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1 Models

1.1 PTL110

- Optional 3-digit, alphanumeric display
- Optical and touch sensing options

<table>
<thead>
<tr>
<th>Family</th>
<th>Housing</th>
<th>Control</th>
<th>Sensor</th>
<th>Touch</th>
<th>Display</th>
<th>Connection*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTL</td>
<td>110</td>
<td>S</td>
<td>FF100</td>
<td>T</td>
<td>D3</td>
<td>QP150</td>
</tr>
</tbody>
</table>

- FF100 = 100 mm fixed field
- FF200 = 200 mm fixed field
- Blank = No sensor input

- T = Touch Sensor with Indicator
- L = Indicator only

- D3 = 3-digit LED display
- Blank = No display

* Models not connected in a series with a quick disconnect require a mating cordset

1.2 K50

- Bright, 50 mm diameter dome
- Optical sensor, capacitive touch button, and push button actuation options
- Optical sensor, touch, and indicator models rated IEC IP67 and IP69K per DIN 40050-9; push button models rated IEC IP65

<table>
<thead>
<tr>
<th>Family</th>
<th>Style</th>
<th>Activation Method</th>
<th>Control</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>K50</td>
<td>P</td>
<td>FF50</td>
<td>S</td>
<td>Q2PS</td>
</tr>
</tbody>
</table>

- FF50 = 50 mm Fixed Field
- FF100 = 100 mm Fixed Field
- FF200 = 200 mm Fixed Field
- PB = Push Button
- L = Indicator

- S = Serial/PICK-IQ™

1.3 Overview of PICK-IQ Devices

Indicator and Touch Area
Each PTL110 device contains an indication area. This indicator area is completely customizable with a variety of colors, intensities, and animations. In the touch sensor models, this indicator area has a laser marked logo and is also a touch surface. The touch sensor can be disabled.

Sensor
Optical sensor models contain a Banner fixed field optical sensor for actuation. Three distance models are available, 50 mm (2 in), 100 mm (4 in), and 200 mm (8 in). The optical sensor can be disabled in PTL110 models.

Only available in K50 optical models.
PTL110 Display

Display models contain a 3-digit, 7-segment display with three decimal points. The display is completely customizable and can show numbers as well as a set of letters and symbols. The decimal points can be configured to show various device statuses.

Connectors

Each PTL110 and Q2PS K50 devices have two M12 cables, one male and one female. These devices may be connected directly into each other. Patch cables may also be used. If needed, additional power may be injected into any part of the system.

1.3.1 Communications

These devices are powered by PICK-IQ™, a purpose-built, Modbus RTU compatible serial bus protocol that uses a Common ID to reduce the typical latency that results from polling multiple devices.

The standard Modbus protocol structure does not offer the performance required to operate medium to large sized pick-to-light systems with low latency response times. Adding more devices to a pick-to-light system running standard Modbus protocol eventually makes a pick-to-light system unusable because of the request/response nature of the protocol. The communication latency to and from the master device is too slow.

Using PICK-IQ adds a simple change to the devices that allow the Modbus master controller to run standard Modbus protocol, but achieve the performance required by a medium to large sized pick-to-light system. This change is the addition of a common ID addressing scheme.

1.3.2 Common ID

PICK-IQ devices each have an individual Modbus address called the device ID. PICK-IQ devices also have another address called the common ID.

By adding a common ID, the device responds to an additional address that can be shared among all devices in the system. For example, if a device has a device ID of 5 and a common ID of 195, then the device responds to all messages addressed to ID 5, regardless of actuation status, and messages are addressed to ID 195 when the device is actuated. The addition of this common address functionality allows the overall system to run much faster than a standard polling Modbus network.

When the Modbus master in the system is looking for an actuated device somewhere in the network, it only needs to poll the common ID instead of the entire system. When a device is actuated, it responds to the common ID. Through the common ID, the master can read the unit’s device ID stored in register 7940. When polling the common ID, Banner recommends reading a minimum of the device ID register 7940 and the output state register 7941. These registers hold the device ID of the device that was actuated and the status of which sensor was actuated on the device. When reading information from the common ID, only registers 7940 through 7942 are accessible. All other registers should be accessed through the device IDs.

After the device ID of the actuated device is known, use direct communication to the device through its unique device ID.

To prevent the device from responding to the same actuation event, reset the output state register 7941 to 0 by either changing the value directly or by writing to any register 8700 through 8752 before polling the common ID for new actuations. Write these values through the devices’ unique device ID and not the common ID. When the value in register 7941 is 0, the device will not respond to the common ID. The addition of this common address functionality allows the overall system to run much faster than a standard polling Modbus network.

Summary of registers:

- 7940—Defines the unique device ID
- 7941—Defines the output state
- 8700—Defines the device job state
- 8810—Defines the common ID

1.3.3 Timeout

When the system is running in normal operation, the master will experience communication timeouts, which are normal and expected. If no devices have been actuated, there will be no responses in the system. For this reason, it is important to configure your system with adequate communication timeouts.

Set the Modbus Master Timeout Adjustment parameters accurately to ensure all actuation events are captured. Modbus master messages polling the common ID result in a timeout most of the time. Set the master polling speed close to the minimum value allowed by the master. 100 ms is acceptable for a fast system response.

The timeout is because a device only responds to the common ID request when it is actuated. After that event, the value in register 7941 will be non-zero. The register remains non-zero until either the master reverts the value back to 0 (acknowledging the event) or the value times out.

Set the output latch timeout value to a value ten times the system polling speed of the master device. For example, if the master is polling the common ID every 100 ms, set the output latch timeout to 1000 ms. These values can be adjusted depending on the desired system performance.

Output latch timeout is defined in register 8812.
2 Configuration Instructions

2.1 Operational Modes

**Basic Mode**—This operating mode is the most straightforward to configure. In basic mode, the master controls all aspects of the device. The master must communicate all logic functions by defining what the transitions will look like.

<table>
<thead>
<tr>
<th>Register</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
</table>
| 8701     | Changes the visual animation of the indicator | 0—Indicator is off  
1—Indicator is on  
2—Indicator flashes with a 50% duty cycle  
3—Indicator strobes with a 20% duty cycle  
11–20—Indicator flashes N-10 times (that is, 15 will flash 5 times, then repeat) |
| 8702     | Selects the color of the indicator | 0 = Off  
1 = Red  
2 = Green  
3 = Yellow  
4 = Blue  
5 = Magenta  
6 = Cyan  
7 = White  
8 = Amber  
9 = Rose  
10 = Lime Green  
11 = Orange  
12 = Sky Blue  
13 = Violet  
14 = Spring Green |
### Registers: Animation Description

<table>
<thead>
<tr>
<th>Animation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steady</td>
<td>Color 1 solid on at defined intensity</td>
</tr>
<tr>
<td>Flash</td>
<td>Color 1 flashes at defined speed, intensity and pattern</td>
</tr>
<tr>
<td>Two Color Flash</td>
<td>Color 1 and color 2 flash alternatively at defined speed, intensities and pattern</td>
</tr>
<tr>
<td>Half/Half Top/Bottom</td>
<td>Color 1 is displayed on the top 50% of the indicator and color 2 is displayed on the bottom 50% of the indicator at defined intensities</td>
</tr>
<tr>
<td>Half/Half Left/Right</td>
<td>Color 1 is displayed on the left 50% of the indicator and color 2 is displayed on the right 50% of the indicator at defined intensities</td>
</tr>
<tr>
<td>Half/Half Rotate</td>
<td>Color 1 is displayed on 50% of the indicator and color 2 is displayed on 50% of the indicator while rotating at defined speed, intensities and rotational direction</td>
</tr>
<tr>
<td>Chase</td>
<td>Color 1 is displayed on 25% of the indicator and color 2 is displayed on 75% of the indicator while rotating at defined speed, intensities and rotational direction</td>
</tr>
<tr>
<td>Intensity Sweep</td>
<td>Color 1 repeatedly increases and decreases intensity between 0% and 100% at defined speed</td>
</tr>
</tbody>
</table>

### Registers: Pattern Description

- **6307, 6318, 6329, 6340, 6351**
  - Normal: Flash with a 50% duty cycle
  - Strobe: Strobe with a 20% duty cycle
  - 3-Pulse: Flash three times, then off, repeat
  - SOS: Flash three times quickly, three times slowly, then three times quickly
  - Random: Randomized pattern

### Registers: State Delays Description

- **6309, 6310, 6320, 6321, 6331, 6332, 6342, 6343, 6353, 6354**
  - State On-delays:
    - State On-delay: Defines the amount of time the device waits to move into the next visual state after actuation. State On-Delay defines the operation of the visual state while Input On-Delay (registers 6001 and 6002) defines the operation of output register change. (e.g.) If the device’s job input is active and the On-Delay is set to 1000 ms it will remain in the Job state for 1000 ms after the sensor is triggered or the touch surface is touched.
  - Job state:
    - Defines the amount of time the device will stay in the visual style of the current pick to light state after actuation before moving to the next state. (e.g.) After a successful pick from the Job state the device will move to the Acknowledge state. If the Acknowledge state Off-Delay is set to 3000 ms the device will remain in the Acknowledge state for 3000 ms before moving to the next visual state. This parameter is useful to show a pick was acknowledged.

### 2.2 Actuator Operation

In the PTL110, each input method can be defined as primary or secondary. This allows the input methods (touch or optical sensor) to be used together as one or independently of each other. The input in the K50 devices is always defined as Input 1.

**Primary Input Operation**—

- Input 1—Touch function of PTL110 or K50 input
- Input 2—Optical sensor of PTL110

<table>
<thead>
<tr>
<th>Input</th>
<th>Register</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input 1</td>
<td>6001</td>
<td>On-delay—Defines the time the button must be pushed or the sensor must be actuated to change the output from 0 to 1.</td>
</tr>
<tr>
<td>Input 2</td>
<td>6003</td>
<td>For example, if input 1 has an on-delay of 1000 ms, the touch surface must be held for 1000 ms before the output register 7941 changes from 0 to 1.</td>
</tr>
</tbody>
</table>
### Output Registers

<table>
<thead>
<tr>
<th>Output Registers</th>
<th>Register</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>7941</td>
<td>Holds the latched statuses of the inputs. This register is designed to be cleared by the master upon receipt. If the register is not cleared, the status will be cleared by the timeout (default 1000 ms) defined in register 8812.</td>
<td>0 = None actuated  1 = Primary actuated  2 = Secondary actuated (PTL110 only)  3 = Both actuated (PTL110 only)</td>
</tr>
<tr>
<td>Output Status</td>
<td>7942</td>
<td>Holds the real time status of the inputs.</td>
<td></td>
</tr>
</tbody>
</table>

### Secondary Input Operation (PTL110 only)

Enabling one input as the secondary input allows separate use of the other input. For example, use the primary input in a standard pick-to-light application and the secondary input as a call for parts. The secondary input has a different logic table.

#### Logic table for secondary input

<table>
<thead>
<tr>
<th>Job Input Logic</th>
<th>Not Actuated</th>
<th>Actuated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Active (0)</td>
<td>Wait State</td>
<td>Secondary Acknowledge State</td>
</tr>
<tr>
<td>Active (Non 0)</td>
<td>Job State</td>
<td></td>
</tr>
</tbody>
</table>

The indicator in the device is fully customizable. A variety of colors, animations, and intensities are available to customize the device for any application or system.

#### Registers

<table>
<thead>
<tr>
<th>Registers</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>6200 (in Basic Mode) or 6304, 6305, 6315, 6316, 6326, 6327, 6337, 6338, 6348, and 6349 (in State Mode)</td>
<td>Customize the intensity of the indicator</td>
<td>0 = High  1 = Medium  2 = Low  3 = Off</td>
</tr>
<tr>
<td>6202</td>
<td>Customize the sensitivity of the touch button</td>
<td>0 — A more deliberate touch is needed to active the touch output. Useful to avoid accidental triggers, such as in areas where water is present.  1 — Balanced sensitivity (default setting)  2 — A less deliberate touch is needed to active the touch output. Useful for faster operation or when operators are wearing gloves.</td>
</tr>
</tbody>
</table>

### 2.3 PTL110 7-Segment Display Operation

The display in the device is fully customizable, including both the digits and decimal points.

#### Registers

<table>
<thead>
<tr>
<th>Registers</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>8703 through 8799</td>
<td>Customizable 3-digit, 7-segment display  - In Primary operation, the values are right justified and null terminated. See Appendix for available characters. Note that upper case and lower case are differentiated and some representations are limited by the nature of the 7-segment display. (ASCII encoded)  - In Secondary operation, decimals stored in register 8703 and show on the display. (decimal encoded)</td>
<td></td>
</tr>
<tr>
<td>Registers</td>
<td>Description</td>
<td>Values</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>--------</td>
</tr>
<tr>
<td>6209</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Character</td>
<td>Value</td>
</tr>
<tr>
<td>0x30</td>
<td>0</td>
<td>0x61</td>
</tr>
<tr>
<td>0x31</td>
<td>1</td>
<td>0x62</td>
</tr>
<tr>
<td>0x32</td>
<td>2</td>
<td>0x63</td>
</tr>
<tr>
<td>0x33</td>
<td>3</td>
<td>0x64</td>
</tr>
<tr>
<td>0x34</td>
<td>4</td>
<td>0x65</td>
</tr>
<tr>
<td>0x35</td>
<td>5</td>
<td>0x66</td>
</tr>
<tr>
<td>0x36</td>
<td>6</td>
<td>0x67</td>
</tr>
<tr>
<td>0x37</td>
<td>7</td>
<td>0x68</td>
</tr>
<tr>
<td>0x38</td>
<td>8</td>
<td>0x69</td>
</tr>
<tr>
<td>0x39</td>
<td>9</td>
<td>0x6A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
<th>Character</th>
<th>Value</th>
<th>Character</th>
<th>Value</th>
<th>Character</th>
<th>Value</th>
<th>Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x41</td>
<td>A</td>
<td>0x4B</td>
<td>K</td>
<td>0x55</td>
<td>U</td>
<td>0x2F</td>
<td>/</td>
</tr>
<tr>
<td>0x42</td>
<td>B</td>
<td>0x4C</td>
<td>L</td>
<td>0x56</td>
<td>V</td>
<td>0x3C</td>
<td>&lt;</td>
</tr>
<tr>
<td>0x43</td>
<td>C</td>
<td>0x4D</td>
<td>M</td>
<td>0x57</td>
<td>W</td>
<td>0x3D</td>
<td>=</td>
</tr>
<tr>
<td>0x44</td>
<td>D</td>
<td>0x4E</td>
<td>N</td>
<td>0x58</td>
<td>X</td>
<td>0x3E</td>
<td>&gt;</td>
</tr>
<tr>
<td>0x45</td>
<td>E</td>
<td>0x4F</td>
<td>O</td>
<td>0x59</td>
<td>Y</td>
<td>0x3F</td>
<td>?</td>
</tr>
<tr>
<td>0x46</td>
<td>F</td>
<td>0x50</td>
<td>P</td>
<td>0x5A</td>
<td>Z</td>
<td>0x5B</td>
<td>[</td>
</tr>
<tr>
<td>0x47</td>
<td>G</td>
<td>0x51</td>
<td>Q</td>
<td>0x20</td>
<td>&quot;blank&quot;</td>
<td>0x5C</td>
<td>\</td>
</tr>
<tr>
<td>0x48</td>
<td>H</td>
<td>0x52</td>
<td>R</td>
<td>0x24</td>
<td>$</td>
<td>0x5D</td>
<td>]</td>
</tr>
<tr>
<td>0x49</td>
<td>I</td>
<td>0x53</td>
<td>S</td>
<td>0x2C</td>
<td>`</td>
<td>0x5E</td>
<td>^</td>
</tr>
<tr>
<td>0x4A</td>
<td>J</td>
<td>0x54</td>
<td>T</td>
<td>0x2D</td>
<td>-</td>
<td>0x5F</td>
<td>_</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0x60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0x7C</td>
<td></td>
</tr>
</tbody>
</table>

6203 Enables the ability to scroll a message longer than 3-digits

0 = Off
1 = Enabled, slow speed
2 = Enabled, standard speed
3 = Enabled, high speed

6205 Controls the scroll timing

6201 Changes the display’s orientation. Standard orientation shows the decimals on the bottom of the display.

0 = Standard (touch sensor/indicator located on the right)
1 = Flipped (touch sensor/indicator located on the left)

6204 Customizes the display’s message on startup

0 = None
1 = Show Modbus settings (slave ID, baud, data bits, parity bit, stop bit)
2 = Show custom message (6400-6409)

6206 through 6208 The display contains three decimal points; each decimal point is customizable

0 — Decimal point remains off
1 — Decimal point remains on
2 — Decimal point flashes
3 — Decimal point turns on when receiving communication
4 — Decimal point is on when idle and off while communicating
5 — Decimal point turns on while the touch sensor or optical sensor is active
2.4 Maximum System Size

The maximum size of the system depends on several factors. Changes to any of these items will affect the maximum number of devices that can be used together in one system.

- **Modbus Master**—Different Modbus masters may place restrictions on the number of devices it can address.
- **Power Supply**—The size of the power supply determines how many devices are able to run at one time. Additional power may be injected into the system anywhere.
- **Cable Length**—Total length of cabling, both from the master to the first device and all cabling connecting the devices. The total amount of cable influences the overall voltage available in the system.
- **Devices Status**—The number of devices typically on or active at any given time. The devices draw power at different levels depending on what features are active in the device.

<table>
<thead>
<tr>
<th>Device Status</th>
<th>Average Watts (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PTL110</td>
</tr>
<tr>
<td>Indicator Off, Display Off, Sensor Off</td>
<td>0.21</td>
</tr>
<tr>
<td>Indicator Off, Display Off, Sensor On</td>
<td>0.58</td>
</tr>
<tr>
<td>Indicator On, Display On (123), Sensor Off</td>
<td>0.91</td>
</tr>
<tr>
<td>Indicator On, Display On (123), Sensor On</td>
<td>1.30</td>
</tr>
<tr>
<td>Indicator On, Display On (888), Sensor Off</td>
<td>0.98</td>
</tr>
<tr>
<td>Indicator On, Display On (888), Sensor On</td>
<td>1.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System Examples (at 24 V dc)</th>
<th>Average Watts per Device (W)</th>
<th>Initial Cable Length (m)</th>
<th>Interconnect Cable Length (m)</th>
<th>Maximum Number of Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.21</td>
<td>10</td>
<td>0.5</td>
<td>119</td>
</tr>
<tr>
<td></td>
<td>0.58</td>
<td>10</td>
<td>0.5</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>1.30</td>
<td>10</td>
<td>0.5</td>
<td>40</td>
</tr>
</tbody>
</table>

2.5 Set the Device ID

The device ID can be set two ways:

- Assign a unique device ID to each device by individually connecting the device and changing the device ID register 6100 (or 7940). This method is consistent with traditional Modbus devices and uses the existing device ID of the device (default ID of 1).
- Write the new device ID to the active device ID register 7940 while the device output register 7941 is active. Output register 7941 is active when the device is actuated.

In this way it is possible to wire a complete system and address multiple devices quickly and easily. The following example is a recommended process to set device ID values through the common ID.

1. Initialize the starting IDs.
   - Determine the range of device IDs (addresses) to be used. Use a broadcast message to change all device IDs to the last address to be used. The initial device ID addresses do not need to be unique. The common ID address must be different than the addresses being assigned to the devices. If you are using 50 devices in the system, set all device IDs to 50.
2. Poll system for an active state.
   - Program the Modbus master to continuously poll the Common ID address requesting the active device ID address register 7940 and device output register 7941. Set the Master’s polling speed to a time value less than the latched output time out value in register 8812. A polling speed of 100 msec works well in most configurations.
3. Actuate a unique device.

---

2 Display status for K50 devices are not applicable.
3 Additional power may be injected anywhere into the system to overcome the voltage drop.
Manually trigger the active state of the device you wish to assign the unique device ID. Continue to manually trigger the active device until the visual state changes. Changing the physical state of the device must be done intentionally as in step 5.

4. Set a unique device ID.
   The device output register 7941 value will be non-zero when the device touch sensor or optical sensor is triggered. During this time the device responds to Modbus commands through the Common ID address. Write the desired device ID value to register 7940 by sending the command to the Common ID device address.

5. Clear the output status and give visual feedback.
   a) Clear the output latch register 7941 by writing directly to the unique device ID that was defined in the previous step.
   b) Write to the unique device ID and change the test mode register 6500 to a value of 1.

   Enabling test mode at this time gives visual feedback to the user that the device has been addressed and displays the actual device ID of the unit on the display if present. This has the additional function of disabling state changes to register 7941 to prevent accidentally addressing the device again.

6. For additional addressing, repeat steps 2 through 5, incrementing the assigned unique device ID values to each device.

7. Initialize the system for use. Send a broadcast message to all devices to clear (set to 0) the test mode register.
## 3 Installation Instructions

### 3.1 Wiring

#### Wiring for the PTL110S QP and K50 Q Models

<table>
<thead>
<tr>
<th>4-pin M12/Euro-style Male</th>
<th>4-pin M12/Euro-style Female</th>
<th>Pin</th>
<th>Wire Color</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>brown</td>
<td>1</td>
<td>brown</td>
<td>10 V DC to 30 V DC</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3</td>
<td>blue</td>
<td>DC common</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4</td>
<td>black</td>
<td>RS-485 (-)</td>
</tr>
<tr>
<td>4</td>
<td>white</td>
<td></td>
<td>white</td>
<td>RS-485 (+)</td>
</tr>
</tbody>
</table>

#### Wiring for the PTL110 QPS and K50 Q2PS Models

<table>
<thead>
<tr>
<th>5-pin M12/Euro-style Male</th>
<th>5-pin M12/Euro-style Female</th>
<th>Pin</th>
<th>Wire Color</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>brown</td>
<td>1</td>
<td>brown</td>
<td>10 V DC to 30 V DC</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3</td>
<td>blue</td>
<td>DC common</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4</td>
<td>black</td>
<td>RS-485 (-)</td>
</tr>
<tr>
<td>4</td>
<td>white</td>
<td></td>
<td>white</td>
<td>RS-485 (+)</td>
</tr>
<tr>
<td>5</td>
<td>gray</td>
<td></td>
<td>gray</td>
<td>Shield</td>
</tr>
</tbody>
</table>
# 4 Troubleshooting

## 4.1 Error Codes

<table>
<thead>
<tr>
<th>Problem</th>
<th>Display</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent communication</td>
<td>N/A</td>
<td>Try slowing the baud rate.</td>
</tr>
<tr>
<td>Hardware error</td>
<td>Err</td>
<td>Return to factory</td>
</tr>
<tr>
<td>Startup self check error</td>
<td>Test Error</td>
<td>Strobes red</td>
</tr>
<tr>
<td></td>
<td>3-pulse flashing red</td>
<td>Return to factory</td>
</tr>
</tbody>
</table>
5 Specifications

5.1 PTL110

Supply and Voltage Current
10 V dc to 30 V dc, UL Listed class 2 power supply
1.65 Watts max. power draw

Maximum Current
155 mA at 10 V dc
60 mA at 24 V dc
55 mA at 30 V dc
Current measurements assume indicator is on at high intensity, display is on, and sensor module is active. Typical device current will be dependent on its configuration.

Construction
Housing: ABS
Indicator: Polycarbonate
Lens: Acrylic

Optical Sensor Emitter LED
Infrared 870 nm

Connections
Integral PVC cable with quick disconnect, length varies depending on model

Environmental Rating
IEC IP54

Certifications

Operating Conditions
−40 °C to +50 °C (−40 °F to +122 °F)
90% at +50 °C maximum relative humidity (non-condensing)

Required Overcurrent Protection

<table>
<thead>
<tr>
<th>Supply Wiring (AWG)</th>
<th>Required Overcurrent Protection (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>22</td>
<td>3.0</td>
</tr>
<tr>
<td>24</td>
<td>2.0</td>
</tr>
<tr>
<td>26</td>
<td>1.0</td>
</tr>
<tr>
<td>28</td>
<td>0.8</td>
</tr>
<tr>
<td>30</td>
<td>0.5</td>
</tr>
</tbody>
</table>

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table. Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply. Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.
5.2 K50 Devices

Supply Voltage
10 V DC to 30 V DC

Supply Current
210 mA maximum current at 10 V DC
Touch Models: 55 mA typical at 24 V DC
Optical Models: 70 mA typical at 24 V DC
Push Button/Indicator Models: 55 mA typical at 24 V DC

Supply Protection Circuitry
Protected against reverse polarity and transient voltages

Touch Dwell Time
If touch dwells for longer than 60 seconds, the output will revert to the untouched state

Touch Response Time
Input Response: 5 ms minimum
Touch Response: 300 ms maximum (Standard Sensitivity touch response)

Optical Sensor Emitter LED
Infrared 870 nm

Operating Conditions
−40 °C to +50 °C (−40 °F to +122 °F)
Humidity: 90% at +50 °C maximum relative humidity (non-condensing)
Storage: −40 °C to +70 °C (−40 °F to +158 °F)

Environmental Rating
Touch, Indicator, and Optical Models: IEC IP67, IP69K per DIN 40050-9
Push Button Models: IEC IP65

Mounting
M30 × 1.5 threaded base, maximum torque 4.5 N·m (40 in·lbf)

Construction
Base, Dome, and Nut: Polycarbonate
Push Button: Thermoplastic

Vibration and Mechanical Shock
Meets IEC 60068-2-6 requirements (Vibration: 10 Hz to 55 Hz, 1.0 mm amplitude, 5 minutes sweep, 30 minutes dwell)
Meets IEC 60068-2-27 requirements (Shock: 30G 11 ms duration, half sine wave)

Connections
Integral 4-pin M12/Euro-style quick disconnect or dual 240 mm (9.4 in), shielded PVC cables with 5-pin M12/Euro-style quick disconnects, depending on model
Models with a quick disconnect require a mating cordset

Certifications


default indicator characteristics

<table>
<thead>
<tr>
<th>Color</th>
<th>Dominant Wavelength (nm) or Color Temperature (CCT) x y</th>
<th>Touch Button Models</th>
<th>Indicator Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>522 0.154 0.700</td>
<td>16.5 23</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>620 0.689 0.309</td>
<td>8.3 7.2</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>576 0.477 0.493</td>
<td>23.8 18</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>466 0.140 0.054</td>
<td>4.6 5.2</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>5700K 0.328 0.337</td>
<td>25.1 21.7</td>
<td></td>
</tr>
<tr>
<td>Cyan</td>
<td>493 0.170 0.340</td>
<td>18.4 26.2</td>
<td></td>
</tr>
<tr>
<td>Magenta</td>
<td>– 0.379 0.172</td>
<td>11.1 9.3</td>
<td></td>
</tr>
<tr>
<td>Amber</td>
<td>589 0.556 0.420</td>
<td>15.7 13</td>
<td></td>
</tr>
<tr>
<td>Rose</td>
<td>– 0.515 0.220</td>
<td>9.1 7.9</td>
<td></td>
</tr>
<tr>
<td>Lime Green</td>
<td>562 0.388 0.561</td>
<td>21.4 27.9</td>
<td></td>
</tr>
<tr>
<td>Sky Blue</td>
<td>486 0.155 0.247</td>
<td>19.5 28</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>599 0.616 0.370</td>
<td>12.1 10.2</td>
<td></td>
</tr>
<tr>
<td>Violet</td>
<td>– 0.217 0.089</td>
<td>9.7 10.7</td>
<td></td>
</tr>
<tr>
<td>Violet</td>
<td>– 0.217 0.089</td>
<td>9.7 10.7</td>
<td></td>
</tr>
<tr>
<td>Spring Green</td>
<td>508 0.177 0.536</td>
<td>17 24.1</td>
<td></td>
</tr>
</tbody>
</table>

Required Overcurrent Protection

**WARNING:** Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
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<table>
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<th>Supply Wiring (AWG)</th>
<th>Required Overcurrent Protection (Amps)</th>
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<tbody>
<tr>
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<tr>
<td>26</td>
<td>1.0</td>
</tr>
<tr>
<td>28</td>
<td>0.8</td>
</tr>
<tr>
<td>30</td>
<td>0.5</td>
</tr>
</tbody>
</table>

4 Q2PS models must be installed to protect the cable and cable entrance from high-pressure spray to meet IP69K.
5 Refer to the CIE 1931 (x,y) Chromaticity Diagram to show equivalent color with indicated color coordinates. Actual coordinates may differ ± 5%.
6 Values shown apply to touch dome models only. Lumen output for optical sensor models is 14% lower and push button models is 10% lower.
5.3 Dimensions

Touch Button

- Pipe Diameter: ø28 [1.10]
- Touch Button: Ø50 mm [1.97"]
- Plate: 30.1 [1.19]
- M5 x 0.8
- 6mm Screw Length Maximum 3 N•m Max Torque

Indicator

- M30 x 1.5 (mounting nut included)
- Internal Threads ½ - 14 NPT
- Max Torque 4.5 Nm (40 in-lbf)
- Max Torque 2.25 Nm (20 in-lbf)
- Indicator: 50.0 mm [1.97"]
- 38 mm (1.50”)
- 20 mm (0.79”)
- 11 mm (0.43”)

Push Button

- Ø50.0 mm [1.97”]
- Ø50.0 mm [1.97”]
- M30 × 1.5
- M12 × 1

Optical Sensor

- Ø50.0 mm [1.97”]
- 36.3 mm [1.43”]
- 67.3 mm [2.65”]
- M30 × 1.5
- M12 × 1
## 6 Accessories

### 6.1 Cordsets

Use single-ended cordsets between the power source and the quick disconnect connection of the first device in a chain. Use double-ended cordsets between devices in a chain.

#### 4-Pin Threaded M12/Euro-Style Cordsets—Single Ended

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQDC-406</td>
<td>1.83 m (6 ft)</td>
<td>Straight</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td>1 = Brown</td>
</tr>
<tr>
<td>MQDC-415</td>
<td>4.57 m (15 ft)</td>
<td></td>
<td></td>
<td>2 = White</td>
</tr>
<tr>
<td>MQDC-430</td>
<td>9.14 m (30 ft)</td>
<td></td>
<td></td>
<td>3 = Blue</td>
</tr>
<tr>
<td>MQDC-450</td>
<td>15.2 m (50 ft)</td>
<td></td>
<td></td>
<td>4 = Black</td>
</tr>
</tbody>
</table>

#### 4-Pin Threaded M12/Euro-Style Cordsets—Double Ended

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQDEC-401SS</td>
<td>0.31 m (1 ft)</td>
<td>Male Straight/Female Straight</td>
<td><img src="image2.png" alt="Diagram" /></td>
<td>Female</td>
</tr>
<tr>
<td>MQDEC-403SS</td>
<td>0.91 m (3 ft)</td>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>MQDEC-406SS</td>
<td>1.83 m (6 ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQDEC-412SS</td>
<td>3.66 m (12 ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQDEC-420SS</td>
<td>6.10 m (20 ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQDEC-430SS</td>
<td>9.14 m (30 ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MQDEC-450SS</td>
<td>15.2 m (50 ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 5-Pin M12/Euro-Style Shielded Cordsets

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQDC-STP-501</td>
<td>0.31 m (1 ft)</td>
<td>Straight</td>
<td><img src="image3.png" alt="Diagram" /></td>
<td>1 = Brown</td>
</tr>
<tr>
<td>MQDC-STP-501</td>
<td>0.91 m (3 ft)</td>
<td></td>
<td></td>
<td>2 = White</td>
</tr>
<tr>
<td>MQDC-STP-506</td>
<td>1.83 m (6 ft)</td>
<td></td>
<td></td>
<td>3 = Blue</td>
</tr>
<tr>
<td>MQDC-STP-515</td>
<td>4.6 m (15 ft)</td>
<td></td>
<td></td>
<td>4 = Black</td>
</tr>
<tr>
<td>MQDC-STP-530</td>
<td>9.1 m (30 ft)</td>
<td></td>
<td></td>
<td>5 = Shield</td>
</tr>
</tbody>
</table>
5-Pin Threaded M12/Euro-Style Shielded Cordsets – Double Ended

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
<th>Style</th>
<th>Dimensions</th>
<th>Pinout (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQDEC-STP-501SS</td>
<td>0.31 m (1 ft)</td>
<td>Male Straight/ Female Straight</td>
<td>Ø 14.5 M12 x 1</td>
<td>1 = Brown</td>
</tr>
<tr>
<td>MQDEC-STP-503SS</td>
<td>0.91 m (3 ft)</td>
<td>40 Typ.</td>
<td>Ø 14.5 M12 x 1</td>
<td>2 = White</td>
</tr>
<tr>
<td>MQDEC-STP-506SS</td>
<td>1.83 m (6 ft)</td>
<td>44 Typ.</td>
<td>Ø 14.5 M12 x 1</td>
<td>3 = Blue</td>
</tr>
<tr>
<td>MQDEC-STP-515SS</td>
<td>4.57 m (15 ft)</td>
<td></td>
<td></td>
<td>4 = Black</td>
</tr>
<tr>
<td>MQDEC-STP-530SS</td>
<td>9.14 m (30 ft)</td>
<td></td>
<td></td>
<td>5 = Shield</td>
</tr>
<tr>
<td>MQDEC-STP-550SS</td>
<td>15.2 m (50 ft)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.2 Brackets

6.2.1 PTL110

Use different brackets for mounting to various surfaces.

**LMBPTL110C**
- For 28 mm tubular racking
- Toolless mount to racking
- Hole center spacing: 50 mm

**LMBPTL110F**
- Flat mount
- For slotted extrusion and flat rail mounting
- 150 mm × 25 mm

**LMBPTL110A45**
- Angle mount
- For slotted extrusion and flat rail mounting
- 143 mm × 19 mm with a 30 mm depth

**ACC-CAP Euro-10**
- 10 Caps
- Seal and protect exposed, unterminated cascade quick disconnect connectors

6.2.2 K50

**SMB30A**
- Right-angle bracket with curved slot for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- 12-ga. stainless steel
- Hole center spacing: A to B=40
- Hole size: A= ø 6.3, B= 27.1 x 6.3, C= ø 30.5

**SMB30FA**
- Swivel bracket with tilt and pan movement for precise adjustment
- Mounting hole for 30 mm sensor
- 12-ga. 304 stainless steel
- Easy sensor mounting to extrude rail T-slot
- Metric and inch size bolt available
- Bolt thread: SMB30FA, A= 3/8 - 16 x 2 in; SMB30FAM10, A= M10 - 1.5 x 50
- Hole size: B= ø 30.1
SMB30FVK
- V-clamp, flat bracket and fasteners for mounting to pipe or extensions
- Clamp accommodates 28 mm dia. tubing or 1 in. square extrusions
- 30 mm hole for mounting sensors

Hole size: A = ø 31

SMB30MM
- 12-ga. stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor

Hole center spacing: A = 51, A to B = 25.4
Hole size: A = 42.6 x 7, B = ø 6.4, C = ø 30.1

SMB30RAVK
- V-clamp, right-angle bracket and fasteners for mounting sensors to pipe or extrusion
- Clamp accommodates 28 mm dia. tubing or 1 in. square extrusions
- 30 mm hole for mounting sensors

Hole size: A = ø 30.5

SMB30SC
- Swivel bracket with 30 mm mounting hole for sensor
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included

Hole center spacing: A= ø 50.8
Hole size: A= ø 7.0, B= ø 30.0

SMBAMS30P
- Flat SMBAMS series bracket
- 30 mm hole for mounting sensors
- Articulation slots for 90°+ rotation
- 12-ga. 300 series stainless steel

Hole center spacing: A=26.0, A to B=13.0
Hole size: A=26.8 x 7.0, B= ø 6.5, C= ø 31.0

SMBAMS30RA
- Right-angle SMBAMS series bracket
- 30 mm hole for mounting sensors
- Articulation slots for 90°+ rotation
- 12-ga. (2.6 mm) cold-rolled steel

Hole center spacing: A=26.0, A to B=13.0
Hole size: A=26.8 x 7.0, B= ø 6.5, C= ø 31.0

TC-K50-CL
- Touch cover

Diameter: A = 67 mm
Height: B = 42.5 mm

LMB30LP
- Low profile
- 30 mm mounting hole
- 300 series stainless steel

LMB30LPC
- For 28 mm tubular racking
- LMB30LP attached to clamp bracket
- Toolless mount to racking
- 30 mm mounting hole

www.bannerengineering.com - Tel: + 1 888 373 6767
7 Product Support and Maintenance

7.1 Contact Us

Banner Engineering Corp. headquarters is located at:

9714 Tenth Avenue North
Minneapolis, MN 55441, USA
Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

7.2 Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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For patent information, see www.bannerengineering.com/patents.

7.3 FCC Part 15 and CAN ICES-3 (B)/NMB-3(B)

This device complies with part 15 of the FCC Rules and CAN ICES-3 (B)/NMB-3(B). Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules and CAN ICES-3 (B)/NMB-3(B). These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the manufacturer.