

JISKOOT™ MEASUREMENT SYSTEMS

# **+ InSpec-Ex Enhanced Controller (ETL-Recognised Component)**











## **Installation, Operation & Maintenance Manual**





## Important Safety Information

Symbols used throughout the supporting documentation and on the products are defined below:

Symbol	Meaning	Definition
	<b>Dangerous Voltage</b>	To indicate hazards arising from dangerous voltages.
	<b>Warning/Caution</b>	An appropriate safety instruction should be followed or caution to a potential hazard exists.
	<b>Protective Earth (Ground)</b>	To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.
	<b>Functional Earth</b>	To identify an earth (ground) terminal in cases where Protective or clean Earth (ground) is explicitly required.
	<b>Frame or Chassis</b>	To identify a frame or chassis bonding terminal
	<b>Heavy</b>	This product is heavy and reference should be made to the safety instructions for provisions of lifting and moving.
	<b>Static Sensitive Device (Hand Prohibited)</b>	All precautions against electro-static discharge (ESD) must be observed to avoid damaging electronic circuits
	<b>Disposal:</b> <ul style="list-style-type: none"><li>- Monitoring and Control Instruments, accessories and their packaging should be sorted for environmental-friendly recycling.</li></ul> <b>Only for EC countries:</b> <p>Do not dispose of Monitoring and Control Instruments into household waste! According to the European Directive 2002/96/EC on waste electrical and electronic equipment (WEEE and its incorporation into national law, Monitoring and Control Instruments that are no longer suitable for use must be separately collected and sent for recovery in an environmental-friendly manner.</p>	
	<b>Tools Required:</b> <ul style="list-style-type: none"><li>- Tools listed next to this symbol will be required to perform the task outlined in the text that follows.</li></ul>	
	<b>Hints &amp; Tips:</b> <ul style="list-style-type: none"><li>- Text may help answer some questions or aid configuration.</li></ul>	

### Terms Used in This Manual

<b>WARNING</b>	A warning identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.
<b>CAUTION</b>	Caution statements Indicate actions or procedures which, if not performed correctly, may lead to personal injury or incorrect function of the instrument or connected equipment.
<b>Note</b>	Indicates additional information about specific conditions or circumstances that may affect instrument operation.

\*Mark of Sensia

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<p align="center"><b>CERTIFIED PRODUCT</b>  <b>Scheduled Document</b>  No modification permitted without reference to the  Nationally Recognized Testing Laboratory</p>
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## REVISION HISTORY

Revision:	Description of change:	Issuer:	Approver:	Date:
1	Issued for approval	MF	PW	12 <sup>th</sup> July 2013
...	...	...	...	...
6	Issued for approval	MF	PW	12 <sup>th</sup> June 2014
7	Branding Updates – Issued for approval	MF	PW	29 <sup>th</sup> January 2018
8	Issued for approval	MF	PW	25 <sup>th</sup> January 2019
9	Change Document Branding	MF	TMM	4 <sup>th</sup> May 2020

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#### GENERAL

### WARNING!

This instrument is designed for connection to hazardous electric voltages.

Ignoring this warning can result in severe personal injury or mechanical damage.

To avoid the risk of electric shock and fire, the safety instructions of this manual must be observed and the guidelines followed.

The specifications must not be exceeded, and the unit must only be applied as described in the following.

Prior to the installation and commissioning of the unit, this manual must be examined carefully.

Only qualified personnel (technicians) should install this unit.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



#### HAZARDOUS VOLTAGE



#### CAUTION!

### WARNING!

Until the instrument is fixed, do not connect hazardous voltages to the instrument.

The following operations should only be carried out on a disconnected unit and under ESD-safe conditions:-

- Dismantlement of the instrument for setting of DIP-switches and jumpers.
- General mounting, connection and disconnection of wires.
- Troubleshooting the unit.

**Repair of the instrument must only be done by Sensia (UK) Ltd.**



#### INSTALLATION

### WARNING!

Installation may only be carried out by electrically skilled and instructed personnel in accordance with national legislation, including the relevant standards.

All technical data on the instrument is to be observed.

Changes to the design and modifications to the equipment are not permitted.

The equipment shall only be operated as intended and only in undamaged and perfect condition.

Sufficient segregation must exist between different cables and wires carrying different types of signal or power and all other circuits.

All wires must be terminated, complete with crimping lugs. Unused cores should be terminated to the earth bus bar.

## Section 1: Introduction

The Jiskoot\* InSpec-Ex\* Controller is intended for use in hazardous locations in which an explosive gas atmosphere, caused by mixtures of air and gases, vapour or mists, exist under normal atmospheric conditions, as defined in the National Electrical Code (NEC) or Canadian Electrical Code (CEC).

Under the National Electrical Code (NEC) and the Canadian Electrical Code (CEC) the InSpec-Ex, with the ETL Recognised Component mark, may be used in the following Hazardous (Classified) Locations:

Class I, Division I, Groups C& D T6

Class I, Zone I, Group IIB T6 (USA Only)

Ambient temperature range Tamb or Ta = -20°C to +50°C or +55°C (-4°F to 122°F or 131°F) depending upon the model.

Different application software installed in the unit will allow it to be used for Sampling, Blending or Wild-stream control applications.

The unit may be sold separately or as part of a system for integration into larger installation.

Depending on the model purchased, the following additional functions maybe integrated into the unit (Over and above a standard safe area InSpec).

- Load-Cell Amplifiers (2 off) to interface with a Jiskoot CanWeigh System
- Isolating Converter (1 off) to interface with Jiskoot CanHigh System
- Auxiliary 24VDC PSU (40 Watts max. continuous load) for powering local 24VDC Solenoid Operated Valves, or similar.
- Auxiliary 24VDC PSU (10 Watts max. continuous Load) for powering local 24VDC transmitters etc.

NOTE: When requesting assistance or spare parts, please provide the Model and Serial Number of the unit to ensure that the correct options are noted.

## Section 2: Model, Options & Marking

Each InSpec-Ex Controller has an associated model number that can be used to identify which options have been fitted. The following table details these:









CODE			DESCRIPTION
A B			<b>Cable Entries:</b>
			M20 threads
B			3/4" NPT threads
	0		<b>User Interface:</b>
	1		No user interface fitted on enclosure
			Standard user interface on enclosure
	A		<b>Certification:</b>
			ATEX (Europe)
	E		ETL-Recognized (USA & Canada)
			<b>AC/DC PSUs:</b>
			0 None fitted
			A 10W 24VDC PSU fitted
			B 60W 24VDC PSU fitted
			C Both 10W & 60W 24VDC PSUs fitted
			<b>CanWeigh/CanHigh:</b>
			0 None
			A 2 Ch. CanWeigh Amplifiers (2 x GMI D1064S)
			B 2 Ch. CanHigh Interface (1 x PR 9202B2B)

### Important Notes:

- Some options are mutually exclusive.
- High Temperature Version – To reduce the internal power dissipation, units operated in higher ambient temperatures are powered from an external 24VDC power supply unit. These units have no additional PSU's fitted in the enclosure, but may switch AC/DC power through relay outputs.



## MARKING (LABEL DETAIL)

LABEL DETAIL	APPLICATION
<div><div><div><div><div>JISKOOT™ InSpec-Ex Controller</div><div>Model : Serial No. : Supply : 100-240 VAC 50/60 Hz Power : 100 W Class I, Zone 1, IIB, T6 (USA) Class I, Div. 1, Groups C &amp; D, T6 - 20 °C &lt; Ta &lt; +50 °C</div><div>RECOGNIZED COMPONENT  Intertek 4010543</div><div>Conforms to UL1203, UL698A &amp; UL61010 Certified to CSA C22.2 No. 14, C22.2 No. 30, C22.2 No. 61010</div><div><b>WARNING</b> - DISCONNECT ALL CIRCUITS BEFORE OPENING THE ENCLOSURE. <b>ATTENTION</b> - DÉCONNECTER TOUS LES CIRCUITS AVANT D'OUVRIR LE BOITIER.</div><div><b>SENSIAGLOBAL.COM</b> Sensia UK Ltd. Tunbridge Wells - Kent - UK - TN2 3EY - UK</div><div></div></div></div></div></div>	<div><div>AC powered unit. With Intrinsically Safe Isolators.</div><div><div>Model Numbers</div><div><div>##EAA</div><div>##EBA</div><div>##ECA</div><div>##EAB</div><div>##EBB</div><div>##ECB</div></div></div></div>
<div><div><div><div><div>JISKOOT™ InSpec-Ex Controller</div><div>Model : Serial No. : Supply : 100-240 VAC 50/60 Hz Power : 100 W Class I, Zone 1, IIB, T6 (USA) Class I, Div. 1, Groups C &amp; D, T6 - 20 °C &lt; Ta &lt; +55 °C</div><div>RECOGNIZED COMPONENT  Intertek 4010543</div><div>Conforms to UL1203 &amp; UL61010 Certified to CSA C22.2 No. 30, C22.2 No. 61010</div><div><b>WARNING</b> - DISCONNECT ALL CIRCUITS BEFORE OPENING THE ENCLOSURE. <b>ATTENTION</b> - DÉCONNECTER TOUS LES CIRCUITS AVANT D'OUVRIR LE BOITIER.</div><div><b>SENSIAGLOBAL.COM</b> Sensia UK Ltd. Tunbridge Wells - Kent - UK - TN2 3EY - UK</div><div></div></div></div></div></div>	<div><div>AC powered unit. Without Intrinsically Safe Isolators.</div><div><div>Model Numbers</div><div><div>##EA0</div><div>##EB0</div><div>##EC0</div></div></div></div>
<div><div><div><div><div>JISKOOT™ InSpec-Ex Controller</div><div>Model : Serial No. : Supply : 24 VDC ± 10% Power : 15 W Class I, Zone 1, IIB, T6 (USA) Class I, Div. 1, Groups C &amp; D, T6 - 20 °C &lt; Ta &lt; +55 °C</div><div>RECOGNIZED COMPONENT  Intertek 4010543</div><div>Conforms to UL1203, UL698A &amp; UL61010 Certified to CSA C22.2 No. 14, C22.2 No. 30, C22.2 No. 61010</div><div><b>WARNING</b> - DISCONNECT ALL CIRCUITS BEFORE OPENING THE ENCLOSURE. <b>ATTENTION</b> - DÉCONNECTER TOUS LES CIRCUITS AVANT D'OUVRIR LE BOITIER.</div><div><b>SENSIAGLOBAL.COM</b> Sensia UK Ltd. Tunbridge Wells - Kent - UK - TN2 3EY - UK</div><div></div></div></div></div></div>	<div><div>DC powered unit. With Intrinsically Safe Isolators.</div><div><div>Model Numbers</div><div><div>##E0A</div><div>##E0B</div></div></div></div>
<div><div><div><div><div>JISKOOT™ InSpec-Ex Controller</div><div>Model : Serial No. : Supply : 24 VDC ± 10% Power : 15 W Class I, Div. 1, Groups C &amp; D, T6 Class I, Zone 1, IIB, T6 (USA) - 20 °C &lt; Ta &lt; +55 °C</div><div>RECOGNIZED COMPONENT  Intertek 4010543</div><div>Conforms to UL1203 &amp; UL61010 Certified to CSA C22.2 No. 30, C22.2 No. 61010</div><div><b>WARNING</b> - DISCONNECT ALL CIRCUITS BEFORE OPENING THE ENCLOSURE. <b>ATTENTION</b> - DÉCONNECTER TOUS LES CIRCUITS AVANT D'OUVRIR LE BOITIER.</div><div><b>SENSIAGLOBAL.COM</b> Sensia UK Ltd. Tunbridge Wells - Kent - UK - TN2 3EY - UK</div><div></div></div></div></div></div>	<div><div>DC powered unit. Without Intrinsically Safe Isolators.</div><div><div>Model Numbers</div><div><div>##E00</div></div></div></div>

## Section 3: Installation Details

Installation may only be carried out by skilled electricians and instructed personnel in accordance with the local statutory, regulatory requirements for the end country of use and customer requirements.

The equipment must not be installed into or operated in Hazardous (Classified) Locations outside the scope of those stated in the previous section of this manual.

All technical data on the enclosure is to be observed.

Changes to the design and modifications to the equipment are not permitted.

For Division 1 hazardous (classified) locations, the equipment must be installed in accordance with Article 504 of the National Electrical Code.

For Zone 0 and Zone 1 hazardous (classified) locations, the equipment must be installed in accordance with Article 505 of the National Electrical Code (USA Only)

The installation of this equipment must meet the requirements of the National Electric Code (NEC) or Canadian Electrical Code (CEC) as applicable and all protective and safety devices or systems must have the appropriate safety approvals for the end country of use for the equipment.

The equipment is intended for permanent connection.

A double pole isolator, having suitable safety approvals for the country of end use of the equipment, must be installed to disconnect the equipment from the supply. It must be located nearby and easily reached, and marked as the disconnecting device for the equipment.

## ENCLOSURE MOUNTING, ORIENTATION & POSITION

### LIFTING



#### CAUTION

This equipment weighs approximately 50kg. and a detailed hazard analysis/risk assessment should be performed before attempting to lift and secure the enclosure into position.

The instrument shall be securely mounted to a suitable vertical flat surface using all four mounting lugs/feet cast onto the enclosure, with ½ inch (M12) mounting bolts and washers.

Depending upon the access limitations, the equipment should be lifted using mechanical lifting aids such as a forklift, or an overhead crane with a suitably rated nylon strop around the body of the housing.

Care must be taken to avoid damaging the threaded entries in the bottom of the enclosure, the front panel window or operators and the flamepath.

When lifting aids cannot be used, the equipment should be put into position as a team lift, employing a minimum of 3 persons.

### ORIENTATION & POSITION

- The unit shall be mounted so that all cable entries are at the bottom of the enclosure.
- Once installed, a minimum of 1.57" (40mm) separation is required and shall be maintained between the flameproof flange joint and any solid object, which is not part of the enclosure.
- The instrument shall be mounted so that the window on the front of the enclosure is eye level, approximately 5' 8" (1.75m), and away from direct sunlight.
- The location should not subject the controller to vibration or shock.
- Sunshades are recommended in hot and sunny environments where temperatures exceed 30°C

## WIRING METHODS & MATERIALS

All field wiring for installations within the United States must conform to the National Electric Code (NEC), NFPA 70, Article 501. All field wiring for installations within Canada must conform to the Canadian Electric Code (CEC). Local wiring ordinances may also apply.

Only personnel who are experienced with field wiring should perform these procedures.

- Personnel installing field wiring must strictly adhere to all manufacturers datasheets and instructions.
- The conduit or cable gland threads must be the same thread size as the enclosure's entry thread size, either M25 & M20, or 1" & ¾" NPT, as determined by the model number – See Section 2:.
- Conduit
  - A conduit seal must be installed within 18 inches of the instrument.
- Cable glands
  - A barrier gland is required due to the volume of the enclosure.
  - Cable glands must be used with an appropriate cable, as per the manufacturer's specifications, to maintain integrity of the installation.
  - The cable must be adequately supported.
- All wires must be terminated, complete with crimping lugs.
- Terminal block screws must be tightened to a torque of 4.4 to 5.3 lb.in.
- The hazardous area end of any unused cores shall be either a) connected to earth or b) adequately insulated by means of suitable terminations (insulation tape alone is not recommended) and connected to earth in the non-hazardous area.

## CABLE/WIRE SELECTION

All field wiring must have a minimum specification of 20 AWG (0.5mm<sup>2</sup>), 75°C, VW-1. It must be suitably sized for the application and local conditions, conform to the National Electric Code (NEC) for installations within the United States, or the Canadian Electric Code (CEC) for installations within Canada. Local wiring ordinances may also apply.

Considerations such as (but not limited to) the supply voltage and frequency, load current, voltage drop, temperature, cable mounting and grouping factors should be considered.

In general, Sensia recommends the following types of cables for the associated signal types:

**Analogue Signals** : Screened twisted pairs with an overall screen.  
Blue cable sheath for Intrinsically Safe circuits.

**Pulse/Frequency Signals** : Screened twisted pairs with an overall screen.  
Blue cable sheath for Intrinsically Safe circuits.

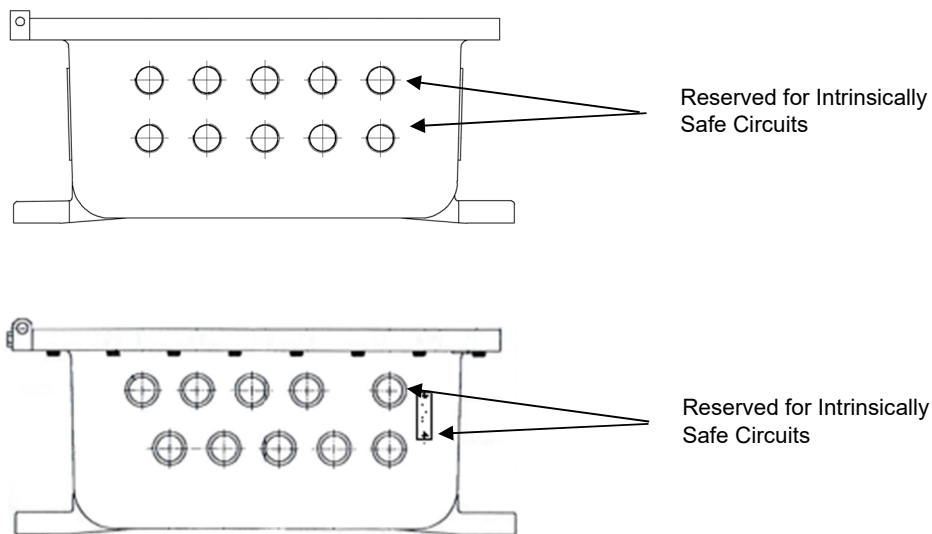
**DC Digital Signals** : Multicore with an overall screen

## CABLE ENTRIES

All enclosure entries must be fitted with a suitable and approved gland or stopping plug.

Intrinsically safe circuits must be installed into the two right hand entries, in the bottom of the enclosure. Once the circuits are brought into the enclosure, they must remain physically and electrically isolated from any other circuits within the enclosure.

No Intrinsically Safe Earth is required as only isolated barriers are used in the unit.



MODEL NUMBER	(REF. ABOVE IMAGE)	
A # # # #	Metric Threads	M20
B # # # #	Imperial Threads	$\frac{3}{4}$ " NPT

## Section 4: Field Connections

### DIN RAIL TERMINALS

TERMINALS	FUSE	CROSS REFERENCE	OPTION	NOTES
1	F1	Section 4: Instrument Power	Yes	InSpec Controller AC Input Power
2				
3	F2		Yes	Internal AC to DC PSU(s) AC Input Power (Internally Linked)
4				
5				Additional Neutral Connections
6				
7	F3	Section 4: Relay Circuits (Outputs)		Relay Output No.1
8				
9	F4			Relay Output No.2
10				
11	F5			Relay Output No.3
12				
13	F6			Relay Output No.4
14				
15	F7	Section 4: Ancillary Power (DC)	Yes	+24VDC 40W Output
16				
17	F8		Yes	InSpec Controller DC Input Power or +24VDC 10W Output
18				
19 to 24				Additional 0VDC (GND) Connections

### EARTHING REQUIREMENTS



An external protective earth (PE) conductor, associated with unit's main power source, must be connected to the dedicated PE terminal. The minimum size of the incoming external earth wire is 2.5mm<sup>2</sup> (14 AWG) and rated for 300V, 105°C, VW-1.

There is provision for making an external earth connection to the enclosure, via an external grounding screw.

### SHIELDED (SCREENED) CABLES

Control & signal cable screens and drain wires should be terminated to a low-impedance earth (ground), preferably using a 360° shield (screen) clamp. If pigtailed, where the screen is brought down to a single wire and connected to the earth point, these must be as short as possible; otherwise the inductance of the pigtail renders it useless at high frequencies.

- For a circuit with an ungrounded source the screen should be terminated at the input end, whereas if the input is floating and the source is grounded then the screen should be terminated at the source end.
- If both the signal source and signal inputs are both grounded, terminating the screen at both ends may reduce the performance of the system.
- To shield against low-frequency electric fields terminate the screen at one end only.
- To shield against low-frequency magnetic fields terminate both ends of the screen.
- Using a shielded twisted pair cable with the screen terminated at only one end gives a good compromise as the twisting minimizes the magnetic coupling, and the screen reduces external capacitive coupling.

## POWER

### INSTRUMENT POWER

The instrument can be powered from either an AC or DC supply, through different terminals.



- Do not attempt to power the instrument from both AC and DC supplies at the same time!
- A double pole isolator, having suitable safety approvals for the country of end use of the equipment, must be installed to disconnect the equipment from the supply. It must be located nearby and easily reached, and marked as the disconnecting device for the equipment.

#### AC Power Supply Connection - Model Numbers

###A#	###B#	###C#
-------	-------	-------

AC power is connected to the unit via terminals **1, 2** and **E**.

TERMINAL	FUSE	DUTY
1	F1	Live
2		Neutral
3	F2	Internally Connected
4		
E		Protective Earth

Power should be connected via a suitable means of a 2 pole disconnect. Ensure that the associated supply fuse or circuit breaker and cabling is suitably sized.

#### DC Power Supply Connection - Model Numbers

###0#
-------

DC power is connected to the unit via terminals **17, 18** and **E**.

TERMINAL	FUSE	DUTY
17	F8	+24VDC
18		GND (0V DC)
E		Protective Earth

Power should be connected via a suitable means of disconnect. Ensure that the associated supply fuse or circuit breaker and cabling are suitably sized.

### ANCILLARY POWER (DC)

#### 24VDC (40 Watts) - Model Numbers

###B#	###C#
-------	-------

An optional AC/DC PSU intended to supply equipment such as solenoid coils.

TERMINAL	FUSE	DUTY
15	F7	+24V DC (40 Watts Max. Continuous Load)
16		GND (0V DC)

#### 24VDC (10 Watts) - Model Numbers

###A#	###C#
-------	-------

An optional AC/DC PSU intended to supply equipment such as temperature, flow or pressure transducers.

TERMINAL	FUSE	DUTY
17	F8	+24V DC (10 Watts Max. Continuous Load)
18		GND (0V DC)

## SIGNALS



### SELV Circuits

All circuits wired to the 16 & 20-way interface modules must be connected to SELV circuits.

## RELAY CIRCUITS (OUTPUTS)

Terminals 7 through 14 inclusive provide connections to the controller's relay outputs as follows:

TERMINAL	FUSE	I/O TYPE	DUTY
7	F3	Relay Output (No.1)	Common
8			Normally Open
9	F4	Relay Output (No.2)	Common
10			Normally Open
11	F5	Relay Output (No.3)	Common
12			Normally Open
13	F6	Relay Output (No.4)	Common
14			Normally Open

**Figure 1 – Relay Connections**

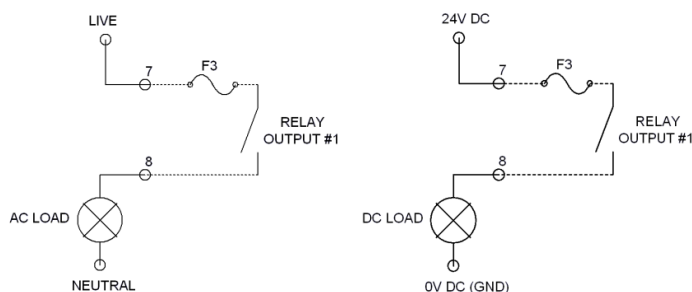
The relay outputs can switch circuits designated as Installation Category III.

Insulation Coordination:

- Coil to Contact - Reinforced
- Normally Open Contact - Functional
- Relay to Other - Reinforced

Each relay output may switch a maximum of 250VAC rms or 30VDC and is rated at 2 Amp resistive load or 1.5 Amp inductive.

All wiring connected to any relay output must have a suitably sized protection device fitted to protect the relay circuit and load being switched by it. Relay outputs are fitted with a voltage dependent resistor (VDR), to suppress any voltage transients that may be generated during switching, extending the life of the relay contacts.



**Figure 2 - Connecting a Relay Output**

## 16-WAY INTERFACE MODULE (TB1)

**IMPORTANT:** Cables terminating to this terminal block must be screened.

This terminal block carries connections for Serial Communications (RS232, RS422 & RS485). Its terminal assignments are as follows:

Terminal	Duty	RS232 (DTE) Duty	RS422/485 Duty
1	Port 1 (Debug)	NC	Not Applicable
2		Rx	
3		Tx	
4		NC	
5	Port 2	GND	GND
6		NC	Rx + ←
7		Rx ←	Rx - ←
8		Tx →	Tx - →
9		NC	Tx + →
10	Port 3	GND	GND
11		NC	Rx + ←
12		Rx ←	Rx - ←
13		Tx →	Tx - →
14		NC	Tx + →
15		GND	GND

\*NC = No Connection (Do not connect)

**Figure 3 - 16-Way Interface Module Connections (TB1)**

### RS422 & RS485 Terminology

The terminology for RS422 and RS485 terminations does vary between manufacturers, but generally is as follows:-

Rx + = R+ = A'
Rx - = R- = B'
Tx + = T+ = A
Tx - = T- = B

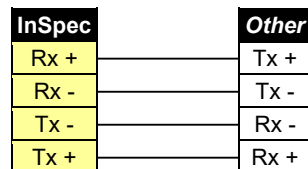
### RS422 & RS485 Termination

For correct operation of the multi-drop bus, the communication lines must be held in the fault tolerant position e.g.

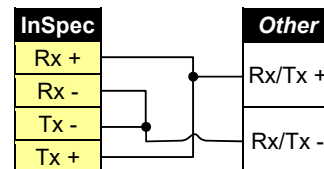
- For **RS422** this is done at each receiver, Rx+ is pulled low (0V) and Rx is pulled high (5V) using 1kΩ resistors.
- For **RS485** this is done at each transceiver, Tx/Rx+ are pulled low (0V) and Tx/Rx- are pulled high (5V) using 1kΩ resistors.
- In either **RS422** or **RS485** mode a 120Ω resistor is available for line termination (Impedance matching).

*Note : The InSpec Controller's serial ports can be individually fully configured for line termination and/or pull-up or pull-down lines for RS422/485.*

### RS422 & RS485 Connections



**Figure 4 - RS422 (4-Wire)**



**Figure 5 - RS485 (2-Wire)**



## 20-WAY INTERFACE MODULE (TB2)

**IMPORTANT:** Cables terminating into Analogue Inputs/Outputs and where possible Pulse Inputs in this terminal block must be screened and kept separate from the digital I/O.

This terminal block carries connections for:

- 1 off 24V DC Supply;
- 4 off Digital I/O points;
- 2 off Pulse Inputs (Voltage or Current Pulse);
- 2 off Analogue Outputs;
- 3 off Analogue Inputs.

Its terminal assignments are as follows:

TB2	TERMINAL	CROSS REFERENCE	DUTY	
	1	Section 4: 24V DC Power (TB2.1 & 2)	0V (+24V DC GND)	
	2		+24V DC Supply	
	3	Section 4: Dual Function Digital Inputs/Outputs (4 Off)	Digital I/O Point No.8	
	4		Digital I/O Point No.7	
	5		Digital I/O Point No.6	
	6		Digital I/O Point No.5	
	7	Section 4: Voltage or Current Pulse Inputs (2 Off)	-	Pulse Input No.2
	8		+	
	9		-	Pulse Input No.1
	10		+	
	11	Section 4: 4-20mA Analogue Output (2 off)	-	Analogue Output No.2
	12		+	
	13		-	Analogue Output No.1
	14		+	
	15	Section 4: 4-20mA Analogue Input (3 off)	-	Analogue Input No.3
	16		+	
	17		-	Analogue Input No.2
	18		+	
	19		-	Analogue Input No.1
	20		+	

**Figure 6 - 20-Way Interface Module Connections (TB2)**

### 24V DC Power (TB2.1 & 2)

**FUSE :** Terminal 2 is fused by a 'PTC Resettable Fuse' rated at 0.3A @ 23°C. In the event that the fuse goes high impedance, equivalent to a conventional fuse blowing, the unit needs to be powered down for more than 1 minute in order to reset the fuse; before powering the unit up again.

### Model Numbers

###A#
###B#
###C#

If the controller is powered via terminals **1, 2 & E** from an AC power supply (Field ConnectionsSection 4: Power), then these connections supply a regulated and fused 24VDC supply, suitable for powering 4-20mA loops, pulse transmitters, and low power DC resistive devices. **Do not connect inductive loads to these terminals.**

**Model Numbers** ###0#

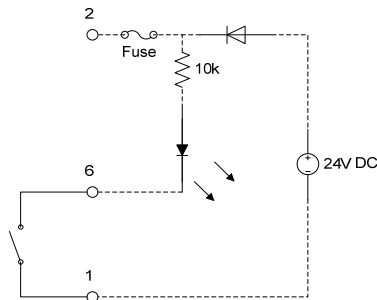
If an AC power supply is not available, the controller is powered via these terminals with a suitably clean and regulated 24V DC supply. Ensure that a suitable means of disconnect is provided and that any associated components are suitably sized.

**Dual Function Digital Inputs/Outputs (4 Off)**

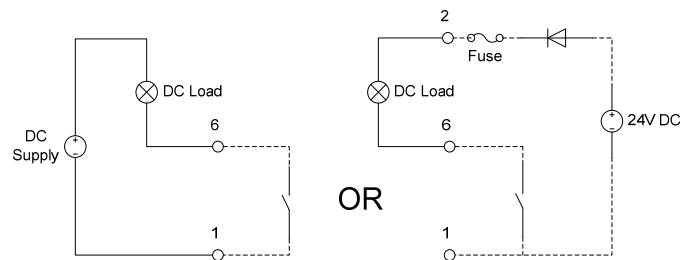
Each digital I/O point is capable of being either a digital input or a digital output as defined by the software application.

Digital inputs require the I/O point to be connected to the Digital I/O Common (Terminal 1 DC ground) to activate the input.

Digital outputs switch the I/O point to the Digital I/O Common (Terminal 1 DC ground), which should be connected to the system DC ground (0V).



**Figure 7 - Connecting a Digital Input<sup>1</sup>**

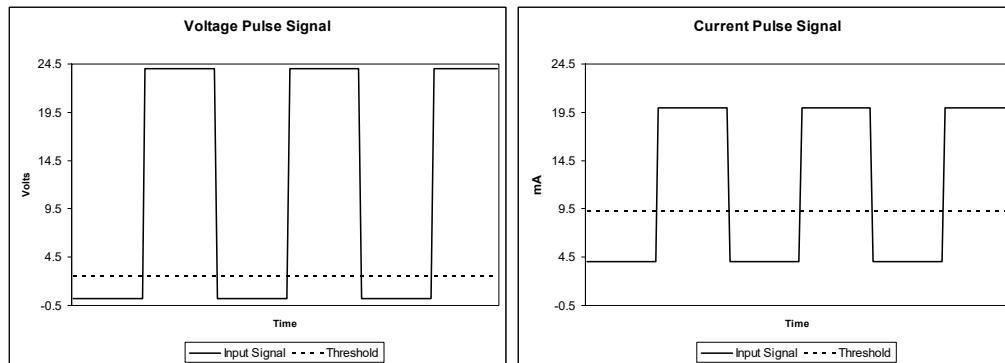
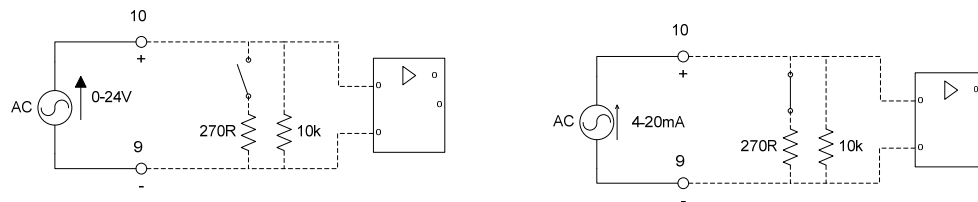


**Figure 8 - Connecting a Digital Output<sup>1</sup>**

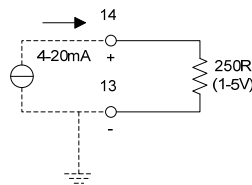
<sup>1</sup> Terminal numbers referenced in the diagram refer to terminal block TB2.

**Voltage or Current Pulse Inputs (2 Off)**

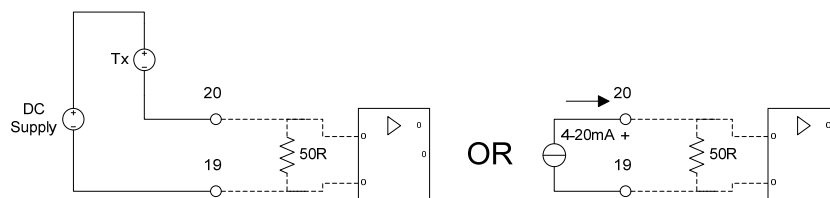
Each Pulse Input is configurable for either voltage or current pulse duty and has a differential input type. If required the trigger threshold of each input can be adjusted to suit a specific application, although the default setting will suit most applications.

**Figure 9 - Voltage and Current Pulse Signals<sup>2</sup>****Figure 10 - Connecting a Voltage or Current Pulse Input<sup>2</sup>****4-20mA Analogue Output (2 off)**

Each analogue output is a current source, sometimes referred to as a 'powered' or 'active' output.

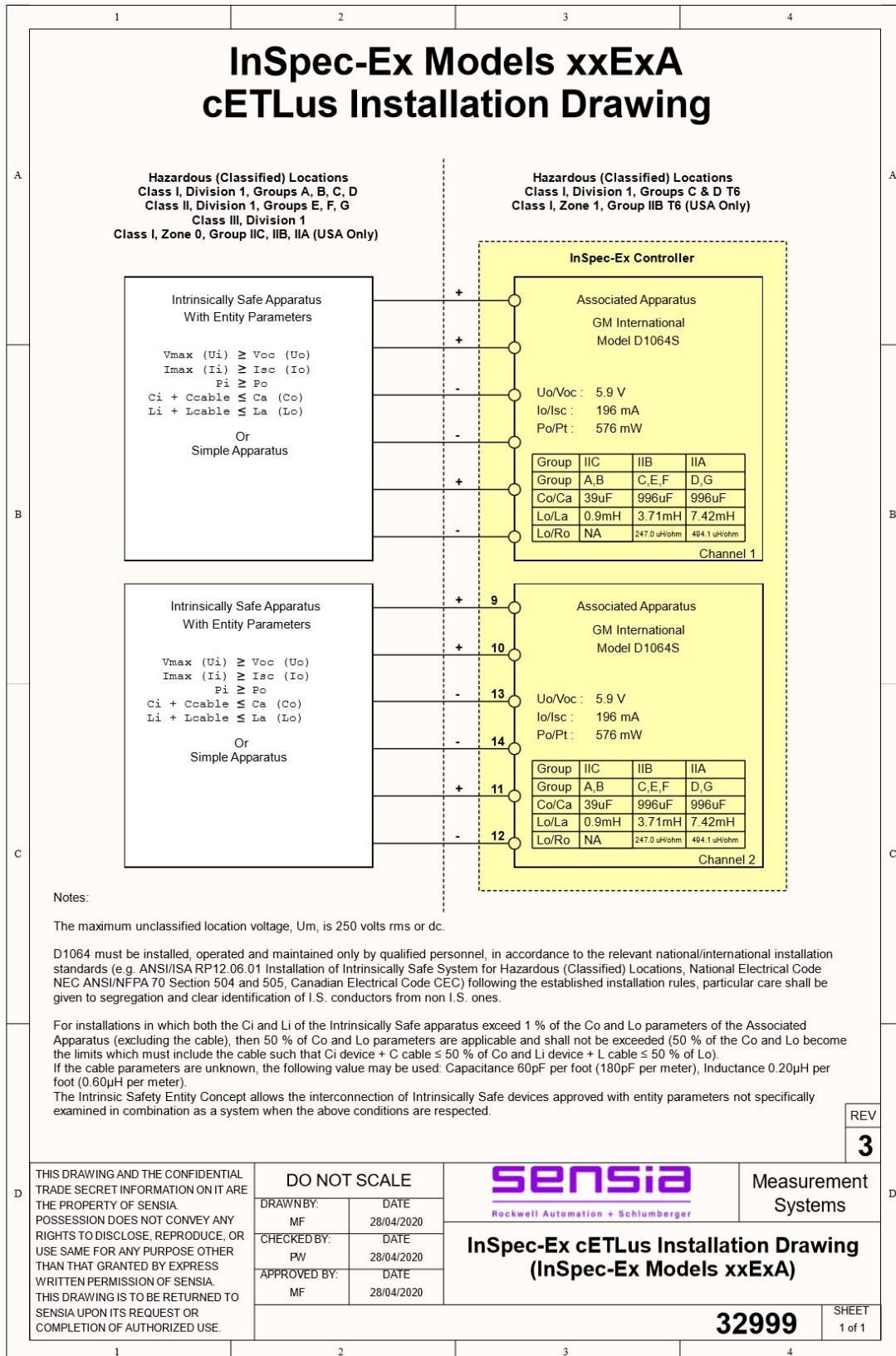
**Figure 11 - Connecting an Analogue Output<sup>2</sup>****4-20mA Analogue Input (3 off)**

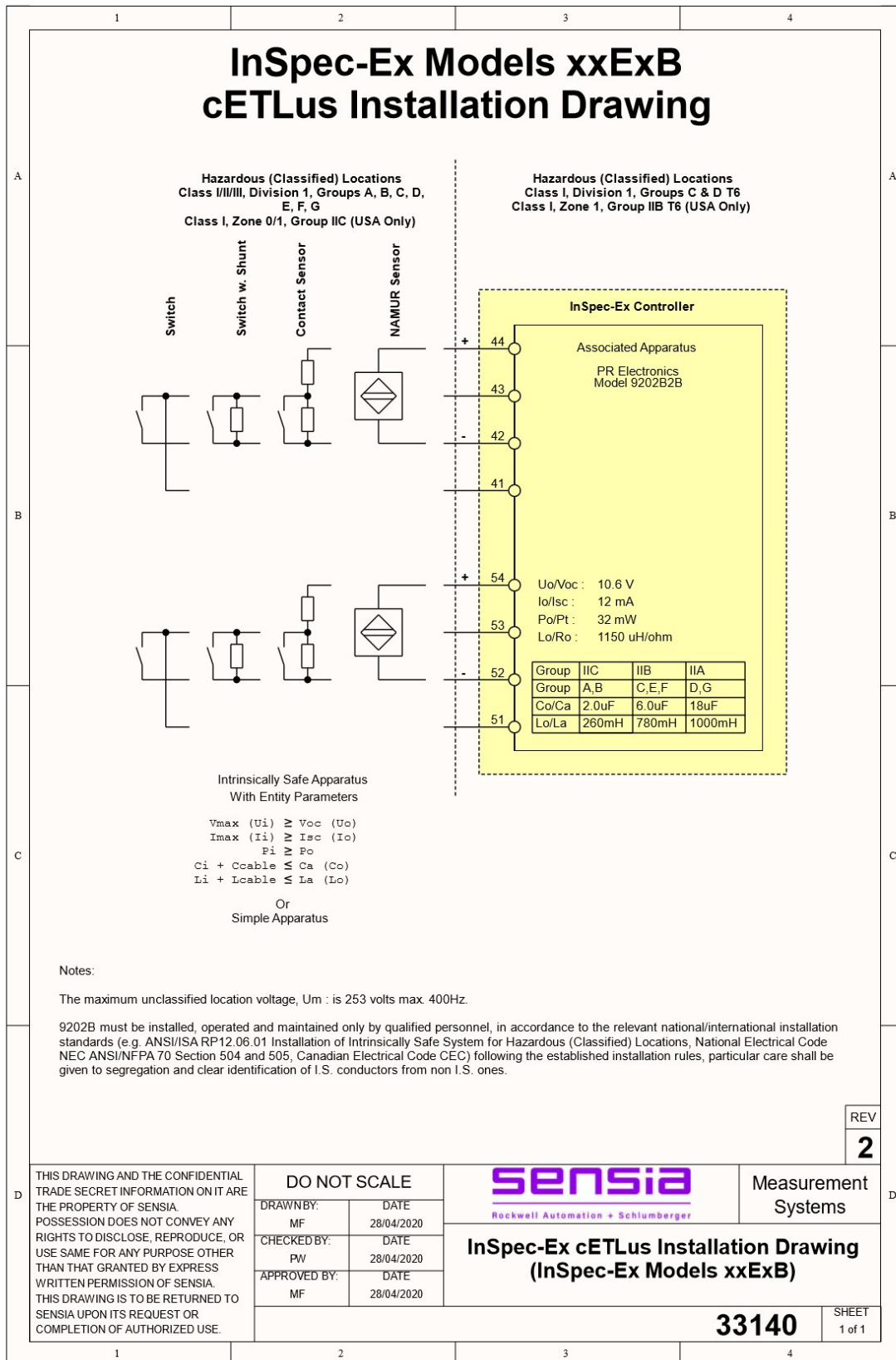
Each analogue input is a passive differential input.

**Figure 12 - Connecting an Analogue Input<sup>2</sup>**

<sup>2</sup> Terminal numbers referenced in the diagram refer to terminal block TB2.

## FIELD CONNECTIONS (INTRINSICALLY SAFE)





## Section 5: Putting Into Service

- Ensure that no unauthorised modifications have been made to the unit.
- Conduit systems - an approved conduit seal shall be used within 18" (450mm) of the enclosure for each conduit run.
- Unused openings for cable or conduit entries shall be closed with blanking elements suitable for the relevant type of protection and shall only be removable with the aid of a tool.
- Ensure that electrical connections are tight and that unused cores are terminated to electrical protective/safety earth at one end.
- Ensure that flame paths are clean and undamaged and that the gasket is secure and undamaged.
- Cover retaining bolts - Use only the bolts supplied with the enclosure. No cover bolts are to be omitted. Install and alternate cover bolt pattern when tightening.

## Section 6: Use

The unit shall only be operated as intended and only in undamaged and perfect condition and only within the environmental and electrical constraints stated within this manual.

## Section 7: Adjustment & Calibration

- Once installed and commissioned the unit requires no adjustment except for periodic recalibration if and when necessary.
- Please refer to the InSpec Controller Handbook Volume 1 for details on the following:
- Analogue input re-calibration;
- Analogue outputs re-calibration;
- Display Contrast Adjustment
- Load-Cell Amplifier Calibration (GM Int. D1064S Modules) - If Fitted.
  - *This procedure requires a GM International Model PPC1090 (Pocket Portable Configurator) or equivalent GM Product.*
  - *Please refer to the D1064S handbook for configuration/operation instructions*
- Can-High Isolating Converter Adjustment (PR Electronics 9202B2B Modules) – If Fitted.
  - *Please refer to the 9202 handbook for configuration/operation instructions.*



**WARNING :** Adjusting the display contrast or Intrinsically Safe Modules requires the enclosure to be open whilst it contains hazardous live parts. This **must** only be carried out within the requirements of all applicable customer, statutory and regulatory requirements.

## Section 8: Safety Information

### ELECTRICAL SAFETY

- **Hazardous Voltages** are capable of rendering an electric shock or burn under normal conditions or in a single fault condition. These are defined as voltages that exceed those of SELV circuits as defined in Section 16:.
- Instrument power should be connected via a suitable power disconnect using a suitably sized and electrically and mechanically protected cable.
- Always replace fuses with appropriate replacements, as defined Section 15:.
- To avoid risk of fire, burns, or damage to your instrument, do not allow conductive/metal objects enter the instruments casing.
- Use only Sensia approved spare parts.
- Do not disassemble. There are no user serviceable parts inside.

### INSULATION TESTING

- This equipment includes protective impedances between the Live, Neutral and Protective Earth of the AC mains power inlet.



## Section 9: Instrument Specification

### GENERAL SPECIFICATIONS

DESIGN AREA	ITEM	DESCRIPTION
<b>Physical</b>	Size (mm)	440mm x 565mm x 240mm (W x H x D) Approx. 17½" x 22¼" x 9½" (W x H x D) Approx.
	Weight	50 kg approx.
	Wire Connections	<b>Screw Terminals</b> : 22-12 AWG (0.5 to 2.5mm²) <b>Interface Modules</b> : 22-12 AWG (0.5 to 2.5mm²) <b>Earth Bus Bar</b> : 22-12 AWG (0.5 to 2.5mm²), 16mm² when cable lug used.
<b>Operating Environment</b>	Equipment Class	I
	Installation Category	II
	Pollution Degree	3 <sup>3</sup> (InSpec-Ex Only)
	Operating Temperature	-20°C to +50°C or +55°C depending upon model. (-4°F to +122°F or +131°F)
	Relative Humidity	80% up to 31°C decreasing linearly to 50% at 40°C
	IP Rating	IP66
	Altitude	2000 metres max. (6562 feet)
<b>User Interface</b>	Display	20 Character x 2 lines.
	LED Indicators	4 multicolour LED's
	Keys	8 operators (21 – Internal Access Only)
<b>Power Supply</b>	Voltage, Frequency	<b>AC</b> : 100 to 240 V AC, 50/60 Hz <b>DC</b> : 24V DC ± 10%
	Power Consumption	<b>AC</b> : 100 Watts Max. (All options fitted) <b>DC</b> : 15 Watts Max. (All options fitted)
<b>Relay Outputs</b>	Quantity	4
	Contact Form	SPST – NO
	Installation Category	III
	Max. Switching Voltage	250V AC, 30V DC
	Max. Switching Current	2 Amps
<b>Digital I/O Points</b>	Quantity	4 <sup>4</sup>
	<b>When configured as an output</b>	
	Contact Form	Solid State Relay
	Load Voltage	24V DC
	Continuous Load Current	0.12A
	Max. On Resistance	35 ohms (Typical 23.5 ohms)

<sup>3</sup> Pollution Degree 3 – Normally only non-conductive POLLUTION occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

<sup>4</sup> If the CanHigh option is fitted, one or two digital IO points will be used by the associated intrinsic safety amplifier.

	Max. Leakage Current	1uA (in off state)
	Over Current Protection	Cut off Current : 160 to 240mA
		Detection Time : 50us
	<b>When configured as an Input</b>	
	Input Type	Volt-free contact
	Max. Excitation Current	2.4mA
<b>Analogue Outputs</b>	Quantity	2
	Output Type	4-20mA Current Source (24V DC Loop Supply)
	Accuracy	±0.1% of FSD (12-bit resolution)
<b>Analogue Inputs</b>	Quantity	3 <sup>5</sup>
	Input Type	4-20mA
	Accuracy	±0.1% of FSD (12-bit resolution)
	Input Impedance	50 ohms
<b>Pulse Inputs</b>	Quantity	2
	Input Type	0 - 24V DC Voltage Pulse or 4 – 20mA DC Current Pulse Max. Frequency 10kHz
	Accuracy	± 1 count in any given sampling period
	Input Impedance	10 k ohms - Voltage input 263 ohms - Current input
	Adj. Trig Threshold Range	Approx. 2.2 to 24 V DC (8 to 20mA DC)
<b>Communications</b>	Quantity	3
	Type	2 off configurable RS232/422/485 ports. 1 off 10/100Mbps Ethernet Port

## INSULATION CO-ORDINATION

The following applies only to the InSpec Controller Electronics.

### AC POWER INLET CREEPAGE/CLEARANCE

Creepage / Clearance from PE to Live or Neutral ≥ 3 / 3 mm

### RELAY OUTPUTS CREEPAGE/CLEARANCE

Creepage / Clearance from Coil to Contact Circuits ≥ 8 / 8 mm

Creepage / Clearance between Relay Circuits ≥ 6 / 6 mm

<sup>5</sup> If the CanWeigh option is fitted, one or two analogue inputs will be assigned for the load-cell amplifier(s).

## COMPLIANCE TO INTERNATIONAL STANDARDS

STANDARD	TITLE
<b>UL698A</b>	Industrial Control Panels Relating to Hazardous (Classified) Locations. (Models ##E#A & ##E#B only).
<b>UL1203</b>	Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
<b>UL61010</b>	Electrical Equipment For Measurement, Control, and Laboratory Use
<b>CSA C22.2 No.14</b>	Industrial Control Equipment. (Models ##E#A & ##E#B only).
<b>CSA C22.2 No.30</b>	Explosion-Proof Enclosures for Use in Class I Hazardous Locations
<b>CSA C22.2 No.61010</b>	Safety requirements for electrical equipment for measurement, control, and laboratory use
<b>FCC CFR47 Part 15</b>	Emission standards for commercial electronic products.

## Section 10: User Interface



The Figure 13 – InSpec Ex Front View

A brief description of the labelled items above follows:

A) The Alarm RGB LED indicator

Colour	Flashing/Steady	Alarm State
Blue	Flashing	- Unacknowledged Warning alarm(s)
Blue	On (Not Flashing)	- Acknowledged Warning alarm(s)
Red	Flashing	- Unacknowledged 'Stop' or 'Emergency Stop' alarm(s)
Red	On (Not Flashing)	- Acknowledged 'Stop' or 'Emergency Stop' alarm(s)

- B) Receiver 2 Tri-Colour LED. The text 'Receiver' is specific to the InSpec Sampler Controller. If you have purchased an InSpec Blender Controller this text will state 'Stream 2'. In either case the LED's indicate which current sampling can/or blending stream is in use. In the case of the sampler, you would always expect either Receiver 1 or Receiver 2 to be lit; whereas in the case of the Blender both streams 1 and 2 will often be active at the same time. The given colour is dependent on the application (Sampler or Blender) and will be explained in the application section of the manual.
- C) Bar Graph Indicator 2. This ten-barred array of LED's represents the user-configured value for the bar graph. A designated register value and associated min and max graph 2 registers (F\_GRAPH\_MIN2/F\_GRAPH\_MAX2) are used to determine the output.
- F) 'DELETE'. This indented secondary button function is associated with the RESET button. When the instrument is being configured the secondary key functions MODE, CANCEL and DELETE are likely to be used far more than their primary button purpose of START, STOP and RESET. The DELETE button allows users to cancel decisions and erase alphanumeric characters from an entered value.
- G) *RESET. This is the primary function of the button and will be used daily/regularly by operators of the instrument to reset a batch/blend. Selecting this button when there is no batch/blend in process will result in a message explaining that there is no batch to reset*
- H) *CURSOR BUTTONS. H points to the right cursor button. Let us look at all of the cursors. The four cursors are primarily used to navigate around the menu. Left and right step you through the available options at any given sub-menu or decision and up and down take you into or out of the current sub-menu. The cursor keys have alternative uses within specific menu functions. i.e., when an engineer is in the register access screen, the right or left cursor will search through the registry looking for a user specified search string. Within the same screen the up and down cursor buttons travel through the registers numerically. On the front panel, the left and right cursor buttons can be used to move between the 12 configurable front display items. In the alarm display screen, the down cursor acts as an acknowledgement button to 'ACK' all active alarms. (See I below).*
- I) *ACK - Acknowledgement The indented ACK button forms the secondary function of the Down cursor button. ACK is used to acknowledge all unacknowledged alarms in the alarm display screen in a two-step process. Pressing this cursor once will take you straight into the display alarms menu option (usually browsed via the 'ControlAlarmsDisplay Alarms' option). Pressing it again will acknowledge all of the alarms in the display. This gives the operator the ability to always look at the new alarms before acknowledging them.*
- K) *Centre Cursor Button. This button doubles up as an alternative Enter key (See E above). Engineers' may find it more convenient/local to use during configuration when they are spending a lot of time using the other directional cursors.*
- L) *TOP. This is the primary function of the button and will be used daily/regularly by operators of the instrument to stop a batch/blend. Selecting this button when there is no batch in process will result in a message explaining that there is no batch to reset.*
- M) *CANCEL. This indented secondary button function is associated with the STOP button. The cancel button can be used to step out of each sub-menu (repeatedly pressing cancel will close the menu and bring you out to the front display) and can be used to cancel out of a control sequence. i.e., when starting a batch/blend the user will be prompted and taken through a series of questions that the user can cancel out of using this button.*
- N) *START. This is the primary function of the button and will be used daily/regularly by operators of the instrument to start a batch/blend. If the instrument is currently running a warning message will appear to tell them a process is currently running.*
- O) *MODE. This is the secondary function of the START button. It will only ever be used by an engineer whilst configuring/changing the current controller's parameters. The mode button is used in the register access screen to bring up a list of function choices that can be performed on any given register (Set Current, Description, Display, Search, View Modbus Address and Set Modbus Address). It can also be optionally used when the engineer selects 'Set Current' on an integer or long integer value to toggle between Decimal and Hex entry mode.*
- P) *Bar Graph Indicator 1. This ten-barred array of LED's represents the user-configured value for the bar graph. A designated register value and associated min and max graph 1 registers (F\_GRAPH\_MIN1/F\_GRAPH\_MAX1) are used to determine the output.*

- Q) The 20x2 LCD front display screen.
- R) Receiver 1 Tri-Colour LED. The text 'Receiver' is specific to the InSpec Sampler Controller. If you have purchased an InSpec Blender Controller this text will state 'Stream 1'. In either case the LED's indicate which current sampling can/or blending stream is in use. In the case of the sampler, you would always expect either Receiver 1 or Receiver 2 to be lit; whereas in the case of the Blender both streams 1 and 2 will often be active at the same time. The given colour is dependent on the application (Sampler or Blender) and will be explained in the application section of the manual.
- S) Status RGB LED. This lamp is used to indicate what the current status of the controller is. Both the sampler and the blender have recognised status conditions indicating the current operating condition of the controller. The given colour is dependent on the application (Sampler or Blender) and will be explained in the application section of the manual.
- T) The up cursor button is primarily used to scroll through the given character set to look for a required alphanumeric character during data entry and to scroll through the register list. It can also be used from the front display to turn 'scrolling' on and off. Scrolling is described in the display section.

## BASIC OPERATION OF THE INSTRUMENT

For instructions on basic operation of the instrument, please refer to Volumes 1 & 2 of the IOM manuals for either the Sampler or Blender Controller, as appropriate.

## Section 11: Inspection & Maintenance

Inspection and maintenance of this equipment should be carried out to the National Electric Code (NEC).

Repairs may only be carried out by a qualified electrician and will subsequently have to be checked by an “expert”.



**WARNING**

**This Instrument Has No User Serviceable Parts  
Any Attempt To Repair The Instrument May Invalidate The Warranty  
Opening up enclosure will reveal hazardous live parts**

### HEALTH & SAFETY PRECAUTIONS

#### MAINTENANCE

There are no special checking or maintenance requirements for this equipment.

Any calibration requires the enclosure to be opened and power to be applied. This may require authorised access under the site permit-to-work system and/or continuous gas monitoring as determined by the site operator's health and safety systems.

#### ANNUAL MAINTENANCE

- It is recommended that the Jiskoot InSpec Ex is calibrated, and a detailed inspection of the equipment carried out at least once per annum.
- The enclosure should be inspected on a regular basis after installing.
- A visual inspection should be made to ensure all cover bolts are installed, tight and in good condition.
- A visual inspection should be made to ensure all conduit/cable connections are intact and free of corrosion.
- If the enclosure must be opened for servicing, the following procedures should be followed:
  - Disconnect power (Isolate circuits)
  - Remove all cover bolts, clean and inspect. Replace any corroded or otherwise damaged bolts with factory approved bolts.

#### ENCLOSURE SCREW/BOLTS



**Use only those bolts supplied with the enclosure.**

#### OTHER

Before reassembling the enclosure, inspect the cover gasket and ensure that it is secure and undamaged. If the gasket is damaged, replace with factory approved gasket and adhesive.

Inspect and clean the machined flanges on the box and cover. Surfaces must be smooth, free of nicks, scratches, dirt or foreign objects.

The enclosure shall be operated as intended and only in undamaged and perfect condition

#### **ATTENTION**



**Caution!**

Handle electronic components and printed circuit card assemblies only when you are properly grounded in an ESD Protected Area (EPA). You are a source of ESD unless you are grounded properly.

Modern electronic devices are very sensitive to static electric charges.

Use a grounding wrist strap at all times.

Place all electronic components on a static-dissipative surface or in a static-shielded bag when they are not in the chassis.

Store and transport ESD-sensitive items in static-shielding containers, such as specially marked bags or boxes.

## Section 12: Product Specific Drawings

Please refer to the project specific documentation package.



## Section 13: Troubleshooting

Please also refer to the trouble shooting section in Volume 1 - InSpec Common Handbook, for trouble shooting of the main instrument.

### SOLVING COMMON PROBLEMS


#### POWER PROBLEMS

##### Instrument does not power up?

- ☑ Check the integrity of the power supply up to the unit and that it is within the acceptable limits (See Section 4: Power).


##### **AC mains powered units:-**

- ☑ Check that the 20mm fuse in the fused terminal 'F2', on the main terminal rail is good and of the correct size and type (See Section 15: Spare Fuses).

 The main instrument has two integral fuses near the IEC inlet that should also be checked if checking 'F2' does not resolve the problem.


##### **DC 24V powered units:-**

- ☑ Check that the 20mm fuse in the fused terminal 'F8', on the main terminal rail is good and of the correct size and type (See Section 15: Spare Fuses).

 The main instrument has an integral 'PTC Resettable Fuse' on the 24V DC power supply inlet. If the fuse has 'blown' the unit needs to be powered down for more than 2 minute to reset the fuse, before powering the unit up again.

##### Instrument power fuses keep blowing?

If the AC power fuses or 24V DC fuse blow regularly the most likely cause of the problem is the external wiring.

- ☑ Check that the external wiring is correct and is without faults.
- ☑ Check that none of the unit's inputs or outputs are being overloaded.
-  If the power supply is of poor quality, internal circuits for suppression of voltage transients may prematurely age the fuses and cause them to blow.

#### DISPLAY PROBLEMS

Any front panels should display a start-up message as soon as they are powered up, but it will take about 5 to 10 seconds for the application software to run up and start updating the display:-

- ☑ If none of the LED's or LCD light up soon after power up, check the integrity of the power supply (See above).
- ☑ Power down the unit for 2 minutes before trying again.

If the LCD contrast is not satisfactory please refer to Volume 1 - InSpec Common Handbook.

#### SERIAL PROBLEMS

If a serial link does not work then double-check the wiring. Connection terminology for RS422 and RS485 does vary between manufacturers is responsible for most problems.

## Section 14: Support

### RECOMMENDED SPARES

When requesting assistance or spare parts, please advise the Instrument Model and Serial Numbers to ensure that the correct options are supplied.

#### **First 10 Years Operation**

During Commissioning and for approximately the first 10 years of operation, Sensia only anticipate the requirement for spare fuses.

#### **10+ Years Operation**

At about 10 years, the internal battery and LCD backlight may require replacement.

### REPACKAGING FOR SHIPMENT

If the instrument is to be shipped to Sensia for service or repair, be sure you do the following:

- Place the instrument in its original container with appropriate packaging material.
- Secure the container with strong tape or metal bands.

## Section 15: Recommended Spare List

When requesting assistance or spare parts, please provide the Model and Serial Numbers to ensure that the correct options are noted.

During the normal course of events we do not anticipate any spares requirements for the InSpec, except for replacement 5 x 20mm cartridge fuses.

### SPARE FUSES

All fuses are 5 x 20mm anti-surge (T) high breaking capacity (H) fuses conforming to UL 248-1 & CSA C22.2 No. 248.1. Replacement fuses must be of an identical specification and pre-approved for AC & DC rating.

The absolute maximum fuse sizes that may be fitted to the unit are listed below: -

Fuse Identifier	Value Type	Duty	Sensia Part No.
F1	5x20mm T 2A H 250V	AC-DC 24VDC PSU Inlet Fuse	3J-28-0050-00
F2	5x20mm T 0.5A H 250V	InSpec Main AC Supply Fuse.	3J-28-0043-00
F3, 4, 5 & 6	5x20mm T 2A H 250V	Relay Output Circuit Fuses	3J-28-0050-00
F7	5x20mm T 2A H 250V	AC-DC 24VDC PSU Output Fuse	3J-28-0050-00
F8	5x20mm T 0.5A H 250V	AC-DC 24VDC PSU Output Fuse (AC Powered Models - xxxAx, xxxBx or xxxCx), or InSpec Main DC Supply Fuse (DC Powered Models - xxx0x).	3J-28-0043-00

### OTHER SPARES

Only exact replacements should be fitted to the InSpec-Ex or suitable alternatives supplied by Sensia (UK) Ltd, covered by the unit's certification. Below is a list of spares: -

InSpec-Ex Model Number	Item	Manufacturer	Model No.	Sensia Part No.
###A	I.S. Load-Cell Amplifier	GM International	D1064S	3J-42-0215-00
###B	I.S. Can-High Isolator	PR Electronics	9202B2B	3J-42-0217-00
###A#	AC/DC PSU, 24VDC, 10W	TDK-Lamda	DSP10-24	3J-24-1018-00
###C#				
###B#	AC/DC PSU, 24VDC, 40W	TDK-Lamda	DSP60-24	3J-24-1019-00
###C#				

## Section 16: Abbreviations & Acronyms

### ABBREVIATIONS & ACRONYMS

AC	- Alternating Current
DC	- Direct Current
DIP	- Dual In-line Package
EMC	- Electromagnetic Compatibility
GND	- GrouND (0V DC)
I/O	- Input or Output
IEC	- The International Electrotechnical Commission
IOM	- Installation, Operation & Maintenance (Manuals/Handbooks)
LCD	- Liquid Crystal Display
LED	- Light-Emitting Diode
NC	- 1. Normally Closed 2. Not Connected (DO NOT CONNECT)
NO	- Normally Open
PE	- Protective Earth
Pollution	- Addition of foreign matter, solid, liquid or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity.
PSU	- Power Supply Unit
PTC	- Positive Temperature Coefficient
RGB	- Red/Green/Blue
rms	- Rout-mean-square (rms value of an AC sine wave is 0.707 times the peak value.)
RS232	- Physical Link Layer Telecommunications Protocol
RS422	- Physical Link Layer Telecommunications Protocol
Rx	- Receive – Telecommunications (RS232)
Rx +	- Receive (non-inverted) – Telecommunications (RS422 or RS485)
Rx -	- Receive (inverted) – Telecommunications (RS422 or RS485)
SELV	- Safety Extra-Low Voltage circuit An SELV circuit is defined as a circuit that is so designed and protected that under both normal and single fault conditions, its voltages do not exceed a safe value. Under normal conditions, the voltage of such a circuit cannot exceed 33 V rms and 46.7 V peak or 70 V DC. In the event of a single fault, the voltage cannot exceed 55V rms and 78 V peak or 140 V DC.
SSR	- Solid State Relay
TVS	- Transient Voltage Suppressor
Tx	- Transmit – Telecommunications
Tx +	- Transmit (non-inverted) – Telecommunications (RS422 or RS485)
Tx -	- Transmit (inverted) – Telecommunications (RS422 or RS485)

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## Appendix A: Publisher Notes

### SUPPORT

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