The D10 Expert Sensor is a high-performance plastic fibre-optic sensor whose many configuration (TEACH mode) options make it suitable for demanding applications. Even with all its features, it is extremely easy to use. Advanced 16-bit microcontroller technology makes this possible.

The D10 Expert provides high-performance sensing in low-contrast applications, with its Expert TEACH setup with static, dynamic and single-point programming plus manual fine adjustment, remote programming and lockout. Its slender, styled housing has a large digital display visible beneath a clear cover for easy programming and status monitoring during operation. The sensor mounts directly to standard 35 mm DIN rail or via the supplied mounting bracket.

The sensor features two outputs with independent set-points: one of two analog choices, depending on model, and one discrete (NPN or PNP, depending on model). Built-in crosstalk avoidance protocol provides trouble-free operation for multiple sensors in one area.

During RUN mode the 4-digit display shows the signal strength as a raw value or as a percentage of the threshold signal. The icons show if the TEACH buttons are disabled, if an OFF-delay is used and if the sensor is set for light or dark operation. In RUN mode, the LCD display is green and the output indicators show if the outputs are conducting.

In SETUP mode, the LCD display turns red. The user can advance through several options: light/dark operate, OFF-delay setting, display parameter and the power/speed combinations.

In TEACH mode, the LCD display is also red. Teaching the sensor can be done by presenting the ON and the OFF condition separately (static 2-point teach), by presenting ON and OFF conditions alternately “on the fly” (dynamic teach) or by presenting a single ON condition, resulting in an upper and a lower threshold (single-point teach).
D10 Expert series
DC operation with analog & discrete outputs

Wave length
Visible red 680 nm
Visible green 525 nm

Adjustments
dark/light operate
output OFF-delay (0, 2, 5, 10, 15, 20, 30, 40, 60, 80 or 100 ms)
push button lockout
response time/optical power
threshold level
display

Supply
Supply voltage $U_B$
12…24 VDC (4…20 mA models)
15…24 VDC (0…10 V models)

Ripple $V_{pp}$
≤ 10 %

No load current $I_0$
≤ 65 mA (4…20 mA models)
≤ 70 mA (0…10 V models)

Delay upon power up $t_d$
150 ms

Protection
reverse polarity
transient voltages
short-circuit
continuous overload
false pulse on power-up

Discrete output
Continuous load current $I_e$
≤ 150 mA
programmable
(10 kHz; 2,5 kHz; 500 Hz; 200 Hz)
4…20 mA or 0…10 VDC
4…20 mA models: 100 $\Omega$ max.
0…10 VDC models: 1 M$\Omega$ max.
1 ms

Analog output
Load
Response time

Material
Housing
black ABS/polycarbonate alloy
clear polycarbonate
IP50

Cover
Protection class
(IEC 60529/EN 60529)
-20…+55 °C
-20…+80 °C

Cable
2 m, PVC 6 x 0,5 mm²

Connector
cable

Indicators
4-digit LCD display program and run settings
Red or green LCD backlight
2 amber LEDs
indicates mode of operation
outputs conducting

Accessories
Brackets
SMBD10 30 623 76
through-hole mounting (included)

Connectors
ZKP6-2/P00 80 074 03
straight type
WKP6-2/P00 80 177 05
right-angled type

Dimensions [mm]

● Cable

● Connector

Wiring

pnp

nnp

* 0…10 VDC or 4…20 mA
D10 Expert series
DC operation with analog & discrete outputs

<table>
<thead>
<tr>
<th>Max. range</th>
<th>Light source</th>
<th>Output functions</th>
<th>Connection</th>
<th>Type</th>
<th>Ident. number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opposed mode PIT46U 1200 mm</td>
<td>red</td>
<td>pnp, 4...20 mA</td>
<td>cable</td>
<td>D10IPFP</td>
<td>30 623 88</td>
</tr>
<tr>
<td></td>
<td>red</td>
<td>pnp, 4...20 mA</td>
<td>connector</td>
<td>D10IPFPQ</td>
<td>30 623 89</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>pnp, 4...20 mA</td>
<td>cable</td>
<td>D10IPFPFPG</td>
<td>30 645 70</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>pnp, 4...20 mA</td>
<td>connector</td>
<td>D10IPFPFGQ</td>
<td>30 645 71</td>
</tr>
<tr>
<td>Opposed mode PIT46U 180 mm</td>
<td>red</td>
<td>pnp, 0...10 VDC</td>
<td>cable</td>
<td>D10UPFP</td>
<td>30 639 95</td>
</tr>
<tr>
<td></td>
<td>red</td>
<td>pnp, 0...10 VDC</td>
<td>connector</td>
<td>D10UPFPQ</td>
<td>30 639 96</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>pnp, 0...10 VDC</td>
<td>cable</td>
<td>D10UPFPG</td>
<td>30 645 76</td>
</tr>
<tr>
<td></td>
<td>green</td>
<td>pnp, 0...10 VDC</td>
<td>connector</td>
<td>D10UPFPGQ</td>
<td>30 645 77</td>
</tr>
</tbody>
</table>

1) with the sensor setup for Super High Power operation 2) models with npn output also available

Selecting the Output Channel
Before going into SETUP or TEACH mode, select the proper output channel. Click on both the “+” and the “-” buttons simultaneously to toggle between Output 1 and Output 2. A pointer in the LCD display shows the selected output.

• SETUP Mode
Enter the SETUP mode by holding down the “+” and the “-” buttons simultaneously until the LCD background becomes red. The sensor will return to RUN mode after cycling through the options, after a 60 s timeout or after holding down both the “+” and the “-” buttons for more than 2 s. In any case, the sensor will store any SETUP modifications already made.

1) Click the “+” button to toggle between light operate and dark operate.
   Click the “-” button to accept and advance to the next parameter.

2) Click the “+” button to toggle between 0, 2, 5, 10, 15, 20, 30, 40, 60, 80 and 100 ms OFF-delay.
   Click the “-” button to accept and advance to the next parameter.

3) • Discrete channel: Click the “+” button to toggle between “raw signal” and “percentage of the threshold value” display. Click the “-” button to accept and advance to the next parameter.
   • Analog channel: Click the “+” button to toggle between “0...10 VDC” and “4...20 mA” display.
     Click the “-” button to accept and advance to the next parameter.

4) Click the “+” button to toggle between Super High Speed, High Speed, High Power, and Super High Power. Click the “-” button to accept and return to RUN mode.

<table>
<thead>
<tr>
<th>Display</th>
<th>SHS</th>
<th>HS</th>
<th>HP</th>
<th>SHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time</td>
<td>50 µs/10 kHz</td>
<td>200 µs/2,5 kHz</td>
<td>1 ms/500 Hz</td>
<td>2,5 ms/200 Hz</td>
</tr>
<tr>
<td>Opposed mode range on PIT46U fibre</td>
<td>red: 300 mm</td>
<td>red: 550 mm</td>
<td>red: 1000 mm</td>
<td>red: 1200 mm</td>
</tr>
<tr>
<td></td>
<td>green: 100 mm</td>
<td>green: 100 mm</td>
<td>green: 160 mm</td>
<td>green: 180 mm</td>
</tr>
<tr>
<td>Diffuse mode range on PBT46U fibre</td>
<td>red: 100 mm</td>
<td>red: 250 mm</td>
<td>red: 300 mm</td>
<td>green: 60 mm</td>
</tr>
<tr>
<td></td>
<td>green: 30 mm</td>
<td>green: 42 mm</td>
<td>green: 100 mm</td>
<td>green: 180 mm</td>
</tr>
</tbody>
</table>

Remote TEACH Input
The gray wire allows all setup operations to be performed remotely and the buttons to be disabled. Check the operations manual for more details.

Gate Input
The pink wire allows the D10 sensor to be gated. When the wire is grounded, the outputs will be prevented from switching.
### D10 Expert series
DC operation with analog & discrete outputs

**• TEACH Mode**
Before teaching the threshold, select the output channel to be configured.

1) **Two-Point Static TEACH**
Enter Static TEACH mode by holding down the “Static (-)” button until the LCD display turns red.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When the display shows “1st”, present the ON target and click the “Static” button.</td>
</tr>
<tr>
<td>2</td>
<td>When the display shows “2nd”, present the OFF target and click the “Static” button.</td>
</tr>
<tr>
<td>3</td>
<td>If the conditions are acceptable, the display will show “PASS”, followed by a number denoting the contrast, then will return to RUN mode with the new settings.</td>
</tr>
<tr>
<td>4</td>
<td>If the conditions are not accepted, the display will show “FAIL” and return to “1st” teach point. After 60 s of inactivity the sensor returns to RUN mode without changing the settings.</td>
</tr>
</tbody>
</table>

2) **Dynamic TEACH**
Enter Dynamic TEACH mode by holding down the “Dynamic (+)” button until the LCD display turns red.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When the button is released, the contrast is evaluated. If the conditions are acceptable, the display will show “PASS”, followed by a number denoting the contrast, then will return to RUN mode with the new settings.</td>
</tr>
<tr>
<td>2</td>
<td>If the conditions are not accepted, the display will show “FAIL” and return to RUN mode without changing the settings.</td>
</tr>
</tbody>
</table>

3) **Single-Point Static TEACH**
Enter Static TEACH mode by holding down the “Static (-)” button until the LCD display turns red.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When the display shows “1st”, present the target and double click the “Static” button. The display will show “Sngl” and “Pt” and return to RUN mode. The output will be ON when the target is presented, OFF when more or less light is received.</td>
</tr>
<tr>
<td>2</td>
<td>If the Single-Point TEACH fails, the display will show “FAIL” and return to “1st” teach point. After 60 s of inactivity, the sensor returns to RUN mode without changing the settings.</td>
</tr>
</tbody>
</table>

**Adaptive Thresholds**
When the sensor is dynamically taught, the dark and light levels are constantly evaluated during RUN mode. The threshold is automatically centred between the light and the dark conditions. The new threshold level is periodically saved in non-volatile memory.

**Manual Adjust**
During RUN mode, the threshold level or tolerance may be adjusted by clicking the “+” or “-“ button.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If the sensor was taught statically, the threshold level will be increased or decreased.</td>
</tr>
<tr>
<td>2</td>
<td>If the sensor was taught dynamically, the threshold level will be increased or decreased and the adaptive threshold will be disabled.</td>
</tr>
<tr>
<td>3</td>
<td>If the sensor is running in single-point mode, the tolerance around the set point will be increased or decreased.</td>
</tr>
</tbody>
</table>
Analog Outputs

Output 1 is configured for either 4 to 20 mA or 0 to 10 VDC analog output, depending on the model. The sensor may be programmed using the two-point TEACH (either static or dynamic) or single-point static TEACH.

- **Teaching two set-points (static or dynamic):** The sensor sets the first taught condition to the highest output level (either 20 mA or 10 V), and the second taught condition to the lowest level (either 4 mA or 0 V), and scales between these points. If the first condition taught has more returned light, the sensor will be in Light Operate mode (LO). If the first taught condition is darker, the sensor will be in Dark Operate mode (DO). To change the slope of the analog output (refer to Figure 1), toggle LO/DO in Setup.

- **Single-point (static) Teach:** The sensor sets the taught condition to the mid-point of its range (12 mA or 5 V, depending on the model). For Light Operate mode, the sensor will automatically scale up to 20 mA (or 10 V) for maximum light condition (the maximum possible received signal) and down to 4 mA (or 0 V) for maximum dark condition (no signal), and vice-versa for Dark Operate mode. To change the slope of the analog output (refer to Figure 2), toggle LO/DO in Setup.

An OFF-delay enabled for the analog output acts as an averaging function. During the OFF-delay period, the sensor will take multiple analog readings and average the result before changing the analog value. This acts to reduce the effects of major spikes in the analog system, in effect “smoothing” the output reading.

**NOTE:** Depending on the application configuration and fibers used, the analog function may or may not behave linearly. The received light intensity will be dictated by the inverse square properties of light.

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**Figure 1.** Analog output as a function of target position – two set-points (static or dynamic)

**Figure 2.** Analog output as a function of target position – single-point TEACH