SIMRAD®

R5000 Processor

Installation manual

English



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Preface

Disclaimer

⚠ Warning: Refer to important safety information in the product documentation and review all warnings, limitations, and disclaimers before using this product.

This product is not a substitute for proper training and prudent seamanship. It is the owner's sole responsibility to install and use the equipment in a manner that will not cause accidents, personal injury or property damage. The user of this product is solely responsible for observing maritime safety practices.

Navigational features that appear in this document are not a substitute for proper training and prudent seamanship. They do not replace a human navigator and SHOULD NOT be relied on as a sole or primary source of navigation. It is the operator's sole responsibility to use more than one navigational methods to ensure the route suggested by the system is safe.

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Warranty

The warranty card is supplied as a separate document. In case of any queries, refer to the brand website of your unit or system:

www.navico-commercial.com

Compliance statement

Navico declare under our sole responsibility that the product conforms with the requirements of:

- European Council Directive 2014/90/EU on Marine Equipment modified by Commission Implementing Regulation (EU) 2023/1667 (8 August 2023) - Wheelmark

The relevant declaration of conformity is available in the product's section at the following website:

- www.navico-commercial.com

About this manual

Intended audience

This manual is written for system installers.

This manual is written for professional installation and service engineers.

The manual assumes that the reader has basic knowledge about this type of equipment with regards to:

- installation work to be carried out
- nautical terminology and practices

Important text conventions

Important text that requires special attention from the reader is emphasized as follows:

→ ***Note:*** Used to draw the reader's attention to a comment or some important information.

⚠ Warning: Used when it is necessary to warn personnel that they should proceed carefully to prevent risk of injury and/or damage to equipment/ personnel.

Change log

Part no	Date and description
988-12282-001	2018-Sept-19
	First version.
988-12282-002	2018-Oct-19
	Updates to parts included and technical specifications.
988-12282-003	2021-July-25
	Updates to compliance, LWE.f
988-12282-004	2023-Sept-25
	Update cover, compliance, and copyright. Add HALO 5000 information.
988-12282-005	2023-December-15
	Updates to comply with IEC62288 Ed.3.

Safety precautions

Safety precautions described in this section are applicable to the radar system. They are general safety precautions that are not related to any specific procedure, and they might therefore not appear elsewhere in this manual. They are recommended precautions that personnel must understand and apply during operation and maintenance of the system.

You are obliged to read these operating instructions prior to operation, and to adhere to the operating instructions in order to prevent possible danger. Prevention of danger includes that operator personnel are trained and authorized for safe operation of the equipment. We assume no liability for damage due to improper operation which could have been prevented.

The system must only be operated by persons who have passed the relevant mandatory training on the respective systems and applications. Only reading these operating

instructions cannot replace such training. Persons authorized to operate, maintain and troubleshoot the system are instructed and trained by Simrad. Persons operating or servicing this radar system must be familiar with the general safety regulations and specific safety systems, and they must have passed all required training. They must have read the relevant operating instructions and manuals before starting to work.

Have these operating instructions always at hand on all relevant locations, and ensure that copies are available to all operators. Operating personnel must at all times follow all safety regulations.

During normal operation, the unit can be quickly disconnected from the main power line by turning OFF the relevant circuit breaker located on the electric switchboard.

Do not replace components or make adjustments inside the unit when the voltage supply is turned ON. Always remove power and discharge to ground a circuit before touching it. Under no circumstances should any person initiate servicing or repairing the unit except in the presence of a qualified person.

Ensure unobstructed access to all operator panels, controls, and relevant switchgear cabinets in order to enable instant response to alarms.

Whenever it is necessary to disconnect the waveguide from a radar transmitter for maintenance purpose, the transmitter output should be terminated with a matched load. If this is not possible, care should be taken. Do not stand in front of an open-ended waveguide from which power is being radiated.

➔ ***Note:*** Main power is always present on the terminal board unless the main break from the power distribution panel of the vessel is turned off.

⚠ Warning: Never look down a waveguide from which power is being radiated!

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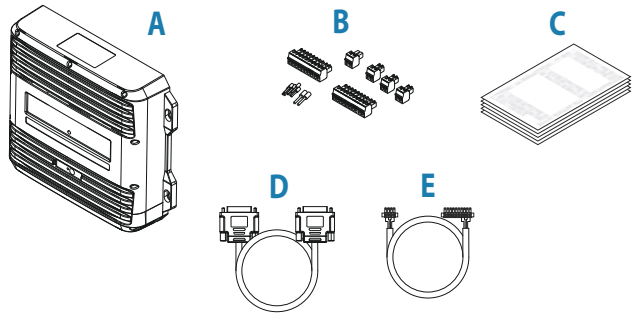
22 Technical specifications
22 R5000 processor unit

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25 R5000 processor unit

1 Parts included

R5000 processor unit



A R5000 processor unit

B Terminal plugs
- 1x power (2 positions)
- 1x serial (14 positions)
- 1x serial (10 positions)
- 3x alarm/DGT/DMA (2 positions)
- Terminal connector kit

C Document pack

D DVI cable for monitor connection, 3 m (9.84 ft)

E Serial cable for monitor control, with terminal plugs, 3 m (9.84 ft)

2 Installation

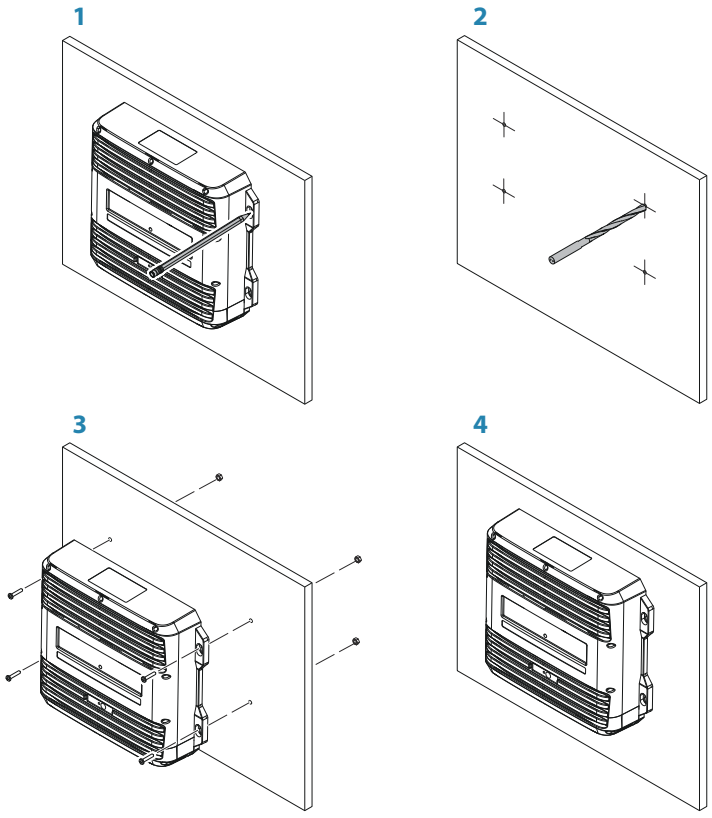
Mounting guidelines

- Choose a location that will not expose the unit to conditions that exceed the specifications, refer to the technical specification in the *"Technical specifications"* on page 22
- The mounting surface needs to be structurally strong, with as little vibration as possible
- Ensure that any holes cut are in a safe position and will not weaken the boat's structure
- Before cutting a hole in a panel, make sure that there are no hidden electrical wires or other parts behind the panel
- Check that it is possible to route cables to the intended mounting location. Leave sufficient clearance to connect all relevant cables
- Make drip and service loops for cables

→ ***Note:*** Where flush or panel mounted, the enclosure should be dry and well ventilated. In small enclosures, it may be required to fit forced cooling.

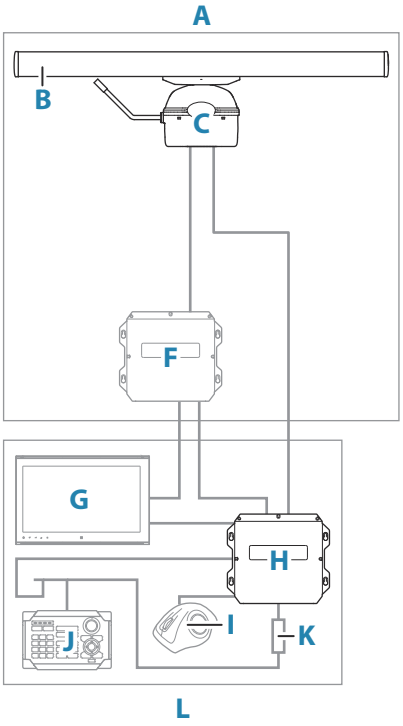
⚠ Warning: Inadequate ventilation and subsequent overheating of the unit may cause unreliable operation and reduced service life. Exposing the unit to conditions that exceed the specifications could invalidate your warranty, refer to the technical specification in the *"Technical specifications"* on page 22.

Wall mounting



3 Wiring

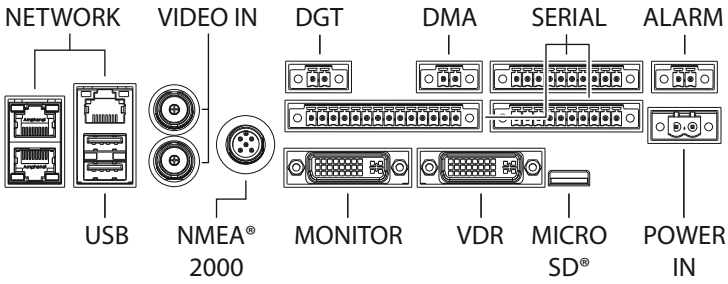
System example



	Description
A	Radar sensor
B	Antenna
C	SRT LAN up-mast or HALO transceiver
F	R5000 power supply unit
G	M5000 monitor
H	R5000 radar processor
I	O5000 trackball
J	O2000 controller or expanded keyboard
K	O2000 power supply unit
L	R5000 control station
M	Managed switch
N	Lightweight Ethernet sensor (LWE IEC 61162-450)
O	VDR

Connectors

R5000 radar processor unit



→ ***Note:*** The video in connectors are not used.

Power

The unit is designed to be powered by 24 V DC.

It is protected against reverse polarity, under voltage and over voltage (for a limited duration).

If R5000 power supply is not used, a fuse or circuit breaker shall be fitted to the positive supply. For recommended fuse rating, refer to *"Technical specifications"* on page 22.

Power connector details



Unit socket (male)



Cable plug (female)

Pin	Purpose
1	+12/24 V DC
2	DC negative

Serial

The serial port provides input (Listeners) and outputs (Talkers) for the various interfaced sensors. The port uses the IEC 61162 (serial balanced) standard.

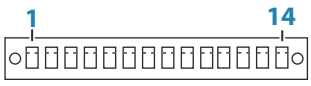
IEC 61162 messages

The serial ports are preconfigured and cannot be changed. For details, refer to the commissioning manual.

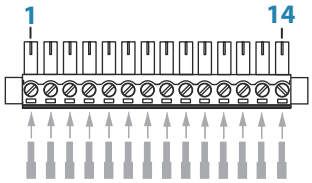
Description	Sentences	Serial ports
Heading input	THS, HDT	Port 1 in
AIS input	VDM, VDO	Port 2 in
Tracking data output	TTD, TLB	Port 1 out
Own-ship speed-log input	VBW, VHW	Port 3 in
Own-ship position, ground speed and time	GLL, GGA, GNS, DTM, RTE, VTG, WPL, ZDA	Port 4 in

Description	Sentences	Serial ports
Own-ship, radar system and tracking data output	OSD, RSD, TTM	Port 4 out
BAM input	ACN, HBT	Port 5 in
BAM output	ALC, ALF, ARC, HBT	Port 5 out
Legacy BAM input	ACK	Port 5 in
Legacy BAM output	ALR, EVE	Port 5 out
Monitor brilliance control input	-	Port 6 in
Monitor brilliance control output	-	Port 6 out

Serial 1-2



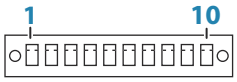
Unit socket (male)



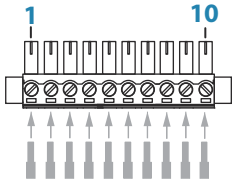
Cable plug (female)

Pin	Port	Purpose
1	Port 1 (IEC 61162-2)	Listener A (Rx_A)
2		Listener B (Rx_B)
3		Shield
4		Ground
5		Talker A (Tx_A)
6		Talker B (Tx_B)
7		Shield
8	Port 2 (IEC 61162-2)	Listener A (Rx_A)
9		Listener B (Rx_B)
10		Shield
11		Ground
12		Talker A (Tx_A)
13		Talker B (Tx_B)
14		Shield

Serial 3-4



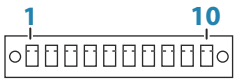
Unit socket (male)



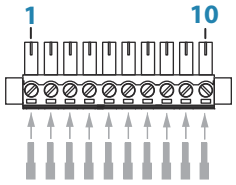
Cable plug (female)

Pin	Port	Purpose
1	Port 3 (IEC 61162-1)	Listener A (Rx_A)
2		Listener B (Rx_B)
3		Shield
4		Talker A (Tx_A)
5		Talker B (Tx_B)
6	Port 4 (IEC 61162-1)	Listener A (Rx_A)
7		Listener B (Rx_B)
8		Shield
9		Talker A (Tx_A)
10		Talker B (Tx_B)

Serial 5-6



Unit socket (male)



Cable plug (female)

Pin	Port	Purpose
1	Port 5 (IEC 61162-1)	Listener A (Rx_A)
2		Listener B (Rx_B)
3		Shield
4		Talker A (Tx_A)
5		Talker B (Tx_B)
6	Port 6 (IEC 61162-1)	Listener A (Rx_A)
7		Listener B (Rx_B)
8		Shield
9		Talker A (Tx_A)
10		Talker B (Tx_B)

Sensor connection

Any sensor connected to the system should meet IMO performance standards and be certified. Failure to do so would make the rest of the system non-compliant.

The system must be connected to an External Position Fixing System (EPFS), a gyrocompass/heading sensor, and a SDME source via serial line.

Ground stabilization requires an external sensor signal capable of providing an input and an indication of own ship's speed over ground, for example from an EPFS, SDME or use of stationary tracked reference targets. If a ground-referenced speed log is used for ground stabilization, it must be of dual axis type.

Connections to a BAM device is mandatory if these devices are available on a vessel.

→ ***Note:*** The gyro-compass or heading sensor must have an update rate that is adequate for the ship's rate of turn – the performance should meet or exceed the relevant standards adopted by the IMO (IMO A.424(XI), A.821(19) and MSC.116(73)).

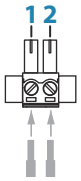
Alarm

The unit can be connected to a Bridge Navigational Watch Alert System through the alarm output connector. This general system failure alarm output is intended to be connected to a BNWAS system.

Alarm connector details



Unit socket (male)



Cable plug (female)

Pin	Purpose	Note
1	External alarm output	normally closed, isolated contact
2		

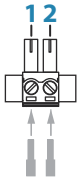
DGT (Dangerous Target)

The DGT output is active when a radar target or AIS target is classified as dangerous. This output is intended to be connected to a BNWAS system.

DGT connector details



Unit socket (male)



Cable plug (female)

Pin	Purpose	Note
1	DGT output	normally closed, isolated contact
2		

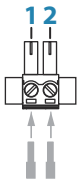
DMA (Dead Man Alarm)

The DMA output is active when an action is made by the operator on the control station. This output is intended to be connected to a BNWAS system.

DMA



Unit socket (male)



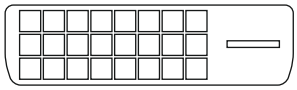
Cable plug (female)

Pin	Purpose	Note
1	DMA output	normally closed, isolated contact
2		

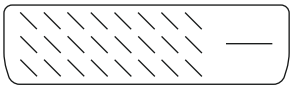
VDR

A DVI-D video output is provided for interface to a 3rd party Voyage Data Recorder (VDR). The output mirrors the screen display at the same resolution. The VDR connected to should accept digital video input.

DVI-D connector details



Unit socket (female)



Cable plug (male)

The unit is equipped with standard DVI connector(s).

→ ***Note:*** The unit should be turned off prior to connecting or disconnecting a DVI cable.

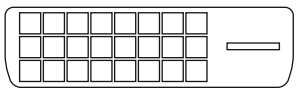
Binary image to VDR over LWE

The Binary Image (BI) can be transferred to VDR by the LWE IEC61162-450 protocol. For more information, refer to *"Ethernet"* on page 15.

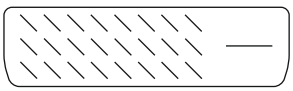
Monitor

The unit can be connected to an external monitor. The image is shown on the external monitor at the units own native resolution.

DVI-D connector details



Unit socket (female)



Cable plug (male)

The unit is equipped with standard DVI connector(s).

→ ***Note:*** The unit should be turned off prior to connecting or disconnecting a DVI cable.

Monitor control wiring

A serial connection to the monitor is required to control the monitor brightness.

For wiring details, refer to the System Installation Manual.

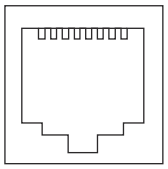
Ethernet

The Ethernet ports can be used to connect radar sensors and other radar processing units to utilize the inter-switching functionality.

The Ethernet ports can also be used to:

- Transmit the Binary Image of the screen to a VDR.
- To receive own-ship sensor data.
- To connect the radar to a Bridge Alarm Managment system (BAM).
- To share data received on the serial ports, Serial to Network Gateway Function (SNGF).

Ethernet connector details



Unit socket (female)

The unit is equipped with standard RJ45 connector(s).

Ethernet expansion device

Connection of network devices can be made via a managed Ethernet expansion device. Additional expansion devices can be added to provide the required number of ports.

Typically, a simple network consisting of only NMEA® 0183 sentences and screen capture images from radars and ECDIS to VDR, and ECDIS route exchange transmitted over LAN using LWE protocol would not need any filtering of the network traffic.

However, to avoid potential problems with certain network infrastructure equipment and port loops, a managed switch shall be used to interconnect components of an LWE network.

Introduction to Lightweight Ethernet

Lightweight Ethernet (LWE), defined by IEC61162-450, is a protocol defined to enable an Ethernet connection between multiple talkers and multiple listeners, using the messages defined in IEC61162-1/2. LWE is an IP-based implementation, making use of a multicast address and corresponding User Datagram Protocol (UDP) port for transmission. LWE is essentially a means to share data between units over Ethernet.

There are some restrictions on the connection of LWE networks:

- The different components are connected through an Ethernet switch, and connection to a router or repeater hubs are not allowed
- No multicast filtering is configured

Equipment on the network that performs system functions can transmit and receive information. Each System Function (SF) is identified by a System Function Identifier (**SFI**) which is unique on any boat network.

→ ***Note:*** If no SFI is entered (remaining with the default 9999 value), the device will not be visible on the LWE network, and it will not share any data.

Every device that is a part of the LWE network shall be assigned an IP address (10.0.0.1 to 10.255.255.253 or 192.168.0.1 to 192.168.255.254). This IP address is to be chosen as a unique address for every device on the boat network.

LWE details

LWE Input messages

System function	Transmission group	Talker ID	Sentences
BAM to Radar	Selectable VDRD, BAM1, BAM2, CAM1 or CAM2	- cc -	ACN, HBT
High update rate navigational data	SATD	- cc -	THS, HDT
Navigational data	NAVD	- cc -	VBW, VHW, DTM, GLL, GGA, GNS, DTM, VTG
AIS target data to radar	TGTD	- cc -	VDM, VDO
SNGF	MISC	- cc -	Unrestricted, (max. serial port buffer capacity: 1023 bytes)
TIME	TIME	- cc -	ZDA
Network administration	NETA	- cc -	SRP

- cc - Received talker identifier as per NMEA®.
- BAM 1 is the default transmission group to interface the BAM.

LWE Output messages

System function	Transmission group	Talker ID	Sentences
Radar target data	TGTD	RA	TTM, TTD, TLB
Radar alert source to BAM	Selectable VDRD, BAM1, BAM2, CAM1 or CAM2	RA	ALC, ALF, ARC, HBT
Navigational data	NAVD	RA	OSD, RSD
SNGF	MISC	SI	As per input in COM1, COM2, COM3 and COM4
Network administration	NETA	SI for each SNGF, RA for the system	SRP

- BAM 1 is the default transmission group to interface the BAM.

LWE Binary Image transfer

System function	Transmission group	Talker ID
Binary Image to VDR	Selectable transfer group 1, 2, 3, 4, 5 or NAVD	RA
VDR acknowledgement to Radar		VR

- Transfer group 1 is the default transfer group to interface the VDR.

Destination multicast Addresses and Port Numbers

Transmission group	Category	Multicast address	Destination port
MISC	Data sharing (SNGFs)	239.192.0.1	60001

Transmission group	Category	Multicast address	Destination port
TGTD	AIS target data, Radar tracked target messages	239.192.0.2	60002
SATD	Ship heading	239.192.0.3	60003
NAVD	EPFS (GPS), Speed	239.192.0.4	60004
VDRD	Data required for the VDR	239.192.0.5	60005
TIME	Time and Date	239.192.0.7	60007
BAM1	BAM compliant alerts source	239.192.0.17	60017
BAM2	BAM compliant alerts source	239.192.0.18	60018
CAM1	BAM compliant alerts source	239.192.0.19	60019
CAM2	BAM compliant alerts source	239.192.0.20	60020
Transfer group 1	Re-transmittable binary file transfer	239.192.0.26	60026
Transfer group 2	Re-transmittable binary file transfer	239.192.0.27	60027
Transfer group 3	Re-transmittable binary file transfer	239.192.0.28	60028
Transfer group 4	Re-transmittable binary file transfer	239.192.0.29	60029
Transfer group 5	Re-transmittable binary file transfer	239.192.0.30	60030
NETA	Network administration, e.g SFI collision detection	239.192.0.56	60056

Alphabetic alert list

Alert type abbreviations:

- C: Caution
- W: Warning
- A: Alarm

Alert text	Description	Type	Cate-gory	Alert ID
AIS Capacity 95%	AIS target processing/displaying is about to be exceeded.	C	B	3043
AIS Capacity Full	AIS capacity exceeded.	W	A	3042
AIS FAIL	AIS failure.	W	B	3015
	Not used. AIS failure.	C	B	10194
AIS TGT in GZ	AIS target in guard zone.	W	A	3048
AIS TGT Lost: #	AIS target # is lost.	W	A	3052
BAM HBT Lost	BAM heartbeat lost.	C	B	10000
Bearing Pulse FAIL	Bearing pulse fault.	W	B	16016
Dangerous AIS TGT	CPA or TCPA values of an activated AIS target less than set limits.	A	A	3044

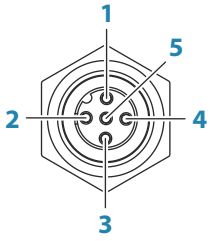
Alert text	Description	Type	Cate-gory	Alert ID
Dangerous TT	CPA or TCPA values of a tracked target less than set limits.	A	A	3044
Door Switch Open	The radar enclosure is open due to maintenance. The radar is not operational.	A	A	3015
EPFS FAIL	Position source failure.	W	B	3015
	Not used. Position source failure.	C	B	10194
Gateware FAIL	Gateway datapath error.	W	B	16026
Geodetic Datum FAIL	Geodetic datum failure.	W	B	3015
GYRO FAIL	Gyro failure.	W	B	3015
	Not used. Gyro failure.	C	B	10194
Heading Line FAIL	Heading line failure.	W	B	3015
Magnetron EOL	Magnetron end of life reached.	C	B	10195
Mechanical FAIL	Mechanical fault.	W	B	16032
Motor driver FAIL	Motor driver failure.	W	B	16045
Motor FAIL	Motor not running.	W	B	16017
Motor or Antenna FAIL	Motor stall.	W	B	16036
PM System FAIL	Performance monitor failure.	W	B	16047
POSN Invalid	Position invalid.	W	B	3015
POSN Unavailable	Position unavailable.	W	B	3015
PSU Hardware FAIL	PSU hardware fault.	W	B	16030
PSU Overheat FAIL	PSU overheat.	W	B	16027
PSU Power FAIL	PSU power.	W	B	16029
PSU Voltage FAIL	PSU voltage.	W	B	16028
Radar Antenna FAIL	Radar antenna failure.	W	B	3015
RADAR FAIL	Radar TXRX failure.	W	B	3015
Radar Persistence FAIL	Persistence corrupt.	W	B	16015
REF TGT Lost	Reference target lost.	W	A	3052
Safety Switch Open	The safety switch is open due to maintenance. The radar is not operational.	A	A	3015
Scanner Config FAIL	Scanner config fault.	W	B	16022
SOG FAIL	Speed Over Ground failure.	W	B	3015
	Not used. Speed Over Ground failure.	C	B	10194
Speed LOG FAIL	Speed log failure.	W	B	3015
	Not used. Speed log failure.	C	B	10194
SPD Long. Axis FAIL	Speed longitudinal axis data failure.	W	B	3015

Alert text	Description	Type	Cate-gory	Alert ID
SPD Tran. Axis FAIL	Speed transversal axis data failure.	W	B	3015
STW FAIL	Speed Through Water failure.	W	B	3015
TGT in GZ	Tracked target # within the vessel's guard zone.	W	A	3048
Train TGT CPA FAIL	Training target CPA out of range.	W	A	3044
Train TGT TCPA FAIL	Training target TCPA out of range.	W	A	3044
Transmitter (Hard) FAIL	PA hard overheat.	W	B	16025
Transmitter (Hard) FAIL	PA hard overcurrent.	W	B	16046
Transmitter (Soft) FAIL	PA soft overheat.	W	B	16024
Trigger FAIL	Trigger failure.	W	B	3015
TT Capacity 95%	Tracked target processing/displaying is about to be exceeded.	C	B	3043
TT Capacity Full	Tracked target capacity exceeded.	W	A	3042
TT Extractor Overload	Target tracking extractor overload.	W	A	3015
TT Lost: #	Tracked target # is lost.	W	A	3052
TT Unavailable	Tracking unavailable.	C	A	16043
TXRX PM Loss	Transmit performance loss.	C	B	16048
UTC Data FAIL	UTC data failure.	W	B	3015
Radar Video FAIL	Radar video failure.	W	B	3015

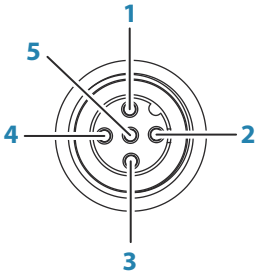
NMEA® 2000

The NMEA® 2000 network is used to connect a remote controller to the unit.

NMEA® 2000 connector details



Unit socket (male)



Cable plug (female)

Pin	Purpose
1	Shield
2	NET-S (+12 V DC)
3	NET-C (DC negative)
4	NET-H
5	NET-L

Video in

Video in is not to be used.

USB devices

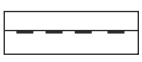
The USB port(s) can be used to:

- connect a keyboard
- connect a mouse
- connect a storage device

The USB devices should be standard PC compatible hardware.

➔ ***Note:*** USB cable length should not exceed 5 m when using regular cables. Lengths over 5 m may be possible with the use of an active USB cable.

USB connector details



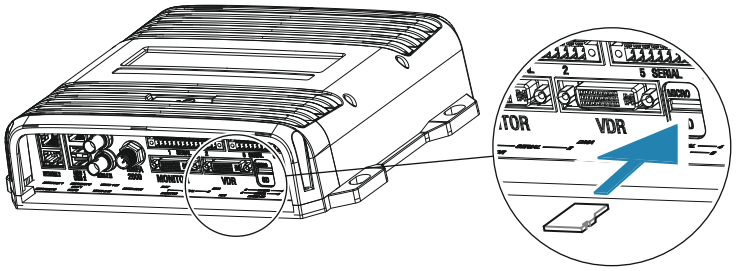
Unit socket (female)



Cable plug/Device plug (male)

The unit is equipped with standard USB type-A connector(s).

Card reader



A memory card can be used for:

- Software updates
- Transfer of user data
- System backup

Card details

The unit supports MicroSD® cards up to 8 GB.

4 Technical specifications

R5000 processor unit

General	
Type approval	Radar Equipment CAT 1 (H), CAT 2 (H) and CAT 3
Environmental	
Temperature	
Operating temperature	-15°C to 55°C (According to IEC 60945 ed. 4.0)
Storage temperature	-15°C to 70°C (According to IEC 60945 ed. 4.0)
Vibration	According to IEC60945 ed. 4.0
Shock	According to RMRS rules (2-020101-040-E Vol 2 - Environmental Test of Equipment)
Equipment category	Protected
IP class	IP2X
Compass safe distance	
Safe distance to the standard magnetic compass	0.7 m (2.3 ft)
Safe distance to the steering magnetic compass	0.3 m (0.99 ft)
Physical	
Dimensions	Refer to dimensional drawings
Weight	1 kg (2.20 lbs.)
Electrical	
Supply voltage	24 V DC ± 30%
Power consumption	Max 45 W
Recommended fuse rating	3 A
I/O interface	
NMEA® 0183	4x IEC 61162-1 2x IEC 61162-2
NMEA® 2000	1 port
Ethernet	3 ports
Alarm output	2 wire interface
VDR	DVI output
DGT (Dangerous Target)	DGT output, active when a radar target or AIS target is classified as dangerous
DMA (Dead Man Alarm)	DMA output, active when an action is made on the control panel
Monitor	DVI output to remote display
Card reader	1 MicroSD® card reader
LWE (IEC 61162-450 Interface)	
Technology	
Standards	100BaseT, IEEE 802.3, IPv4
IP address (selectable):	
Class A	Between 10.0.0.1 to 10.255.255.253

Class B	Between 172.16.0.1 to 172.31.255.254
Class C	Between 192.168.0.1 to 192.168.255.254
Ethernet Protocol	
IEC61162-450 Implemented datagrams	"UdPbC", "RrUdP"
Binary Image transfer protocols	Edition 2 and legacy Edition 1
Binary Image types	JPG, PNG
Maximum number of datagrams per second received,	1000 (intended for and processed by the equipment) 2000 (not intended for the equipment) 500 (not intended for the equipment at 50% of the maximum load of 1000)
Network Traffic Filtering	IGMP version 2 by external managed switch
Communication redundancy	RSTP by external managed switch
Other Network Functions	Navico Radar Protocol (NRP)

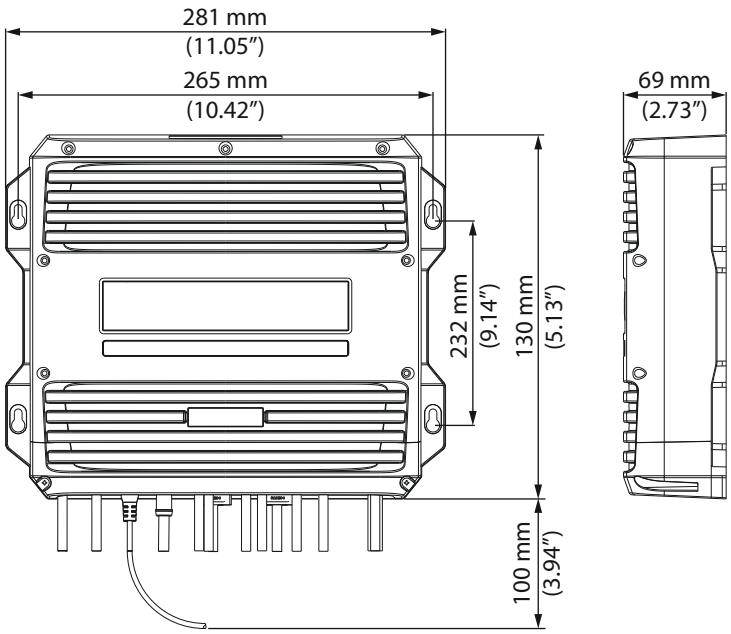
5 Accessories

The most up-to-date accessories list is available at:

- www.navico-commercial.com

6 Dimensional drawings

R5000 processor unit



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