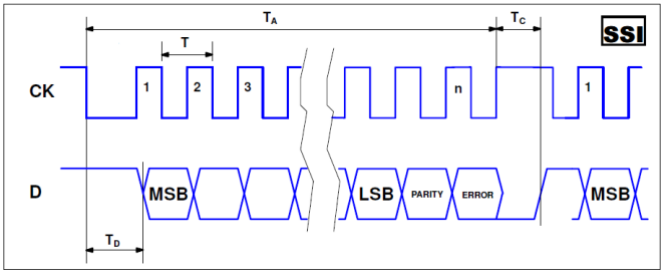
Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

Serial Signals SSI version:

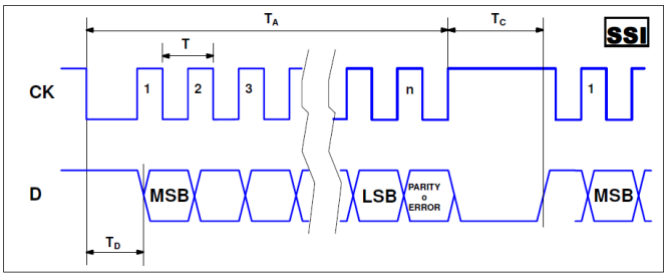


Interface	SSI (Synchronous Serial Interface) Binary - Gray
Signals level	EIA RS 422
Clock frequency	0.1 + 1.2 MHz* Duty cycle 50% ±10%
n	26 bit (resolution 1 – 0.1 µm) 30 bit (resolution 0.05 - 0.01 µm)
T_A	Clock sequence
T_C	max. 15 µs bei 100 KHz
T_D	max. 7 µs

* The maximum frequency is guaranteed with a cable length up to 10 m.



Interface	SSI (Synchronous Serial Interface) Binary
n	Position bit + Parity + Error



Interface	SSI (Synchronous Serial Interface) Binary
n	Position bit + Parity
	Position bit + Error

Parameters for SSI Protocol

Position bit

The value is transmitted with sign at 26 bit (for resolution 1 - 0.1 µm) or 30 bit (for resolution 0.05-0.01 µm)

Optional bit

Parity: an additional bit for odd parity or even parity is transmitted
Error: it signals an error in reading the absolute position

- Error bit = 1 absolute position ok
- Error bit = 0 absolute position wrong

Code

The code used for the transmission of the position is in binary or Gray format.
In case the Gray format is used, it is not possible to have the optional bit in the transmitted frame.

Refresh time

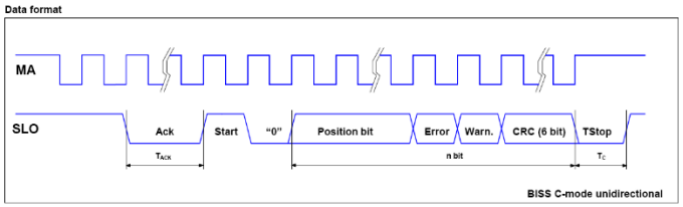
At the end of **T_c** period, the sensor provides a new position.
If a new position is not required, the sensor refreshes its position every 2 ms.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

SSI timeout
In case of error/interruption of the serial line, the sensor goes back in the "ready" status after a period of 400 µs.

Position error condition
In case of wrong absolute position, the status of the error bit, if enabled, is at 0 and a position value equal to 0 is transmitted. If the error bit is not enabled, the sensor will force the D signal low.

BiSS-C (unidirectional) version:



Interface	BiSS-C unidirectional
Signals level	EIA RS 485 / RS 422
Clock frequency	0.5 + 5 MHz* Duty cycle 50% ±10%
n	26 + 2 + 6 bit (resolution 1 - 0.1 µm) 32 + 2 + 6 bit (resolution 0.05 - 0.01 µm)
T_C	max. 20 µs
T_{ACK}	2 Clock

* The maximum frequency is guaranteed with a cable length up to 6 m.

Parameters for BiSS-C (unidirectional) Protocol

Position bit
The value is transmitted with sign at 26 bit (for resolution 1 - 0.1 µm) or at 32 bit (for resolution 0.05 – 0.01 µm).

Error: it signals an error in the absolute position reading.
- Error bit = 1 absolute position ok
- Error bit = 0 absolute position wrong

Warning
It signals a reading difficulty
- Warning bit = 1 reading ok
- Warning bit = 0 difficulty in reading

Aktualisierungszeit
At the End of **T_c** period, the scale provides a new position.
If a new position is not required, the sensor refreshes its position every 2 ms.

BiSS timeout
In case of error/interruption of the serial line, the scale goes back in the "ready" status after a period of 100 µs.

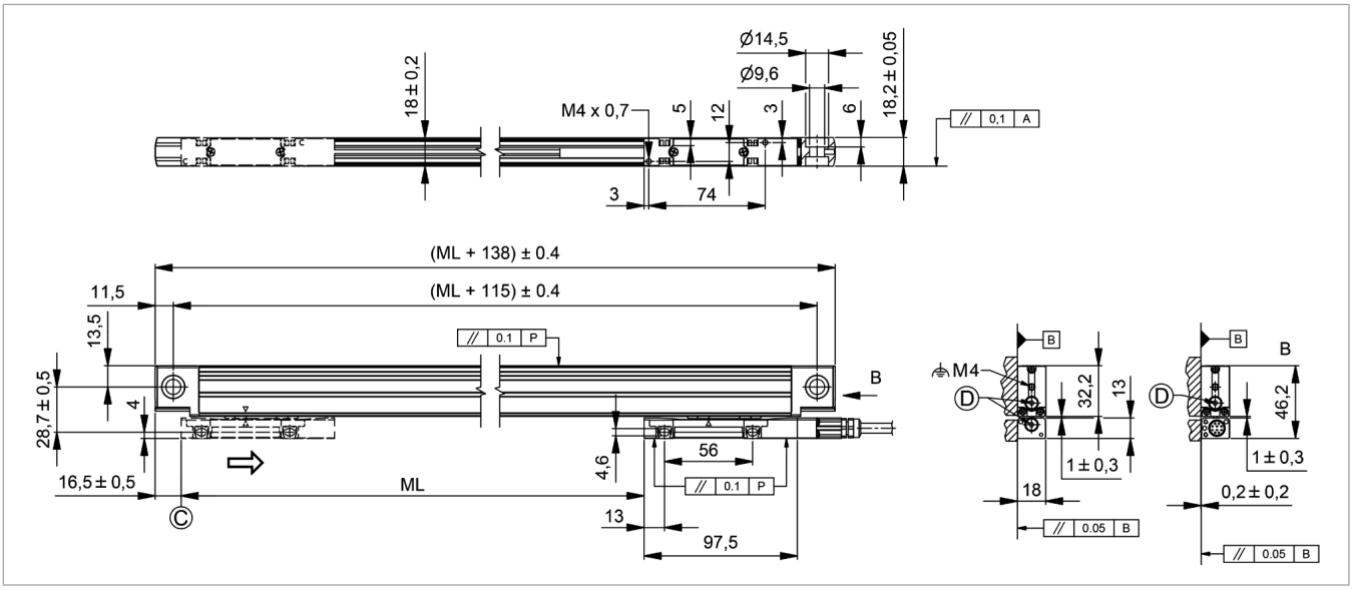
CRC6 polynomial
CRC at 6 bit inverted, with polynomial 0x43, MSB as first bit of the frame.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

Mechanical Characteristics

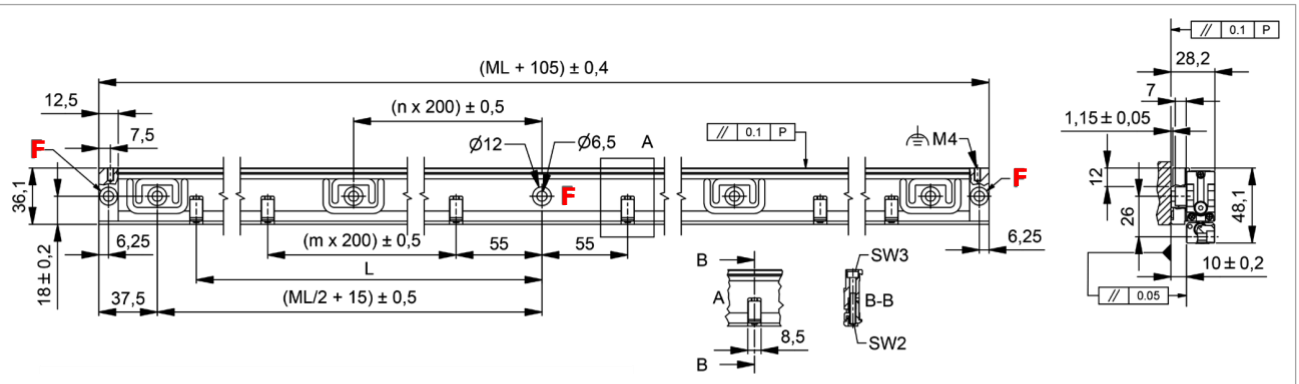
- PROFILE made of anodized aluminum.
- Dimensions 32.2 x 18 mm.
- SPRING SYSTEM for misalignment compensation and self-correction of mechanical hysteresis.
- Non-extendible SEALING LIPS, along the sliding side of the reader head.
- Pressurizable READER HEAD, consisting of tie rod and reading block, with fully-protected place for electronic boards.
- READING BLOCK sliding through ball bearings.
- Die-cast TIE ROD, with nickel surface treatment.
- Absolute glass GRATING, placed in the scale housing.
- Elastomeric GASKETS which allow to reproduce the full protection in mechanical joints (in case of disassembling).
- SUPPORTING BAR for measuring lengths higher than 1.340 mm (optional for lower measuring lengths).
- Full possibility to disassemble and reassemble it.
- Possibility of direct service.

Dimensions (standard mounting)

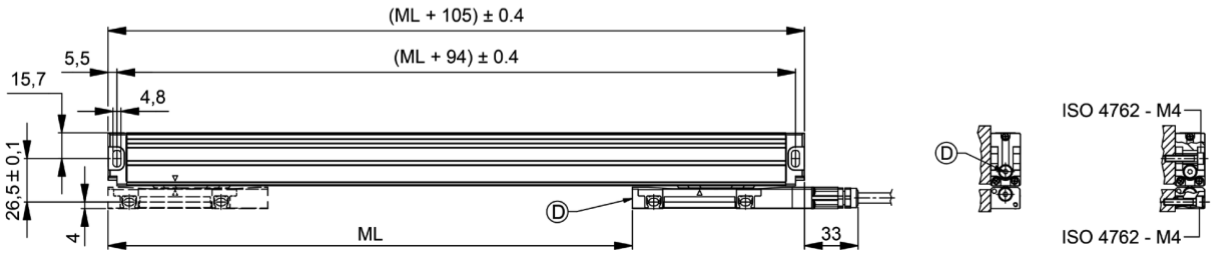


Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

Dimensions (mounting with supporting bar)

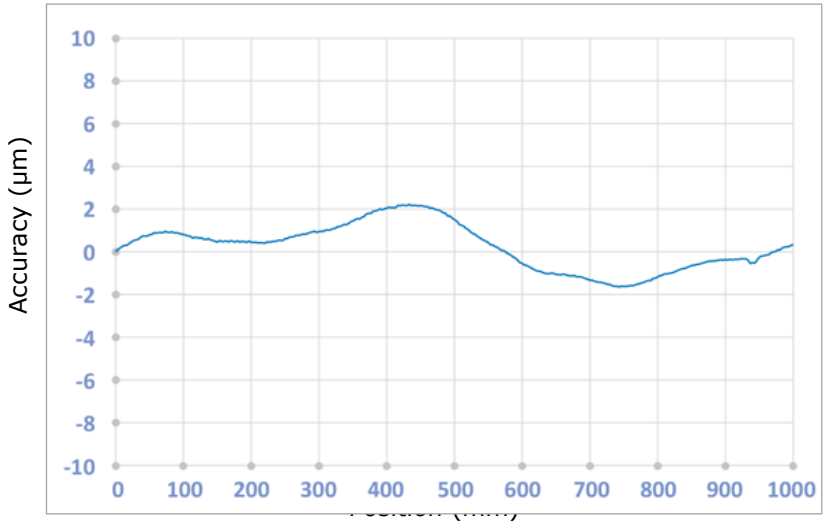


The supporting bar fixing determines the position of the FEP.
Use the fixing hole **F** (central or lateral) that makes the FEPs of the scale and its supporting bar coherent.



ML = Measuring length, P = Machine guide, C = Measuring length start, ML (20 mm absolute),
D = Compressed air inlet M5, Dimensions in mm

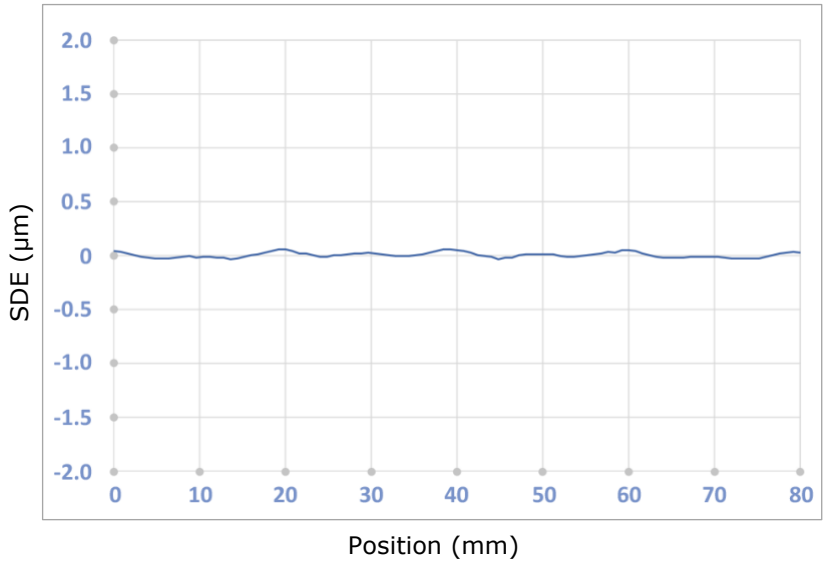
Accuracy



Accuracy graph: deviation between the value measured by the encoder and the value measured by the reference system.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

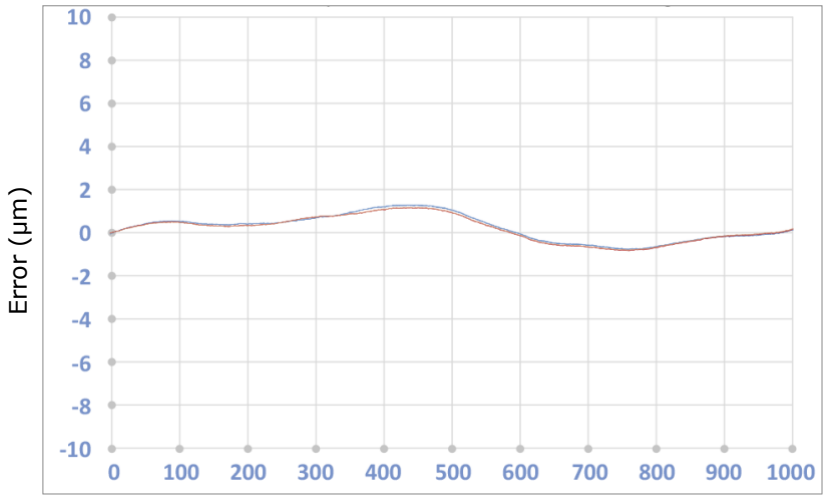
Interpolation - SDE



SDE (sub-division error) graph:
accuracy of the interpolation device within the single grating pitch.

Repeatability

☐ Movement in positive direction ☐ Movement in negative direction



Repeatability graph obtained by carrying out the measurements several times in both directions of advancement.

- Unidirectional repeatability: measurement error detected without inverting the movement direction of the encoder.
- Hysteresis: difference in the measure due to the inversion of the encoder movement direction.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

The graphs show tests carried out in a metrological room under controlled climatic conditions:
T= 20 °C ± 0.1 °C and R.H.= 45 ÷ 55%. The reference system for the comparison of position measurements is interferometric with 0.001 µm resolution and equipped with an environmental compensation device.

INNOVATIVE SYSTEM FEP
FixedExpansionPoint

GVS 508 is supplied with a Fixed Expansion Point (FEP) positioned in the middle (standard), on the left (LT) or on the right (RT). Based on the application, the customer can determine the linear thermal expansion direction, so as to maximize the machining accuracy and repeatability even in the presence of significant temperature changes. In case of a lateral FEP, the scale is provided with a special elastic end cap on the opposite side, that leaves the scale free to expand in the predetermined correct direction. Also in case of mounting with supporting bar, it is possible to determine the central or lateral position of the FEP through its specifically-designed elastic fixing.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

Ordering Code

Model	GVS508	-	T1A	-	2040	-	05V	-	S0	-	V	-	M 4.0/S	-	SC	-		-

Scale type, resolution

T1	= 1 µm
T01	= 0,1 µm
T005	= 0,05 µm
T001	= 0,01 µm
A	= absolute

Measuring length [mm]

2.040	= max. Measuring length*

Power supply

05V	= 5 VDC

Output signal

S0	= SSI programmable
S1	= SSI binary
S2	= binary + even parity
S3	= binary + odd parity
S4	= SSI binary + error
S5	= SSI binary + even parity + error
S6	= SSI binary + odd parity + error
S7	= SSI gray
B1	= BiSS-C binary

Incremental signal

V	= +1Vpp
	= no cod. (no incremental signal)

Cable length

Mxx	= length in meter
M4.0	= 4 m (standard)
M50	= 50 m

Cable type

S	= Pur cable (6-wire: only serial), (10-wire: serial and analog)

Connector, wiring

SC	= without connector, open cable end
Cxx	= progressive

FEP (fixed expansion point)

	= no code. central FEP (standard)
RT	= right FEP
LT	= left FEP

Special, pressurization

	= no code. (standard)
SPxx	= special (on request)
PR	= pressurized

* For measuring lengths higher than 1.340 mm it is necessary to use the supporting bar (optional for lower measuring lengths).

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de

Ordering code accessories (supporting bar)

Model	SB50	-	2040

SB50 = SB50

Measuring length [mm]
2.040 = max. Measuring length*
(look to technical datas)

* For measuring lengths higher than 1.340 mm it is necessary to use the supporting bar (optional for lower measuring lengths).

Accessories (supporting bar)

Without prior notice, the products may be subject to modifications that the Manufacturer reserves to introduce as deemed necessary for their improvement.

Willtec Messtechnik GmbH & Co. KG, Eschenweg 4, 79232 March-Hugstetten,
Fon: +497665/93465-0 Fax: +497665/93465-22
info@willtec.de www.willtec.de