micronor

Declaration of Conformity (EU)

We, the manufacturer,

Micronor Inc.
900 Calle Plano, Suite K, Camarillo, CA 93012, USA
Telephone +1-805-389-6600, Fax +1-805-389-6605, Email sales@micronor.com

declare under the DoC is issued under our sole responsibility and belongs to the following products:

- Fiber optic absolute encoder system, consisting of:
- MR430-1, Controller
- MR431-A06, Sensor
- MR439-PXX, Cables

That the equipment is in conformity with the following relevant European Union harmonization legislation:

- Equipment for Potentially Explosive Atmospheres Directive (ATEX), 2014/34/EU
- Electromagnetic Compatibility Directive (EMC), 2014/30/EU
- Low Voltage Directive (LVD) 2014/35/EU

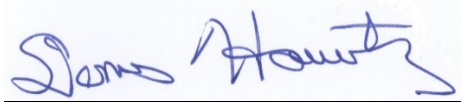
to which this declaration relates in conformity with the following standards or other normative documents (latest version of EN or corresponding IEC document used):

- EN 60079-0:2018
- EN 60079-14:2014
- EN 60079-28:2015
- EN 60825-1:2014
- EN 61010-1:2010
- EN 61000-6-2:2005+AC:2005
- EN 61000-6-4:2007+A1:2011

Certification Agency

- Certification Management Ltd, EU Notifying Body 2503, IEC Ex Certification Body
- CML Evaluation Report R12019A/00, GB/CML/ExTR 18.0240/00

Signed for and on behalf of:



Camarillo, CA 2018-12-28 Dennis Horwitz, Product Manager

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Declaration of Conformity (IECEx and North America)

We, the manufacturer,

Micronor Inc.
900 Calle Plano, Suite K, Camarillo, CA 93012, USA
Telephone +1-805-389-6600, Fax +1-805-389-6605, Email sales@micronor.com

declare under the DoC is issued under our sole responsibility and belongs to the following products:

- Fiber optic absolute encoder system, consisting of:
- MR430-1, Controller
- MR431-A06, Sensor
- MR439-PXX, Cables

That the equipment is in conformity with the following International (IEC) and North American requirements:

- Explosive Atmospheres/Hazardous Locations, IEC Ex
- Electromagnetic Compatibility for Industrial Environments, IEC and FCC
- Electrical Safety, IEC and FDA/NEC

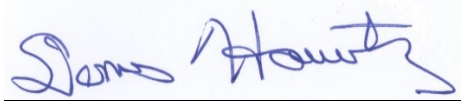
to which this declaration relates in conformity with the following standards or other normative documents:

- IEC 60079-0:2017, Edition 7.0
- IEC 60079-14:2013, Edition 5.0
- IEC 60079-28:2015: Edition 2.0
- IEC 60825-1: 2014, Edition 3.0
- IEC 61010-1:2010. Edition 3.0
- IEC 61000-6-2:2005, Edition 2.0
- IEC 61000-6-4:2006, Edition 2.0 +AMD1:2010 +ISH1:2011
- US CFR, FDA, Title 21, Chapter 1, Subchapter J, Parts 1000-1050
- US CFR, FCC, Title 47, Chapter 1, Subchapter A, Part 15
- US NFPA 70, NEC, 2014

Certification Agency

- Certification Management Ltd, EU Notifying Body 2503, IEC Ex Certification Body
- CML Evaluation Report R12019A/00, GB/CML/ExTR 18.0240/00

Signed for and on behalf of:



Camarillo, CA 2018-12-28 Dennis Horwitz, Product Manager

Product Assessment Report

Product Description: MR430 series Fiber Optic Absolute Encoder system

Affected Products: The following is referred to as the **Controller** in this document:
MR430-1 DIN Rail Mount Controller

The following is referred to as the **Sensor** in this document:
MR431-A06 Size 11 Shafted Sensor

The following is referred to as the Cable Assembly in this document:
MR439-PXX M-POF Cable Assembly where XX is length in meters

Document: 98-0430-02
Revision: A
Dated: 28-December-2018
Number of Pages: 11

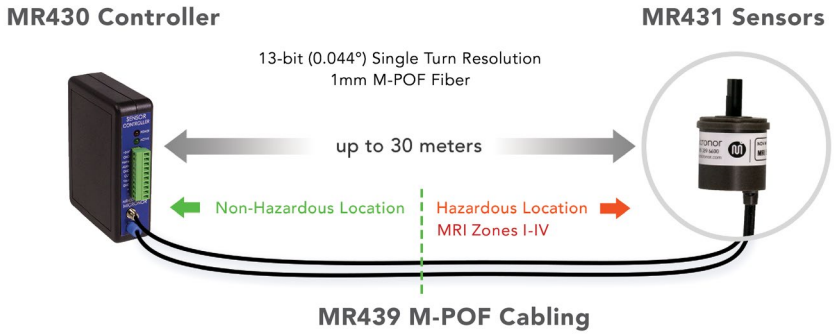
Revision History

Revision	Date	Description
A	12/28/2018	Original Release

Assessment Outline

1. Product Overview

The MR430 series Fiber Optic Absolute Encoder System consists of a non-electric, passive MR431 Sensor, MR439 M-POF Duplex Cable Assembly, and active MR430 Controller.



2. Risk Assessment By Category

This report constitutes a self-assessment executed by Micronor Inc. and is not a Certificate of Compliance.

2.1 LED 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. 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
3. Micronor 98-0430-51, *MR430 series LED Level Measurement*, Rev A, August 2018

Summary:

The MR430 fiber optic encoder system meets Class 1 LED 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 MR430 Controller, the LED safety class designation and product labeling requirements apply only to the MR430 Controllers as the "active" optoelectronic half of the MR430 system.

As an LED source, the MR430 Controller is exempt from annual FDA/CDRH registration and production reports.

Analysis:

The following table summarizes the evaluation results and applicable product markings for the MR430 Controller. As passive devices, the MR431 Sensors and MR439 Cable Assemblies do not require any LED safety markings.

Parameters	Controller Model MR430
Wavelength/Source Type	650 nm / LED NOTE: All power levels are measured directly at the fiber tip.
Maximum Pulse Energy in Normal Operation	E = 12.10 nJ (< 1.04% of AEL and MPE Limits)
IEC Class 1 Limit	Calculated from IEC 60825-1: AEL = 1.1736 µJ MPE (Eye) = 1.1614 µJ, MPE (Skin) = 1.924 mJ
IEC/CDRH Classification	Class I (Not Harmful)
Product Markings	Serial Number and Date of Manufacture No warning label required for Class 1 products

2.2 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 7.0, 2017
3. IEC 60079-14, *Explosive Atmospheres - Part 14: Electrical installations design, selection and erection*, Edition 5.0, 2013
4. IEC 60079-28, *Explosive Atmospheres - Part 28 : Protection of equipment and transmission systems using optical radiation*, Edition 2, 2015
5. IECEx Test Report GB/CML/ExTR 18.0240/00 (CML Report R12019A/00), *Evaluation of MR430 Series Controller and Sensors*, November 2018. NOTE: Contact Micronor for copy of full IECEx TR report, Micronor document 98-430--20
6. National Fire Protection Association, NFPA 70, *National Electric Code (NEC)*, 2014.
7. Micronor 98-0430-10, *MR430 series Inherent Safety Evaluation,* Rev B, October 2018

Summary:
Per IECEx Test Report, the MR430 sensor system is not considered an independent source of ignition as the optical radiation output of the MR430 Controller falls under the EPL Mb/Ga/Da safe optical radiation limits per IEC 60079-0, IEC 60079-14 and IEC 60079-28.

The following tables summarize assessments and applicable markings for the MR430 Controllers and Sensors:

Parameters	Ex Classification MR430 Controller
Environmental Rating	-5° to +55° C, 25-95% RH
Explosive Environments	Controller shall be installed in non-hazardous location only Controller is a source of inherently safe optical radiation for MR430 Sensor applications in Mines, Gas or Dust Atmospheres requiring EPL Mb, Gb, Gc, Db, or Dc. Consult IECEx Test Report (ExTR) GB/CML/ExTR 18.0240/00
ATEX	[EPL Mb, Gb, Gc, Db, Dc]
IECEx	[EPL Mb, Gb, Gc, Db, Dc]
North America	Controller shall be installed in non-hazardous location only
Product Markings	For installation in non-hazardous location only -5°C ≤ Ta ≤ +55°C

Parameters	Ex Classification MR430 series Sensors
Environmental Rating	-5° to +55° C, 0-95% RH
Explosive Environments	Sensor can be installed and operated in conjunction with MR430 Controller and Sensor Cabling in any Mine, Gas or Dust atmosphere with the following EPL, Zone, or Class/Division/Group classifications Consult IECEx Test Report (ExTR) GB/CML/ExTR 18.0240/00
Equipment Protection Levels	EPL Mb, Gb, Gc, Db, Dc
Zones	Zone 1, 2, 21, 22
Classes	Class I/II/III, Division 2
ATEX	EPL Mb, Gb, Gc, Db, Dc
IECEx	EPL Mb, Gb, Gc, Db, Dc
North America	Exempt, non-electrical
Product Markings	Simple Mechanical Device -5°C ≤ Ta ≤ +55°C

Parameters	Ex Classification MR439 series Sensor Cable Assemblies
Environmental Rating	-40° to +60° C, 0-95% RH
Explosive Environments	Sensor Cabling can be installed and operated in conjunction with MR430 Controller and Sensor in Mines, Gas or Dust atmospheres with the following EPL, Zone or Class/Dvisioin/Group classification Consult IECEx Test Report (ExTR) GB/CML/ExTR 18.0240/00
Equipment Protection Levels	EPL Mb, Gb, Gc, Db, Dc
Zones	Zone 1, 2, 21, 22
Classes	Class I/II/III, Division 2
ATEX	EPL Mb, Gb, Gc, Db, Dc
IECEx	EPL Mb, Gb, Gc, Db, Dc
North America	Exempt, non-electrical
Product Markings	Simple Mechanical Device -40°C ≤ Ta ≤ +60°C

Analysis:
Per Directive 2014/34/EU Article 1 Section 4, the MR430 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.

Certification Management Ltd (CML, a Certification Agency) evaluated the Micronor MR430 system and verified that the MR430 Controller (as source of optical radiation) is not considered a source of ignition per safe optical power limits and assessments using the following standards:

- IEC 60079-14, Clause 5.7.1
- IEC 60079-28, Clause 1 (3)
- Source driver fault analysis per IEC 60079-28, Clause 5.2.2.2

Optical power measurements and source driver fault analysis were performed and documented in Micronor test report 98-0430-10 in accordance with IEC 60825-1 and IEC 60079-14. Optical assessments performed per IEC 60825-1 establish that the MR430 Controller meets Class 1 requirements. IEC 60079-28 Clause 1 (3) specifically states that Class 1 devices are considered inherently safe, exempt from the scope of IEC 60079-28, and suitable for use in EPL Mb/Gb/Gc/Db/Dc applications without further testing.

The following table summarizes results of source failure mode assessment tests performed on the laser 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.

Parameters	Controller Model MR430-1
Wavelength/Source Type	650nm LED NOTE: All power levels are measured directly at the fiber tip.
Maximum Optical Power/Pulse Energy	P_{avg} = 0.546 mW (11.6 mW peak power for duration of 40 µs at rep rate of 1.17 kHz) E = 12.10 nJ
EPL Ma/Mb Limit	150 mW (Per Table 2 of IEC 60079-28)
EPL Ga/Da Limit	35 mW (Per Clause 5.7.1 of IEC 60079-14)
EPL Gb/Gc/Db/Dc Limit	35 mW (Per Table 3 of IEC 60079-28)
Safe Optical Power Limit For All Atmospheres	15 mW (Per Table 2 of IEC 60079-28)

2.4 Operating Guidance

Summary:
In normal operation, the MR430 series Sensor does not present a hazard when operated within the environmental specifications of a particular model. As a mechanical device operating in a hazardous location, the engineer should be conservative in his design and the operator follow his system's inspection and maintenance procedures. This section outlines potential mechanical failure modes of the Sensor and methods for their prevention.

Analysis:

MR430 Controller shall always be mounted in non-hazardous location or housed in a suitably-certified enclosure as part of a larger Ex assembly.

MR430 series Rotary Sensors can be mounted and operated in the specified hazardous and non-hazardous areas. As a mechanically rotating component, care must be taken to not overload the sleeve bearing design which can create excessive surface heat which could potentially ignite an explosive environment. The user shall be aware of these potential failure modes and recommended operation:

Potential Ignition Source			Measures applied to prevent the source becoming effective	Ignition protection used (To be determined by the integrator or user)
Normal Operation	Expected Malfunction	Rare Malfunction		
	Uneven wear in bearings can result in frictional heating or mechanical deformation		This is a generic discussion of bearing failure applicable to any and all equipment incorporating bearings. Summary: Bearing life can vary with application, environmental factors, RPM and shaft load conditions. For high reliability applications, it is conservatively recommended that the unit be replaced after 5 years of continuous operation.	EN 13463-1 (User Instructions) And EN-13463-5 (Constructional Safety "c")
		Bearing Failure can result in frictional heating or mechanical deformation	This is a generic discussion of bearing failure applicable to any and all equipment incorporating bearings. Summary: Generically, bearing failure usually occurs when excessive loads (combinations of radial, axial, RPM, temperature, shock, vibration, etc.) combine to cause premature bearing wear and excessive temperature rise approaching MIE. Any temperature can then be compared to normal bearing operation where the typical temperature rise is 10-50°F above	EN 13463-1 (User Instructions) and EN-13463-6 (Control of Ignition Sources "b", if monitoring is fitted)

			ambient depending on the operating conditions. Bearing failure is rarely a catastrophic event but a gradual deterioration. For a high reliability application, the user should consider implementing one or more of the following: 1. If motor overrun could occur, the user should consider the use of torque limiting safety couplings. 2. A temperature sensor could be placed on the encoder housing closest to the bearings to monitor surface temperature relative to MIE. 3. The encoder should be examined periodically for abnormally high surface temperatures or physical signs of abnormal noise or discoloration.	

2.5 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:

Applicable Directives	Product Models	
	MR430 Controller	All MR431 Sensors All MR439 Cable Assemblies
Low Voltage Directive	Exempt	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 MR430 Controllers are exempt from the Low Voltage Directive because:

- Maximum operating voltage is 28V DC
- 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 MR431 Sensors and MR439 Cable Assemblies are non-electrical, passive devices and exempt from the Low Voltage Directive.

2.6 Electromagnetic Compatibility (EMC)

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, *Part 6-2: Generic standards – Immunity standard for industrial environments*, Edition 2.0, January 2005
4. IEC 61000-6-4, *Part 6-4: Generic standards – Emission standard for industrial environments*, Edition 2.0:2006 + AMD1:2010 + ISH1:2011
5. Micronor 98-0430-20, *CE Test Report for Sensor Controller Model MR430-1*, Compatible Electronics Inc., Report A80725I1, July 2018

Summary:
The MR430 series is designed for use in Industrial Electromagnetic Environments. EMC verification testing was performed on a MR430-1 DIN Rail Mount Controller at an outside test lab.

MR430 Sensors and MR439 Cable Assemblies are not subject to EMC testing since they are non-electrical, passive devices and, therefore, exempt from the EMC Directive.

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

Applicable Directives	Product Models		
	MR430-1 Controller	MR430-1 Controller	MR439-PXX Cable Assembly
USA FCC Part 15	Exempt	Exempt	Exempt
EMC Directive	Generic Standards for Industrial Environments IEC 61000-6-2: Immunity IEC 61000-6-4: Emissions	Passed	Exempt

Analysis:
EMC verification testing was successfully performed on a MR430-1 DIN Rail Mount Controller.

2.7 Control of Production

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, Micronor maintains am ISO9001:2015 approved Quality System.

Analysis:
Micronor Quality Manual 94-QMS-001
No further analysis required.

2.8 CE Mark

Summary and Analysis:
The Sensor, Cable Assemblies and Controller meet applicable EC requirements and qualify for CE marking.

3. Product Markings

The following are samples of product labels in compliance with Section 2.

3.1 MR430-1 Controller

MR430-1 Fiber Optic Position Sensor Controller		
Terminal	**Function**	**Description**
1	Power Supply	+24V / 65mA Operating +18V to +28V
2	Power GND	
3	Home Input	+24V signal sets Home position
4	Auxiliary Input	Reserved for future use
5	GND	Signal is on pins 2,5,8
6	Digital Output	Setpoint Output. 5V logic
7	Voltage Output	Position Output Voltage (-10V to +10V)
8	GND	Signal is on pins 2,5,8
9	Current Output (+)	4-20mA isolated current output < 8V burden voltage
10	Current Output (-)	
micronor Camarillo, CA USA T +1 805 389 6600 F +1 805 389 6605 www.micronor.com MADE IN USA		CLASS 1 LED PRODUCT VISIBLE LED RADIATION *For installation in non-hazardous locations only* -5°C≤Ta≤+55°C

3.2 MR431-A06 Sensor

3.3 MR439-PXX Series Cable Assembly

Cable Assembly shown connected to Sensor
No label on cable

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 inspect optical connections before reconnecting. If dirty, then clean and inspect again before reconnecting.
- In hazardous environments, always operate the Sensors under conservative shaft and bearing loads.

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APPENDIX A: Terms and Acronyms

AEL	Admissable Emission Limit. The maximum accessible emission level permitted within a particular class. The AEL is determined as a product of the maximum permissible exposure (MPE) times an area factor called the limiting aperture (LA). The LA is dependent on laser wavelength pupil size. AEL=MPE * area of LA.
EN	European Norm. European standards maintained by CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization) and ETSI (European Telecommunications Standards Institute):
EPL	Equipment Protection Level. The level of protection assigned to equipment based on its risk of becoming a source of ignition, and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres which may exist in coal mines. Atmosphere prefixes: M=Mines, G=Gas, D=Dust. Levels of Protection suffix: a,b,c.
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.
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.
MPE	Maximum Permissible Exposure. This is the minimum irradiance or radiant exposure that may be incident upon the eye (or the skin) without causing biological damage.
MTBF	Mean Time Between Failures.
Simple Apparatus	As defined in the EC ATEX Guidelines, simple apparatus (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.

APPENDIX B Cross-Reference of EN versus IEC Standards

The following table provides cross-reference of EN versus IEC standards used in the Declaration of Conformity.

EN	IEC	Title
EN 60079-0:2018	IEC 60079-0:2017, Edition 7.0	Explosive atmospheres - Part 0: Equipment - General requirements
EN 60079-14:2014	IEC 60079-14:2013, Edition 5.0	Explosive atmospheres - Part 14: Electrical installations design, selection and erection
EN 60079-28:2015	IEC 60079-28:2015, Edition 2.0	Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation
EN 60825-1:2014	IEC 60825-1:2014, Edition 3.0	Safety of laser products - Part 1: Equipment classification and requirements
EN 61000-6-2:2005+AC:2005	IEC 61000-6-2:2005, Edition 2.0	Part 6-2: Generic standards-Immunity standard for industrial environments
EN 61000-6-4:2007+A1:2011	IEC 61000-6-4:2006, Edition 2.0+AMD1:2010+ISH1:2011	Part 6-4: Generic standards-Emission standard for industrial environments
EN 61010-1:2010	IEC 60825-1:2010, Edition 3.0	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements
EN 61326-1:2013	IEC 61326-1:2012 Edition 2.0	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

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