PICK-IQ® Devices Product Manual

Original Instructions
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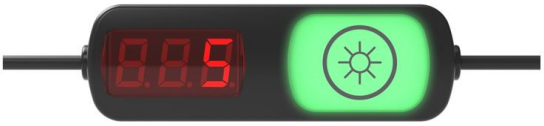
Chapter 1 Models

PTL110



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

Family	Housing	Control		Sensor	Touch	Display		Connection*
PTL	110	S	–	FF100	T	D3	–	QP150

- S = PICK-IQ® Serial Communication
- 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
- QP150 = Dual 150 mm PVC cable with 4-pin M12 quick disconnects; QPS150 = Dual 150 mm PVC shielded cable with 5-pin M12 quick disconnects

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

K30



- Bright, 30 mm diameter dome
- Capacitive touch button actuation option
- Touch and indicator models rated IP67 and IP69K per ISO 20653

Family	Style	Activation Method	Control	Connector
K30	P	T	S	Q2PS

- T = Touch Button; L = Indicator
- S = Serial/PICK-IQ®
- Q = 4-pin integral M12 quick disconnect; Q2PS = Dual 240 mm (5.9 in) PVC shielded cables with 5-pin integral M12 quick disconnects

Models with a quick disconnect require a mating cordset

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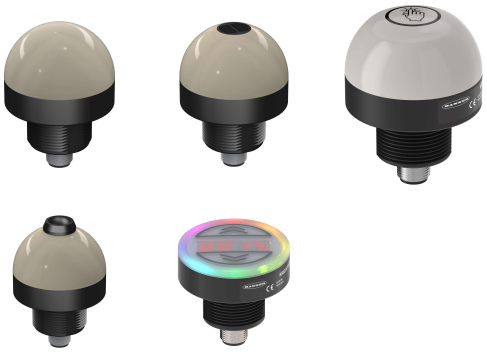
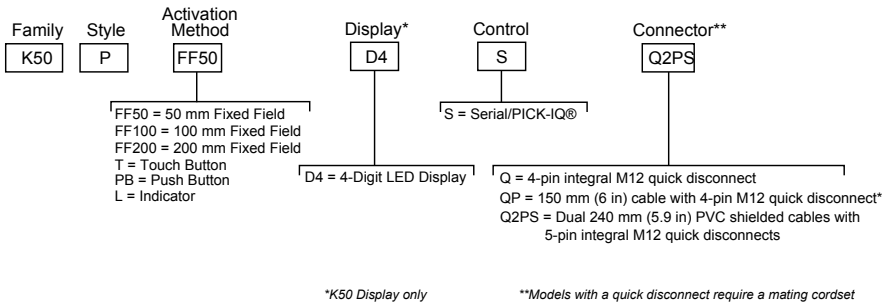
K50



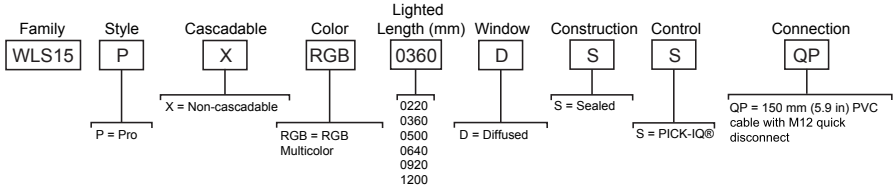
- Bright, 50 mm diameter dome
- Optical sensor, capacitive touch button, and push button actuation options
- Dual touch areas with display models
- Optical sensor, touch, display, and indicator models rated IP67 and IP69K per ISO 20653; push button models rated IP65



WLS15



- Bright, programmable strip light with RGB LEDs
- Individual LED control and ability to divide light into up to 10 total segments depending on length
- Rugged, water-resistant design; environmental rating of IP66 and IP67



Overview of PICK-IQ Devices

Indicator and Touch Area

Each 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.

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Sensor

Optical sensor models contain a Banner fixed field optical sensor for actuation. Three distance models are available, 50 mm (2 in)[1], 100 mm (4 in), and 200 mm (8 in). The optical sensor can be disabled in PTL110 models.

K50 Display

Display models contain a 4-digit, 7-segment display with four decimal points. The device has two independent touch areas, and 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.

PTL110 Display

Display models contain a 3-digit, 14-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, Q2PS K30, 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.

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.

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] Only available in K50 optical models.

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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.

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Chapter 2 Configuration Instructions

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.

Register	Description	Values	
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

State Mode—State mode requires the configuration of the device to define the visual settings for the four standard pick-to-light logic states, defined below. These settings are embedded inside the device and do not require communication from the master device to change visual states after the device is actuated. This allows the device to respond immediately to any interaction and allows the communication to the master to happen simultaneously.

Register	Description	Values
6300	Enables state mode	0 = Disabled (device will operate in Basic Mode) 1 = Enabled (device will operate in State Mode and use the configurations defined below)
6301 through 6354	Defines visual settings for pick to light states.	Registers 6301 to 6310 define the Waiting State Registers 6312 to 6321 define the Mispick State Registers 6323 to 6332 define the Job State Registers 6334 to 6343 define the Acknowledge State Registers 6345 to 6354 define the Secondary Acknowledge State * Refer to PICK-IQ® Register Map for descriptions and enumerations of these visual states
8700	Moves a device from the Wait state to the Job state	0 = Wait. Device is waiting and should not be triggered. If the device is triggered it will move to the Mispick state. 1 = Job. Device is active and should be triggered. If the device is triggered it will move to the Acknowledge state.

The job state animation and color may also be modified using registers 8701 and 8702 when in State Mode. Any values written to these registers override the values in registers 6323 and 6324. This allows the device to maintain a common set of Waiting, Acknowledge, and Mispick settings. This functionality allows the on-the-fly customization of the Job animation and color, which can be useful when multiple operators are picking from the same area.

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Primary Output Logic Tables in State Mode		
Job Input Logic (Register 8700)	**Not Actuated**	**Actuated**
Not Active (0)	Wait State	Mispick State
Active (1)	Job State	Acknowledge State

Registers	Animation	Description
6301, 6312, 6323, 6334, 6345	Off	Indicator off
	Steady	Color 1 solid on at defined intensity
	Flash	Color 1 flashes at defined speed, intensity and pattern
	Two Color Flash	Color 1 and color 2 flash alternatively at defined speed, intensities and pattern
	Half/Half Top/Bottom	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
	Half/Half Left/Right	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
	Half/Half Rotate	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
	Chase	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
	Intensity Sweep	Color 1 repeatedly increases and decreases intensity between 0% and 100% at defined speed

Registers	Pattern	Description
6307, 6318, 6329, 6340, 6351	Normal	Flash with a 50% duty cycle
	Strobe	Strobe with an 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-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.

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 and K30 devices is always defined as Input 1, and the input in the K50 Display models is always defined as Input 2.

Primary Input Operation—

- Input 1—Touch function of PTL110, K50, or K30 input
- Input 2—Optical sensor of PTL110, dual touch zone for K50 Display

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Input	Register	Description
Input 1	6001	On-delay—Defines the time the button must be pushed or the sensor must be actuated to change the output from 0 to 1. 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.
Input 2	6003	

Output Registers	Register	Description	Values
Output	7941	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.	0 = None actuated 1 = Primary actuated 2 = Secondary actuated (PTL110 only) 3 = Both actuated (PTL110 only)
Output Status	7942	Holds the real time status of the inputs.	

Secondary Input Operation (PTL110 and K50 Display 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		
Job Input Logic	**Not Actuated**	**Actuated**
Not Active (0)	Wait State	Secondary Acknowledge State
Active (Non 0)	Job State	

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	Description	Values
6200 (in Basic Mode) or 6304, 6305, 6315, 6316, 6326, 6327, 6337, 6338, 6348, and 6349 (in State Mode)	Customize the intensity of the indicator	0 = High 1 = Medium 2 = Low 3 = Off
6202	Customize the sensitivity of the touch button	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 need to active the touch output. Useful for faster operation or when operators are wearing gloves.

PTL110 14-Segment Display Operation

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

Registers	Description
6209	Customizable 3-digit, 14-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 14-segment display. (ASCII encoded) • In Secondary operation, decimals stored in register 8703 and show on the display. (decimal encoded)

Registers	Description	
	Value	Character
8703 through 8799	0x30	0
	0x31	1

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Registers	Description	
	Value	Character
	0x32	2
	0x33	3
	0x34	4
	0x35	5
	0x36	6
	0x37	7
	0x38	8
	0x39	9
	0x61	a
	0x62	b
	0x63	c
	0x64	d
	0x65	e
	0x66	f
	0x67	g
	0x68	h
	0x69	i
	0x6A	j
	0x6B	k
	0x6C	l
	0x6D	m
	0x6E	n
	0x6F	o
	0x70	p
	0x71	q
	0x72	r
	0x73	s
	0x74	t
	0x75	u
	0x76	v
	0x77	w
	0x78	x
	0x79	y
	0x7A	z
	0x41	A
	0x42	B
	0x43	C
	0x44	D
	0x45	E
	0x46	F
	0x47	G

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Registers	Description	
	Value	Character
	0x48	H
	0x49	I
	0x4A	J
	0x4B	K
	0x4C	L
	0x4D	M
	0x4E	N
	0x4F	O
	0x50	P
	0x51	Q
	0x52	R
	0x53	S
	0x54	T
	0x55	U
	0x56	V
	0x57	W
	0x58	X
	0x59	Y
	0x5A	Z
	0x20	"blank"
	0x24	$
	0x2C	'
	0x2D	-
	0x2F	/
	0x3C	<
	0x3D	=
	0x3E	>
	0x3F	?
	0x5B	[
	0x5C	\
	0x5D	]
	0x5E	^
	0x5F	_
	0x60	'
	0x7C	|

Registers	Description	Values
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	

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Registers	Description	Values
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

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.

Device Status[2]	Average Watts (W)		
	PTL110	K30	K50
Indicator Off, Display Off, Sensor Off	0.21	N/A	N/A
Indicator On, Display Off, Sensor Off	N/A	0.67	1.32
Indicator Off, Display Off, Sensor On	0.58	N/A	0.67
Indicator On, Display Off, Sensor On	N/A	N/A	1.68
Indicator On, Display On (123), Sensor Off	0.91	N/A	N/A
Indicator On, Display On (123), Sensor On	1.30		
Indicator On, Display On (888), Sensor Off	0.98	N/A	N/A
Indicator On, Display On (888), Sensor On	1.35		

[2] Display status for K30 and K50 devices are not applicable.

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System Examples (at 24 V DC)			
Average Watts per Device (W)	Initial Cable Length (m)	Interconnect Cable Length (m)	Maximum Number of Devices[3]
0.21	10	0.5	119
0.58	10	0.5	49
1.30	10	0.5	40

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.

   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.

Non-Volatile Registers

Non-volatile registers save their value to a persistent memory component, which allows them to maintain their value when power is turned off.

PTL110 devices with date code range of 20281 (date code register value 2020-10-07) to 22355 (date code register value 2022-12-21) will not save their value by default, otherwise they will save their value by default. To enable these registers to save their value, the Saving feature must be used by setting the holding register at address 6120 to a value of 0. When

[3] Additional power may be injected anywhere into the system to overcome the voltage drop.

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Saving is allowed, changing affected registers causes their new value to be saved. The non-volatile memory has a limited endurance that allows approximately 100 million changes to be saved in total.

PTL110 devices prior to the date code range of 20281 (date code register value 2020-10-07) do not have the ability to control the Saving feature. Writes to the non-volatile register groups are always saved for these devices, and approximately 1 million writes per register group are supported for those devices.

PTL110 Gen 2 devices and K50 Display devices have two save options: reset to non-volatile register or default save to volatile register.

> **NOTE:** Do not change these registers frequently. To help maintain lifetime, write multiple consecutive registers as one Modbus message instead of sending individual write messages for each register.

Non-Volatile Register Groups		
Register Address	**Register Map Name**	**Is Saving Disabled by Register Address 6120?**
6000-6003	Holding Registers for Outputs	Yes
6100-6103	Holding Registers to Configure Modbus Communication	Yes
6200-6209	Holding Registers for Device-Specific Configuration	Yes
6300-6355	Holding Registers to Configure State Mode	Yes
6400-6409	Holding Registers to Define a Custom Startup Message	Yes
8810-8813	Common ID Configuration Holding Registers	Yes

For applications that require frequent changing between a large variety of indications, it is recommended to disable saving during these frequent changes. Alternatively, Basic Mode can be used because some of its main control registers (for example, Color at register address 8702) are not saved.

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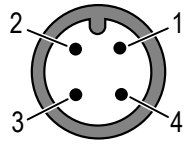
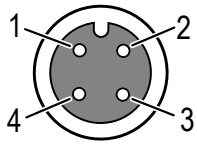
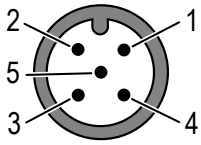
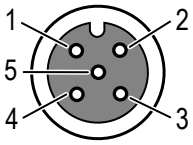
Chapter 3 Installation Instructions

Wiring

Wiring for the PTL110S QP, K30 Q, and K50 Q Models				
4-pin M12 Male	4-pin M12 Female	Pin	Wire Color	Connection
		1	brown	10 V DC to 30 V DC
		3	blue	DC common
		4	black	RS-485 (-)
		2	white	RS-485 (+)

Wiring for the PTL110 QPS, K30 Q2PS, and K50 Q2PS Models				
5-pin M12 Male	5-pin M12 Female	Pin	Wire Color	Connection
		1	brown	10 V DC to 30 V DC
		3	blue	DC common
		4	black	RS-485 (-)
		2	white	RS-485 (+)
		5	gray	Shield

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Chapter 4 Troubleshooting

Error Codes

Problem	Display		Solution
	7-Segment	Indicator	
Intermittent communication	N/A	N/A	Try slowing the baud rate.
Hardware error	Err	3-pulse flashing red	Return to factory
Startup self check error	Test Error	Strobes red	Return to factory

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FCC Part 15 Class B for Unintentional Radiators 22
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Chapter 5 Specifications

PTL110 Specifications

Supply and Voltage Current

10 V DC to 30 V DC, UL Listed class 2 power supply

1.35 Watts maximum power draw

Maximum Current

135 mA at 10 V DC

50 mA at 24 V DC

45 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 a quick-disconnect connector, length varies depending on model

Environmental Rating

IP54

Memory

The endurance of each 32-byte page that holds non-volatile register data is at least 1,000,000 write cycles.

Operating Conditions

–40 °C to +50 °C (–40 °F to +122 °F)

90% at +50 °C maximum relative humidity (non-condensing)

Certifications

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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.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

K30 Specifications

Supply Voltage

10 V DC to 30 V DC

Supply Current

Indicator Models:

60 mA maximum current at 10 V DC
28 mA typical at 24 V DC

Touch Models:

65 mA maximum at 10 V DC
30 mA typical at 24 V DC

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

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)

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Environmental Rating

IP67, IP69K per ISO 20653[4]

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)

Mounting

M22 × 1.5 threaded base, maximum torque 4.5 N·m (40 in·lbf)

Construction

Base, Dome, and Nut: Polycarbonate

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)

Memory

The endurance of each 32-byte page that holds non-volatile register data is at least 1,000,000 write cycles.

Connections

Integral 4-pin M12 male quick-disconnect connector or dual 240 mm (9.45 in) PVC-jacketed cables with 5-pin M12 male and 5-pin M12 female quick-disconnect connectors, depending on model

Models with a quick-disconnect connector require a mating cordset

[4] Q2PS models must be installed to protect the cable and cable entrance from high-pressure spray to meet IP69K.

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.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

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Default Indicator Characteristics

Color	Dominant Wavelength (nm) or Color Temperature (CCT)	Color Coordinates[5]		Lumen Output (Typical at 25 °C)	
		x	y	Touch Button Models	Indicator Models
Green	522	0.154	0.7	7.7	8.7
Red	620	0.689	0.309	3.1	3.6
Yellow	576	0.467	0.463	7.8	8.9
Blue	466	0.14	0.054	1.7	1.9
White	5700K	0.328	0.337	9.6	10.7
Cyan	493	0.157	0.331	8.7	9.9
Magenta	–	0.392	0.186	4.2	4.6
Amber	589	0.556	0.42	5.8	6.4
Rose	–	0.525	0.237	3.5	3.9
Lime Green	562	0.383	0.523	10	11.5
Sky Blue	486	0.145	0.24	9.2	10.5
Orange	599	0.616	0.37	4.6	5.1
Violet	–	0.224	0.099	3.4	3.9
Spring Green	508	0.155	0.524	8	9

K50 Specifications

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
Display Models: 220 mA typical at 10 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: IP67, IP69K per ISO 20653[6]
Push Button Models: IP65

Memory
The endurance of each 32-byte page that holds non-volatile register data is at least 1,000,000 write cycles.

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 quick-disconnect connector or dual 240 mm (9.4 in) shielded PVC cables with 5-pin M12 quick-disconnect connectors, depending on model
Models with a quick disconnect require a mating cordset

[6] 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%.

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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.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Certifications

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Default Indicator Characteristics

Color	Dominant Wavelength (nm) or Color Temperature (CCT)	Color Coordinates[7]		Lumen Output (Typical at 25 °C)		
		x	y	Touch Button Models[8]	Indicator Models	Display Models
Green	522	0.154	0.7	16.5	23	3.2
Red	620	0.689	0.309	8.3	7.2	1.7
Yellow	576	0.477	0.493	23.8	18	4.7
Blue	466	0.14	0.054	4.6	5.2	0.6
White	5700K	0.328	0.337	25.1	21.7	4.7
Cyan	493	0.17	0.34	18.4	26.2	3.6
Magenta	–	0.379	0.172	11.1	9.3	2.1
Amber	589	0.556	0.42	15.7	13	3.2
Rose	–	0.515	0.22	9.1	7.9	1.9
Lime Green	562	0.388	0.561	21.4	27.9	3.9
Sky Blue	486	0.155	0.247	19.5	28	3.8
Orange	599	0.616	0.37	12.1	10.2	2.5
Violet	–	0.217	0.089	9.7	10.7	1.2
Spring Green	508	0.177	0.536	17	24.1	3.3

WLS15 Specifications

Supply Voltage

12 V DC to 30 V DC

Use only with suitable Class 2 power supply (UL) or a SELV power supply (CE)

See electrical characteristics on product label

Light Length	Typical Current			Maximum Current
	12 V DC	24 V DC	30 V DC	A
0220 mm	0.12	0.06	0.05	0.125

Continued on page 21

[7] Refer to the CIE 1931 (x,y) Chromaticity Diagram to show equivalent color with indicated color coordinates. Actual coordinates may differ ± 5%.
[8] Values shown apply to touch dome models only. Lumen output for optical sensor models is 14% lower and push button models is 10% lower.

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Continued from page 20

Light Length	Typical Current			Maximum Current
	12 V DC	24 V DC	30 V DC	A
0360 mm	0.24	0.12	0.1	0.25
0500 mm	0.36	0.18	0.15	0.375
0640 mm	0.48	0.24	0.2	0.5
0920 mm	0.72	0.36	0.3	0.75
1200 mm	0.96	0.48	0.4	1

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

NOTE: Do not spray cable with high-pressure sprayer, or cable damage will result.

Construction

Clear anodized aluminum housing

Polycarbonate outer housing

Polyamide end caps

Connections

150 mm (6 in) PVC-jacketed cable with a 4-pin M12 male quick-disconnect connector

Models with a quick disconnect require a mating cordset

Input Response Time

45 ms maximum

Mounting

Integral mounting slots for M4 (#8) screws, tighten to 0.56 N·m (5 in·lbf) max torque

Multiple bracket options available

Secure cables within 150 mm (5.9 in) of the light

NOTE: It is recommended to use the provided mounting bushings when mounting using the endcaps. Center the mounting bushings in each slot to allow for expansion and contraction. Install using a M4 (#8) screw in each bushing torqued to a maximum of 0.45 N-m (4 in-lbf). For 920 mm and 1200 mm models in environments that vary more than 10 °C (18 °F), it is recommended to use one of the mounting bracket options instead of the end cap slots. If using the LMBWLS15 clip bracket and additional attachment is desired, only one end may be fastened using one of the spacers provided in the LMBWLS15 hardware packet to allow the opposite end to expand and contract. See mounting options in the instruction manual for bracket and tape options that allow expansion and contraction over temperature variations.

Environmental Rating

Rated IP66 and IP67

Suitable for wet locations per UL 2108

Vibration and Mechanical Shock

Vibration: 10 Hz to 55 Hz, 1.0 mm peak-to-peak amplitude per IEC 60068-2-6

Shock: 15G 11 ms duration, half sine wave per IEC 60068-2-27

Operating Temperature

–40 °C to +50 °C (–40 °F to +122 °F)

Storage Temperature: –40 °C to +70 °C (–40 °F to +158 °F)

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.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Certifications

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Light Characteristics

RGB LED PWM Frequency: 1kHz

Color	Dominant Wavelength (nm) or Color Temperature (CCT)	Color Coordinates[9]		Lumens at Specified Length (Typical at 25 °C)					
		X	Y	220 mm	360 mm	500 mm	640 mm	920 mm	1200 mm
Daylight White	5000K	0.345	0.352	30	60	90	120	180	240
Incandescent White	2700K	0.46	0.411	30	60	90	120	180	240
Warm White	3000K	0.44	0.404	30	60	90	120	180	240
Fluorescent White	4100K	0.376	0.374	30	60	90	120	180	240
Neutral White	5700K	0.328	0.337	30	60	90	120	180	240
Cool White	6500K	0.314	0.324	30	60	90	120	180	240
Green	532	0.181	0.735	45	90	135	180	270	360
Red	621	0.691	0.308	25	50	75	100	150	200
Yellow	578	0.473	0.474	35	70	105	140	210	280
Blue	467	0.137	0.056	10	20	30	40	60	80
Magenta	-	0.379	0.177	20	40	60	80	120	160
Cyan	492	0.15	0.334	30	60	90	120	180	240
Amber	590	0.552	0.414	30	60	90	120	180	240
Rose	-	0.508	0.23	25	50	75	100	150	200
Lime Green	565	0.393	0.535	40	80	120	160	240	320
Orange	600	0.611	0.37	30	60	90	120	180	240
Sky Blue	485	0.146	0.241	25	50	75	100	150	200
Violet	-	0.212	0.091	15	30	45	60	90	120
Spring Green	509	0.157	0.553	40	80	120	160	240	320

FCC Part 15 Class B for Unintentional Radiators

(Part 15.105(b)) 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. 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 dealer or an experienced radio/TV technician for help.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada ICES-003(B)

This device complies with 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.

Cet appareil est conforme à la norme NMB-3(B). Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne peut pas occasionner d'interférences, et (2) il doit tolérer toute interférence, y compris celles susceptibles de provoquer un fonctionnement non souhaité du dispositif.

[9] Refer to the CIE 1931 (x,y) Chromaticity Diagram to show equivalent color with indicated color coordinates. Actual coordinates may differ ± 5%.

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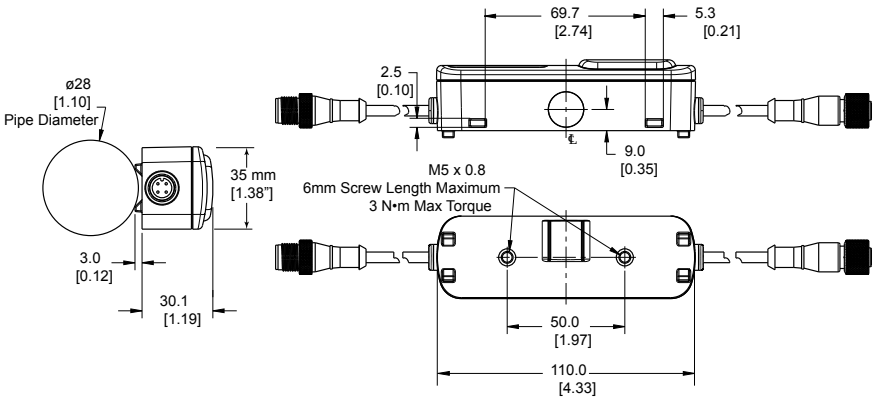
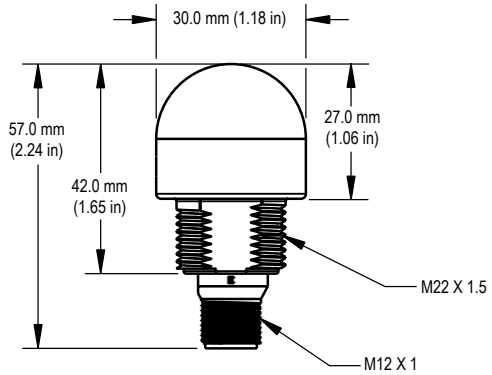
Dimensions

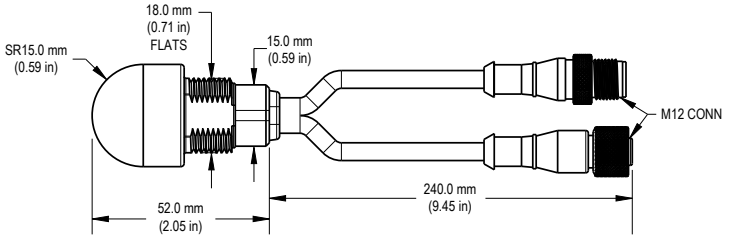
PTL110



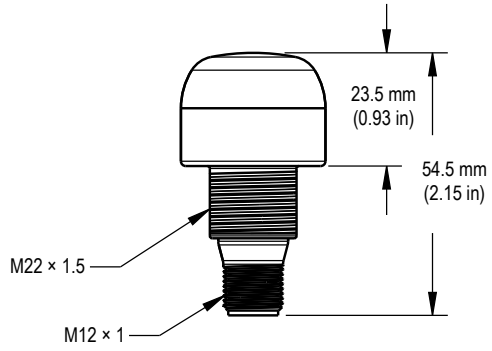
K30

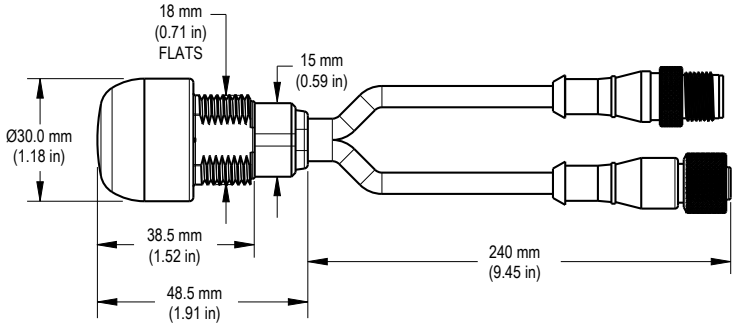
Indicator





Touch Button





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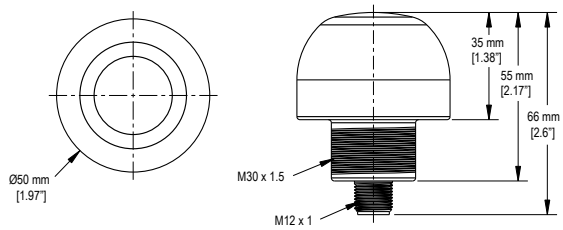
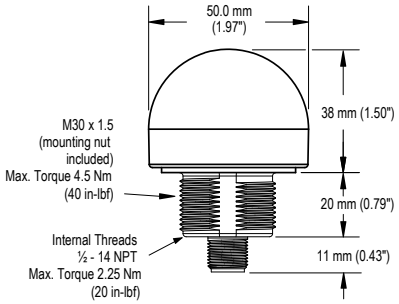
K50

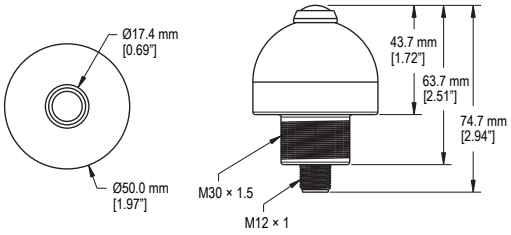
Touch Button



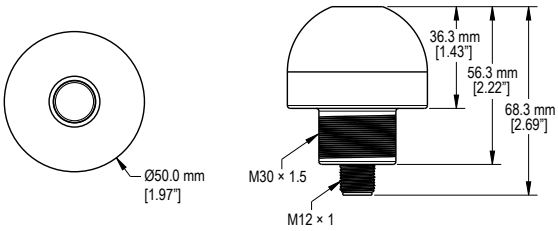
Indicator



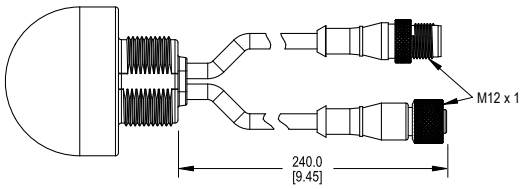
Push Button



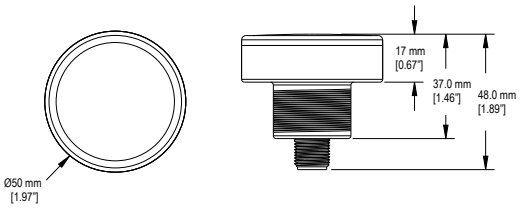
Optical Sensor



Splitter Cordset

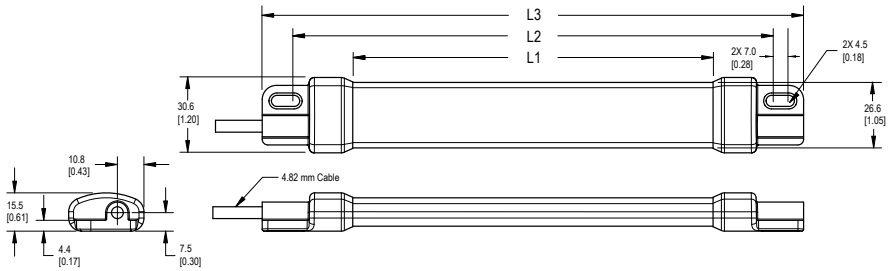


Display Button



NOTE: The splitter cordset dimensions are functionally identical for all K50 devices; the K50 Indicator is shown.

WLS15



Models	L1	L2	L3
WLS15..0220..	146.4 mm (5.76 inches)	194 mm (7.64 inches)	220 mm (8.66 inches)
WLS15..0360..	286.4 mm (11.28 inches)	334 mm (13.15 inches)	360 mm (14.17 inches)
WLS15..0500..	426.4 mm (16.79 inches)	474 mm (18.66 inches)	500 mm (19.69 inches)
WLS15..0640..	566.4 mm (22.3 inches)	614 mm (24.17 inches)	640 mm (25.2 inches)

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Continued from page 24

WLS15..0920..	846.4 mm (33.32 inches)	894 mm (35.2 inches)	920 mm (36.22 inches)
WLS15..1200..	1126.4 mm (44.35 inches)	1174 mm (46.22 inches)	1200 mm (47.24 inches)

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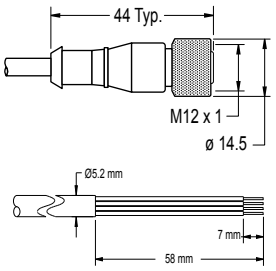
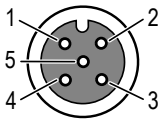
Brackets 27

Chapter 6 Accessories

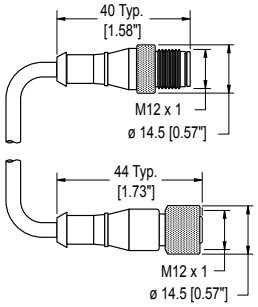
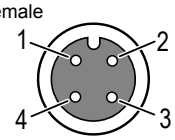
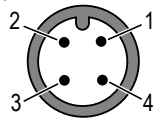
Cordsets

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 Single-Ended M12 Female Cordsets

Model	Length	Style	Dimensions	Pinout (Female)	
MQDC-403	1 m (3.28 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Not used
MQDC-406	2 m (6.56 ft)				
MQDC-410	3 m (9.8 ft)				
MQDC-415	5 m (16.4 ft)				
MQDC-430	9 m (29.5 ft)				
MQDC-450	15 m (49.2 ft)				
MQDC-460	18.3 m (60 ft)				
MQDC-470	21 m (68.9 ft)				
MQDC-4100	30 m (98.43 ft)				

4-Pin Double-Ended M12 Female to M12 Male Cordsets

Model	Length	Style	Dimensions	Pinout
MQDEC-401SS	0.31 m (1 ft)	Male Straight/Female Straight		Female  Male  1 = Brown 2 = White 3 = Blue 4 = Black
MQDEC-403SS	0.91 m (2.99 ft)			
MQDEC-406SS	1.83 m (6 ft)			
MQDEC-412SS	3.66 m (12 ft)			
MQDEC-415SS	4.58 m (15 ft)			
MQDEC-420SS	6.10 m (20 ft)			
MQDEC-430SS	9.14 m (30.2 ft)			
MQDEC-450SS	15.2 m (49.9 ft)			

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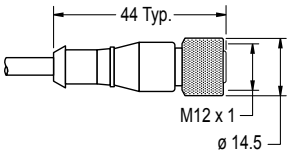
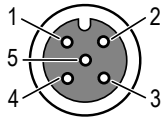
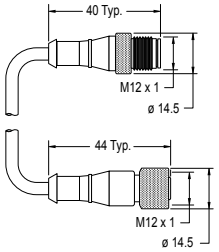
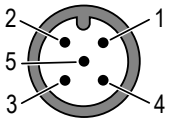
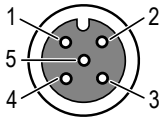
5-Pin Single-Ended M12 Female Shielded Twisted Pair Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDC-STP-501	0.31 m (1 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Shield
MQDC-STP-503	0.92 m (3 ft)			
MQDC-STP-506	1.83 m (6 ft)			
MQDC-STP-515	4.57 m (15 ft)			
MQDC-STP-530	9.15 m (30 ft)			

5-Pin Double-Ended M12 Female to M12 Male Shielded Twisted Pair Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Male)**	**Pinout (Female)**
MQDEC-STP-501SS	0.31 m (1 ft)	Male Straight/Female Straight			
MQDEC-STP-503SS	0.91 m (2.99 ft)				
MQDEC-STP-506SS	1.83 m (6 ft)				
MQDEC-STP-515SS	4.58 m (15 ft)				
MQDEC-STP-530SS	10 m (32.8 ft)			1 = Brown 2 = White 3 = Blue	4 = Black 5 = Shield
MQDEC-STP-550SS	15 m (49.2 ft)				

Brackets

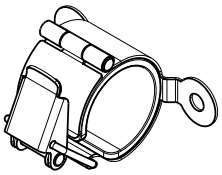
PTL110 Brackets

Use different brackets for mounting to various surfaces.

LMBPTL110C

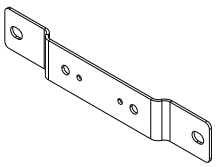
- For 28 mm tubular racking
- Toolless mount to racking
- CAD Files: DXF, PDF, IGS, STP

Hole center spacing: 50 mm



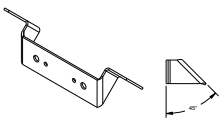
LMBPTL110F

- Flat mount
- For slotted extrusion and flat rail mounting
- 150 mm × 25 mm
- CAD Files: DXF, PDF, IGS, STP



LMBPTL110A45

- Angle mount
- For slotted extrusion and flat rail mounting
- 143 mm × 19 mm with a 30 mm depth
- CAD Files: DXF, PDF, IGS, STP



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ACC-CAP M12-10
- 10 Caps
- Seal and protect exposed, unterminated M12 quick-disconnect connectors

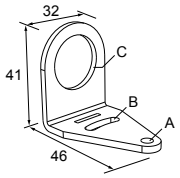


K30 Brackets

All measurements are listed in millimeters, unless noted otherwise. The measurements provided are subject to change.

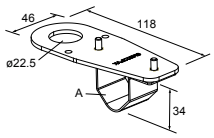
SMB22A
- Right-angle bracket with curved slot for versatile orientation
- 12-ga. stainless steel
- Mounting hole for 22 mm sensor
- CAD Files: DXF, PDF, IGS, STP

Hole center spacing: A to B = 26.0
Hole size: A = ø 4.6, B = 4.6 x 16.9, C = 22.2



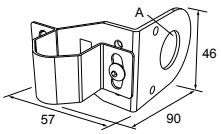
SMB22FVK
- V-clamp, flat bracket and fasteners for mounting to pipe or extensions
- Clamp accommodates 28 mm diameter tubing or 1 in. square extrusions
- 22 mm hole for mounting sensor
- CAD Files: DXF, PDF, IGS, STP

Hole size: A = ø 22.5



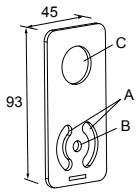
SMB22RAVK
- V-clamp, right-angle bracket and fasteners for mounting to pipe or extensions
- Clamp accommodates 28 mm diameter tubing or 1 in. square extrusions
- 22 mm hole for mounting sensor
- CAD Files: DXF, PDF, IGS, STP

Hole size: A = ø 22.5



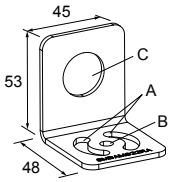
SMBAMS22P
- Flat SMBAMS series bracket with 22 mm hole for mounting sensors
- Articulation slots for 90+° rotation
- 12-ga. (2.6 mm) cold-rolled steel
- CAD Files: DXF, PDF, IGS, STP

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 22.5



SMBAMS22RA
- Right-angle SMBAMS series bracket with 22 mm hole for mounting sensors
- Articulation slots for 90+° rotation
- 12-ga. (2.6 mm) cold-rolled steel
- CAD Files: DXF, PDF, IGS, STP

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 22.5



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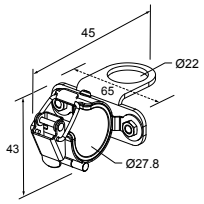
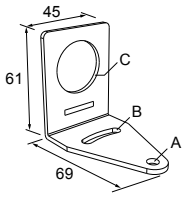
LMB22LPC
- For 28 mm tubular racking
- Toolless mount to racking
- 22 mm mounting hole
- CAD Files: DXF, PDF, IGS, STP



K50 Brackets

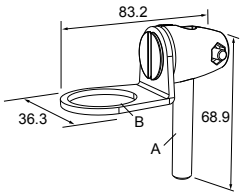
SMB30A
- Right-angle bracket with curved slot for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- 12-gauge stainless steel
- CAD Files: DXF, PDF, IGS, STP

Hole center spacing: A to B=40
Hole size: A=ø 6.3, B= 27.1 × 6.3, C=ø 30.5



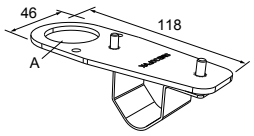
SMB30FA
- Swivel bracket with tilt and pan movement for precise adjustment
- Mounting hole for 30 mm sensor
- 12-gauge 304 stainless steel
- Easy sensor mounting to extrude rail T-slot
- Metric- and inch-size bolt available
- CAD Files: DXF, PDF, IGS, STP

Bolt thread: SMB30FA, A=3/8 - 16 × 2 in; SMB30FAM10, A=M10 - 1.5 × 50
Hole size: B=ø 30.1



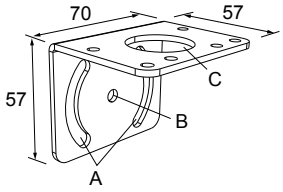
SMB30FVK
- V-clamp, flat bracket and fasteners for mounting to pipe or extensions
- Clamp accommodates 28 mm dia. tubing or 1 in. square extrusions
- 30 mm hole for mounting sensors
- CAD Files: DXF, PDF, IGS, STP

Hole size: A=ø 31



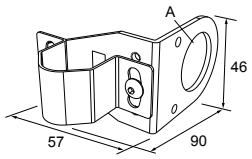
SMB30MM
- 12-gauge stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- CAD Files: DXF, PDF, IGS, STP

Hole center spacing: A=51, A to B=25.4
Hole size: A=42.6 × 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
- CAD Files: DXF, PDF, IGS, STP

Hole size: A=ø 30.5



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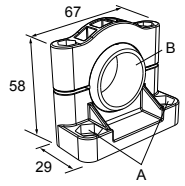
SMB30SC

- Swivel bracket with 30 mm mounting hole for sensor
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included
- CAD Files: DXF, PDF, IGS, STP

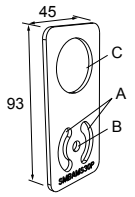
Hole center spacing: A=ø 50.8
Hole size: A=ø 7.0, B=ø 30.0



SMBAMS30P

- Flat SMBAMS series bracket
- 30 mm hole for mounting sensors
- Articulation slots for 90°+ rotation
- 12-gauge 300 series stainless steel
- CAD Files: DXF, PDF, IGS, STP

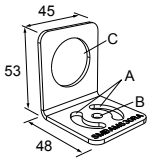
Hole center spacing: A=26.0, A to B=13.0
Hole size: A=26.8 × 7.0, B=ø 6.5, C=ø 31.0



SMBAMS30RA

- Right-angle SMBAMS series bracket
- 30 mm hole for mounting sensors
- Articulation slots for 90°+ rotation
- 12-gauge (2.6 mm) cold-rolled steel
- CAD Files: DXF, PDF, IGS, STP

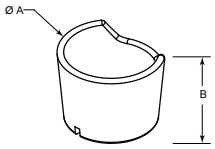
Hole center spacing: A=26.0, A to B=13.0
Hole size: A=26.8 × 7.0, B=ø 6.5, C=ø 31.0



TC-K50-CL

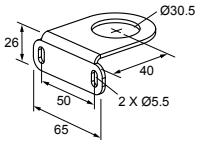
- Touch cover
- CAD Files: DXF, PDF, IGS, STP

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



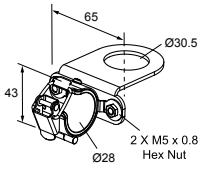
LMB30LP

- Low profile
- 30 mm mounting hole
- 300 series stainless steel
- CAD Files: DXF, PDF, IGS, STP



LMB30LPC

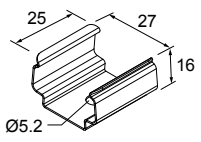
- For 28 mm tubular racking
- LMB30LP attached to clamp bracket
- Toolless mount to racking
- 30 mm mounting hole
- CAD Files: DXF, PDF, IGS, STP



WLS15 Brackets

LMBWLS15

- Stainless steel clip bracket
- Includes 3 clip brackets and 2 plastic spacers
- Clearance hole for M5 hardware
- CAD Files: DXF, PDF, IGS, STP



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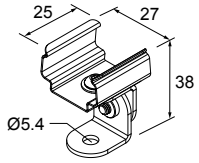
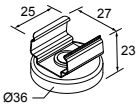
LMBWLS15-150S

- Set of 2 stainless steel swivel brackets, allows for 150° of movement
- Clearance hole for M5 button head screw
- CAD Files: DXF, PDF, IGS, STP



LMBWLS15MAG

- Set of 2 brackets
- Magnetic mounting bracket for attachment to steel and iron surfaces
- CAD Files: DXF, PDF, IGS, STP



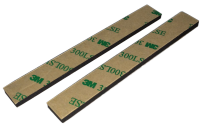
LMBWLS15TD

- Includes 4 100 mm (4 in) strips of 3M™ Dual Lock™ reclosable fasteners
- Recommended for mounting to metal and plastic surfaces
- Strong, pressure-sensitive adhesive bonds on contact



LMBWLS15TF

- Includes 2 100 mm (4 in) strips of double-sided foam urethane strips
- Acrylic adhesive provides high bond strength to most surfaces
- Bonds to low surface energy plastics such as polypropylene and powder-coated paints



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Repairs 32
Contact Us 32
Banner Engineering Corp Limited Warranty 32

Chapter 7 Product Support and Maintenance

Clean with Mild Detergent and Warm Water

Wipe down the device with a soft cloth dampened with a mild detergent and warm water solution. Do not use any other chemicals for cleaning.

Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

> **IMPORTANT:** If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

Contact Us

Banner Engineering Corp. | 9714 Tenth Avenue North | Plymouth, MN 55441, USA | Phone: + 1 888 373 6767

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

Banner Engineering Corp Limited Warranty

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