KONGSBERG

# RSER200-4

# Hardware Module Description

Kongsberg Maritime Part no.603444
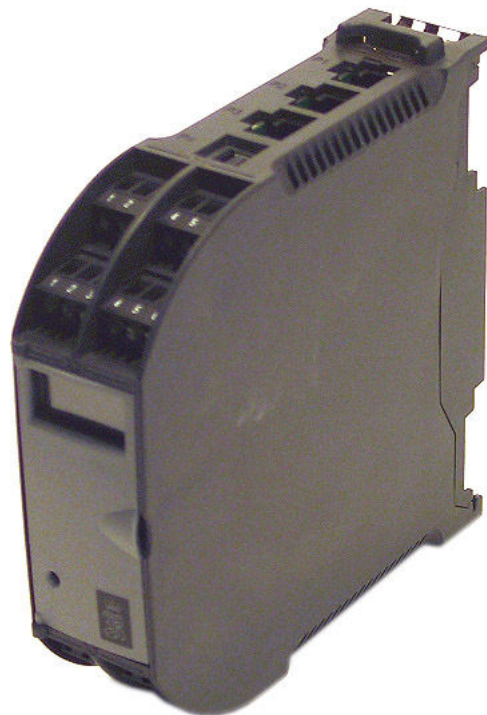
## Document history

| Document number: 300993 | | |
|---|---|---|
| Rev. A | November 2006 | First version. |
| Rev. B | November 2010 | New review of document. Text edited. |

# Table of contents

# 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
- Compliant to standards IEC 60945 and IACS E10

# Function

*Figure 1    RSER200-4 function diagram*



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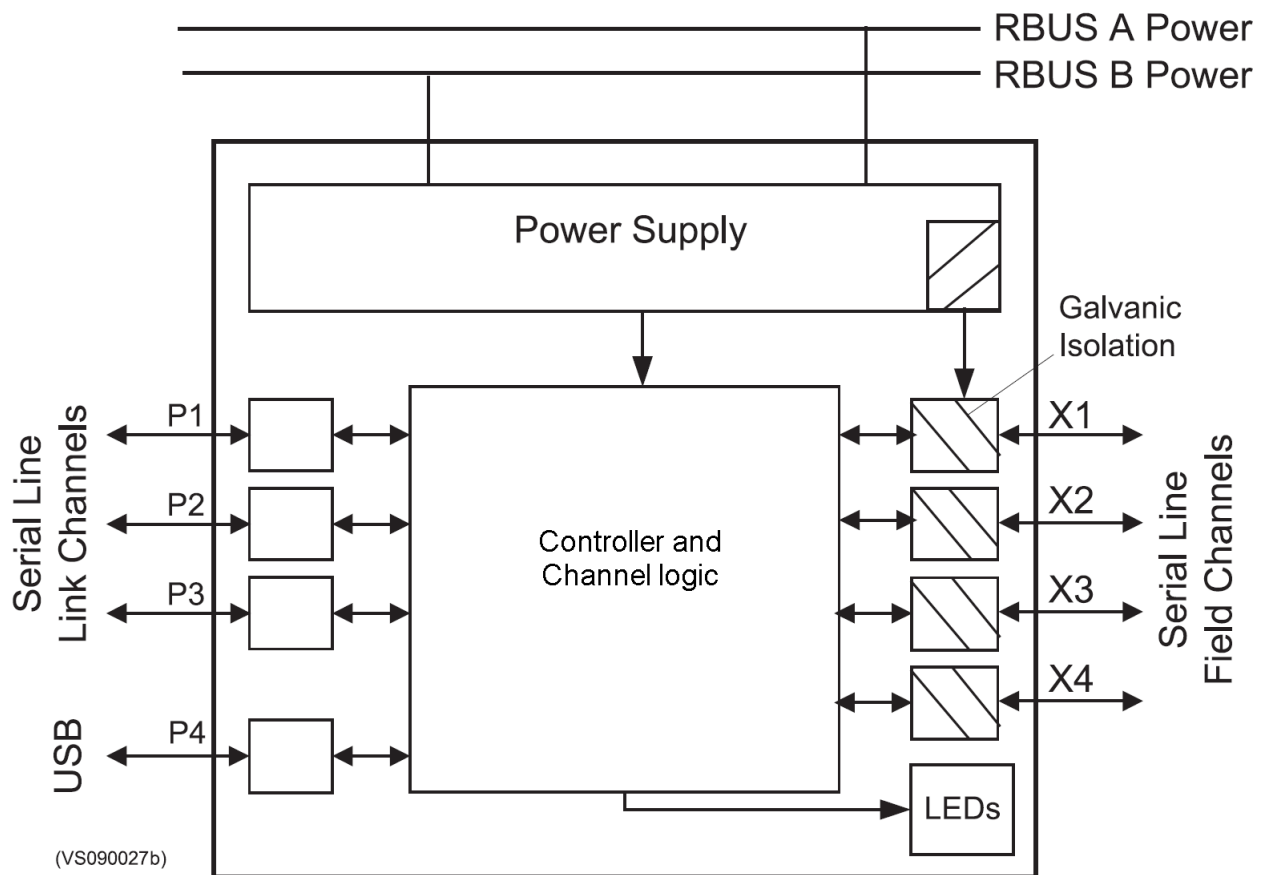
The interface module can be connected to up to three controllers (A, B, C) via the three RJ45 connectors (P1, P2, P3), and up to four field equipment (1, 2, 3, 4) via the four terminal blocks (X1, X2, X3, X4).

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 Figure 1 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*
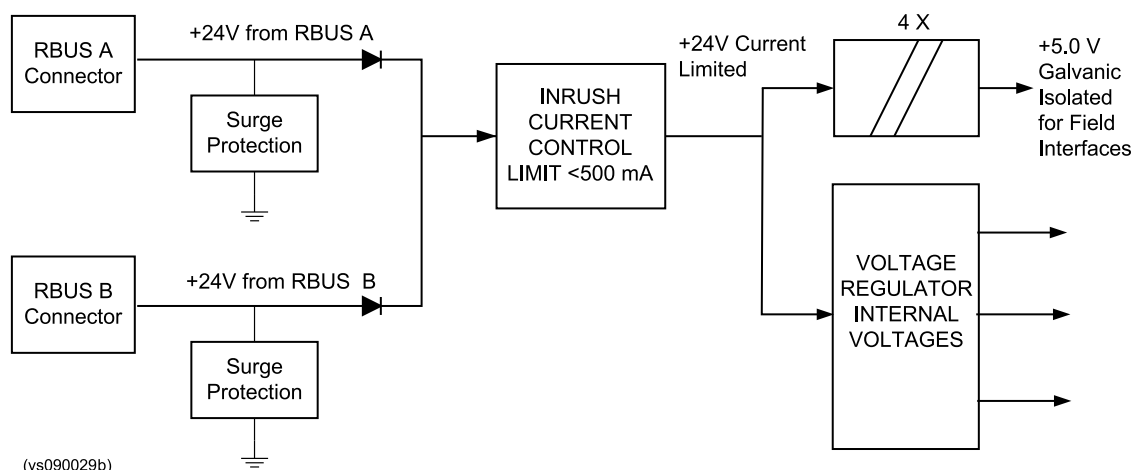
# RCU communication interface

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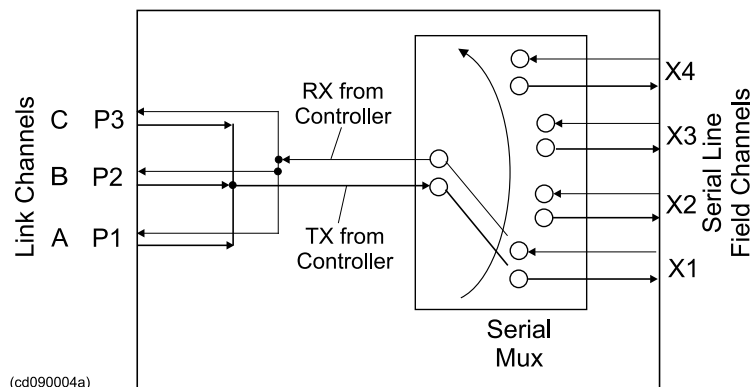
Dual or triple redundant controllers can be connected to the module. The controllers will receive data simultaneously, but only the system master is allowed to transmit.

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*



(cd090005a)
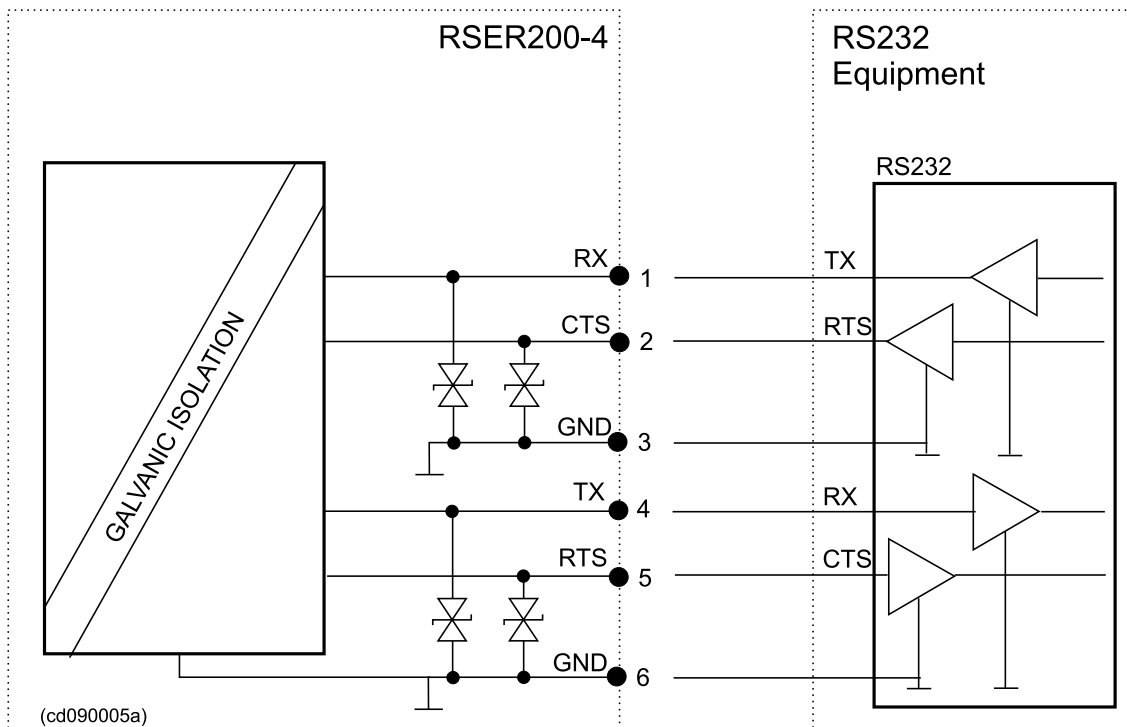
## RS422 interface

*Figure 5    RS422 interface principle*



(cd090006a)
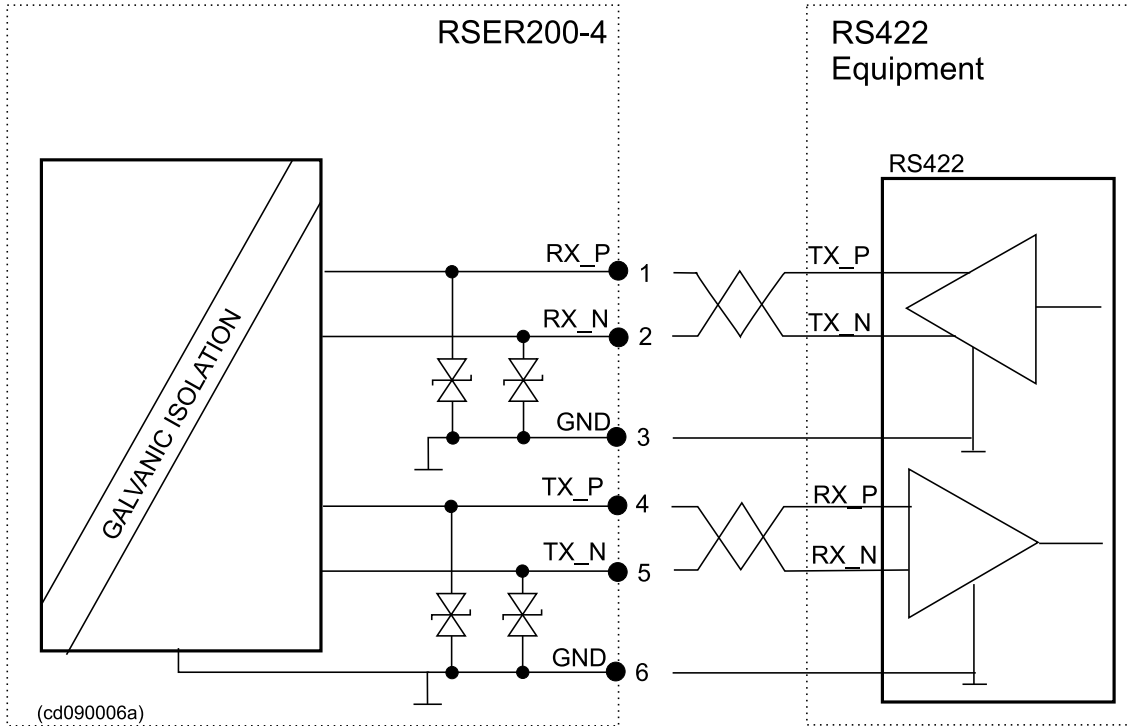
## RS485 interface

*Figure 6    RS485 interface principle , 3 wires*



(cd090008a)
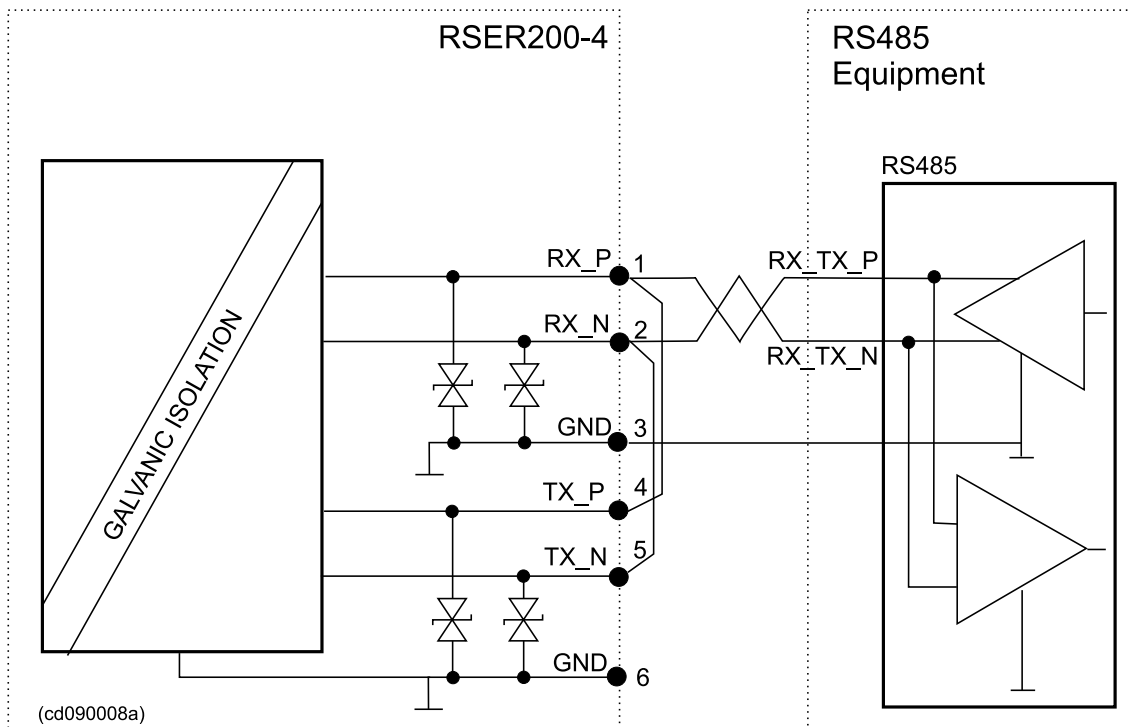
*Figure 7    RS485 serial bus with line termination*



(cd090020a)
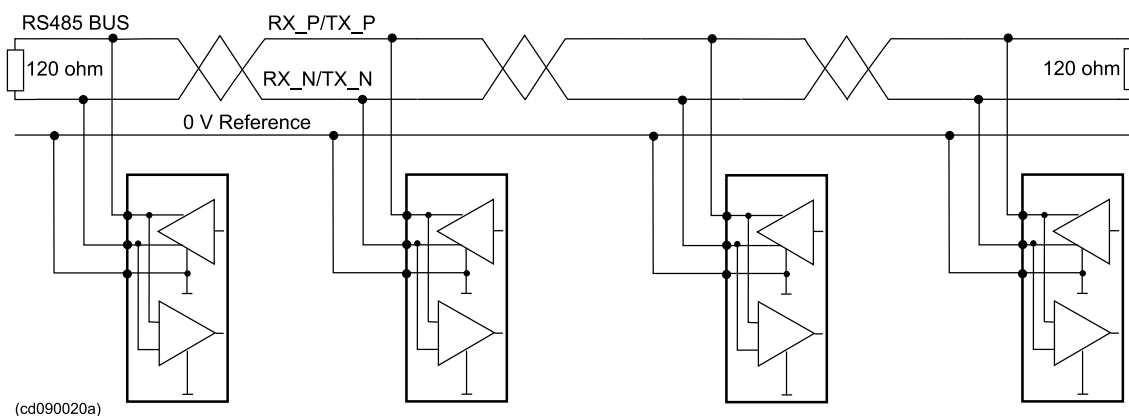
### NMEA 0183 interface

*Figure 8    NMEA 0183 interface principle*



(CD090007A)
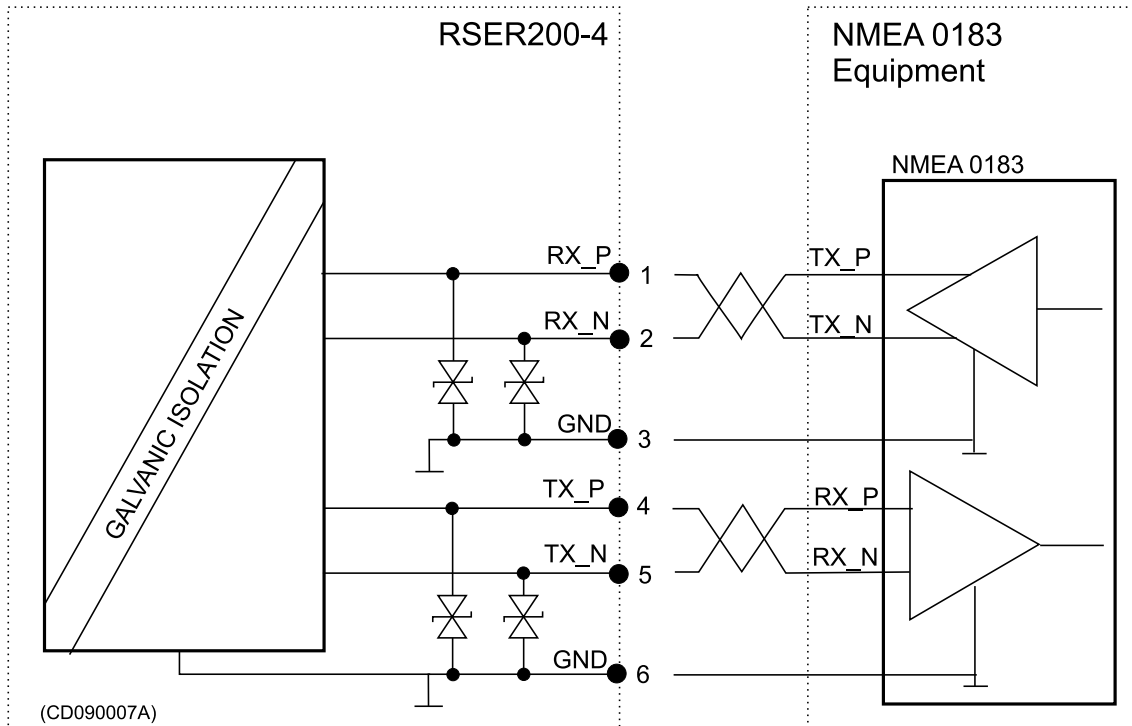
# LED indicators

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

*Figure 9    LED indicators layout*



(vs090045a)

*Table 1    LED indicators on module front*

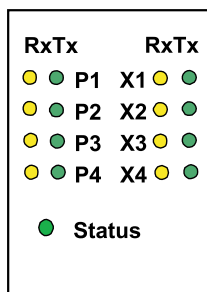| LED name | Colour, state | Function |
|---|---|---|
| Status | Green, fixed | Normal operation. The module is OK and it has communication with at least one RCU |
| | Red, fixed | Serious HW or SW error condition occurred, watchdog activated |
| | Red, flashing | During boot |
| RX P1 | Yellow, flashing | 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*
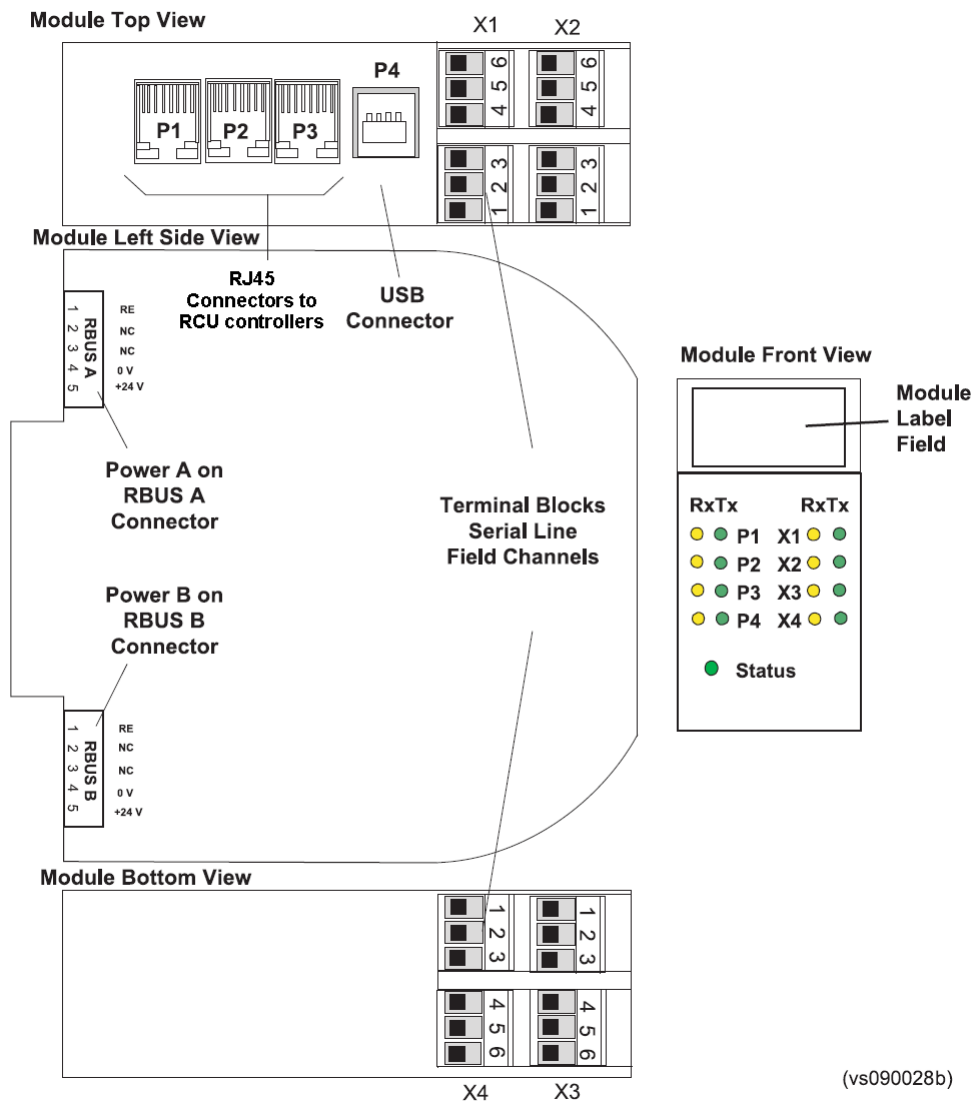
The following sections describe the module label layout, and the connectors' layout and pin allocation.

# 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*
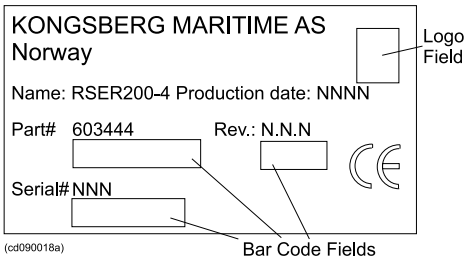
# P1 to P3 - Link Channel connectors

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.
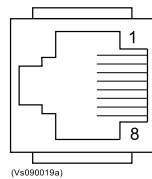
*Figure 12    Front view of RJ45 with pin layout*



(Vs090019a)

*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.
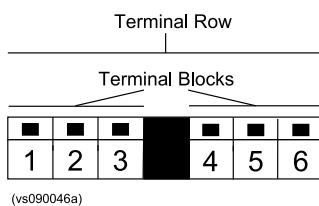
*Figure 13   X1 to X4 terminal layout*



(vs090046a)

*Table 5   Field channel terminal allocation*

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

# 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.

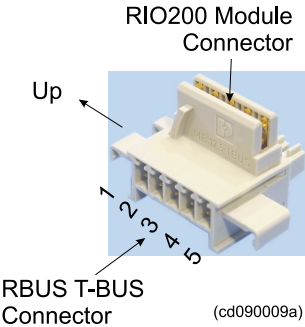*Figure 14    RBUS A and B, T-BUS™ rail connector terminal layout*



*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.*

**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.



RIO200 Module Mounting Principle
Right Side View

Spring-buckle Lock

RBUS A Connector

Module
Rear Part

RBUS B Connector

Rail Hook

(CD3259)
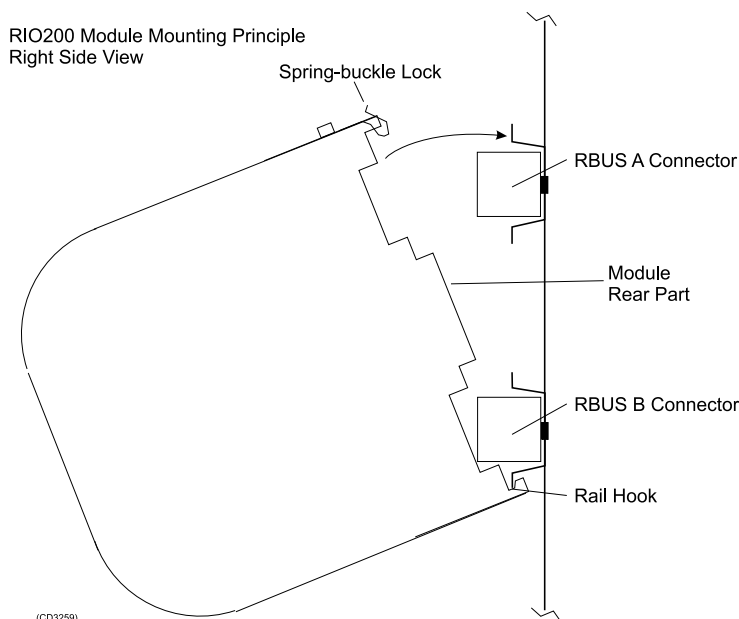
**4** Connect the link channel patch cables to the connectors P1 to P3 as appropriate.

**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.
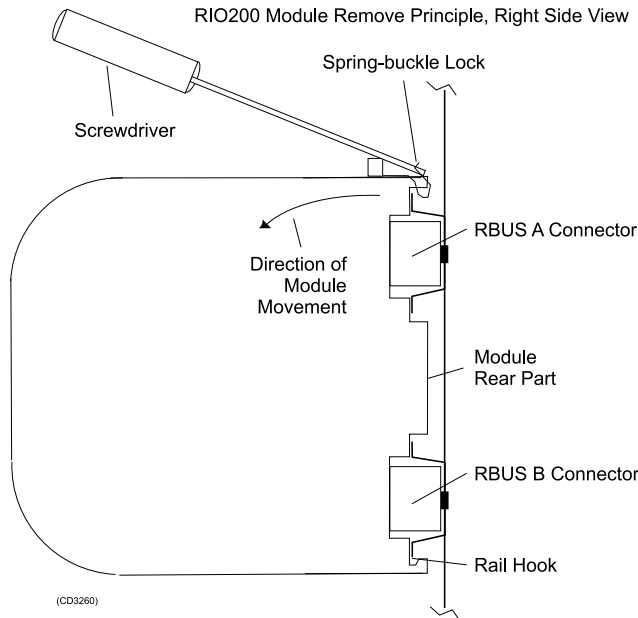
# Replacement

*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.
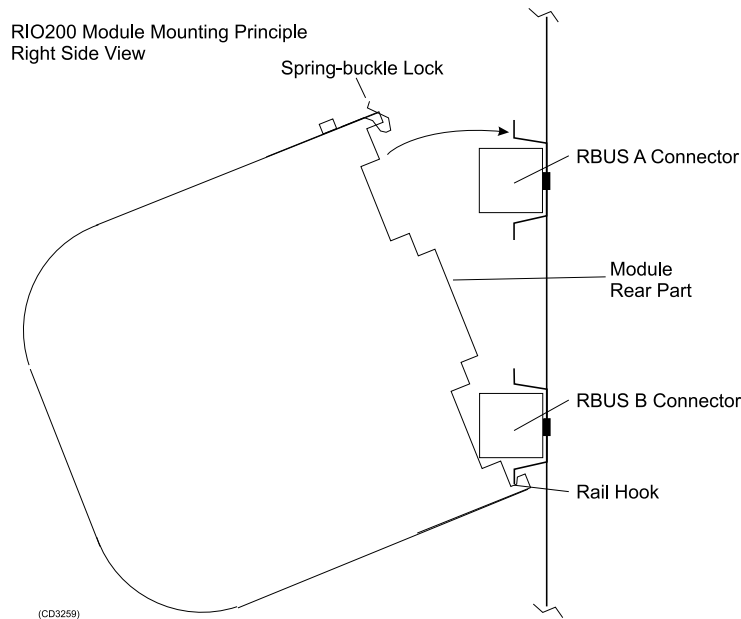


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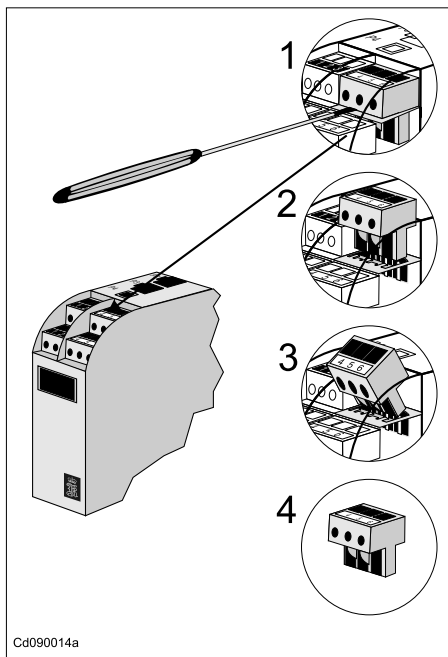
2    Unplug the Link Channel cables connected to connectors P1 to P3.

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

RIO200 Module Remove Principle, Right Side View

Spring-buckle Lock

Screwdriver

Direction of
Module
Movement

RBUS A Connector

Module
Rear Part

RBUS B Connector

Rail Hook

(CD3260)

**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.

RIO200 Module Mounting Principle
Right Side View

Spring-buckle Lock

RBUS A Connector

Module
Rear Part

RBUS B Connector

Rail Hook

(CD3259)

**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.



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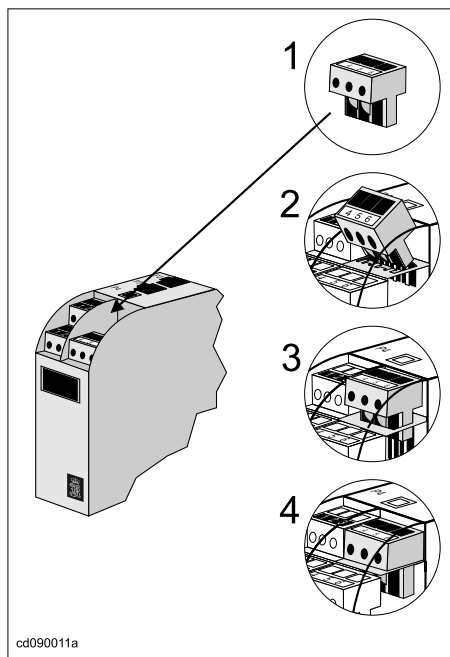
**10**  If power is OFF, turn ON power. The module status LED will be lit red initially during start-up. The module status LED will be lit green when the RSER200-4 communication with a controller (RCU) is established.