

Pick-to-Light Solutions Guide

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Chapter 1 Product Overview

The Pick-to-Light Solutions Guide uses a ScriptBasic program and application-specific XML developed by Banner to quickly integrate a system without the need to have an advanced understanding of programming methods.

Definition of PICK-IQ®

The Pick-to-Light Solutions Kit allows users to interface with PICK-IQ® products. PICK-IQ is a modified usage of the Modbus RTU protocol that allows for quick responses in large serial networks. Each Pick-to-Light device is assigned a common ID and a unique device ID. This allows a unique device to be written with specific information, but a controller to only monitor a single ID point for the speed of a two-node network.

Understanding the Application Control

Pick-to-Light, also known as light-directed or light-guided picking, refers to the use of colored LED indicators to guide assemblers and operators to the correct part or product location. Pick-to-Light solutions can also be used to indicate the number of parts to pick and proper pick order.

These solutions make manual picking processes faster and more accurate in a wide variety of applications including assembly, kitting, and order fulfillment.

The four main states of a pick device are:

PTL110 Pick-to-Light Sensor



Wait State

The device is either inactive or the bin is not selected in the current pick group (default = color and animation off).

Mispick State

While in Wait State, when the primary or secondary sensor becomes active, the state changes to Mispick after the on-delay is met, and stays on for the duration of the sensor actuation. Mispick on-delay is used to filter unintended activations (default = red flash).

Job State

When the Job Status is not zero, the individual device goes into the Job State, indicating that it is in the current pick routine. Animation, color, intensity, speed, pattern, and direction are controlled for maximum efficiency (default = green steady).

Acknowledge State

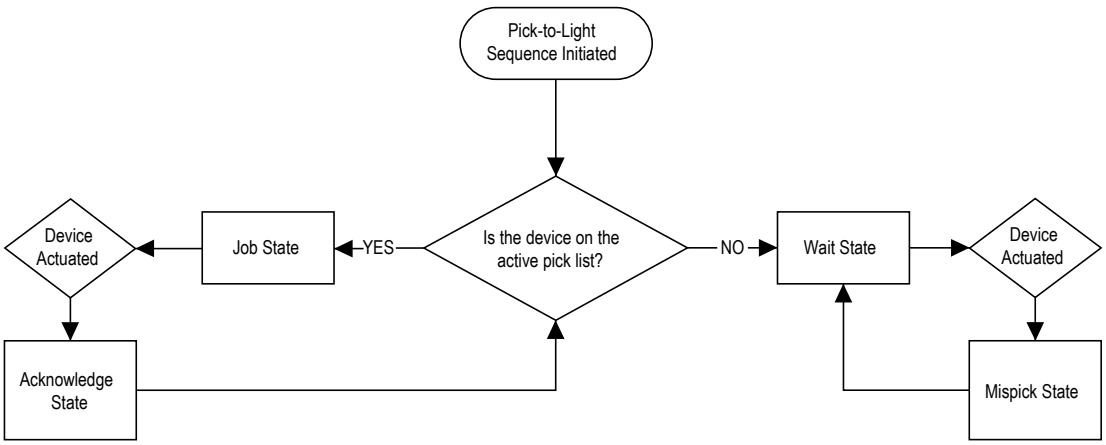
The Acknowledge State is activated when either of the sensors are actuated in the Job State. A secondary Acknowledge State (2) is included to distinguish between touch and optical sensor interaction (default = yellow steady).

Primary Output Logic Tables

Job Input Logic	Touch or Sensor Not Activated	Touch or Sensor Activated
Not Active	Wait State	Mispick State
Active	Job State	Acknowledge State

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Pick-to-Light Flowchart



Features



- Operator tasks are integrated at the device level
- Multiple methods to access and control registers to allow integrations across platforms
  - Modbus RTU
  - Ethernet TCP/IP
  - Ethernet/IP
  - Direct API connection
  - Cloud Interface
- All the device level logic is written and tested; user is focused on higher level data aggregation out of the box
- Ability to store 256 recipes for a pick station or to configure them spontaneously
- Allows for a sequential or batch picking mode
- Easily assign Device IDs with flexibility for moves, adds, and changes
- Touch and optical sensor interactions can be uniquely identified to provide dual functionality

Solution Components

DXM700

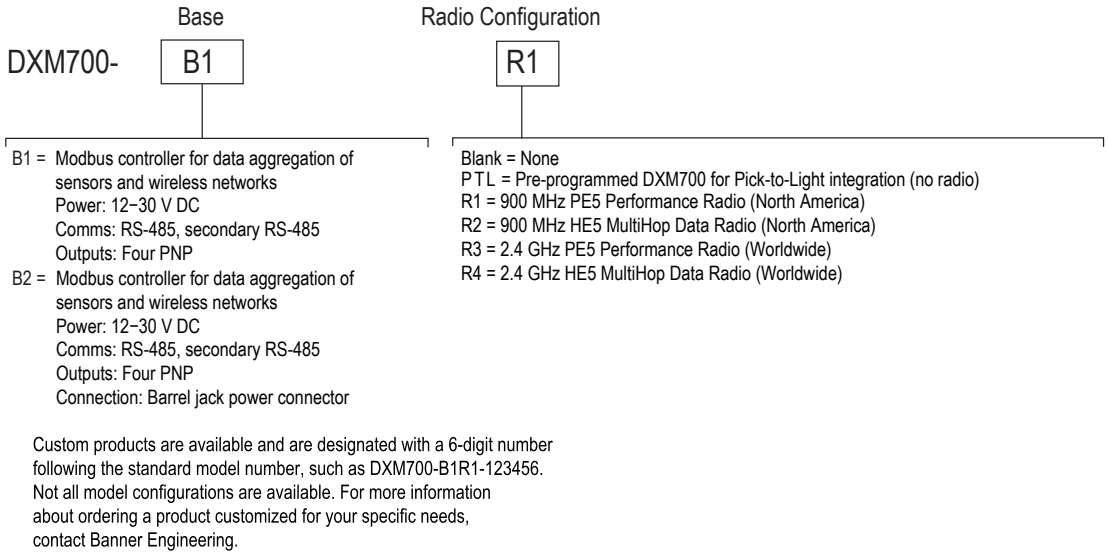
DXM700-B1-PTL



The DXM700 Controller with the ScriptBasic Solution completes all of the low-level logic for a Pick-to-Light device and provides access to supervisory systems. The internal Modbus master controls the main Pick-to-Light network, while the interface to the control system is either through an ethernet port or a high-speed serial port.

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Model	Description
DXM700-B1-PTL	Pre-Programmed DXM700 for Pick-to-Light Integration



Custom products are available and are designated with a 6-digit number following the standard model number, such as DXM700-B1R1-123456. Not all model configurations are available. For more information about ordering a product customized for your specific needs, contact Banner Engineering.

Reference the following documents for further information about the DXM700:

DXM700-B1 Wireless Controller Datasheet	Original document PN 207893
DXM700-Bx Wireless Controller Instruction Manual	Original document PN 207894

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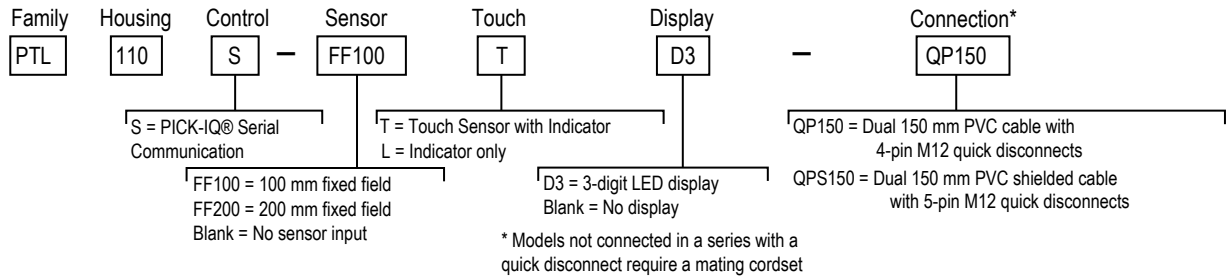
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Chapter 2 Compatible Hardware

PTL110

The PTL110 with PICK-IQ® is an indicator with the ability to change colors and animation styles to bring active attention to a bin. The addition of the optional 3-digit LED display allows for quantities or scrolling messages. Optional inputs can be a touch sensor on the indicator and/or a fixed-field sensor in the base. Low power methods allow for 64 devices to be wired on one 24 V DC power source.



NOTE: Address initialization requires a touch sensor. Adding the display option allows you to view the device ID, which makes set-up and maintenance easy.

Reference the following documents for further information about the PTL110:

PTL110S Pick-to-Light -- Datasheet	Original document PN 206183
PTL110S Pick-to-Light -- Instruction Manual	Original document PN 206185
PTL110S Pick-to-Light Device Registers	Original document PN 209995

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Chapter 3 Configuration Instructions

To customize the system for an application, basic modifications need to be made to the template. If the pre-configured DXM700-B1-PTL is not being used, there are two files that can be uploaded to a DXM700: the XML file that defines the DXM's hardware configuration, and the ScriptBasic file that controls the run-time logic. Loading these files and making adjustments requires the use of Banner's DXM Configuration Software v4 and the Pick-to-Light ScriptBasic file via the link below. Users with a DXM700-B1-PTL may skip these steps.

1. Download the pre-configured files. (B_5915802)
2. Extract the ZIP files into a folder on the user's computer, noting the file location.
3. Connect the DXM700 using the USB cable supplied with the DXM700 to a computer containing the DXM Configuration Tool V4 software.
    a. Download and install the DXM Configuration Software v4 (B_4496867) if not already installed on the computer.
4. Launch the software and select DXM700 when prompted.
5. Load the Pick-to-Light file by going to the **File › Load** menu. Choose the configuration (.xml) file.
6. Connect the software to the DXM700 by going to the **Device › Configuration Settings** menu.
    a. Select **Serial**.
    b. Select the COM port that the USB cable is plugged into.
    c. Click **Connect.**

    If it is unclear which COM port is being used and/or multiple ports appear, attempt connection to each one until there is a successful connection, and there is confirmation of the connection on the bottom toolbar.
7. Upload the PTL110 file by going to the **Upload Script › Settings** screen. Click **Upload File** and select the file.
8. Select the uploaded file in the window to the right of the **Upload Script** button. Click **Add Selected to Startup**.

    The DXM700 runs this script every time it restarts.
9. Save the XML file using the **File › Save**menu.

NOTE: The tool does not autosave. Save the XML file any time the XML has been changed.

NOTE: Local Register 199 changes from 0 to 1 when the script begins running.

Initialization Modes

The Initialization modes in the DXM program can test the Pick-to-Light network, trigger demonstration modes, or assign Device IDs to one or more devices in the network. Initialization modes use DXM Local Registers 851-853. A remote server uses DXM Local Registers 851-853 to trigger these operations:

DXM Local Register Number	Name	Description
1	Initialization Mode	Initialization Mode register to select operation to run
851	Starting DID	Starting Device ID, first assigned Device ID for Pick-to-Light devices
852	Ending DID	Ending Device ID, last assigned Device ID for Pick-to-Light devices

Initialization Modes	Local Registers	Value	Description
Test Mode	1	3	Broadcast a sequence of light changes for each device in the network
	851	First ID	First ID in the network

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Initialization Modes	Local Registers	Value	Description
	852	Last ID	Last ID in the network
Assign Device IDs	1	2	Start the process of assigning IDs to each device
	851	First ID	First ID to assign in the network
	852	Last ID	Last ID to assign in the network

NOTE: If the script becomes unresponsive in an initialization mode, write a 1 into Local Register 7.

Assign a Single Device ID

The following method only works with Pick-to-Light devices with touch sensors.

1. Set DXM Local Register 851 (Starting DID) to the value of the Device ID.
2. Set DXM Local Register 1 (Initialization Mode) to a value of 1.

   When the DXM Controller recognizes a value of 1 in the Initialization Mode register, it begins broadcasting the network devices into the Test Mode (blue flashing with Device ID displayed).
3. If the Device ID is present in the network, that device resets to Device ID 1 (default) to eliminate duplication.

   The process causes the devices to flash.
4. Touch the sensor on the new device to assign the ID.

   When a device is selected, the indicator changes to green. Local Register 1 returns to the value 0 to signal completion.

Assign Multiple Device IDs

The following method only works with Pick-to-Light devices with touch sensors. Device IDs are assigned in sequential order.

1. Set DXM Local Register 851 (Starting DID) to the value of the first Device ID.
2. Set DXM Local Register 852 (Ending DID) to the last Device ID.
3. Set DXM Local Register 1 (Initialization Mode) to a value of 2.

   When the DXM Controller recognizes a value of 2 in the Initialization Mode register, it begins the process of assigning IDs to Pick-to-Light devices in the network. The process starts by flashing all devices red.
4. Touch the sensor on the first device to assign the first ID.

   When a device is selected, the color for that device changes to green.
5. Touch the sensor on the next device.

   The controller assigns the next ID to that device. The process continues until all devices are assigned IDs.

Connectivity Test Mode

1. Set DXM Local Register 1 (Initialization Mode) to a value of 3 to trigger the DXM Controller to quickly flash each Pick-to-Light device in the connected network continuously.

   This starts at the value in Local Register 851 and goes through until the value in Local Register 852, and then repeats.

   The purpose of this is to demonstrate the absolute best-case speed of the serial network.
2. Set DXM Local Register back to 0 to terminate the mode.

Clear Mode

1. Set DXM Local Register 1 (Initialization Mode) to a value of 6 to trigger the DXM Controller to:
   - Do a broadcast transmission to clear the three-digit displays
   - Set all units into Wait State
   - Set Color 1, Color 2, and Animation to a value of 0
2. When complete, it sets the DXM Local Register 1 back to a value of 0.

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Using Read/Write Registers Operation

There are four registers that are used to control a Register read/write portal to any externally connected PICK-IQ® device. Data of up to 10 holding registers are handled with a single transfer:

1. Write the function, address, number of registers, and write data (if needed).
2. Write the Device ID number for the selected device to trigger the operation.

After the Device ID is detected as non-zero, it forms the device message and begins the broadcast. Once the operation is complete, it zeroes out the Read/Write Device ID.

	Local Register Name	Values	Description
700	RdWrDID	1-247,4096	Specify the Device ID to read or write, 4096 = Broadcast to all
701	RdWrFunction	0, 1	0 = Read operation, 1 = Write operation
702	RdWrAdrs	1 - 65535	Starting address in the Device
703	NumOfRegs	1-10	Read or write up to 10 registers
704	WrData1	0 - 65535	Write data
...	...		...
713	WrData10	0 - 65535	Write data
714	RdData1	0 - 65535	Read data
...	.....	.....	.....
723	RdData10	0 - 65535	Read data

Examples

How to Read Job Mode Settings with Device ID 12

To read registers 6324 through 6333:

1. Write a 0 (zero) into RdWrFunction register (#701) to request a Read.
2. Write a 6324 into RdWrAddrs (#702) to start at the Job Mode animation address.
3. Write a 10 into Number of Registers (#703) so all registers are read.
   The Read takes place when the RdWrDID (#700) receives a 12 to read DID 12.
   RdWrDID (#700) turns to 0 (zero) when complete, and the data will be in RdData1 through RdData10 (Registers 714-723).
   Registers #701, #702, and #703 keep the previous values, so writing a 13 into RdWrDID (#700) writes to the next device.

   The program changes the DID from 13 to 0 (zero) when complete and places the data in #714-#723.

How to Write Wait Mode Settings with Device ID 8

To read registers 6302 through 6311:

1. Write a 1 (one) into RdWrFunction register (#701) for Write.
2. Write a 6302 into RdWrAddrs (#702) to start at the Wait Mode animation address.
3. Write a 10 into Number of Registers (#703) so all registers are written.
4. Write the desired data into fields WrData1 through WrData10 (#704 to #713).
   The Write takes place when the RdWrDID (#700) receives an 8 to read DID 8.
   RdWrDID (#700) turns to 0 (zero) when complete, and the data will still be in WrData1 (#704) and WrData10 (#713).
   Registers #701, #702, and #703 keep the previous values, so writing a 9 onto RdWrDID (#700) writes to the next device. DID 4096 broadcasts to all devices on the network.

   When complete, the program changes the DID from 9 to 0 (zero).

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Chapter 4 Operating Modes

Operating modes are defined by DXM Local Register 5. DXM Local Registers 6 through 8 are control registers that vary the **Pick Sequence** or **Batch Sequence** operation. Pick Sequence is the operating mode that turns on pick devices in a sequential order; Batch Sequence turns them on simultaneously. The Pick-to-Light list ID and the list entries are in DXM Local Registers 10 and higher.

DXM Local Register Number	Name	Description
5	Operation Mode	Selects one of the operational modes: **Teach Mode**, **Pick Sequence**, **Batch Sequence**, and **Save Host List**.
6	Run Host List	When running **Pick Sequence** or **Batch Sequence** modes, the list can come from the DXM SD card or from the Host when it writes the list into DXM Local Registers. **Run Host List = 0** runs the list from the SD Card on the DXM Controller **Run Host List = 1** runs the list written to the DXM Local Registers by the host system
7	Stop Operation	Stop = 1 pulls the program out of a loop and resets to 0 when complete.
8	Run List Once	DXM Local Register 8 set to a 1 value forces the **Pick Sequence** or **Batch Sequence** operation to only run one time. The program zeroes out the Operation Mode register when a sequence is finished.
10	List ID	A numeric value to identify the list stored in DXM Local Registers 11 and higher. The list is stored in pairs of numbers for each entry: the Device ID and the Count.
11	List Entry(n) DID	Identifies the Device ID of the device in the network.
12	List Entry(n) Count	Defines the count value associated to the previous Device ID. The count can be the display on the LED display or encoded in the flash pattern for the device.
13	List Entry(n+1) DID	Entry N+1 on the list
14	List Entry(n+1) Count	Entry N+1 on the list

Operating Mode	Local Register	Value	Description
Teach Mode	5	1	Set DXM Local Register 5 (Operation Mode) to a value of 1 to start Teach Mode. Teach Mode continues until Operation Mode register is set to zero.
	10	List ID	A unique identifier for the list created, typically a number from 1-256. The list is stored on the SD card using this ID.
Sequence Pick Mode	5	2	Set DXM Local Register 5 (Operation Mode) to a value of 2 to start a pick sequence with the list ID defined in DXM Local Register 10 (List ID).
	10	List ID	The stored list is loaded from the SD card into Local Registers 10+. The List ID defines which stored list is loaded.
Batch Pick Mode	5	3	Set DXM Local Register 5 (Operation Mode) to a value of 3 to start a batch pick with the list ID (Local Register 10) defining the stored list.
	10	List ID	The stored list is loaded from the SD card into Local Registers 10+. The List ID defines which stored list is loaded.
Save Host List	5	4	The host writes Local Registers 10+, defining a list for the DXM Controller. Set DXM Local Register 5 (Operation Mode) to a value of 4 to save the list in Local Registers to the SD card.
	10	List ID	A unique identifier for the list created, typically a number from 1-256. The list is stored on the SD card using this ID.

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Operating Mode	Local Register	Value	Description
Compact List	5	5	Removes redundant lists the user may have created on the SD card. For example, if the user creates 3 different sequences with the same list ID, only the last list is actually used, and the others can be deleted.

Teach Mode

The DXM Controller saves a user-defined sequence of light activations. The following method only works with Pick-to-Light devices with touch and optical sensor options.

1. To enter Teach Mode, set DXM Local Register 5 (Operation Mode) to a value of 1 and DXM Local Register 10 (List ID) to the list ID.

   As the Teach sequence progresses, DXM Local Registers 11 and higher store the captured list.
2. Trigger the sensor on each device in sequence to define a list.

   The DXM Controller turns on the green light when a device is selected and turns off the light when another device is selected. While the sensor is active, the touch increases the count, and optical sensor decreases the count.
3. Terminate the mode by writing the DXM Local Register 5 (Operation Mode) to a value of 0.

   The list is automatically stored under the recipe in the value of Local Register 10 on the DXM SD card in the root directory, file SBFile1.dat.

Sequence Pick Mode

Sequence Pick Mode turns on pick devices in sequential order based on the List ID.

1. Set Local Register 10 (List ID) to the list ID and Local Register 5 (Operation Mode) to a value of 2.
   - To run a list only once, set DXM Local Register 8 (Run List Once) to a value of 1.
   - To run a list written to the Local Registers from the host, not the SD card, set DXM Local Register 6 (Run Host List) to a value of 1.

   This starts the Pick-to-Light sequence. The list is in DXM Local Registers 11+: Register 11 contains the first Device ID in the sequence, and Register 12 contains the count associated to the first Device ID. Each subsequent device on the list is stored in DXM Local Registers requiring two Local Registers for each device. The list terminates with a zero in the Device ID.
2. Terminate the mode by setting the DXM Local Register 5 (Operation Mode) to a value of 0.

   After the mode is terminated, the last Pick-to-Light device must be selected before the mode is terminated.

Batch Pick Mode

Batch Pick Mode turns on the pick devices simultaneously based on the List ID.

1. To start the Batch sequence, set DXM Local Register 10 (List ID) to the List ID and DXM Local Register 5 (Operation Mode) to a value of 3.
   - To run a list only once, set DXM Local Register 8 (Run List Once) to a value of 1.
   - To run a list written to the Local Register from the host (not the SD card), set DXM Local Register 6 (Run Host List) to a value of 1.

   The list is in Local Registers 11+, and all devices defined in the list turn on.
2. Activate the sensor on the Pick-to-Light device. This causes the controller to turn off the light.

   When all devices are turned off, the process starts again.
3. Terminate the mode by setting DXM Local Register 5 (Operating Mode) to a value of 0.

Host Load List

The host loads the List ID, the list of devices, and the counts into Local Registers 10+. When the host writes the Operating Mode register (Local Register 5) with a value of 4, the list is stored on the DXM Controller SD card.

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Compact List

Saving a list to the SD card always appends it to the end of the file SbFile1.dat. It never deletes any lists. After many teach operations, it is possible to get multiple lists with the same List ID.

1. To remove multiple lists in SBFile1.dat with the same List ID, set DXM Local Register 5 (Operation Mode) to a value of 5.

   If there are multiple lists with the same List ID, the last duplicate entry is the one saved in the file.
2. The file SBFile1.dat can also be edited manually. Use the DXM Configuration Tool to read or write files to the SD card.

File SbFile1.dat

The pick lists created during a Teach operation or by the user are stored in a file named SbFile1.dat in the root directory of the DXM local SD card. An example of the file is shown below. All values are separated by a comma. The first entry on the line is the List ID, and the last entry on a line is an E, indicating the end of the list. The in-between value pairs define the Device ID and Count for each pick. The Device ID is the Pick-to-Light identifier given to a device when it is commissioned in the network. The count is either the number of flashes for the device or a value to be put on the Pick-to-Light LED/LCD display.

List_ID,DevID,Count,DevID,Count, … ,E,

1,101,123,102,234,103,345,104,456,105,567,106,678,107,789,108,890,109,1,110,2,E,
33,101,1,102,2,103,3,104,4,E,
35,101,1,102,2,103,3,104,4,105,5,E,
37,106,1,107,2,E,

> **NOTE:** Because the program only saves one value to be used as display data, the display information is limited.

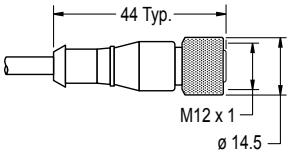
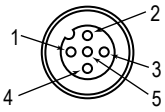
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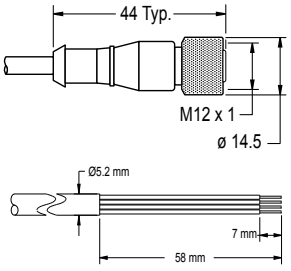
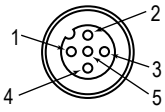
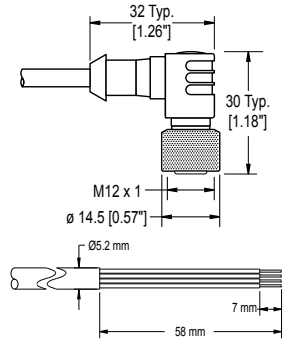
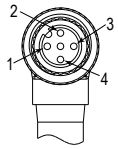
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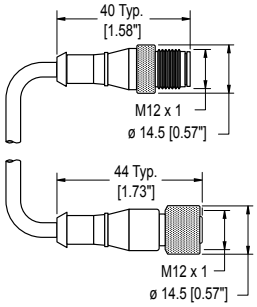
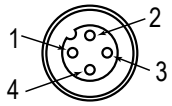
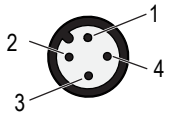
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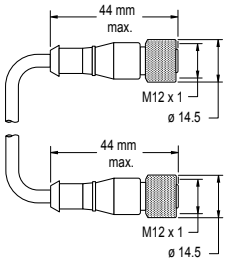
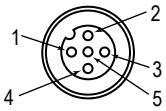
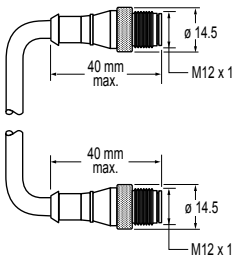
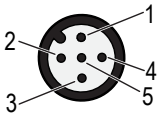
Cordsets

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)			

4-Pin Single-Ended M12 Female Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**	
MQDC-406	2 m (6.56 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Not used
MQDC-415	5 m (16.4 ft)				
MQDC-430	9 m (29.5 ft)				
MQDC-450	15 m (49.2 ft)				
MQDC-406RA	2 m (6.56 ft)	Right-Angle			
MQDC-415RA	5 m (16.4 ft)				
MQDC-430RA	9 m (29.5 ft)				
MQDC-450RA	15 m (49.2 ft)				

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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)			

4-Pin Double-Ended M12 Shielded Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout**	**Key**
MQDEC-STP-501SS-FF	0.31 m (1 ft)	Female Straight/ Female Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Shield
MQDEC-STP-501SS-MM	0.31 m (1 ft)	Male Straight/Male Straight			

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Chapter 6 Product Support and Maintenance

Recommended Resources

PTL110S Pick-to-Light Device Register Map	Original document PN 209995
PTL110S Pick-to-Light Devices - Instruction Manual	Original document PN 206185
DXM Configuration Software V4 - Instruction Manual	Original document PN 209933
DXM700 Controller - Instruction Manual	Original document PN 207894
ScriptBasic for DXM Controller	Original document PN 186221
DXM Controller Protocol	Original document PN 186221

Contact Us

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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.

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