T30 DC-Voltage Sensors Product Manual

Original Instructions
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Chapter 1 Features

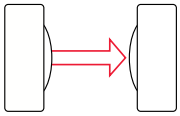
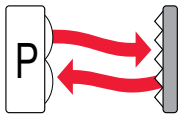
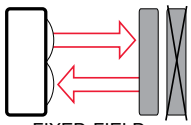


- Featuring EZ-BEAM® technology, specially designed optics and electronics provide reliable sensing without adjustments
- “T” style PBT polyester housing with 30 mm threaded lens in opposed, retroreflective, or fixed-field modes
- Completely epoxy-encapsulated providing superior durability, even in harsh sensing environments, rated to IP69K per ISO 20653
- Innovative dual-indicator system takes the guesswork out of sensor performance monitoring
- Advanced diagnostics warn of marginal sensing conditions or output overload
- 10 V DC to 30 V DC; choose SPDT (complementary) NPN or PNP outputs (150 mA maximum each)

WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Models

Sensing Mode	Model	Output	Range	Connection
 OPPOSED	T306E	-	60 m (196.8 ft)	2 m (6.5 ft) cable
	T306E W/30	-		9 m cable
	T306EQ	-		4-pin M12 quick disconnect (QD)
	T30SN6R	NPN		2 m (6.5 ft) cable
	T30SN6R W/30	NPN		9 m cable
	T30SN6RQ	NPN		4-pin M12 QD
	T30SP6R	PNP		2 m (6.5 ft) cable
	T30SP6R W/30	PNP		9 m cable
	T30SP6RQ	PNP		4-pin M12 QD
 POLAR RETRO	T30SN6LP	NPN	6 m (19.7 ft)	2 m (6.5 ft) cable
	T30SN6LPQ	NPN		4-pin M12 QD
	T30SP6LP	PNP		2 m (6.5 ft) cable
	T30SP6LP W/30	PNP		9 m cable
	T30SP6LPQ	PNP		4-pin M12 QD
 FIXED-FIELD	T30SN6FF200	NPN	200 mm (7.9 in) cutoff	2 m (6.5 ft) cable
	T30SN6FF200 W/30	NPN		9 m cable
	T30SN6FF200Q	NPN		4-pin M12 QD
	T30SP6FF200	PNP		2 m (6.5 ft) cable
	T30SP6FF200 W/30	PNP		9 m cable
	T30SP6FF200Q	PNP		4-pin M12 QD

Continued on page 4

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Continued from page 3

Sensing Mode	Model	Output	Range	Connection
	T30SN6FF400	NPN	400 mm (15.7 in) cutoff	2 m (6.5 ft) cable
	T30SN6FF400Q	NPN		4-pin M12 QD
	T30SP6FF400	PNP		2 m (6.5 ft) cable
	T30SP6FF400 W/30	PNP		9 m cable
	T30SP6FF400Q	PNP		4-pin M12 QD
	T30SN6FF600	NPN	600 mm (23.6 in) cutoff	2 m (6.5 ft) cable
	T30SN6FF600Q	NPN		4-pin M12 QD
	T30SP6FF600	PNP		2 m (6.5 ft) cable
	T30SP6FF600 W/30	PNP		9 m cable
	T30SP6FF600Q	PNP		4-pin M12 QD

Integral 2 m (6.5 ft) unterminated cable models are listed. Models with a quick disconnect require a mating cordset.

The following models are no longer available for order but are still covered by the information in this document.

T30SN6LP W/30 T30SN6FF400 W/30 T30SN6FF600 W/30

Fixed-Field Mode Overview

T30 self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff (a type of background suppression). Their high excess gain and fixed-field technology allow the detection of objects of low reflectivity while ignoring background surfaces.

The cutoff distance is fixed. Backgrounds and background objects must always be placed beyond the cutoff distance.

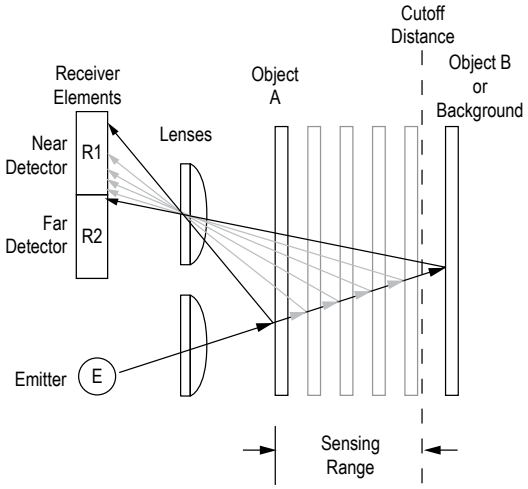
Fixed-Field Sensing Theory of Operation

The T30 Fixed-Field Series Sensor compares the reflections of its emitted light beam (E) from an object back to the sensor's two differently aimed detectors, R1 and R2. See "Figure: Fixed-Field Concept" on page 5. If the near detector's (R1) light signal is stronger than the far detector's (R2) light signal (see object A in the Figure below, closer than the cutoff distance), the sensor responds to the object. If the far detector's (R2) light signal is stronger than the near detector's (R1) light signal (see object B in the Figure below, beyond the cutoff distance), the sensor ignores the object.

The cutoff distance for the T30 is fixed at 200, 400, or 600 mm (7.9, 16.7, or 23.6 in). Objects lying beyond the cutoff distance are usually ignored, even if they are highly reflective. However, under certain conditions, it is possible to falsely detect a background object (see "Background Reflectivity and Placement" on page 9).

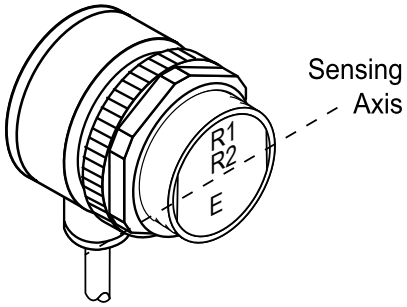
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Fixed-Field Concept



Object is sensed if amount of light at R1 is greater than the amount of light at R2

Fixed-Field Sensing Axis



In the drawings and information provided in this document, the letters E, R1, and R2 identify how the sensor's three optical elements (Emitter "E", Near Detector "R1", and Far Detector "R2") line up across the face of the sensor. The location of these elements defines the sensing axis, see "Figure: Fixed-Field Sensing Axis" on page 5.

The sensing axis becomes important in certain situations, such as when the object is beyond the cutoff distance as shown in "Background Reflectivity and Placement" on page 9.

Specifications

Supply Voltage and Current

10 V DC to 30 V DC (10% maximum ripple)

Supply current (exclusive of load current):

Emitters, Non-Polarized, Retro: 25 mA
Receivers: 20 mA
Polarized Retroreflective: 30 mA
Fixed-Field: 35 mA

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Output Protection Circuitry

Protected against output short-circuit, continuous overload, and false pulse on power-up

LED

Opposed mode models: Infrared, 950 nm

Polarized retroreflective mode models: Visible red, 680 nm

Fixed-field mode models: Infrared, 880 nm

Output Configuration

SPDT solid-state DC switch; NPN or PNP outputs, depending on model

Light Operate: Normally open output conducts when sensor sees its own (or the emitter's) modulated light

Dark Operate: Normally closed output conducts when the sensor sees dark; the normally closed output may be wired as a normally open marginal signal alarm output, depending on wiring to power supply

Output Rating

150 mA maximum each

When wired for alarm output, the total load may not exceed 150 mA

OFF-state leakage current: < 1 µA at 30 V DC

ON-state saturation voltage: < 1 V at 10 mA DC; < 1.5 V at 150 mA DC

Connections

2 m (6.5 ft), 9 m (30 ft) integral PVC cable, or Integral 4-pin M12 male quick-disconnect connector, depending on your model

Output Response Time

Opposed mode: 3 ms ON, 1.5 ms OFF

Retro, Fixed-Field and Diffuse: 3 ms ON and OFF

NOTE: 100 ms delay on power-up; outputs do not conduct during this time

Repeatability

Opposed mode: 375 µs

Retro, Fixed-Field and Diffuse: 750 µs

Repeatability and response are independent of signal strength

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Indicators

Two LEDs (Green and Amber)

Green ON steady: power to sensor is ON

Green flashing: output is overloaded

Amber ON steady: N.O. output is conducting

Amber flashing: excess gain marginal (1 to 1.5 times) in light condition

Construction

Housing: PBT polyester

Lens: Polycarbonate (opposed-mode) or acrylic

Environmental Rating

Leakproof design rated IP69K per ISO 20653

Operating Conditions

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

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

Vibration and Mechanical Shock

All models meet MIL-STD-202F, Method 201A (Vibration: 10 Hz to 60 Hz maximum, 0.06 inch (1.52 mm) double amplitude, 10G acceleration) requirements. Method 213B conditions H&I. (Shock: 75G with device operating; 100G for non-operation)

Certifications

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1831 Diegem, BELGIUM

Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

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.

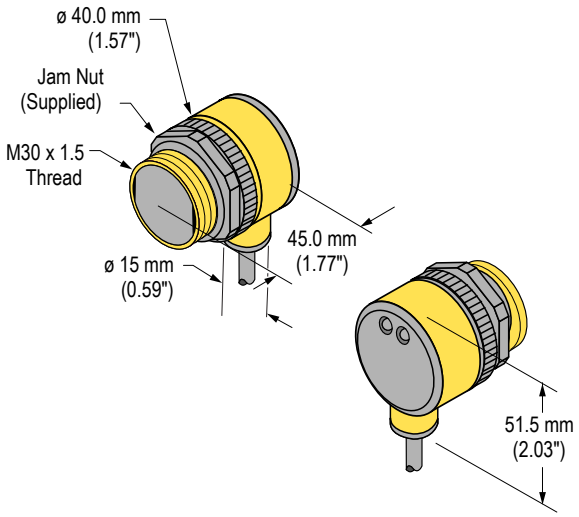
Supply wiring leads < 24 AWG shall not be spliced.

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

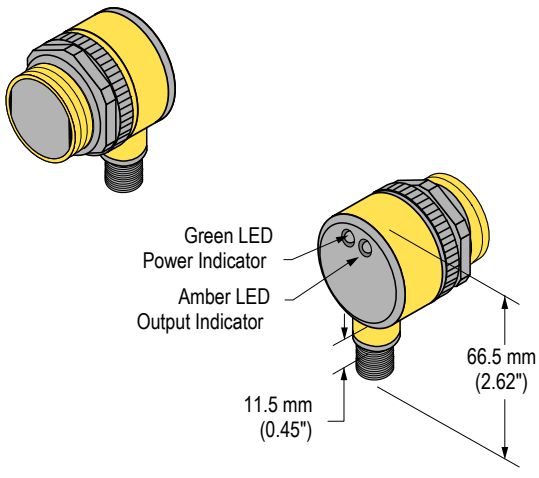
Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Dimensions

Cabled models



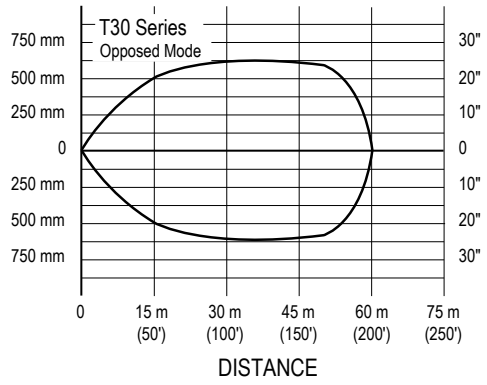
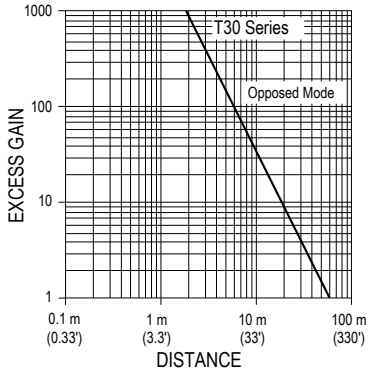
Quick disconnect models



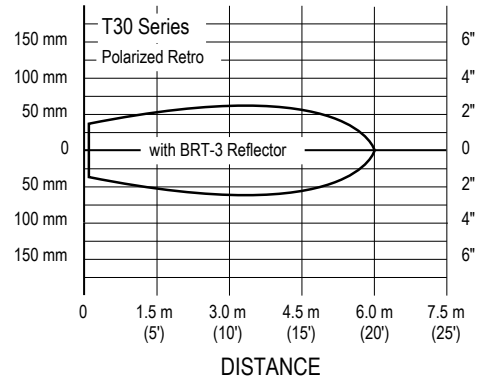
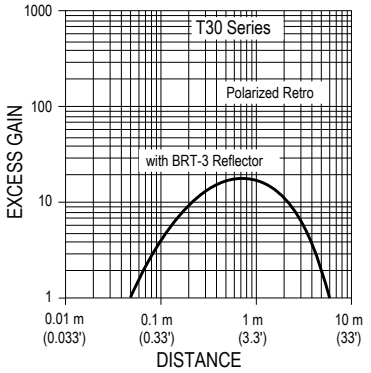
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Performance Curves

Opposed Mode Sensors

Beam Pattern	Excess Gain
	

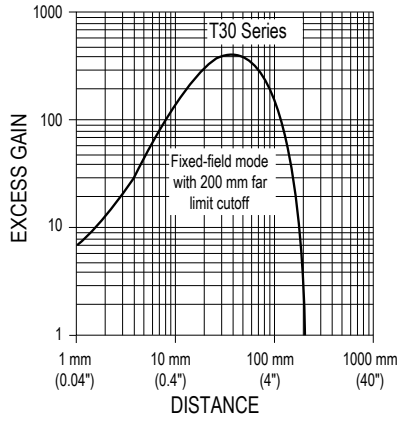
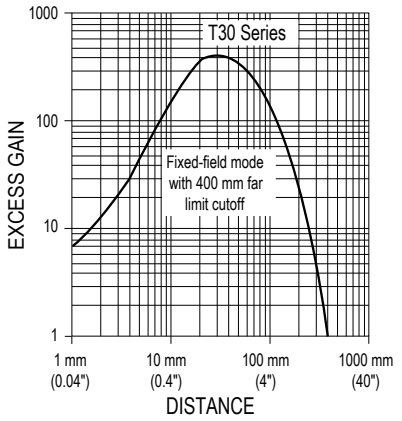
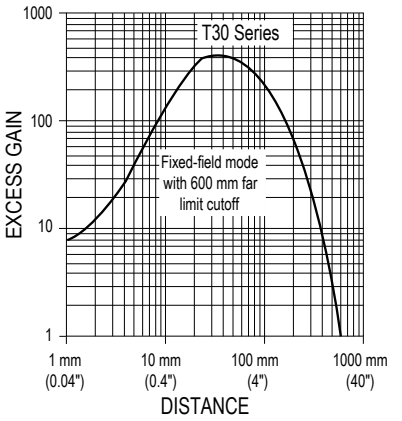
Polarized Retro Mode Sensors[1]

Beam Pattern	Excess Gain
	

[1] *Performance based on use of a model BRT-3 retroreflector (3-inch diameter). Actual sensing range may be more or less than specified, depending on the efficiency and reflective area of the retroreflector used.*

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Fixed-Field Mode Sensor Excess Gain[2]

Fixed-Field – 200 mm	Fixed-Field – 400 mm	Fixed-Field – 600 mm
		
Ø 16 mm spot size at 35 mm focus	Ø 17 mm spot size at 35 mm focus	Ø 17 mm spot size at 35 mm focus
Ø 20 mm spot size at 200 mm cutoff	Ø 25 mm spot size at 400 mm cutoff	Ø 30 mm spot size at 600 mm cutoff
Using 18% gray test card: cutoff distance will be 95% of value shown.	Using 18% gray test card: cutoff distance will be 90% of value shown.	Using 18% gray test card: cutoff distance will be 85% of value shown.
Using 6% black test card: cutoff distance will be 90% of value shown.	Using 6% black test card: cutoff distance will be 85% of value shown.	Using 6% black test card: cutoff distance will be 75% of value shown.

[2] Performance based on use of a 90% reflectance white test card. Focus and spot sizes are typical.

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Chapter 2 Sensor Setup

Sensing Reliability

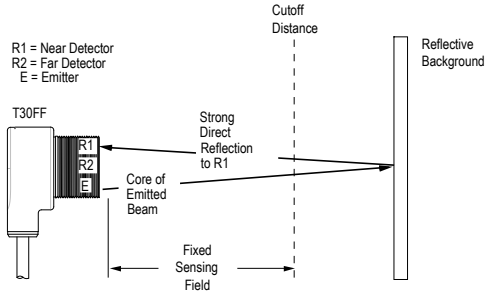
For the highest sensitivity, position the target for sensing at or near the point of maximum excess gain. Maximum excess gain for all models occurs at a lens-to-object distance of about 40 mm (1.5 in). Sensing at or near this distance makes maximum use of each sensor's available sensing power. The background must be placed beyond the cutoff distance. Note that the reflectivity of the background surface also may affect the cutoff distance. Following these guidelines improves sensing reliability.

Background Reflectivity and Placement

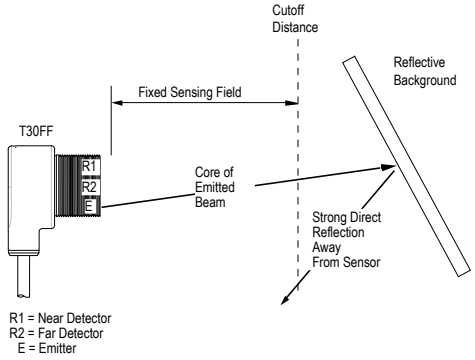
Avoid mirror-like backgrounds that produce specular reflections. A false sensor response occurs if a background surface reflects the sensor's light more to the near detector (R1) than to the far detector (R2). The result is a false ON condition ("Figure: Reflective Background - Problem" on page 9). Correct this problem by using a diffusely reflective (matte) background or angling either the sensor or the background (in any plane) so the background does not reflect light back to the sensor ("Figure: Reflective Background - Solution" on page 9). Position the background as far beyond the cutoff distance as possible.

An object beyond the cutoff distance, either stationary (and when positioned as shown in "Figure: Object Beyond Cutoff - Problem" on page 9), or moving past the face of the sensor in a direction perpendicular to the sensing axis, may cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. Correct the problem by rotating the sensor 90° ("Figure: Object Beyond Cutoff - Solution" on page 9). The object then reflects the R1 and R2 fields equally, resulting in no false triggering. A better solution, if possible, may be to reposition the object or the sensor.

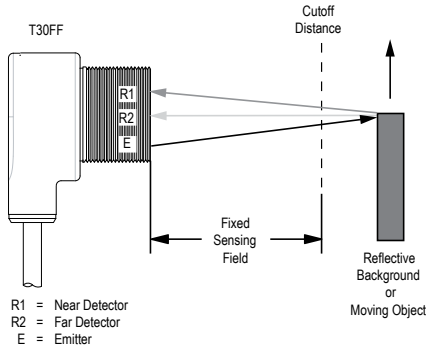
Reflective Background - Problem



Reflective Background - Solution

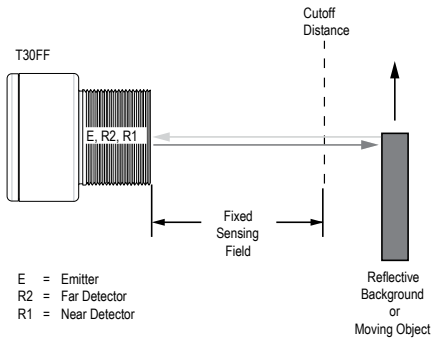


Object Beyond Cutoff - Problem



A reflective background object in this position or moving across the sensor face in this axis and direction may cause a false sensor response.

Object Beyond Cutoff - Solution



A reflective background object in this position or moving across the sensor face in this axis is ignored.

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Color Sensitivity

The effects of object reflectivity on cutoff distance, though small, may be important for some applications. It is expected that at any given cutoff setting, the actual cutoff distance for lower reflectance targets is slightly shorter than for higher reflectance targets. This behavior is known as color sensitivity.

For example, an excess gain of 1 for an object that reflects 1/10 as much light as the 90% white card is represented by the horizontal graph line at excess gain = 10. An object of this reflectivity results in a far-limit cutoff of approximately 190 mm (7.5 in) for the 200 mm (8 in) cutoff model, for example; and 190 mm represents the cutoff for this sensor and target.

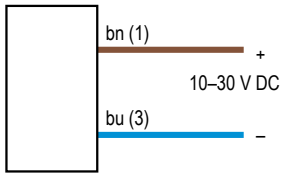
These excess gain curves were generated using a white test card of 90% reflectance. Objects with reflectivity of less than 90% reflect less light back to the sensor and thus require proportionately more excess gain to be sensed with the same reliability as more reflective objects. When sensing an object of very low reflectivity, it may be essential to sense it at or near the distance of maximum excess gain.

Wiring Diagrams

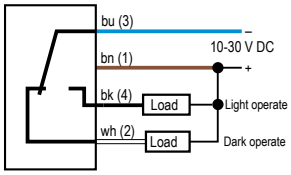
In light operate (LO) mode, the output is ON when the target returns the same or more light to the sensor and OFF when the sensor detects less light than the configured/taught target. In **opposed and retroreflective sensing modes**, light operate is active when the beam is unblocked. In **diffuse, fixed field, and adjustable field sensor modes**, light operate is active when the target is present.

In dark operate (DO) mode, the output is ON when the target returns less light to the sensor than the configured target and OFF when the sensor detects more light than the configured/taught target. In **opposed and retroreflective sensing modes**, dark operate is active when the beam is blocked. In **diffuse, fixed field, and adjustable field sensor modes**, dark operate is active when the target is absent.

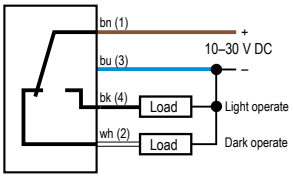
Cabled emitters



NPN standard



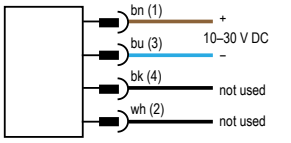
PNP standard



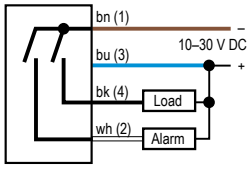
Key:

1 = Brown
2 = White
3 = Blue
4 = Black

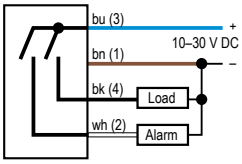
Quick disconnect emitters



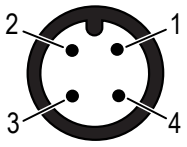
NPN alarm



PNP alarm



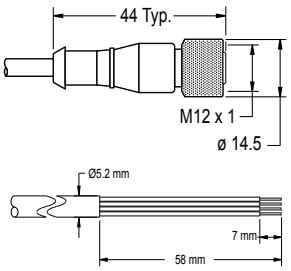
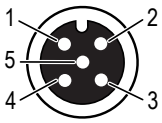
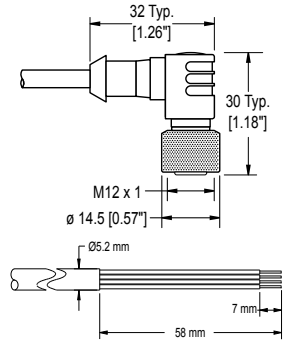
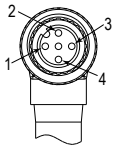
4-pin M12 male quick disconnect



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Chapter 3 Accessories

Cordsets

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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Chapter 4 Product Support and Maintenance

Repairs and Translations (No Field-Replaceable Parts)

English

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.

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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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Obtain assistance with product repairs by contacting your local Banner Engineering Corp distributor or by calling Banner directly at (763) 544-3164. Access literature translated into your native language on the Banner website at www.bannerengineering.com or contact Banner directly at (763) 544-3164.

Deutsch

Wenden Sie sich zur Fehlerbehebung dieses Geräts an Banner Engineering. **Versuchen Sie nicht, Reparaturen an diesem Banner-Gerät vorzunehmen. Das Gerät enthält keine am Einsatzort auszuwechselnden Teile oder Komponenten.** Wenn ein Banner-Anwendungstechniker zu dem Schluss kommt, dass dieses Gerät, ein Teil oder eine Komponente davon defekt ist, erhalten Sie von dem Techniker Erläuterungen zu Banners RMA-Verfahren (Return Merchandise Authorization) für die Warenrückgabe.

```
WICHTIG: Wenn Sie der Techniker anweist, das Gerät zurückzusenden, verpacken Sie es bitte sorgfältig. Transportschäden bei der Rücksendung werden von der Garantie nicht abgedeckt.
```

Unterstützung bei Produktreparaturen erhalten Sie von Ihrem örtlichen Banner Engineering Corp Händler oder direkt von Banner unter Tel. (763) 544-3164. Die in Ihre Muttersprache übersetzte Literatur finden Sie auf der Banner-Website unter www.bannerengineering.com oder kontaktieren Sie Banner direkt unter Tel. (763) 544-3164.

Français

Pour plus d'informations sur le dépannage du produit, contactez Banner Engineering. **Ne tentez pas de réparer ce dispositif Banner. Il ne contient aucun composant ou pièce qui puisse être remplacé sur place.** Si un ingénieur de Banner conclut que le dispositif ou l'une de ses pièces ou composants est défectueux, il vous informera de la procédure à suivre pour le retour des produits (RMA).

```
Important : Si vous devez retourner le dispositif, emballez-le avec soin. Les dégâts occasionnés pendant le transport de retour ne sont pas couverts par la garantie.
```

Pour vous aider lors de la réparation de produits, contactez votre distributeur Banner local our appelez directement Banner au (763) 544-3164. La documentation traduite dans votre langue est disponible sur le site internet de Banner www.bannerengineering.com ou contactez directement Banner au (763) 544-3164.

Italiano

Per le procedure di individuazione e riparazione dei guasti di questo dispositivo, contattare Banner Engineering. **Non tentare di riparare questo dispositivo Banner, in quanto non contiene parti o componenti sostituibili dall'utente.** Se il dispositivo, una parte del dispositivo o un componente del dispositivo viene riscontrato difettoso da un tecnico Banner, il nostro personale vi comunicherà la procedura da seguire per ottenere l'autorizzazione al reso.

```
Importante: Se si ricevono istruzioni di rispedire il dispositivo al produttore, imballarlo con cura. I danni dovuti al trasporto non sono coperti dalla garanzia.
```

Per assistenza nelle riparazioni dei prodotti, contattare il distributore locale Banner Engineering Corp o contattare direttamente Banner al numero (763) 544-3164. È possibile accedere alla documentazione tradotta nella propria lingua madre sul sito Web Banner all'indirizzo www.bannerengineering.com o contattare direttamente Banner al numero (763) 544-3164.

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Español

Comuníquese con Banner Engineering para solucionar de problemas de este dispositivo. **No intente ninguna reparación a este dispositivo de Banner, contiene piezas o componente que no se pueden cambiar en terreno.** Si algún ingeniero de aplicaciones de Banner determina que el dispositivo, alguna de las piezas o alguno de los componentes del dispositivo está defectuoso, le informará el procedimiento de autorización de devolución de mercancía (RMA, por sus siglas en inglés) de Banner.

Importante: Si se le solicita devolver el dispositivo, empáquelo con cuidado. Puede haber daños durante el envío de devolución que no estén cubiertos por la garantía.

Para reparaciones de productos, por favor contacte a su distribuidor local de Banner Engineering o llame a Banner directamente al 00 1 (763) 544-3164. Vea la literatura traducida en su idioma en el sitio web Banner en www.bannerengineering.com o comuníquese con Banner directamente al 00 1 (763) 544-3164.

中国人

如需对本装置进行故障排查，请联系邦纳。**请勿尝试自行维修该邦纳装置；本装置不包含任何可在现场更换的部件或组件。** 若经邦纳应用工程师确认设备、设备部件或组件存在缺陷，他们将告知您邦纳退货授权 (RMA) 流程。

重要注意事项： 如被要求退回装置，请妥善包装后寄回。退货运输过程中发生的损坏不在保修范围内。

请联系当地的 Banner Engineering Corp 经销商或直接致电 Banner +1 (763) 544-3164，以获得产品维修帮助。请访问邦纳网站 www.bannerengineering.com 或直接拨打 +1 (763) 544-3164 联系邦纳，获取翻译成您母语的资料。

한국인

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중요: 제품을 반송하도록 안내 받으셨다면 잘 포장해주십시오. 반송 도중에 발생한 손상은 보증 서비스가 적용되지 않습니다.

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日本語

この装置のトラブルシューティングについては、バナーエンジニアリングにお問い合わせください。**このバナー装置には、現場では交換できない部品またはコンポーネントが含まれているため、修理を試みてはいけません。** バナーのアプリケーションエンジニアが装置、装置の部品、または装置のコンポーネントに欠陥があると判断した場合、バナーのRMA（返品承認）手続きについてお知らせします。

重要 ： 返品を指示された場合は、装置を丁寧に梱包してください。返品時に発生した破損は保証の対象外となります。

製品の修理については、最寄りのBanner Engineering Corp代理店にお問い合わせいただくか、米国+1 (763) 544-3164まで直接お電話でお問い合わせください。バナーのウェブサイト（www.bannerengineering.com）でお客様の言語に翻訳された資料にアクセスするか、米国+1 (763) 544-3164まで直接お電話でお問い合わせください。

čeština

Pro řešení problémů se zařízením kontaktujte společnost Banner Engineering. **Neprovádějte žádné opravy zařízení Banner. Neobsahují žádné komponenty nebo části, které by byly vyměnitelné.** Pokud je zařízení, jeho část nebo díl označen technikem společnosti Banner jako poškozený, bude Vám doporučeno vyplnit reklamační RMA protokol.

Důležité: Pokud byl vydán požadavek na vrácení zařízení, pečlivě ho zabalte. Poškození vzniklé při dopravě není považováno za záruční opravu.

Pokud produkt potřebuje opravu, vyžádejte si pomoc od místního distributora společnosti Banner Engineering Corp nebo přímo na telefonním čísle (763) 544-3164. Dokumentaci přeloženou do vašeho jazyka si vyhledejte na webových stránkách společnosti Banner na adrese www.bannerengineering.com nebo se obraťte přímo na společnost Banner na telefonním čísle (763) 544-3164.

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Polski

W celu rozwiązania problemów z urządzeniem należy skontaktować się z działem technicznym firmy Banner Engineering. **Pod żadnym pozorem nie próbuj naprawiać tego urządzenia firmy Banner; nie zawiera ono części ani elementów, które można wymieniać samodzielnie.** Jeśli urządzenie, jego część lub element zostaną uznane za wadliwe przez inżyniera technicznego Banner, poinformuje on użytkownika o firmowej procedurze zwrotu towaru (RMA) firmy Banner.

Ważne: Jeśli urządzenie ma zostać zwrócone, należy je starannie zapakować. Uszkodzenia powstałe podczas odsyłki nie są objęte gwarancją.

Aby uzyskać pomoc w zakresie naprawy produktu, należy skontaktować się z lokalnym dystrybutorem Banner Engineering Corp lub zadzwonić bezpośrednio do firmy Banner pod numer (763) 544-3164. Dostęp do literatury przetłumaczonej na swój język ojczysty można uzyskać na stronie internetowej firmy Banner pod adresem www.bannerengineering.com lub kontaktując się bezpośrednio z firmą Banner pod numerem (763) 544-3164.

Português

Entre em contato com a Engenharia da Banner para a solução de problemas deste dispositivo. **Não tente fazer nenhum reparo neste dispositivo Banner; ele não contém peças ou componentes substituíveis em campo.** Se um técnico de aplicações da Banner determinar que o dispositivo, peça ou componente do dispositivo está com defeito, ele o informará sobre o procedimento de RMA (Autorização de Devolução de Mercadoria) da Banner.

Importante: Se for instruído a devolver o dispositivo, embale-o com cuidado. Os danos ocorridos no transporte de devolução não são cobertos pela garantia.

Obtenha assistência para reparos do produto entrando em contato com o distribuidor local da Banner Engineering Corp ou ligando diretamente para a Banner no telefone (763) 544-3164. Acesse a literatura traduzida para seu idioma nativo no site da Banner em www.bannerengineering.com ou entre em contato diretamente com a Banner pelo telefone (763) 544-3164.

Türkçe

Bu cihazda sorun giderme işlemleri için Banner Engineering ile iletişime geçin. **Bu Banner cihazını onarmaya çalışmayın; cihaz sahada değiştirilebilir parça veya bileşen içermez.** Bir Banner Uygulama Mühendisi tarafından cihazın, cihazın bir parçasının veya bir cihaz bileşeninin kusurlu olduğu tespit edilirse, Banner RMA (İade Mal Yetkilendirme) prosedürü hakkında bilgilendirilirsiniz.

ÖNEMLİ: İade etmeniz istenirse, cihazı dikkatli bir şekilde paketleyin. İade nakliyesinde meydana gelecek hasarlar garanti kapsamında değildir.

Yerel Banner Engineering Corp distribütörünüzle iletişime geçerek veya doğrudan (763) 544-3164 numaralı telefondan Banner'ı arayarak ürün onarımlarıyla ilgili yardım alın. Ana dilinize çevrilmiş dokümanlara www.bannerengineering.com adresindeki Banner web sitesinden erişebilir veya (763) 544-3164 numaralı telefondan doğrudan Banner ile iletişime geçebilirsiniz.

Contact Us

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

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