Draw-wire Displacement Sensors
Series DLS-P60/P96/P115
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Safety

1. Safety
1.1 Symbols Used
Knowledge of the operating instructions is a prerequisite for equipment operation. The following symbols are used in this instruction manual:

- **DANGER!** - imminent danger
- **WARNING!** - potentially dangerous situation
- **IMPORTANT!** - useful tips and information

1.2 Warnings
- **Do not open the sensor housing**
  - Danger of injury from pre-tensioned spring motor
- **Do not let the measuring wire rewind without control (snap back)**
  - Danger of injury from whiplash effect of the wire with assembly bolts/clips
  - Destruction of wire
  - Destruction of sensor
- **Do not pull or loop the measuring wire around unprotected parts of the body**
  - Danger of injury
- **Do not pull the measuring wire over measuring range**
  - Destruction of the measuring wire
  - Destruction of the sensor
  - Danger of injury
Safety

• Avoid banging and knocking the sensor
  □ Damage to or destruction of the sensor
• The power supply may not exceed the specified limits
  □ Damage to or destruction of the sensor
  □ Danger of injury
• Power supply must be connected in accordance with the safety regulations for electrical equipment
  □ Danger of injury
  □ Damage to or destruction of the sensor safety

1.3 Notes on CE Identification

The following applies to series DLS draw wire sensors with voltage or current output:
EU regulation 89/336/EEC

Products which carry the CE mark satisfy the requirements of the EU regulation EU 89/336/EEC ‘Electromagnetic Compatibility’ and the European standards (EN) listed therein. The EU declaration of conformity is kept available according to EU regulation, article 10 by the authorities responsible at

Penny & Giles Controls Ltd
15 Airfield Road
Christchurch
Dorset
BH23 3TG

Draw wire sensors with potentiometer output are not automatically operable devices (components). An EC declaration of conformity or CE identification is therefore not required by EMC law (§5, par. (5)).
The draw wire sensors are designed for use in industry and satisfy the requirements of the standards:

- EN 50 081-2 RFI emission
- EN 61 000-6-2 Immunity to interference

The draw wire sensors satisfy the requirements if they comply with the regulations described in the instruction manual for installation and operation.

The draw wire sensors have been tested according to the following EMC standards:

**EN 55 011**

Emission of electromagnetic fields Group1 / Class B
RFI emission over mains cable Group1 / Class B

**EN 61 000-6-2**

ESD (air and contact discharge) EN 61000-4-2 Criterion B
Transient disturbance variables (burst) EN 61000-4-4 Criterion B
Magnetic fields EN 61000-4-8 Criterion A
Mains-borne disturbance ENV 50141 Criterion A
Radiated interference ENV 50140 Criterion A
1.4 Proper Use

Draw wire sensors are used for
- distance or displacement measuring
- position determination
of components or moving machine parts.

The sensors may only be operated within the limits specified in the technical data (chap. 2).

Draw wire sensors should only be used in such a way that in case of malfunction or failure personnel or machinery are not endangered.

Additional precautions for safety and damage prevention must be taken for safety-related applications.

1.5 Proper Environment

- Protection class for sensor: IP65
- Operating temperature: -20 to +80 °C, (-4 to +176 °F)
- Storage temperature: -40 to +80 °C, (-40 to +176 °F)
- Humidity: 5 - 95% (no condensation)
- Ambient pressure: atmospheric pressure
- Vibration: according to IEC 68-2-6
- Mechanical shock: according to IEC 68-2-27
- EMC: According to EN 50 081-2 Spurious emission
  EN 61 000-6-2 Resistance to disturbance

1) Models with male plug connection only with gasketed female plug

IMPORTANT!
Note the slight power dissipation of the potentiometer above +40°C (+104 °F)! (-0.15W/10K)
2. Functional Principle, Technical Data

2.1 Functional Principle

With the wire principle, a linear motion is transformed into a change in resistance by a rotation.

A measuring wire made of highly flexible stainless steel wires is wound onto a drum with the aid of a long life spring motor.

The winding drum is coupled axially with a
- multi-turn potentiometer (Type DLS-....-Pxx-....-P/U/I) respectively with a
- encoder (Type DLS-....-Pxx-....-E/A).

*Fig. 2.1: Draw-wire sensor with potentiometer*
2.2 Structure

The draw wire principle is used in the housing design P60 with different measuring lengths from 100 to 5,000 mm (3.93 to 197 in).

Five versions of the electrical connection are possible:

- Potentiometer output (resistance divider)
- Voltage output (with integrated electronics)
- Current output (with integrated electronics)
- Incremental encoder (with integrated electronics, output: HTL- or TTL-level)
- Absolute encoder (with integrated electronics)¹

2.3 Technical Data

<table>
<thead>
<tr>
<th>Modell</th>
<th>DLS-100 P60</th>
<th>DLS-150 P60</th>
<th>DLS-300 P60</th>
<th>DLS-500 P60</th>
<th>DLS-750 P60</th>
<th>DLS-1000 P60</th>
<th>DLS-1500 P60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>mm (inch)</td>
<td>100 (3.94)</td>
<td>150 (5.91)</td>
<td>300 (11.8)</td>
<td>500 (19.7)</td>
<td>750 (29.5)</td>
<td>1,000 (39.4)</td>
</tr>
<tr>
<td>Lin. % FSO</td>
<td>±0.1 % FSO</td>
<td>±0.25 % FSO</td>
<td>±0.5 % FSO</td>
<td>±0.1 % FSO</td>
<td>±0.25 % FSO</td>
<td>±0.5 % FSO</td>
<td>±0.1 % FSO</td>
</tr>
<tr>
<td>Linearity</td>
<td>mm (inch)</td>
<td>0.5 (0.02)</td>
<td>0.75 (0.03)</td>
<td>1 (0.04)</td>
<td>1.5 (0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>% FSO</td>
<td>0.16 (0.006)</td>
<td>0.16 (0.006)</td>
<td>0.07 (0.003)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor element</td>
<td>wire-wound</td>
<td>hybrid-potentiometer encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>-20 ... 80 °C (-4 ... +178 °F)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ For absolute encoder, additional electronics required.
### Functional Principle, Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>DLS-100</th>
<th>DLS-150</th>
<th>DLS-300</th>
<th>DLS-500</th>
<th>DLS-750</th>
<th>DLS-1000</th>
<th>DLS-1500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P60</td>
<td>P60</td>
<td>P60</td>
<td>P60</td>
<td>P60</td>
<td>P60</td>
<td>P60</td>
</tr>
<tr>
<td>Material</td>
<td>Housing Wire</td>
<td>aluminium stainless steel with polyamid sheath (wire)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire acceleration</td>
<td>g</td>
<td>appr. 10 ... 30 g (depends on measuring range)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire retraction force (min)</td>
<td>N</td>
<td>6.5 4.5 6 6 4 5 3.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire extension force (max)</td>
<td>N</td>
<td>7.5 5.5 7.5 7.5 5.5 7.5 5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor mounting</td>
<td></td>
<td>mounting grooves in the housing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire mounting</td>
<td></td>
<td>wire clip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>g</td>
<td>appr. 370 (DLS - ... - P60 - CR - P) appr. 455 (DLS - ... - P60 - SR - U/I) 500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire misalignment</td>
<td></td>
<td>max. 3 degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>EN 60 529: 1991</td>
<td>IP 65 (only if plug is connected to socket)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>IEC 68-2-6</td>
<td>20 g, 20 Hz ... 2 kHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>IEC 68-2-27</td>
<td>50 g, 10 ms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td>Output P/E Output U/I</td>
<td>integral cable, radial, 1 m long flange connector, radial, 8-pin, DIN45326</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Specification for digital output (Encoder E/A), see page 46. FSO = Full Scale Output
### Basic data

**Modell**

<table>
<thead>
<tr>
<th>P96 / P115</th>
<th>DLS-2000 P96</th>
<th>DLS-2500 P96</th>
<th>DLS-3000 P115</th>
<th>DLS-4000 P115</th>
<th>DLS-5000 P115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output type</td>
<td>P/U/I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring range</td>
<td>mm (inch)</td>
<td>2000 (78.7)</td>
<td>2500 (98.4)</td>
<td>3000 (118)</td>
<td>4000 (157)</td>
</tr>
<tr>
<td>Linearity</td>
<td>±mm (inch)</td>
<td>2 (0.08)</td>
<td>2.5 (0.10)</td>
<td>3 (0.12)</td>
<td>6 (0.24)</td>
</tr>
<tr>
<td>Resolution</td>
<td></td>
<td></td>
<td></td>
<td>quasi infinite</td>
<td></td>
</tr>
<tr>
<td>Sensor element</td>
<td></td>
<td>hybrid-potentiometer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td>-20 ... +80 °C (-4 ... +178 °F)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Housing Wire</td>
<td>aluminium stainless steel with polyamid sheath (wire)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire acceleration</td>
<td>g</td>
<td>8</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire retraction force (min)</td>
<td>N</td>
<td>5</td>
<td>5.5</td>
<td>4.5</td>
<td>4</td>
</tr>
<tr>
<td>Wire extension force (max)</td>
<td>N</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>8.5</td>
</tr>
<tr>
<td>Sensor mounting</td>
<td></td>
<td>mounting grooves in the housing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire mounting</td>
<td></td>
<td>wire clip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>g</td>
<td>appr. 1,100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire misalignment</td>
<td></td>
<td>max. 3 degrees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>EN60529:1991</td>
<td>IP 65 (only if plug is connected to socket)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>IEC 68-2-6</td>
<td>20 g, 20 Hz ... 2 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>IEC 68-2-27</td>
<td>50 g, 5 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td></td>
<td>Output P</td>
<td>integral cable, axial, 1 m long</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output U/I</td>
<td>flange connector, radial, 8-pin, DIN45326</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Models with potentiometric output DLS - .... - Pxx - CR - P

Electrical data
Supply voltage: max. 32 VDC at 1 kOhm / max. 1 W
Resistance: 1kOhm ± 10 % (potentiometer)
Viper current: 3 mA
Temperature coefficient: ± 0.0025 % FSO/K (± 0.0014 % FSO/°F)
Sensitivity: depends on measuring range, individually reported on product label
Electrical connection: Integral cable, radial, 3 wire, 1 m long

Models with voltage output DLS - .... - Pxx - SR - U

Electrical data
Supply voltage: 14 to 27 VDC non stabilized
Current consumption: 30 mA max.
Output voltage: 0 to 10 VDC (Options: 0 - 5 / ± 5 V)
Output current: 2 mA max.
Load impedance: > 5 kOhm
Output noise: 0.5 mV_{eff}
Temperature coefficient: ± 0.005 % FSO/K (± 0.0028 % FSO/°F)

Adjustment ranges
Zero: ± 20 % FSO
Sensitivity: ± 20 %
Electromagnetic compatibility (EMC): acc. EN 50081-2 and EN 61000-6-2

IMPORTANT!
Note the slight power dissipation of the potentiometer above +40°C (+104 °F)!
(-0.15W/10K)
Models with current output (2-wire) DLS - .... - Pxx - SR - I

**Electrical data**
- Supply voltage: 14 to 27 VDC non stabilized (measured on the input terminal of the sensor)
- Current consumption: 35 mA max.
- Output current: 4 to 20 mA
- Load: < 600 Ohm
- Temperature coefficient: ± 0.01 % FSO/K (± 0.005 % FSO/°F)
- Output noise: < 1.6 µA

**Adjustment ranges**
- Zero: ± 18 % FSO
- Sensitivity: ± 15 %
- EMC: acc. EN 50081-2 and EN 61000-6-2

Models with Incremental-/Absolute-encoder DLS - .... - P60 - CR - E/A

**Technical data**
- Measuring range: 1,500 mm (59.05 in)
- Linearity: ±0.05 % FSO
- Resolution: 10 pulses per mm, corresponds 0.1 mm (A1, A2), other resolution on request
- Sensor element: Incremental or absolute encoder
- Wire acceleration: appr. 10 g
- Protection class: IP65 / EN 60 529: 1991
- EMC: acc. EN 50081-2 and EN 61000-6-2
Delivery

Incremental encoder output:
• HTL (10...30 V, max. 150 mA without load)
• TTL (5 V, max. 150 mA without load)

Absolute encoder output:
• CAN bus
• SSI
• Profi bus

3. Delivery
3.1 Unpacking
Do not unpack sensor by pulling the wire or wire bolt / clip.

Check for completeness and shipping damages immediately after unpacking.

In case of damage or missing parts, please contact the manufacturer or supplier.

3.2 Storage
Store only with the transport protection in place (This prevents the measuring wire being pulled out and accidental is snapping back)

• Storage conditions:
  - temperature -40 to +80 °C, (-40 to +176 °F)
  - humidity 5 - 95 % (no condensation)
  - atmospheric pressure

IMPORTANT!
Remove shipping protection of measuring wire by qualified personnel only and immediately before mounting.
4. Installation and Assembly

4.1 Precautionary Measures

- Do not pull the measuring wire over range
  - Damage to or destruction of the sensor is possible

- Do not damage the measuring wire by
  - oiling or greasing
  - bending
  - pulling at an angle
  - allowing to loop around objects
  - fixing to the target when wound up
  - looping around parts of the body

4.2 Sensor Assembly

- Mount the sensor through mounting grooves for nut M4 DIN 934 or bolt M4 DIN 931 (see fig. 4.1 ... 4.10).

- Mount the sensor through mounting clips MT60-DLS (see fig. 8.6).

The sensor does not have to be oriented in a special way.

Choose the installation position so that damage and soiling of the measuring wire is avoided.

DANGER!
Uncontrolled retraction (snap back) of the measuring wire may destroy the sensor / measuring wire
Danger of injury!

IMPORTANT!
Do not let the measuring wire snap!
No warranty by damage through snapping.
Installation position with measuring wire outlet facing downwards prevents liquids penetrating the measuring wire outlet.
Installation and Assembly

DANGER!

A measuring wire under tension where operators are standing can lead to injuries.

Danger of damage to wire and sensor.

Do not twist the measuring wire.

Fig. 4.1: Model DLS - .... - P60 - CR - P

Fig. 4.2: Dimensions for mounting holes model DLS - .... - P60 - CR - P

DLS-P60...

Dimensions in mm (inches), not to scale

Drive depth max. 7 mm (0.27)

Mounting grooves for nut M4 DIN 934 or bolt M4 DIN 931

Cable bending
R > 15 (0.59) one time
R > 50 (1.97) alternating

2xM4 for MT60-DLS mounting clip
2x ø4.3 for bolt M4 DIN 931

Range for wire outlet
Fig. 4.3: Model DLS - .... - P60 - SR - U/I

Fig. 4.4: Dimensions for mounting holes model DLS - .... - P60 - SR - U/I

Drive depth max. 7 mm (0.28)

Mounting grooves for nut M4 DIN 934 or bolt M4 DIN 931

Cover bolt for GAIN and ZERO pot.

2xM4 for MT60-DLS mounting clips

2x Ø4.3 for bolt M4 DIN 931

Range for wire outlet

MR 100/300/500/1,000 mm

MR 150/750/1,500 mm

24.2 (0.95)

16.2 (0.64)

10 (0.39)

40 (1.57)

40 (1.57)

75 (2.95)

38.6 (1.52)

60 (2.36)

60 (2.36)

59 (2.32)

4 (0.16)

38.6 (1.52)

38.6 (1.52)

63 (2.48)

63 (2.48)

ø58 (2.28)
Installation and Assembly

DANGER!

A measuring wire under tension where operators are standing can lead to injuries.

Danger of damage to wire and sensor.

Do not twist the measuring wire.

Fig. 4.5: Model DLS - .... - P60 - CR - E

Mounting grooves for nut M4 DIN 934 or bolt M4 DIN 931

Drive depth max. 7 mm (0.28)

Fig. 4.6: Dimensions for mounting holes model DLS - .... - P60 - CR - E

- 2xM4 for MT60-DLS mounting clip
- 2x φ4.3 for bolt M4 DIN 931

Range for wire outlet

Cable bending
R > 20 one time
R > 75 alternating
100 (3.94) resp. 40 (1.57) for CAN-bus

Dimensions in mm (inches), not to scale

DLS-P60...
DLS-P96...

Cable bending
DLS-P96:
R > 20 one time
R > 75 alternating
100 (3.94) resp. 40 (1.57) for CAN-bus

**Fig. 4.7: Model DLS - .... - P96**

**Fig. 4.8: Dimensions for mounting holes model DLS - .... - P96**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>DLS-2000-P96</td>
<td>32 (1.26)</td>
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<tr>
<td>DLS-2500-P96</td>
<td>41.4 (1.63)</td>
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</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>DLS-2000-P96</td>
<td>67 (2.64)</td>
</tr>
<tr>
<td>DLS-2500-P96</td>
<td>76.4 (3.01)</td>
</tr>
</tbody>
</table>
Fig. 4.9: Model DLS - .... - P115

Fig. 4.10: Dimensions for mounting holes model DLS - .... - P115

DANGER!
A measuring wire under tension where operators are standing can lead to injuries.
Danger of damage to wire and sensor.
Do not twist the measuring wire.

<table>
<thead>
<tr>
<th>DLS-P115</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLS-3000-P115</td>
<td>178 (7.01)</td>
</tr>
<tr>
<td>DLS-4000-P115</td>
<td>173 (6.81)</td>
</tr>
<tr>
<td>DLS-5000-P115</td>
<td>173 (6.81)</td>
</tr>
</tbody>
</table>

Dimensions in mm (inches), not to scale
Cable bending DLS-P115:
- R > 20 one time
- R > 75 alternating
100 (3.94) resp. 40 (1.57) for CAN-bus
4.3 Wire Guide and Fastening

The measuring wire is fixed to the target using a wire clip.

The measuring wire must be fed perpendicularly from the sensor housing.

Misalignment only permissible up to 3 degrees.

Dragging of the measuring wire on the inlet hole or other objects leads to damage and/or snapping of the measuring wire.

If the measuring wire cannot be fed vertically out of the housing, it is essential to use a guide pulley (accessory TR1-DLS).

Keep measuring wire in an area where it cannot be snagged or otherwise beviolated.

DANGER!

A measuring wire under tension where operators are standing can lead to injuries.

Danger of damage to wire and sensor.

Do not twist the measuring wire.

Fig. 4.11: Wire fastening and misalignment
4.4  Power Supply and Display/Output Device

<table>
<thead>
<tr>
<th>Electrical connection</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>- CR - integr. cable</td>
<td>- SR - Connector - P Potentiometer</td>
</tr>
<tr>
<td>Color 47 100</td>
<td>Pin</td>
</tr>
<tr>
<td>white</td>
<td>1</td>
</tr>
<tr>
<td>brown</td>
<td>2</td>
</tr>
<tr>
<td>green</td>
<td>3</td>
</tr>
<tr>
<td>shield</td>
<td>shield</td>
</tr>
</tbody>
</table>

Tab. 4.1 : Connection pin assignment DLS - ... - Pxx - CR - P

Draw wire sensors with potentiometer output are connected according to the pin assignment see table 4.1 and fig. 4.12.

<table>
<thead>
<tr>
<th>Electrical connection</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>- SR - (^1) Device plug DIN 45 326</td>
<td>- U Voltage - I Current</td>
</tr>
<tr>
<td>Pin-Nr.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>supply +</td>
</tr>
<tr>
<td>2</td>
<td>ground</td>
</tr>
<tr>
<td>3</td>
<td>signal</td>
</tr>
<tr>
<td>4</td>
<td>ground (signal)</td>
</tr>
</tbody>
</table>

Tab. 4.2 : Connection pin assignment DLS - ... - Pxx - SR - U/I

1) Pin 5 - 8 are not connected.
Draw wire sensors with voltage or current output are connected by the 8-pin built-in plug according to the pin assignment see table 4.2 and fig. 4.13, 4.14.

An 8-pin cable socket for the user-side assembly of your own connecting cable is part of the delivery scope of the standard sensors.

**Note when assembling:**

- A screened cable must be used!
- Earth screen on electronics side.
- Recommended conductor cross-section 0.14 mm² (up to 9 m/30 ft cable length)
- Maximum cable diameter 8 mm / 0,3 inch.

The EMC regulations are only satisfied under these basic conditions.

A pre-assembled connecting cable PC3/8 is available as an accessory (see chap. 8.2).
Installation and Assembly

Fig. 4.13: Model with voltage output

Fig. 4.14: Model with current output

Note the pin assignment for draw-wire displacement sensors with **encoder output** (E, A). The sensor contains an additional supplement for detailed information.

<table>
<thead>
<tr>
<th>Electrical connection</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>- CR - integr. cable</td>
<td>- E - Encoder</td>
</tr>
<tr>
<td>Color</td>
<td></td>
</tr>
<tr>
<td>brown</td>
<td>$U_{a1}$</td>
</tr>
<tr>
<td>green</td>
<td>$U_{a1}$</td>
</tr>
<tr>
<td>grey</td>
<td>$U_{a2}$</td>
</tr>
<tr>
<td>pink</td>
<td>$U_{a2}$</td>
</tr>
<tr>
<td>red</td>
<td>$U_{a0}$</td>
</tr>
<tr>
<td>black</td>
<td>$U_{a0}$</td>
</tr>
<tr>
<td>blue</td>
<td>+10...30 V sens</td>
</tr>
<tr>
<td>white</td>
<td>0 V sens</td>
</tr>
<tr>
<td>brown/green</td>
<td>+10...30 VDC supply</td>
</tr>
<tr>
<td>white/green</td>
<td>0 V supply</td>
</tr>
<tr>
<td>violet</td>
<td>$U_{as}$</td>
</tr>
<tr>
<td>Schirm</td>
<td>Housing</td>
</tr>
</tbody>
</table>
5. Operation

For draw wire sensors with potentiometer output (P) there are no adjustment and setting elements.

Draw wire sensors with voltage output (U) or current output (I) are equipped with integrated electronics with setting potentiometers (trimmers) for zero and gain.

The access holes for the trimmers are located in the housing cover.

With the zero trimmer the zero point can be shifted by ± 20 % of the range with voltage output (± 18 % with current output).

With the gain trimmer the signal span (sensitivity) is adjusted by ±20 % with voltage output (± 15 % with current output). For draw wire sensors with encoder output (E,A) there are no adjustment and setting elements.

6. Operation and Maintenance

The measuring wire, the wire drum, the spring motor and the potentiometer may not be greased or oiled.

The notes on wire guiding in section 4.3 must be observed during operation.

Imperfect wire guiding can lead to increased wear and premature defects.

The warranty and all liability claims are null and void if the device is manipulated by unauthorised persons. Repairs are to be made exclusively by Penny & Giles Controls Ltd.
7. Warranty

All components of the device have been checked and tested for perfect function in the factory.

In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to Penny & Giles Controls Ltd.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced within this period if you return the device to Penny & Giles Controls Ltd free of charge.

This warranty does not apply towards damages resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

Repairs must be done exclusively by Penny & Giles Controls Ltd.

No other claims, except as warranted, are accepted.

The terms of the purchasing contract apply in full.

Penny & Giles Controls Ltd will specifically not be responsible for eventual consequential damages.

Penny & Giles Controls Ltd always strives to supply customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right for design changes without prior notice is accordingly reserved.

For translation in other languages the data and statements of the German language operation manual are to be taken as authoritative.
8. Appendix
8.1 Accessories and Spare Parts

PC3/8  Sensor connecting cable, 3 m (10 ft) long with a female plug and free leads, IP40

FC8    Cable female plug for standard models, inclusive screwdriver, 8-pin DIN 45 326, IP40

FC8/90 Cable female plug 90° angled for standard models, 8-pin DIN 45 326, IP65

MH1-DLS Magnetic holder with hole for M4 wire coupling, wire clip or attachment head (see fig. 8.1)

MH2-DLS Magnetic holder, threaded M4/nut M4 for P60-mounting in mounting groove (see fig. 8.2)

TR1-DLS Guide pulley adjustable with mounting socket (see fig. 8.3)

TR3-DLS Guide pulley fix with mounting socket (see fig. 8.4)

GK1-DLS Attachment head with mounting thread (see fig. 8.5)
       DIN 71 752 G4 x 3, weight appr. 7 g

MT60-DLS Mounting clamps for P60-mounting (see fig. 8.6)

WE-xxxx-M4 Wire extension with 2 x M4 thread (see fig. 8.7) wire length in millimetres for xxxx, max. 10,000 mm (33 ft)

WE-xxxx-CLIP Wire extension with wire clip (see fig. 8.8) wire length in millimetres for xxxx, max. 10,000 mm (33 ft)
### 8.2 Cable Connection and Color Code

**Connection cable PC3/8**

<table>
<thead>
<tr>
<th>PIN</th>
<th>Cable color</th>
<th>Assignment</th>
<th>- P</th>
<th>- U</th>
<th>- I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>white</td>
<td>input+ supply+</td>
<td>input+</td>
<td>supply+</td>
<td>supply+</td>
</tr>
<tr>
<td>6</td>
<td>green</td>
<td>n.c.</td>
<td>n.c.</td>
<td>n.c.</td>
<td>n.c.</td>
</tr>
<tr>
<td>2</td>
<td>brown</td>
<td>ground</td>
<td>ground</td>
<td>ground</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>yellow</td>
<td>n.c.</td>
<td>ground</td>
<td>n.c.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>grey</td>
<td>n.c.</td>
<td>n.c.</td>
<td>n.c.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>green</td>
<td>signal</td>
<td>signal</td>
<td>n.c.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>blue</td>
<td>n.c.</td>
<td>n.c.</td>
<td>n.c.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>red</td>
<td>n.c.</td>
<td>n.c.</td>
<td>n.c.</td>
<td></td>
</tr>
</tbody>
</table>

- **outer cable area with total screen**
- **inner cable 3-wire with screen**
- **grounding at electronics side**

1) n.c. = not connected
8.3 Drawings and References for Attachment
(not to scale)

Fig. 8.1: Magnetic holder MH1 - DLS

Mounting instructions for magnetic holder

The force normal to the St 37 plate is approximately 18 kg (635 oz) at 20 °C (+68 °F).

The lateral force sustainable is, dependent on the surface, about 20 - 35 % of normal adhesion.

Operation temperature: -40 to +120 °C (-40 °F to +248 °F)
Temperature coefficient of the adhesion (reversible): -4 % per 10 °C at 20 °C

Strong vibration may cause a displacement of the magnetic holder when subject to a strong lateral force.

Weight appr. 100 g
IMPORTANT! When mounting, make sure there is adequate adhesion! Uneven surfaces, layers of lacquer and rust reduce adhesion.

Mounting instructions for magnetic holder

The force normal to the St 37 plate is approximately 13 kg / 459 oz at +20 °C (+68 °F).

The lateral force sustainable is, dependent on the surface, about 20 - 35 % of normal adhesion.

Operation temperature: -40 to +120 °C (-40 °F to +248 °F)
Temperature coefficient of the adhesion (reversible): -4 % per 10 °C at 20 °C

Strong vibration may cause a displacement of the magnetic holder when subject to a strong lateral force.

Weight appr. 55 g
Fig. 8.3: Guide pulley TR1-DLS with mounting socket

Legend:
mm
(inches)

Adjust the distance, that the wire can’t snap off!
Appendix

Fig. 8.4: Guide pulley TR3-DLS fix with mounting socket

Fig. 8.5: Attachment head GK1-DLS
1 Set contains:

- 2 Pcs. mounting clamp Alu anodized
- 2 Pcs. bolt M4x20 DIN 933-A2
- 2 Pcs. antiturn washer J4.3 DIN 6797
- 2 Pcs. nut M4 DIN 934-A2

---

Fig. 8.6: Mounting clamp MT60-DLS
The delivery includes:
1 Pcs. wire extension
2 Pcs. nut M4 DIN 934-A2
2 Pcs. antiturn washer J4.3 DIN 6797
1 Pcs. distance piece M4 15 mm long

Fig. 8.7: Wire extension
WE-xxxx-M4

Fig. 8.8: Wire extension
WE-xxxx-CLIP
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