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Corporation

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## BDI-FLX<sup>™</sup> 2W-IS BURST DISC SENSOR SYSTEM OPERATOR'S MANUAL

**IMPORTANT**

USER SHOULD READ CAREFULLY AND UNDERSTAND  
THIS MANUAL BEFORE INSTALLING, OPERATING OR  
TESTING THIS UNIT

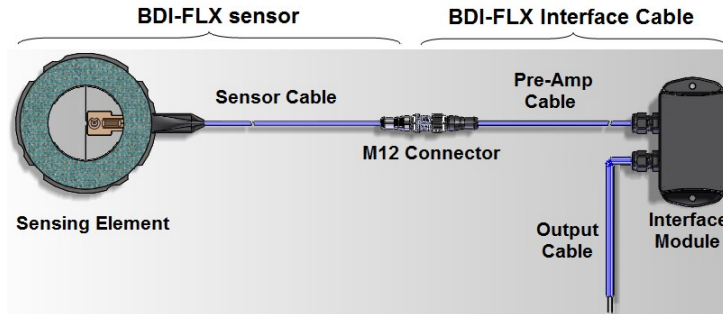
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## I. PRODUCT DESCRIPTION

**WARNING:** For full liquid applications: The BDI-FLX Sensor requires dynamic movement to signal. Slow reversal of the rupture disc, such as with liquid thermal expansion, will not cause the BDI-FLX Sensor to indicate. A small crack in a rupture disc score will not cause the BDI-FLX Sensor to indicate. Note that the BDI-FLX Sensor is designed to indicate within a few milliseconds, so full reversal and full opening of the rupture disc must occur within a few milliseconds. If full liquid flow at set pressure or a gas head will not be present during rupture of disc, contact CDC for evaluation.

The BDI-FLX™ Burst Disc Sensor Systems are designed to continuously monitor the status of rupture discs and output a switch signal to a system when such rupture discs have relieved an over-pressure condition. The system is comprised of two components: the BDI-FLX sensor and the BDI-FLX interface cable. The interface cable processes the sensor's signal and outputs a switch type signal.



The BDI-FLX Burst Disc Sensor Systems contain numerous advances in rupture disc burst monitoring and alarm switching technology. Designed to meet the needs of a variety of applications and diverse industries, the BDI-FLX product family includes three models:

- BDI-FLX 2W-IS for use in hazardous environments and intrinsically-safe applications
- BDI-FLX 2W-NIS for direct PLC or discrete input
- BDI-FLX 4W-NIS for use as dry contact switch that can be used a wide variety of power options and control/alarm inputs

This user manual provides detail specifications, electrical system requirements, wiring and operating instructions for model 2W-IS.

The BDI-FLX 2W-IS model is a 2-wire intrinsically safe device for use with a safety barrier (barrier not provided). It provides a digital switching signal over a single pair of wires. It is designed in compliance with ATEX and IECEx requirements for use in intrinsically safe applications as category 1 equipment for Group II and Group III, i.e., gas and dust areas when it is connected to a compatible intrinsically safe isolated repeater or barrier<sup>1</sup>.

The interface cable contains a built-in microprocessor that processes the sensor signal and produces a logic output, offering plant operators a reliable rupture disc status signal. The unit outputs a continuous current signal (4.5 mA typical) as disc in normal operation and requires maximum 0.85 mA leakage current flowing through the load which is in-series connected to the module when switching OFF.

The interface cable incorporates a “failsafe” design: should there be a disc burst or an interruption of the sensor signal or power line, the output of the interface module is always switched automatically to the safe “OFF” condition.

## SPECIFICATIONS

### Electrical Specifications

Power Supply:	6 ~12 VDC
Operating Temperature:	BDI-FLX Interface Cable -40°C to 70°C (-40°F to 158°F) BDI-FLX Sensor -40°C to 204°C (-40°F to 400°F)
Field sensor operating current:	15 µA
Output configuration:	ON: 4.5 mA typical (min: 2.5 mA; max: 4.85 mA) OFF: max: 850 µA; min: 75 µA
Power-up Time Delay:	62 ms
Polarity Protection:	Protected (up to 60 V)
Transient Over-voltage Protection:	Protected
Output Cable:	18 AWG, shielded twisted pair (STP) PVC tray cable (TC), CMG under UL-NEC
Approvals:	CE, ATEX, IECEx, UL/cUL
Marking Code:	ATEX (Directive 2014/34/EU):

#### **BDI-FLX Interface Cable:**

⊕ II 1 G Ex ia IIC T4 Ga  
II 1 D Ex ia IIIC T135°C Da IP67  
-40°C ≤ Ta ≤ +70°C

#### **BDI-FLX Sensor:**

⊕ II 1 G Ex ia IIC Tx Ga  
II 1 D Ex ia IIIC Tx Da  
-40°C ≤ Ta ≤ +204°C

IECEx (IEC Ex Scheme):

Ex ia IIC T4 Ga, Ex ia IIIC T135°C Da IP67

UL (cULus Hazloc):

Refer to UL C/US Intrinsic Safety Control Drawing GEP-6615

### **Mechanical Specifications**

Housing Material:	ABS
Housing Inflammability Class:	UL 94 V-0
Housing Dimensions:	3.1 x 2.1 x 1.1 in. / 79 x 54 x28 mm
Mounting:	Wall panel
Cable Gland Material:	Nylon
Output Cable OD:	5.8 mm
Degree of Protection:	IP67

## II. HANDLING AND UNPACKING

The personnel responsible for the assembly, operation, inspection and maintenance of the BDI-FLX Burst Disc Sensor System must be appropriately qualified.

The BDI-FLX Burst Disc Sensor System is a precision device. Always follow these guidelines when handling and unpacking the product to prevent damage:

- A. Use care when unpacking/handling the product.
- B. Inspect the package for damage or missing items upon delivery.
- C. Mark any damage or missing items and report it to Customer Service at Continental Disc Corporation.

**WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD!**

**When installed in hazardous locations, precautions must be taken to ensure electrostatic charging cannot occur. Prevent unintentional contact or clean with a dry cloth. Clean ONLY with a damp cloth. Do NOT use any solvent.**

**CAUTION: Always observe the applicable local standards, regulations and safety requirements. Failure to comply with required safety precautions may result in serious injury or damage to people/property/product and loss of all claims for damages.**

### III. STORAGE

The BDI-FLX interface cable is to remain packed in the box in which it is shipped until ready for installation. This unit should be stored in a cool dry atmosphere with ambient temperatures within

-40°C to 50°C  
(-40°F to 122°F).

### IV. INSTALLATION

**WARNING: These installation and servicing instructions are for use by qualified personnel only. To avoid injury and electrical shock, do not perform any servicing other than that contained in this manual. The installation and wiring of this unit should be performed in accordance with the latest edition of the governing Electrical Code.**

**WARNING: Disconnect power to the unit before wiring.**

**NOTE:** This section describes the procedures and requirements for connecting the BDI-FLX 2W-IS interface cable to the user's system. For installation of the BDI-FLX sensor please refer to "Preparation and Installation of the BDI-FLX Sensor and connection to the BDI-FLX Interface Cable Assembly" document provided with the BDI-FLX sensor.

1. The BDI-FLX Burst Disc Sensor System is not equivalent to a traditional mechanical switch. The user must read carefully the installation procedure for the selected model and verify that their system meets the required conditions for the specific unit.
2. The BDI-FLX 2W-IS System drops a certain amount of voltage in operation, typically about 5.5 V. This voltage drop determines how many volts the load (e.g., the safety barriers or control system digital input channel) can obtain from the supply voltage. If the supply voltage minus the voltage drop is not sufficient for load normal operation, the device will not turn ON. Check the receiving system manufacturer's specifications for the input ON voltage threshold.
3. The BDI-FLX 2W-IS System leaks a small amount of current through the loop when they output a switching "OFF" signal. This current value is typically 0.075 mA at normal environmental condition and will not be over 0.85 mA under specified operating conditions. The current flows through the load and produces a small voltage across the load. If this voltage is greater than the value that will allow it to turn 'OFF', the load will remain in the ON state although the sensor unit has switched OFF. Check the manufacturer specifications for the control input OFF voltage threshold.
4. The BDI-FLX 2W-IS System output is designed as Normally Closed (ON state). Each time the unit is powered up, the output stays OFF for about 62 ms (power-up time delay) then switches ON. This warm-up period allows the power line to stabilize. User should examine their receiving system power-up set time for logic adaptation.
5. The BDI-FLX Burst Disc Sensor System is designed for continuous monitoring of disc burst. When powering up on initial installation or upon restoring power from a lost power condition, the unit will reset itself automatically. When the BDI-FLX system trips an OFF signal as a result of a disc burst, the user should replace the rupture disc and BDI-FLX sensor. The user can reuse the interface cable. Re-powering the system without replacing the BDI-FLX sensor could result in a false normal (ON) signal.

**WARNING:** Installation of intrinsically safe equipment must be performed in accordance with the requirements of the government and other local authority having jurisdiction. System components and installation methods must be approved by the appropriate recognized approval authority.

Prior to installation, review the certification marking on the device label to confirm it is appropriately certified for your region, suits your site classification and complies with your hazardous area safety philosophy.

When the BDI-FLX 2W-IS Burst Disc Sensor System is used in an explosive area, it must be operated in conjunction with a safety barrier or isolator suitable for the hazardous area classification and substance group. The BDI-FLX 2W-IS System entity parameters must match in accordance with the safety barrier or isolator entity parameters. This is to insure safe operation within explosive environments.

**CAUTION:** Lead polarity must be observed when connecting the two wires to the barrier input channel.

### **Required System Conditions:**

#### Safety Entity Parameter Requirements:

1. 2W-IS maximum intrinsically safe input parameters:  
 $U_i = 12 \text{ V}$ ;  $I_i = 60 \text{ mA}$ ;  $P_i = 180 \text{ mW}$
2. 2W-IS equivalent internal parameters:  
 $C_i = 1.11 \mu\text{F}$ ;  $L_i = 0$

Associate IS Barrier entity parameters must meet the following requirements:

$$\begin{aligned} U_o &\leq 12 \text{ V} \\ I_o &\leq 60 \text{ mA} \\ P_o &\leq 180 \text{ mW} \\ C_o &\geq 1.11 + C_{\text{cable}} (\mu\text{F}) \\ L_o &\geq L_{\text{cable}} \end{aligned}$$

#### SPECIAL CONDITIONS FOR SAFE USE

When located in a Zone 0 hazardous area, the user shall ensure that electrostatic charging of the interface enclosure cannot occur.

When located in Zone 1 or Zone 2, the interface enclosure represents an electrostatic hazard and the enclosure shall only be cleaned using a damp cloth. Solvents shall not be used.

#### Operating Requirements:

1. Max. voltage drop across the barrier ( $V_{\text{drop}}$ ) with ON state current of 4.5 mA:  
 $V_{\text{drop}} \leq V_{\text{pw}} - 5.5\text{V}$  ( $V_{\text{pw}}$  is the in-series power supply voltage)
2. OFF state input signal current for the barrier ( $I_{\text{OFF}}$ )  
 $I_{\text{OFF}} \geq 0.85 \text{ mA}$
3. ON state input signal current for the barrier ( $I_{\text{ON}}$ )  
 $I_{\text{ON}} \leq 2.5 \text{ mA}$

NOTE: The BDI-FLX 2W-IS Burst Disc Sensor System intrinsically safe entity parameters should not be mixed with equipment functionality (operating) parameters. Those safety barriers that satisfy the entity parameter requirements do not guarantee proper functioning of the BDI-FLX System. Both requirements must be met for safe and proper operation.

Safety Barrier Selection Considerations:

The BDI-FLX 2W-IS Burst Disc Sensor System output is typically connected to the load through an intrinsically safe barrier or isolated repeater. Proper selection of the barriers or isolators is essential. The barrier input power and capacitance/inductance capacity must be within the BDI-FLX System permitted range.

The isolated repeater or barrier must keep a proper activation current and provide the BDI-FLX 2W-IS System with enough voltage for a reliable operation.

The BDI-FLX 2W-IS System output is compatible with NAMUR (IEC 60947-5-6) sensor current level. Most NAMUR sensor applicable intrinsically safe switching amplifiers are suitable and can be found in various safety barrier manufacturers catalogs.

NOTE: Certain shunt diode (Zener) barriers are designed for mechanical switch (dry contact) input applications. These are not recommended for use with the BDI-FLX 2W-IS System since these barriers typically provide highly restrictive voltage for the hazardous field devices. However, some Zener barriers can be utilized if both the parameter entity and the 2W-IS operating conditions are met. If utilizing Zener barriers, the user must verify the complete loop resistance including barrier end-to-end resistance and constant voltage drop.

For new installations the selection of an isolator is recommended. Isolated barriers can typically drive higher load resistance than a Zener barrier. Other advantages of isolators include isolation between input, output and power. Most isolators provide short circuit protection and regulated power to the field and no I.S. earth required, thus avoiding complex ground loop problems.

The following are recommended barriers that can be used with the BDI-FLX 2W-IS system:

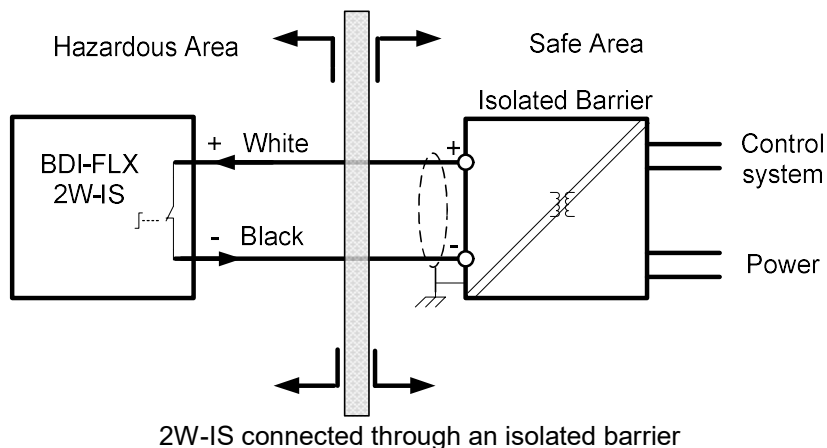
IS Isolators:

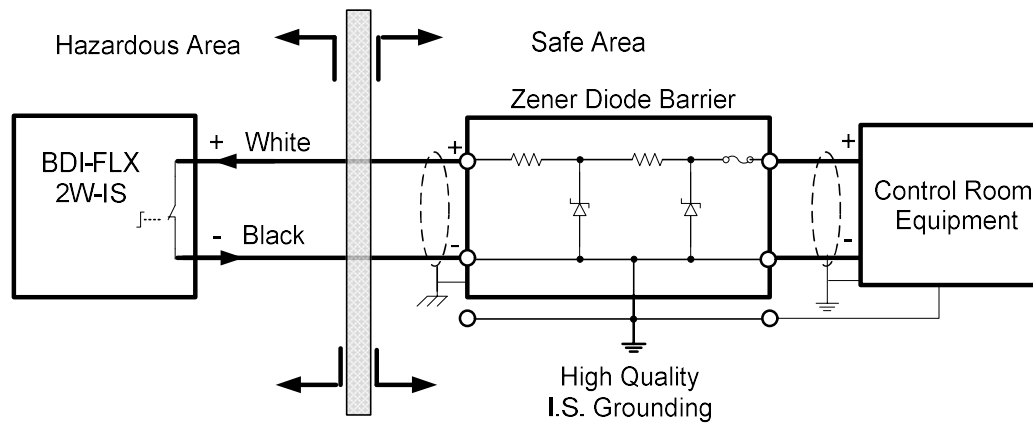
- MTL: MTL551x Series; MTL5018
- Pepperl+Fuchs: KCD2-SR-Ex1.LB
- R. STAHL: 9170/0-1x Series
- Weidmuller: ACT20X-HDI-SDO Series
- Phoenix: PI-EX-NAM Series

Zener barriers:

- MTL: MTL774x Series

Wiring Diagram:





2W-IS connected through a zener diode barrier

**Note:** The shield (drain wire) of the BDI-FLX System output cable should be grounded at the barrier site and the shield throughout the cable must be connected to ground at a single point.

The shield of shielded cable from barrier to control room should be grounded at the control panel site and NOT connected to the barrier site.

The Zener diode barrier safety ground requires the ground path must have less than 1  $\Omega$  of resistance from the barrier to the main earth ground electrode.

### **Installation:**

#### **1. Mount the BDI-FLX Interface Cable Enclosure**

Bolt the BDI-FLX interface cable enclosure to a wall or rack using mounting bracket hardware. Consider the distance and location for convenient sensor connection.

The enclosure can be installed in hazardous or non-hazardous environment. The interface cable must always be connected through a safety barrier located at the non-hazardous area for all intrinsically safe applications.

#### **2. Connect BDI-FLX Sensor to the BDI-FLX Interface Cable model 2W-IS**

Connect the BDI-FLX sensor pigtail to the BDI-FLX interface cable through the M12 connector. After insertion, fasten the M12 screw ring to lock the connection.

#### **3. Connect Output Cable**

Terminate the output cable wires according to the wiring diagram. The 2W-IS two wires must be routed into the appropriate barrier terminals (typically the discrete input channel).

Terminate all other correlated wires and ground properly before operation.

**CAUTION:** To properly maintain the intrinsic safety of the system and to ensure immunity of the system to external interference, appropriate shielded cable should be used. Individual runs should use a shielded twisted pair (STP) cable such as Belden #1032A or equivalent. Multiple runs from safety barrier to field junction box should use individual or overall shielded multiple twisted pairs cable such as Belden #9504, #9328 or equivalent. Remove a maximum 20 mm of insulation from wires prior to connecting.

#### **4. Final Check**

Check all wiring to ensure proper connections with no unwanted possible shorts, grounds, or open circuits.

#### **5. Energize Power to Unit**

With the disc, sensor system, safety barrier and output load installed and properly connected the unit can be powered and ready for operation.



## **V. MAINTENANCE**

The BDI-FLX interface cables have been designed to operate with little maintenance required. Periodic checks should be made to ensure the units are clean and free from contaminating, humid or hot atmospheres, and are in good physical and electrical condition.

Should the system fail to function properly, the user should check for the following items where applicable:

- A. You have the correct BDI-FLX sensor model for your application.
- B. All specified conditions of the connected system listed in Section V are met
- C. The unit is connected to the barrier or control input channel in the correct polarity
- D. There is no ground loop through the cable signal transmission
- E. The BDI-FLX sensor pigtail cable has been properly connected to the interface cable prior to powering the unit
- F. The power is on
- G. All wiring is connected properly per this instruction manual
- H. The connected barriers or input channels are working properly
- I. The user receiving system (PLC/DCS, etc.) is functioning properly
- J. There is no short or open circuit in the disc sensor, interface cable or connectors
- K. The disc and sensor are in good condition

Note: If the sensor has tripped an OFF signal due to disc burst or signal interruption, the system needs to be reset following instructions listed in Section V.

The BDI-FLX interface modules are designed with industrial category components and every effort has been made to make the unit as easily serviceable as possible. Should there be a problem before or during operation please contact Continental Disc Corporation Customer Service for assistance. Do not repair or modify the product without consultation of Continental Disc Corporation. Disassembly of the unit and/or replacement of components may lead to improper function of the system and safety hazards.

## **VI. LIMITED WARRANTY**

Products manufactured by Continental Disc Corporation have a warranty against defective workmanship and material for a period of one year after date of invoice. In no event shall Continental Disc Corporation's liability for damages with respect to any of the products furnished under this Agreement exceed the charges previously paid by the customer to Continental Disc Corporation for such products. Buyer's sole remedy for breach of this Agreement is repair or replacement of defective parts furnished by Continental Disc Corporation, which have been returned to Continental Disc Corporation's factory at purchaser's expense. It is expressly agreed between purchaser and Continental Disc Corporation that the remedy of repair and replacement is the exclusive and sole remedy of the purchaser.

## **VII. DISCLAIMER OF WARRANTIES**

Except as specifically provided in this Agreement, there are no warranties, expressed or implied, including, but not limited to any implied warranties of merchantability or fitness for a particular purpose.

## **VIII. DISCLAIMER OF CONSEQUENTIAL DAMAGES**

In no event shall Continental Disc Corporation be liable for consequential damages, including but not limited to damages for loss of use, damages for lost profits, and damages for resulting harm to property other than the Continental Disc Corporation assemblies and their component parts.

Customer acknowledges and understands that the provisions of these additional terms and conditions, including this paragraph concerning disclaimer of consequential damages and limitation or remedy, apply fully to the purchase of the products.

## **IX. WARRANTY EXCLUSIONS**

This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced, or removed.