Declaration of Conformity

We

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

declare that the product

Fiber Optic Incremental Encoder System  Item Code(s)
Controller Module     MR302-1, MR302-2
Sensors      MR303, MR304

Country of Origin: Camarillo, CA USA

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

<table>
<thead>
<tr>
<th>Requirement</th>
<th>MR302 Controllers</th>
<th>MR30X Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Laser Safety</td>
<td>Class 1 laser device per IEC 60825</td>
<td>Exempt</td>
</tr>
<tr>
<td>2. ATEX Directive</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>3. Low Voltage Directive</td>
<td>Exempt</td>
<td>Exempt</td>
</tr>
<tr>
<td>4. EMC Directive</td>
<td>Exempt</td>
<td>Exempt</td>
</tr>
<tr>
<td>5. CE Mark</td>
<td>Applicable</td>
<td>Applicable</td>
</tr>
</tbody>
</table>

Place: Camarillo, CA, USA
Date of Issue: 5-December-2016

Dennis Horwitz
Micronor Inc.
Vice President, Sales and Marketing
dennis@micronor.com

Ref: N:\Declaration of Conformity\MR302 Controllers DOC\98-0302-12_A_MR302 Declaration of Conformity_Released_5-Dec-2016.docx
Product Assessment Report

Product Description: MR30X series Fiber Optic Incremental Encoder system

Affected Products: The following are referred to as the Controller in this document:
MR302-1 DIN Rail Mount Controller
MR302-1 OEM Controller

The following are referred to as the Sensor in this document:
MR303 series Linear Encoder
MR304 series Rotary Encoder

Document: 98-0302-12
Revision: A
Dated: 5-December-2016
Number of Pages: 16

Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Draft)</td>
<td>5-December-2016</td>
<td>Original release</td>
</tr>
</tbody>
</table>

Assessment Outline

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2. Risk Assessment by Category
   2.1. Laser Safety
   2.2. Explosive Atmospheres
   2.3. ATEX Directive
   2.4. Operating Guidance
   2.5. Low Voltage Directive
   2.6. EMC Directive
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   3.2. MR302-2 OEM Controller
   3.3. MR303 Linear Encoder
   3.4. MR304 Rotary Encoder
4. User Obligations

Appendix A. Bearing Life Analysis
Appendix B. Terms and Acronyms
1. **Product Overview**

The MR30X series Fiber Optic Incremental Encoder System consists of a non-electric, passive Sensor and active Controller which are connected via a duplex multimode fiber optic link:

2. **Risk Assessment By Category**

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

2.1 **Laser Safety**

**References:**
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

**Summary:**
The MR30X series encoder system meets Class 1 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 MR302 Controller, the laser safety class designation and product labeling requirements apply only to the MR302 Controller as the “active” optoelectronic half of the MR30X encoder system.

For FDA compliance, annual production reports for the MR302 Controller shall be filed and the product shall be marked with a serial number and date of manufacture (month/year).

**Analysis:**
For multi-wavelength systems, IEC 60825-2 Section D.4.1.1 describes how multi-wavelength systems are evaluated by summing the ratios of the powers ($\Sigma$Power/Limit) at each wavelength. If the ratio is less than 1, than the emissions are within Class 1 limits. For either Controller model, the results are $<< 1$ to confirm Class I classification.

The following table summarizes the evaluation results and applicable product markings for the MR302 Controller. As passive devices, the MR30X Sensors do not require any laser safety markings.
Parameters & Controller Models

<table>
<thead>
<tr>
<th>Parameters</th>
<th>MR302-1</th>
<th>MR302-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wavelength/Source Type</strong></td>
<td>850nm VCSEL</td>
<td>980nm / VCSEL</td>
</tr>
<tr>
<td><strong>Maximum Output Power in Normal Operation</strong></td>
<td>Output power measured using 62.5/125 MMF with NIST-traceable OPM, Property# TE-068</td>
<td>Output power measured using 62.5/125 MMF with NIST-traceable OPM, Property# TE-068</td>
</tr>
<tr>
<td>MR302-1</td>
<td>0.39mW (-4.1dBm)</td>
<td>0.33 mW (-4.9 dBm)</td>
</tr>
<tr>
<td>MR302-2</td>
<td>0.27mW (-5.7dBm)</td>
<td>0.47 mW (-3.28 dBm)</td>
</tr>
<tr>
<td><strong>IEC Class 1 Limit</strong></td>
<td>From IEC 60825-2, Table D.1: ( \frac{\text{Power}}{\text{Limit}} &lt; 1 )</td>
<td></td>
</tr>
<tr>
<td>MR302-1</td>
<td>( \frac{\text{Power}}{\text{Limit}} = 0.139 ), ( \text{Power} = 0.72mW )</td>
<td></td>
</tr>
<tr>
<td>MR302-2</td>
<td>( \frac{\text{Power}}{\text{Limit}} = 0.152 ), ( \text{Power} = 0.74mW )</td>
<td></td>
</tr>
<tr>
<td><strong>Classification</strong></td>
<td>Class I (Not Harmful)</td>
<td></td>
</tr>
<tr>
<td><strong>Product Markings</strong></td>
<td>FDA: Serial Number and Date of Manufacture</td>
<td></td>
</tr>
</tbody>
</table>

### 2.2 Explosive Atmospheres

**References:**


**Summary:**

Per IECEx Test Report, the MR302 Controller 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 with emissions (\( \text{Power} \)) below 15mW, as defined in IEC 60825-1, are suitable for use in EPL 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 MR30X Controller and Sensors:
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Ex Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex Classification (MR302)</td>
<td><strong>Controller</strong> shall be installed in non-hazardous location only</td>
</tr>
<tr>
<td>MR302 series Controllers</td>
<td><strong>Controller</strong> shall be installed in non-hazardous location only</td>
</tr>
<tr>
<td>Environmental Rating</td>
<td>-5° to +55° C, 0-95% RH</td>
</tr>
<tr>
<td>Classification</td>
<td><strong>Controller</strong> shall be installed in non-hazardous location only</td>
</tr>
<tr>
<td>ATEX</td>
<td>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.</td>
</tr>
<tr>
<td>IECEx Section 1 (3)</td>
<td>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</td>
</tr>
<tr>
<td>NEC</td>
<td>Exempt</td>
</tr>
<tr>
<td>Product Markings</td>
<td>For installation in non-hazardous location only</td>
</tr>
<tr>
<td></td>
<td>-5°C ≤ Ta ≤ +55°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Ex Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex Classification (MR30X)</td>
<td><strong>Controller</strong> shall be installed in non-hazardous location only</td>
</tr>
<tr>
<td>MR30X series Sensors</td>
<td><strong>Controller</strong> shall be installed in non-hazardous location only</td>
</tr>
<tr>
<td>Environmental Rating</td>
<td>MR303: -10°C to +60°C, 0-95% RH</td>
</tr>
<tr>
<td></td>
<td>MR304: -40°C to +80°C, 0-95% RH</td>
</tr>
<tr>
<td>Explosive Environments</td>
<td><strong>Sensor</strong> can be installed and operated in hazardous locations with an EPL of Mb, Gb, Gc, Db or Dc (or equivalent) - mines, gaseous and dust</td>
</tr>
<tr>
<td>ATEX</td>
<td>Considered 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 MR302 Controller (source)</td>
</tr>
<tr>
<td>IEC Ex</td>
<td>Considered 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 MR302 Controller (source)</td>
</tr>
<tr>
<td>NEC</td>
<td>Exempt</td>
</tr>
<tr>
<td>Product Markings</td>
<td>Simple Mechanical Device</td>
</tr>
<tr>
<td></td>
<td>For MR303, Add “-10°C ≤ Ta ≤ +60°C”</td>
</tr>
<tr>
<td></td>
<td>For MR304, Add “-40°C ≤ Ta ≤ +80°C”</td>
</tr>
</tbody>
</table>

**Analysis:**
The MR302 series Controllers (as source of optical radiation) are Class 1 laser sources with emissions below £ Power < 15mW and, therefore, not considered a source of ignition per Section 1 (3) of IEC 60079-28 Ed.2. The MR30X series encoder and controller system are suitable for use in EPL Mb/Gb/Gc/Db/Dc applications.

### 2.3 ATEX Directive

**Reference:**

**Summary:**
As Class 1 device, the MR302 Controller is not considered to have an independent source of ignition per Section 1 (3) of IEC 60079-28. The MR30X 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 MR30X 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 MR302 series Controllers are subject to IEC 60079-28 which defines optical radiation requirements for explosive atmospheres. However, Class 1 laser 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 motor drive, actuator or similar electromechanical motion system is the responsibility of the system integrator. Mechanical design, load analysis and establishment of system maintenance/inspection procedures are a critical part of any electromechanical or similar motion system design operating in a harsh or hazardous environment. All have a direct impact on Sensor/Encoder reliability. Section 4 (see Bearings) and the bearing life analysis of Appendix B highlight the mechanical design responsibilities of the user.

### 2.4 Operating Guidance

**Summary:**
In normal operation, the MR30X 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:**

MR302 Controller shall always be mounted in non-hazardous location or housed in a suitably-certified enclosure as part of a larger Ex assembly.

MR30X series Sensors can be mounted and operated in the specified hazardous and non-hazardous areas.

As the MR304 Encoder is a mechanically rotating component, care must be taken to not overload the bearings 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:

<table>
<thead>
<tr>
<th>Potential Ignition Source</th>
<th>Measures applied to prevent the source becoming effective</th>
<th>Ignition protection used (To be determined by the integrator or user)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Operation</td>
<td>Expected Malfunction</td>
<td>Rare Malfunction</td>
</tr>
<tr>
<td>Uneven wear in bearings can result in frictional heating or mechanical sparking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
conservatively recommended that the unit be replaced after 10 years of continuous operation.

| Bearing Failure or Loss of Lubrication can result in frictional heating or mechanical sparking | 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 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. | EN 13463-1 (User Instructions) and EN-13463-6 (Control of Ignition Sources “b”, if monitoring is fitted) |


<table>
<thead>
<tr>
<th>Applicable Directives</th>
<th>Product Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Voltage Directive</td>
<td>Exempt</td>
</tr>
</tbody>
</table>
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 MR302-1 and MR302-2 Controllers operate to 28V DC and 5.5V DC, respectively, and are not covered by equipment list in Annex II. Therefore, the Controllers are exempt.

The MR30X Sensors are non-electrical, passive devices and exempt from the Low Voltage Directive.

2.6 Electromagnetic Compatibility (EMC)

Summary:

<table>
<thead>
<tr>
<th>Applicable Directives</th>
<th>Product Models</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC Directive</td>
<td>MR302 Controller</td>
<td>Exempt</td>
</tr>
<tr>
<td></td>
<td>All MR30X Series Sensors</td>
<td>Exempt</td>
</tr>
</tbody>
</table>

Analysis:
The MR302 series Controller is a component and therefore exempt from the EMC Directive. The user shall follow appropriate grounding and shielding practices when integrating the OEM Controller into the manufacturer’s system.

MR30X Sensors are non-electrical, passive devices and, therefore, exempt from the EMC Directive.

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 a Quality System in which the MR30X series products are governed by a controlled set of bill of materials as well as documented assembly and test procedures.

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

2.8 CE Mark

Summary and Analysis:
The Sensor 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 MR302-1 Controller

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
<th>50mA typ.</th>
<th>18V – 24V Trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24VDC Power Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ground Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>External Input</td>
<td>18V – 24V</td>
<td>4-20mA</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Analog Signal Out Positive</td>
<td>Voltage</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Analog Signal Out Negative</td>
<td>Current 4-20mA</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Encoder A+</td>
<td>Configured for:</td>
<td>8V</td>
</tr>
<tr>
<td>8</td>
<td>Encoder A-</td>
<td>12V</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Encoder B+</td>
<td>24V</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Encoder B-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2 MR302-2 Controller

MR302-2 Encoder Interface

MICRONOR INC
900 Calle Plano, Ste K
Camarillo, CA 93012
www.micronor.com
805 389 6600
Made in USA
3.3 MR303 Sensor

MICRONOR
MR303-B400C10
Incremental

Fiber Multimode
62.5/125μm

3.3 MR304 Sensor

MR304-E03C1R5
SN: 2233
MR304 Incremental Encoder 512ppr
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
- In hazardous environments, always operate the Sensors under conservative mechanical bearing loads.
- Power supply to Controller shall be current limited to 200mA or less
APPENDIX A: Bearing Life Analysis

Reference:
ANSI/AFBMA Std 9-1990, Load Ratings and Fatigue Life for Ball Bearings

Background (excerpt from ANSI/AFBMA 9-1990):
Bearing life is defined as the length of time, or the number of revolutions, until a fatigue spall of a specific size develops. This life depends on many different factors such as loading, speed, lubrication, fitting, setting, operating temperature, contamination, maintenance, plus many other environmental factors. Due to all these factors, the life of an individual bearing is impossible to predict precisely.

ANSI/AFBMA Std 9-1990 provides a common industry basis for estimating bearing life. L10 life is the life that 90 percent of a group of apparently identical bearings will complete or exceed before a permanent deformation of 0.0001 of the rolling diameter. General industry experience shows that a permanent deformation of this size, at the center of the most heavily loaded ball/raceway contact, can be tolerated in most bearing applications without the subsequent bearing operation being impaired. The basic static load rating is, therefore, given a magnitude such that approximately this deformation occurs when the static equivalent load is equal to the load rating.

\[
L_{10} = \left( \frac{C_r}{P_r} \right)^3
\]

Where
\[
L_{10} = \text{Basic rating life, in million revolutions}
\]
\[
C_r = \text{Basic dynamic radial load rating, N (lbs)}
\]
\[
P_r = \text{Dynamic equivalent load rating, N (lbs)}
\]

For many applications, it may be desirable to calculate life for a different reliability and/or for special bearing properties and operating conditions which deviate from the conventional in such a way that it is justified to take their influence into special consideration. The adjusted rating life, Ln, i.e. the basic rating life adjusted for a reliability of (100-n)\% for special bearing properties and for specific operating conditions is given by:

\[
L_{na} = a_1a_2a_3L_{10}
\]

Where
\[
L_{na} = \text{Adjusted life, in million revolutions}
\]
\[
L_{10} = \text{Basic rating life, hr}
\]
\[
L_3 = 97\% \text{ reliability}
\]
\[
L_1 = 99\% \text{ reliability}
\]
\[
a_1 = \text{Life adjustment factor for bearing reliability}
\]
\[
\text{For calculating } L_3, a_1 = 0.44
\]
\[
\text{For calculating } L_1, a_1 = 0.21
\]
\[
a_2 = \text{Life adjustment factor for bearing materials and processing}
\]
\[
a_3 = \text{Life adjustment factor for bearing operating conditions}
\]
The model for calculating bearing load is as follows:

\[
\text{Load on Front Bearing (B)} = \frac{(\text{Shaft Load} \times (a + b))}{a}
\]

\[
\text{Load on Rear Bearing (A)} = \frac{(\text{Shaft Load} \times b)}{a}
\]

Reference data for bearings used on MR320 series Sensors:

<table>
<thead>
<tr>
<th>Encoder Model</th>
<th>Bearing Type</th>
<th>(C_r) (Static) N</th>
<th>(C_{or}) Dynamic N</th>
<th>Maximum RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR30</td>
<td>623-2Z</td>
<td>180 N</td>
<td>540 N</td>
<td>60,000</td>
</tr>
<tr>
<td></td>
<td>(Front and Rear)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum shaft load specifications for MR320 series Sensors:

<table>
<thead>
<tr>
<th>Sensor Model</th>
<th>Maximum Radial Shaft Load</th>
<th>Maximum Axial Shaft Load</th>
<th>Maximum Electrical RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR304</td>
<td>2 lbs.</td>
<td>1 lb.</td>
<td>10,000 RPM</td>
</tr>
</tbody>
</table>

Specifications subject to change without notice
Reliability Software Used

To calculate System MTBF (Mean Time Between Failures), Weibull reliability analysis was applied using **WEIBULL-DR Version 15** software (www.applicationsresearch.com). First, the **BEARING LIFE CALCULATIONS** function (see sample screen below) was used to calculate $L_{10}$ as well as the Weibull Characteristic Life – for each bearing. Next (for each bearing), the corresponding Weibull Characteristic Life with default Beta Shape Factor =2 is then transferred as a failure mode to the **ASSEMBLY RELIABILITY MODEL** function. With the two bearings (modes) entered, the software calculates both System MTTB and Weibull MTBF. Sample screens from the MR324 bearing analysis are shown below.

**BEARING LIFE CALCULATIONS**

![Sample Screen](image)

**MR304 Front and Rear Bearing Input**
MR304 MTBF Based On Weibull Multiple Mode Reliability Model

MR304 Sensor Bearing MTTF Analysis

Two different bearing life cycle analyses were performed. For long term reliability, we recommend an operating condition based on 10% of the maximum Axial and Radial Shaft Load Specification. For purposes of analysis, we use 1 lbf (50% of max) Radial and 0.5 lbf Axial (50% of max) Loading.

Analysis #1 at 1,000 RPM (Typical Application):
- Axial load = 0.5 lbf
- Radial load = 1 lbf centered over exposed shaft length
- **System MTBF is 1.15E+07 hours (equivalent to 1314.1 years)**

Analysis #2 at 10,000 RPM (Mechanical speed limit):
- Axial load = 0.05 lbf
- Radial load = 1.00 lbf centered over exposed shaft length
- **System MTBF is 1.15E+06 hours (equivalent to 131.4 years)**

###
### APPENDIX B: Terms and Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX</td>
<td>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.</td>
</tr>
<tr>
<td>EN</td>
<td>European Norm. European standards maintained by CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization) and ETSI (European Telecommunications Standards Institute);</td>
</tr>
<tr>
<td>EPL</td>
<td>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.</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission (U.S. Government)</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration (U.S. Government)</td>
</tr>
<tr>
<td>IEC</td>
<td>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. <a href="http://www.iec.ch">www.iec.ch</a></td>
</tr>
<tr>
<td>Inherently Safe Optical Radiation</td>
<td>Visible or infrared radiation that is incapable of producing sufficient energy under normal or specified fault conditions to ignite a specific hazardous atmospheric mixture.</td>
</tr>
<tr>
<td>Intrinsically Safe</td>
<td>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”.</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization. ISO is the world’s largest developer of voluntary International Standards. <a href="http://www.iso.org">www.iso.org</a></td>
</tr>
<tr>
<td>LED</td>
<td>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.</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures.</td>
</tr>
<tr>
<td>Simple Apparatus</td>
<td>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.</td>
</tr>
<tr>
<td>VCSEL</td>
<td>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.</td>
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</tbody>
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