High-Frequency RFID Reader with Modbus Product Manual

Original Instructions
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Contents

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Chapter Contents

Chapter 1 Overview

The RFID Read/Write head works with high-frequency tags designed to be installed on industrial equipment to report equipment or process information back to a central control system. Tool and process information, such as tool IDs, parameters, purchase date, maintenance status, and service life, can be stored in the tag. Read/write heads collect and report this information to manage manufacturing processes and maintenance cycles.

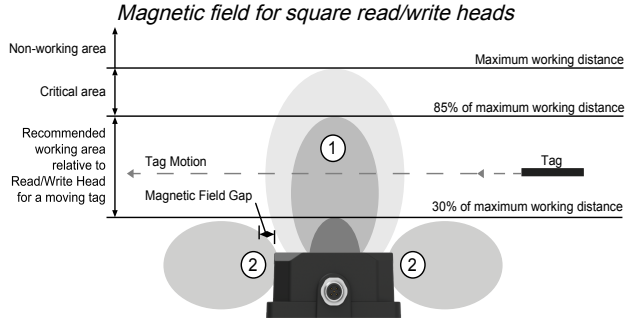
Typical applications include:

- Managing tool and/or fixture locations
- Locating parts within a manufacturing process
- Tracking service life

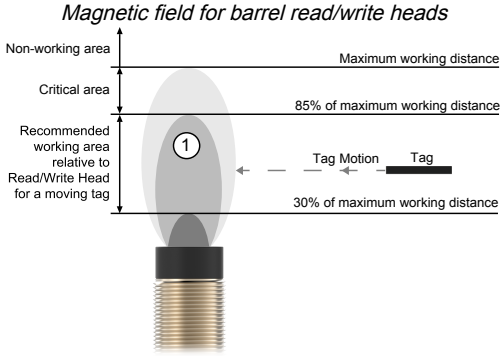
Read/write heads generate an induced magnetic field. This magnetic field is divided into minimum, maximum, and recommended working distances.

- Maximum distance: Outside the maximum distance (see "Maximum Distance Between the Read/Write Head and Tag" on page 6), data may not transfer correctly from the tag, resulting in a data error
- Recommended maximum working distance: The recommended maximum working distance is about 85% of the maximum range. Within this recommended working distance, the tag activates and communicates reliably with the read/write head.
- Minimum distance (30% of the maximum distance): For applications involving moving tags, Banner Engineering Corp recommends positioning the read/write head and tag separation distance to be greater than 30% of the maximum distance.

Magnetic field for square read/write heads



Magnetic field for barrel read/write heads



1. Main magnetic field
2. Secondary magnetic field (applies to square read/write heads only)

The tag should approach the read/write head within the maximum distance as listed in "Maximum Distance Between the Read/Write Head and Tag" on page 6, but can approach from any direction. The best performance is when the read/write head and tag are when the tag's front face is parallel to the reader.

When operating in a metallic working environment, thoroughly test your application to ensure the read/write head and tag are operating as expected.

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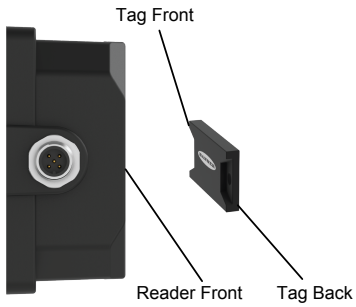
Install the read/write head and tag faces to be parallel



RFID Read/Write Head Models

RFID Read/Write Head with Modbus Models

Models	Read/Write Distance Range (depends on the tag model used)	Size	Connector	
BID-HS30-MQ	0-60 mm	30 Dia x 92 mm	A-Code M12	
BID-HQ90-MQ	0-110 mm	90 x 90 x 40 mm	A-Code M12	

The maximum distance between the read/write head and the tag varies depending on the tag model used. Always test your installation before mounting your components.

RFID Tag Models

RFID Tag Models

Tag Models	Can be Mounted on Metal	Size	Memory	
THS30C	No	30 mm dia	112 bytes	
THS30C-2K	No	30 mm dia	2000 bytes	
THB14M5C	Can be installed on or embedded in metal	14 x 18.6 mm	112 bytes	

Continued on page 5

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Continued from page 4

Tag Models	Can be Mounted on Metal	Size	Memory	
THQ40C	No	40 x 22 mm	112 bytes	
THQ40C-2K	No	40 x 22 mm	2000 bytes	
THQ40CM	Can be installed on or embedded in metal	40 x 22 mm	112 bytes	
THQ66C	No	66 x 34 mm	112 bytes	
THQ66C-2K	No	66 x 34 mm	2000 bytes	
THQ66CM	Can be installed on or embedded in metal	66 x 34 mm	112 bytes	

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Chapter Contents

Chapter 2 Installation Instructions

Maximum Distance Between the Read/Write Head and Tag

Maximum distance (mm) between the read/write head and tag for non-metal installations

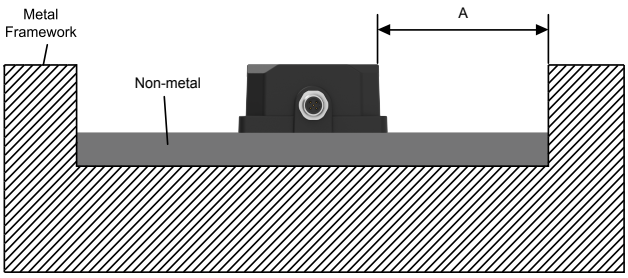
	Tags								
Readers	**THB14M5C**	**THS30C**	**THS30C-2K**	**THQ40C**	**THQ40C-2K**	**THQ40CM**	**THQ66C**	**THQ66C-2K**	**THQ66CM**
BID-HS30-MQ	20	60	60	50	50	30	75	65	35
BID-HQ90-MQ	15	80	80	65	65	45	110	100	55

Maximum distance (mm) between the read/write head and tag when installed on or embedded within metal

	THQ40CM			THQ66CM		
Readers	**Non-Metal Installation**	**Installed on Metal**	**Embedded within Metal**	**Non-Metal Installation**	**Installed on Metal**	**Embedded within Metal**
BID-HS30-MQ	30	40	30	35	40	45
BID-HQ90-MQ	45	45	60	55	55	70

Installing the Read/Write Heads on Metal

Embedding the read/write head into metal



If the read/write head is to be installed on metal, note that the read/write head performance is affected.

- Increase the distance between the read/write head and the metal surface by adding a non-metallic medium at least 20 mm thick
- When the distance between the metal surface and the read/write head is greater than 20 mm, the read/write head's performance is the same as that of a read/write head installed on a non-metallic surface
- In a metallic application, reduce the distance between the read/write head and the tag

If the read/write head is to be embedded within metal, allow for at least 10 cm (A) of distance between the read/write head and the metal that the read/write head is embedded into to preserve performance. We recommend that the value A is not less than half of the read/write head's length and/or width.

When installing multiple read/write heads in an enclosed metal framework, install the read/write heads at least 2.5 m apart.

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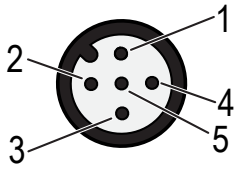
Installing the RFID Tags

- In an application with multiple tags, ensure the tags are mounted outside the minimum tag distance
- In an application with multiple read/write heads, verify that the read/write heads are separated by at least the minimum distance
- Any metal near the read/write head can affect the read/write head's performance.
  - When the tag is embedded into metal, place the tag parallel to the metal plane's surface or allow the tag to be higher than the surface of the metal
  - Tag models designated as being able to be installed in metal can be installed directly on a metallic surface; tags that cannot be installed within metal should be installed at least 20 mm away from metal.

Wiring

Wiring for the read/write head with Modbus

5-pin A-Code Male Pinout	Pin	Wire Color	Description
	1	Brown (bn)	24 V DC
	2	White (wh)	RS-485 A
	3	Blue (bu)	0 V/Ground
	4	Black (bk)	RS-485 B
	5	Shielding layer	Polyethylene shielding layer

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Chapter Contents

Chapter 3 Configuration Instructions

Modbus Registers

Function r/w	Function Code	Register	Register Quantity	Register	Description
Read tag hf	3	32782	4	r	Read Tag HF Returns "04" code when the tag is not present
Tag memory	3, 16	0-32767		r/w	Register number range 1-60 Register 0 corresponds to bytes 0 and 1 Register 1 corresponds to bytes 2 and 3, etc
Device add setting	6	32768	1	w	Device add, settable range 1-247; restart effect after setting Default value: 2
Baud rate	6	32769	1	w	1: 9600, 2: 19200, 3: 38400, 4: 57600, 0: 115200 Default value: 2
Working mode	3, 16	32770	4	r/w	0: auto read uid; 1: auto read byte; 2: non-auto read card Default value: 0
Start add	3, 16	32771		r/w	Bit 15-bit 0 auto read byte start add (do not use 0)
Read qty	3, 16	32772		r/w	Bit 15-bit 8 reservation (do not use 0) Bit 7-bit 0 qty of auto-reading byte
Cache time	3, 16	32773		r/w	Bit 15: reservation (do not use 0) Bit 14-bit0 cache time, unit 10ms
Tag detection online	3	32774	1	r	Get the reader's GPI status Check whether the tag is present in range (bit 0). Bit 1 mark is an online mark; 1 means the tag is in the read-write range. HF reader auto card reading mode, bit 2 and 3. (00: no tags in identification area, 01: tag is in the critical section, 10: tag is in the vice workspace, 11: tag is in the main workspace)
Get GPI	3	32787	1	r	Bit 0: GPI 1 status; bit 1: GPI 2 status; bit 2: GPI 3 status; bit 3: GPI 4 status; bit 4: 7 the number of GPI supported by the reader
GPO control	6	32776	1	w	Control GPO status (1 means on)

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Chapter Contents

Chapter 4 Operate the RFID System

Follow these instructions to operate your High-Frequency RFID Read/Write Head and tag system.

Refer to "Modbus Registers" on page 8 for the complete list of registers.

1. Connect to the server (default ID = 2, baud rate = 19200, and parity = none).
2. Change the connection settings to your desired settings.
   Registers 32770 through 32773 must be read and written to as one write/read command.
3. Read UID registers 32782 through 32785.
   These registers must read as a single read command.
4. Read and/or write to the tag memory registers 0 through 32767.
   These registers must be read or written to in groups of **four** registers, for example, 4, 8, 12, etc.

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Chapter Contents

Chapter 5 Specifications

RFID Read/Write Head Specifications

Supply Power

Model	Supply Voltage	Current
BID-HS18	24 V DC ±10%	< 0.05 A at 24 V DC
BID-HS30	24 V DC ±10%	< 0.05 A at 24 V DC
BID-HQ50	18-30 V DC	< 0.07 A at 24 V DC
BID-HQ90	18-30 V DC	< 0.07 A at 24 V DC

Construction

BID-HS18 and BID-HS30 models: Nickel-plated brass

BID-HQ50 and BID-HQ90 models: Polycarbonate-ABS thermoplastic

Weight

BID-HS18: 0.05 kg

BID-HS30: 0.11 kg

BID-HQ50: 0.12 kg

BID-HQ90: 0.33 kg

Communication

Modbus RS-232/RS-485

Operating Conditions

BID-HS18, -HS30, and -HQ50 models: –25 °C to +70 °C (–13 °F to +158 °F)

BID-HQ90 model: –40 °C to +70 °C (–40 °F to +158 °F)

95% maximum relative humidity (non-condensing)

Storage Conditions

BID-HS18, -HS30, and -HQ50 models: –25 °C to +85 °C (–13 °F to +185 °F)

BID-HQ90 model: –40 °C to +85 °C (–40 °F to +185 °F)

Environmental Rating

IP67

Certifications

CE

Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

Model	FCC ID	IC ID
BID-HS30-MQ	2BP53-HRM304850	34211-HRS304850
BID-HQ90-MQ	2BP53-HRS904850	34211-HRS904850

RFID Tag Specifications

See "RFID Tag Models" on page 4 and "RFID Tag Dimensions" on page 12.

Rewrite Times

100,000

Material

PBT polyester

Installation and Environmental Conditions

Models	Installation	Temperature	IP Rating
THS30C	M5 screw (1)	–40 °C to +70 °C (–40 °F to +158 °F)	IP68
THS30C-2K	M5 screw (1)	–40 °C to +70 °C (–40 °F to +158 °F)	IP68
THB14M5C	Threaded stud (1)	–25 °C to +75 °C (–13 °F to +167 °F)	IP68
THQ40C	M3 screws (2)	–25 °C to +75 °C (–13 °F to +167 °F)	IP67
THQ40C-2K	M3 screws (2)	–25 °C to +75 °C (–13 °F to +167 °F)	IP67
THQ40CM	M3 screws (2)	–25 °C to +75 °C (–13 °F to +167 °F)	IP67
THQ66C	M3 screws (4)	–25 °C to +75 °C (–13 °F to +167 °F)	IP67
THQ66C-2K	M3 screws (4)	–25 °C to +75 °C (–13 °F to +167 °F)	IP67
THQ66CM	M3 screws (4)	–25 °C to +75 °C (–13 °F to +167 °F)	IP67

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FCC Part 15 Class A for Intentional Radiators

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(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 Statement for Intentional Radiators

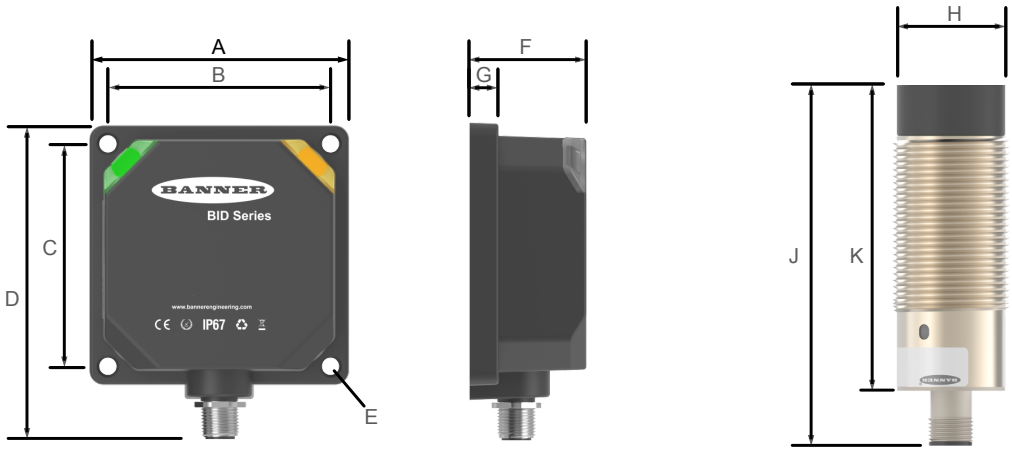
This device contains licence-exempt transmitters(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient des émetteurs/récepteurs exemptés de licence conformes à la norme Innovation, Sciences, et Développement économique Canada. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RFID Read/Write Head Dimensions



RFID Read/Write Head with Modbus Dimensions (mm)

Models	A	B	C	D	E	F	G	H	J	K
BID-HS30-MQ	—	—	—	—	—	—	—	30	92	78
BID-HQ90-MQ	90	77	77	108.6	M5	40	10	—	—	—

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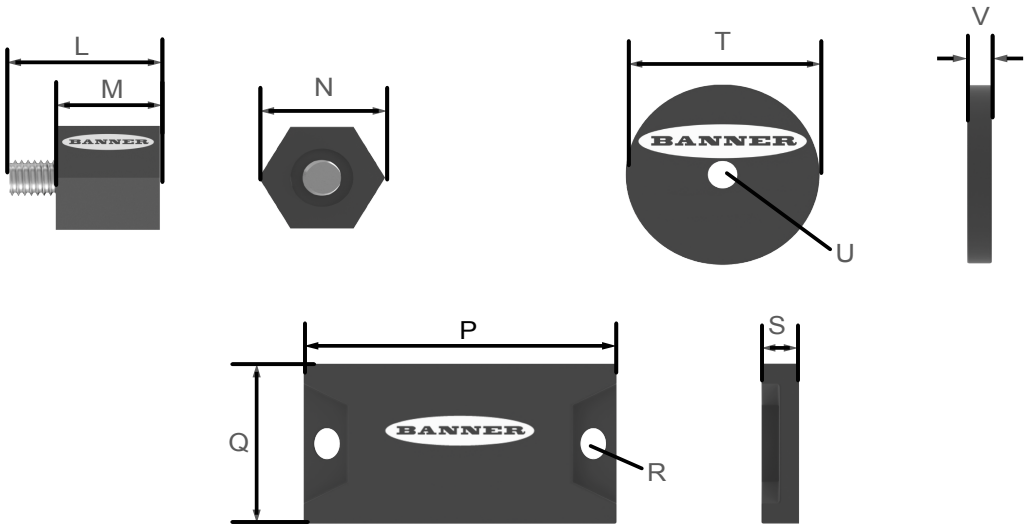
RFID Tag Dimensions



RFID Tag Dimensions (mm)

	L	M	N	P	Q	R	S	V	W	X
THS30C	—	—	—	—	—	—	—	30	5	2.6
THS30C-2K	—	—	—	—	—	—	—	30	5	2.6
THB14M5C	18.8	13	16	—	—	—	—	—	—	—
THQ40C	—	—	—	40	22	3.2 × 4.2	4.8	—	—	—
THQ40C-2K	—	—	—	40	22	3.2 × 4.2	4.8	—	—	—
THQ40CM	—	—	—	40	22	3.2 × 4.2	4.8	—	—	—
THQ66C	—	—	—	66	34	3.3	4.8	—	—	—
THQ66C-2K	—	—	—	66	34	3.3	4.8	—	—	—
THQ66CM	—	—	—	66	34	3.3	4.8	—	—	—

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Chapter Contents

Chapter 6 Accessories

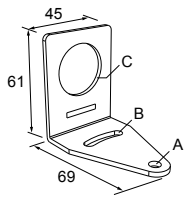
Brackets for the 30mm Barrel Readers

The following brackets work with the 30 mm barrel read/write heads.

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

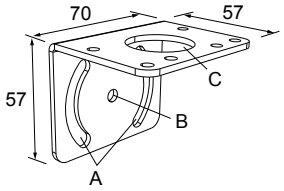
Hole center spacing: A to B=40
Hole size: A=ø 6.3, B= 27.1 × 6.3, C=ø 30.5



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

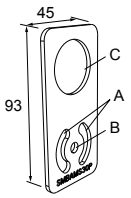
Hole center spacing: A = 51, A to B = 25.4
Hole size: A = 42.6 × 7, B = ø 6.4, C = ø 30.1



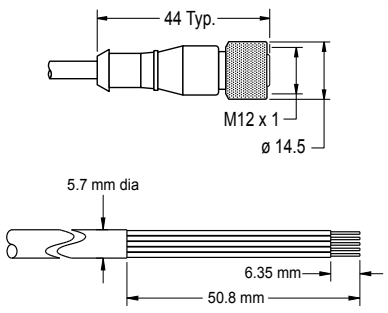
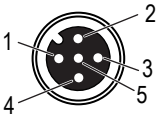
SMBAMS30P

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

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



Cordsets

5-pin A-Code Single-Ended M12 Female Cordsets (datasheet p/n 235936)				
Model	**Length**	**Dimensions (mm)**	**Pinout (Female)**	
BC-M12F5-22-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
BC-M12F5-22-2	2 m (6.56 ft)			
BC-M12F5-22-5	5 m (16.4 ft)			
BC-M12F5-22-8	8 m (26.25 ft)			
BC-M12F5-22-10	10 m (30.81 ft)			
BC-M12F5-22-15	15 m (49.2 ft)			

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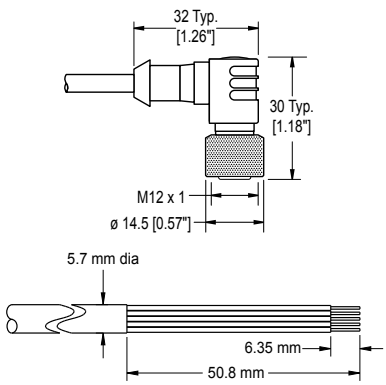
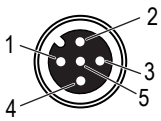
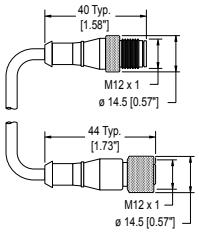
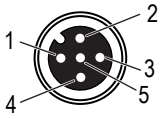
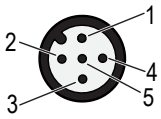
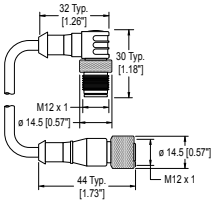
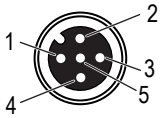
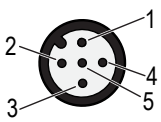
5-pin A-Code Single-Ended M12 Female Right-Angle Cordsets (datasheet p/n 235936)				
Model	**Length**	**Dimensions (mm)**	**Pinout (Female)**	
BC-M12F5A-22-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
BC-M12F5A-22-2	2 m (6.56 ft)			
BC-M12F5A-22-5	5 m (16.4 ft)			
BC-M12F5A-22-8	8 m (26.25 ft)			
BC-M12F5A-22-10	10 m (30.81 ft)			
BC-M12F5A-22-15	15 m (49.2 ft)			

5-pin A-Code Double-Ended M12 Female to M12 Male Cordsets (datasheet p/n 236183)				
Model	**Length**	**Dimensions (mm)**	**Pinouts**	
BC-M12F5-M12M5-22-1	1 m (3.28 ft)		Female  Male 	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
BC-M12F5-M12M5-22-2	2 m (6.56 ft)			
BC-M12F5-M12M5-22-5	5 m (16.4 ft)			
BC-M12F5-M12M5-22-8	8 m (26.25 ft)			
BC-M12F5-M12M5-22-10	10 m (30.81 ft)			
BC-M12F5-M12M5-22-15	15 m (49.2 ft)			

5-pin A-Code Double-Ended M12 Female Straight to M12 Male Right-Angle Cordsets (datasheet p/n 236183)				
Model	**Length**	**Dimensions (mm)**	**Pinouts**	
BC-M12F5-M12M5A-22-1	1 m (3.28 ft)		Female  Male 	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
BC-M12F5-M12M5A-22-2	2 m (6.56 ft)			
BC-M12F5-M12M5A-22-5	5 m (16.4 ft)			
BC-M12F5-M12M5A-22-10	10 m (30.81 ft)			

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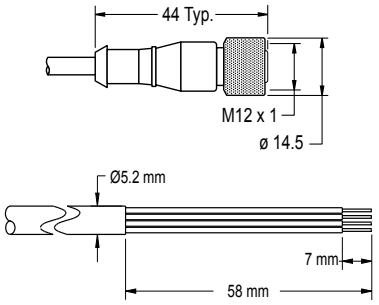
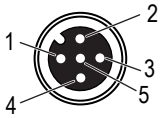
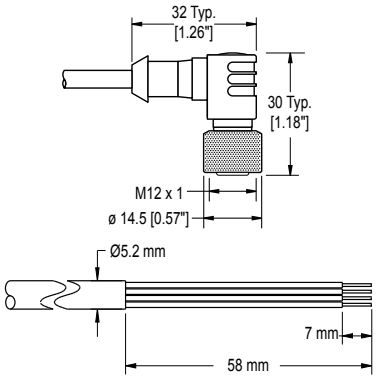
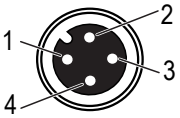
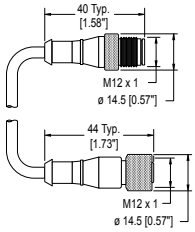
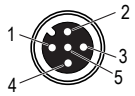
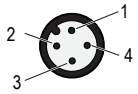
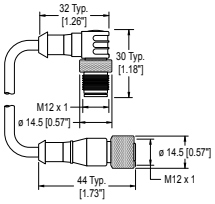
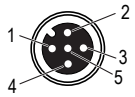
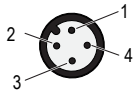
4-pin Single-Ended M12 Female Cordsets (datasheet p/n 235937)				
Model	**Length**	**Dimensions (mm)**	**Pinout (Female)**	
BC-M12F4-22-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused c UL us LISTED
BC-M12F4-22-2	2 m (6.56 ft)			
BC-M12F4-22-5	5 m (16.4 ft)			
BC-M12F4-22-8	8 m (26.25 ft)			
BC-M12F4-22-10	10 m (30.81 ft)			
BC-M12F4-22-15	15 m (49.2 ft)			
BC-M12F4-22-20	20 m (65.61 ft)			
BC-M12F4-22-25	25 m (82.02 ft)			
BC-M12F4-22-30	30 m (98.42 ft)			

4-pin Single-Ended M12 Female Right-Angle Cordsets (datasheet p/n 235937)				
Model	**Length**	**Dimensions (mm)**	**Pinout (Female)**	
BC-M12F4A-22-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused c UL us LISTED
BC-M12F4A-22-2	2 m (6.56 ft)			
BC-M12F4A-22-5	5 m (16.4 ft)			
BC-M12F4A-22-8	8 m (26.25 ft)			
BC-M12F4A-22-10	10 m (30.81 ft)			
BC-M12F4A-22-15	15 m (49.2 ft)			

4-pin A-Code Double-Ended M12 Female to M12 Male Cordsets (datasheet p/n 236186)				
Model	**Length**	**Dimensions (mm)**	**Pinouts**	
BC-M12F4-M12M4-22-1	1 m (3.28 ft)		Female  Male 	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused c UL us LISTED
BC-M12F4-M12M4-22-2	2 m (6.56 ft)			
BC-M12F4-M12M4-22-3	3 m (9.84 ft)			
BC-M12F4-M12M4-22-4	4 m (13.12 ft)			
BC-M12F4-M12M4-22-5	5 m (16.4 ft)			
BC-M12F4-M12M4-22-10	10 m (30.81 ft)			
BC-M12F4-M12M4-22-15	15 m (49.2 ft)			

4-pin A-Code Double-Ended M12 Female to M12 Male Right-Angle Cordsets (datasheet p/n 236186)				
Model	**Length**	**Dimensions (mm)**	**Pinouts**	
BC-M12F4-M12M4A-22-1	1 m (3.28 ft)		Female  Male 	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused c UL us LISTED
BC-M12F4-M12M4A-22-2	2 m (6.56 ft)			
BC-M12F4-M12M4A-22-5	5 m (16.4 ft)			
BC-M12F4-M12M4A-22-8	8 m (26.25 ft)			
BC-M12F4-M12M4A-22-10	10 m (30.81 ft)			
BC-M12F4-M12M4A-22-15	15 m (49.2 ft)			

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Chapter Contents

Chapter 7 Product Support and Maintenance

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.

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