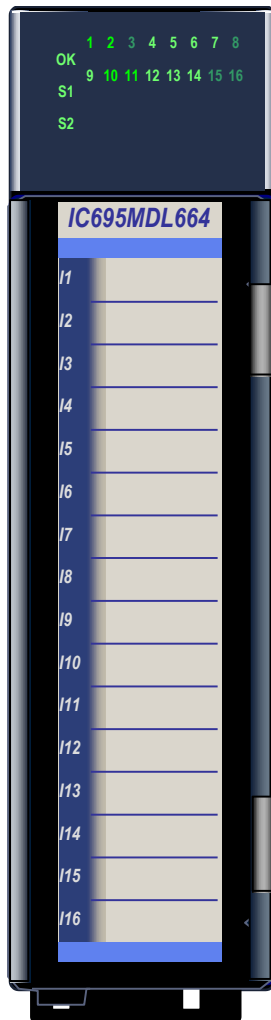


PACSystems* RX3i

IC695MDL664

GFK-2590
March 2011

Digital Input Module with Diagnostics – 16-Channel



The **Smart Digital Input** module, IC695MDL664 provides 16 positive logic input channels in two groups of eight. The module uses 24 VDC field input power.

Each group of eight inputs is referenced to an isolated common connection. This module can be used with either a Box-style (IC694TBB032) or Spring-style (IC694TBS032) front terminal block.

Input characteristics are compatible with a wide range of input devices, such as pushbuttons, limit switches, and electronic proximity switches. Current into an input point results in a logic 1 in the input status table (%I).

Power to operate field devices must be supplied by the user.

Sixteen dual LEDs indicate the ON/OFF/FAULT status of points 1 through 16. Two LEDs, S1 and S2 indicate whether field power is applied to each of the two input channel groups, and the status of the terminal block. The module also logs an *Addition of Terminal Block* or *Loss of Terminal Block* message to the I/O fault table to report the terminal block status. This module can be installed in any I/O slot in an RX3i system.

The blue bands on the label show that MDL664 is a low-voltage module.

Features of the Smart Digital input module include:

- Selectable Input Filter Time from 0.5 ms to 100 ms.
- Open wire / Short to DC- (with external sense resistor)
- Short to DC + (with external sense resistor and external pull-up resistor)
- Input Pulse Test

* Indicates a trademark of GE Intelligent Platforms, Inc. and/or its affiliates. All other trademarks are the property of their respective owners.

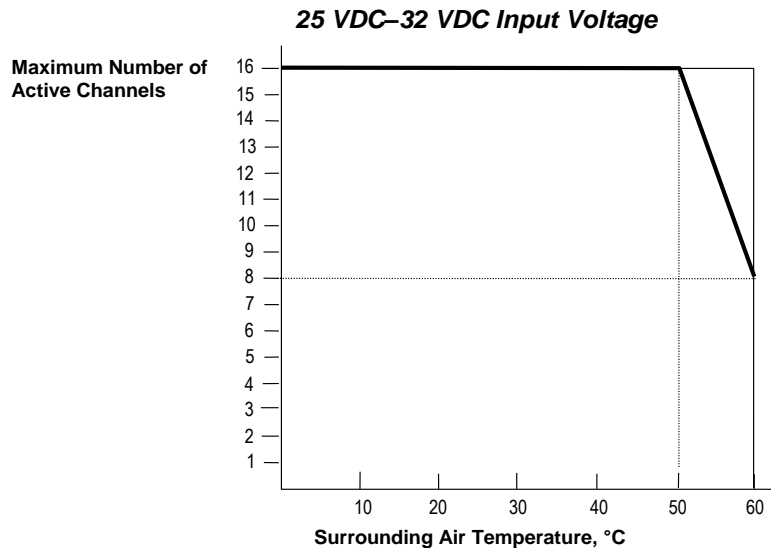
MDL664 Specifications

Inputs per Module	16 (two isolated groups of 8 inputs each)
Power Requirements	
Input Voltage (24V nominal), V_{IN}	18 VDC–32 VDC
Ripple Voltage, maximum	10% V_{pp}
Backplane Power Consumption +3.3VDC +5.1VDC	95 mA 225 mA (worst-case, i.e. with all channels on.)
Thermal derating	None required with input voltages in the 18 VDC–24 VDC range. For the 25 VDC–32 VDC range, see the “MDL664 Thermal Derating Curve.”
Input Characteristics	
DC Characteristics	
Input Resistance	1966 Ω
Input Capacitance	0.05 μ f
Input Current (at 24VDC)	12.2 mA
Input Voltage ON (Logic 1)	$0.5 \times V_{IN}$ VDC
Input Voltage OFF (Logic 0)	$0.3 \times V_{IN}$ VDC
AC Characteristics	
Turn On Delay, typical	20.6 ms
Turn Off Delay, typical	20.6 ms
Digital Input Filter Time	0.5–100 ms, 20 ms default
Isolation	
Field to Backplane	250 V_{AC}
Group to Group	250 V_{AC}

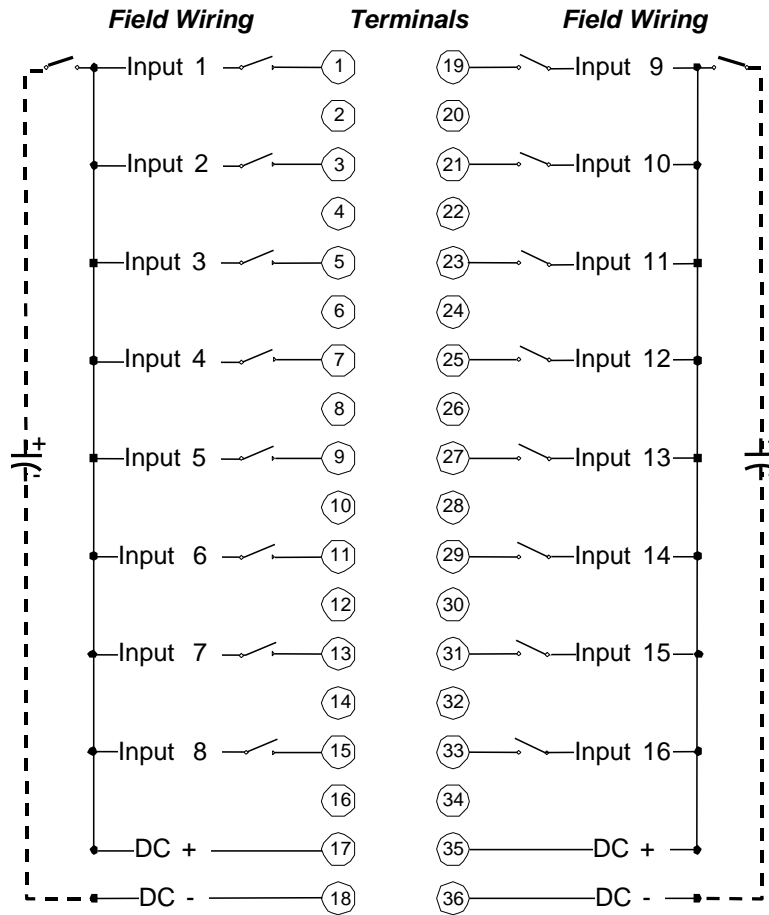
Refer to the PACSystems RX3i System Manual, GFK-2314, for product standards, and general operating specifications, and installation requirements.

MDL664 Thermal Derating

With input voltage in the 18 VDC to 24 VDC range, no temperature derating is required, and all input channels can operate within the entire Surrounding Air temperature range. With input voltage greater than 24 VDC, the number of active channels must be reduced as temperature increases, according to the following derating curve.



Field Wiring: MDL664



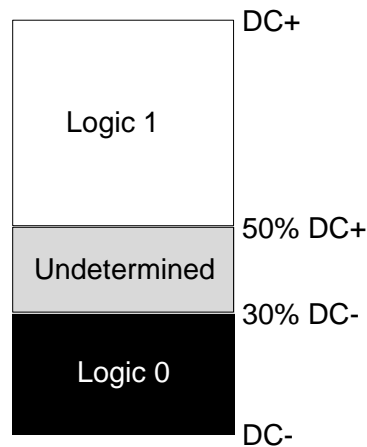
Connections	Terminals
Input 1	1
NC	2
Input 2	3
NC	4
Input 3	5
NC	6
Input 4	7
NC	8
Input 5	9
NC	10
Input 6	11
NC	12
Input 7	13
NC	14
Input 8	15
NC	16
DC +	17
DC -	18

Terminals	Connections
19	Input 9
20	NC
21	Input 10
22	NC
23	Input 11
24	NC
25	Input 12
26	NC
27	Input 13
28	NC
29	Input 14
30	NC
31	Input 15
32	NC
33	Input 16
34	NC
35	DC+
36	DC-

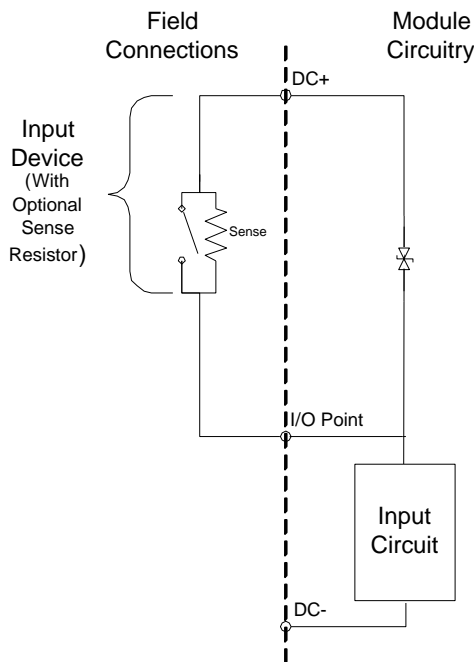
Circuit Operation

The input circuit references the input to the common (DC -) on the field side of the module. An ON condition for the input device is read as a logic 1, and an OFF condition for the input device is read as a logic 0.

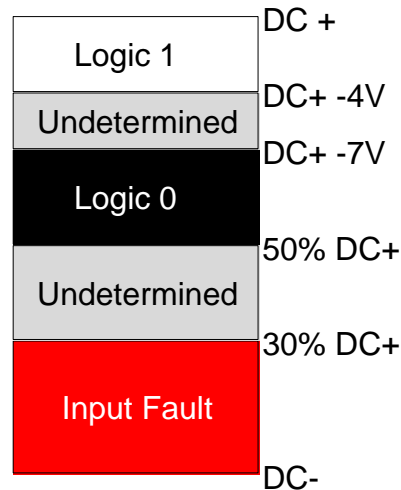
Normal Thresholds



Tri-state Operation (Open Wire / Short to DC- Detection)

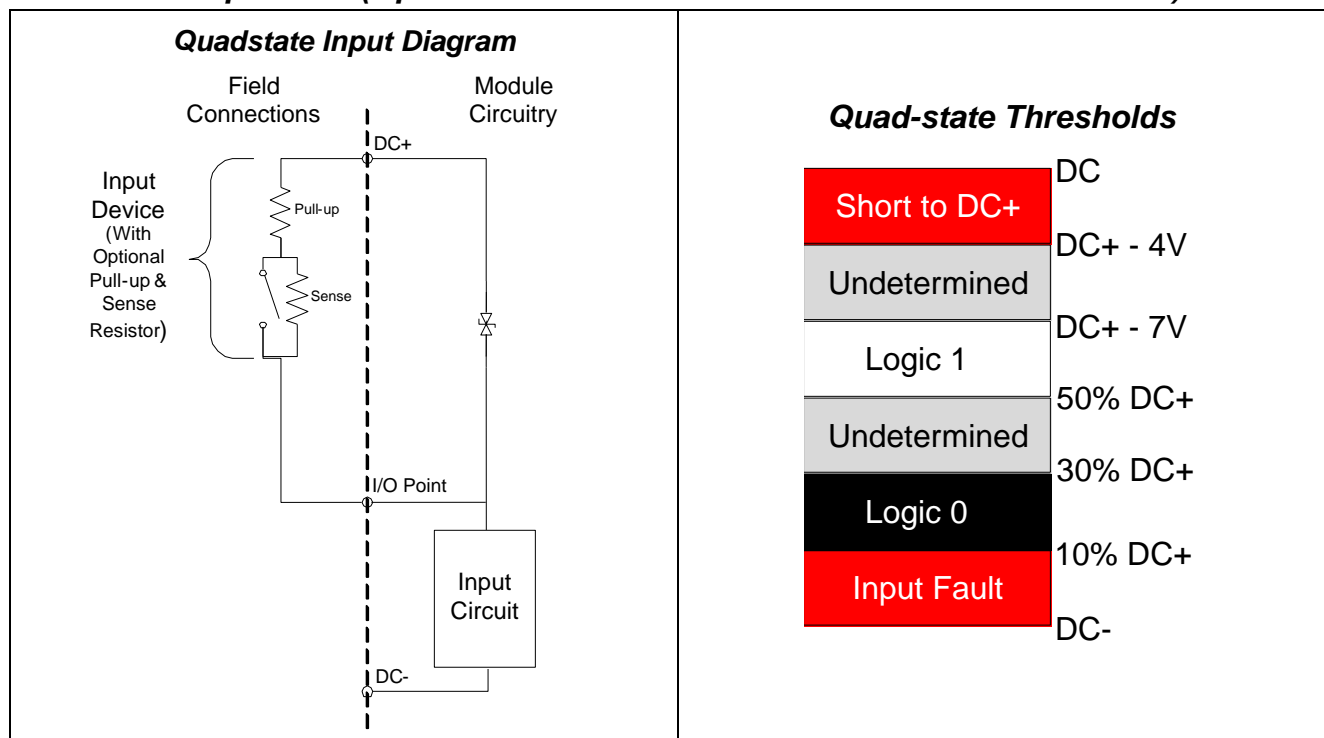


Tri-state Thresholds



The Open Wire / Short to Ground diagnostic can be enabled on any circuit configured as a tri-state input. In addition to being configured as a tri-state input, the circuit must have a non-inductive sense resistor placed as close as practical to the actual dry contacts (such as across the field device terminals).

Quad-state Operation (Open Wire / Short to DC- and Short to DC+ Detection)



The Open Wire / Short to DC- diagnostic and the Short to DC+ diagnostic can be enabled on any circuit configured as a quad-state input. In addition to being configured as a quad-state input, the circuit must have a non-inductive sense resistor placed as close as practical to the actual dry contacts (such as across the field device terminals) and a pull-up resistor between the high side of the Input Device and DC+.

LED Operation

The Smart Input Module has 19 bi-color LEDs on the faceplate. The states of the input points are indicated by 16 green and amber channel status LEDs. The Module OK LED indicates module status. The field status LEDs (S1 and S2) indicate whether the external +24 VDC power supply is present and is above the minimum level, whether faults are present, and whether the terminal block is locked into place.

LED Name	Function	LED Indications
OK	Module status	Off: Module is not receiving power from the RX3i backplane or the module has failed self-test.
		Solid green: Module OK and configured.
		Blinking green: The module has not received configuration from the CPU. If configuration is not successful, the module will continue to blink in this mode.
		Amber: Module hardware watchdog timeout
		Blinking amber: Module internal error. Record the blink pattern and contact technical support.
1-16	Channel status	Off: Input is off
		Green: Input is on
		Amber: Input fault
S1, S2	Terminal block and field power status	Off: Terminal present and field power not present
		Green: Terminal and field power present
		Red: Terminal not present or field power over-voltage

Note: The OK, S1 and S2 LEDs blink green in unison when the module is in firmware update mode.

Input and Output Data Formats

Channel Value Data

The module reports its input channel data in one bit per input, beginning at the configured *Channel Value Reference Address*.

Channel Diagnostic and Status Data

The module can be configured to report channel diagnostic and status data to the CPU. The CPU stores this data at the module's configured *Diagnostic Reference Address*. Use of this feature is optional.

The data for each channel occupies two words whether or not the channel is used.

Note: At least two sweeps must occur to clear the diagnostic bits: one scan to send the %Q data to the module and one scan to return the %I data to the CPU. Because module processing is asynchronous to the controller sweep, more than two sweeps may be needed to clear the bits, depending on the sweep rate and the point at which the data is made available to the module.

<i>Bit Offset</i>	<i>Description</i>
0–3	Reserved
4	Set on when open wire is detected.
5	Set on when short to power is detected.
6–8	Reserved
9	Set on when pulse test has failed.
10–14	Reserved
15	Set on when channel communication error is detected.
16	Set on when pulse test is complete. Note: This bit remains set until the corresponding pulse test command bit is cleared.
17–30	Reserved
31	Set on when any channel fault is detected.

Module Status Data

The module can be configured to return two words of module status data to the CPU. The CPU stores this data in the module's 32-bit configured Module Status Data reference area.

<i>Bit Offset</i>	<i>Description</i>
0	When on, indicates module I/O data is ready.
1	Set on when Terminal block is present.
2	Set on when loss of field power for one or more groups is detected.
3	Set on when module over temperature is detected.
4	Set on when pulse test has failed on any channel.
5	Reserved
6	Set on when loss of group 1 field power is detected.
7	Set on when loss of group 2 field power is detected.
8	Set on when channel fault is reported on any channel.
9–31	Reserved

Pulse Test Command Output Data

The module uses these bits (one bit per input), beginning at the configured *Pulse Command Output Reference Address* to command an on-demand pulse test. To command an on-demand pulse test, the Pulse Test Enable parameter for the channel must be set to *Enabled – Manual*.

Diagnostics

The module always performs a set of standard diagnostic checks. Individual circuits can be configured not to log a fault to the CPU if a fault occurs. The module returns current diagnostics for all circuits to %I bits.

Input Pulse Test

The Input Pulse Test is an optional diagnostic feature that exercises the input points to confirm they can detect and respond to changes in the actual input state. Pulse testing verifies the ability of a module's inputs to detect a change in state. Pulse Testing should be enabled if the module has loads that hold state for long periods of time. The application must be capable of withstanding the loss of the input feedback for up to 16 ms.

When the pulse test occurs, the input point power is removed, and then the input is connected internally to DC+. This verifies the ability of the input to detect a change in state. Each of the input points is tested individually to ensure there are no shorts between inputs. If a change in state is not detected, a fault is logged with the CPU. Valid field power must be present for the pulse test to run successfully.

On Demand Pulse Test

To use this feature, the channel's Pulse Test Enable parameter must be set to *Enabled-Manual*. To command a pulse test, set the Pulse Test Command bit for the channel(s) to be pulse tested.

The module will perform one or more pulse tests for each channel selected. Since this will take many sweeps, you should keep the Pulse Test Command bit set until the Pulse Test Complete bit is set for that channel in the Channel Diagnostic and Status Data.

The module will keep the Pulse Test Complete bit set as long as the Pulse Test Command bit is set. One output scan with the Pulse Test Command bit cleared clears the Pulse Test Complete status bit and the Pulse Test Failure diagnostic bit.

Automatic Pulse Test

To use this feature, the channel's Pulse Test Enable parameter must be set to *Enabled-Auto*.

The Input Pulse Test occurs at a frequency selected in the Hardware Configuration, with no intervention from the CPU. The pulse test execution is based on the Time of Day clock set in the CPU, and the frequency is relative to 12:00am. For example, a frequency of 12 hours will result in a pulse test run at 12:00am and 12:00pm.

If the pulse test fails, the Pulse Test Failed bit is set.

Configuration

Module Settings

<i>Parameter</i>	<i>Function</i>
Channel Value Reference Address Channel Value Reference Length	Specifies the memory location where the module reports 16 bits of channel values.
Diagnostic Reference Address	Specifies the starting address for reporting channel diagnostics data.
Diagnostic Reference Length	Provides 32 bits of diagnostic data per channel. Setting this value to 0 disables channel diagnostics reporting.
Module Status Reference Address	Specifies the starting address for reporting module status data.
Module Status Reference Length	Provides 32 bits of module status data. Setting this value to 0 disables channel diagnostics reporting.
Pulse Test Command Output Reference Address/ Pulse Test Command Output Reference Length	Specifies the memory location for manual pulse test command data.
Channel Faults w/o Terminal Block	Enables or disables generation of channel faults and alarms after a Terminal Block has been removed.
Inputs Default w/o Terminal Block	Enables or disables defaulting inputs when the terminal block is removed.
Loss of Terminal Block Detection	Enables or disables logging of a fault to indicate a Terminal Block has been removed.
Loss of Field Power Group 1 Detection/ Loss of Field Power Group 2 Detection	Enables or disables loss of field power detection for the specified group.
Inputs Default	Specifies whether inputs will go to Force Off or Hold Last State if module loses communication with the CPU.
I/O Scan Set	Assigns the module I/O status data to a scan set defined in the CPU configuration. Determines how often the RX3i polls the data.

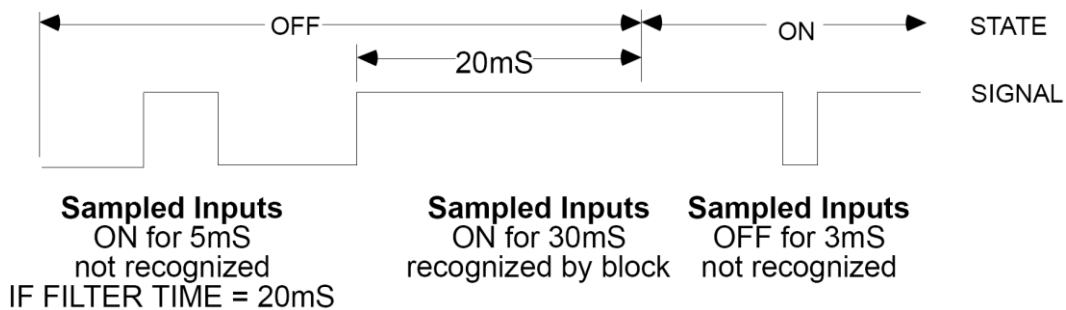
Channel Settings

<i>Parameter</i>	<i>Function</i>	<i>Input Type</i>
<i>Input Type</i>	Selects the input operation, along with enabling the corresponding fault logging. Choices are: Dual state, Tri-state or Quad-state.	
Digital Filter	Enables or disables the digital filter for the input.	All
Digital Filter Frequency	Selects the digital filter frequency in 0.5ms increments. For details, see "Input Filter Time."	All
Pulse Test Enable	Enables or disables pulse testing of input. Allows you to select Manual or Automatic pulse testing. For details about this feature, refer to "Diagnostics" on page 7.	All
Pulse Test Frequency	If Pulse Test Enable is set to Auto, allows you to select the frequency of pulse testing.	All
<i>Diagnostic Reporting Enable</i>	Enables or disables channel diagnostics. If enabled, channel diagnostic data is written to the Channel Diagnostic and Status Data.	All
Open Wire Reporting Enable	If enabled, an open wire condition is reported in the Channel Diagnostic and Status Data.	Tri-State Quad-State
Short to Power Reporting Enable	If enabled, a short to power is reported in the Channel Diagnostic and Status Data.	Quad-State

<i>Parameter</i>	<i>Function</i>	<i>Input Type</i>
Pulse Test Failed Enable	If enabled, the results of manual or automatic pulse testing are reported in the Channel Diagnostic and Status Data.	All
<i>Fault Reporting Enable</i>	If enabled, channel faults are reported to the I/O fault table.	All
Open Wire Reporting Enable	If enabled and the corresponding diagnostic reporting is enabled, an open wire condition is reported in the I/O fault table.	Tri-State Quad-State
Short to Power Reporting Enable	If enabled and the corresponding diagnostic reporting is enabled, a short to power is reported in the I/O fault table.	Quad State
Pulse Test Failed Enable	If enabled and the corresponding diagnostic reporting is enabled, a failed pulse test is reported in the I/O fault table.	All

Input Filter Time

An input filter time of 0.5 ms to 100 ms can be selected for the module, in 0.5ms increments. The default filter time is 20 ms. The input filter can be disabled.



The filter is a digital low-pass filter. The module continuously samples an input for the length of the filter time period. The input must remain at a constant state for the length of the Filter Time for the module to recognize the state.

An input filter helps reject spurious noise spikes and multiple inputs generated by the bounce of mechanical devices. In controlled, noise-free environments, signals generated by clean, solid state electronics may be unnecessarily slowed by a filter, delaying system response. In such an environment, no additional filter time is needed. In noisy environments, use a longer filter time to prevent noise from possibly causing erratic or unsafe system operations.

Important Product Information for this Release

Release History

<i>Part Number</i>	<i>Firmware Revision</i>	<i>Comments</i>
IC695MDL664-AA	1.00	Initial Release

Functional Compatibility

Programming Software	Proficy Machine Edition Logic Developer PLC, version 6.00, SIM 21 or later is required to configure the MDL664.
RX3i CPU Firmware	The MDL664 requires CPU firmware version 6.70 or later.

UL Class 1 Division 2 & ATEX Zone 2 Hazardous Area Warnings

1. EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C, D, DIV. 2 HAZARDOUS AREAS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY.
2. WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2 & ATEX ZONE 2.
3. WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

ATEX Zone 2 Hazardous Area Requirements

In order to maintain compliance with the ATEX Directive, an RX3i system located in a Zone 2 area (Category 3) must be installed within a protective enclosure meeting the criteria detailed below:

- IP54 or greater, and
- Mechanical strength to withstand an impact energy of 3.5 Joules