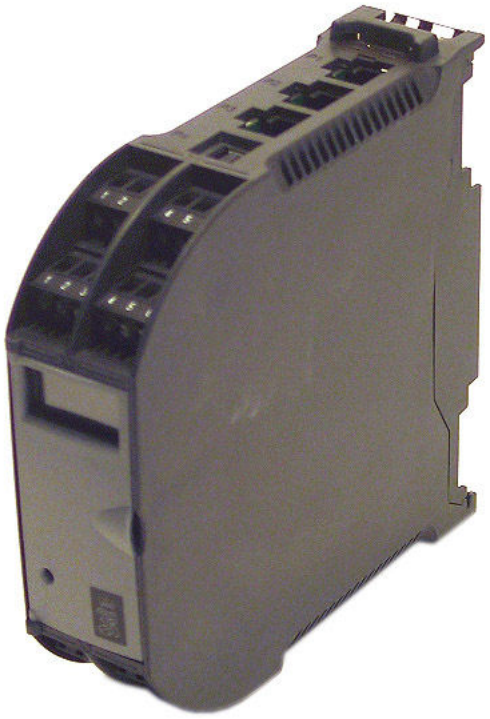
KONGSBERG

RSER200-4

Hardware Module Description

Kongsberg Maritime Part no.603444



300993/C

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Document history

Document number: 300993 / Rev. C		
Rev. A	November 2006	First version.
Rev. B	November 2010	New review of document. Text edited.
Rev. C	January 2012	Revised information about the Field channel terminal allocation (X1 to X4).

Note

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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.
e-mail: km.documentation@kongsberg.com

Table of contents

Glossary 4
OVERVIEW 5
Document user 5
Module 5
FUNCTION 6
Power supply input 7
RCU communication interface 8
RCU cable interface 8
Field Channel interfaces 8
LED indicators 11
USB interface 12
Watchdog 12
TECHNICAL SPECIFICATIONS 13
CONFIGURATION 15
Module identification 16
Ex label 16
P1 to P3 - Link Channel connectors 17
P4 - USB connector 18
X1 to X4 - Field channel terminal rows 19
RBUS A and RBUS B connector 20
INSTALLATION 21
Ex Zone 2 installation requirements 21
Installation procedure 22
REPLACEMENT 23

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
NMEA	National Marine Electronics Association
PE	Protective Earth
RIO200	Kongsberg Maritime Remote I/O 200 module family
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
RS232	Electrical Interface standard for single ended serial data communication
RS422	Electrical Interface standard for single ended, differential, balanced serial data communication
RS485	Electrical Interface standard for differential, balanced, multipoint serial data communication
RSER200–4	Serial line interface module
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 RSER200-4 is a module in the Kongsberg RIO200 module family. These modules provide functions such as I/O interface, network hub/repeater and serial line interface. They have identical housing and are mechanically snap on mounted on a horizontal dual-rail system.

The RSER200-4 is a four channel, galvanic isolated, serial line, interface module that can be interfaced to one, two or three host RCU controller(s). The four field channels are individually configurable as either RS232, RS422, RS485 or NMEA 0183 for connection to field equipment, or interface at 3rd party vendors.

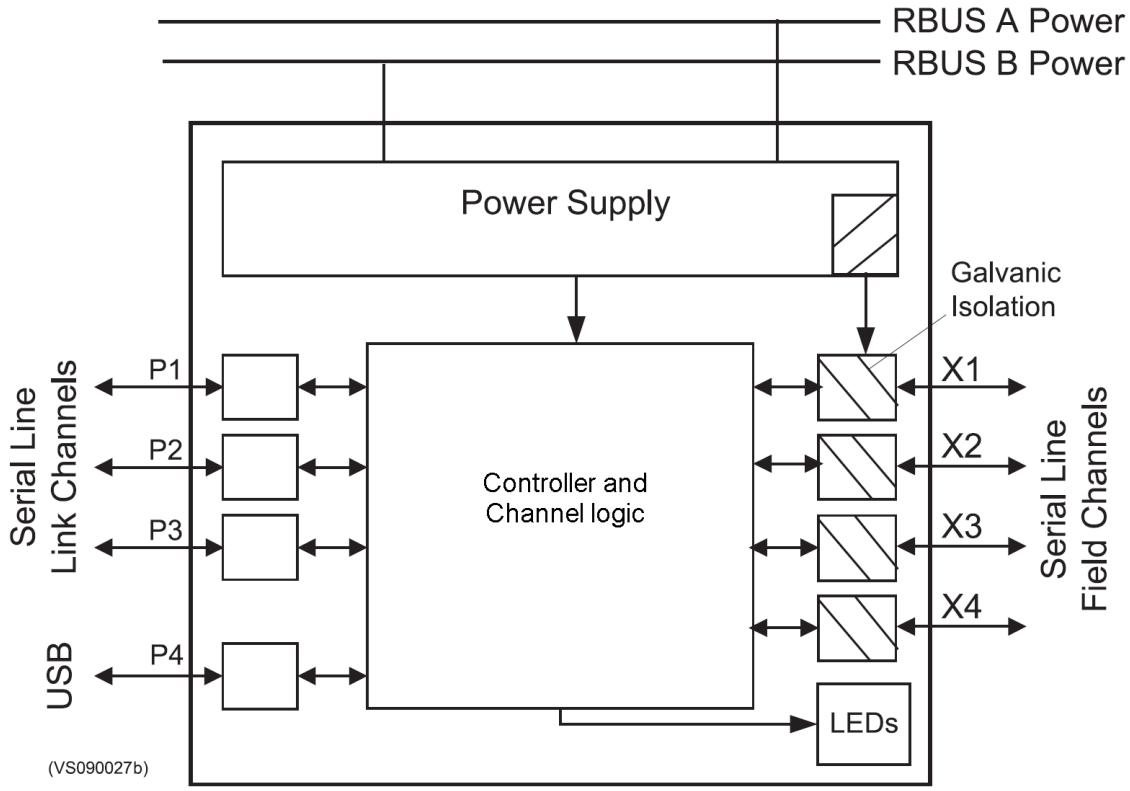
The RSER200-4 is powered via the RBUS connectors T-BUS™.

The RSER200-4 contains the following features:

- Isolated serial line field channels
- Run/error LED on front showing module status
- Flashing LEDs on front showing transmit and receive data status for each channel
- All internal voltages are monitored
- Designed for snap on and hot swap replacement
- Complies to standards; IEC 60945 and IACS E10
- Ex Zone 2 type approved

Function

Figure 1 RSER200-4 function diagram



The interface module can be connected to up to three controllers (A, B, C) via the three RJ45 connectors (P1, P2, P3), and up to four field equipment (1, 2, 3, 4) via the four terminal blocks (X1, X2, X3, X4).

The module contains a USB interface (P4) intended for test and service purposes. It provides functions to monitor the serial line activity and the general status of the module.

The RSER200-4 consists of the main function blocks as shown in the function diagram (see for block/function diagram of the RSER200-4).

- Power supply
- Controller and channel logic
- Link and field interfaces
- Watch Dog
- USB interface
- LEDs (Status, RX and TX)

Power supply input

The RSER200-4 accepts single or dual 24 VDC as supply voltage(s) via the RBUS A and RBUS B rail connectors.

The module is provided with “ideal diodes” to interconnect the two bus rail power supplies without loss of voltage. It is also provided with inrush current protection and system short circuit protection. The design thus offer hot swap plug and play functionality.

Figure 2 Power block diagram for RSER200-4

RCU communication interface

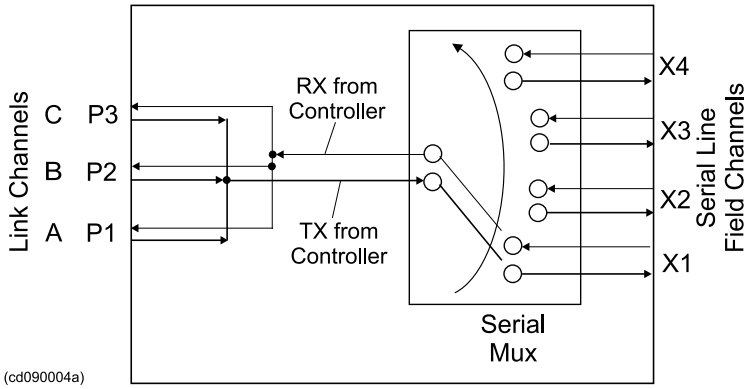
The illustration in figure below shows the communication switching principles for RSER200-4.

Each RCU controller (A, B or C) can transceive serial data via RJ45 connector P1, P2 or P3 on the RSER200-4 module to four (X1 to X4) serial line field channels. This is achieved by multiplexing.

Dual or triple redundant controllers can be connected to the module. The controllers will receive data simultaneously, but only the system master is allowed to transmit.

The system master control logic is hosted between the RCU controllers.

Figure 3 Serial line switching principles



RCU cable interface

The physical cable interconnection between the controller and RSER unit is provided with standard patch cables with RJ45 connectors according to the T568B standard. The RCU channel interfaces are implemented with a high speed RS422 Link.

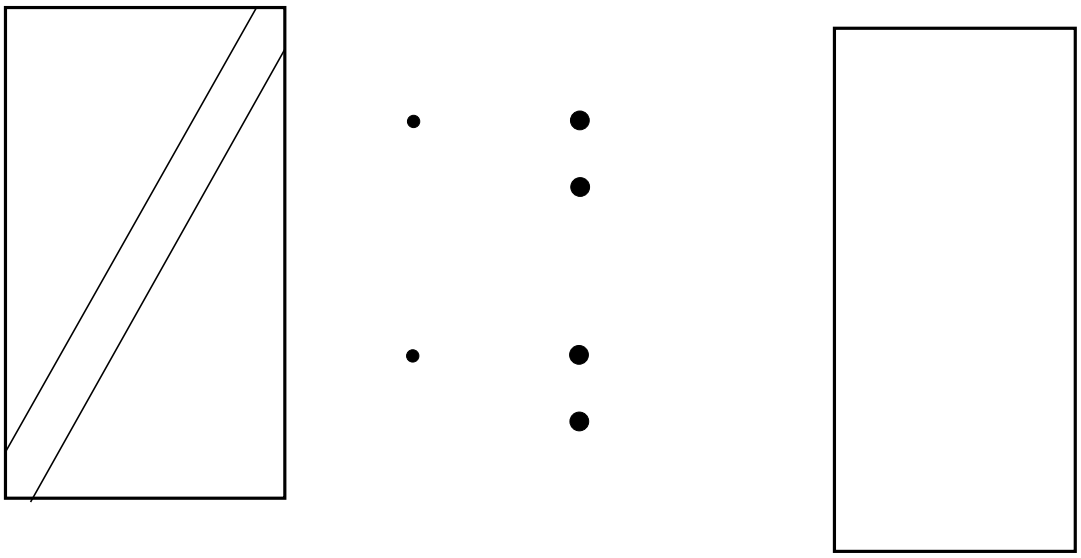
Field Channel interfaces

Four isolated, identical, serial line field channels 1, 2, 3 and 4 are available on terminal (X1 to X4). Each of them can be SW configured to handle either RS232, RS422, RS485 or NMEA 0183 standards.

The physical channel cable interconnection from the RSER unit to other units on the RBUS, are provided with a shielded twisted pair (STP) cable. For cable specification, see section 'Technical Specifications'.

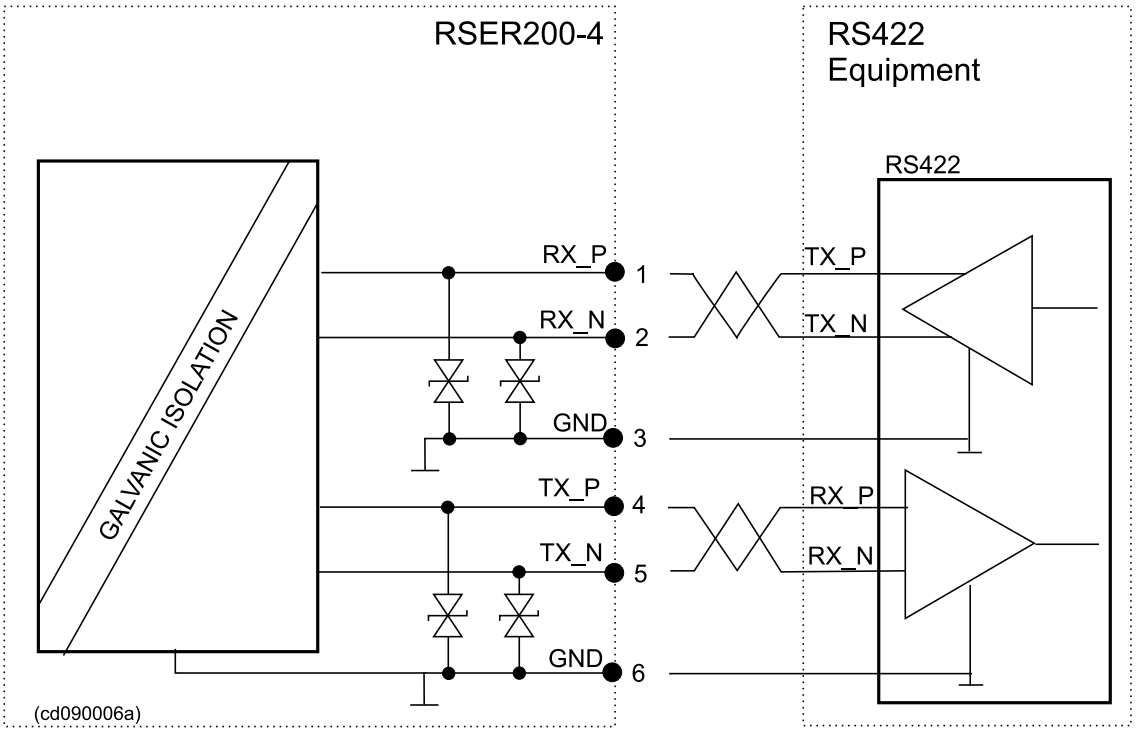
RS232 interface

Figure 4 RS232 interface principle



RS422 interface

Figure 5 RS422 interface principle



RS485 interface

Figure 6 RS485 interface principle , 3 wires

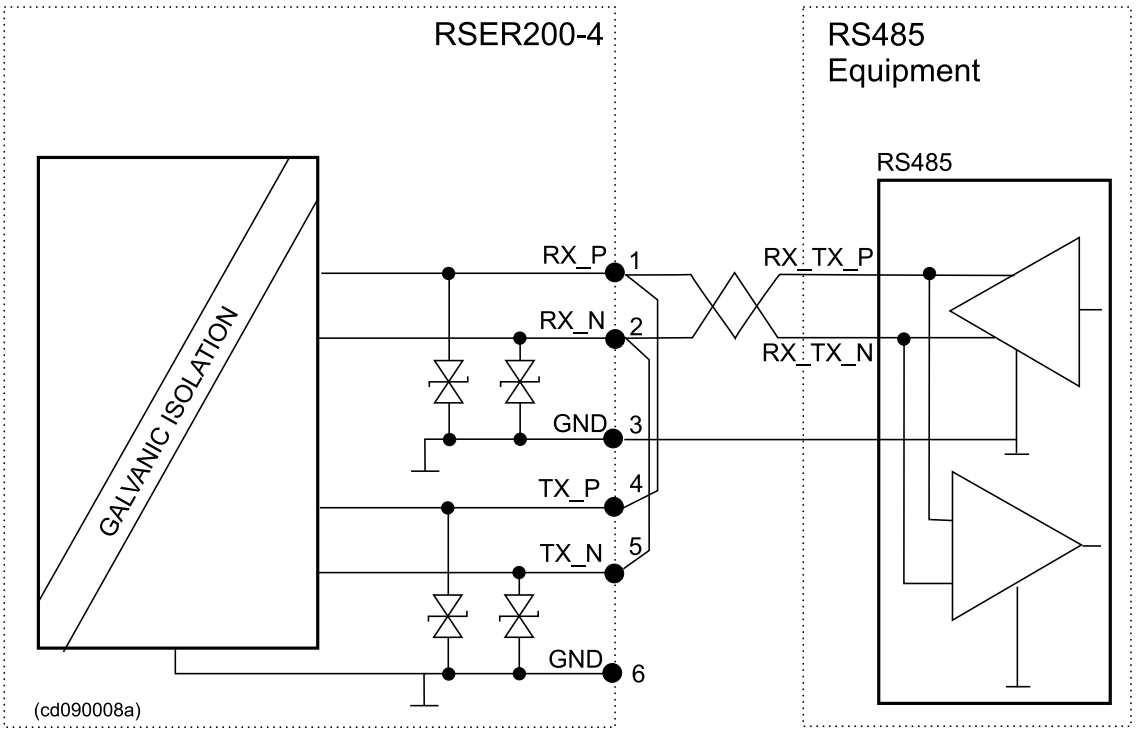
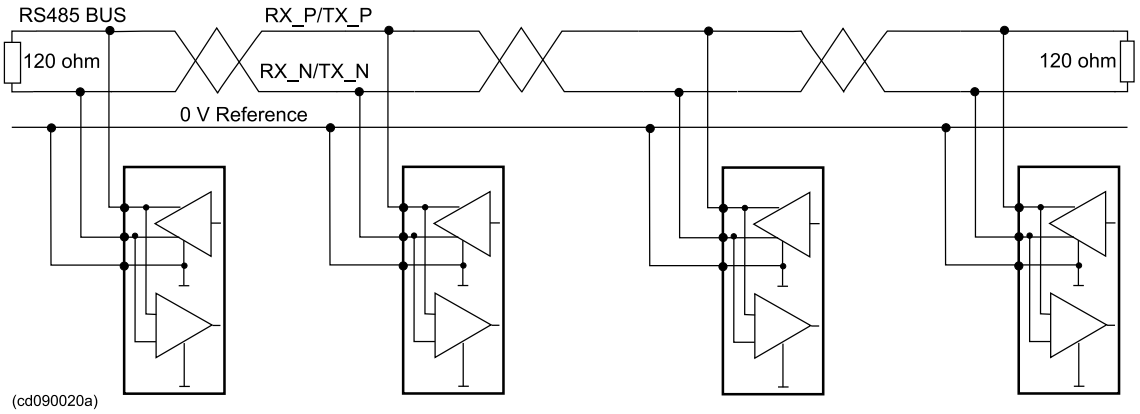
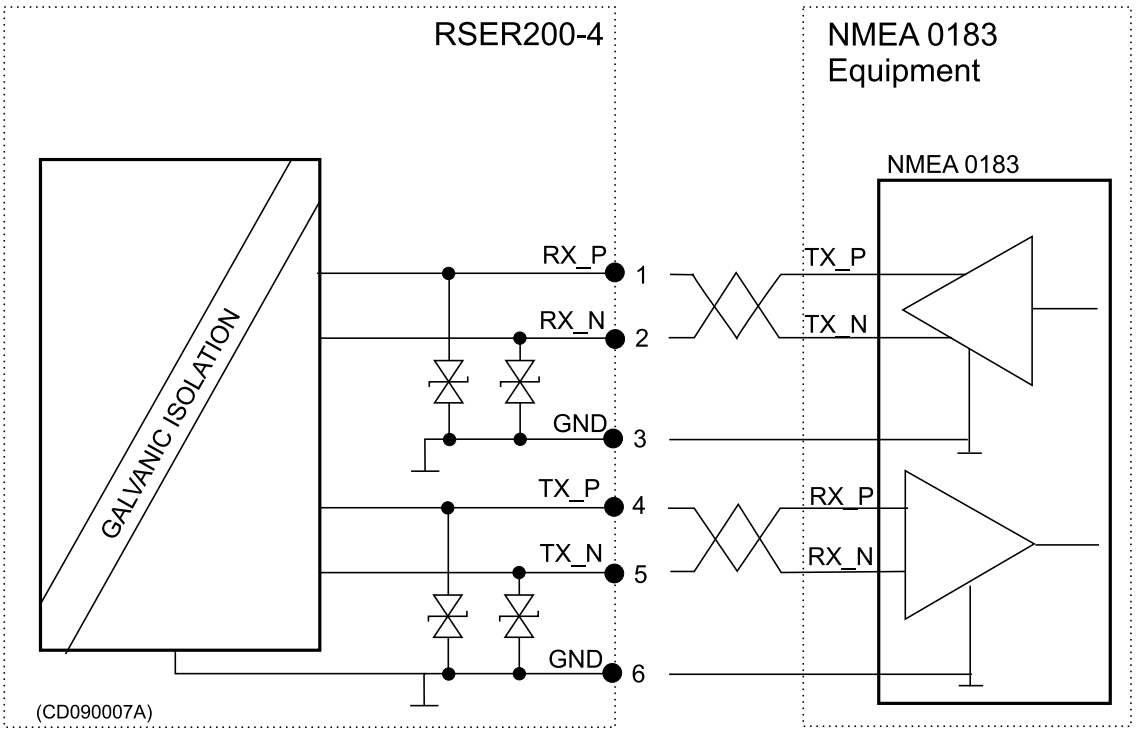


Figure 7 RS485 serial bus with line termination



NMEA 0183 interface

Figure 8 NMEA 0183 interface principle



LED indicators

The module front is provided with seventeen LED indicators for indication of RX and TX status (see illustration).

Figure 9 LED indicators layout

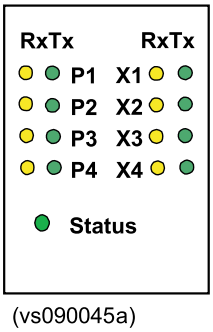


Table 1 LED indicators on module front

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 link channel A (P1)
RX P2		Receiving data on link channel B (P2)
RX P3		Receiving data on link channel C (P3)
RX P4		Receiving data on USB port (P4)
TX P1	Green, flashing	Transmitting data on link channel A (P1)
TX P2		Transmitting data on link channel B (P2)
TX P3		Transmitting data on link channel C (P3)
TX P4		Transmitting data on USB port (P4)
RX X1	Yellow, flashing	Receiving data on field channel X1
RX X2		Receiving data on field channel X2
RX X3		Receiving data on field channel X3
RX X4		Receiving data on field channel X4
TX X1	Green, flashing	Transmitting data on field channel X1
TX X2		Transmitting data on field channel X2
TX X3		Transmitting data on field channel X3
TX X4		Transmitting data on field channel X4

Note

All RX, TX LEDs except for P4 will be lit during boot.

USB interface

A USB port (USB 2.0) is included on the module 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.

Watchdog

A built-in watchdog restarts the module program if a software error occurs. The communication will stop and after some seconds the Bus communication will be normal again.

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	160 mA
Power ON inrush current	Maximum 960 mA@25ms
RCU Interface	
Bit rate	1 Mbps
Cable length, maximum	100 m
Cable attenuation	< 6.5 db / 100m @ 10 MHz (CAT 5)
	Most important parameter: Capacitance <= 50 pF/m
Interface type	RS422
Serial line field channels	
Interface types	RS232, RS422, RS485, NMEA 0183
Bit rate	300 bps - 115 kbps
Connections	
Power supply	RBUS A and RBUS B, Phoenix 5-pole T-BUS™ connectors
Link channels (P1 to P3)	RJ45 unshielded
Field channels (on X1 to X4)	3mm slotted screw terminals
Cable cross section	Terminal blocks 2.5 mm²
USB port (P4)	Standard USB B connector
Watchdog	
Watchdog timeout	Maximum 1 sec., programmable
Mechanical specification	
Size (WxHxD)	35 x 130 x 130 mm
Weight	0.34 kg
Mounting	Snap on dual DIN-rail

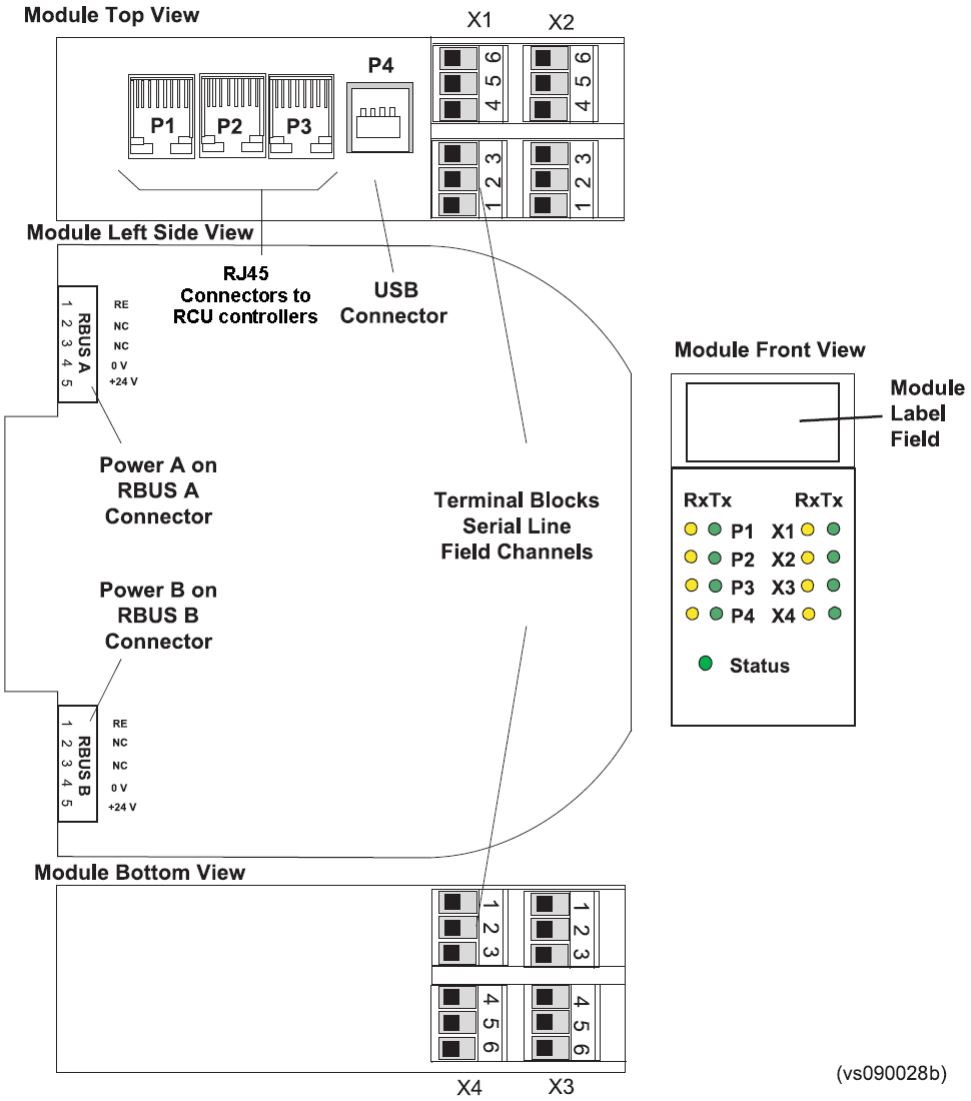
Table 2 Technical specifications (cont'd.)

Environmental requirements	
Operating temperature	-15 °C - +70 °C
Storage temperature	-25 °C - +70 °C
Vibration	Maximum 1.0 g
IP class	IP20
Compliant to standards	IEC 60945 and IACS E10
Life cycle predictions	
Predicted failure rate @ GB 25°C: (60% confident, based on chip suppliers data and MIL-HDBK-217F)	20.9 Years

Configuration

The illustration below shows the layout of the RSER200-4 module.

Figure 10 Layout of RSER200-4

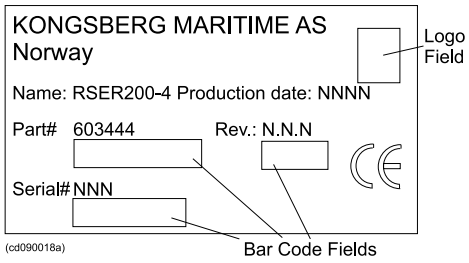


The following sections describe the module label layout, and the connectors' layout and pin allocation.

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#). The identical information is also available from the diagnostic system.

Figure 11 Module identification label



Ex label

The Ex label contains two lines of information:

- Nemko 07ATEX3090X is the type approval certificate number.
- II 3G EEx nA II T4 Ta: 55ºC are the Ex requirements satisfied by the module.

P1 to P3 - Link Channel connectors

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

These connectors are RJ45, 8 pin, unshielded.

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

Figure 12 Front view of RJ45 with pin layout

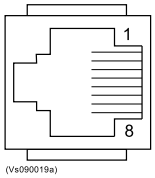


Table 3 Link Channel connectors (RJ45) pin allocation

Pin no.	Name	Function
1	RXn-P	Link Channel #n Receive, Positive terminal
2	RXn-N	Link Channel #n Receive, Negative terminal
3	TXn-P	Link Channel #n Transmit, Positive terminal
4	CTSn-P[1]	Link Channel #n Clear To Send, Positive input terminal
5	CTSn-N[1]	Link Channel #n Clear To Send, Negative input terminal
6	TXn-N	Link Channel #n Transmit, Negative terminal
7		Not connected
8	0 V	0 V, signal reference terminal

where n = 1 for P1, 2 for P2, 3 for P3

[1] – CTS is here an input signal used for flow control between RCU and RSER. It reads from RCU that RCU is ready to receive.

P4 - USB connector

This connector i an USB type B, 6 pin, shielded.

Table 4 USB B pin allocation

Pin no.	Name	Function
1	VCC	+5 VDC from host computer
2	USB_D-	USB Transceiver Data Low
3	USB_D+	USB Transceiver Data High
4	0 V	0 V, signal reference terminal

Note

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

X1 to X4 - Field channel terminal rows

There are four terminal rows on the front of the module (X1 to X4). Each terminal row is associated with one field channel. Each terminal row is divided into two terminal blocks.

The terminal blocks are provided with a removable header with three screw terminals (terminals numbered 1 to 3 and 4 to 6 respectively) on each (see figure below). Each terminal block is provided with coding pins that prevent you from swapping headers between X1 and X2, and between X3 and X4.

Figure 13 X1 to X4 terminal layout

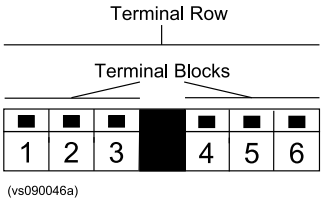


Table 5 Field channel terminal allocation

Pin no.	Name	Function
1	RX_n/RXP_n *	RX for RS232 or RXN for RS422/485/NMEA
2	CTS_n[1]/RXN_n *	CTS for RS232 or RXP for RS422/485/NMEA
3	SERn_0V	Signal ground reference for n
4	TX_n/TXP_n *	TX for RS232 or TXN for RS422/485/NMEA
5	RTS_n[2]/TXN_n *	RTS for RS232 or TXP for RS422/485/NMEA
6	SERn_0V	Signal ground reference for n

where n = 1 for X1, 2 for X2, 3 for X3, 4 for X4

[1] – CTS is here an input signal used for flow control between RSER and field equipment. It reads from field equipment that field equipment is ready to receive.

[2] – RTS is here an output signal used for flow control between RSER and field equipment. It is signalling to field equipment that RCU is ready to receive.

* According to the RS422/485 standard, the “P” notation correspond to B and the “N” notation correspond to A.

RBUS A and RBUS B connector

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

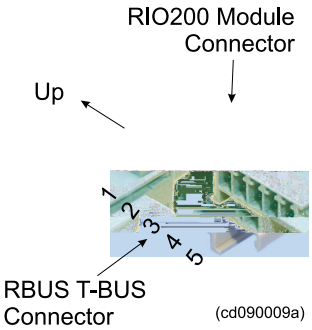


Table 6 RBUS A and RBUS B rail connector terminal allocation

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.

Ex Zone 2 installation requirements

The choice of enclosure, placement of modules, components and free volume inside enclosure will affect the temperature.

When the module is used in Ex Zone 2, the following requirements must be met:

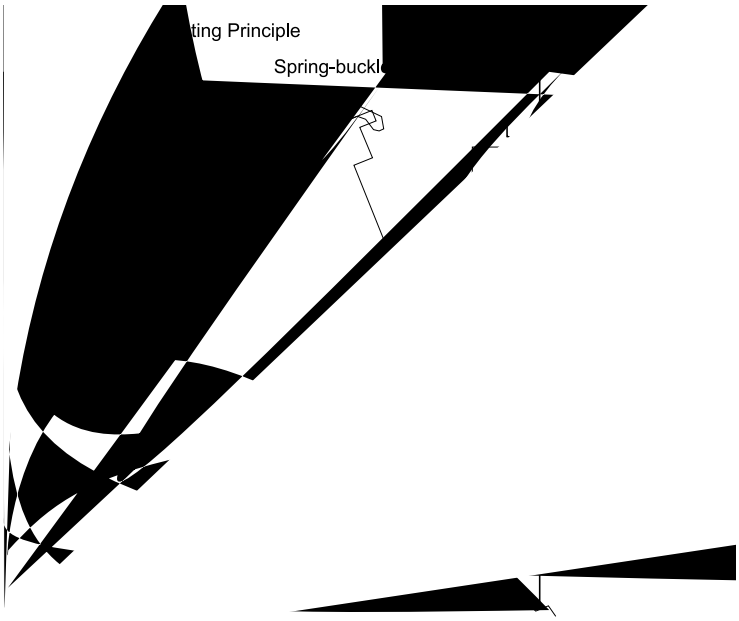
- The RSER200–4 shall be mounted in an enclosure which complies with the requirement of clause 26.3 of EN 60079-15 and fulfil IP 54, or alternatively is mounted in an EEx e-enclosure.
- Maximum surface temperature shall not exceed temperature class T4 corrected for the maximum ambient temperature at service (Ta: 55°C) within the safety margin of 5°K.
- Maximum ambient temperature inside enclosure shall not exceed 75°C.

Installation procedure

1 Open the module front door.

2 Label the module with the appropriate module name.

3 Hook the RSER200-4 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.



4 Connect the link channel patch cables to the connectors P1 to P3 as appropriate.

5 Connect the field channel cable wires to the terminal blocks X1 to X4 on the RSER200-4 as appropriate. Use a flat-bit screwdriver to fasten the wires. The terminal blocks accept up to 2.5 mm^2 wire dimension.

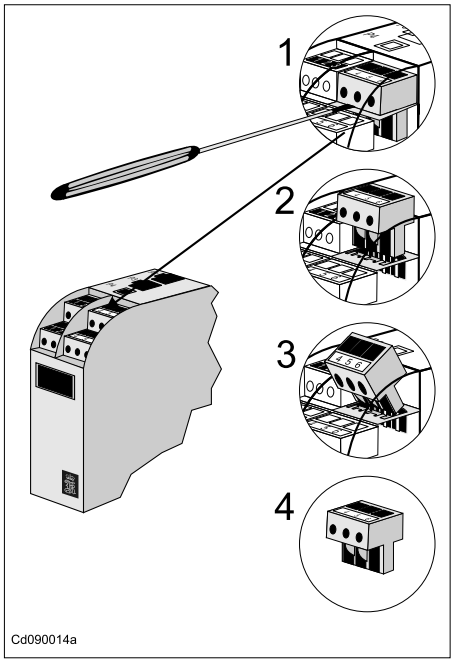
6 Turn ON power. The module status LED will be lit red initially during start-up. The module status LED will be lit green when the RSER200-4 communication with a controller (RCU) is established.

Replacement

Caution

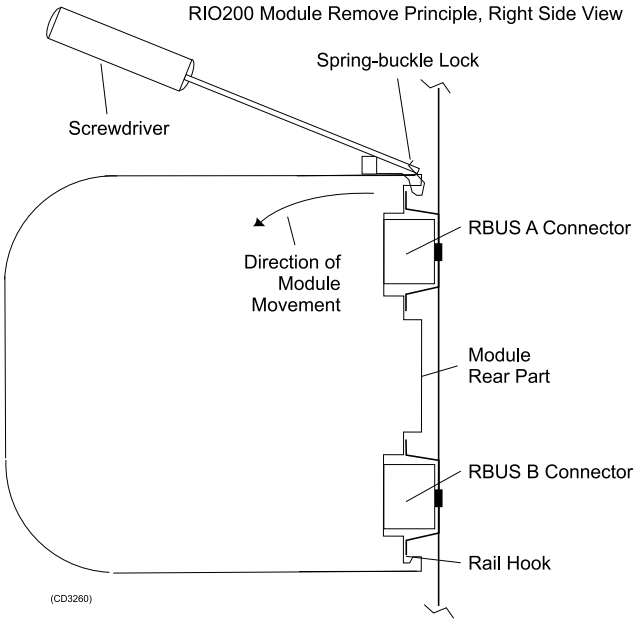
The module can be unpacked and handled without ESD protection, but electrostatic discharge can damage components on the module when terminating wires and cables to it. Therefore always wear a correctly-connected earthing strap when working on the module.

1 Remove the terminal block headers on X1 to 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 Link Channel cables connected to connectors P1 to P3.

3 Remove the RSER200-4 module from the bus rails by using a screwdriver to unlock spring buckle.

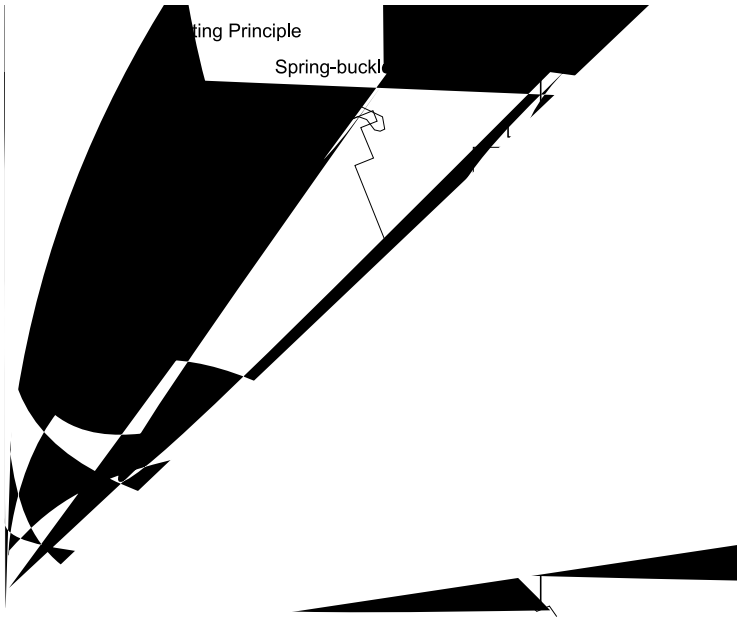


4 Put the module aside and label it with its fault symptoms.

5 Label the new RSER200-4 module.

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

7 Hook the RSER200-4 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.



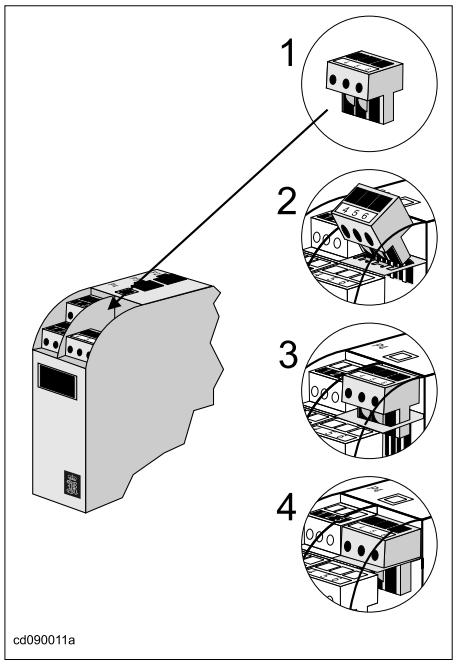
8 Reconnect the link channel cables to the connectors P1 to P3 as appropriate.

9 Reconnect the terminal block headers X1 to X4 on the RSER200-4 as appropriate by pushing them into position (see note and illustration below).

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. The module status LED will be lit green when the RSER200-4 communication with a controller (RCU) is established.

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