KONGSBERG

RCU502

Hardware Module Description

Kongsberg Maritime Part no.330924

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Document history

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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

ADC	Analog Digital Converter
BITE	Built-In Test Equipment
CAN	Controller Area Network
CPLD	Complex Programmable Logic Device
CPU	Central Processing Unit
DI	Digitial Input
DLL	Delay locked loop
DO	Digital Output
DSP	Digital Signal Processor
ECC	Error Correction Code
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
FPGA	Field Programmable Gate Arrys
GND	Module 0 V reference
HF	High Frequency
HW	Hardware
I^{2c}	Inter Integrated Circuit
	2wire computer bus interface
IE	Instrumentation Earth
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
IRQ	Interrupt request
KM	Kongsberg Maritime
LAN	Local Area Network
LED	Light Emitting Diode
Link Channel	Point to point serial line interface between RCU502 and RSER200-4
MAC	Media Access Control
MB	Mega bit
MH_z	Mega Hertz
MTBF	Mean Time Between Failure
NMI	Non-Maskable Interrupt
PCI	Peripheral Component Interconnect
	Computer bus interface

PE	Protective Earth
PLD	Programmable Logic Device
Process Net	Process Network A and B based on Ethernet 10BASE-T/100BASE-TX
PROFIBUS	Process Field Bus
PROFIBUS DP	PROFIBUS DP is a device level bus that supports both analog and discrete signals. PROFIBUS DP has widespread usage for such items as remote I/O systems, motor control centres, and variable speed drives. PROFIBUS DP communicates at speeds from 9.6 kbps to 12 Mbps over distances from 100 to 1,200 meters.
RAM	Random Access Memory
RBUS	Remote I/O Process Bus
RBUS interface	RIO communication link based on multi-drop 2 Mbps RS485 with Manchester encoding
RBUS Power	Electrical power supply to the RIO200 modules including field channels
RCU502	Remote Controller Unit series 502
RedNet	Redundancy Network based on Ethernet 100BASE-TX/1000BASE-T
RHUB200–5	RBUS hub module
RIO	Remote I/O
RIO200	Kongsberg Maritime Remote I/O 200 module family
RIO420	Kongsberg Maritime Remote I/O 420 module family
RFI	Radio Frequency Interference
RMP	Remote Multi Purpose I/O module
ROM	Real Only Memory
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
SBC	Single Board Computer
SRAM	Static Random Access Memory
SDRAM	Synchronous Dynamic Random Access Memory
TN-S-DC	Terra Neutral Separated Direct Current
UART	Universal Asynchronous Receiver/Transmitter

WD Watchdog

1 Module overview

1.1 Document user

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

1.2 Module functions and features

The RCU502 is a controller module for process control purposes. It is based on the PowerPC™ Host Processor MPC8245 running at 400 MHz and with RAM memory running at 133 MHz.

The main functions and features of the RCU502 are:

- 32-bit CPU running at 400 MHz
- VxWorks real-time operating system
- 64 MByte RAM
- 32 MByte Flash memory
- 4 general-purpose opto-isolated digital input channels
- 4 general-purpose opto-isolated digital output channels
- 1 Watchdog status opto-isolated digital output channel
- 24 Serial lines for 3rd party interface
- Dual Process Net, Ethernet interfaces (10BASE-T/100BASE-TX) for interconnecting operator stations and controllers
- Dual Field network (10BASE-T/100BASE-TX) for interfacing of field instruments
- Dual RedNet, Ethernet interfaces (100BASE-TX/1000BASE-T) for redundancy configurations
- Dual RBUS interface for connection to RIO200 and RIO420 modules
- 2 CAN interfaces
- 2 PROFIBUS DP interfaces
- Built-in real-time clock
- Cooling fan alarm
- High temperature alarm

- Over/under-voltage power alarms
- Dual supply voltage (24 VDC)
- Low power consumption (Max. 20 W)
- Built-in Test Equipment (BITE) for module monitoring during run-time
- Run status LED
- Eight test status LEDs
- Compliant to standards IEC 60945 and IACS E10
- SIL compliant according to IEC 61508

1.3 Safety information

This unit has been developed in accordance with IEC 61508 ed. 2.

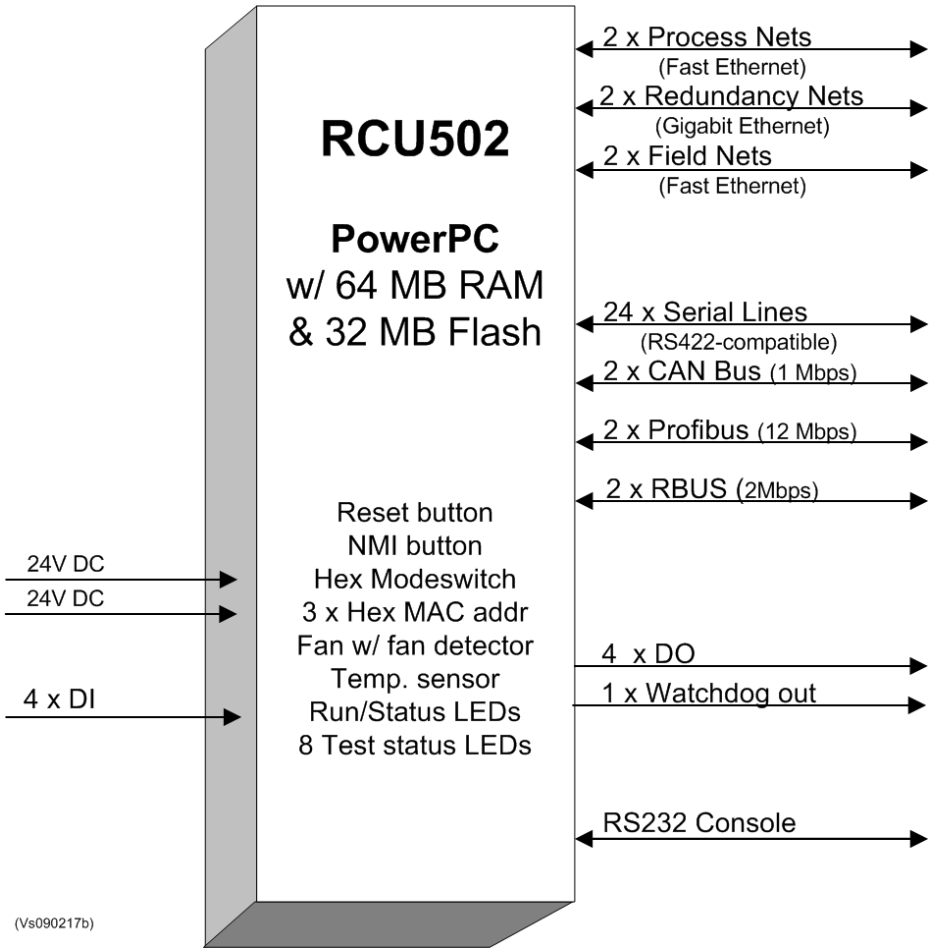
It can be used in safety functions for SIL 1,2 and 3, provided topologies and calculations are fulfilled as required by the K-Safe documentation. The relevant K-Safe documentation prepared for each safety project is based on the K-Safe Operator Manual (KM document 343964) and the K-Safe Architecture Specification (KM document 331002).

2 Module function

RCU502 is a high performance, general purpose, real-time process control computer for use in a wide variety of KM system applications in both on- and offshore installations. The processor core is an embedded Power PC™architecture. The unit is SIL qualified and prepared for triple unit redundancy topologies.

Except for that the serial link 7 and 8 are replaced with field Ethernet, the unit is fully backward compatible with the prior RCU501. It is also functionally compatible, but not plug compatible, with RCU500.

Figure 1 RCU502 interface block diagram



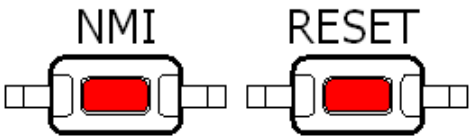
The RCU502 provides alarm functions such as:

- Fan alarm
- Temperature alarm
- Voltage alarm

2.1 Controls, indicators and system connector

The RCU502 is provided with the NMI and RESET function controls/buttons located in the upper right-hand corner of the module.

Figure 2 NMI and RESET buttons layout



(Vs090015a)

2.1.1 NMI push-button

The NMI stops the executing programs in the RCU. Watchdog will be activated and all output will turn to fail safe state. Now the RCU can be inspected by qualified KM personnel. The RCU may be restarted by pushing the RESET button.

2.1.2 RESET push-button

Pushing the reset button will restart the RCU. Consequentially output will go to fail safe state. After the reset is complete the application will be initiated automatically.

The reset button is used in order to reload the application.

2.1.3 RCU condition monitoring

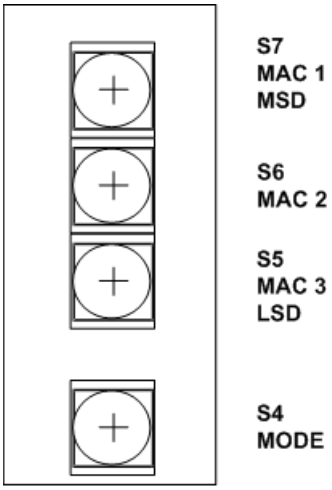
2.1.3.1 RCU502 system alarms

The RCU502 contains numerous system alarms that will be given to the operator when a fault occurs. Detailed alarm description, possible consequences and corrective action is given in the online AIM User Guide.

2.1.4 Address switches (MAC 1, MAC 2, MAC 3)

The RCU502 has three hexadecimal switches MAC 1 (S7), MAC 2 (S6), MAC 3 (S5) by which you can set the MAC address for NET A and NET B.

Figure 3 Address switches and Mode switch



MAC address format for NET A is: 02:41:4C:42:1X:XX

MAC address format for NET B is: 02:41:4C:42:2X:XX

where X:XX is MAC 1:MAC 2 MAC 3.

2.1.4.1 Example of address setting

The hexadecimal switch settings:

MAC 1 = 1, MAC 2 = 2, MAC 3 = 3

give the MAC addresses:

NET A: 02:41:4C:42:11:23

NET B: 02:41:4C:42:21:23.

2.1.5 MODE switch

The RCU502 has a hexadecimal MODE switch (S4) (see Figure 3 on page 13), which is used to set operational mode. It is used for flashing resident application programs to the flash memory and for advanced servicing and debugging purposes.

The front MODE HEX switch controls the booting of code. The following HEX switch settings can be used:

MODE HEX switch setting	Function
0	The RCU boots normally. The switch shall almost always be in this position. The other positions are for special purposes only to be operated by KM qualified personnel only.
1	The RCU will only attempt to boot from the Process network.
2	The RCU will only attempt to boot from the Process network.
5	ECC is not started. BIST is skipped which means that the RAM is not zero'ed. The target shall enter the boot loop.
D	ECC is not started. BIST is skipped which means that the RAM is not zero'ed. The target shall enter the boot monitor. (Auto boot is disabled)
F	Application will not be started (initApplication() is not called.)

Note

The switch has to be set to 0 (zero) for normal operation (default setting).

2.1.6 LED indicators

2.1.6.1 Run status LED

The status LED is located on the front cover. It can be red or green - indicating **run** or **error** status.

Table 1 LED indicator information

LED name	Colour	Function
Run status	Green	**Run** Green when the watchdog is enabled and is ON (see section 2.11.1 on page 20.
	Red	**Error** Red when the watchdog is disabled or is OFF

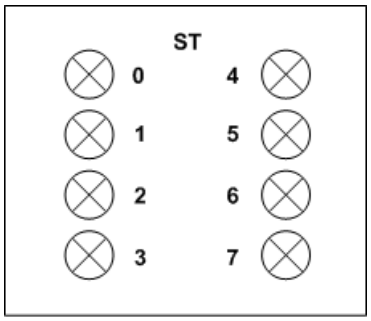
2.1.6.2 Eight test status LEDs

The RCU502 has eight test status LEDs used for signalling test status conditions. The LEDs ST0 to ST3 are used by the internal test programs.

The LEDs, ST4 to ST7 can be used by the application programs or for debug purposes. Eg. ST3 is Flash test, ST4 is online and ST7 is scan task.

The eight LEDs are located in the upper left-hand corner of the module.

Figure 4 Test status LEDs layout



(Vs090017a)

The following table shows the start-up sequence (1 = light, 0 = dark).

Table 2 Start-up LED status pattern

Phase	ST3–ST0	Task running
HW Testing	0001	Test of bootPROM checksum
	0010	Test of RAM
	0011	PCI Test
	0100	Test of FLASH
	0101	FPGA Test
	0110	Serial Test
	0111	Timer Test
SW Booting	1000	Entered boot monitor

Table 2 Start-up LED status pattern (cont'd.)

Phase	ST3–ST0	Task running
	1001	Getting bootp on net A
	1001 flashing	Booting on net A
	1010	Getting bootp on net B
	1010 flashing	Booting on net B
	1011 flashing	Started initializing the basic SW
Application running	0000	Calling initApplication and starting the application code

2.1.7 RS232 console connector (P6)

The P6 connector is used for interfacing a data terminal to the RCU502 CPU during advanced servicing and debugging.

The RCU502 Console connector P6 is an eight-pin unshielded RJ45 modular jack connector with RS232-compatible signalling, designed to support hyper terminal (or similar) protocol communication.

Note

***Safety**: There are restrictions with respect to use of this functionality in safety systems. The safety will be de-guarded in debugging mode.*

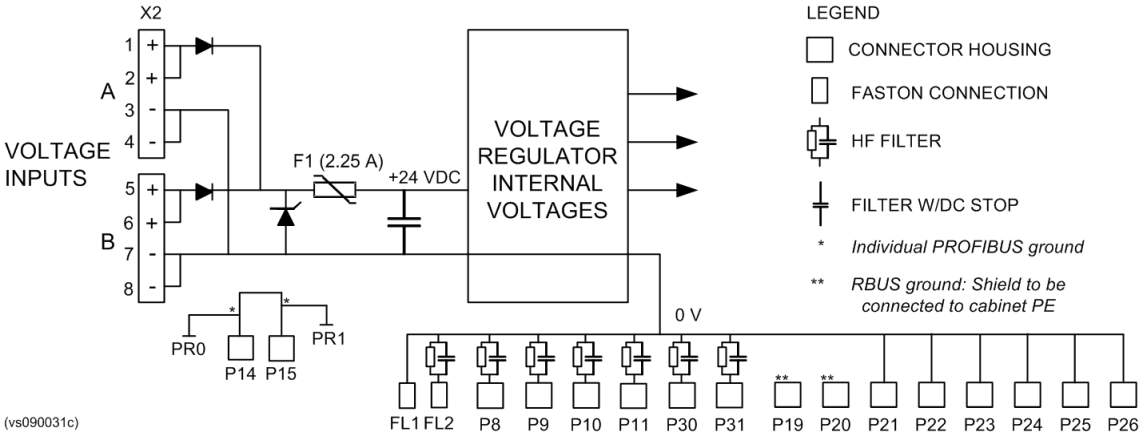
2.2 Power supply

One or two power supplies (24 VDC) can be connected to RCU502 using the dual terminal block X2. Two independent power supplies (X2 A and B connection) are used when power supply redundancy is required.

To protect the voltage regulators against overvoltage, a tranzorber is mounted across the power terminals of X2. To protect the voltage regulators against overload, an automatic resetable fuse is implemented on the input side. It is however mandatory to fit an external fuse on the module power supply.

The internal voltages are monitored by the module.

Figure 5 Power supply principles



2.3 Process Net interfaces

The Process Net interfaces, Net A and Net B, are available on P8 and P9 respectively. The physical interface complies with IEEE 802.3 10BASE-T/100BASE-TX.

Typical communication is between RCUs and towards the operator stations (OS).

2.4 FieldNet interfaces

RCU502 is provided with two FieldNet interfaces, FieldNet 1 (P30) and FieldNet 2 (P31) for Ethernet communication with the field instrumentation e.g. fire centrals etc.

Typical communication protocols may be e.g. Modbus TCP and PROFInet.

Note

***Safety**: For IEC 61508 functions only qualified I/O drivers shall be used.*

2.5 RedNet interfaces

RCU502 is provided with two Ethernet based ports RedNet Next (P10) and RedNet Previous (P11) for redundancy interconnection of the RCUs.

Two or three RCU502 can be interconnected in redundancy configurations.

Interconnecting cables used for RedNet must be provided with crossed RX and TX pairs.

Figure 6 Dual RCU redundancy

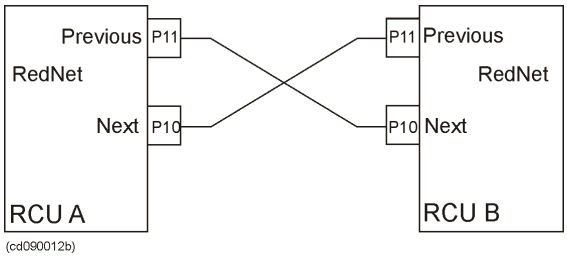
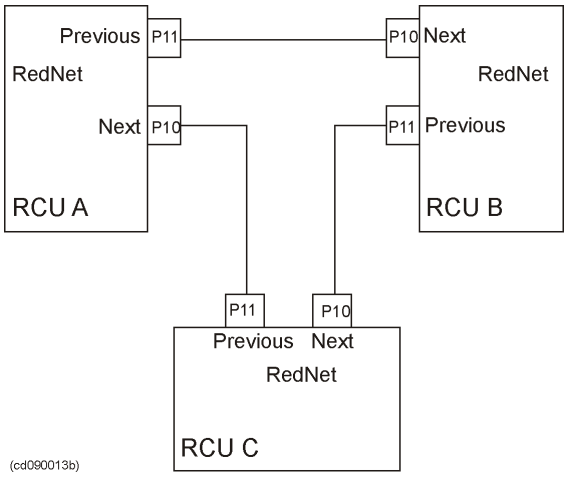


Figure 7 Triple RCU redundancy



2.6 Serial line interfaces

The RCU502 is provided with 6 Link Channel interfaces (SER1 to SER6). They are dedicated for interfacing with RSER200-4 modules. Every Link channel may interface four separate serial channels. Thus, the total number of 3rd party serial line interfaces are 24.

- Each Link Channel is available on a RJ45 connector (P21 to P26).
- Each Link Channel connector has adjacent Tx and an Rx LEDs.
- Each Rx signal interface is galvanic isolated using an optocoupler.
- The total bit rate is 1 Mbps.

Note

***Safety**: For IEC 61508 functions only qualified I/O drivers shall be used.*

2.7 RBUS interfaces

The RCU502 has two galvanic isolated remote IO process bus interfaces (RBUS A and RBUS B) for single or redundant RBUS Link networks. The bus facilitates communication between single or redundant controllers and I/O modules in the RIO200 and RIO420 systems. The RBUS is based on multidrop RS485 serial lines.

The two RBUS Link interfaces are available on the P19 and P20 connectors respectively.

2.8 CAN interfaces

The RCU502 is provided with two CAN ports (CANBUS 1 and CANBUS 2), which are available on the X4 and X5 connectors respectively. The CAN interfaces are designed according to the requirements of Device Net.

Note

***Safety**: For IEC 61508 functions only qualified I/O drivers shall be used.*

2.9 PROFIBUS DP interfaces

The RCU502 contains two PROFIBUS DP ports (PROFIBUS 1 and PROFIBUS 2), which are available on the P14 and P15 connectors. There are no internal termination resistors, consequently PROFIBUS plugs with resistors is mandatory.

Note

***Safety**: For IEC 61508 functions only qualified I/O drivers shall be used.*

2.10 Onboard I/O channels and Watchdog

The four onboard DI channels, the four onboard DO channels and the one Watchdog channel are all opto-isolated. The channels are available on the X3 connector. After reset of the module the four DO channels are set to **0** i.e. no current in the optocouplers.

Note

***Safety**: The onboard I/O signals shall neither be used in IEC 61508 systems for SIL functions nor for SIL monitoring functions.*

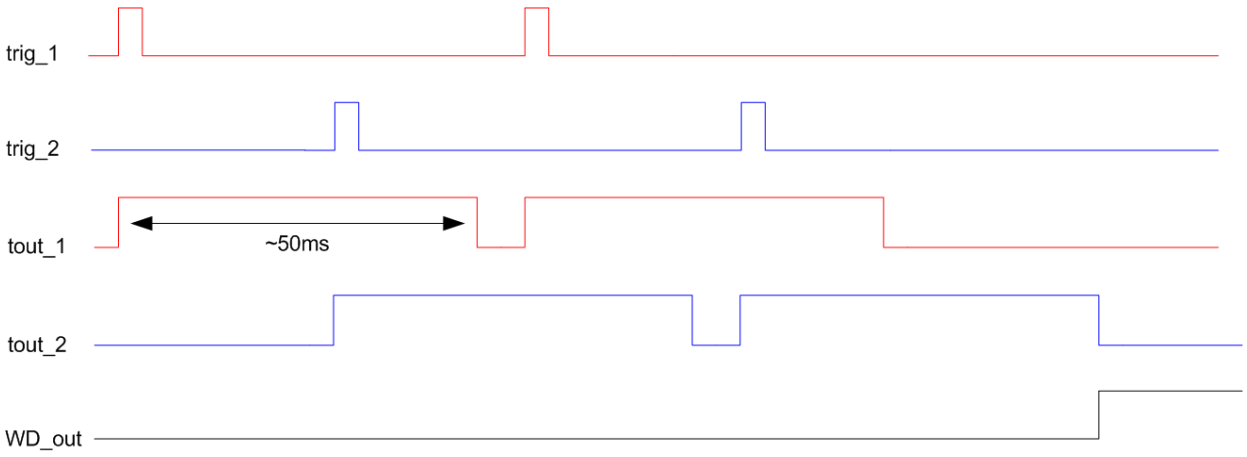
2.11 Self diagnostics

Extensive self-diagnostics are embedded into the design in order to detect faults.

2.11.1 Watchdog control

The RCU502 module have an embedded time controlled watchdog (WD) unit. This unit is to assure that the module goes to a controlled fail-safe mode in case of an internal computer mal-function. The WD unit is trigging (*trig_1* and *Trig_2* on figure 9) two (different) discrete logic devices. The logic devices will generate fail-safe (*WD_out* on figure 9) if one or both the 'keep-alive' trig pulses are missing.

Figure 8 Watchdog timer



2.12 Module grounding

Module ground is wired to system ground (IE or PE).

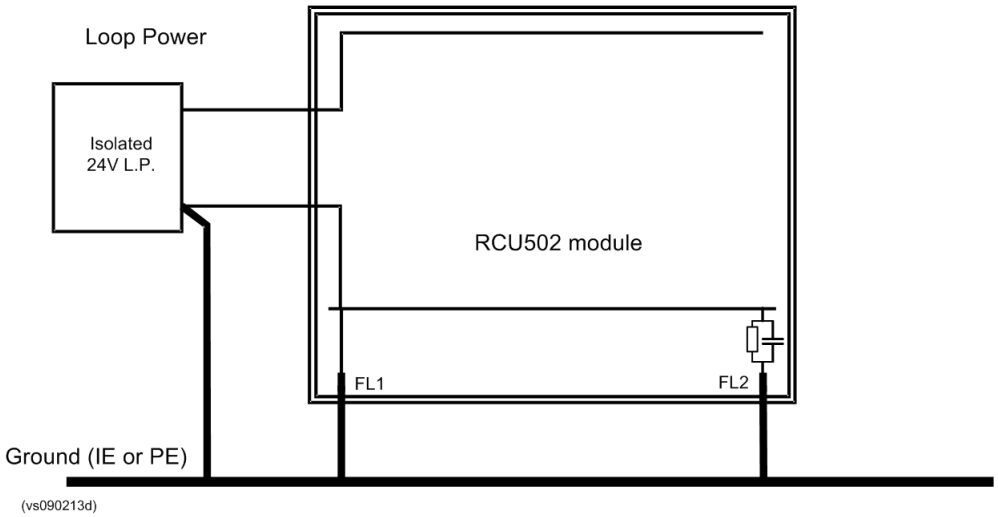
In a TN-S-DC system the module can be grounded to IE or PE using the fast-on terminal FL1 and FL2 according to IEC 60364.

Earth fault detection may be done by using external devices.

Note

This is the recommended ground alternative due to high noise immunity, over-voltage protection as well as EMC (ESD, RFI etc).

Figure 9 Module grounding in a TN-S-DC system according to IEC 60364



2.13 Safety functions

The RCU502 module is certified for use in IEC 61508 systems for SIL functions. The guidelines and limitations given in the K-Safe documentation must be followed.

3 Technical specifications

Table 3 Technical specification

Power supply requirements	
Input voltage	+24 VDC nominal (+18 - +32 VDC)
Nominal current consumption	Max. 0.8 A
Maximum start-up current	3.8 A
Power consumption	Max. 20 W
Heat dissipation	Max. 20 W
Power connectors	Screw terminal (slotted)
	Cable cross section 2.5 mm^2
Central processor and memory specifications:	
Processor type	PowerPC™ Host Processor MPC8245
Processor clock frequency	400 MHz
RAM size and speed	64 MByte DRAM at 132 MHz w/ECC
PROM	16 MByte application Flash-file
Watchdog specifications	
Watchdog time-out	0.1748 s to 5.594 s, programmable
General Purpose I/O channel specifications	
Digital output (DO)	4 general purpose digital opto-isolated outputs. Max. 30 mA
	1 opto-isolated watch dog (for external interface) Max. 30 mA
Digital input (DI)	4 opto-isolated inputs
I/O connectors	
	Cage clamps
	Cable cross section 0.75mm^2
Network interface specifications	
Process Net interface	P8, P9: 2 x Ethernet IEEE 802.3 type 10BASE-T/100BASE-TX interface, available on two shielded RJ45 modular jack connectors.
FieldNet interface	P30, P31: 2 x Ethernet IEEE 802.3 type 10BASE-T/100BASE-TX interface, available on two shielded RJ45 modular jack connectors.

Table 3 Technical specification (cont'd.)

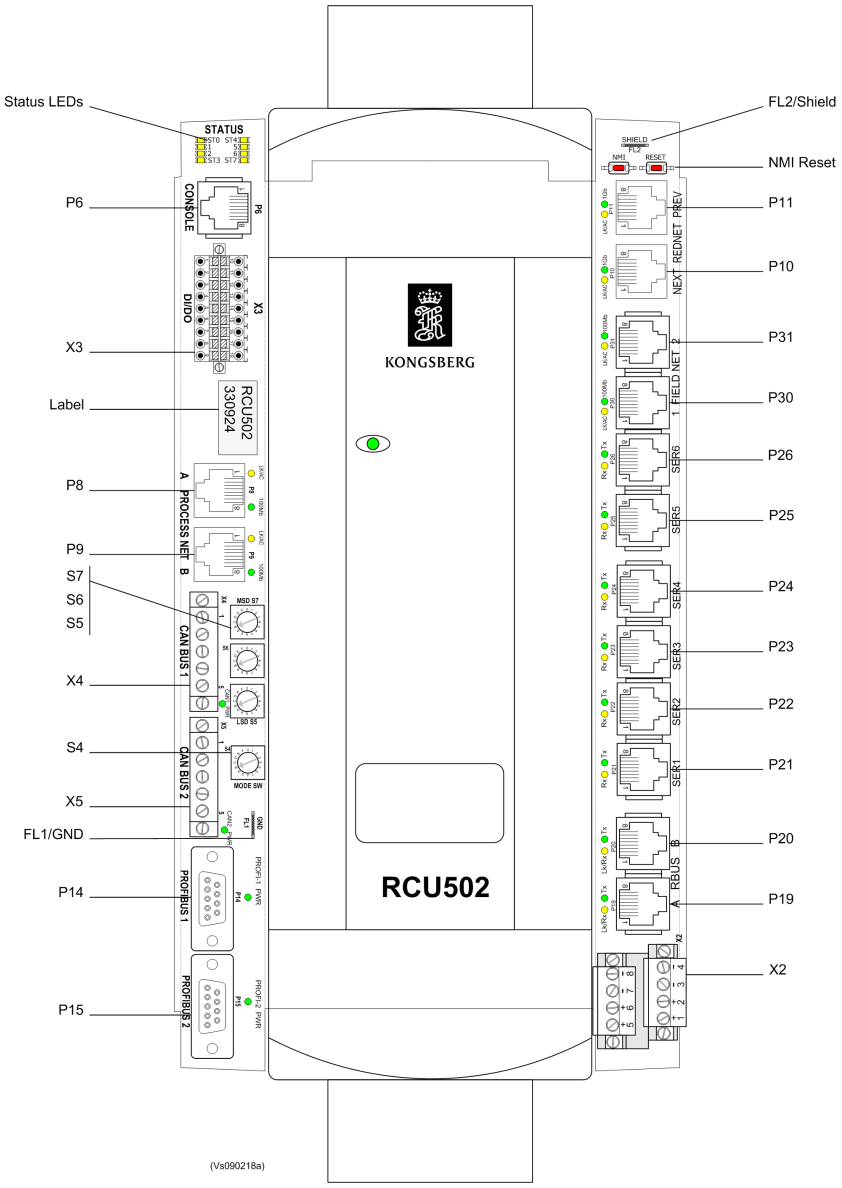
RedNet interface	P10, P11: 2 x Ethernet IEEE 802.3 type 100BASE-TX/1000BASE-T interface, available on two shielded RJ45 modular jack connectors.
Serial Line interface	
Channels	24 separated insulated serial lines for 3rd party interface distributed on 6 shielded RJ45 modular jack connectors.
Physical layer	RS232, RS422, RS485 and NMEA 0183 multidrop via RSER 200–4
Bit rate per channel	Max. 115kb/s
Remote I/O interface specifications	
RBUS	P21, P26: 2 x RBUS Link interface, available on two shielded RJ45 modular jack connectors.
Serial line type	RS485 multidrop
Signal code	Manchester encoded (self-clocked)
Power supply voltage	+18 - +32 VDC
Current consumption	Max. 50 mA
Isolation voltage	500 V
Number of addresses	99
Connector	9 Pin DSUB female
Bit rate	2 Mbit/sec
Copper wire topology	
Insulation	500 V maximum (optocoupler)
Physical layer	RS-485 multidrop
Cable attenuation	< 6.5 dB/100 m @ 10 MHz (CAT 5)
Cable length	Maximum 200 m between repeaters. Maximum 3 repeaters.
Fibre optics topology (w/additional fibre media converter)	
Fibre cable	62.5/125 µm, multi-mode
Connector	ST
Maximum cable length	1000 m (point to point), 500 m if used in patch panel topology.
Fieldbus interface specifications	
CAN interface	X4, X5: 2 x CANopen/DeviceNet. Available on two 5-pole terminal blocks with screw terminals handling 2.5 mm^2 wires
Bit rate	Maximum 1 Mbps. (DeviceNet not defined above 500 kbps)
PROFIBUS DP interface	P14, P15: 2 x Profibus interface, opto-isolated, available on two 9 pin female D-sub connectors.
Bit rate	Maximum 12 Mbps

Table 3 Technical specification (cont'd.)

Console interface specifications	
Connector type	RJ45 unshielded
Serial line type	RS232
Bit rate	9600 bps, 8 bit data, 1 stop bit, none parity
Fan specifications	
Fan noise	32 dB
Fan size	60 mm x 60 mm x 28 mm
Fan MTBF	50,000 hours
Mechanical specifications	
Module size (W x H x D)	158 x 355 x 87 mm
Weight	1.34 kg
Mounting	Screw locks on DIN-rail T35–15/7.5
Environmental requirements	
Temperature operational	-15 °C – +70 °C
Temperature storage	-25 °C – +70 °C
Vibration	Maximum 1.0 g
IP class	IP 20
Compliant to standards	IEC 60945 and IACS E10
Life cycle predictions	
Predicted failure rate @ GB 25ºC (60% confident, based on chip suppliers data):	42.06 years
Predicted failure rate @ NS 35ºC (Environmental de-rating based on Rome Laboratory toolkit):	11,5 years
Safety IEC 61508	
Failure rates per channel level	See PSA RCU502 KM FMEA doc. no. 335925
Diagnostic Coverage	See PSA RCU502 KM FMEA doc. no. 335925
Proof test interval recommendation	Every 8760 hrs or as per SIL calculation for the specific delivery project
Recycling	
RoHS compliant 	Compliant to EU directive 2002/95: Restriction of the use at certain hazardous substances in Electrical and Electronic Equipment (RoHS).
Recycling	Module recycling according to EU directive 2002/96: Waste Electrical and Electronical Equipment (WEEE).

4 Module pin and connector description

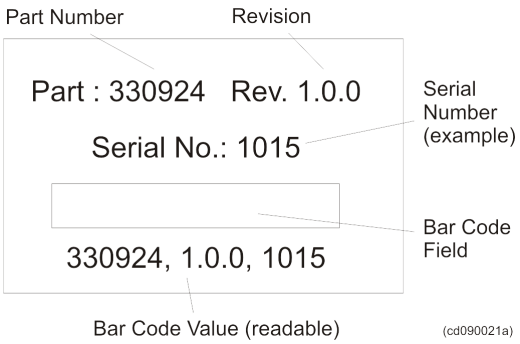
Figure 10 Layout of RCU502



4.1 Module identification

For any communication with Kongsberg Maritime regarding this module please refer to the module name (RCU502) and information on the module identification label.

Figure 11 Module identification label (example)



4.2 P6 pin allocation (Console connection)

P6 is an 8-pin RJ45, unshielded modular jack connector for RS232 serial line, console connection.

Figure 12 Front view of RJ45 with pin layout

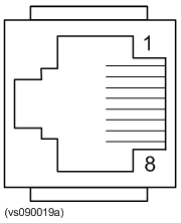


Table 4 P6 pin allocation

Pin no.	Signal name	Function
1		Not connected
2		Not connected
3		
4	0 V	0 V GND
5	CPU_RS232_TX	Transmit Data
6	CPU_RS232_RX	Receive Data
7		Not connected
8		

4.3 P8 and P9 (Process Net connection) pin allocation

P8 and P9 are shielded RJ45, modular jack connectors that provide Process Net connections (Net A (P8) and Net B (P9)) to the module.

Table 5 P8 and P9 pin allocation

Pin	Signal name	Function
1	TXP	Positive transmit line
2	TXN	Negative transmit line
3	RXP	Positive receive line
4		Not connected
5		
6	RXN	Negative receive line
7		Not connected
8		

Note

Each connector housing of P8 and P9 is connected via a HF filter to module 0 V within the module (see Figure 5 on page 17).

4.4 P30 and P31 (FieldNet connection) pin allocation

RCU502 provides two ports, FieldNet 1 (P30) and FieldNet 2 (P31), for Ethernet communication with the field instrumentation. P30 and P31 are shielded RJ45 modular jack connectors.

Table 6 P30 and P31 pin allocation

Pin	Signal name	Function
1	TXP	Positive transmit line
2	TXN	Negative transmit line
3	RXP	Positive receive line
4		Not connected
5		
6	RXN	Negative receive line
7		Not connected
8		

Note

Each connector housing of P30 and P31 is connected via a HF filter to module 0 V within the module (see Figure 5 on page 17).

4.5 P10 and P11 (RedNet connection) pin allocation

RCU502 provides two ports, REDNET NEXT (P10) and REDNET PREV (P11), for redundancy connection between RCU modules. P10 and P11 are shielded RJ45 modular jack connectors.

Interconnecting cables used for RedNet must be provided with crossed RX and TX pairs.

See Figure 12 on page 26 for connector pin layout.

Table 7 P10 and P11 pin allocation

Pin	Signal name	Function
1	TXP	Positive transmit line
2	TXN	Negative transmit line
3	RXP	Positive receive line
4		Not connected
5		
6	RXN	Negative receive line
7		Not connected
8		

Note

Each connector housing of P10 and P11 is connected via a HF filter to module 0 V within the module (see Figure 5 on page 17).

4.6 P14 and P15 pin allocation (PROFIBUS DP connection)

RCU502 provides two PROFIBUS DP ports (PROFIBUS 1 (P14) and PROFIBUS 2 (P15)). P14 and P15 are 9-pin, female, D-sub connectors.

Figure 13 P14 and P15 pin layout and allocation

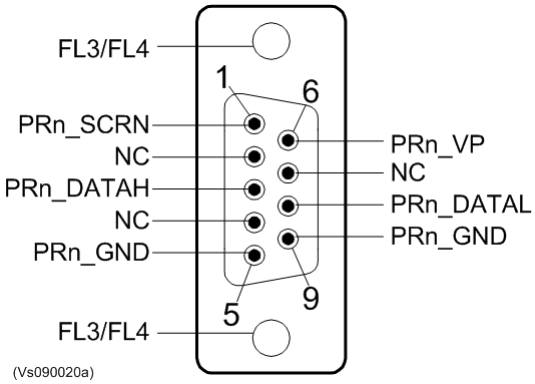


Table 8 P14 and P15 pin allocation

Pin no.	Signal name P14	Signal name P15	Function
1	PR0_SCRN	PR1_SCRN	For cable screen connection *
2			Not connected
3	PR0_DATA_H	PR1_DATA_H	PROFIBUS Data, High terminal (RS485)
4			Not connected
5	PR0_GND	PR1_GND	PROFIBUS, signal reference *
6	PR0_VP	PR1_VP	PROFIBUS, 5 VDC (isolated)
7			Not connected
8	PR0_DATA_L	PR1_DATA_L	PROFIBUS Data, Low terminal (RS485)
9	PR0_GND	PR1_GND	PROFIBUS, signal reference *

** Common potential (PROFIBUS ground).*

Note

Connector housing of P14 and P15 are connected to individual PROFIBUS ground (see Figure 5 on page 17).

4.7 P19 and P20 pin allocation (RBUS connection)

RCU502 is provided with two RBUS connectors: RBUS A (P19) and RBUS B (P20). P19 and P20 are shielded RJ45 modular jack connectors.

Cable shield to be grounded in cabinet PE.

Table 9 P19 and P20 pin allocation

Pin no.	Signal name	Function
1	DATA_H	RS485 serial line high terminal
2	DATA_L	RS485 serial line low terminal
3		Not connected
4	0 VDC	0 V individual RBUS ground
5		
6		Not connected
7	24 V	+24 VDC, interface input supply voltage
8	0 VDC	0 V individual RBUS ground

4.8 P21 to P26 pin allocation (Link Channel connection)

RCU502 is provided with 6 Link Channel connectors SER1 (P21) to SER 6 (P26). P21 to P26 are shielded RJ45 modular jack connectors.

The Link Channel interface to RSER200-4 has to use a straight (not crossed) cable with all 8 pins in use.

Table 10 P21 to P26 pin allocation

Pin no.	Signal name	Function
1	TXn-P	Link Channel #n Transmit, Positive terminal
2	TXn-N	Link Channel #n Transmit, Negative terminal
3	RXn_P	Link Channel #n Receive, Positive terminal
4	RTSn_P [1]	Link Channel #n Request To Send, Positive output terminal
5	RTSn_N[1]	Link Channel #n Request To Send, Negative output terminal
6	RXn_N	Link Channel #n Receive, Negative terminal
7		Not connected
8	0 V	0 V, signal reference terminal

where n = 1 for P21, 2 for P22, ..., 6 for P26

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

Note

Each connector housing of P21 to P26 is connected to common ground (see Figure 5 on page 17).

4.9 X1 (Fan connection)

X1 (Fan connection) is a 3 pin male connector located within the lower hatch-covered part of the module.

Table 11 X1 pin allocation

Pin no.	Pin name	Function
1	Pulse	Fan running feedback signal
2	0 VDC	Supply voltage 0V reference
3	+24 VDC	Fan supply voltage

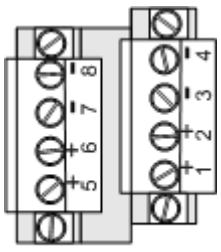
4.10 X2 (Power connection)

X2 (Power connection) is an 8-pole dual terminal block with screw terminals. The connector is provided with two removable headers (terminal 1 to 4 and 5 to 8 respectively).

Cable cross section: 2.5 mm^2

The connected power supply shall be a power that fulfills the requirements to "separated or safety extra-low voltage" (SELV). Note that transorbers on the RCU will start to drain current to ground at approximately 35 V and will shortcut at any voltage above approximately 50 V.

Figure 14 X2 terminal layout



(vs090039a)

Table 12 X2 terminal allocation

Terminal number	Terminal name	Function
1	+24 VDC	Supply voltage A, positive terminal
2		
3	0 VDC	Supply voltage A, 0 V terminal
4		
5	+24 VDC	Supply voltage B, positive terminal
6		
7	0 VDC	Supply voltage B, 0 V terminal
8		

4.11 X3 (DI, DO, WD)

X3 is a dual-row 18-pole terminal block with spring-lock terminals. It is provided with a removable header.

Cable cross section: 0.75 mm²

Figure 15 X3 terminal layout and allocation

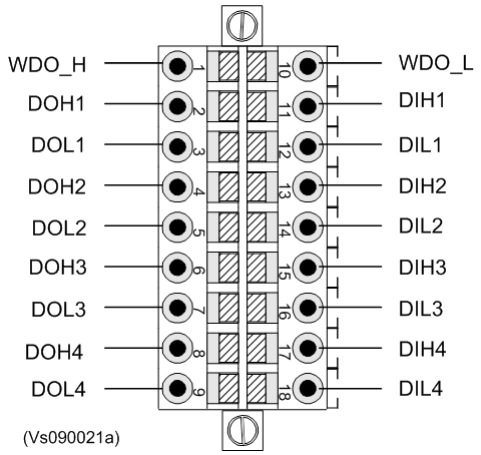


Table 13 X3 terminal allocation

Terminal number	Signal name	Function
1	WDO_H	Watchdog Out (opto collector)
2	DOH1	DO1 (opto collector)
3	DOL1	DO1 (opto emitter)
4	DOH2	DO2 (opto collector)

Table 13 X3 terminal allocation (cont'd.)

Terminal number	Signal name	Function
5	DOL2	DO2 (opto emitter)
6	DOH3	DO3 (opto collector)
7	DOL3	DO3 (opto emitter)
8	DOH4	DO4 (opto collector)
9	DOL4	DO4 (opto emitter)
10	WDO_L	Watchdog Out (opto emitter)
11	DIH1	DI1 (opto anode)
12	DIL1	DI1 (opto cathode)
13	DIH2	DI2 (opto anode)
14	DIL2	DI2 (opto cathode)
15	DIH3	DI3 (opto anode)
16	DIL3	DI3 ((opto cathode)
17	DIH4	DI4 (opto anode)
18	DIL4	DI4 (opto cathode)

4.12 X4 and X5 pin allocation (CAN connection)

RCU502 is provided with two CAN ports CANBUS 1 (X4) and CANBUS 2 (X5). X4 and X5 are 5-pole terminal blocks with spring loaded terminals. The terminal blocks have removable header.

Cable cross section: 2.5 mm^2

Figure 16 X4 and X5 terminal layout

Table 14 X4 and X5 terminal allocation

Terminal number	Signal name X4	Signal name X5	Function
1	VNEG_C0	VNEG_C1	Bus power reference (0 V)
2	CANL_C0	CANL_C1	Bus low signal
3	SHIELD_C0	SHIELD_C1	Shield (AC termination) *
4	CANH_C0	CANH_C1	Bus high signal
5			Not connected

** Ground via HF filter to module 0 V.*

4.13 FL1/GND (Module ground connection)

The FASTON terminal FL1/GND is ground reference (0 V) for the RCU502 module. The module is grounded by wiring this terminal to an earth bar.

4.14 FL2 (Floating module with HF ground connection)

The FASTON terminal FL2 is HF (high frequency) ground reference (0 V) for the RCU502 module. The module is HF grounded by wiring this terminal to an earth bar.

5 Module installation

Note

As long as the module is attached vertically on a DIN rail the fan fitted on the lower end of the unit will provide sufficient flow of air through the unit.

1. Label the module.
2. Set correct MAC address to the module by rotating the three decimal switches to values as appropriate.
3. Verify that the MODE switch is set to **0**.
4. Fix the module to the rail by fasten the module attachment screws , one at the top and one at the bottom of the unit.
5. Connect the earth terminations to the FASTON connectors FL1 and FL2 as appropriate.
6. Connect the power wires to the screw terminals on X2 connector as appropriate by using a screw driver.

   Note

   ***Safety**: For safety systems refer to the K-Safe guidelines.*

7. If relevant, connect the DI, DO and Watchdog wires to X3 as appropriate by using a screw driver.
8. If relevant, connect the CAN-bus wires to X4 and X5 as appropriate by using a screw driver.
9. Connect all cable plugs to the connectors as appropriate.
10. Check that all cable plugs and screw terminal wires are properly fixed to avoid any loose connection.
11. Turn ON power.
12. Verify that the Run/Error LED shows red and later green after software program has been loaded and is running.
13. Verify by the system user interfaces that the module is working OK.

6 Module replacement

6.1 Module replacement procedure

1 Turn off the power to the module by tripping the corresponding circuit-breaker(s) or terminal block(s) with fuse.

2 Remove all cables attached to the module including the earth terminations to the fast-ons (see Note).

Note

The connectors X2 to X5 can be split by firstly release the attachment screws and then split the header from the connector body using a thin bladed screwdriver.

3 Remove the module from the rail by loosen the bottom and top attachment screws.

4 Unpack the spare (new) RCU502.

5 From the new module remove all connector headers being in use.

6 Label the new module as the one being replaced.

7 Set correct MAC address to the module by rotating the three decimal switches to the same value as for the replaced.

8 Verify that the MODE switch is set to **0**.

9 Fix the module to the rail by fasten the attachment screws at the top and bottom.

10 Connect the earth terminations to the FASTON connectors FL1 and FL2 as appropriate.

11 Refit the connector headers to X2 to X5 as appropriate by using a screwdriver.

12 Reconnect all cables to the module as appropriate.

13 Check that all cable plugs and screw terminal wires are properly fixed to avoid any loose connection.

14 Turn ON power.

15 Verify that the Run/Error LED shows red and later green after software program has been loaded and is running.

16 Verify by the system user interfaces that the module is working OK.

17 For the replaced module: Re-attach all Space Connectors from the replaced module. Make a short defective performance description of why the module was replaced.

18 Ensure that KM Service desk or the Project Manger (as applicable) is informed about replaced modules and new module serial numbers.

6.2 Fan replacement

6.2.1 Spareparts

Spare fan Kongsberg Maritime part no: 600686

6.2.2 Replacement procedure

1 Turn off the power to the module by tripping the corresponding circuit breaker(s).

2 Remove the lower part of the hatch by loosen the fixing screw.

3 Grip the fan and gently pull it out (no hooks need to be bent).

4 Disconnect the fan plug from the X1 connector by gently pushing down and pulling the lock peg out.

5 Examine the new fan (see Note).

Note

The new fan body shall have a gasket located on the top side to avoid a loose assembly.

Be aware of determining correct fan orientation. Blowing direction must be into the module. See arrow marks on the fan for your guidance.

6 Insert the fan plug into the X1 connector.

7 Slide the spare fan into the guides. The wires should be to the left (seen from the module's lower end).

8 Refit the lower hatch part and fasten the screw.

9 Turn on the power circuit(s) to the module.

10 Verify that the fan is running in a proper way and that the air direction is correct (see Note above).

11 Verify that the Run/Error LED shows red and later green after software program has been loaded and is running.

12 Verify by the system user interfaces that the module is working OK.

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