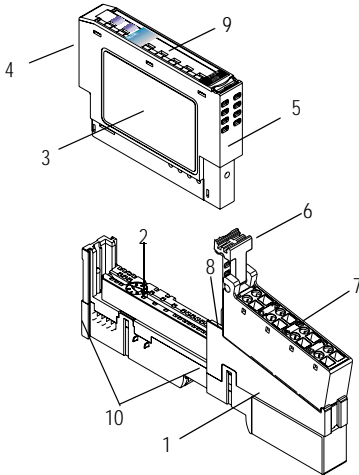


EH-RIO Synchronous Serial Interface Absolute Encoder Module

Catalog Number RIO-SSI



43122

	Description		Description
1	Mounting Base ¹	6	RTB Removal Handle
2	Mechanical Keying (orange)	7	Removable Terminal Block (RTB) ¹
3	Module Wiring Diagram	8	DIN Rail Locking Screw (orange)
4	Module Locking Mechanism	9	Slide-in Writable Label
5	Insertable I/O Module	10	Interlocking Side Pieces

¹ Wiring Base Assembly consists of item 1) mounting base, RIO-MB and item 7) removable terminal block, RIO-SC or RIO-SP.

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.



In no event will Hitachi Europe be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Hitachi Europe cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Hitachi Europe. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual we use notes to make you aware of safety considerations.

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

ATTENTION**Environment and Enclosure**

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as “open type” equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool.

Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication.

About the RIO-SSI Module

The RIO-SSI (synchronous serial interface) module collects serial data from industrial absolute-position encoding sensors that use standard SSI protocol. The RIO-SSI module is inserted into a EH-RIO terminal base that provides common power, communications, and wiring connections for the SSI sensors.

ATTENTION

EH-RIO is grounded through the DIN rail to chassis ground. Use zinc plated, yellow chromated steel DIN rail to assure proper grounding. Using other DIN rail materials (e.g., aluminum, plastic, etc.), which can corrode, oxidize, or are poor conductors, can result in improper or intermittent platform grounding.

WARNING

When you connect or disconnect the removable terminal block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

ATTENTION**Preventing Electrostatic Discharge**

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.

When not in use, store the equipment in appropriate static-safe packaging.

Installing the Mounting Base

To install the mounting base on the DIN rail, proceed as follows.

1. Position the mounting base vertically above the installed units (adapter, power supply, or existing module).
2. Slide the mounting base down so that the interlocking side pieces engage the adjacent module or adapter.
3. Press firmly to seat the mounting base on the DIN rail.

The mounting base will snap into place.

Installing the I/O Module

The module can be installed before or after base installation. Make sure that the mounting base is correctly keyed before installing the module into the mounting base. In addition, make sure the mounting base locking screw is positioned horizontally in reference to the base.

1. Using a bladed screwdriver, rotate the keyswitch (2) on the mounting base clockwise until the number required for the type of module being installed aligns with the notch in the base.

Refer to page 1-19 for the keyswitch position.

WARNING

When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

2. Make certain the DIN rail locking screw is in the horizontal position.

You cannot insert the module if the locking mechanism is unlocked.

3. Insert the module straight down into the mounting base and press to secure.

The module will lock into place.

Installing the Removable Terminal Block (RTB)

A removable terminal block is supplied with your wiring base assembly.

To remove the removable terminal block, pull up on the RTB handle. This lets you remove and replace the mounting base as necessary without removing any of the wiring.

To reinsert the removable terminal block, proceed as follows.

1. Insert the end opposite the handle into the base unit.

This end has a curved section that engages with the wiring base.

WARNING



When you connect or disconnect the removable terminal block (RTB) with field-side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

2. Rotate the terminal block into the wiring base until it locks itself in place.
3. If an I/O module is installed, snap the RTB handle in to place on the module.

Removing a Mounting Base

To remove a mounting base, you must remove any installed module, and remove the removable terminal block (if wired).

1. Unlatch the RTB handle on the I/O module.
2. Pull on the RTB handle to remove the removable terminal block.

WARNING

When you connect or disconnect the removable terminal block (RTB) with field-side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

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3. Press on the module lock on the top of the module.
 4. Pull on the I/O module to remove from the base.

WARNING

When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

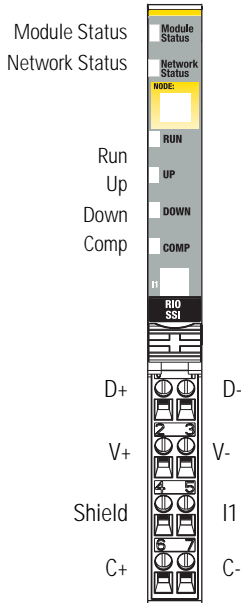
Be sure that power is removed or the area is nonhazardous before proceeding.

-
5. Use a small-bladed screwdriver to rotate the orange, base locking-screw to a vertical position.

This releases the locking mechanism.

6. Lift straight up to remove.

Wiring the Synchronous Serial Interface Module



31545-MC

- D = Data
- I1 = Digital Sourcing Input 1
- C = Clock
- V = SSI Sensor

0 D+	1 D-
2 V+	3 V-
4 Shield	5 I1
6 C+	7 C-

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D = Data I1 = Digital Sourcing Input 1
C = Clock V = SSI Sensor

Module Terminations

0	D ⁺¹
1	D ⁻¹
2	V+
3	V-
4	Shield
5	I1
6	C ⁺¹
7	C ⁻¹

1 D and C are RS422-type differential pairs.

WARNING



If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This can cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

Communicating with the RIO-SSI Module

The RIO-SSI module transmits SSI sensor data over the DeviceNet network. Data can be exchanged with the master through a polled, cyclic, or change-of-state connection. Bit-Strobe Command Response Messaging and the Unconnected Message Manager (UCMM) are not supported⁽¹⁾. The module produces and consumes data as follows:

I/O Connection Type	Consumes	Produces
Polled	2 bytes	10 bytes
Cyclic	2 bytes	10 bytes
Change-of-State	2 bytes	10 bytes

Consume and Produce Bit/Byte Definitions

Byte	Bit	Description
Produce 0	0-7	Low byte of present low SSI word. Bit 0 is the least significant bit of the entire present SSI word.
Produce 1		High byte of present low SSI word.
Produce 2		Low byte of present high SSI word.
Produce 3		High byte of present high SSI word. Bit 7 is the most significant bit of the entire present SSI word.
Produce 4		Low byte of stored low SSI word. Bit 0 is the least significant bit of the entire stored SSI word.
Produce 5		High byte of stored low SSI word.
Produce 6		Low byte of stored high SSI word.
Produce 7		High byte of stored high SSI word. Bit 7 is the most significant bit of the entire stored SSI word.

⁽¹⁾ If you are not familiar with these terms, see the DeviceNet Specification for definitions (www.odva.org).

Byte	Bit								Description
Produce 8	7	6	5	4	3	2	1	0	Status Byte 0 ⁽²⁾
	C2ST	C1ST	C2R	C1R	INC	DEC	RUN	I1	
Produce 9	7	6	5	4	3	2	1	0	Status Byte 1 ⁽²⁾
	RES	RES	RES	LHON	IDF ⁽¹⁾	CCE	CCF	SPF	

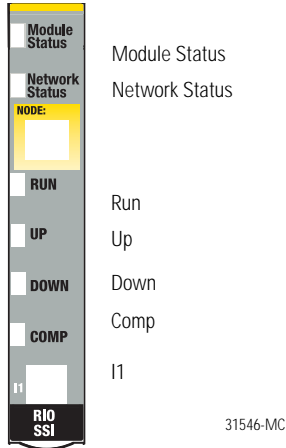
⁽¹⁾ Monitor IDF to determine the validity of the produced data. If IDF=1, the SSI data is false.

⁽²⁾ For detailed descriptions of these bits, see RIO-SSI User Manual.

Byte	Bit								Description
Consume 0	7	6	5	4	3	2	1	0	Master ACK Byte ⁽¹⁾
	RES	RES	RES	SCMP2	SCMP1	CC2	CC1	LACK	
Consume 1	7	6	5	4	3	2	1	0	CONS1
	RES	RES	RES	RES	RES	RES	RES	RES	

⁽¹⁾ The master must provide the Master ACK Byte in order to receive the polled Produced bytes 0-9.

Troubleshooting with the Indicators



Indication	Probable Cause
Module Status	
Off	No power applied to device.
Green	Device operating normally.
Flashing Green	Device needs commissioning due to missing, incomplete, or incorrect configuration.
Flashing Red	Recoverable fault.
Red	Unrecoverable fault may require device replacement.
Flashing Red/Green	Device is in self-test.

Indication	Probable Cause
Network Status	
Off	Device is not on line. - Device has not completed dup_MAC_id test. - Device not powered - check module status indicator
Flashing Green	Device is on line, but has no connections in the established state.
Green	Device is on line and has connections in the established state.
Flashing Red	One or more I/O connections in timed-out state.
Red	Critical link failure - failed communication device. Device detected error that prevents it communicating on the network.
Flashing Red/Green	Communication faulted device - the device has detected a network access error and is in communication faulted state. Device has received and accepted an Identify Communication Faulted Request - long protocol message.

Indication	Probable Cause
Run Status	
Off	Module is commanded to stop retrieving SSI data.
Green	Module is commanded to retrieve SSI data.

Indication	Probable Cause
Up Status	
Off	SSI data not increasing, or no SSI data is being received.
Green	SSI data is increasing.



Indication	Probable Cause
Down Status	
Off	SSI data not decreasing, or no SSI data is being received.
Green	SSI data is decreasing.

Indication	Probable Cause
Comp Status	
Off	Comparator function not in use, or comparator value not attained.
Green	Comparator value is attained.

Indication	Probable Cause
I1 Status	
Off	Latching input I1 is OFF.
Yellow	Latching input I1 is ON.

Safety Approvals

The following information applies when operating this equipment in hazardous locations:	Informations sur l'utilisation de cet équipement en environnements dangereux:
<p>Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.</p>	<p>Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.</p>

The following information applies when operating this equipment in hazardous locations:		Informations sur l'utilisation de cet équipement en environnements dangereux:	
WARNING 	EXPLOSION HAZARD <ul style="list-style-type: none"> Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. Substitution of components may impair suitability for Class I, Division 2. If this product contains batteries, they must only be changed in an area known to be nonhazardous. 	AVERTISSEMENT 	RISQUE D'EXPLOSION <ul style="list-style-type: none"> Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Specifications

RIO-SSI Absolute Encoder Module

Number of SSI Channels	1
Encoder Type	Any absolute encoder supporting standard SSI protocol including linear, rotary, and optical distance measuring devices. Most-Significant Bit Aligned data format. Physical interface for clock and data signals is RS-422.
Module Location	RIO-BSC or RIO-BSP wiring base assembly
Keyswitch Position	2
Pointbus Current	110mA @ 5V dc
Power Dissipation	0.94W
Isolation Voltage	Tested to 1250V ac for 60s between each of these isolated areas: <ul style="list-style-type: none"> • Logic side and field power • Logic side and shield • Shield and field power
Mass	1.12oz (31.78g)
SSI Data Rate	125kHz, 250kHz, 500kHz, 1MHz, 2MHz (software selectable)
SSI Bits Per Word	2-31 (software selectable)
SSI Word Delay Time ¹	16 μ s-64ms (software selectable)
SSI Word Length	4 bytes (32 bits)
SSI Features	Gray or binary code capable with gray to binary conversion, increasing or decreasing SSI count indication, 2 SSI word comparator values, SSI word latching with I1 input
SSI Position Forming Time ²	\geq 0.5ms
SSI Cable Type	UL CM/AWM 2464/CSA Type CMG FT4 or similar cable utilizing shielded twisted pairs for D+/- and C+/- connections. See sensor manufacturer for actual cable required for the SSI sensor under use. I1 input can be wired separate from SSI cable ⁽¹⁾ .

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SSI Cable Length	Depends on desired SSI data rate: 125kHz - 1050ft (320m) 250kHz - 525ft (160m) 500kHz - 195ft (60m) 1MHz - 65ft (20m) 2MHz - 25ft (8m)		
SSI Sensor Power (At V+/- Terminals)	10-28.8V dc common with field power voltage, 0.75A dc maximum with short circuit protection		
SSI Clock Drive Current (Out of C+/- Terminals)	125mA maximum		
Input I1	IEC Type 3 voltage and current characteristics, sourcing type		
	<u>Minimum</u>	<u>Nominal</u>	<u>Maximum</u>
ON-State Voltage	0V dc	--	FPV* -10
ON-State Current	2mA	4mA (FPV=24V dc)	5mA
OFF-State Voltage	FPV-5	--	FPV
OFF-State Current	1.2mA	--	--
Input Impedance	--	3.6k Ω	4.7k Ω
Input Filter Time	--	0.5ms	--
	* = FPV Field Power Supply Voltage		
Field Power Supply Voltage (Bus Supply)	<u>Minimum</u>	<u>Nominal</u>	<u>Maximum</u>
	10V dc	24V dc	28.8V dc
LED Indicators	All powered from the logic side		

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20 to 55°C (-4 to 131°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock):
Operating	30g
Nonoperating	50g
Vibration	IEC60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±2kV at 5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports ±2kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Emissions	CISPR 11 Group 1, Class A

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Enclosure Type Rating	None (open-style)	
Conductors	Wire Size	14 AWG (2.5mm ⁽²⁾) - 22AWG (0.25mm ⁽²⁾) solid or stranded with maximum 3/64 inch (1.2mm) insulation rated at 75°C min
	Category	2
Field Wiring Terminations	0 - D+	1 -D-
	2 - V+	3 -V-
	4 - Shield	5 - I1
	6 - C+	7 - C-
Terminal Base Screw Torque	7 pound-inches (0.6Nm) maximum	
Dimensions	Inches	2.217H x 0.47W x 2.97L
	(Millimeters)	(56H x 12W x 75.5L)
Certifications: (when product is marked)	c-UL-us	UL Listed for Class I, Division 2 Group A, B, C, D Hazardous Locations, certified for U.S. and Canada
	CE	European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-4; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity

(1) Time between successive SSI words (T_p). Also called Dwell Time.

(2) Roughly corresponds to the maximum time the SSI sensor can be expected to output a particular position value while in motion. To use the RIO-SSI module with sensors that have faster position forming times, change the SSI Word Filter Control parameter from its default value of 5 (max). Changing this parameter from its default value sacrifices electrical noise environment performance for sensor data conversion speed.

Notes:

EH-RIO is a trademark of Hitachi Europe.