

**New!**



Optical Safety Systems

## PICO-GUARD™ Systems

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**Coming Soon!**

# PICO-GUARD™ Systems



The PICO-GUARD Fiber Optic Safety System combines photoelectric and fiber optic technologies to efficiently solve a variety of safeguarding applications:

- Monitoring machine access doors and gates
- Entry/exit (work cell access) guarding
- Short-range perimeter guarding
- Multiple fiber optic beam solutions for custom guarding applications

At the heart of the system is the controller: a diverse-redundant, microcontroller-based photoelectric device designed specifically for use with plastic fiber optic cable.\* In addition, the system incorporates a number of optical elements, including plug-on, snap-lock fiber optic safety interlock switches, fiber optic grid arrays, and single-point beam devices.

The controller has four separate optical channels. Each channel produces pulsed optical signals that travel through the plastic fiber optic cable, through one or more optical elements, and ultimately back to the controller. Each of the controller's receiver circuits monitors its specific signal to verify that its channel is in the safe state. If a person blocks one of the beams in a grid array or opens a door being monitored by the system, the optical signal is "blocked" and does not return to the receiver. The absence of this signal is detected and the solid-state safety outputs switch to their off state, which stops or otherwise prevents the dangerous motion.

- Non-contact Fiber Optic Safety System is ideal for guarding dangerous machinery that can stop immediately after a stop signal is issued.
- Controller has four optical channels and redundant Output Signal Switching Devices (OSSDs).
- PICO-GUARD Optical Elements – Interlock Switches, Points and Grids – provide multiple guarding solutions in one system. They have no electrical connection and function either as emitters or receivers, depending on their connection to the controller. This minimizes the required component inventory and simplifies installation.
- Optical elements are designed to meet the requirements for safeguarding in potentially explosive environments<sup>1</sup> (controller must be isolated or located outside of the volatile area).
- Diverse-redundant, self-checking design to achieve control reliability and meet IEC 61496-1 type 4 and ISO 13849-1 (EN 954-1) Category 4 requirements (approvals pending).
- Accessory interface module available for ac or larger dc loads.
- Optional remote display module available.

Each PICO-GUARD Fiber Optic Safety System requires a controller, optical fiber and one or more pairs of optical elements. Controllers include the System manual and controller mounting hardware.



\* Patents Pending

<sup>1</sup> Approvals Pending

# SFCDT-4A1 PICO-GUARD Controller

- Two Universal Safety Stop Interface (USSI) inputs which can be used to cascade controllers or monitor other safeguarding devices (with either Banner OSSDs or relay contact outputs).
- Selectable functions:
  - Selectable Auto/Manual Power-up – Determines whether the System will require a manual reset to proceed to Run mode when power is applied.
  - Selectable Trip/Latch Output – Determines whether the System will require a manual reset to turn on the OSSD outputs after an optical channel has been blocked.
  - External Device Monitoring (EDM) – Allows the System to monitor the status of external devices, such as MPCEs (One- or Two-Channel Monitoring, or OFF).
  - Optical Channel Controls – Individual optical channels can be switched to ON or OFF for applications that require fewer than four operating optical channels. (At least one channel must be set to ON.)
- Two solid-state safety outputs to control 24V dc loads
- Fast 13 millisecond output response time for the optical channels and 7 millisecond output response time for the USSIs
- Removable terminal blocks speed and simplify wiring
- Sleek, compact, robust housing
- Auxiliary, Weak Signal and Fault outputs for non-safety monitoring
- RS-232 status and diagnostic output (diagnostic/system status and excess gain estimation software included)
- 35 mm DIN-rail mount
- User-friendly status indicators on the controller's face



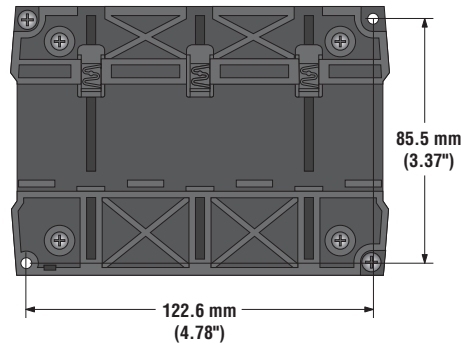
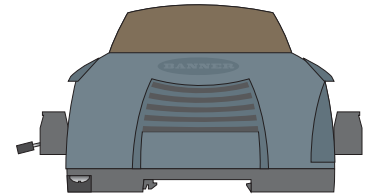
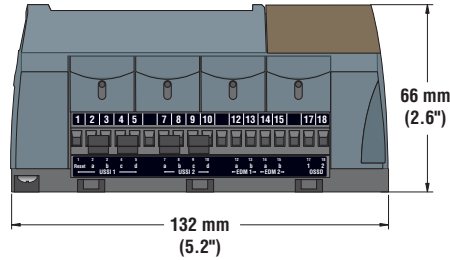
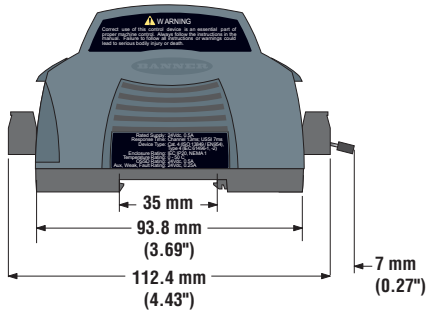
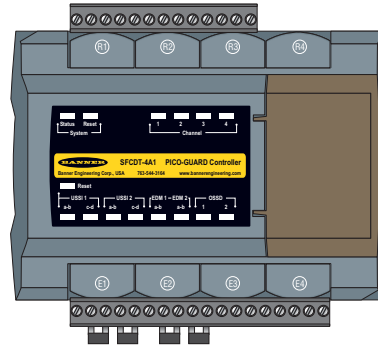
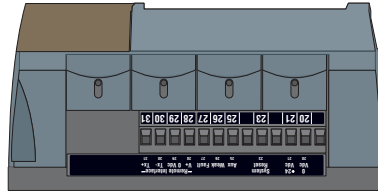
Note: For general hookup information, see pages 300-302.

## Remote Display

This DIN-mountable unit provides an additional readout of the controller's status indicators.



### PICO-GUARD Controller Dimensions



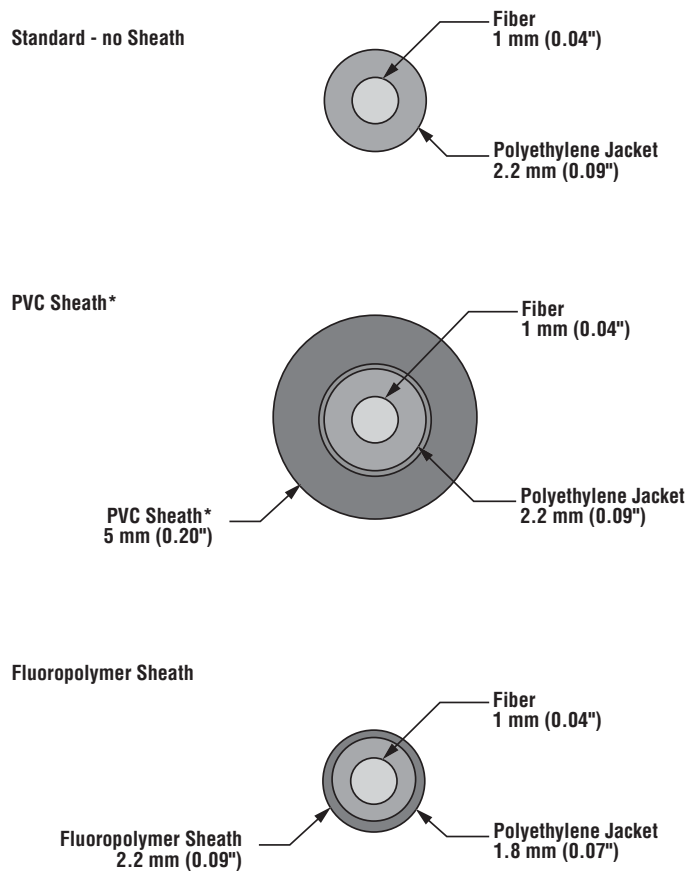
PICO-GUARD Controller Specifications	
<b>System Power Requirements</b>	24V dc +15%, 10% maximum ripple; 500 mA max., exclusive of output load
<b>Short Circuit Protection</b>	All inputs and outputs are protected from short circuits to +24V dc or dc common
<b>Response Time</b>	<b>Optical Channel:</b> 13 milliseconds max. (Time between the interruption of an optical path and the OSSD safety outputs turning off.) <b>USSI Inputs:</b> 7 milliseconds max. (Time between actuation of the safety stop input device and the OSSD safety outputs turning off.)
<b>Safety Rating</b>	Type 4 per IEC 61496-1, -2; Category 4 per ISO 13849-1 (EN 954-1)
<b>EDM Input</b>	Two normally closed contact inputs for external device monitoring (EDM). Each input monitors the status of a forced-guided monitor contact of an external safety device or MPCE. The EDM inputs must be high (10 to 30V dc) when the external device or MPCE is OFF, and must be low (less than 3V dc) when the external device or MPCE is ON. External devices or MPCEs must meet certain timing requirements, depending on the configuration setting
<b>System Reset Input</b>	The Reset input must be high (10 to 30V dc) for 0.25 to 2 seconds and then low (less than 3V dc) to reset the system from a manual power-up, optical channel latch or system lockout condition.
<b>USSI 1 Reset Input</b>	The Reset input must be high (10 to 30V dc) for 0.25 to 2 seconds and then low (less than 3V dc) to reset the system from a manual power-up, optical channel latch or system lockout condition.
<b>USSI 1 Input</b>	Dual-channel, redundant inputs for monitoring output contacts or handshake compatible safety solid-state outputs of other safety stop devices. OFF (stop) signals cause the PICO-GUARD OSSDs to latch OFF (Latch condition).
<b>USSI 2 Input</b>	Dual-channel, redundant inputs for monitoring output contacts or handshake-compatible safety solid-state outputs of other safety stop devices. OFF (stop) signals cause the PICO-GUARD OSSDs to turn OFF (Trip condition).
<b>OSSD Outputs</b>	Two diverse-redundant solid state 24V dc, 0.5A max. sourcing OSSD (Output Signal Switching Device) safety outputs. <b>ON-state voltage:</b> > $V_{in} - 1.5V$ dc <b>OFF-state voltage:</b> 1.2V dc max. <b>Max. load resistance:</b> 1,000 ohms <b>Max. load capacitance:</b> 0.1 $\mu$ F
<b>Non-Safety Outputs (Aux., Weak Signal, Fault)</b>	Solid state 24V dc (> $V_{in} - 1.5V$ dc), 0.25A max. sourcing non-safety outputs
<b>Remote Status Interface</b>	Isolated RS-232 non-safety output for setup or monitoring the system status. Connections provided for a Remote Display unit (see Accessories on page 52).
<b>Controls and Adjustments</b>	Redundant switches for Auto/Manual power-up, Trip/Latch output operation and 1- or 2-channel EDM operation. Redundant switches for ON/OFF of each optical channel. (NOTE: At least one optical channel must be ON.)
<b>Ambient Light Immunity</b>	> 10,000 lux at 5° angle of incidence
<b>Strobe Light Immunity</b>	Totally immune to one Federal Signal Corp. "Fireball" model FB2PST strobe
<b>Emitter Element</b>	Visible red LED, 660 nm at peak emission
<b>Enclosure Rating</b>	IEC IP20, NEMA 1
<b>Connections</b>	See pages 300-302 for general hookup information.
<b>Operating Conditions</b>	<b>Temperature:</b> 0° to 50° C (+32° to 122° F) <b>Relative Humidity:</b> 95% maximum (non-condensing)
<b>Status Indicators</b>	System Status (bi-color Red/Green): overall status of the PICO-GUARD system System Reset (bi-color Yellow/Red): status of the System Reset input; indicates system reset needed Channel (4 bi-color Red/Green): each shows the status of one optical channel USSI (2 bi-color Red/Green): status of the USSI input channels (a-b and c-d) USSI 1 Reset (bi-color Yellow/Red): status of USSI 1 reset input; indicates USSI 1 reset needed EDM (bi-color Red/Green): status of the EDM input channels OSSD (bi-color Red/Green): status of the OSSD outputs Config (bi-color Red/Green): status of the system configuration

# PICO-GUARD Optical Fibers

- Easy-to-use fiber connections between controller and devices
- 1 mm Solid-core plastic fiber is available in three types:
  - Polyethylene jacketed** – “standard” plastic optical fiber, excellent for most applications
  - Polyethylene jacketed with integral PVC sheathing** – for applications that must withstand mechanical abrasion or very harsh duty, and
  - Polyethylene jacketed with integral fluoropolymer sheathing** – for applications that must withstand harsh chemicals or gases
- Accessory sheathing is also available to provide additional protection for the 2.2 mm O.D. fibers (see Accessories, page 52)

PICO-GUARD Plastic Optical Fiber (Bulk – Cut to Length)		
Model	Length	Jacket/Sheath
PIU430U	9 m (30')	Polyethylene jacket
PIU460U	18 m (60')	Polyethylene jacket
PIU430UXP	9 m (30')	Polyethylene jacket, PVC sheath
PIU460UXP	18 m (60')	Polyethylene jacket, PVC sheath
PIU430UXT	9 m (30')	Polyethylene jacket, Fluoropolymer sheath
PIU460UXT	18 m (60')	Polyethylene jacket, Fluoropolymer sheath

## PICO-GUARD Optical Fiber Features and Dimensions



Note: PVC sheathing must be stripped back to allow the 2.2 mm polyethylene jacket to be inserted into the fiber connection point.

PICO-GUARD Plastic Optical Fiber (Fixed lengths with optically-polished ends)			
Length	Standard Jacket	PVC Sheath	Fluoropolymer Sheath
0.3 m	PWS43P	PWXP43P	PWXT43P
0.5 m	PWS45P	PWXP45P	PWXT45P
0.7 m	PWS47P	PWXP47P	PWXT47P
1.0 m	PWS410P	PWXP410P	PWXT410P
1.5 m	PWS415P	PWXP415P	PWXT415P
2.0 m	PWS420P	PWXP420P	PWXT420P
2.5 m	PWS425P	PWXP425P	PWXT425P
3.0 m	PWS430P	PWXP430P	PWXT430P
3.5 m	PWS435P	PWXP435P	PWXT435P
4.0 m	PWS440P	PWXP440P	PWXT440P
4.5 m	PWS445P	PWXP445P	PWXT445P
5.0 m	PWS450P	PWXP450P	PWXT450P
6.0 m	PWS460P	PWXP460P	PWXT460P
7.0 m	PWS470P	PWXP470P	PWXT470P
8.0 m	PWS480P	PWXP480P	PWXT480P
9.0 m	PWS490P	PWXP490P	PWXT490P
10 m	PWS4100P	PWXP4100P	PWXT4100P
11 m	PWS4110P	PWXP4110P	PWXT4110P
12 m	PWS4120P	PWXP4120P	PWXT4120P
13 m	PWS4130P	PWXP4130P	PWXT4130P
14 m	PWS4140P	PWXP4140P	PWXT4140P
15 m	PWS4150P	PWXP4150P	PWXT4150P
20 m	PWS4200P	PWXP4200P	PWXT4200P
25 m	PWS4250P	PWXP4250P	PWXT4250P
30 m	PWS4300P	PWXP4300P	PWXT4300P



# Fiber Optic Safety Interlock Switches

- These components have no electrical connection and function either as emitters or receivers, depending on their connection to the controller. This minimizes the required component inventory and simplifies installation.
- Available in several configurations for easy installation and proper operation on a variety of doors and other hard-guarding applications: opposed, right-angle and dual/actuator models.
- Adaptor bracket available to retrofit select magnetically coded safety switches.
- Solid-state design and no moving mechanical parts for long-term reliability when safeguarding frequently accessed areas.
- Rated at IEC IP67 and NEMA 6P
- Unique single-switch-per-door monitoring technique is designed to meet Safety Category 4 applications per ISO 13849 (EN 954-1) (approvals are pending).
- A series connection of multiple Fiber Optic Safety Interlock Switches on a single fiber channel can achieve this same high level of safety, to dramatically reduce installation and maintenance costs.



## PICO-GUARD Fiber Optic Safety Interlock Switches

Model*	Orientation/Type	Size	Mounting Flange
SFI-S1R	Straight	8 mm	Right Side
SFI-S1L	Straight	8 mm	Left Side
SFI-R1R	Right-angle	8 mm	Right Side
SFI-R1L	Right-angle	8 mm	Left Side
SFI-D1	Dual	8 mm	–
SFI-A1	Actuator	8 mm	–

The Interlock Switches mount with user-supplied M4 or #10 hardware

\* Note: Select two models to create one switch pair. Models SFI-A1 and SFI-D1 work together (see page 50).

Fiber Optic Safety Interlock Switches Specifications	
<b>Operating Distance</b>	1-50 mm (0.04" - 2") max.
<b>Mounting</b>	Holes for M4 (#10) screw (not included),
<b>Construction</b>	Polycarbonate plastic housing and window
<b>Operating Conditions</b>	<b>Temperature:</b> 0° to +70°C (+32° to 158°F) <b>Relative Humidity:</b> 95% (non-condensing)
<b>Environmental Rating</b>	IEC IP67, NEMA 6P

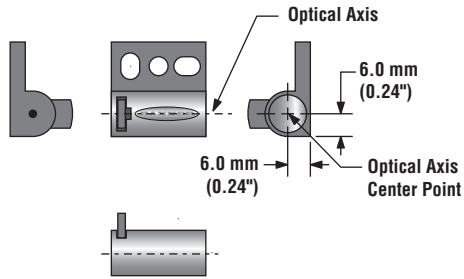
# PICO-GUARD™ Systems

## Optical Elements

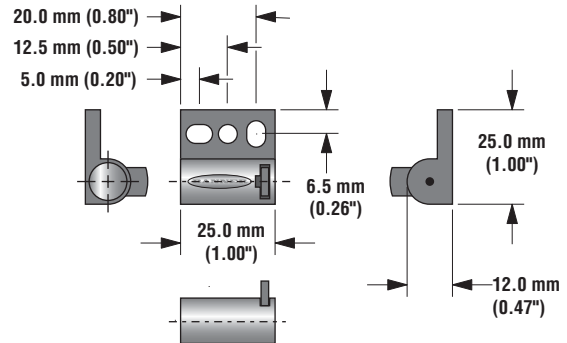
### PICO-GUARD Fiber Optic Safety Interlock Switches Dimensions

Optical Safety Systems

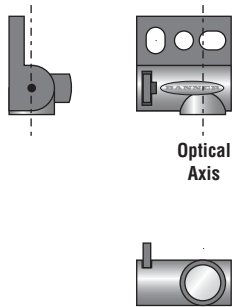
**SFI-S1L**



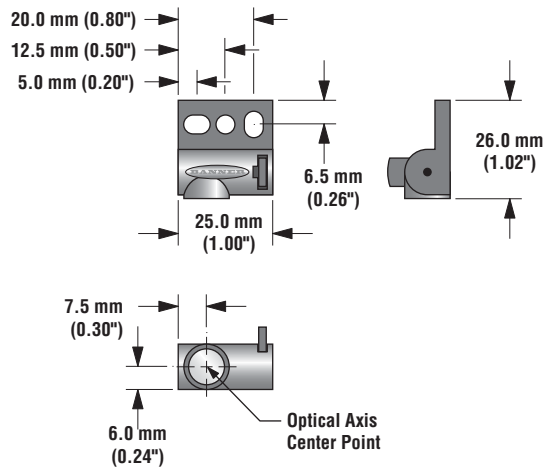
**SFI-S1R**



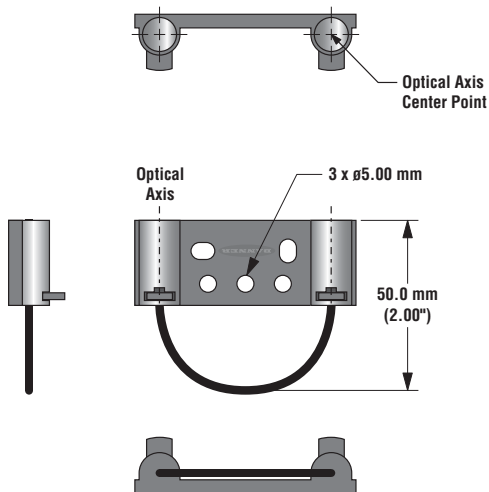
**SFI-R1L**



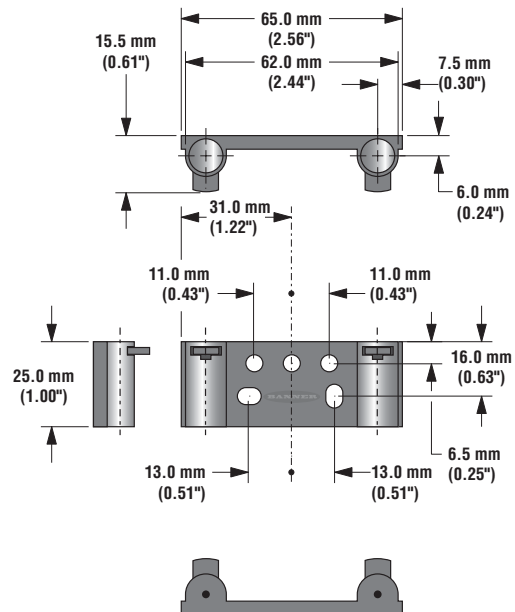
**SFI-R1R**



**SFI-A1**



**SFI-D1**







## Fiber Optic Safety Grids\*

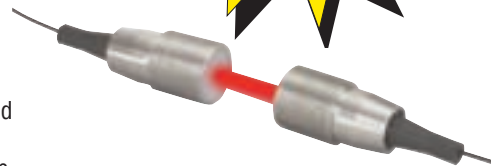
The PICO-GUARD Fiber Optic Safety Grids have 2, 3, or 4 beams in an IEC IP65 aluminum enclosure. They connect to the controller via fiber optic cable and are designed to meet ANSI/RIA R15.06, ANSI B11 and ISO 13855 (EN 999) standards for proper beam placement in pass-through guarding applications.



## Fiber Optic Safety Points\*

PICO-GUARD Fiber Optic Safety Points are single-beam optical elements. They are suitable for custom beam-spacing applications. They come in 12 mm and 30 mm, IEC IP65 barrel configurations with integrated, cut-to-length fiber optic cable.

PICO-GUARD Fiber Optic Safety Points and Grids are designed for use in access-guarding and perimeter-guarding applications. They are designed to detect a torso (rather than a hand or an arm) as a person enters a hazardous area. In these applications, personnel typically can pass through the light grid (which disables or stops the hazard), and then may continue into the hazardous area after the hazard has been stopped.



\* These components have no electrical connection and function either as emitters or receivers, depending on their connection to the controller. This minimizes the required component inventory and simplifies installation.

PICO-GUARD Accessories	
Model	Description
SFA-FA	In-line signal attenuator
SFA-FS	Fiber splice
SFA-IMB1	Optional interlock switch mounting brackets (retrofits SI-MAG1SM)
SFM-IMB2	Optional interlock switch mounting brackets (retrofits SI-MAG2SM)
SFA-RD	Remote display
SFA-AT	Alignment tool (available soon)
PFC-2-25	Bag of 25 PFC-2 plastic optical fiber cutters
FS64P100	Black PVC sheathing, 100'
MGA-KS0-1	SPST key reset switch, no wires (includes key)
IM-T-9A	Interface module (3 N/O redundant-output contacts). See page 60.
IM-T-11A	Interface module (2 N/O redundant-output contacts + 1 N/C auxiliary contact). See page 60.
LAT-1	Laser alignment tool
BRT-THG-2-100	50 mm (2") wide reflective tape, 2.5 m (100") long

PICO-GUARD Replacement Parts	
Model	Description
69761†	PICO-GUARD Controller manual
69763†	PICO-GUARD Application and Design Guide
109907†	PICO-GUARD Fiber Optic Interlock Switch models SFI-R1R/-R1L data sheet
109908†	PICO-GUARD Fiber Optic Interlock Switch models SFI-D1/-A1 data sheet
109909†	PICO-GUARD Fiber Optic Interlock Switch models SFI-S1R/-S1L data sheet
109910†	PICO-GUARD models SFA-FA/FS Attenuator/Splice data sheet
SFA-CTB1	PICO-GUARD controller 4-position terminal block
SFA-CTB2	PICO-GUARD controller 9-position terminal block
SFA-CTB3	PICO-GUARD controller 18-position terminal block
SFA-CMH	PICO-GUARD controller mounting hardware
SFA-IAG	Interlock alignment guide

†NOTE: Instruction manuals are available at no charge for system evaluation. Visit Banner's website at [www.bannerengineering.com](http://www.bannerengineering.com), or contact your local Banner sales office.