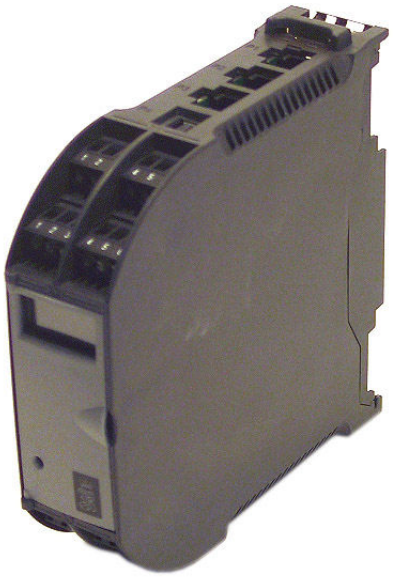
KONGSBERG

RHUB200-5

Hardware Module Description

Kongsberg Maritime Part no.603442



300994/B

Document history

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Rev. A	November 2006	First version.
Rev. B	November 2010	New review of document. Text edited.

Note

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.
Kongsberg Maritime disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Comments

To assist us in making improvements to the product and to this manual, we welcome comments and constructive criticism.
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Glossary

DI	Digital Input
DO	Digital Output
ESD	Electrostatic Discharge
GND	Signal ground
IE	Instrumentation Earth
I/O	Input/Output
LED	Light Emitting Diode
MTBF	Mean Time Between Failure
PE	Protective Earth
RBUS	Remote I/O Process Bus that covers both communication link and power
RBUS Power	Electrical power supply to the RIO200 modules including field channels
RBUS Link	RIO communication link based on multi-drop 2 Mbps RS485 with Manchester encoding
RCU	Remote Controller Unit
RHUB200-5	RBUS Hub module
RIO200	Kongsberg Maritime Remote I/O 200 module family
RMP	Remote Multi Purpose I/O module
PSU	Power Supply Unit
USB	Universal Serial Bus

Overview

Document user

This document is intended to be used for HW engineering, hook-up and maintenance. Physical interfaces and capabilities are described.

Module

The RHUB200-5 is a module in the Kongsberg RIO200 module family. The modules in the RIO200 family provide functions such as I/O interface, network hub/repeater and serial line interface. They have identical housing and are snap on mounted on a horizontal, dual-rail system.

The RHUB200-5 is a five channel hub and repeater module dedicated for use in the Kongsberg RBUS system(s). The design offer up to triple redundant interface towards host RCU controller(s). The five serial bus channels for interface of remote process I/O are individually galvanic insulated.

Up to three RHUB200-5 modules can be connected in series (between an RCU controller and a I/O module in the RIO200/420 family) to obtain more segregation of the RBUS topology.

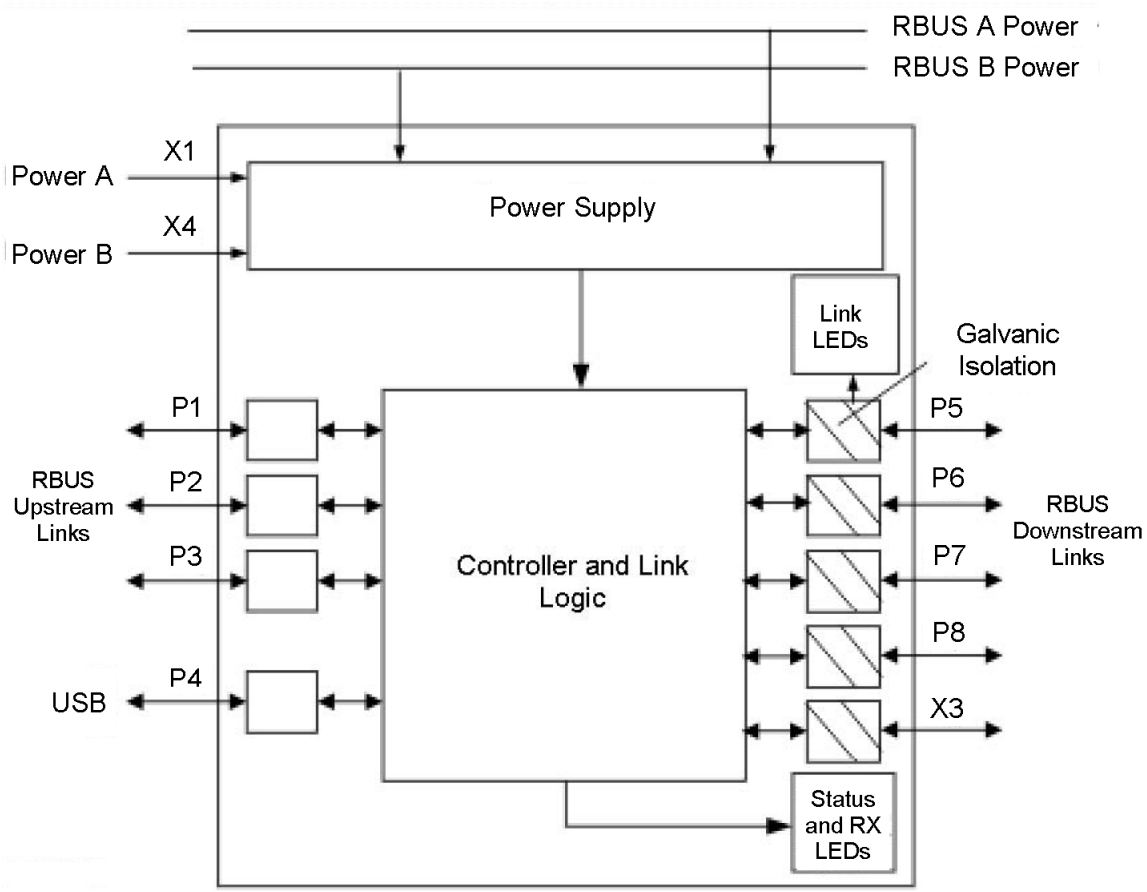
The RHUB200-5 is (usually) powered via the RBUS rail connectors, but it can also be powered from other power supplies via the terminal blocks X1 and X4.

The RHUB200-5 contains the following features:

- Five RBUS serial interfaces
- HUB topology configuration offer insulated RBUS segregation
- Repeater topology configuration offer insulated RBUS extension (maximum 3 i series)
- Run/error LED on front showing module status
- Flashing LEDs on front showing receive/transmit data status for each channel
- Dsigned for swap on and hot swap module replacement
- Comply to standards IEC 60945 and IACS E10

Function

Figure 1 RHUB200-5 function diagram



In HUB topology configuration, the module offer insulated RBUS segregation.

In repeater topology configuration, the module offer insulated RBUS extension.

The module can interface up to three RCU controllers (A, B and C) via the three RJ45 connectors P1, P2 and P3. It can further link five RBUS systems, whereof four cabinet internal interfaces via the four RJ45 connectors P5, P6, P7 and P8. The main purpose of the terminal block X3 is typical to interface field cabling from external cabinets.

The RHUB200-5 consists of the main function blocks as shown in the illustration above.

- Power
- Controller and link logic
- RCU Interface
- RBUS serial interfaces
- USB interface
- LEDs (Status, RX, Link)

Power supply input

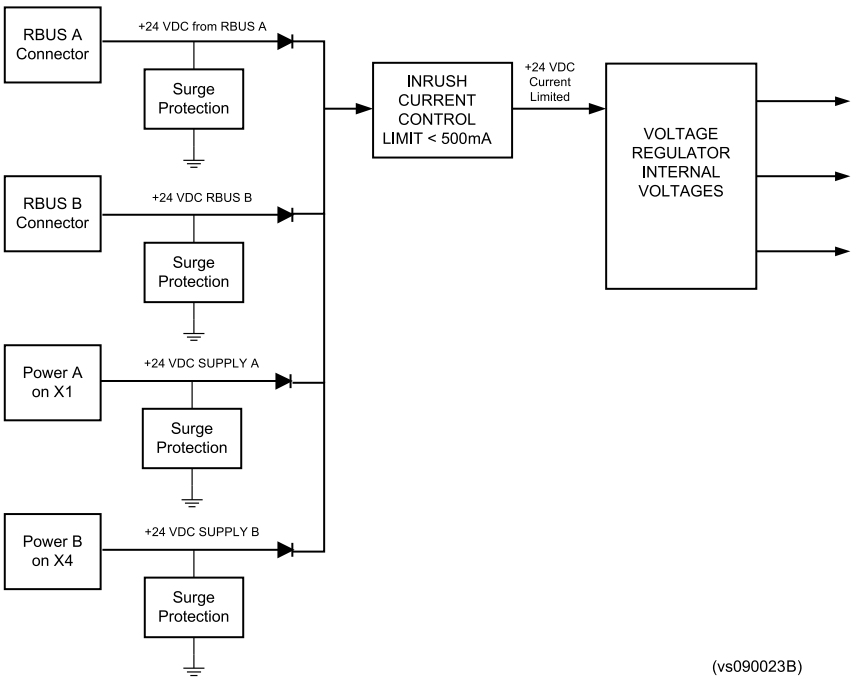
The RHUB200-5 accepts single or dual 24 VDC as supply voltage(s). It has four power ports to handle power redundancy.

- Powered via RBUS rail Power (RBUS A and RBUS B connectors)
- Powered from external supplies via the terminal rows X1 and X4

The module is provided with “ideal diodes” to interconnect the four power supplies without loss of voltage. It is also provided with inrush current protection: Thus, system short circuit protection offer hot swap plug and play functionality.

Internal power supply voltages are monitored by the module.

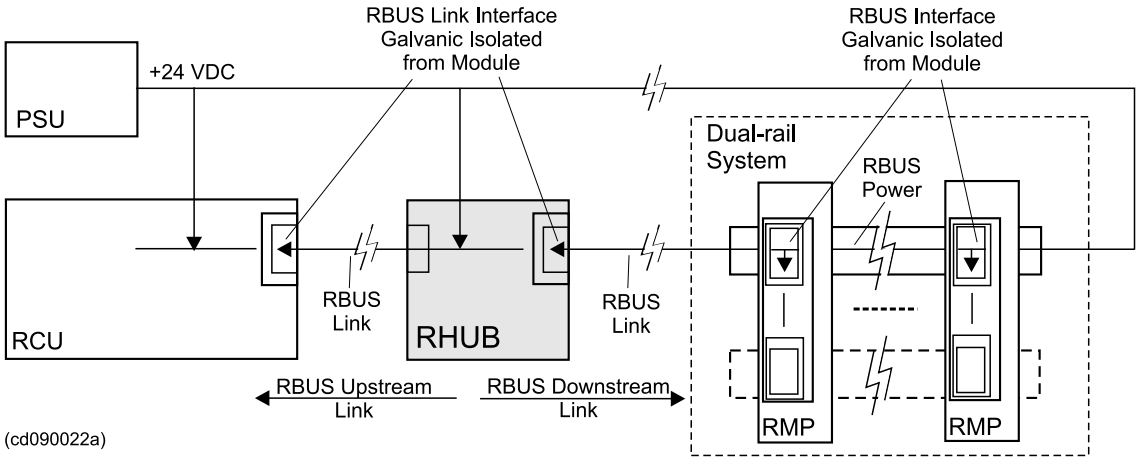
Figure 2 Power block diagram for RHUB200-5



Power and grounding principles

The RHUB200-5 is provided with galvanic isolated communication interfaces. On the RCU interface, the insulation is provided on the RCU side of the communication link, as illustrated in figure 3 below.

Figure 3 Power and grounding principles



RCU Upstream interfaces

Three identical RBUS interfaces A, B and C, dedicated for RCU interface, are available on the RJ45 connectors P1, P2, and P3. In order to bias the galvanic insulated RS485 transceiver inside the interfaced host RCU, this external 24 VDC bias power is supplied from the corresponding RHUB unit(s) interconnected in the system topology, typical via a common signal and power cable (one pair signal and one pair power).

The design is also provided with termination network and over-voltage protection.

RBUS I/O interfaces

Five isolated, RBUS I/O interfaces, dedicated for downstream applications, are available on the connectors P5, P6, P7, P8 (RJ45s) and X3 (terminal block). These five channels are functional wise identical. The RBUS RS485 insulated transceiver inside the RHUB is biased from the corresponding RBUS/HUB topology. This external 24 VDC is typical supplied via a common signal and power cable (one pair signal and one pair power). The RBUS communication interface is an RS485 transceiver design and is further provided with termination network and over-voltage protection.

Interconnecting several RHUB200-5

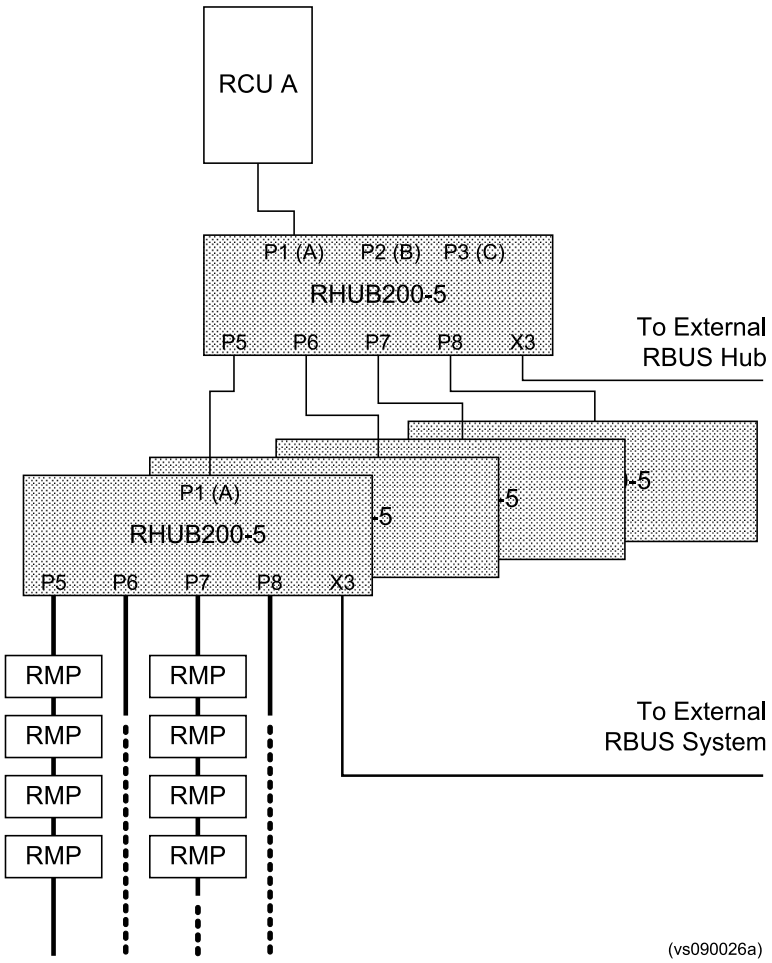
Several RHUB200-5 can be interconnected in different topologies to facilitate network segregation between one controller (RCU) and several RBUS sub-systems (see example in illustration).

The physical cable interconnection between the controller and HUB unit are provided with standard patch cables with RJ45 connectors according to the T568B standard.

Note

Maximum three RHUB200-5 modules can be connected in series due to transmission timing limitations.

Figure 4 Multiple RHUB200-5 block diagram

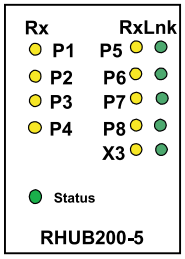


Standard patch cables with RJ45 connectors are used when interconnecting the RBUS to modules within a cabinet (P5 to P8). Shielded twisted pair (STP) field cables are used for interconnecting RBUS Link interfaces between cabinets (X3).

LED indicators

The module front is provided with 15 LED indicators. The LED layout is shown in the following illustration.

Figure 5 LED indicators layout



(vs090047a)

Table 1 LED indicators on module front

LED name	Colour, state	Function
Status	Green, fixed	Normal operation. The module is OK and it has communication with at least one RCU
	Red, fixed	Serious HW or SW error condition occurred, watchdog activated
	Red, flashing	During boot
RX P1	Yellow, flashing	Receiving data on RBUS Upstream Link interface A (P1)
RX P2		Receiving data on RBUS Upstream Link interface B (P2)
RX P3		Receiving data on RBUS Upstream Link interface C (P3)
RX P4		Receiving data on USB console connection (P4)
RX P5		Receiving data on RBUS Downstream Link interface P5
RX P6		Receiving data on RBUS Downstream Link interface P6
RX P7		Receiving data on RBUS Downstream Link interface P7
RX P8		Receiving data on RBUS Downstream Link interface P8
RX X3		Receiving data on RBUS Downstream Link interface X3
LNK P5	Green, fixed	RBUS Downstream Link interface P5 is powered
LNK P6		RBUS Downstream Link interface P6 is powered
LNK P7		RBUS Downstream Link interface P7 is powered
LNK P8		RBUS Downstream Link interface P8 is powered
LNK X3		RBUS Downstream Link interface X3 is powered

Note

RHUB200-5s with serial number 1079 and below have been provided with swapped LED functions for P5 to P8 and X3 compared to the table above. This means that for these early modules the RX LEDs (P5 to P8 and X3) are the green flashing LEDs in the right column, and the LNK LEDs (P5 to P8 and X3) are the yellow fixed LEDs in the left column. Refer to section Module identification on page 15 on how to locate the module serial number.

USB interface

A USB port (USB 2.0) is included on the module for future use to facilitate direct communication with the module controller for test and service purposes. The interface uses a USB B type connector (P4) and is protected by a transient suppressor.

Technical Specifications

Table 2 Technical specifications

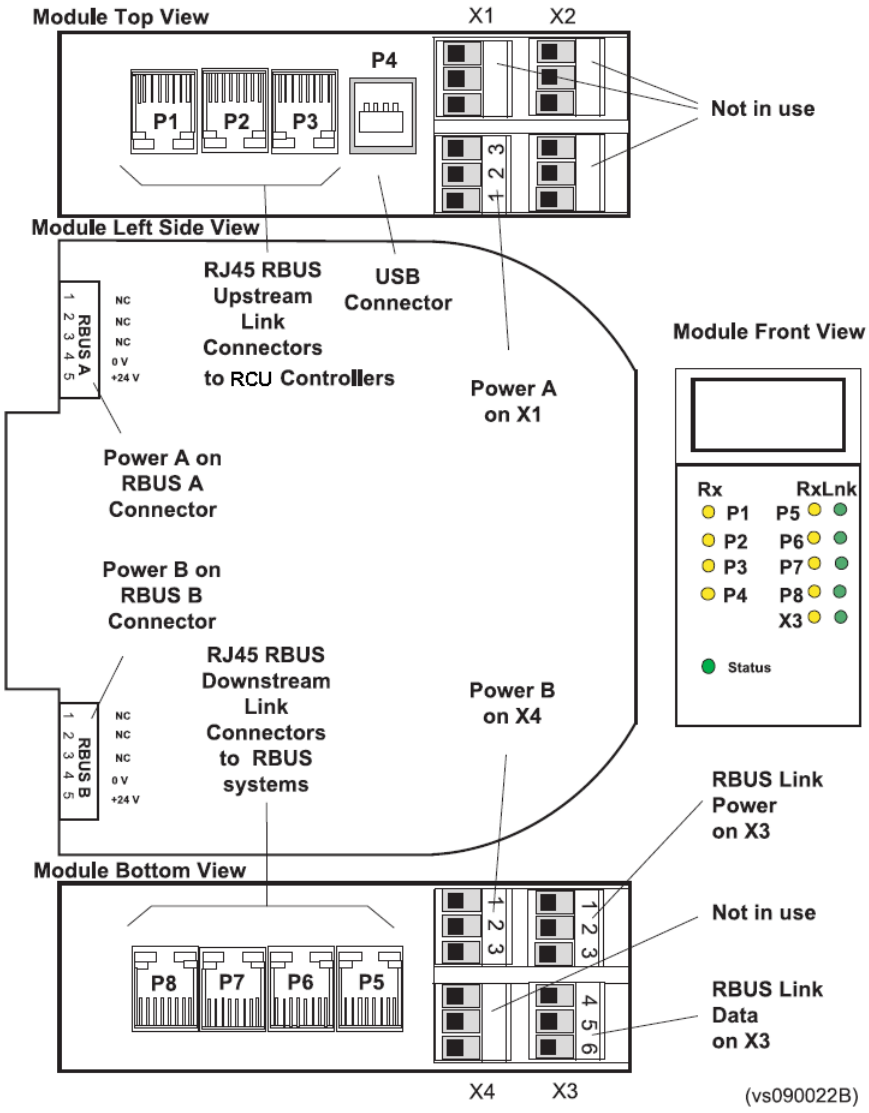
Power specifications	
Input voltage	+24 VDC nominal (+18 - +32 VDC)
Power on rise time	Maximum 20 ms/V monotonic
Current consumption	100 mA
Power ON inrush current	Maximum 0.5 A
Start up voltage	Minimum 21.6 V
Module short circuit current	Maximum 0.5 A for 50 ms
Power Dissipation	Maximum 5W, all channels interfaced
RBUS Link interface	
Serial line type	RS485 multidrop
Power supply voltage	+18 - +32 VDC
Bit rate	2 Mbps
Isolation voltage (downstream only)	500 V
Connections	
Power supplies	Terminal blocks for X1 and X4, and T-BUS™ connector for RBUS A and RBUS B
Connectors X1 to X4:	Terminal Block Screw terminated (3.0 mm slotted) Cable cross section 2.5 mm²
RBUS Upstream Link interfaces	RJ45 for P1 to P3
RBUS Downstream Link interfaces	RJ45 for P5 to P8, and terminal row for X3
USB port	Standard USB B connector (P4)
Watchdog	
Watchdog time-out	Maximum 1 sec.
Mechanical specification	
Size (WxHxD)	35 x 130 x 130 mm
Weight	0.30 kg

Environmental requirements	
Operating temperature	-15 °C - +70 °C
Storage temperature	-25 °C - +70 °C
Vibration	0.7 g
IP class	IP20
Compliant to standards	IEC 60945 and IACS E10
Life cycle prediction	
Predicted failure rate @GB 25 °C (60% confident, based on chip suppliers data and MIL-MDBK-217F)	33.5 years

Configuration

The illustration below shows the layout of the RHUB200-5.

Figure 6 Layout of RHUB200-5



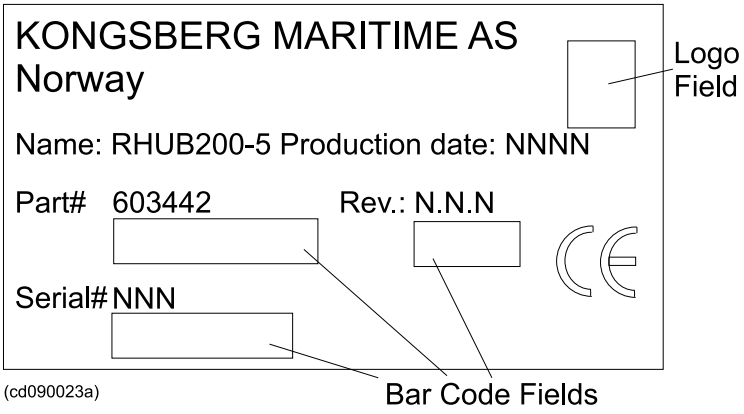
The following sections describe the module label layout, and the connectors' layout and pin allocation.

Module identification

There is a module identification label on each module. For any communication with Kongsberg Maritime regarding this module you should refer to the part number (Part#), revision (Rev.) and serial number (Serial#) (see figure below).

This information is also available from the diagnostic system.

Figure 7 Module identification label



P1 to P3 – RCU Upstream connectors

The HW interface of P1 to P3 are designed according to the T568B standard.

P1 to P3 are RJ45, 8 pin, unshielded, female connectors.

The Link channel connection to RCU has to use a straight (not crossed) cable with all 8 pins in use.

Figure 8 Front view of RJ45 with pin layout

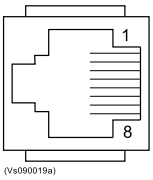


Table 3 P1 to P3 connectors (RJ45) pin allocation

Pin no.	Name	Function
1	DATA_x_H	RS485 Transceiver Data High for channel x
2	DATA_x_L	RS485 Transceiver Data Low for channel x
3	0 V	0 V supply voltage reference terminal
4		
5		
6		Not connected
7	24 VDC	+24 VDC supply voltage to upstream device
8		Not connected

where x = A for P1, B for P2, C for P3,

P4 - USB connector

This is an USB B, 6 pin, shielded, female connector.

Table 4 P4 connector pin allocation

Pin no.	Name	Function
1	VCC	From host +5 VDC
2	USB_D-	USB Transceiver Data Low
3	USB_D+	USB Transceiver Data High
4	0 V	Signal ground reference

Note

Connector housing of USB connector is terminated to 0 V via an HF capacitor within the module.

P5 to P8 – RBUS Downstream Link connectors

These are RJ45, 8 pin, unshielded, female connectors.

See Figure 8 on page 16 for connector pin layout.

Table 5 P5 to P8 connectors (RJ45) pin allocation

Pin no.	Name	Function
1	DATA_x_H	RS485 Transceiver Data High for channel x
2	DATA_x_L	RS485 Transceiver Data Low for channel x
3	0 VDC_x	0 V, reference terminal from sub-system x
4		
5		
6		Not connected
7	24 VDC_x	+24 VDC supply from RBUS system x
8		Not connected

where x = P5, P6, P7, P8

X1 – External power A terminal row

This is a terminal row with two terminal blocks. Each terminal block is provided with a removable header. Terminals 1 to 3 are used for power (see table below).

Figure 9 X1 terminal layout

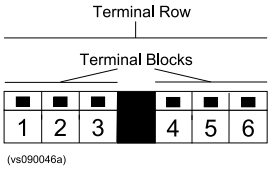


Table 6 X1 terminal allocation

Terminal no.	Name	Function
1	+24 V PWR A	+24 VDC from external Power A connection
2	0 V PWR A	External Power A, 0 V reference
3		Not connected

X2 – Dummy terminal row

This terminal row is not in-use. It comprises two terminal blocks whereof each is provided with three screw terminals and removable headers.

X3 – RBUS Link connector downstream external

This is a terminal block with 6 screw terminals. It is provided with two removable headers (terminal 1 to 3 and 4 to 6).

See Figure 9 on page 18 for connector pin layout.

Table 7 X3 terminal allocation

Terminal no.	Name	Function
1	+24 V PWR	+24 VDC power voltage to interface
2	0 V PWR	0 V, power voltage reference terminal to interface
3		Not connected
4	DATA_H	RS485 Transceiver Data High
5	DATA_L	RS485 Transceiver Data Low
6	0 V DATA	0 V, signal ground reference

X4 – External power B terminal row

This is a terminal row with two terminal blocks. Each terminal block is provided with a removable header. Terminals 1 to 3 are used for power (see table below).

See Figure 9 on page 18 for connector pin layout.

Table 8 X4 terminal allocation

Terminal no.	Name	Function
1	+24 V PWR B	+24 VDC, power terminal for Power B
2	0 V PWR B	0 V, power terminal for Power B
3		Not connected

RBUS A and RBUS B connectors

The two RBUS A and RBUS B connectors are of type 5-pole Phoenix T-BUS™ connectors. They are located on the dual-rail and provides RBUS Power connections.

The module is provided with printed circuit board based connectors that fit to the T-BUS™ connectors.

Figure 10 RBUS A and B, T-BUS™ rail connector terminal layout

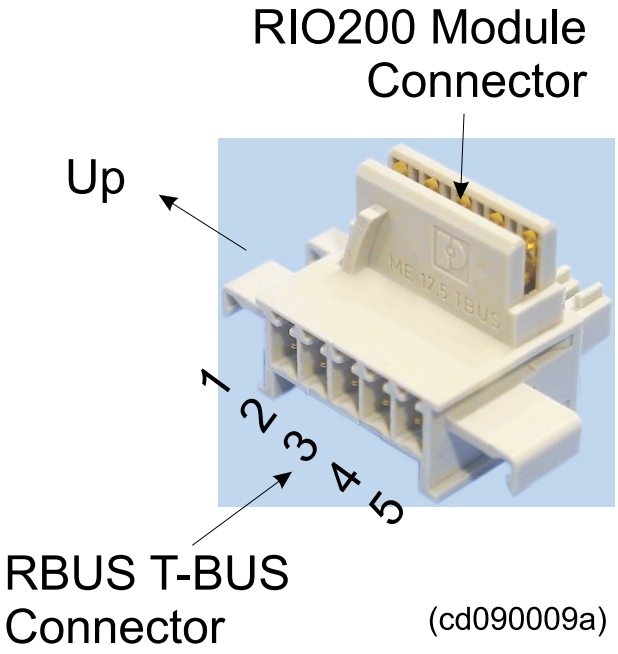


Table 9 RBUS A and RBUS B rail connector terminal allocation

Terminal number	Terminal Name	RBUS sub-system	Function
1	RE		Reference earth
2	DATA_L	RBUS Link	Not connected
3	DATA_H		Not connected
4	0 VDC	RBUS Power	0 VDC, power terminal
5	24 VDC		+24 VDC, power terminal

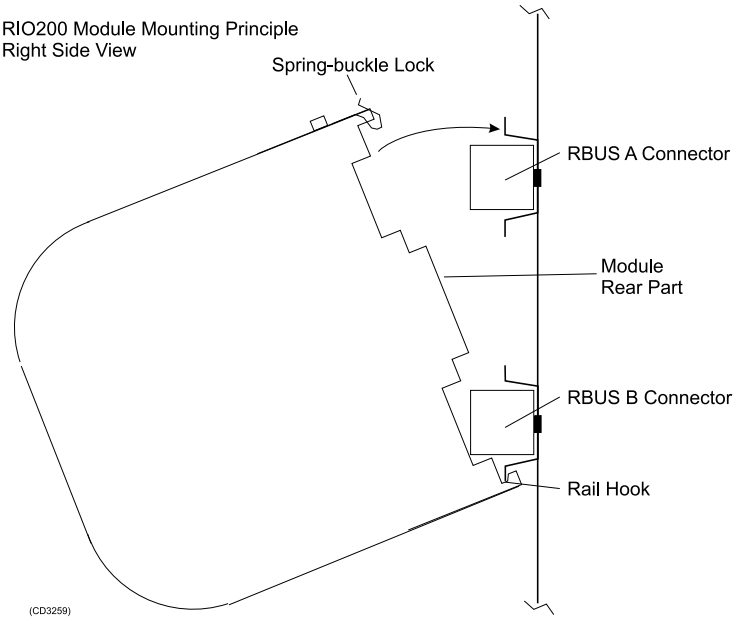
Installation

Caution

The module can be unpacked and handled without ESD protection, but electrostatic discharge can damage components on the module when terminating wires and cables to it. Therefore always wear a correctly-connected earthing strap when working on the module.

1 Label the module with the appropriate equipment name.

2 Hook the RHUB200-5 on to the lower DIN rail in a 30° angle and snap it to the RBUS connectors and upper DIN rail in one rotating movement.



3 Connect the RBUS patch cables to connectors P1 to P3 and P5 to P8 as appropriate.

4 Connect the power and field cable wires to the terminal blocks on X1, X3 and X4 on the RHUB200-5 as appropriate. Use a flat-bit screwdriver to fasten the wires. The terminal blocks accept up to 2.5 mm^2 wire dimension.

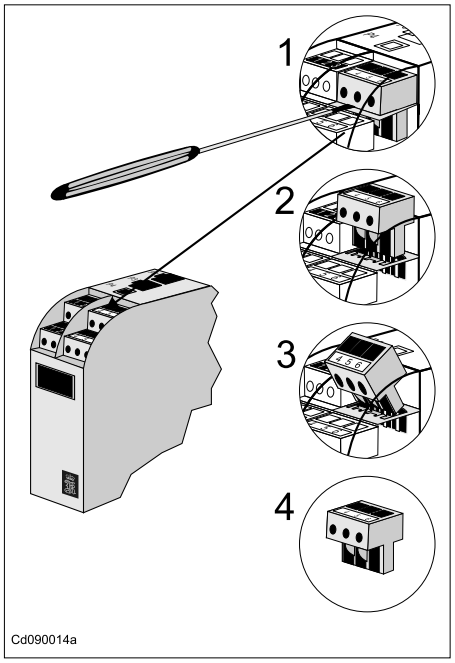
5 Turn ON power. The module status LED will be lit red initially during start-up and turns to green when the module has started.

Replacement

Caution

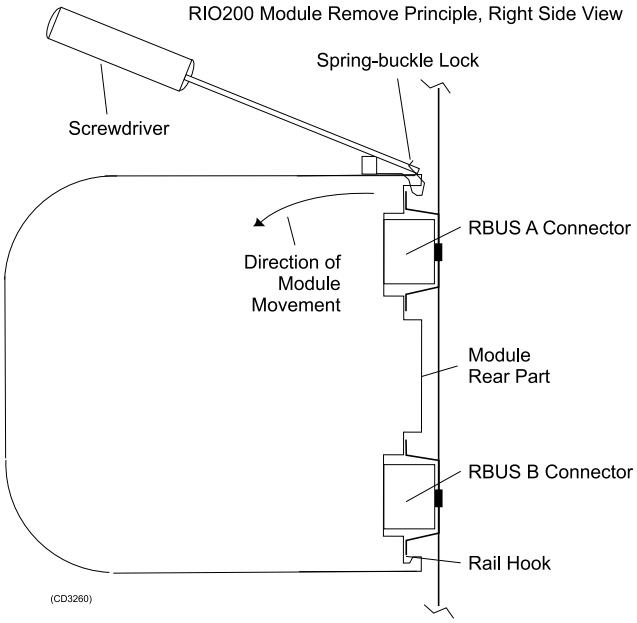
The module can be unpacked and handled without ESD protection, but electrostatic discharge can damage components on the module when terminating wires and cables to it. Therefore always wear a correctly-connected earthing strap when working on the module.

1 Remove the terminal block headers on X1, X3 and X4 that are in use (the ones with wires attached). Use a flat-bladed screwdriver and jack the headers out in a vertical direction according to steps 1 to 4 in the following illustration.



2 Unplug the RBUS patch cables connected to connectors P1 to P3 and P5 to P8.

3 Remove the RHUB200-5 module from the bus rails by using a screwdriver to unlock the spring buckle.

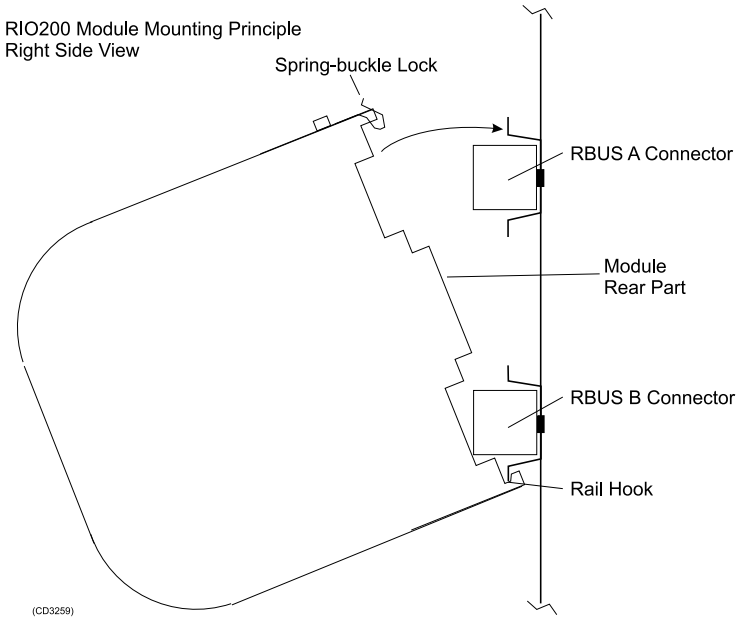


4 Put the module aside and label it with its fault symptoms.

5 Label the new RHUB200-5 module.

6 On the new module remove the same terminal block headers as were removed from the other module, by using a flat-bladed screwdriver and jack them out, one by one.

7 Hook the RHUB200-5 on to the lower DIN rail in a 30° angle and snap it to the RBUS connectors and upper DIN rail in one rotating movement.



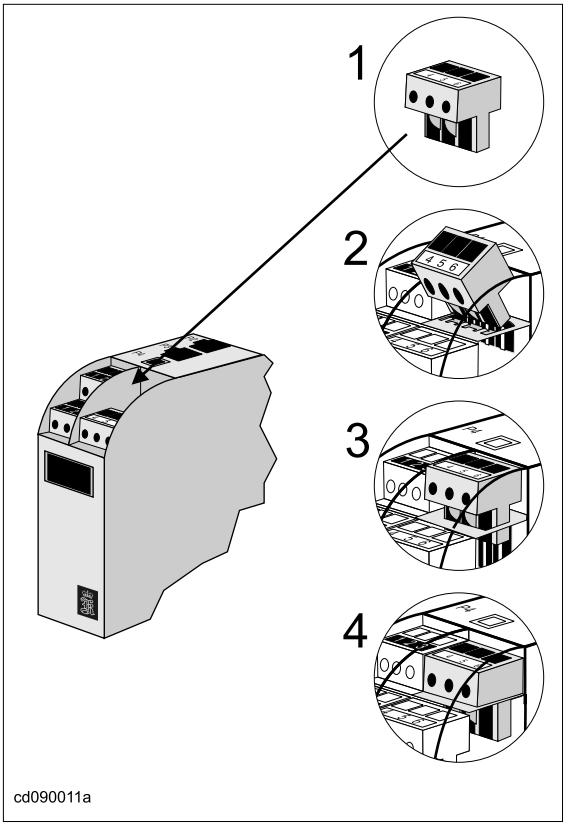
8 Connect the RBUS patch cables to connectors P1 to P3 and P5 to P8 as appropriate.

9 Reconnect the terminal block headers X1, X3 and X4 on the RHUB200-5 as appropriate by pushing them into position (see note and illustration).

Note

The terminal block headers are coded so there is only one way to enter all four headers on one side of the module.

The following illustration shows how to re-enter a terminal block header by performing the steps 1 to 4.



10 If power is OFF, turn ON power. The module status LED will be lit red initially during start-up and turns green when the module has started and communication is OK.

11 Check the RBUS Downstream Link LEDs. Check also the RBUS Downstream Link LEDs on the higher level devices (i.e. on RCU and RHUB) for the same link segment.