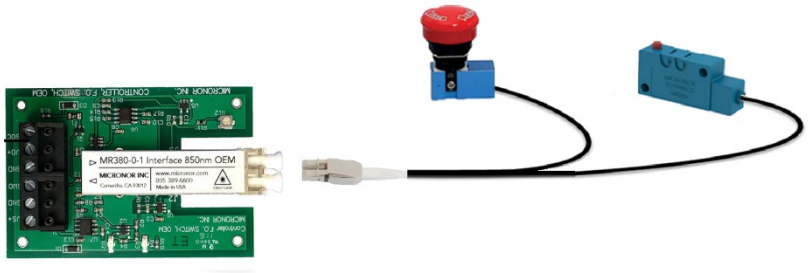
MR380-0-UNI
Fiber Optic
Universal OEM Signaling Controller
Instruction Manual

DOC: 98-0380-32
Revision C dated 5/12/2023



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Revision History

REV	Date	Notes
A	2/10/2016	Initial Release
B	8/1/2016	Update for New Terminal Plug
B1	10/20/2016	Added Explosive Atmosphere specification
B2	3/7/2017	Added Extended Temperature model MR380-0-1E
B3	9/27/2019	Added Updated MR380 Declaration of Conformity
C	5/12/2023	Update for MR380-0-UNI Universal Controller

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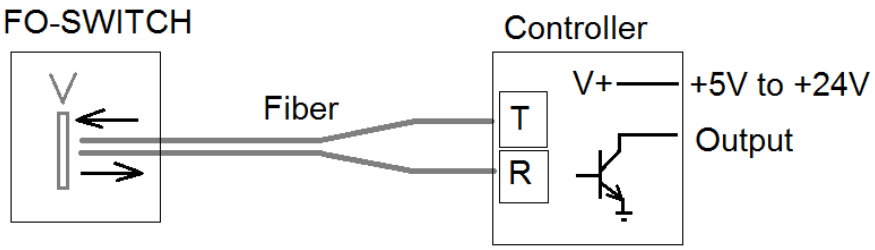
1. Product Description

1.1 Fiber Optic Switch Sensor Controller Board

A fiber optic switch works on the basis of interrupting a light beam when a certain event occurs and the switch is activated. Although switches take on various forms such as, Toggle, E-STOP, Push-Button and so on, the principle of sensing the switch state remains the same via interruption of the optical beam. MICRONOR has implemented the concept by using a transmit fiber and a receive fiber. The transmitter sends a constant light level via the transmit fiber and the receive fiber guides the light back. When the switch is not activated, most of the light is guided back to the receiver. When the switch is activated, little or no light is coupled back to the receiver.



The MICRONOR Fiber Optic switches are immune to EMI/RFI and can be deployed at great distances from the electrical controller. Applications include:

- MRI machines operate under an extremely strong electromagnetic field. Special switches are manufactured to be entirely free of metallic materials and, thus, will not interfere with the MRI imaging process.
- Pipe and tube welding produces extreme interference while the welding process is active
- Surgical robots must perform 100% reliably
- Oil & Gas since there is no sparking
- Aerospace actuators operating in and around other noise generating avionics
- Aerial Tramways, Gondolas, Skilifts etc, because immunity to lightening.

An all-optical, non-electronic passive solution, such as the fiber optic switch, provides complete immunity to such interferences.

1.2 Fiber Optic Controller Board

The MR380-0 Controller Board is intended for the OEM user in support of deployment of the various Fiber Optic Signaling products. The OEM PCB contains a stabilized transmitter and a sensitive optical receiver. There are two digital outputs

a.) 5V logic Level signals a High when optical power is received.

b.) Open-collect output for activating an external relay (or other electrical load) when sufficieant optical power is received.

This universal PCB may be used in conjunction with many of the MICRONOR signaling devices.

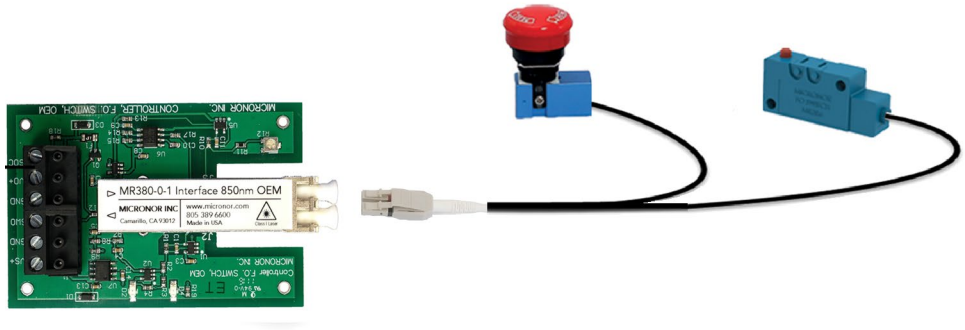


Figure 1. MR380 Fiber Optic Signaling Devices

The MR380-0-UNI is intended for OEM applications where the PCB can be mounted into a suitable enclosure and where it is sufficiently protected from the environment such as water and dust or similar influences. Optically the interface board is compatible with both single mode OS1 and multimode OM1 (62.5µm/125µm) and OM2/OM3 (50µm/125µm) fiber cabling.

1.3 Functional Description

The "Universal" Controller

The MR380-0 OEM Controller is designed to be universally compatible with any standard fiber optic cabling. This is accomplished through the design of its transmit and receive fibers.

In fiber optics, coupling two fibers of different core diameters is only permitted when the core of the receiving fiber is the same size or larger than that of the transmitting fiber. For example, transmitting from OS1 9/125µm single mode fiber to OM1 62.5/125µm or OM2 50/125 multimode fiber does not produce any losses since the core diameter expands from 9µm to 62.5µm or 50µm. Conversely, transmitting from OM1 or OM2 fiber to OS1 fiber causes significant losses and is unacceptable as the core of the receiving fiber is smaller than that of the transmitting fiber. However, if the receiving fiber is only slightly smaller than the transmitting fiber, there is a smaller loss that can be built into the system loss budget. For

example, transmitting from OM1 fiber (62.5µm core) to OM2 fiber (50µm core) produces a loss of approximately 1.2dB, which is not a problem in most situations.

In the MR380-0 controller, the transmit fiber is OS1 9/125µm single mode fiber. Since the core of the fiber is smaller than any other standard fiber, no losses are produced at this connection, no matter which standard fiber the rest of the system uses. And, at the other end, the controller's receive fiber is OM1 62.5/125µm multimode fiber. Similarly, no losses are produced at the receive connection because the OM1 fiber is larger than any standard fiber the rest of the system might use.

As a result, the MR380-0 controller is compatible with any standard fiber, hence its designation as a universal controller. Despite this designation, users should use the same fiber throughout their system to avoid complications and simplify future alterations.

Functional Block Diagram

A functional block diagram is shown in *Figure 10*, showing the switch sensor, optical link and controller module. The switch is connected to the controller by a duplex fiber optic cable of readily available 50/125µm or 62.5/125µm multimode fiber or 9/125µm single mode fiber. The controller's 9/125µm single mode transmit fiber guides steady optical power from a near-IR light source to the optical switch. Then, a 62.5/125µm multimode receive fiber returns the light relaying if the switch is open or closed.

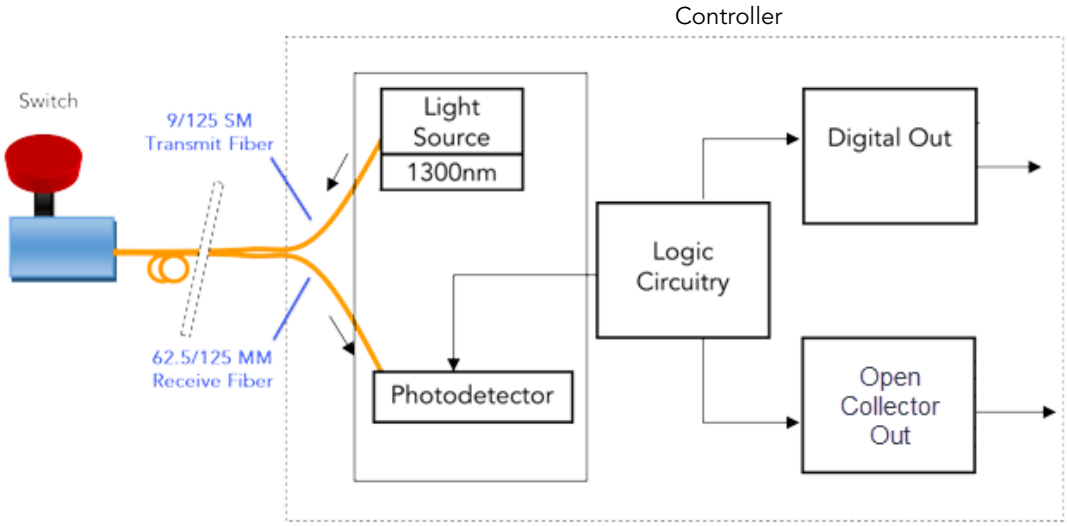


Figure 2. Block Diagram for a MR380-0 Controller System

The light source power is held constant under normal operating conditions allowing for a known system loss budget when designing a system. Additionally, the optics within the switch are designed to couple maximum light back into the receive fiber enabling the ability to create long distance systems and chain multiple switches.

Next, the optical power is identified by the photodetector and translated into a logic signal depending on the power level. The photodetector operates with an active low signal scheme

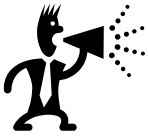
which provides a known failure state. The controller then interprets events such as broken fiber, poor connection, high loss or a depressed switch as a failure or 'EMERGENCY ON'.

The photodetector outputs a logic signal to the remaining logic circuitry which then interprets high or low levels for the +5V digital and Open-Collector outputs.

2. Initial Preparation

2.1 Unpacking and Inspection

The unit was carefully inspected mechanically and electrically before shipment. When received, the shipping carton should contain the following items listed below. Account for and inspect each item before the carton is discarded.



The PCB is an electronic Assembly and susceptible to ESD. Please use appropriate grounding and caution when handling the PCB.

In the event of a damaged product, write or call your nearest MICRONOR AG sales office.

Please retain the shipping container in case re-shipment is required for any reason.

2.2 Damage in Shipment

If you receive a damaged product you should:

1) Report the damage to your shipper immediately.
2) Inform MICRONOR AG or your local Micronor representative.
3) Save all shipping cartons.

Failure to follow this procedure may affect your claim for compensation.

2.3 Standard Contents

MR380-0-UNI OEM Controller Board:

- PCB board with built-in Duplex LC interface and 3.5mm contact strip.
- CamdenBoss P/N CTB1301/6A
  6C, Screw-Type Terminal Plug, 5mm Contact Spacing

This Instruction Manual can be downloaded from www.micronor.com

3. Installation and Operation

3.1 Mounting the Sensor Unit

When installing the sensor, be careful not to bend the fiber excessively. It is recommended to keep the minimum bend radius 25mm (1") or larger. Ensure that the fiber outlet at the switch is protected from excessive pulling or bending.

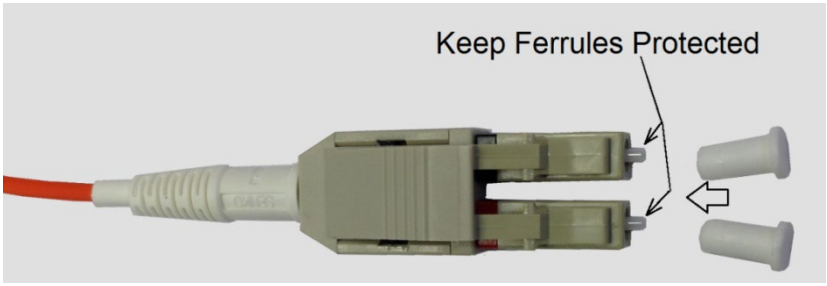


Figure 3. Keep LC Duplex connector ends protected when not in use

Make sure that the fiber optic connector tips are always covered when not in use. Always clean and inspect the connector ends before mating to interface.

Be sure to use proper fiber optic cleaning tools and procedures such as the MICRONOR MR321C Cleaning Kit. Improper tools and/or processes may damage or contaminate the optical interface.

3.2 Mounting the MR380-0 Controller PCB

The controller PCB should be mounted on 4 standoffs.
Clearance shall be available for access to the Fiber Optic Interface.
The mounting holes are suitable for #2-56 or M2.5 screws.
The mounting holes are electrically connected to GND.
Consult Reference Drawing 98-0380-15 for more information

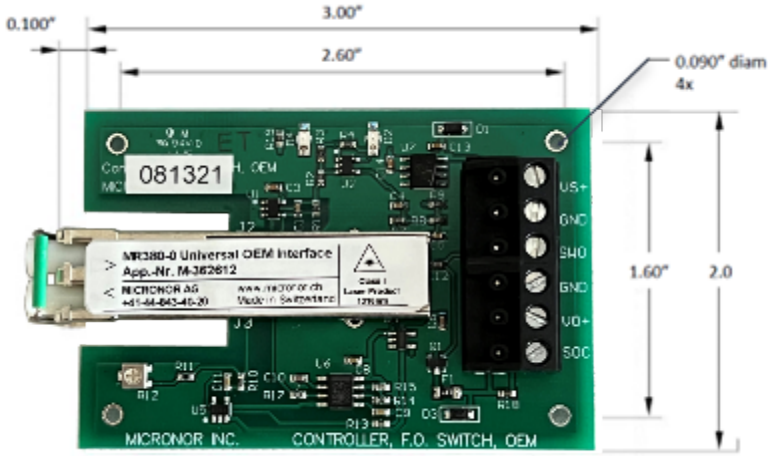


Figure 4. Dimensions of MR380-0 Controller PCB

3.3 Optical Connections to the MR380-0 Controller

A duplex fiber optic cable is used to interconnect the sensor and controller. The sensor incorporates a 1.5m optical pigtail (or as specified by customer). If a longer connection to the controller is required, then a fiber optic extension cable may be used.

Remove the dust cap form both the cable connector and the optical port on the controller. Insert the LC connector as shown. There should be a positive click when the connector is engaged properly.

Do not force the Fiber Optic Connector!

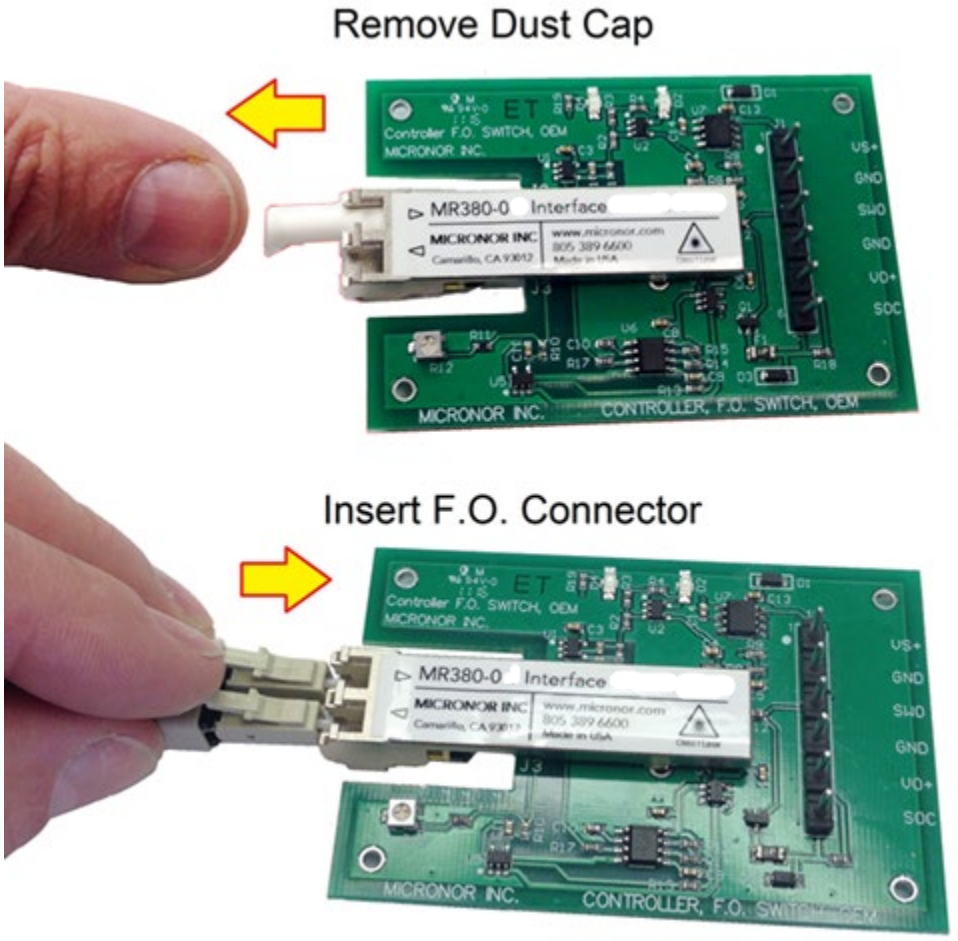


Figure 5. Make optical connection using LC-Duplex optical connector

3.4 Electrical Connections To MR380-0 Controller

The may be unit is powered with any voltage between 5V and 24V DC.
Current consumption is typ. 8mA at 5V DC and +12mA at 24V DC excluding any external load.

CamdenBoss P/N CTB1301/6A (supplied) 6C, Screw-Type Terminal Plug, 5mm Spacing	
PIN	Function
1	+5V to +24V DC Power Supply
2	GND
3	+5V Logic Out
4	GND
5	DC Supply (Out)
6	Open Collector Out

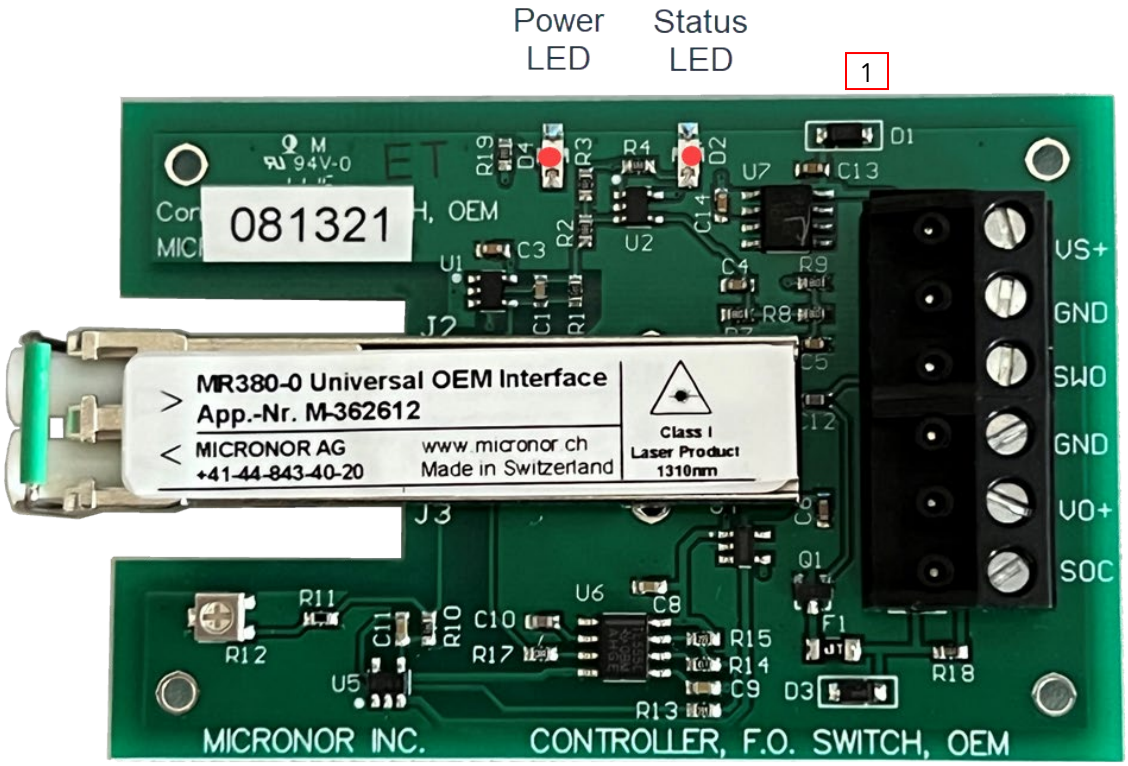


Figure 6. Layout of MR380-0 PCB

NOTE: Mounting holes are internally connected to GND.
When all connections are made, than apply DC voltage in the range of +5V to max +24V.
If the sufficient optical power is received, then the onboard LED will light up. It is OFF when no optical power is received.

Interfacing with an external Relay

An external relay may be connected to the open-collector terminal (6).

The maximum voltage allowed for this output is up to the power supply Voltage.

If the pull-up resistor R8 is removed, then voltages exceeding the V Supply up to 48V are allowed.

The current load shall not exceed 180mA.

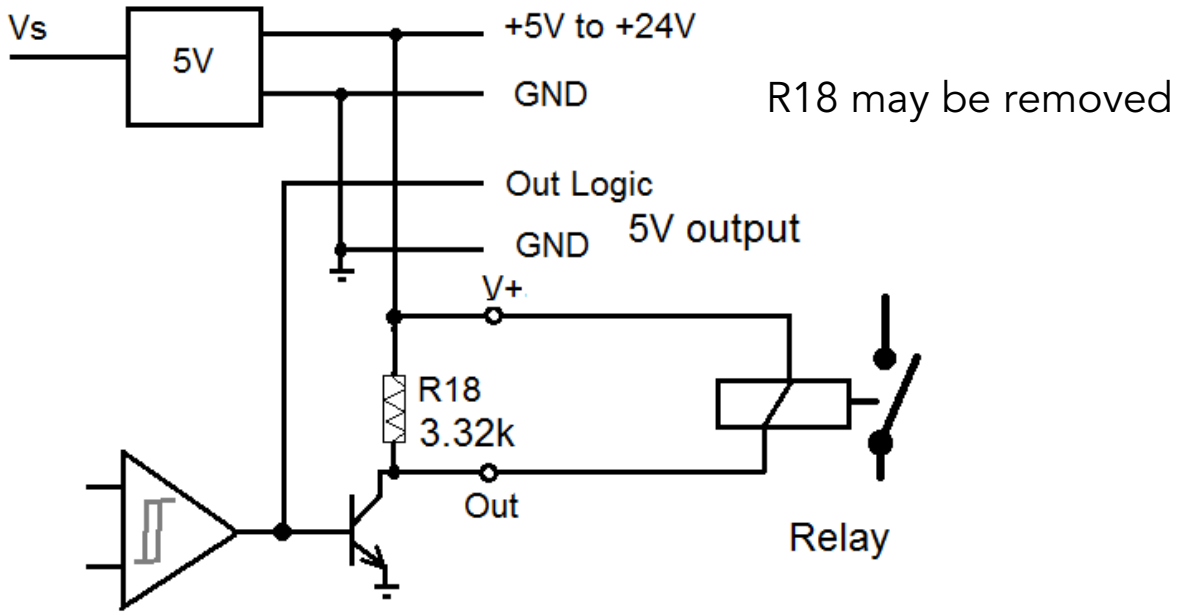


Figure 7. External Relay Connection

4. Warranty Information

Warranty

MICRONOR AG warrants this product to be free from defects in material and workmanship for a period of 1 (one) year from date of shipment. During the warranty period we will, at our option, either repair or replace any product that proves to be defective.

Applying improper supply voltage (greater then 24VDC or reverse polarity) voids the warranty.

To exercise this warranty, write or call your local MICRONOR AG representative, or contact MICRONOR AG headquarters. You will be given prompt assistance and return instructions. Send the product, transportation prepaid, to the indicated service facility. Repairs will be made and the product returned transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days. MICRONOR AG resreves the option to either repair, or replace product.

Limitations of Warranty

This warranty does not apply to defects resulting from unauthorized modification or misuse of any product or part. This warranty also does not apply to Fiber Optic Connector interfaces, improper mouning of the PCB, fuses or AC line cords. This warranty is limited to the maximum price paid by purchaser to MICRONOR AG, excluding any shipping, transportation or duties. This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability of fitness for a particular use. MICRONOR AG shall not be liable for any indirect, special or consequent damages.

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5. Specifications

5.1 MR380-0-UNI Universal OEM Signaling Controller

Functional States	Example: MR386 Series Fiber Optic Microswitch
For Normally Open (NO) Sensors - Plunger Up - Plunger Down (Normal State)	 LED=Off, Logic Output=LO, Open Collector Outut=OFF LED=On, Logic Output=HI, Open Collector Output=ON
For Normally Open (NC) Sensors - Plunger Up (Normal State) - Plunger Down	 LED=On, Logic Output=HI, Open Collector Output=ON LED=Off, Logic Output=LO, Open Collector Outut=OFF
Functional States	**Example: MR387 Series Fiber Optic E-Stop**
-Normal Positon (Up) -Emergency State (Down)	LED=On,Logic Output=HI, Open Collector Output=ON LED=Off, Logic Output=LO, Open Collector Outut=OFF
Electrical	**Note: Electrical connections shall not exceed 3 meters**
Connector	CamdenBoss P/N CTB1301/6A, 6C, Screw-Type Terminal Plug, 5mm contact spacing, 1.5mm^2 cable entry
Logic Output	High=4.5V min. (2k Ohm Load), Low=0.25V max.
Open Collector Output	Maximum Load Voltage 24V Maximum Current 180mA, Protected by resettable fuse
Power Supply	+5VDC to +24V DC maximum Current Consumption=8mA max at 5V DC, 12mA at +24V and R8 installed
Optical	**Class 1 Eye Safe**
Laser Safety Classification	Class 1 Eye Safe, 1310nm, VCSEL
Connectior	LC Duplex, PC Polish
Compatible Fiber Types	62.5/125µm OM1 Multimode, or 50/125µm OM2/OM3 Multimode, or 9/125µm OS1 Single Mode
Optical Loss Margin	OM1=21dB, OS1=18dB, max
Maximum Optical Link Length	Distance is a function of the user's system loss budget which si the total round-trip loss of all optical link components – multiple sensors, connectors, splices, and cable segments. Consult Application Note AN118 for more information.
Explosive Atmospheres	**Inherently Safe Optical Radiation**
Ex Classification	Controller shall be installed in non-hazardous location only Power supply to Controller shall be current limited to 200mA or less
ATEX	CE [EPL Mb/Gb/Gc/Db/Dc]
IEC Ex/EAEU/GOST	[EPL Mb/Gb/Gc/Db/Dc]
North America	Controller shall be installed in non-hazardous location only
Environmental Performance	
Temperature/Humidity	-40°C to +70°C (-40°F to +158°C, 0-85% RH, Non-Condensing
Ingress Protection	IP00 (none)
Physical Attributes	
Mounting	4x #2-56 or M2.5 screws, Mounting pattern 1.60" x 2.60"
Size	5.08 x 7.62cm (2.00" x 3.00")

Weight	25g (1oz)

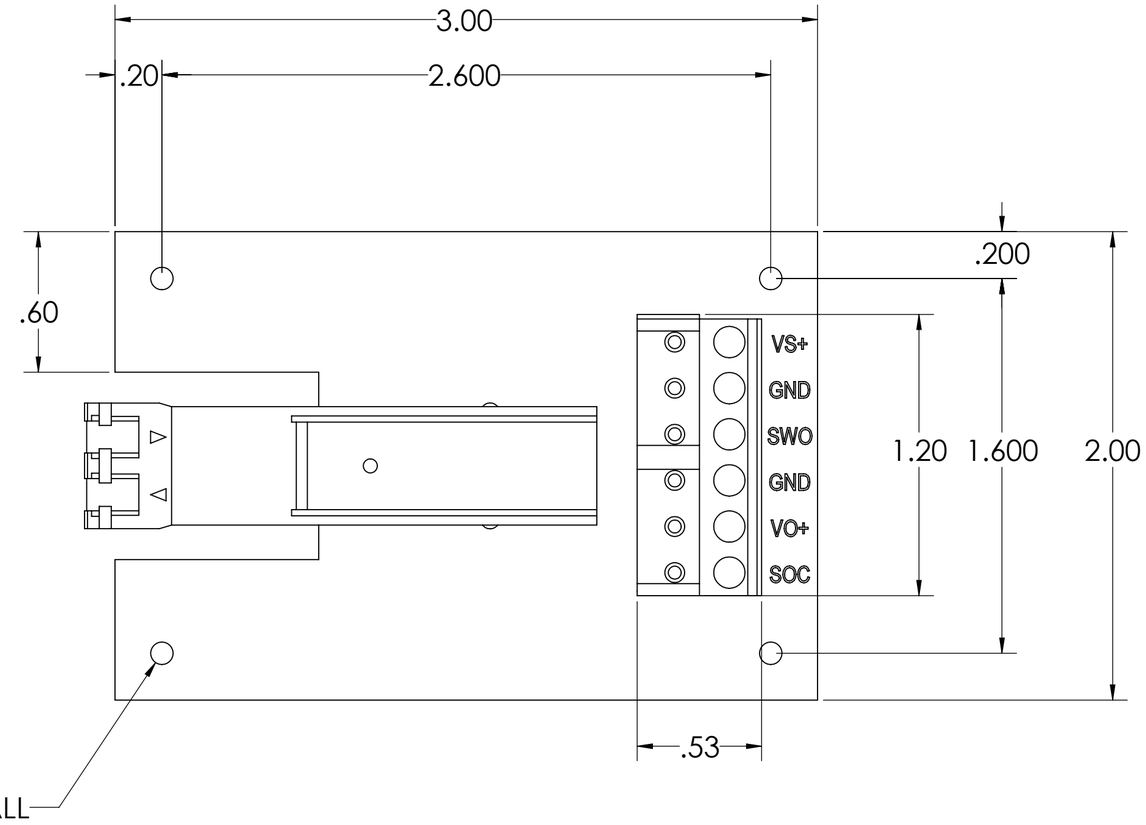
Specifications subject to change without notice

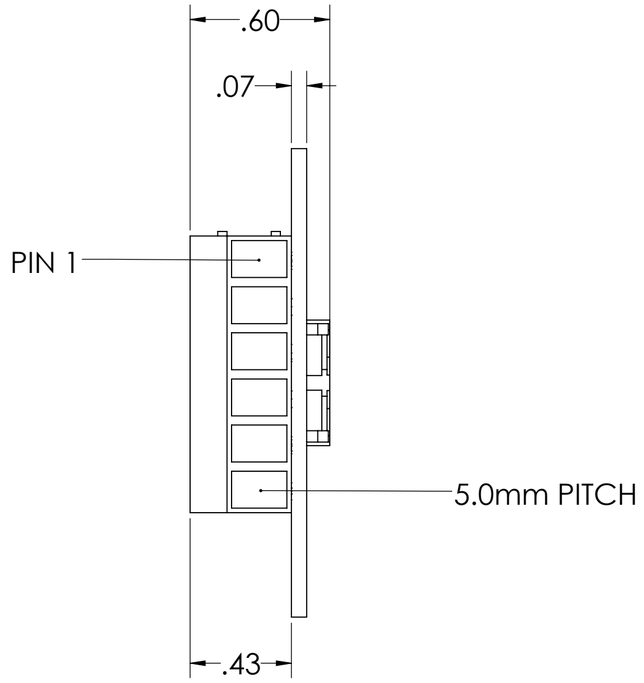
6. Reference Documents

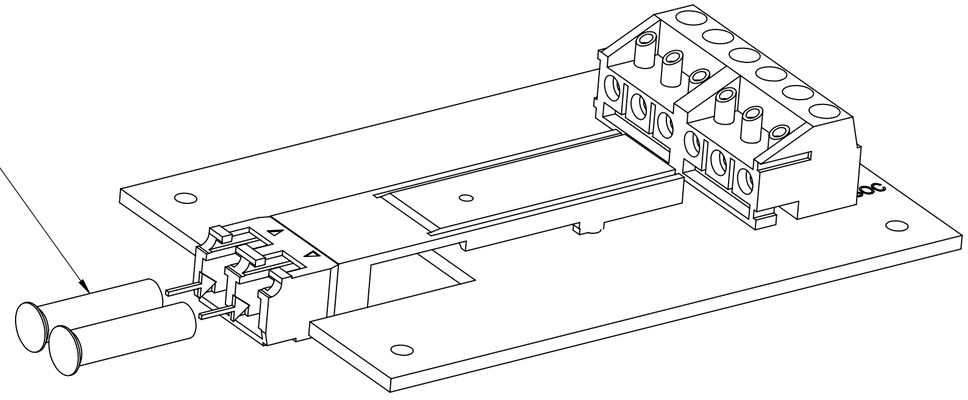
Documents appear on the following pages.

6.1 MR380-0 OEM Controller Reference Drawing

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	NEW RELEASE	8/4/2016	AD
A1			DNH







PART NUMBER ORDERING CODE

MR380 - X - X X

Temperature Range

Blank Standard, -10C to +65C
E Extended, -40C to +70C

WAVELENGTH

1 MULTIMODE 850nm

PRODUCT

0 PCB CONTROLLER

2 WARNING: KEEP CONNECTOR COVERS IN PLACE DURING STORAGE TO PROTECT OPTICAL CONNECTOR

1 WARNING: AVOID SHARP BENDS IN FIBER CABLING KEEP BEND RADIUS GREATER THAN 0.5 INCH [13MM].

NOTES: UNLESS OTHERWISE SPECIFIED

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ±.01 THREE PLACE DECIMAL ±.004	DRAWN	A DU	4/28/16
			CHECKED		
			ENG APPR.		
			MFG APPR.		
			Q.A.		
		INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:		
		MATERIAL			
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

MICRONOR INC.
CAMARILLO, CA (805) 389-6600

TITLE:
CONTROLLER OEM

SIZE	DWG. NO.	REV
C	MR380-0	A1
SCALE: 2:1	WEIGHT:	SHEET 1 OF 1