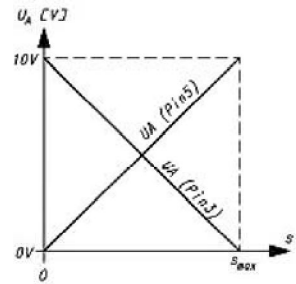
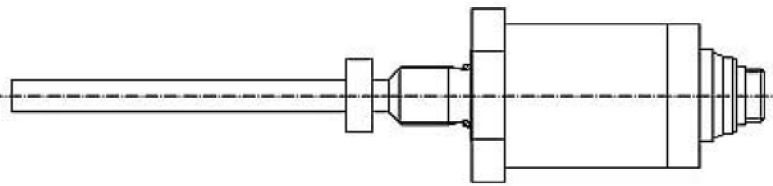
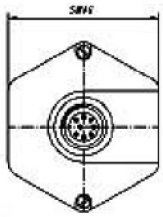


Electronic accessories



BTL5 – with analogue interface (BTL 5-A11-M....-B-S32)

Data sheet Balluff position measuring system



Technical data

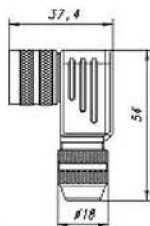
Output signal	0...10V and 10...0V (rising and falling)
Output current max.	10 mA
Load resistance	-
System resolution	0,33 mV
Repeatability	<10µm
Hysteresis	<5µm
max. linearity deviation	±100µm up to L=500mm; 0,02% FS at L>500mm
Measured value rate	2KHz
Housing material	anodised aluminium
Flange and tube material	stainless steel 1.4301
Pressure-resistant up to	60 MPa
Operating voltage	24VDC ±20% (stabilised)
Residual ripple	<0,5Vss
Current consumption	<150 mA
Reverse polarity protection	yes
Overvoltage protection	Transzorb protection diodes
Temperature coefficient of the complete system	150µV/°C+(5ppm/°C×PxU/L)]x(T2-T1)
Operating temperature	-40...+85°C
Storage temperature	-40...+100°C
Static electricity (ESD)	IEC 1000-4-2 severity level 3
Electromagnetic fields (RFI)	IEC 1000-4-3 severity level 3
Fast transient disturbances (BURST)	IEC 1000-4-4 severity level 4
Conducted disturbances	IEC 1000-4-6 severity level 3
Radio interference emission	EN 55011 group 1, class A
Shock load	100g/ 6ms to IEC68-2-27
Vibration	12g, 10...2000Hz to IEC68-2-6
Dielectric strength	500 V (ground to housing)
Traverse speed of the position transmitter	any
Protection class to IEC	IP 67 (with screwed connector)

Connector (optional)

straight connector

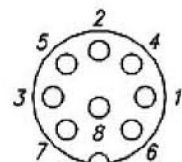


angled connector



Connector pin assignment

Terminal assignment	Pin	Colour
Output signals	1	YE -
	2	GY 0V output
	3	PK 10...0V
	4	- -
Operating voltage	5	GN 0...10V
	6	BU GND
	7	BN +24V DC
	8	WH (GND)



BKS connection, view of the solder terminal end of the socket body of the connector

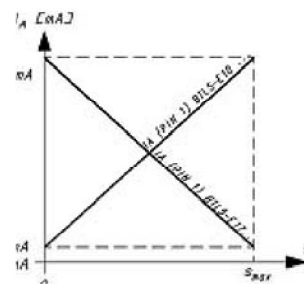
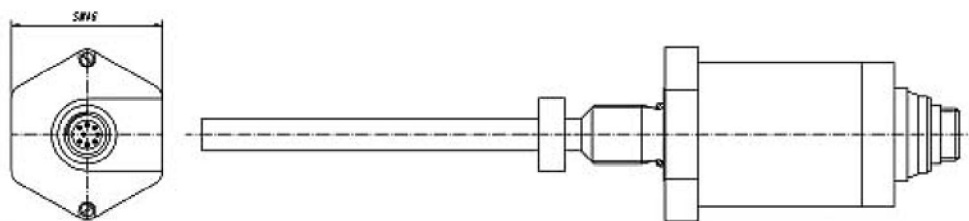
Code number for the model code

Manufacturer of the position measuring system	1
Type of the position measuring system	1

Other position measuring systems from this manufacturer are also available on request!

BTL5 – with analogue interface (BTL 5-E10-M....-B-S32)

Data sheet Balluff position measuring system



Technical data

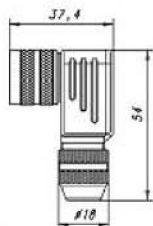
Output signal	4...20mA
Load resistance	<500Ω
System resolution	0,35μA
Repeatability	<10μm
Hysteresis	<5μm
max. linearity deviation	±100μm up to L=500mm; 0,02% FS at L>500mm
Measured value rate	2KHz
Housing material	anodised aluminium
Flange and tube material	stainless steel 1.4301
Pressure-resistant up to	60 MPa
Operating voltage	24VDC ±20% (stabilised)
Residual ripple	<0,5Vss
Current consumption	<150 mA
Reverse polarity protection	yes
Overvoltage protection	Transzorb protection diodes
Temperature coefficient of the complete system	$[150\mu V/^{\circ}C + (5ppm/^{\circ}C \times P \times U/L)] \times (T_2 - T_1)$
Operating temperature	-40...+85°C
Storage temperature	-40...+100°C
Static electricity (ESD)	IEC 1000-4-2 severity level 3
Electromagnetic fields (RFI)	IEC 1000-4-3 severity level 3
Fast transient disturbances (BURST)	IEC 1000-4-4 severity level 4
Conducted disturbances	IEC 1000-4-6 severity level 3
Radio interference emission	EN 55011 group 1, class A
Shock load	100g/ 6ms to IEC68-2-27
Vibration	12g, 10...2000Hz to IEC68-2-6
Dielectric strength	500 V (ground to housing)
Traverse speed of the position transmitter	any
Protection class to IEC	IP 67 (with screwed connector)

Connector (optional)

straight connector

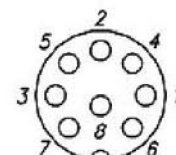


angled connector



Connector pin assignment

Terminal assignment	Pin	Colour	
Output signals	1	YE	4...20 mA
	2	GY	0V output
	3	PK	-
	4	-	-
Operating voltage	5	GN	-
	6	BU	GND
	7	BN	+24V DC
	8	WH	(GND)



BKS connection, view of the solder terminal end of the socket body of the connector

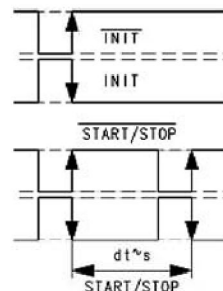
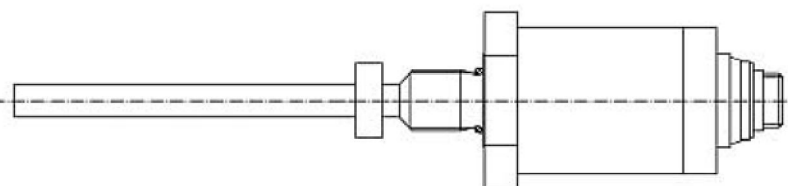
Code number for the model code

Manufacturer of the position measuring system	1
Type of the position measuring system	2

Other position measuring systems from this manufacturer are also available on request!

BTL5 – with digital pulse interface (BTL 5-P1-M....-B-S32)

Data sheet START/STOP

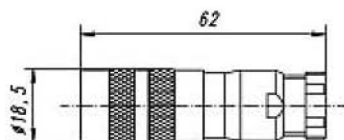


Technical data

Output signal	pulse P
System resolution	$\leq 2\mu\text{m}$ (depending on evaluation)
Repeatability	$< 6\mu\text{m}$ (hysteresis + resolution)
Hysteresis	$< 4\mu\text{m}$
max. linearity deviation	$\pm 100\mu\text{m}$ up to $L=500\text{mm}$; $0,02\%$ FS at $L>500\text{mm}$
Measured value rate	$F_{\text{standard}}=1\text{kHz} \leq 1400\text{mm}$
Housing material	anodised aluminium
Flange and tube material	stainless steel 1.4301
Pressure-resistant up to	60 MPa
Operating voltage	24VDC $\pm 20\%$ (stabilised)
Residual ripple	$< 0,5\text{Vss}$
Current consumption	$< 90\text{ mA}$
Reverse polarity protection	yes
Overvoltage protection	Transzorb protection diodes
Temperature coefficient of the complete system	$(6\mu\text{m} \pm 5\text{ppm} \times L)/^\circ\text{C}$
Operating temperature	$-40 \dots +85^\circ\text{C}$
Storage temperature	$-40 \dots +100^\circ\text{C}$
Static electricity (ESD)	IEC 1000-4-2 severity level 3
Electromagnetic fields (RFI)	IEC 1000-4-3 severity level 3
Fast transient disturbances (BURST)	IEC 1000-4-4 severity level 4
Conducted disturbances	IEC 1000-4-6 severity level 3
Radio interference emission	EN 55011 group 1, class A
Shock load	100g/ 6ms to IEC68-2-27
Vibration	12g, 10...2000Hz to IEC68-2-6
Dielectric strength	500 V (ground to housing)
Traverse speed of the position transmitter	any
Protection class to IEC	IP 67 (with screwed connector)

Connector

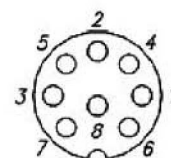
straight connector



Angled connector for this position measuring system on request

Connector pin assignment

Terminal assignment	Pin	Colour	
Output signals	1	YE	I_A INIT
	2	GY	O_A Start/Stop
	3	PK	I_B INIT
	4	-	-
Operating voltage	5	GN	O_B Start/Stop
	6	BU	GND
	7	BN	+24V DC
	8	WH	(GND)



BKS connection, view of the solder terminal end of the socket body of the connector

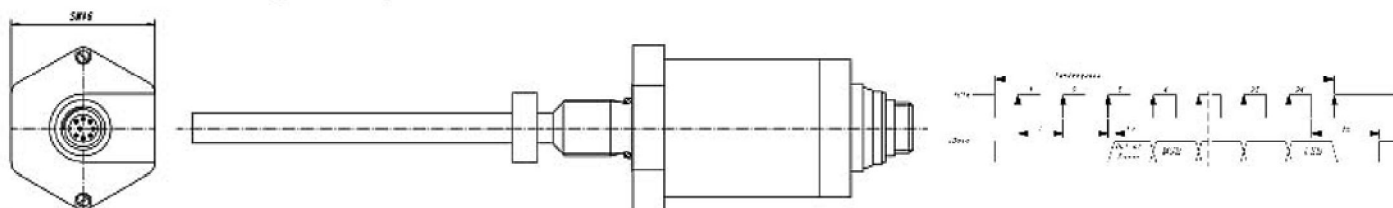
Code number for the model code

Manufacturer of the position measuring system	1
Type of the position measuring system	3

Other position measuring systems from this manufacturer are also available on request!

BTL5 – with synchronous serial interface (BTL 5-S113-M....-B-S32)

Data sheet Balluff position measuring system



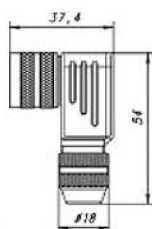
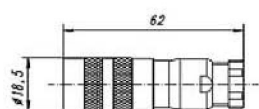
Technical data

Output signal	synchronous serial
Coding	Gray code rising (24 bit)
System resolution	10µm
Repeatability	10µm
max. linearity deviation	±30 µm independent of length
Measured value rate	2KHz
Housing material	anodised aluminium
Flange and tube material	stainless steel 1.4301
Pressure-resistant up to	60 MPa
Operating voltage	24VDC ±20% (stabilised)
Residual ripple	<0,5Vss
Current consumption	<80 mA
Reverse polarity protection	yes
Overvoltage protection	Transzorb protection diodes
Temperature coefficient of the complete system	(6µm±5ppm×L)/°C
Operating temperature	-40...+85°C
Storage temperature	-40...+100°C
Static electricity (ESD)	IEC 1000-4-2 severity level 3
Electromagnetic fields (RFI)	IEC 1000-4-3 severity level 3
Fast transient disturbances (BURST)	IEC 1000-4-4 severity level 4
Conducted disturbances	IEC 1000-4-6 severity level 3
Radio interference emission	EN 55011 group 1, class A
Shock load	100g/ 6ms to IEC68-2-27
Vibration	12g, 10...2000Hz to IEC68-2-6
Dielectric strength	500 V (ground to housing)
Traverse speed of the position transmitter	any
Protection class to IEC	IP 67 (with screwed connector)

Connector (optional)

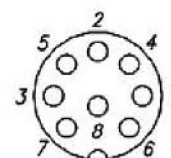
straight connector

angled connector



Connector pin assignment

Terminal assignment	Pin	Colour
Output signals	1	YE +Clk
	2	GY +Data
	3	PK -Clk
	4	-
Operating voltage	5	GN -Data
	6	BU GND
	7	BN +24V DC
	8	WH must remain free



BKS connection, view of the solder terminal end of the socket body of the connector

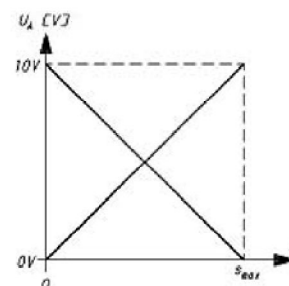
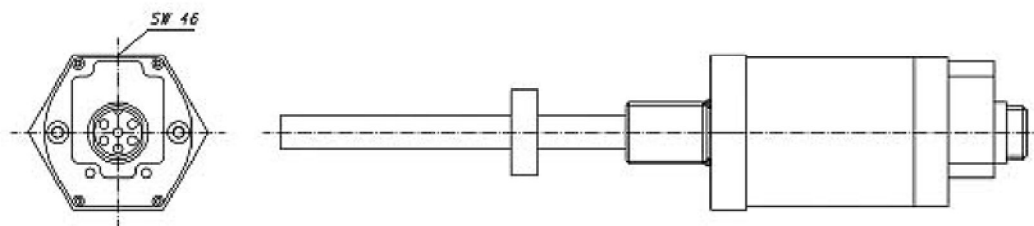
Code number for the model code

Manufacturer of the position measuring system	1
Type of the position measuring system	4

Other position measuring systems from this manufacturer are also available on request!

RH – with analogue interface (RH-M-...M-D60-1-V01)

Data sheet MTS position measuring system



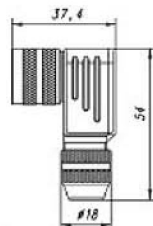
Technical data

Output	0...10 VDC – input resistance of the controller: $\geq 5 \text{ k}\Omega^*$
Adjustment of zero and end point	100% of the measuring range
Resolution	10 μm or 16 bit
Linearity tolerance (uncorrected)	$< \pm 0,02 \text{ \% F.S.}$ (minimum $\pm 50 \text{ }\mu\text{m}$) independent of external temperature influences
Repeatability	$< \pm 0,001 \text{ \% F.S.}$ (Minimum $\pm 2,5 \mu\text{m}$)
Hysteresis	$< 4 \text{ }\mu\text{m}$
Measuring rate	1000 Hz typical at the output (10 KHz internal)
Supply voltage	24 VDC (+20%/-15%)
Current consumption	100 mA typical
Residual ripple	$< 1 \text{ \% s-s}$
Temperature coefficient	$< 40 \text{ ppm/}^\circ\text{C}$
Dielectric strength	500 V (0 V to housing)
Operating temperature	-40...+75°C
EMC test	DIN IEC 801-4/ severity level 4/ CE tested
Shock test	100g (single shock) to IEC standard 68-2-27
Vibration test	5g/ 10...150Hz to 68-2-6
Mounting position	any
Traverse speed of the position transmitter	any
Housing material	die-cast aluminium housing
Scale with flange	stainless steel
Pressure resistance	35 MPa (53 MPa peak pressure)
Protection class to IEC	IP 67 (with screwed connector)

Connector (optional)

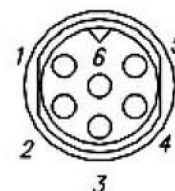
straight connector

angled connector



Connector pin assignment

Pin	Cable	Function
1	grey	0...10V
2	pink	DC Ground
3	yellow	10...0
4	green	DC Ground-
5	brown	+24 VDC (-15%/+20%)
6	white	DC Ground (0V)



Device connector
(view of plug side)

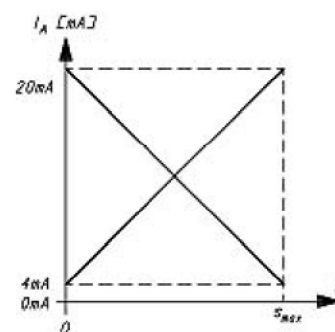
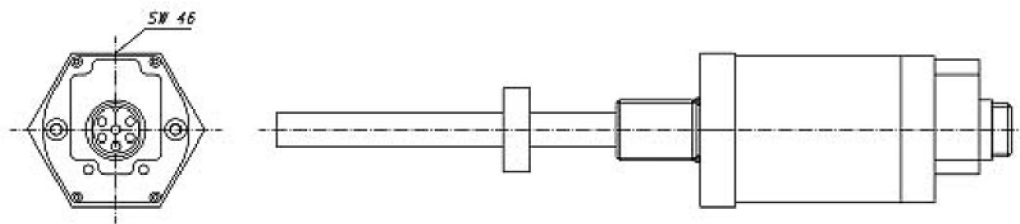
Code number for the model code

Manufacturer of the position measuring system	3
Type of the position measuring system	1

Other position measuring systems from this manufacturer are also available on request!

RH – with analogue interface (RH-M-....M-D60-1-A01)

Data sheet MTS position measuring system



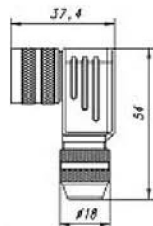
Technical data

Output	4...20 mA – load: min. 0 Ω / max. 500 Ω *
Adjustment of zero and end point	100% of the measuring range
Resolution	10 μ m or 16 bit
Linearity tolerance (uncorrected)	< $\pm 0,02$ % F.S. (minimum ± 50 μ m) independent of external temperature influences
Repeatability	< $\pm 0,001$ % F.S. (Minimum $\pm 2,5$ μ m)
Hysteresis	< 4 μ m
Measuring rate	1000 Hz typical at the output (10 KHz internal)
Supply voltage	24 VDC (+20%/ -15%)
Current consumption	100 mA typical
Residual ripple	< 1% s-s
Temperature coefficient	< 40 ppm/ $^{\circ}$ C
Dielectric strength	500 V (0 V to housing)
Operating temperature	-40...+75 $^{\circ}$ C
EMC test	DIN IEC 801-4/ severity level 4/ CE tested
Shock test	100g (single shock) to IEC standard 68-2-27
Vibration test	5g/ 10...150Hz to 68-2-6
Mounting position	any
Traverse speed of the position transmitter	any
Housing material	die-cast aluminium housing
Scale with flange	stainless steel
Pressure resistance	35 MPa (53 MPa peak pressure)
Protection class to IEC	IP 67 (with screwed connector)

Connector (optional)

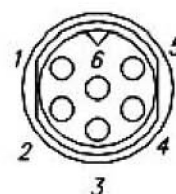
straight connector

angled connector



Connector pin assignment

Pin	Cable	Function
1	grey	4...20 mA
2	pink	DC Ground
3	yellow	20...4 mA
4	green	DC Ground-
5	brown	+24 VDC (-15%/+20%)
6	white	DC Ground (0V)



Device connector
(view of plug side)

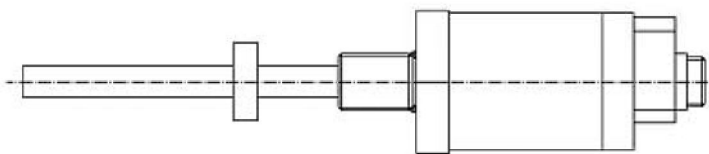
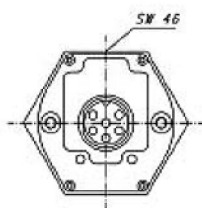
Code number for the model code

Manufacturer of the position measuring system	3
Type of the position measuring system	2

Other position measuring systems from this manufacturer are also available on request!

RH – with SSI (synchronous serial interface) interface (RH-M-...M-D70-1-S2G2100)

Data sheet MTS position measuring system



Pulse diagram



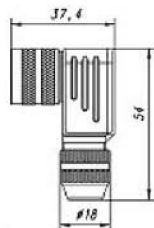
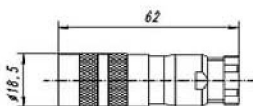
Technical data

Data length	24 Bit*
Coding	Gray*
Resolution	0,01mm*
Measuring direction	forward*
Linearity tolerance (uncorrected)	$< \pm 0,01$ % F.S. (minimum $\pm$ / $\pm$ future) independent of external temperature influences
Repeatability	$< \pm 0,001$ % F.S. (Minimum $\pm 2,5\mu\text{m}$)
Hysteresis	$< 4 \mu\text{m}$
Supply voltage	24 VDC (+20%/-15%)
Current consumption	70 mA typical
Residual ripple	$< 1\%$ s-s
Temperature coefficient	< 15 ppm/°C
Dielectric strength	500 V (0 V to housing)
Operating temperature	-40...+75°C
EMC test	DIN IEC 801-4/ severity level 4/ CE tested
Shock test	100g (single shock) to IEC standard 68-2-27
Vibration test	5g/ 10...150Hz to 68-2-6
Mounting position	any
Traverse speed of the position transmitter	any
Housing material	die-cast aluminium housing
Scale with flange	stainless steel
Pressure resistance	35 MPa (53 MPa peak pressure)
Protection class to IEC	IP 67 (with screwed connector)

Connector (optional)

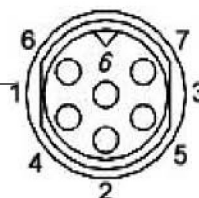
straight connector

angled connector



Connector pin assignment

Pin	Cable	Function
1	grey	Data (-)
2	pink	Data (+)
3	yellow	Clock (+)
4	green	Clock (+)
5	brown	+24 VDC
6	white	0V
7		do not connect



Device connector
(view of plug side)

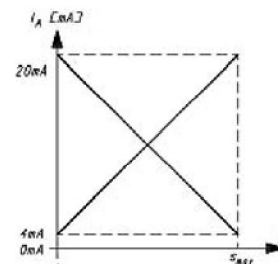
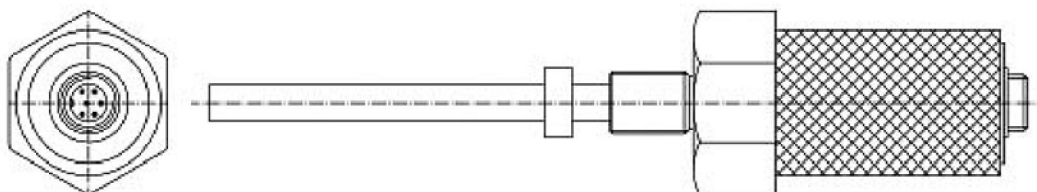
Code number for the model code

Manufacturer of the position measuring system	3
Type of the position measuring system	3

Other position measuring systems from this manufacturer are also available on request!

LA – with analogue interface (characteristic adjustable 0 mA)

Data sheet TR position measuring system

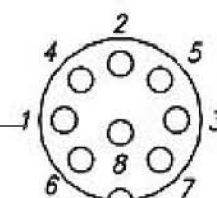


Technical data

Output signal	0...20 mA (rising from flange)
Load resistance	max. 500Ω
Resolution	max. 0,1 mm
Repeatability	≤0,01mm
Hysteresis	<0,1mm
max. linearity deviation	<0,05% of the measuring length
Material of the measuring rod	Cr/Ni alloy
Magnetic interference field (measured at the measuring plane)	< 3 mT (milli Tesla)
Pressure-resistant up to	60 MPa
Operating voltage	24VDC ±10%
Residual ripple	+/- 5% of the operating voltage
Power consumption (without load)	< 4 Watt
Temperature coefficient	< 5 μm/°C
Operating temperature range	0...+70°C
Storage temperature range	-30...+80°C
Vibration load (sine 50-2000Hz) to DIN IEC68-2-27	≤100 m/s ² (10g)
Shock load (11 ms) to DIN IEC 68-2-27	≤1000 m/s ² (100g)
EMC	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Traverse speed of the position transmitter	any
Relative humidity	98 % (no condensation)
Protection class	IP 65 (only for correctly screwed and wired connectors)

Connector pin assignment

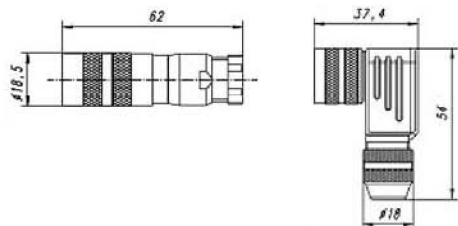
Output	Pin
free	1
analogue output 0V	2
Input / start point When applying high or > 8 V the new zero point is adopted	3
Input / end point When applying high or > 8 V the new end point is adopted	4
Analog I: 0-20 mA	5
0V, GND	6
19...27 V	7
free	8



BKS connection
rear view of
the connector

Connector (optional)

straight connector angled connector



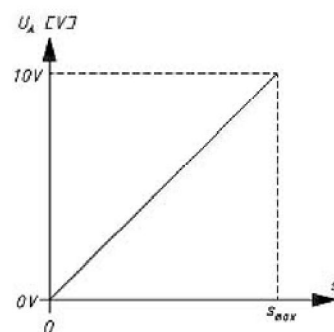
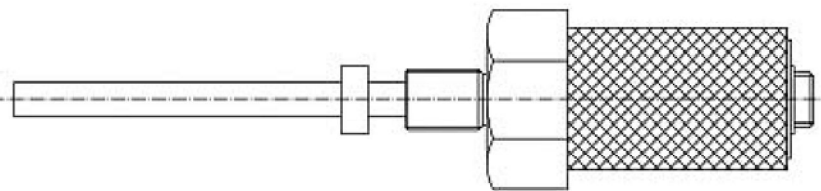
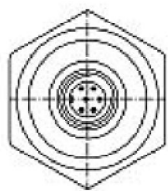
Code number for the model code

Manufacturer of the position measuring system	6
Type of the position measuring system	4

Other position measuring systems from this manufacturer are also available on request!

LA – with analogue interface (characteristic adjustable 0 V)

Data sheet TR position measuring system



Technical data

Output signal	0...10V (rising from flange)
Load resistance	min. 680 Ω
Resolution	max. 0,1 mm
Repeatability	$\leq 0,01$ mm
Hysteresis	$< 0,1$ mm
max. linearity deviation	$< 0,05\%$ of the measuring length
Material of the measuring rod	Cr/Ni alloy
Magnetic interference field (measured at the measuring plane)	< 3 mT (milli Tesla)
Pressure-resistant up to	600 bar static
Operating voltage	24VDC $\pm 10\%$
Residual ripple	$\pm 5\%$ of the operating voltage
Power consumption (without load)	< 4 Watt
Temperature coefficient	$< 5 \mu\text{m}/^\circ\text{C}$
Operating temperature range	0...+70°C
Storage temperature range	-30...+80°C
Vibration load (sine 50-2000Hz) to DIN IEC68-2-26	$\leq 100 \text{ m/s}^2$ (10g)
Shock load (11 ms) to DIN IEC 68-2-27	$\leq 1000 \text{ m/s}^2$ (100g)
EMC	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Traverse speed of the position transmitter	any
Relative humidity	98 % (no condensation)
Protection class	IP 65 (only for correctly screwed and wired connectors)

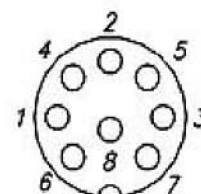
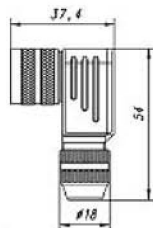
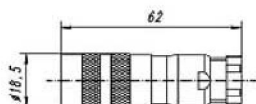
Connector pin assignment

Output	Pin
free	1
analogue output 0V	2
Input / start point	
When applying high or > 8 V the new zero point is adopted	3
Input / end point	
When applying high or > 8 V the new end point is adopted	4
Analogue I: 0-10 V	5
0V, GND	6
19...27 V	7
free	8

Connector (optional)

straight connector

angled connector



BKS connection
rear view of
the connector

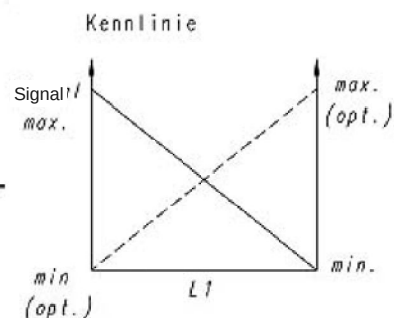
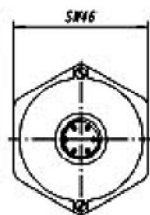
Code number for the model code

Manufacturer of the position measuring system	6
Type of the position measuring system	3

Other position measuring systems from this manufacturer are also available on request!

TLI – contactless measuring principle PsP (TLI-....-2-111-101)

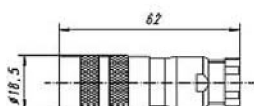
Data sheet Novotechnik position measuring system



Technical data

Electrical data												
Electrically defined range (stroke)	50	100	150	200	250	300	400	500	600	800	1000	mm
Independent linearity	0,2	0,2	0,2	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	±%
Repeatability	12,5	15	17,5	20	22,5	25	30	35	40	50	60	µm
Repeat accuracy	2,5	5	7,5	10	12,5	15	20	25	30	40	50	µm
Supply voltage Ub	24 (18VDC...30VDC, ripple max. 1 VDC) VDC											
Output signal	0,1...10 (load > 10 kΩ) VDC											
Characteristic curve	rising characteristic from flange											
Hysteresis	10											µm
Gradient tolerance	0,3											±%
Temperature coefficient	< 50											ppm/°K
Current consumption	max. 40 (without signal current) mA											
Overvoltage protection	40 (max.100 ms)											VDC
Mechanical data												
Actuating force	max.0,1											N
Actuating speed	max. 10 (mechanical)											ms ⁻¹
Actuating acceleration	max. 300											ms ⁻²
Radial load on probe	max. 0,5											N
Pressure resistance	max. 35 MPa (pressure peaks max. 60 MPa) MPa											
Impact resistance	5 (max. 50 impacts) N											
Operating conditions												
Temperature range	-40...+80											°C
Operating humidity range	0...3 (H ₂ O in Öl)											% R. H.
Shock to DIN EC68T2-27	50 (11 ms)											g
Vibration test to DIN IEC 68-2-6	6 (electrical function 10Hz-150Hz, mechanical function 10 Hz – 2000 Hz)											g
Service life	200 000											Km
Protection class	IP 65 (DIN 40050/ IEC 529)											

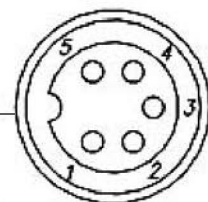
Connector (optional)
straight connector



Angled connector for this position measuring system available on request

Connector pin assignment

Terminal assignment	Pin
Ground	1
Current output	2
Supply voltage	3
free	4
Voltage output	5



Rear view of the terminal end of the socket body of the position measuring system

Connect the cable screen to earth at the electronics end, not at the sensor end.

Code number for the model code

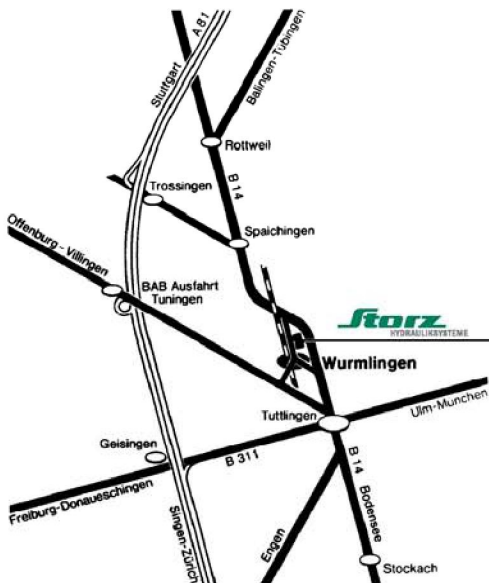
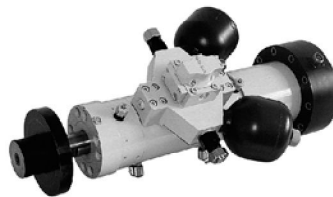
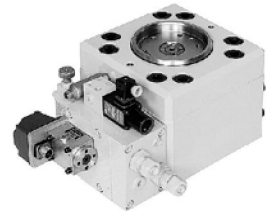
Manufacturer of the position measuring system	7
Type of the position measuring system	1

Other position measuring systems from this manufacturer are also available on request!

Product range



Hydraulic cylinders to DIN/ISO
Hydraulic standard cylinders
Hydraulic telescopic cylinders
Hydraulic cylinders with position measuring systems
Test-machine cylinders
Special cylinders for all applications
Standardized mounting parts
Hydraulic power units and components
Plant engineering



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