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Declaration of Conformity

We

Micronor Inc.
900 Calle Plano, Suite K, Camarillo, CA 93012, USA

declare that the product

Fiber Optic Signaling Sensor System	**Item Code(s)**
Controller Modules (Multimode Only)	**MR380-0, MR380-1, MR380-2, MR382-1**
Sensors	**MR381, MR382, MR383, MR384, MR385, MR386, MR387**
Country of Origin: Camarillo, CA USA	

to which this declaration relates in conformity with the following standards, normative documents and/or customer requirements:

Requirement	MR380 Controllers (Multimode)	MR380 Sensors
1. Laser Safety	Class 1 laser devices per IEC 60825	Exempt
2. ATEX Directive	Sensor and Controller are exempt: Not considered to have an independent source of ignition. (a) Optical sources which meet the Class I limits are considered suitable for use in locations with an EPL of Mb, Gb, Gc, Db or Dc as per Clause 1 (3) of IEC 60079-28:2015 Ed 2. IECEx GB/CML/ExTR 16.0105/00, R1198C/00, Evaluated by Notified Body 2503, Certification Management Limited, Unit 1 Newport Business Park, New Port Road, Ellesmere Port, CH65 4LZ, United Kingdom	
3. Functional Safety	For MR387 E-Stop Sensor and MR380-1 DIN Rail Mount Controller Only: SIL=1, PL=c, SFF=97.85%, DC=75.76%	
4. Low Voltage Directive	Exempt	Exempt
5. EMC Directive	MR380-0, Exempt MR380-1/MR380-2/MR382-2, Passed	Exempt
6. CE Mark	Applicable	Applicable

Place: Camarillo, CA, USA
Date of Issue: 7-March-2017

Dennis Horwitz
Micronor Inc.
Vice President, Sales and Marketing
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Ref: N:\Declaration of Conformity\MR380-X MM Controller DOC\DOC_MR380_MM_RevC Sept-2016\MICRONOR_98-0380-05_C1_MR380 Declaration of Conformity_Released_7-March-2017.docx

Product Assessment Report

Product Description: MR380 series Fiber Optic Signaling Sensor system

Affected Products: The following models are referred to as the **Controller** in this document:
MR380-0-1 OEM E-Stop Controller, Multimode, 850nm
MR380-0-1 OEM E-Stop Controller, Multimode, 850nm, Extended Temp
MR380-1-1 DIN Rail Mount E-Stop Controller, Multimode, 850nm
MR380-1-2 DIN Rail Mount E-Stop Controller, Multimode, 1310nm
MR380-2-2 DIN Rail Mount Switch Controller, Multimode, 1310nm
MR382-1-1 DIN Rail Mount U-Beam Controller, Multimode, 850nm

The following are referred to as the **Sensor** in this document:
MR381-X-X Fiber Optic E-Actuator (any model)
MR382-X-X Fiber Optic U-Beam (any model)
MR383-X-X Fiber Optic Key Switch (any model)
MR384-X-X Fiber Optic Push Button (any model)
MR385-X-X Fiber Optic Foot Pedal (any model)
MR386-X-X Fiber Optic Microswitch (any model)
MR387-X-X Fiber Optic E-Stop (any model)
And custom versions of any of the above sensors

Document: 98-0380-05
Revision: C1
Dated: 7-March-2017
Number of Pages: 14

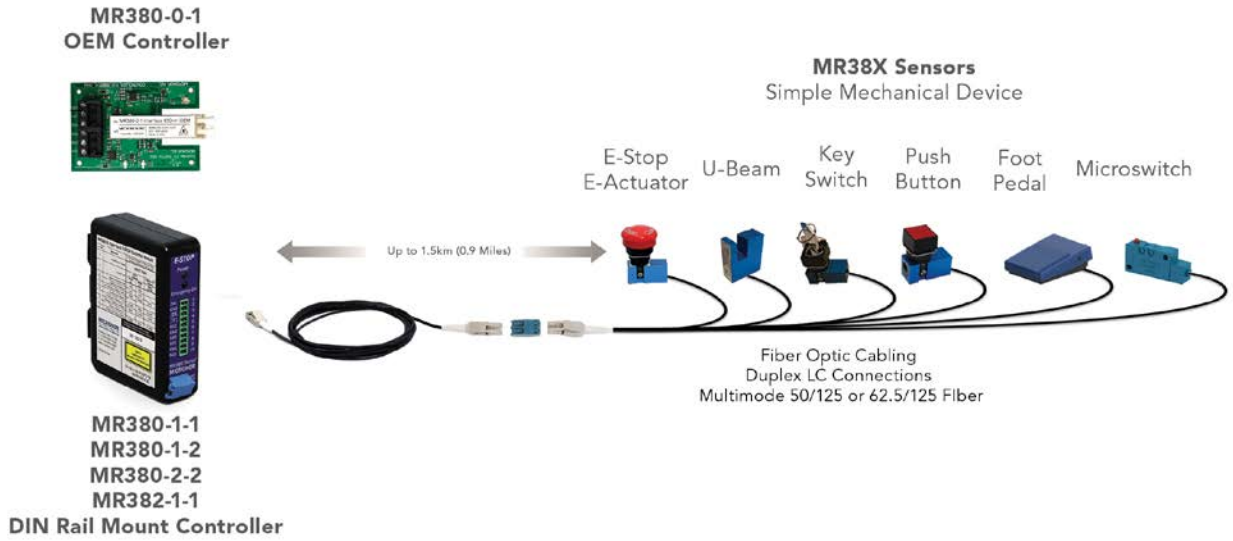
Revision History

Revision	Date	Description
0	13-Dec-2013	Original release
A (1)	18-March-2015	Added SFF and DC parameters under Functional Safety
B (2)	13-July-2015	Added 50/125 multimode pigtail version and Universal Controller
C	27-Sept-2016	Updated Ex compliance with CML/IECEx Test Report Added new Sensor and OEM controller products Integrated MR382 U-Beam product line
C1	7-March-2017	Added Extended Temperature model MR380-0-1E

Assessment Outline

1. Product Overview

The MR380 series Fiber Optic Signaling Sensor System consists of one or more passive Sensors (optically wired in series) and active Controller which are connected via a duplex multimode fiber optic link:



2. Risk Assessment By Category

2.1 Product Function (MR387 E-Stop System Only)

Reference:
1. ISO 13850, *Safety of machinery - Emergency Stop - Principles for design*, Edition 2006

Summary:
The combination of the MR380-1 series Controller and MR387 E-Stop Sensor meets the purpose and essential functionality of an Emergency Stop Device but the fiber optic sensor/interrogator aspect of the device excludes it from meeting all performance requirements typical of a conventional electromechanical E-STOP. This product is designed for applications and environments where a conventional electromechanical E-STOP cannot be used.

Parameter	Applies to E-Stop system Only, Consisting of MR380-1 Controller and MR387 E-Stop Sensor
Functionality	ISO 13850 NOTE: ISO 13850 defines the characteristics and requirements for a traditional electromechanical E-STOP switch. The MR380 Fiber Optic E-STOP System borrows the definition of purpose and functionality only.

Analysis:
ISO 13850 defines the functional requirements and design principles for the emergency stop function and emergency stop device on machinery. In operation, an emergency stop function is initiated by single human action to initiate the event(s) required to bring the machinery to a fail-safe condition. What constitutes a fail-safe condition and how the machine reaches that state is the responsibility of the machinery designer.

The Micronor MR387 Fiber Optic E-STOP Sensor System functions similar to a standard electromechanical, mushroom-style E-Stop. The passive optical sensor integrates a conventional E-STOP actuator which controls

an optical circuit or light path - similar to the way an electromechanical E-STOP switch directly controls an electrical circuit. As required by ISO 13850, the MR387 E-STOP Sensor incorporates the same mechanical latching and reset mechanism as a conventional E-STOP. The optical transmit and receive paths comprise a duplex fiber link which is completed by connection to a MR80 Controller module. This module contains the system's optoelectronics as well as the electrical interface and relay contacts which connect to the machinery's control system.

The MR387 Fiber Optic E-STOP System is designed to be used where a conventional electromechanical emergency stop device cannot be used or is impractical to install. The passive optical E-STOP sensor provides immunity to EMI/RFI/lightning, can be safely used in hazardous locations, and can operate over extremely long distances. Typical applications and environments where the sensor can be used:

- Hazardous locations (gaseous or dust) such as mines, chemical plants, oil rigs and grain elevators
- Long haul distances (up to 2500 meters) such as mines and remotely located machinery
- Noisy electrical environments
- High electromagnetic field environments such as MRI and other extreme EMF process applications

2.2 Laser Safety

References:

1. IEC 60825-1, *Safety of laser products - Part 1: Equipment classification, requirements and user's guide*, Edition 3.0, May 2014
2. IEC 60825-2, *Safety of laser products - Part 2: Safety of optical fibre communication systems (OFCS)*, Edition 2004+A2, October 2010
3. FDA, *Code of Federal Regulations (CFR), Title 21, Chapter 1 - Food and Drug Administration - Department of Health and Human Services, Subchapter J-Radiological Health*, Parts 1000-1050
4. Micronor 98-0380-03, *MR380-1 CDRH Supplemental Information*, Revision B, April 2016
5. Micronor 98-0380-30, *MR380-0 LASER Level Measurement*, Revision A, March 2015

Summary:

The MR380 system meets the laser safety requirements per IEC 60825-1 which is recognized as a harmonized standard by both the U.S. Food and Drug Administration (FDA) and European Union. Since the optical radiation originates from the MR380 Controller, the laser safety class designation and product labeling requirements apply only to the MR380 Controllers as the "active" optoelectronic half of the MR380 system.

For FDA compliance, annual production reports for the MR380 Controller shall be filed and the product shall be marked with a serial number and date of manufacture (month/year).

Analysis:

Optical output power of the Controllers corresponding IEC Classifications and marking requirements are shown in the following table:

Parameters	Controller Models		
	MR380-0-1 MR380-0-1E	MR380-1-1 MR382-1-1	MR380-1-2 MR380-2-2
Wavelength (Type of Source)	850 nm Pulsed (VCSEL)	850 nm CW (VCSEL)	1310nm CW (LED)
Output Power	0.126 mW (-9 dBm)	0.100 mW (-10 dBm)	0.0126 mW (-19 dBm)
IEC Class 1 Limit	3.88 mW (+5.8 dBm)	3.88 mW (+5.8 dBm)	77.8 mW (+18.9 dBm)
Classification	Class I (Not Harmful)		
Required Markings	FDA: Serial Number and Date of Manufacture IEC 60825-1 Labeling Requirement: 		

2.3 Explosive Atmospheres

References:

1. ATEX Directive 2014/34/EU, *Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres*.
2. IEC 60079-0, *Explosive Atmospheres - Part 0 Equipment – General Requirements*, Edition 5, 2007
3. IEC 60079-28, *Explosive Atmospheres - Part 28 : Protection of equipment and transmission systems using optical radiation*, Edition 2, 2015
4. IECEx Test Report GB/CML/ExTR 16.0105.00/00 (CML Report R1198C/00), *Evaluation of MR380 Series Controller and Sensors*, August 2016. NOTE: Contact Micronor for copy of full IECEx test report, Micronor document 98-0380-16.
5. National Fire Protection Association, NFPA 70, *National Electric Code (NEC)*, 2014.
6. Micronor 98-0380-07, *MR380 Inherent Safety Evaluation*, Revision C, August 2016
7. Micronor 98-0380-30, *MR380-0 LASER Level Measurement*, Revision A, March 2015

Summary:
Per IECEx Test Report, the MR380 optical radiation output meets Class 1 requirements and is therefore considered inherently safe and exempt from the scope of IEC 60079-28. Clause 1 (3) of IEC 60079-28:2015 states that optical sources which meet the limits of Class 1 lasers, as defined in IEC 60825-1, are suitable for use in EPM Mb/Gb/Gc/Db/Dc applications.

The NEC does not address fiber optic sensors and is exempt.

The following tables summarize assessments and applicable markings for the MR380 series Controllers and Sensors:

Parameters	Controller Models	
	MR380-0-1 MR380-0-1E	MR380-1-1 MR380-1-2 MR380-2-2 MR382-1-1
Environmental Rating	-10° to +65° C, 0-85% RH	-5° to +55° C, 0-95% RH
Classification	Controller shall be installed in non-hazardous locations only	
ATEX	Optical sources which meet the Class I limits are considered suitable for use in locations with an EPL of Mb, Gb, Gc, Db or Dc as per Clause 1(3) of IEC 60079-28:2015 Ed 2. Consult IECEx Test Report (ExTR) GB/CML/ExTR 16.0105/00	
IECEx	Optical sources which meet the Class I limits are considered suitable for use in locations with an EPL of Mb, Gb, Gc, Db or Dc as per Clause 1(3) of IEC 60079-28:2015 Ed 2. Consult IECEx Test Report (ExTR) GB/CML/ExTR 16.0105/00	
NEC	Exempt	
Product Markings	Product does not have room for special markings	For Installation in non-hazardous location only -5° C ≤ Ta d +55°

Parameters	Sensor Models
	All Sensor Products In These Series MR381, MR382, Mr383, MR384, MR385, MR386, MR387
Environmental Rating	-40° to +65° C, 0-95% RH
Classification	Sensor can be installed and operated in hazardous locations with an EPL of Mb, Gb, Gc, Db, Dc (or equivalent) – mines, gaseous, and dust

ATEX	Suitable for installation and use in locations with a required EPL of Mb, Gb, Gc, Db or Dc as long as the sensor is used with the MR380 Controller (source) Consult IECEx Test Report (ExTR) GB/CML/ExTR 16.0105/00
IECEx	Suitable for installation and use in locations with a required EPL of Mb, Gb, Gc, Db or Dc as long as the sensor is used with the MR380 Controller (source) Consult IECEx Test Report (ExTR) GB/CML/ExTR 16.0105/00
NEC	Exempt
Product Markings	Simple Mechanical Device

Certification Management Ltd (CML, a Notified Body) evaluated the MR380 Fiber Optic Signaling Sensor system and verified that the MR380 Controller (as a source of optical radiation) is a Class 1 optical source and not considered a source of ignition per Section 1 (3) of IEC 60079-28 Ed.2. The MR380 sensors and controllers are suitable for use in EPL Mb/Gb/Gc/Db/Dc applications.

The following table summarizes results of source failure mode assessment tests performed on the optical driver to determine the maximum power output. The measured peak power is then compared to the safe optical power limits for various EPL applications. In all cases, the maximum output of the Controller falls within all EPL limits.

Ex Parameters	Controller Model		
	MR380-0-1 MR380-0-1E	MR380-1-1 MR382-1-1	MR380-1-2 MR380-2-2
Wavelength/Source Type	850 nm Pulsed (VCSEL)	850 nm CW (VCSEL)	1310nm CW (LED)
Maximum Peak Power	Ppeak=14.5 mW Pulse Width=1 µs E=3.25 nJ	Ppeak=11 mW Pulse Width=1 µs E=1.64 nJ	Ppeak=0.966 mW
EPL Ma/Mb Limit	150mW (Per Clause 6.6.2 of IEC 60079-0 and Table 2 of IEC 60079-28)		
EPL Da/Db/Dc Limit	35mW (Per Clause 6.6.2 of IEC 60079-0 and Table 3 of IEC 60079-28)		
Safe Optical Power Limit For All Atmospheres	Pmax=15mW or Emax=17µJ (Per Table 2 of IEC 60079-28)		

2.4 ATEX Directive

Reference:

1. ATEX Directive 2014/34/EU, *Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres*.
2. IECEx Test Report GB/CML/ExTR 16.0105/00 (CML Report R1198C/00), *Evaluation of MR380 Series Controller and Sensors*, August 2016. NOTE: Contact Micronor for copy of full IECEx test report, Micronor document 98-0330-22. . NOTE: Contact Micronor for copy of full IECEx test report, Micronor document 98-0380-16.

Summary:

Per the IECEx Test Report, the MR380 signaling sensor system has been evaluated and verified that the MR380 Controller (as a source of optical radiation, categorized Class 1) is not considered to have an independent source of ignition per Section 1 (3) of IEC 60079-28. The MR380 encoder and controller system are suitable for safe use in EPL Mb/Gb/Gc/Db/Dc applications without further consideration.

Analysis:
Per Directive 2014/34/EU Article 1 Section 4, the MR380 series Sensors are exempt as follows: "..equipment and protective systems where the explosion hazard results exclusively from the presence of explosive substances or unstable chemical substances". The Sensors are entirely mechanical, non-electrical, passive optical devices which do not represent an explosive hazard by themselves.

As the source of optical radiation for the sensor system, the MR380 Controller would be subject to IEC 60079-28 which defines optical radiation requirements for explosive atmospheres. However, Class 1 Laser and LED devices are categorically exempted from the standard per Section 1 (3) and suitable for safe use in EPL Mb, Gb, Gc, Db, and Dc applications without further consideration.

The Controller shall be considered a "component", integrated with the user's control system and shall be installed in a non-hazardous area. The Controller may be mounted inside a suitably-certified enclosure (such as an explosion proof enclosure, flameproof enclosure or in a purged/pressurized system) if required by the application. The user is responsible for any additional system design, installation and certifications for the overall assembly.

The Sensor and Controller shall be considered a "system", as neither provides an autonomous function. The Ex certification of a complete sensor system, including all cabling and installation, is the responsibility of the system integrator.

2.5 Functional Safety (MR387 E-Stop System Only)

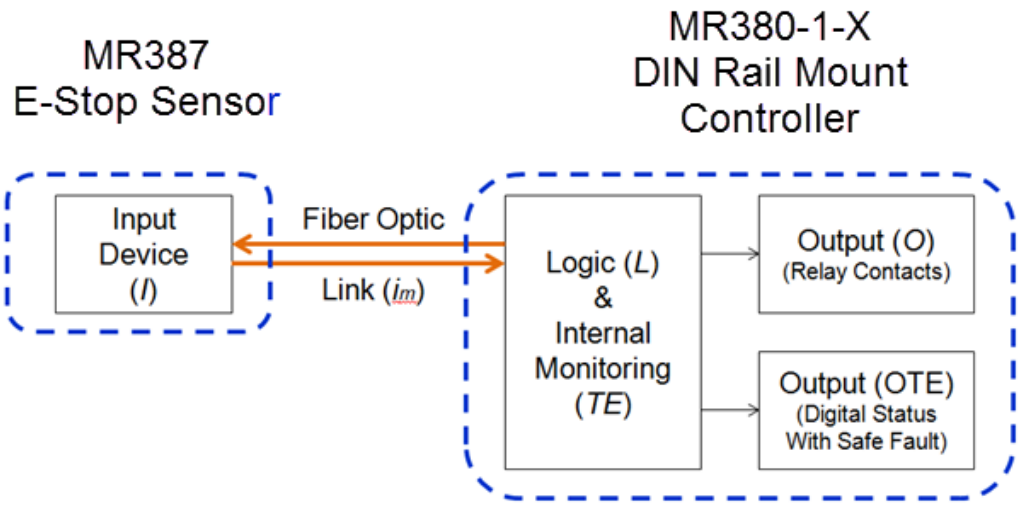
References:
1. ISO 13849-1, *Safety of machinery — Safety-related parts of control systems - Part 1: General principles for design*, Edition 2006 + Techical Corrigendum 1, February 2009
2. ISO/TR 13849-100, Technical Report, *Safety of machinery — Safety-related parts of control systems - Part 100: Guidelines for the use and application of ISO 13849-1*, First Edition, September 2000
3. MIL-HDBK-217, *Military Handbook, Reliability Prediction of Electronic Equipment*, Revision F + Notice 1 + Notice 2, February 1995
4. VITA 51.0, *Reliability Prediction*, June 2012
5. VITA 51.1, *Reliability Prediction - MIL-HDBK-*217 Subsidiary Specification, June 2008
6. Micronor, *MR380 Bill Of Materials Spreadsheet*, Revision B, September- 2013
7. Micronor, MR380_RevB.pdf, Schematic of MR380 Electronics Board
8. Micronor, x2_Reliability_FIT_MR380_12_22_14_.xlsx, Reliability table of MR380 system components

Summary:
This section applies only to the MR387 E-Stop System which consist of the MR387 E-Stop sensor and MR380-1-X Multimode Controller.

The following table summarizes the Functional Safety attributes of the Fiber Optic E-STOP system:

Functional Safety Parameters	System Configuration (MR387 Sensor + MR380-1-X Multimode Controller)
Category	Category 2 per ISO 13849-1
MTTF (for System)	35.4 years, 3.10 E+05 hrs
MTTFd (for System)	70.8 years, 6.20 E+05 hrs
Safety Integrity Level (SIL)	SIL=1
Performance Level (PL)	PL=c
Safe Failure Fraction (SFF)	SFF=97.85%
Diagnostic Coverage (DC)	DC=75.76%

Analysis:
Per ISO 13849-1, the MR387 Fiber Optic E-STOP System is classified as a Category 2 component per the block diagram below. The digital outputs (OTE) provide a separate means for the User's Machinery to monitor the state of the E-STOP system independent of the relay contacts (O). In event of a system fault such as a broken fiber optic link, the outputs (O and OTE) default to Safe Fault (Emergency ON).



ISO 13849-1 requires a reliability assessment of MTTFd which is then used in the determination of PL and SIL values. The method used is the Parts Count method per MIL-HDBK-217 Notice 2 supplemented by updates provided by VITA 51.0/51.1. For the optical sources used in the controller, we used MTTF data provided by the device manufacturers. Standard component failure factors from MIL-HDBK-217 Notice 2 were supplemented by: (1) updated reliability factors provided by VITA and (2) failure rate data provided by the optical source manufacturers. This resultant MTTF failure rate is provided in the summary table.

For determination of MTTFd, Annex C of ISO 13849-1 provides guidance that typically only 50% of failures lead to a dangerous failure. Therefore MTTFd is calculated to be twice the MTTF value.

MTTFd is then used to determine PL and SIL classifications per Table 1 of TR-62061. These values are provided in the summary table at the beginning of this section.

Next careful analysis was conducted on all components of the system. Each component was designated one of the following categories: safe detected, safe undetected, dangerous detected, and dangerous undetected. Each component is analyzed individually as the only failing component in the system.

The MR387 E-STOP system is designed to actively keep the relay contacts polarized in a known state. If the system were to lose power the relay will switch to a safe state, along with the normally high digital outputs. If either the relay or digital signals contradict each other the system is known to have failed in some capacity.

The MR387 E-STOP sensor has the capacity of a dangerous failure in the form of an unlatching push button. Upon user depression of the button, the switch the switch should latch itself into a safe state. If the switch does not latch the system is in a dangerous failure state. The immediate feedback of a non-depressed switch provides a means of detecting a failure.

The dangerous failures exist only with components dealing with the signaling of the state the relay is in. The digital output signals and the relay contacts are the most critical reliability points in the system along with the switch. If the relay contacts were to fail to switch polarity there would be no immediate feedback other than comparing them to the state of the digital outputs; this would be considered a dangerous undetected failure.

Using the same component failure rates used for MTTF calculation, the Safe Failure Fraction (SFF) and Diagnostic Coverage (DC) of the MR387 ESTOP system can be determined. Tabulating the values and calculating the proportions from the Micronor MR380 components spreadsheet, the SFF and DC parameters were calculated.

2.6 Electromagnetic Compatibility

References:

1 FCC, *Code of Federal Regulations (CFR), Title 47-Telecommunication, Chapter 1-Federal Communications Commission, Subchapter A-General, Part 15-Radio Frequency Devices*, As of 27-September-2013

2 EMC Directive, *Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility*, 2014.

3 IEC 61000-6-2, *Electromagnetic compatibility (EMC), Part 6-2: General standards - Immunity for industrial environments, Edition 2.0, January 2005.*

4 IEC 61000-6-4, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments*, *Edition 2.0, July 2006*

5 Micronor 98-0380-06, *EMC Test Report for MR380-1*, Compatible Electonics Inc., Report A31120I1, Revision A, December 2013

Summary:

The MR380 series is designed for use in Industrial Environments. EMC verification testing were performed on a MR380-1 DIN Rail Mount Controller at an outside test lab. The MR380-1, MR380-2 and MR382-1 Controllers are considered similar in design.

The MR380-0-1 OEM Controller is considered exempt since it is classified as a "component."

The MR380 Sensors are not subject to EMC testing since they are passive devices

FCC Section 15.103b specifically exempts digital devices used exclusively in an electronics control system in an industrial plant.

EMC Directive Parameters	Product Models		
	MR380-0-1 MR380-0-1E	MR380-1-1 MR380-1-2 MR380-2-2 MR382-1-1	All MR380 Sensors
USA FCC Part 15	Exempt	Exempt	Exempt
European Union EMC 2004/108/EC	Exempt	Immunity: IEC 61000-6-2 Emissions: IEC 61000-6-4	Not applicable since passive device

Analysis:

EMC verification testing was performed on a MR380-1-X series DIN Rail Mount Controller.

2.6 Low Voltage Directive

References:

1. Low Voltage Directive, *Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to making available on the market of electrical equipment designed for use within certain voltage limits, 2014*
2. IEC 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements, Edition 3.0 + corrigendum 1 + 2, October 2013.*

Summary:

Low Voltage Directive Parameters	Product Models	
	All MR380 Controllers	All MR380 Sensors
Low Voltage Directive	Exempt	
Electrical Safety	Applicable sections of IEC 61010-1	Not applicable since passive device

Analysis:
Per Article 1 of the Low Voltage Directive, "This Directive shall apply to electrical equipment designed for use with a voltage rating of between 50 and 1,000 V for alternating current and between 75 and 1,500V for direct current, other than the equipment and phenomena listed in Annex II." .

The MR380 Controllers are exempt from the Low Voltage Directive because:

- Maximum operating voltage is 24V DC
- The MR380-1-X DIN Rail Mount Controllers incorporate a relay whose contacts are specified for use up to maximum 75 VAC and 50 VDC
- Product is not covered by the equipment list in Annex II

General electrical safety principles and design assessment were carried out per IEC 61010-1.

The MR380 Sensors are non-electrical, passive devices and exempt from the Low Voltage Directive.

2.7 Control of Production

References:
1. EC, *Directive 2006/42/EC Of The European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC*, 2006 + Corrigendum, March 2007

Summary:
In addition to the technical requirements covered in this document, the fixing of the European Commission CE mark also requires all products are produced in a controlled and reproducible manner. In satisfaction of this requirement, the MR380 series products are governed by a controlled set of bill of materials as well as documented assembly and test procedures.

Analysis:
No further analysis required.

2.8 CE Mark

References:
1 European Union, *Directive 2006/42/EC Of The European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC*, 2006 + Corrigendum, March 2007

Summary and Analysis:
All applicable EC directives were reviewed and product compliance verified.

3. Product Markings

The following are samples of product labels incorporating CE mark and all other applicable markings, class designations and warnings/cautions as described in Section 2.

3.1 MR380 Series Sensor

Depending on space available on the product, MR380 series Sensors may be labeled similar to example shown below.

CE MR387-2-05
E-STOP Switch

Simple Mechanical Device

3.2 MR380 Series OEM Controllers

MR380-0-1 Interface 850nm OEM

MICRONOR INC
Camarillo, CA 93012

www.micronor.com
805 389 6600
Made in USA

Class I Laser

3.2 MR380 Series OEM Controllers

MR380-1 Fiber Optic E-STOP Controller

Terminal	Description	*For Typical Emergency Stop Operation Connect to Terminals 5 & 6 or 8 & 9*		
1	+24VDC Power Supply	STATE TABLE		
2	Ground Input	Module Powered		Module Not Powered
		Switch ON	Switch OFF	Switch ON/OFF
3	Digital 24V Normally High	LOW	HIGH	-
4	Digital 5V Normally High	LOW	HIGH	-
5	Normally Closed Relay Contact 2	OPEN	CLOSED	OPEN
6	Common Relay Contact 2	-	-	-
7	Normally Open Relay Contact 2	CLOSED	OPEN	CLOSED
8	Normally Closed Relay Contact 1	OPEN	CLOSED	OPEN
9	Common Relay Contact 1	-	-	-
10	Normally Open Relay Contact 1	CLOSED	OPEN	CLOSED

micronor

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MADE IN USA

Product conforms to 21 CFR 1040 and IEC 60825-1:2004 at date of manufacture:

CLASS 1
LASER PRODUCT
INVISIBLE LASER RADIATION

For installation in non-hazardous locations only
-5°C≤Ta≤+55°C

4. User Obligations

- Do not look into the optical port of the Controller or any optical connectors with the aid of any optical magnification device.
- Always clean optical connections before reconnecting
- Power supply to MR380 Controller shall be limited to 200 mA

###

APPENDIX A: Terms and Acronyms

ATEX	Atmosphères Explosibles (Explosive Atmosphere). By ratifying the guideline 94/9/EC on 23 March 1994 the European Parliament and the Council of the European Union started to harmonize the different national legislative provisions for the operation in areas with potentially explosive atmospheres. As an acronym, ATEX generally refers to the equipment regulations and standards established by EU directive 94/9/EC.
Dangerous Detected	Failure that is dangerous but is detected by internal diagnostics which go to the predefined alarm state. This failure rate is expressed as λ_{dd}
Dangerous Failure	A failure of a system component that leads to catastrophic failure into a dangerous state. If the relay contacts do not change polarity when critical component fails, then the state or failure is considered dangerous.
Dangerous Undetected	Failure that is dangerous and that is not being diagnosed by internal diagnostics. This failure rate is expressed as λ_{du}
DC	Diagnostic Coverage (DC) is used to characterize the effectiveness of diagnostic testing. $DC = \Sigma\lambda_{dd} / (\Sigma\lambda_{dd} + \Sigma\lambda_{du})$
EN	European Norm. European standards maintained by CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization) and ETSI (European Telecommunications Standards Institute):
FCC	Federal Communications Commission (U.S. Government)
FDA	Food and Drug Administration (U.S. Government)
IEC	International Electrotechnical Commission. IEC is the international standards commission that prepares and publishes all standards for electrical, electronic and related technologies. The worldwide organization promotes international unification of standards or norms. Its formal decisions on technical matters express, as nearly as possible, an international consensus. www.iec.ch
Inherently Safe Optical Radiation	Visible or infrared radiation that is incapable of producing sufficient energy under normal or specified fault conditions to ignite a specific hazardous atmospheric mixture. In this document, the term "intrinsically safe" is preferentially used because the industrial community is more familiar with this terminology and less familiar with the new terminology developed with the very recent release (August 2006) of IEC 60079-28 Edition 1.0.
Intrinsically Safe	According to IEC 60079-28, the term "intrinsically safe" now specifically applies to electrical circuits while "inherently safe" applies to optical radiation. The terms are used interchangeably in this document due to the user's greater familiarity with "intrinsically safe"
ISO	International Organization for Standardization. ISO is the world's largest developer of voluntary International Standards. www.iso.org
LED	Light Emitting Diode. A device used in a transmitter to convert information from electrical to optical form. It typically has a large spectral width. A semiconductor device that emits light when forward biased.
MTTF	Mean Time To Failure. Expectation of the mean time to failure.
MTTFd	Mean Time To Dangerous Failure. Expectation of the mean time to dangerous failure.
PL	Performance Level (PL) describe the targeted level of safety performance for a given system. Standard ISO/EN 13849-1 defines five PL levels a-e.

Safe Detected	Failure that deviates the output toward the safe state failure but is detected by internal diagnostics which cause the output signal to go to the predefined alarm state. This failure rate is expressed as $»_{sd}$
Safe State Failure	A failure of a system component that leads to the triggering into a safe sate. A safe state would be considered any situation where the relay contacts switch polarity from the normally functioning state.
Safe Undetected	Failure that deviates the output toward the safe state failure but is undetected by internal diagnostics. This failure rate is expressed as $»_{su}$
SFF	Safe Failure Fraction (SFF) is the probability of the system failing in a safe state. The dangerous (or critical) states are identified from a Failure Mode and Effects Analysis (FMEA). $SFF = (1 - »_{du}) / »_{total}$ where $»_{total} = »_{du} + »_{dd} + »_{su} + »_{sd}$
SIL	Safety Integrity Level (SIL) is a relative level of risk-reduction provided by a safety function, or to specify a target level of risk reduction. Standard IEC 61508 defines four levels SIL 1-4.
Simple Apparatus	As defined in the EC ATEX Guidelines, simple apparatuses (exclusions to the Directive) are "equipment and protective systems where the explosion hazard results exclusively from the presence of explosive substances or unstable chemical substances." In other words, under intended use and fault condition, the equipment have no known effective source of ignition.
SOP	Safe Optical Power. The SOP levels for various apparatus groups/temperature class combinations are provided in Table 2 of IEC 60079-28. By design, the MR310 CW optical output never exceeds the worst case SOP level.
VCSEL	Vertical-Cavity Surface-Emitting Laser. A type of semiconductor laser with laser beam emission perpendicular to the chip surface, contrary to conventional edge-emitting semiconductor lasers (also in-plane lasers) where laser light is emitted at one or two edges.

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