sensia
Rockwell Automation + Schlumberger

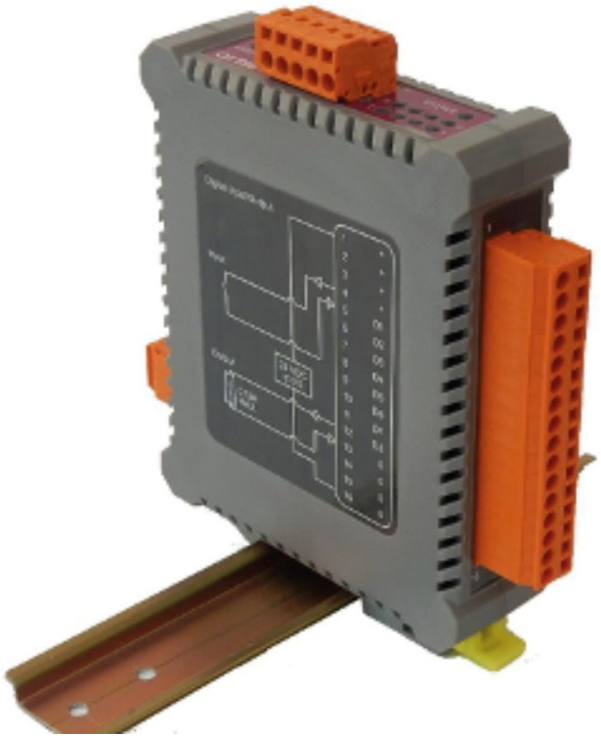
+ MEASUREMENT

JISKOOT™ MEASUREMENT SYSTEMS

+ InSpec Remote I/O Module

Installation, Operation & Maintenance Manual

MODEL: RIO-DIO (DIGITAL INPUT/OUTPUT)
RIO-PUL (PULSE/FREQUENCY INPUT)
RIO-ANI (ANALOG INPUT)
RIO-ANO (ANALOG OUTPUT)



Manual No. H109, Rev. 2

Important Safety Information

Terms Used in This Manual

Caution	**Caution, risk of electric shock**
Attention	***Attention, risque d'électrocution***

WARNING	**A warning identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.**
AVERTISSEMENT	***Un avertissement identifie des informations sur des pratiques ou des circonstances pouvant entraîner des blessures corporelles ou la mort, des dommages matériels ou des pertes économiques.***

Caution	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.
Attention	*Indiquez les actions ou les procédures qui, si elles ne sont pas effectuées correctement, peuvent entraîner des blessures ou un mauvais fonctionnement de l'instrument ou de l'équipement connecté.*

Note	Indicates additional information about specific conditions or circumstances that may affect instrument operation.
Remarque	*Indique des informations supplémentaires sur des conditions ou des circonstances spécifiques pouvant affecter le fonctionnement de l'instrument.*

REVISION HISTORY

Revision:	Description of change:	Issuer:	Approver:	Date:
1	1st Issue	MF	TMM	26 July 2018
2	Change Document Branding to Sensia	MF	TMM	1st May 2020

*Mark of Sensia

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GENERAL

WARNING!

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

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

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

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

GENERAL

AVERTISSEMENT!

Pour éviter tout risque de choc électrique et d'incendie, les consignes de sécurité de ce manuel doivent être observées, et les instructions suivies.

Les spécifications ne doivent pas être dépassées, et l'unité ne doit être appliquée que comme décrit dans le texte suivant.

Ce manuel doit être examiné avec soin, avant l'installation et la mise en service de l'unité.

Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection assurée par l'équipement peut être altérée.

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.

INSTALLATION

AVERTISSEMENT!

L'installation ne peut être effectuée que par un électricien qualifié, conformément à la législation nationale, y compris les normes pertinentes.

Toutes les données techniques sur l'instrument doivent être observées.

Modifications de l'équipement ne sont pas autorisés.

L'équipement ne doit être utilisé comme prévu par le fabriquant et uniquement si il est en parfait état.

Une séparation suffisante doit exister entre les différents câbles et les fils transportant différents types de signaux ou de puissance et tous les autres circuits.

Tous les fils doivent être terminés, avec pattes de sertissage. Les noyaux non-utilisés doivent être terminés au jeu de barres de la terre.

Section 1: **Introduction**

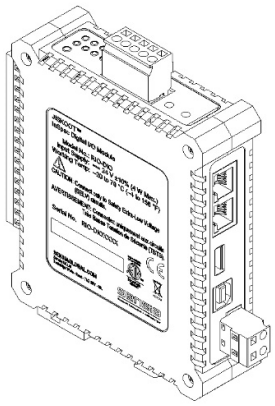
DESCRIPTION

The Jiskoot™ InSpec* Remote I/O Module is designed to extend the I/O capabilities of the Jiskoot InSpec Enhanced Controller for sampling, blending, or wild stream control applications.

These modules are not intended for use in explosive atmospheres, such as in the presence of flammable liquids, gases or dust. However, the modules are available in a package suitable for explosive atmospheres, the Jiskoot InSpec Remote I/O Hub.

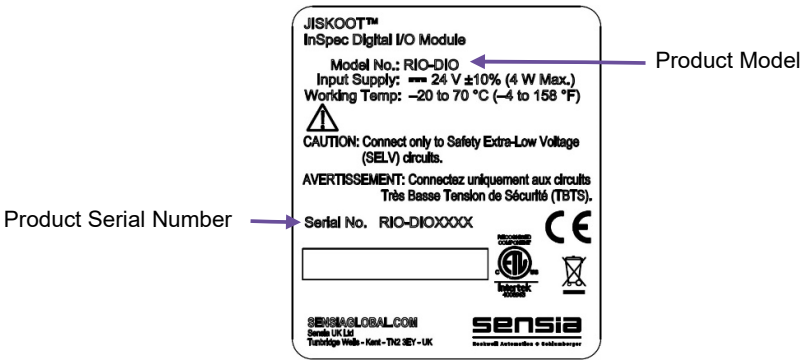
Modules may be sold separately or as part of a system. They are not intended to be used as a stand-alone piece of equipment, but rather, to be integrated into an end-product.

Each module provides 8 channels of input or output and clips onto standard IEC/EN 60715 TH 35 steel mounting rail. Four module types are available - digital input/output, pulse input, analogue input, and analogue output. The maximum number of modules that can be combined in an application is limited only by the application software and Ethernet LAN constraints.



PRODUCT IDENTIFICATION

Each module is labelled with a serial tag that identifies it by model (I/O type) and serial number.

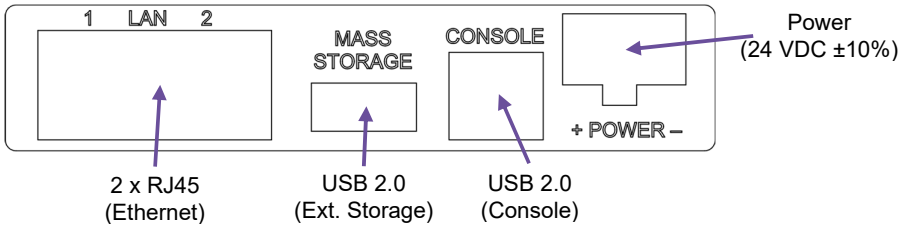


PRODUCT MODEL		DUTY
RIO-DIO	(Digital IO)	8 x digital input/outputs
RIO-PUL	(Pulse Input)	8 x pulse (frequency) inputs
RIO-ANI	(Analogue Input)	8 x 4-20 mA analogue inputs
RIO-ANO	(Analogue Output)	8 x 4-20 mA analogue outputs

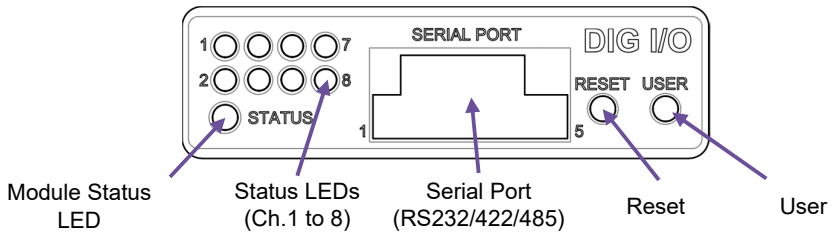
STANDARD FEATURES

Each module features standard connections for power, Ethernet, serial communications and field inputs and outputs. A set of LEDs indicate the local status of the module and I/O and a push-button allows the module to be reset locally.

Power & Ethernet



Status LEDs, Pushbuttons & Serial Communications



Module Status LED

LED DEFINED OPERATION	DESCRIPTION
Off	No power/device failure
Flashing Green	Normal: connected and polling (2 Hz).
Flashing Red	Operational alarm (2 Hz).
Solid Green	Device in Bootloader mode, unknown software error, or state machine has stopped.
Solid Red	Reset / Watchdog Reset

Channel Status LEDs

MODULE (8 X LEDS)	LED DEFINED OPERATION	DESCRIPTION
Digital IO (RIO-DIO)	Solid Green	Digital Input On
	Solid Red	Digital Output On
Pulse Input (RIO-PUL)	Flashing Green	Pulses coming in
	Solid Red	No count
Analogue Input (RIO-AIN)	Solid Green	Input within limits
	Solid Red	Input outside limits
Analogue Output (RIO-ANO)	Solid Green	Output healthy
	Solid Red	Output fault

OPTIONS

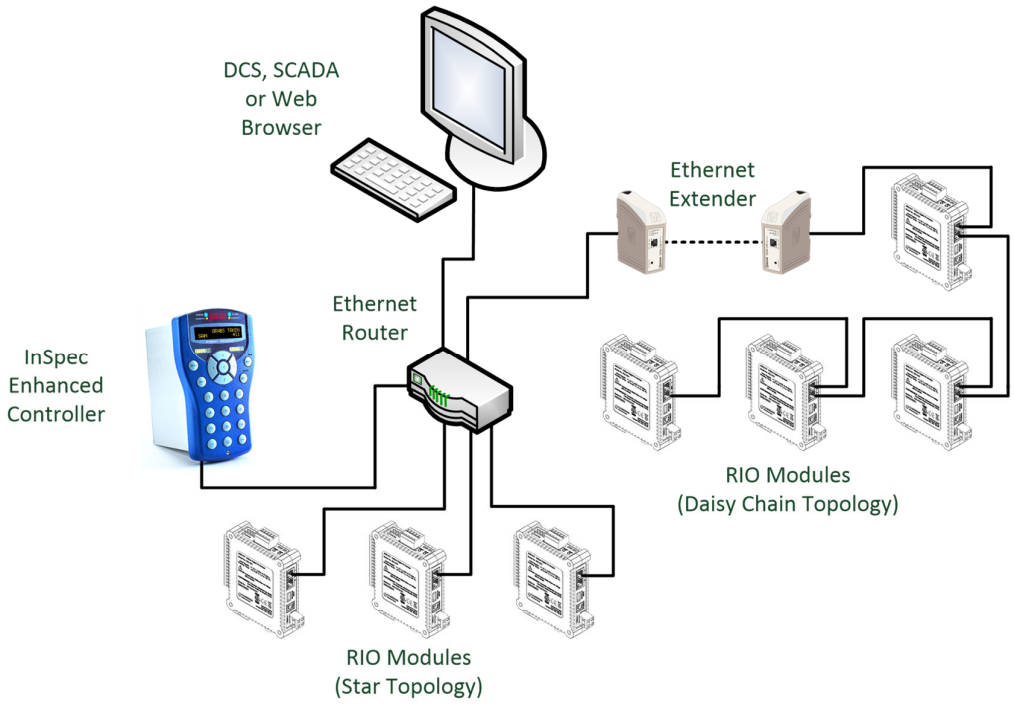
There are 4 Remote I/O module types: RIO-DIO, RIO-PUL, RIO-AIN & RIO-ANO.

The modules do not have any hardware or internal configuration options, for example internal switches, jumpers or links.

WEB BROWSER-BASED INTERFACE

The web browser-based interface in the InSpec Enhanced Controller equips you to configure, calibrate and perform simple diagnostic tests on each module. You need only an Ethernet connection and IP address to connect to the controller.

Please refer to the InSpec Enhanced Controller manuals for further information.



Section 2: **Specifications**

Table 2.1 — InSpec Remote I/O Module General Specifications

DESIGN AREA	ITEM	DESCRIPTION	
Physical	Size (H x W x D	Approx.134 x 33 × 110 mm (excluding connectors)	
	Weight	Approx. 0.3 kg (including connectors)	
	Wire connections	USB 2.0 Type A and Type B, Ethernet (10/100 BASE-T) RJ45, Other (Cage Clamp®): 0.08 to 2.5 mm² (28 to 12 AWG)	
	Mounting	IEC /EN 60715 TH 35 steel mounting rail	
Operating Environment	Installation category	I	
	Pollution degree	2 (normally, only non-conductive pollution occurs; however, temporary conductivity caused by condensation will occur occasionally)	
	Operating temperature	-20 to 70°C (-4 to 158°F)	
	Relative humidity	80% up to 31°C (87.8°F), decreasing linearly to 50% at 40°C (104°F)	
	Altitude	2000 m (6,562 ft.) max.	
User Interface	LED indicators	9 bi-colour LEDs (red, green); 8 channel-specific status indicators and 1 module status indicator	
	Buttons	2 push-buttons	
Power Supply	Voltage	DC: 24 VDC (± 10%)	
	Power consumption (max.)	RIO-DIO : 4 Watts	RIO-PUL : 5 Watts
		RIO-ANI : 4 Watts	RIO-ANO : 7 Watts
	Fuse (Internal)	1A (self-resetting PTC) fuse	
Communications (USB)	Type	USB 2.0	
	Quantity	1 x USB Type A – Mass storage devices only 1 x USB Type B – Operating System Console Port (Shell)	
Communications (Ethernet)	Type	Base 10/100 Ethernet LAN RJ-45 Connector	
	Quantity	2	
	Supported Protocols	Modbus TCP	
Communications (Serial)	Type	RS-232/422/485 (Software Configurable)	
	Quantity	1	
	Supported Protocols	TBA	

Table 2.2 — Module Type RIO-DIO Specifications

DESIGN AREA	ITEM	DESCRIPTION
Channels	Type	Software-configurable input/output
	Quantity	8
Digital Output	Type	Sourcing
	Contact form	Solid-state relay (SPST – NO)
	Load voltage	26.4 VDC max.
	Continuous load current	0.12 A max.
	Max. on resistance	35 ohms (typical 23.5 ohms)
	Max. leakage current	1 µA (in “off” state)
	Overcurrent protection	Cut-off current: 160 to 240 mA
		Detection Time: 50 µs
Digital Input	Type	Sinking
	Input voltage	26.4 VDC max.
	Input current	Min. turn-on current < 1mA @ 24 VDC. Max. 2.4mA @ 24 VDC
LEDs	Status	8 off, 1 per channel

Table 2.3 — Module Type RIO-PUL Specifications

DESIGN AREA	ITEM	DESCRIPTION
Channels	Type	Voltage - Differential Input
	Quantity	8
Pulse Input	Input Frequency	10 kHz max. (50:50 duty cycle)
	Input voltage range	0 V to 26.4 VDC
	Input threshold	0 to 24 VDC approx. (programmable, per channel)
	Input impedance	10 k ohms
	Accuracy	±1 count in a sampling period
LEDs	Status	8 off, 1 per channel

Table 2.4 — Module Type RIO-ANI Specifications

DESIGN AREA	ITEM	DESCRIPTION
Channels	Type	Current (4-20 mA) – Differential Input
	Quantity	8
Analogue Input	Accuracy	±0.05% of full-scale at calibrated temperature
	Temperature effect	±0.25% of full scale over full operating temperature range
	Input impedance	110 ohms (500 ohms max.)[1]
	Calibration	Via web interface
LEDs	Status	8 off, 1 per channel

[1] The input impedance seen by the current source varies, depending upon the loop current and voltage, due to operation of the input protection circuit.

Table 2.5 — Module Type RIO-ANO Specifications

DESIGN AREA	ITEM	DESCRIPTION
Channels	Type	Current (4-20 mA) - Sourcing
	Quantity	8
Analogue Output	Accuracy	±0.05% of full-scale at calibrated temperature
	Temperature effect	±0.25% of full scale over full operating temperature range
	Max. Load	2000 ohms max. per bank (Ch. 1-4, Ch. 5-8), 1000 ohms max. per channel.
	Calibration	Zero and full-scale - via web interface
LEDs	Status	8 off, 1 per channel

COMPLIANCE WITH INTERNATIONAL STANDARDS

STANDARD	COMPLIANCE
EN 61010-1: 2010 IEC 61010-1: 2010 UL 61010-1: 2012 CAN/CSA-C22.2 No. 61010-1: 2012	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
IEC 61326-1:2013	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
IEC 61000-3-2:2014	Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
IEC 61000-3-3:2013	Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
FCC CFR47 Part 15.107 & 109	Federal Communications Commission, Code of Federal Regulations Title 47 – Telecommunications, Part 47, Part 15 - Radio Frequency Devices, Subpart B – Unintentional Radiators, 107 – Conducted Limits & 109 – Radiated emission limits.

Section 3: **Installation**

WARNING	All technical specifications must be respected (Section 2:) The module is not intended for stand-alone use, but is incorporated into the final product, access to which is only allowed to competent persons. A suitable mechanical, electrical and fire enclosure must be provided by the end use equipment for mechanical, electric shock and fire hazard protection.
AVERTISSEMENT	*Toutes les spécifications techniques sont à respecter (*Section 2:*).* *La module n'est pas destiné une unité isolée, mais est incorporée dans les produits finaux hôte dont l'accès n'est autorisé qu'aux personnes compétentes.* *Une enceinte appropriée doit être prévue par l'utilisateur final pour assurer la protection contre les chocs mécaniques, les chocs électriques et l'incendie.*

OVERVIEW

The module is fully assembled at the time of shipment and ready for mounting.

ENVIRONMENT

The instrument is designed for use in a dry and ventilated indoor environment, where neither explosive atmospheres or flammable materials exist.

Avoid direct sunlight, dust, mechanical vibrations and shock, humid atmospheres and prolonged condensation.

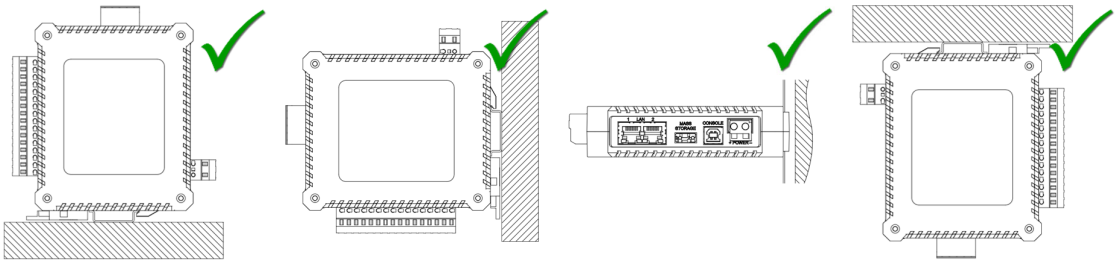
Heating in excess of the stated limits for ambient temperature should be avoided by way of ventilation.

MOUNTING

Only technicians who are familiar with the technical terms, warnings, and instructions in the manual and who are able to follow these should connect the device.

ORIENTATION AND SPACING

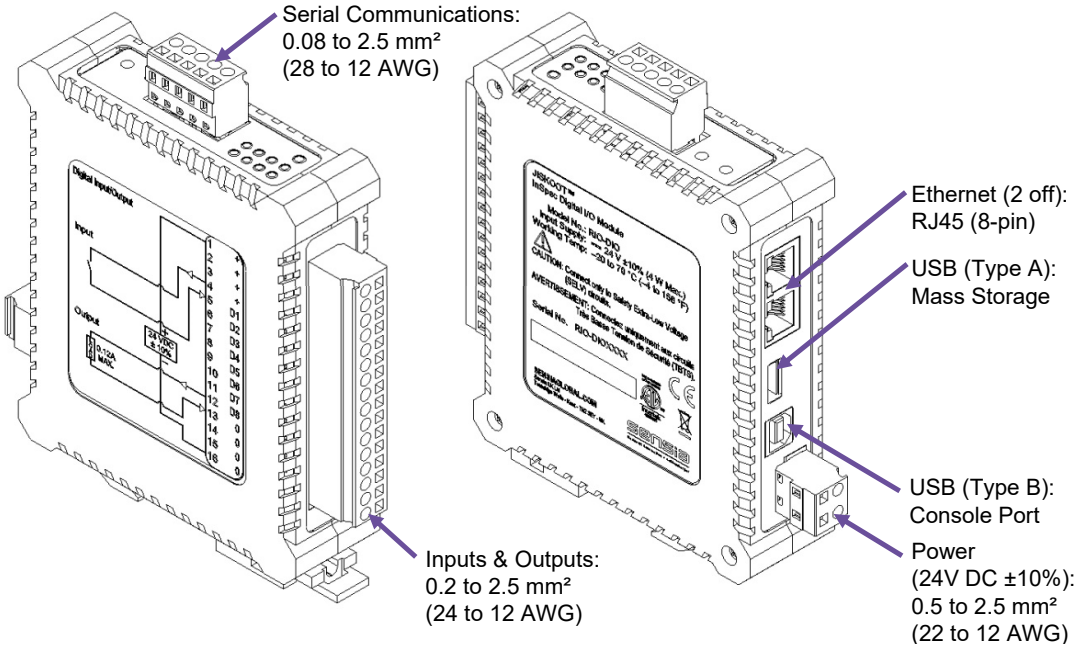
Mount the module on IEC /EN 60715 TH 35 steel mounting rail, in any orientation, in a location that it is easily accessed for maintenance.



Leave enough space around the modules to ventilate heat efficiently.

WIRING

WARNING	All wiring must conform to the local codes and ordinances that are in your particular location. All circuits wired to the module must be connected to SELV circuits. All plugs must be plugged into the module.
AVERTISSEMENT	*Tout le câblage doit être conforme aux codes et aux ordonnances locaux de votre site particulier.* *Tous les circuits câblés aux fiches 5 et 6 doivent être reliés à des circuits TBTS.* *Toutes les fiches doivent être enfichées au module.*



MINIMUM WIRING REQUIREMENTS

CONNECTOR	MINIMUM WIRE SIZE	RECOMMENDED WIRE TYPE
24V DC “Power” (2-way plug)	0.5mm² (22 AWG)	UL Style 1015, CSA TEW, BS6231
Field wiring (26-way plug	0.2mm² (25 AWG)	UL Style 1015, CSA TEW, BS6231
“Serial Port” (5-way plug)	0.08mm² (28 AWG)	UL Style 1015, CSA TEW, BS6231

EARTHING (GROUNDING) REQUIREMENTS

Each module must be mounted on a IEC /EN 60715 TH 35 steel mounting rail that is connected to a low-impedance earth (ground).

Shielded (Screened) Cables

Signal or control cable screens and drain wires should be terminated onto a low-impedance earth (ground), preferably using a 360° shield (screen) clamp. If pigtails are used, where the screen is brought down to a single wire and connected to the earth point, they must be as short as possible; otherwise the inductance of the pigtail renders it ineffective at high frequencies.

- For a circuit with an ungrounded source, the screen should be terminated at the input end.
- If the input is floating and the source is grounded, the screen should be terminated at the source end.
- If both the signal source and signal inputs are grounded, terminating the screen at both ends is not recommended as it 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. The circuit loop area should be kept small, and the screen should not form part of the circuit.

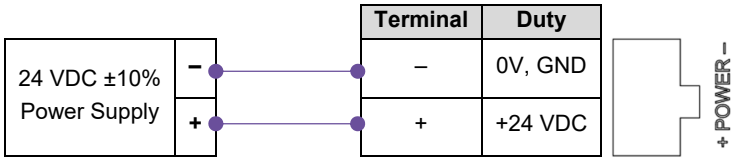
POWER (24 V DC ±10%)

WARNING	The main power supply must be provided via a double pole isolator with a fuse to AC-DC power supply; located nearby and well identified and appropriate safety approvals for the country of final use of equipment.
AVERTISSEMENT	*D'alimentation électrique principal doit être assurée via un double isolateur de pôle avec un fusible à l'alimentation AC-DC électrique; situé à proximité et bien identifiés et approbations de sécurité appropriées pour le pays d'utilisation finale de l'équipement.*

The modules must be connected to an external DC power supply, capable of supplying a clean (low noise) regulated 24 V DC ±10% supply, with sufficient capacity to supply the total load.

The output of the power supply must be overload protected and double/reinforced insulated from the AC supply per IEC/EN/UL 61010-1 and CSA C22.2, No. 61010-1. Refer to Table 2.1 for module power consumption values.

Only use a clean, overload protected, 24 VDC supply to power the modules. Maximum recommended fuse size is 2 amps. When a RIO-DIO module is switching inductive loads, consider a separate supply for the analog inputs and outputs.



Each module has an internal PTC resettable fuse that will go to a high resistance to limit current flow in the event of a fault (equivalent to a conventional fuse blowing). To reset the fuse, power down the unit, wait 1 minute to reset the fuse, and power the unit up again.

COMMUNICATIONS

USB 2.0 Type B (Console)

This port is reserved for instructed personnel only to gain access to the module's operating system console (shell), command line interface.

USB 2.0 Type A (Mass Storage)

This port is reserved for use with a USB flash drive for product software/firmware updates.

Ethernet (RJ45) – LAN Ports 1 and 2

The two RJ45 ports provide for Ethernet communications required for accessing the module's internal registers via the Modbus TCP protocol. The ports have Auto-MDI/MDIX and support both "straight through" and "crossover" cables without any reconfiguration.

LED COLOUR	LED STATUS	INDICATION
Green	Link/Activity	ON = Link established Flashing = Data Activity (Port Active)
Yellow	Speed	ON = 100Mb/s OFF = 10Mb/s

Each module may be daisy-chained (linear topology) with other modules using the two Ethernet ports. The maximum cable distance between modules (a segment) is 100 m (330 ft). If a greater distance is required, consider using a Westermo™ Model DDW-120 Ethernet SHDSL Extender (www.westermo.com).

Serial Communications

The Serial Port on top of the module supports digital serial communication using EIA-RS-232, EIA-RS-422 and EIA-RS-485 hardware; but is reserved for future use.

RS-232 communication is only suitable for point-to-point short range communications, typically 15 m (50 ft) or less. Distances of up to 1200 m (4000 ft) may be achieved with RS-422 or RS-485 communications and will support multiple nodes on the same network.

TERMINAL	RS-422/RS-485 DUTY		RS-232 (DTE) DUTY	
1	0V, GND	—	0V, GND	—
2	Tx+	→	NC*	—
3	Tx-	→	Tx	→
4	Rx-	←	Rx	←
5	Rx+	←	NC*	—

**NC means "No Connection." Do not connect.*

RS-422 Terminology

The terminology for RS-422 terminations is generally as follows:

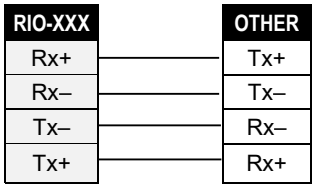
Rx+	=	R+	=	A'
Rx–	=	R–	=	B'
Tx+	=	T+	=	A
Tx–	=	T–	=	B

RS-422 and RS-485 Termination

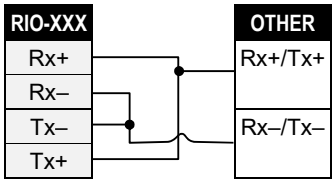
For correct operation of the multi-drop bus, the communication lines must be held in the default fault-tolerant position. For RS-422, this is done at each receiver. Rx+ is pulled low (0 V) and Rx- is pulled high (5 V).

For RS-485, this is done at each transceiver. Tx+/Rx+ is pulled low (0 V) and Tx–/Rx– is pulled high (5 V).

RS-422 and RS-485 Connections



RS-422 Connections

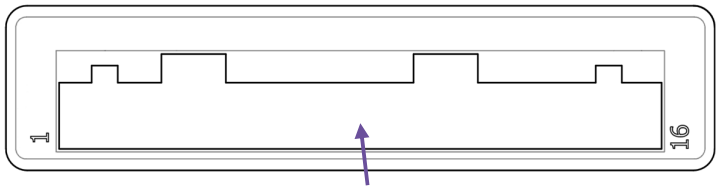


RS-485 Connections

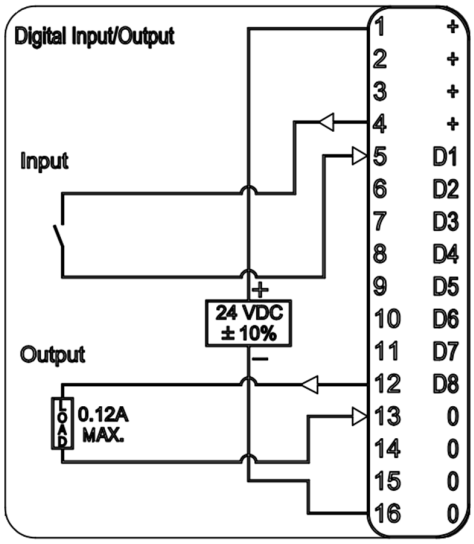
FIELD INPUT & OUTPUT CONNECTIONS

WARNING	A mechanically keyed connector system avoids misconnection between the different types of module. Do not modify!
AVERTISSEMENT	*Un système de connecteurs à clé mécanique évite les erreurs de connexion entre les différents types de modules. Ne pas modifier!*

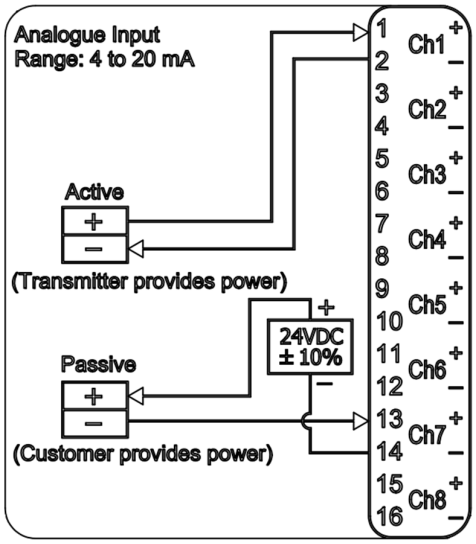
Field Inputs & Outputs Panel



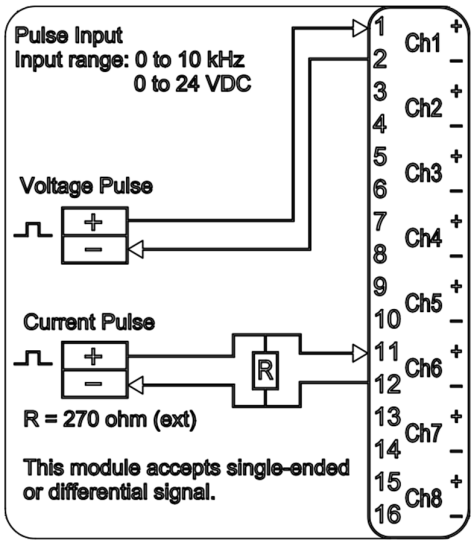
Digital Input / Output



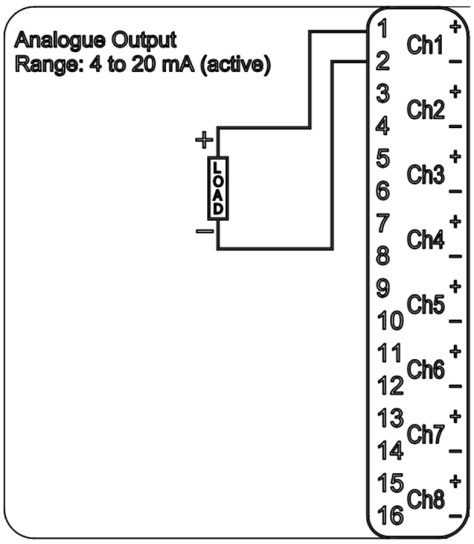
Analogue Input



Pulse Input



Analogue Output



Section 4: **Operation**

Please refer to the InSpec Enhanced Controller manuals for information on how to integrate the module(s) into a system, configure and perform basic diagnostics using the web interface.

The operation of the Remote I/O modules is controlled from the InSpec Enhanced Controller, using the Modbus TCP protocol.

COMMUNICATIONS FAILURE

WARNING	In the event of a communications failure to the Remote I/O module(s), they will assume a known state. It is incumbent on the system design to ensure that it operates in a safe manner at all times, even in the event of a communications failure.
AVERTISSEMENT	*En cas d'échec de communication avec le (s) module (s) RIO, ils prendront un état connu. Il incombe à la conception du système de s'assurer qu'il fonctionne en toute sécurité, même en cas de panne de communication.*

KNOWN STATES

PRODUCT MODEL		DUTY
RIO-DIO	(Digital Input/Output)	All digital outputs **OFF**
RIO-PUL	(Pulse Input)	N/A
RIO-ANI	(Analogue Input)	N/A
RIO-ANO	(Analogue Output)	All analogue outputs set to **4mA**

Section 5: **Maintenance and Troubleshooting**

DEVICE MAINTENANCE

DEVICE CLEANING

Use only a damp cloth to clean the instrument to avoid static electricity.

DEVICE REPAIR

CAUTION!	There are no user-serviceable parts within this product. Any attempt to repair the device may invalidate the warranty.
ATTENTION!	*Il n'y a à l'intérieur aucun élément susceptible d'être changé ou modifié par l'utilisateur.* *Toute tentative de réparation de l'appareil peut invalider la garantie.*

DEVICE TROUBLESHOOTING

Please observe all safety warnings and precautions at the front of this handbook.

No LEDs lit (No power)	Check the integrity of the power supply connected to the unit and verify that it is within acceptable limits (Section 2:, 'Power Supply). The unit is protected by a 'PTC Resettable Fuse'. If the fuse has 'blown' power down the unit, wait 1 minute to reset the fuse, and power the unit up again. Disconnect all the field wiring and repeat the above steps again to try and isolate the fault.
Status LED – Green – Flashing	Normal : Connected and polling (2 Hz) No action necessary.
Status LED – Green – Solid	Software Error or device has powered up into the bootloader app. Reboot the unit by pressing the Reset button on top of the module.
Status LED – Red – Flashing	The device is operating, but there is a problem that needs further investigation.
Status LED – Red – Solid	The unit is in a Reset or Watchdog timeout condition.
Digital Output stopped working	Check the wiring. If safe to do so, try exercising the output via the InSpec Controller web interface, using the `Remote DIGITAL 'n'` page. Check that the corresponding red digital output status LED is toggling on/off in time with the output. If an overload condition has occurred on the digital output, disconnect the field wiring (or remove power), wait 1 minute to reset the fuse, and power the unit up again. Try a different digital output channel.
Digital Input stopped working	Check the wiring. If safe to do so, try exercising the input and monitoring it via the InSpec Controller web interface, using the `Remote DIGITAL 'n'` page. Check that the corresponding green digital input status LED is toggling on/off in time with the input. Try a different digital input channel.
Pulse Input stopped working	Check the wiring. If safe to do so, try exercising the input and monitoring it via the InSpec Controller web interface, using the `Remote PULSE 'n'` page.

	Check that the corresponding green pulse input status LED is flashing when an input is applied. Try a different pulse input channel.
Analogue Input stopped working	Check the wiring. If safe to do so, try exercising the input and monitoring it via the InSpec Controller web interface, using the `Remote ADC 'n'` page. Check that the corresponding analogue input status LED is green when a valid (4-20mA current) is applied. Try a different analogue input channel.
Analogue Output stopped working	Check the wiring. If safe to do so, try exercising the output via the InSpec Controller web interface, using the `Remote DAC 'n'` page. Check that the corresponding analogue output status LED is green. A red LED will indicate that the output is overloaded. Try a different analogue output channel.

SERVICE

RECOMMENDED SPARES

When requesting assistance or spare parts, please provide the instrument model and serial numbers to ensure that the correct options are supplied.

REPACKING FOR SHIPMENT

When shipping the device to Sensia for service or repair, we recommend the box-in-box technique. Place the instrument in all its original packaging, and then place this box inside a strong outer box, with about 60 to 100 mm internal cushioning material, closed and sealed by H-taping with pressure sensitive tape.

If the original packaging is not available, pack the module in electrostatic discharge (ESD) shielding packaging, and then place into static-free (low charging) packaging materials to avoid additional damage to your device.

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Appendix A: **Publisher Notes**

SUPPORT

For further support, contact:

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