



## DLS SERIES

# DRAW WIRE LINEAR SENSORS

# INNOVATION IN MOTION

The DLS series of draw-wire linear position sensors are a cost effective way to measure linear displacements up to 5000mm in the most demanding industrial environments. Using proven potentiometer and encoder technologies to provide analog or digital signals proportional to the displacement of a retractable steel wire, these sensors are ideally suited to a diverse range of applications where only minimal space is available. Applications include fork lifts, elevators, cranes, irrigation gates, automotive crash testing and airframe structural testing.

## The operating principle

Draw-wire linear position sensors measure the linear movement of a component via a highly flexible steel wire which is wound onto a drum by a durable spring-driven motor. The winding drum is linked axially to a multi-turn potentiometer, incremental encoder or absolute encoder. A linear movement is transformed into a rotation by the draw-wire principle and converted into a proportional analog signal or to countable increments. Versions with integral electronics produce voltage and current signals at the output which are proportional to the displacement. Draw-wire sensors are simple in application and represent a very economical investment. There is a significant advantage in that, despite their compact installation size, the sensors can cover large measurement ranges.



## Features

- 100 to 5000mm measuring range
- Rugged, compact design
  - Profiled enclosure
- Analogue and digital outputs
  - Protected to IP65
  - CE Approved

## Benefits

- short to long range capability from a minimal sensor footprint
- Suitable for a wide range of industrial applications
- Easy and flexible installation
- Choice of interface signals
- Suited to hostile conditions
- Confidence in EMC performance



### EMC Directive 89/336/EEC

The products detailed in this document have been tested to the requirements of EN50081-1 (Emissions) and EN 50082-2 (Immunity).



### Quality Assurance

Penny + Giles are accredited to BS EN ISO9001:2000. Quality is at the heart of all our systems ensuring the reliability of our products from initial design to final despatch.

Certificate No. LRQ0924881

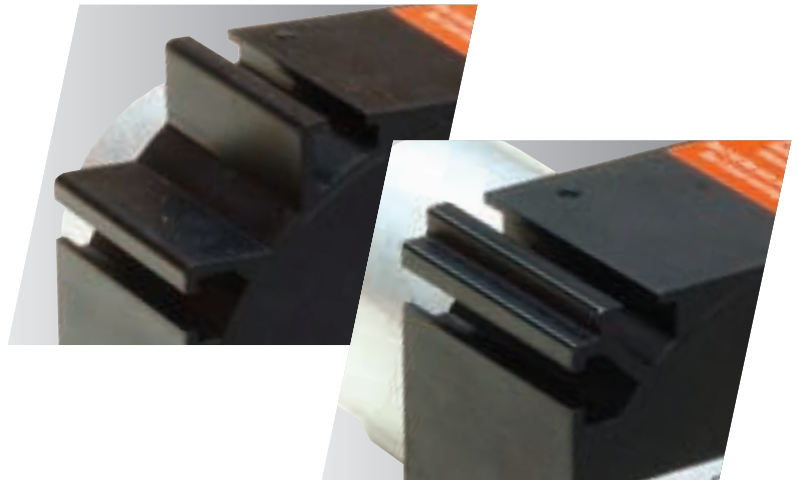
# DLS DRAW-WIRE LINEAR SENSORS

## Choice of models

The DLS linear sensors cover a measuring range from 100mm to 5000mm in three models. The P60 offers 100 to 1500mm range with a choice of three analogue and two digital output types. Models P96 and P115 cover five measuring ranges from 2000mm to 5000mm and offer three analogue and one digital output types.

## Choice of mountings

The DLS linear sensors are housed in a high strength aluminium profile that has mounting grooves incorporated in four sides. These give the user a choice of using captive nuts with bolts to mount the sensor body, or to use optional mounting clamps from the range of accessories offered. The draw-wire can be attached to the moving component by a simple hook, or alternative magnetic holders, guide pulleys and wire extensions can be supplied to aid installation. The guide pulleys allow the draw-wire to be routed around obstacles in difficult installations.



## Integrated signal conditioning

Users can save space, time and money by opting to use the versions that include integrated signal conditioning. The voltage (U) option allows the sensor to operate from 14 to 27Vdc supply and provides 0 to 10Vdc output. The current (I) option includes integrated electronics to provide a 2-wire 4 to 20mA output operating from a 14 to 27Vdc supply. Both voltage and current output options include user adjustable controls for zero and gain to aid installation and set-up.



**DLS Series P60**

Page 4

- Measuring range to 1500mm
- 60mm square housing
- Choice of potentiometer, voltage, current or encoder outputs
- Protected to IP65



**DLS Series P96**

Page 6

- Measuring range 2000 to 3000mm
- 96mm square housing
- Choice of potentiometer, voltage, current or encoder outputs
- Protected to IP65



**DLS Series P115**

Page 8

- Measuring range 3000 to 5000mm
- 115mm square housing
- Choice of potentiometer, voltage, current or encoder outputs
- Protected to IP65

# DLS SERIES P60

Series P60 Draw Wire Linear Sensors are for general purpose use. Numerous options enable a suitable sensor to be selected for almost any application. There is a choice of seven measurement ranges with three analogue and two digital types of output signal. Mounting grooves on four sides of the housing facilitate quick and flexible mounting. The series has an attractive price/performance ratio based on state of the art technology.

## PERFORMANCE

Measuring range	mm	100	150	300	500	750	1000	1500
Output types (See data on page 10 for details)		P/U/I	P/U/I	P/U/I	P/U/I	P/U/I	P/U/I	P/U/I/E/A*
Independent linearity	P/U/I	±%	<0.5	<0.5	<0.25	<0.1	<0.1	<0.1
	E	±%	-	-	-	-	-	<0.05
Resolution		%	0.16	0.16	0.07	Virtually infinite	Virtually infinite	
Sensor element								
Wirewound potentiometer		Y	Y	Y				
Hybrid potentiometer					Y	Y	Y	Y
Incremental encoder								Y
Absolute encoder*								Y

\*specification for output A on request

Wire acceleration	g	10-30 (depends on measuring range)						
Wire extension force max.	N	7.5	5.5	7.5	7.5	5.5	7.5	5.5
Wire retraction force min.	N	6.5	4.5	6	6	4	5	3.5
Wire misalignment max.	°	3						
Operational temperature	°C	-20 to +80						
Protection class		IP65 (only if plug is connected to socket)						
Vibration IEC 68-2-6		20g, 20Hz - 2kHz						
Shock IEC 68-2-27		50g, 10ms						
Weight	g	370 (CR-P); 455 (SR-U/I)						

## Materials

Housing	Aluminium, anodised
Measuring wire	Coated polyamid stainless steel
Sensor attachment	Mounting grooves in the housing
Wire attachment	Wire clip

## AVAILABILITY

Options CR-P available from stock. Ask our sales office for details on other options

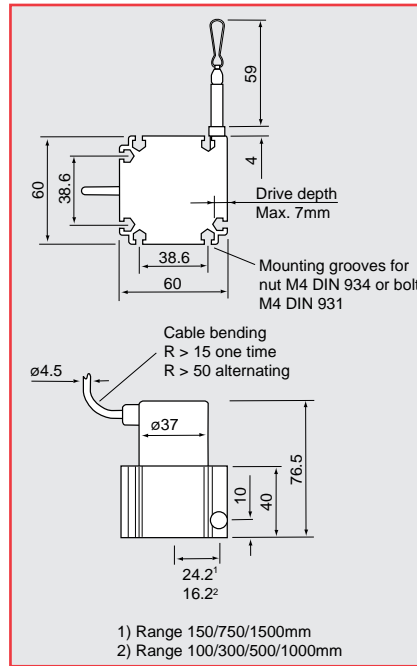
## ORDERING CODES AND OPTIONS

DLS - .... - P60 - .... - ....	
Measuring range	Output
Connection	P = Potentiometer (all ranges)
SR = Radial plug for outputs U and I	U = Voltage (all ranges)
CR = Radial cable for outputs P and E	I = Current (all ranges)
	E = Incremental Encoder (1500mm only)
	A = Absolute Encoder (1500mm only)

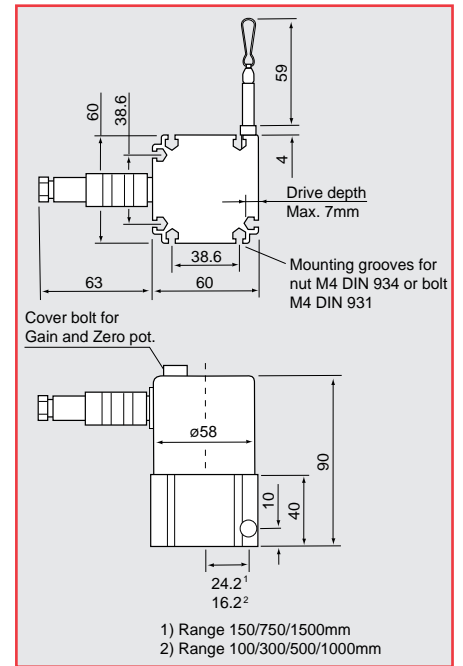
# DLS SERIES P60 DIMENSIONS

Drawings not to scale

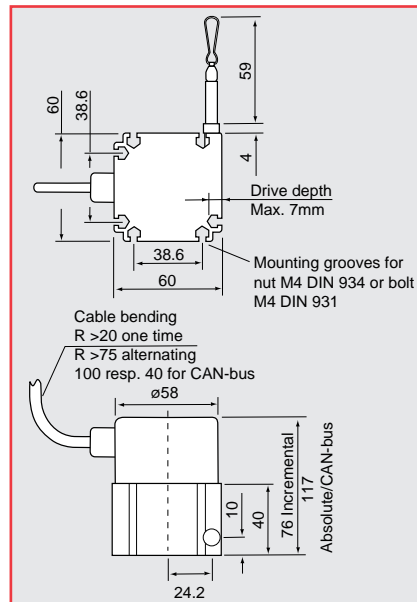
## ANALOGUE OUTPUT DLS - ..... - P60 - CR - P



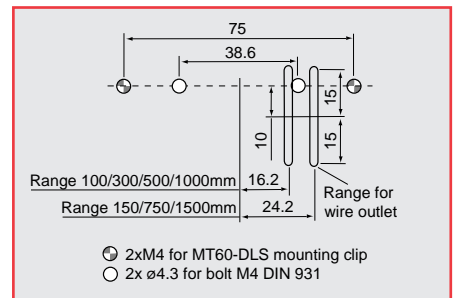
## ANALOGUE OUTPUT DLS - .... - P60 - SR - U/I



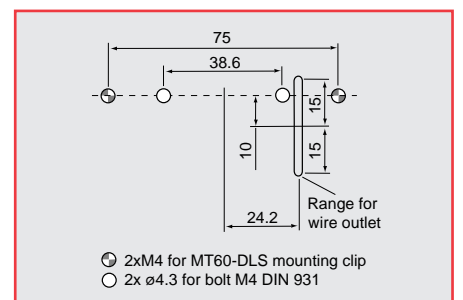
## DIGITAL OUTPUT DLS - 1500 - P60 - CR - E



## Dimensions for mounting analogue output version



## Dimensions for mounting digital output version (1500mm only)

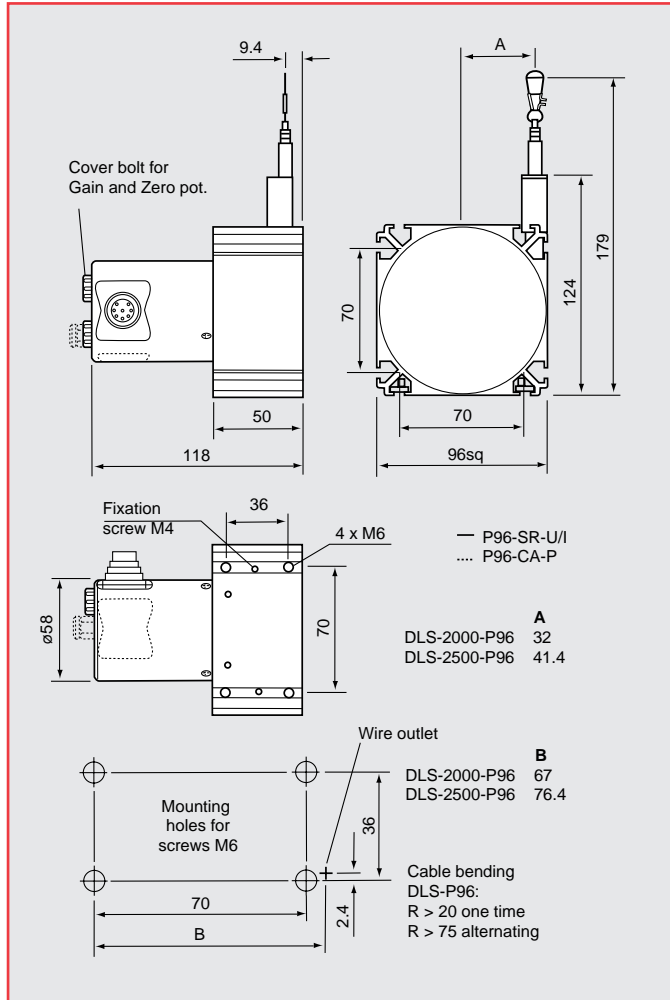




**DLS SERIES P96**  
**DIMENSIONS**

Drawings not to scale

**ANALOGUE OUTPUT**  
DLS - .....- P96 - CA - P  
DLS - .....- P96 - SR - U/I



# DLS SERIES P115

Series P115 Draw Wire Linear Sensors have a choice of three measurement ranges with three analogue and one digital output signal. Mounting grooves on four sides of the housing facilitate quick and flexible mounting. The series has an attractive price/performance ratio based on state of the art technology, and is suitable for a range of industrial applications where large measurement ranges can be measured from a compact sensor footprint.

## PERFORMANCE

Measuring range	mm	3000	4000	5000
<b>Output types</b> (See data on page 10 for details)		P/U/I	P/U/I	P/U/I/E
<b>Independent linearity</b>	P/U/I ±%	0.1	0.15	0.15
	E ±%	-	-	0.02
<b>Resolution</b>	%	Virtually infinite		
<b>Sensor element</b>				
Hybrid potentiometer		Y	Y	Y
Incremental encoder				Y
<b>Wire acceleration</b>	g	6		
<b>Wire extension force max.</b>	N	8	8.5	9
<b>Wire retraction force min.</b>	N	4.5	4	4
<b>Wire misalignment max.</b>	°	3		
<b>Operational temperature</b>	°C	-20 to +80		
<b>Protection class</b>		IP65 (only if plug is connected to socket)		
<b>Vibration IEC 68-2-6</b>		20g, 20Hz - 2kHz		
<b>Shock IEC 68-2-27</b>		50g, 5mS		
<b>Weight</b>	g	1100		
<b>Materials</b>				
Housing		Aluminium, anodised		
Measuring wire		Coated polyamid stainless steel		
<b>Sensor attachment</b>		Mounting grooves in the housing		
<b>Wire attachment</b>		Wire clip		

## AVAILABILITY

Options CA-P available from stock. Ask our sales office for details on other options

## ORDERING CODES AND OPTIONS

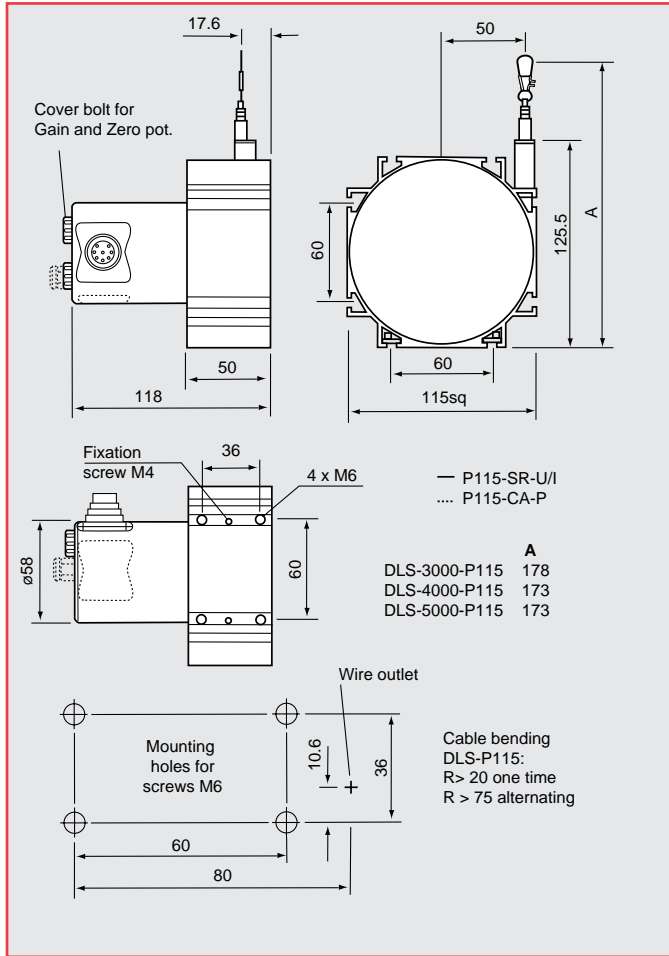
DLS - .... - P115 - .... - ....

Measuring range	.....	Output
Connection	.....	P = Potentiometer (all ranges)
SR = Radial plug for outputs U and I		U = Voltage (all ranges)
CA = Axial cable for output P		I = Current (all ranges)
CR = Radial cable for output E		E = Incremental encoder (5000mm only)

**DLS SERIES P115**  
**DIMENSIONS**

Drawings not to scale

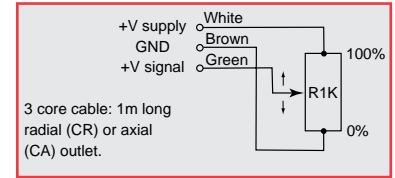
**ANALOGUE OUTPUT**  
**DLS - .....- P115 - CA - P**  
**DLS - .....- P115 - SR - U/I**



## OUTPUT OPTIONS AND ELECTRICAL CONNECTIONS - ANALOGUE

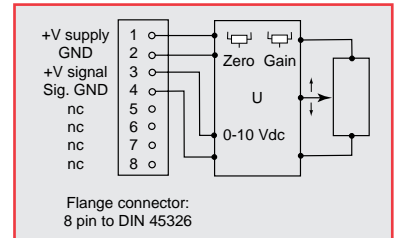
### Potentiometric output (P)

Supply voltage (max.)	32Vdc
Resistance $\pm 10\%$	1k $\Omega$
Recommended wiper current (max.)	3mA
Temperature coefficient	$\pm 0.0025\%$ FSO/ $^{\circ}\text{C}$
Sensitivity	Depends on measuring range (Specified on test report supplied)
Operating mode	The potentiometer must only be used as a voltage divider.
Wiper circuit impedance	Minimum of 0.5M $\Omega$ is recommended



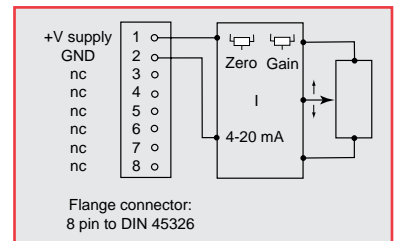
### 0 to 10Vdc Voltage output (U)

Supply voltage (max.)	14 to 27Vdc (unregulated)
Current consumption (max.)	30mA
Output voltage	0 to 10Vdc (Option: 0 to 5Vdc; $\pm 5\text{Vdc}$ )
Output current (max.)	2mA
Load impedance	>5k $\Omega$
Output noise	0.5mV <sub>eff</sub>
Temperature coefficient	$\pm 0.005\%$ FSO/ $^{\circ}\text{C}$
EMC	EN50081-2; EN50082-2
Adjustment range	
	Zero $\pm 20\%$ FSO
	Gain $\pm 20\%$



### 4 to 20mA 2-wire Current output (I)

Supply voltage* (max.)	14 to 27Vdc (unregulated)
Current consumption (max.)	35mA
Output current range	4 to 20mA
Load	<600 $\Omega$
Output noise	<1.6 $\mu\text{A}_{\text{eff}}$
Temperature coefficient	$\pm 0.01\%$ FSO/ $^{\circ}\text{C}$
EMC	EN50081-2; EN50082-2
Adjustment range	
	Zero $\pm 18\%$ FSO
	Gain $\pm 15\%$

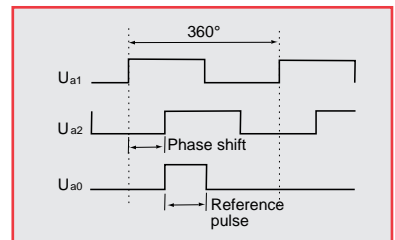


\*measured at pins on sensor

## OUTPUT OPTIONS AND ELECTRICAL CONNECTIONS - DIGITAL

### Incremental Encoder output (E) -

Supply voltage	10 - 30Vdc
Current consumption (max.)	150mA
Output	HTL square wave
Resolution	
DLS-1500-P60-CR-E	10 pulses per mm, corresponds to 0.1mm
DLS-3000-P96-CR-E	5.77 pulses per mm, corresponds to 0.17mm
DLS-5000-P115-CR-E	4.76 pulses per mm, corresponds to 0.21mm
EMC	EN50081-2; EN50082-2



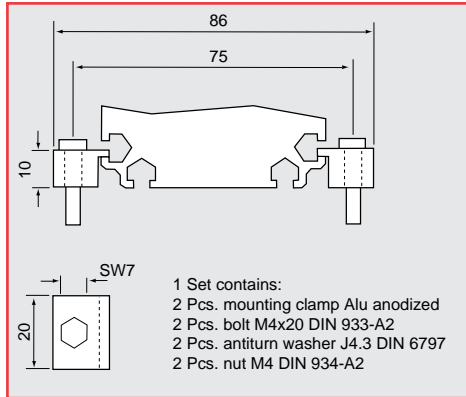
### Absolute Encoder output (A) -

Please ask for more details on the absolute encoder outputs available, which include CAN bus, SSI and Profi bus.

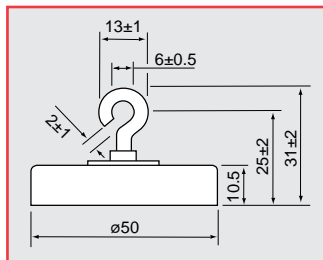
connection	output
brown	U <sub>a1</sub>
green	$\overline{U_{a1}}$
grey	U <sub>a2</sub>
pink	$\overline{U_{a2}}$
red	U <sub>a0</sub>
black	$\overline{U_{a0}}$
blue	+10...30V sens
white	0V sens
brown/green	+10...30Vdc supply
white/green	0V supply
violet	U <sub>as</sub>
screen	housing

## ACCESSORIES

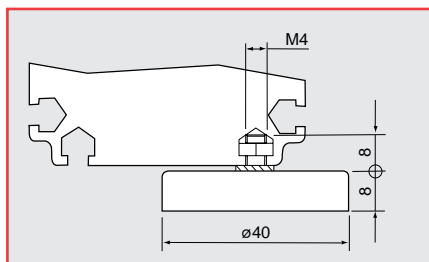
### Mounting clamps for series P60 MT60-DLS



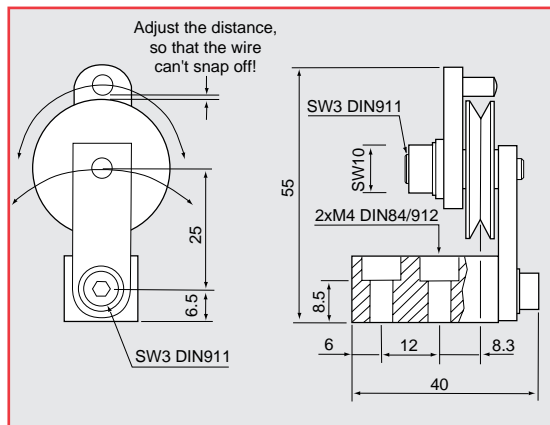
### Magnetic holder for wire clip MH1-DLS



### Magnetic holder for sensor body MH2-DLS



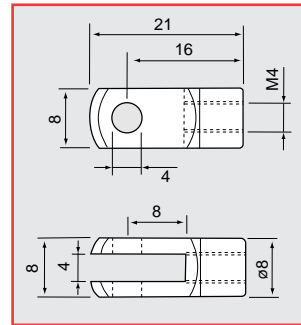
### Guide pulley (adjustable) with mounting socket TR1-DLS



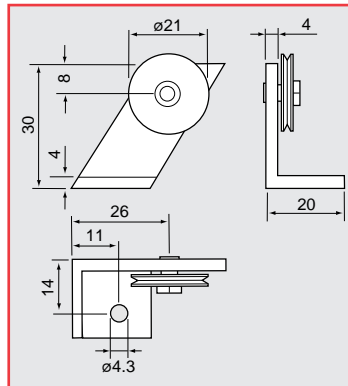
## OTHER ACCESSORIES

- Sensor connecting cable, 3m long PC3/8
- Cable female plug (standard) FC8
- Cable female plug, 90° angled FC8/90

### Attachment head with mounting thread M4 GK1-DLS

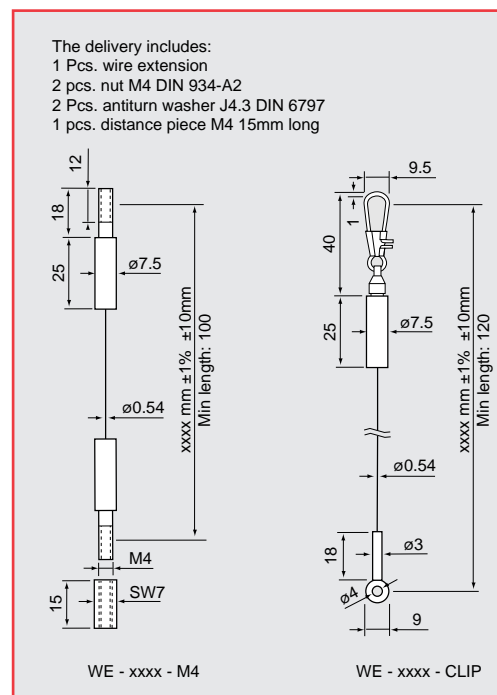


### Guide pulley (fixed) with mounting socket TR3-DLS



### Wire extension with wire clip WE-xxxx-CLIP (max.10m)

### Wire extension with 2 x M4 thread WE-xxxx-M4 (max.10m)





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Innovation In Motion

