PUBLICATION NW4000-10

Issue 1.80

SHIP'S AND OPERATORS INSTRUCTION MANUAL

- **Installation**
- **Configuration**
- **Operation**
- **Maintenance**

NW4000-series

VOYAGE DATA RECORDER

VDR & (S)VDR COMMON DATA

Table of Contents

Amendment Record *8*

VDR Software Version (Updates) *9*

Important Notices *10*

List Of Abbreviations *12*

List Of Specifications *13*

IMO guidelines on Voyage Data Recorder ownership and recovery *15*

1.0 Manual Organisation *17*

The following publications are applicable to the NW-4000 series of Voyage Data Recorders; **17**

1.1 Manual Conventions **18**

1.2 Introduction **19**

2.0 System Overview *20*

2.1 System architecture **20**

2.2 Installation Planning **25**

2.3. System Components and functions *29*

2.3.1 HSS – Hardened Storage Server **29**

2.3.2 PSU – Power Supply and Switch Unit **34**

2.3.3 BCU - Bridge Control Unit **37**

2.3.4 WIM - WaveNet Interface Modules **40**

2.3.5 WIM – Wavenet Adaptor Modules **42**

2.3.6 Adaptor Slot Allocation Table **43**

2.3.7 NW-4420 WaveNet 4-Channel Bridge Microphone & 2 Ch VHF adaptor **45**

2.3.7.1 Connecting VHF transceivers **48**

2.3.7.2 Microphones and VHF recording configuration **49**

2.3.10 NW-4430 - WaveNet 8-Channel Serial/NMEA adaptor **50**

2.3.11 NW-4432 WaveNet 8-Channel Digital adaptor **52**

2.3.12 NW-4445 RADAR VIDEO VGA, SVGA, SXGA **54**

2.3.13 NW-4450 Wavenet 4-Channel analogue adaptor 4-20 ma **57**

2.3.14 NW-4452 Wavenet 4-Channel analogue adaptor -10v/+10v **59**

2.3.15 Microphone tests **63**

3.0 System functions and features *65*

3.1 Data Compression **65**

3.2 Data Time Stamping **65**

3.3 Design and Construction **65**

3.4 Resistance to Tampering **65**
3.5 Operation **65**
3.6 Data Storage and Format **65**
3.7 Data Block **66**
3.8 Recording method **66**
3.9 System Integrity **66**
3.10 Data Saving **66**
3.11 Power Supplies - Normal Operation **67**
3.12 Reserve Power Source **67**
3.13 Recording Period and Duration **67**
4.0 Data Items to be Recorded for S-VDR ***68***
4.1 Date and Time **68**
4.2 Ship's Position **68**
4.3 Speed **68**
4.4 Heading **68**
4.5 Bridge Audio **68**
4.6 Communications Audio **68**
4.7 Radar Data, Post-Display Selection **69**
4.8 Echo Sounder **69**
5.0 Data Items to be Recorded for VDR (additional) ***70***
5.1 Main Alarms **70**
5.2 Rudder Order and Response **70**
5.3 Engine Order and Response **70**
5.4 Hull Openings (Doors) Status **70**
5.5 Watertight and Fire Door Status **70**
5.6 Accelerations and Hull Stresses **70**
5.7 Wind Speed and Direction **71**
6.0 IEC 61162 Sentence Formats ***72***
7.0 System Installation ***73***
8.0 Installation guidelines ***74***
8.1 HSS - Hardened Storage Server (Capsule) **74**
8.2 PSU - Power Supply and (data) Switch Unit **76**
8.3 BCU - Bridge Control and Alarm Unit **81**
8.4 WIM - WaveNet Interface Modules **84**
8.5 Microphones **87**
9. System Configuration ***98***
9.1 Network connection **99**

9.2 VDR Access solutions **101**
9.3 VDR-Administrator Menu Structure **104**
9.4 Installation and Operational Modes **106**
9.5 System Network Check **109**
9.6 Device Identification **110**
9.7 System Interface Check **112**
9.8 Power Supply & Data Switch Check **114**
9.9 Bridge Control Unit Check **116**
9.10 Hardened Storage Server (capsule) Check **117**
10. Interfacing ***119***
10. 1 General **119**
10.2 Configuration of Recording Channels **120**
10.2.2 Configuring NMEA serial Channels and Vessel Data **122**
10.2.1 Configuring Audio Channels **128**
10.2.2 Configuring Digital Channels **130**
10.2.3 Configuring Analogue Channels **133**
10.2.4 Configuring the Radar channel **136**
10.3 Radar Video selection and tuning **137**
11. Saving or Retrieving the VDR Configuration ***142***
12. Alarms and Warnings ***143***
12.1 General **143**
12.2 Alarm and Warnings display **143**
12. 3 Navigating thru the Alarms and Warnings **144**
12. 4 Alarms and Warnings messages **144**
12.4.1 Power Failure (ALARM) **144**
12.4.2 Recording Channels (WARNING) **144**
12.4.3 Units or devices (WARNING) **145**
12.4.4 Radar video data (WARNING) **145**
12.4.5 Time reference (ALARM) **145**
12.4.6 Position Information (ALARM) **145**
12.4.7 Heading Information lost (ALARM) **145**
12.4.8 Microphone errors (ALARM) **145**
12.4.9 Recording function / Memory Storage errors (ALARM) **145**
13. Alarms and Warnings Log ***146***
14. System Monitoring ***147***
14.1 Event Log **148**
14.2 Access Log **149**

15. Security *150*
15.1 Password Protection 150
16. Downloading Recorded Data *151*
16.1 Downloading WavePlay replay software 151
16.2 Downloading data from the VDR 152
17. Bridge Control Unit – Operator Manual *159*
17.1 General 159
17.2.1 BCU Display and Keyboard functionality 159
17.2.2 BCU display 160
17.2.3 VDR Network Access Port 160
17.2.4 Push-button functions 160
17.2.5 Rotating Button functions (Jog-dial) 160
17.2.6 Indicator lamp functions 161
17.3. Operating the Bridge Control Unit 162
17.4. Bridge Control Unit Menu selection 162
17.5. Bridge Control Unit Menus and Functionality Overview 164
17.5.0 Test Menu - BCU Test 165
17.5.1 Display Test 165
17.5.2 Keyboard Test 165
17.5.3 LED Test 165
17.5.4 Jog Dial Test 165
17.5.5 Audible Alarm test 166
17.5.1 Menu Test - Microphone test 166
17.5.3 Menu Events 167
17.5.4 Menu Alarms 169
17.5.5 Menu System 170
18. Software version control *171*
19. Maintenance *172*
19.1 Batteries (PSU) 172
19.2 Glands and seals (HSS) 172
19.3 Underwater Locator beacon (HSS) 172
19.4 Annual Performance Test *173*
19.4.1 General 173
19.4.2 Reference documents 173
20. Installation record (forms) *174*
20.1 Microphones 174
20.2 WaveNet adaptors 175

21. NOTES ***191***
Annual Performance Test documentation ***195***

CONFORMITY STATEMENT

This equipment has been designed to comply with IMO regulations for VDR and (S)VDR and their relevant IEC91666(-2), IEC60945 and IEC61162 Performance Standards.

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Technical details contained in this publication are subject to change without notice.

CE

Amendment Record

When an amendment is incorporated into this publication, the details should be recorded below. Where the equipment has been modified, the modification number shown on the Amendment Instruction Sheet is also to be recorded.

Amendement Nbr	Date	Updated by

VDR Software Version (Updates)

To obtain the current software version in the VDR:
push the OK button on the Bridge Control Unit

To Version number	Date	Updated by

Important Notices

HEALTH AND SAFETY

All personnel are required to study these notices and familiarise themselves with all applicable safety precautions and bring them to the attention of others in the vicinity.

HIGH VOLTAGE WARNING

LETHAL HIGH VOLTAGES ARE PRESENT IN THE VOYAGE DATA RECORDER

A current of 100 mA passing through the human body for one second can kill. This can occur at voltages as low as 35V AC or 50V DC. Some equipment in the system uses electrical power that can be lethal. Whenever practical, before carrying out installation, maintenance or repair, personnel involved must:

(1) Isolate the equipment from the electrical supply.
(2) Make tests to verify that the isolation is complete.
(3) Ensure that power cannot be accidentally reconnected.

DO NOT OPEN ANY OF THE UNITS WHEN THE VOYAGE DATA RECORDER IS OPERATIONAL UNLESS FULLY QUALIFIED TO DO SO.

If it is essential to work on the equipment with power connected, work must only be undertaken by qualified personnel who are fully aware of the danger involved and who have taken adequate safety precautions to avoid contact with dangerous voltages.

HEALTH HAZARD

- This equipment contains materials which produce toxic fumes when ignited.
- The inhalation of dust and fumes or any contact with lubricants when cleaning the equipment may be temporarily harmful to health, depending on individual allergic reactions. Components which are broken or overheated may release toxic fumes or dust and must be treated with caution. Do not inhale the fumes and ensure that the dust and debris do not enter open cuts or abrasions. It is prudent to regard all damaged components as being potentially toxic, requiring careful handling and appropriate disposal.

PERSONAL PROTECTION

Personal protection must be used whenever the possibility of an uncontrolled hazard exists. For example, a suitable face visor, gloves and a body apron should be worn when handling cathode ray tubes, as a precaution against injury in the event of breakage.

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

CAUTION : Handling of Electrostatic-Sensitive Semiconductor Devices

Certain semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or sub-units containing these devices:

- Persons removing sub-units from any equipment using these devices must be earthed by a wrist strap and a resistor at the point provided on the equipment.
- Soldering irons used during the repair operations must be low voltage types with earthed tips and isolated from the mains voltage by a double insulated transformer.
- Outer clothing worn must be unable to generate static charges.
- Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.

List Of Abbreviations

API	Application Program Interface
ARPA	Automatic Radar Plotting Aid
BCU	Bridge Control Unit
CCTV	Closed Circuit Television
CD ROM	Compact Disk Read Only Memory
COG	Course Over Ground
EBL	Electronic Bearing Line
ECDIS	Electronic Chart Display Information System
EPFS	Electronic Position Fixing System
EPIRB	Emergency Position Indicating Radio Beacon
FSP	Field Service Program
GPS	Global Positioning System
HSS	Hardened Storage Server
IEC	International Electro technical Commission
IMO	International Maritime Organization
INS	Integrated Navigation System
IP	Internet Protocol
LCD	Liquid Crystal Display
LED	Light Emitting Diode
NMEA	National Marine Electronic Association
PC	Personal Computer
PMC	Protective Memory Capsule
PRF	Pulse Repetition Frequency
PSU	Power Supply & Switch Unit
RIP	Radar Interlay Processor
ROM	Read Only Memory
ROV	Remotely Operated Vehicle
SINAD	Signal to Noise And Distortion
SNTP	Standard Time Network Protocol
SOG	Speed Over Ground
SOLAS	Safety Of Life At Sea
STW	Speed Through Water
TFTP	Text File Transfer Protocol
ULB	Underwater Locator Beacon
UPS	Uninterruptible Power Supply
USB	Universal Serial Bus
UTC	Universal Time Constant
VCR	Video Cassette Recorder
VDR	Voyage Data Recorder
VESA	Video Electronics Standards Association
VHF	Very High Frequency
VRM	Variable Range Marker
WAM	WaveNet Adaptor Module
WIM	WaveNet Interface Module

List Of Specifications

IEC 61996:1999 Shipborne Voyage Data Recorder - Performance requirements – methods of testing and required test results.

IEC PAS 61996-2 Part 2: (2005-07) Simplified voyage data recorder (S-VDR) – Performance requirements – Methods of testing and required test results

IMO A.658(16): Use and fitting of retro-reflective materials on life-saving appliances

IMO A.662(16): Performance standards for float-free release and activation arrangements for emergency radio equipment

IMO A.694(17): General requirements for shipborne radio equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for electronic navigational aids

IMO A.810(19): Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz

IMO A.830(19):1995, Code on alarms and indicators

IMO A.861(20): Performance standards for shipborne voyage data recorders (VDRs)

IMO MSC.81(70): Testing of life-saving appliances

IMO MSC.163(78): Performance standards for shipborne simplified voyage data recorders(S-VDR).

Eurocae: ED56A – Minimum operational performance specification (MOPS) for cockpit voice recorder system

VESA:1996, Video electronics standards association – Discrete monitor timings standard 1.0, Revision 0.7 (DMTS)

SAE AS8045:1988, Engineering society for advancing mobility land, sea, air, and space – Minimum performance standard for underwater locating devices – Acoustic-self-powered

IEC 60068-2-27:1987, Environmental testing – Part 2: Tests – Test Ea and guidance: Shock

IEC 60268:1998, Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index

IEC 60936-1:1999, Maritime navigation and radiocommunication equipment and systems – Radar – Part 1: Shipborne radar – Performance requirements – Methods of testing and required test results

IEC 60936-3: Maritime navigation and radiocommunication equipment and systems – Radar – Part 3: Shipborne radar with chart facilities – Methods of testing and required test results

IEC 60945:2002, Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results

IEC 61097-2: 2002, Global maritime distress and safety system (GMDSS) – Part 2: COSPAS SARSAT EPIRB – Satellite emergency position-indicating radio beacon operating on 406 MHz – Operational and performance requirements, methods of testing and required test results

IEC 61097-7:1996, Global maritime distress and safety system (GMDSS) – Part 7: Shipborne VHF radiotelephone transmitter and receiver – Operational and performance requirements, methods of testing and required test results

IEC 61162 (all parts), Maritime navigation and radiocommunication equipment and systems – Digital interfaces

IEC 61260:Electroacoustics – Octave-band and fractional-octave-band filters

IEC 61672 (all parts), Electroacoustics – Sound level meters

IEC 61993-2, Maritime navigation and radiocommunication equipment and systems – Automatic identification systems (AIS) – Part 2: Class A shipborne equipment of the universal automatic identification systems (AIS) – Operational and performance requirements, methods of test and required test results

VESA: 1996 Video electronics standards association - Discrete monitor timings standard 1.0, Revision 0.7 (DMTS)

IMO guidelines on Voyage Data Recorder ownership and recovery

Ownership of VDR information

1 The ship owner will, in all circumstances and at all times, own the VDR and its information. However, in the event of an accident the following guidelines would apply. The owner of the ship should make available and maintain all decoding instructions necessary to recover the recorded information.

Recovery of VDR and relevant information

2 Recovery of the VDR is conditional on the accessibility of the VDR or the information contained therein.

2.1 Recovery of the VDR information should be undertaken as soon as possible after an accident to best preserve the relevant evidence for use by both the investigator1 and the ship owner. As the investigator is very unlikely to be in a position to instigate this action soon enough after the accident, the owner must be responsible, through its on-board standing orders, for ensuring the timely preservation of this evidence.

2.2 In the case of abandonment of a vessel during an emergency, masters should, where time and other responsibilities permit, take the necessary steps to preserve the VDR information until it can be passed to the investigator.

2.3 Where the VDR is inaccessible and the information has not been retrieved prior to abandonment, a decision will need to be taken by the flag State in co-operation with any other substantially interested States on the viability and cost of recovering the VDR balanced against the potential use of the information. If it is decided to recover the VDR the investigator should be responsible for co-ordinating its recovery. The possibility of the capsule having sustained damage must be considered and specialist expertise will be required to ensure the best chance of recovering and preserving the evidence. In addition, the assistance and co-operation of the owners, insurers and the manufacturers of the VDR and those of the protective capsule may be required.

Custody of VDR information:

3 In all circumstances, during the course of an investigation, the investigator should have custody of the original VDR information in the same way that the investigator would have custody of other records or evidence under the Code for the Investigation of Marine Casualties and Incidents.

3.1 The term investigator refers to the Marine Casualty Investigator as per the terms of the Code for Investigation of Marine Casualties and Incidents.

3.2 Refer to paragraph 4.11 of the Code for the Investigation of Marine Casualties and Incidents, as adopted by resolution A.849(20).

3.4 In all circumstances the investigator is responsible to arrange down loading and read-out of the information and should keep the ship owner fully informed. In some cases, the assistance of specialist expertise may be required.

Access to the VDR information

5 A copy of the VDR information must be provided to the ship owner at an early stage in all circumstances.

6 Further access to the information will be governed by the applicable domestic legislation of the flag State, coastal State and other substantially interested States as appropriate and the guidelines given in the Code for the Investigation of Marine Casualties and Incidents.

7 Any disclosure of VDR information should be in accordance with section 10 of the Code for the Investigation of Marine Casualties and Incidents

1.0 Manual Organisation

All manuals referring to the NW-4000 series of VDR are 'common documents' since they are both applicable to (S)implified Voyage Data Recordes as well as 'full' VDR's.

This document covers all physical and wiring aspects of the (S)VDR and VDR **installation** up until the moment the system is powered-up, and includes configuration of all data-sources connected (recording channels) thereafter (i.e. radar, gps, compass, alarms, etc.).

It therefore covers all information required to commission the VDR and is intended for the authorised (certified) party installing the VDR.

Furthermore this manual covers all user related **operational** aspects and is intended to inform and assist the crew in the day-to-day operation of the VDR, and especially the user functions of the Bridge Control Unit in Section 17.

This manual also covers **maintenance aspects**, including those being part of the Annual Performance Test, which document may also be used as a self-contained document to report the results of the performance tests.

All manuals need to remain on board of the vessel.

The following publications are applicable to the NW-4000 series of Voyage Data Recorders;

NW4000 -- 10 **VDR Ship's And Operators Instruction Manual (this manual)**
NW4000 -- 20 **VDR Annual Performance Test and Certification**[1]
NW4000 -- 50 **VDR WavePlay Data replay manual**
NW4000 -- 60 **VDR Authority Access Manual**[2]

[1] This document references document NW-4000-10 (this manual) which should be available.
[2] To review the downloaded data, the NW4000-50 VDR WavePlay Data replay Manual is required.

1.1 Manual Conventions

VDR
The entire Voyage Data Recorder system including all of it's Units

Unit
A physical part of the VDR contained in a separate housing, i.e. PSU (Power Supply and Switch Unit) or BCU (Bridge Control Unit)

Device
A physically separated part within a Unit, i.e. signal adaptor or other (part of) assembly or equipment not physically part of the VDR.

Sensor
Any external equipment or unit (i.e. radar, gps, etc.) from which data is acquired. Sensors provide signals or data to the VDR

1.2 Introduction

The Voyage Data Recorder (furthermore referred to as VDR), records the outputs from sensors (connected external equipment) and ultimately passes the data to a protective capsule for storage.

This data is stored for a rolling 12 hour minimum period so that in the event of an accident the capsule can be recovered and an analysis of the events leading up to the incident may be conducted.

All available data is recorded until ship's power to the VDR fails, and from then only selected data (bridge audio) is recorded for a further two hours after which recording stops automatically.

The following data is recorded when the system is deployed as an S-VDR;

- Date and time from a source external to the ship, e.g. GPS
- Ship's position from a designated electronic positioning system, e.g. GPS
- Speed through the water and/or over the ground longitudinal and transverse from the Log
- Heading from the ship's designated compass
- Bridge audio via the VDR microphones.
- Communications audio from a designated VHF.
- Displayed video image from a single designated X or S band radar display, or – alternatively – an AIS in the event a radar interface possibility is not feasible.
- Depth under keel from the echo sounder.

Additionally recording of the following data is required when the system is deployed as a VDR:

- Mandatory main alarms.
- Rudder order and response.
- Engine order and response.
- Status of watertight doors as mandated by the IMO.
- Wind speed and direction, relative or absolute.
- Hull stress monitoring data, where such a system is fitted.

2.0 System Overview

2.1 System architecture

The VDR consists of the following Units:

- Hardened Storage Server Capsule (HSS)
- Power Supply & Data Switch Unit (PSU)
- Bridge Control Unit (BCU)
- WaveNet Interface Modules (WIM) and WaveNet Adaptor Modules (WAM)

These units are interconnected by a single network (WaveNet) cable for both power-supply (also in the event of failure of the main power supply) as well as data transport.

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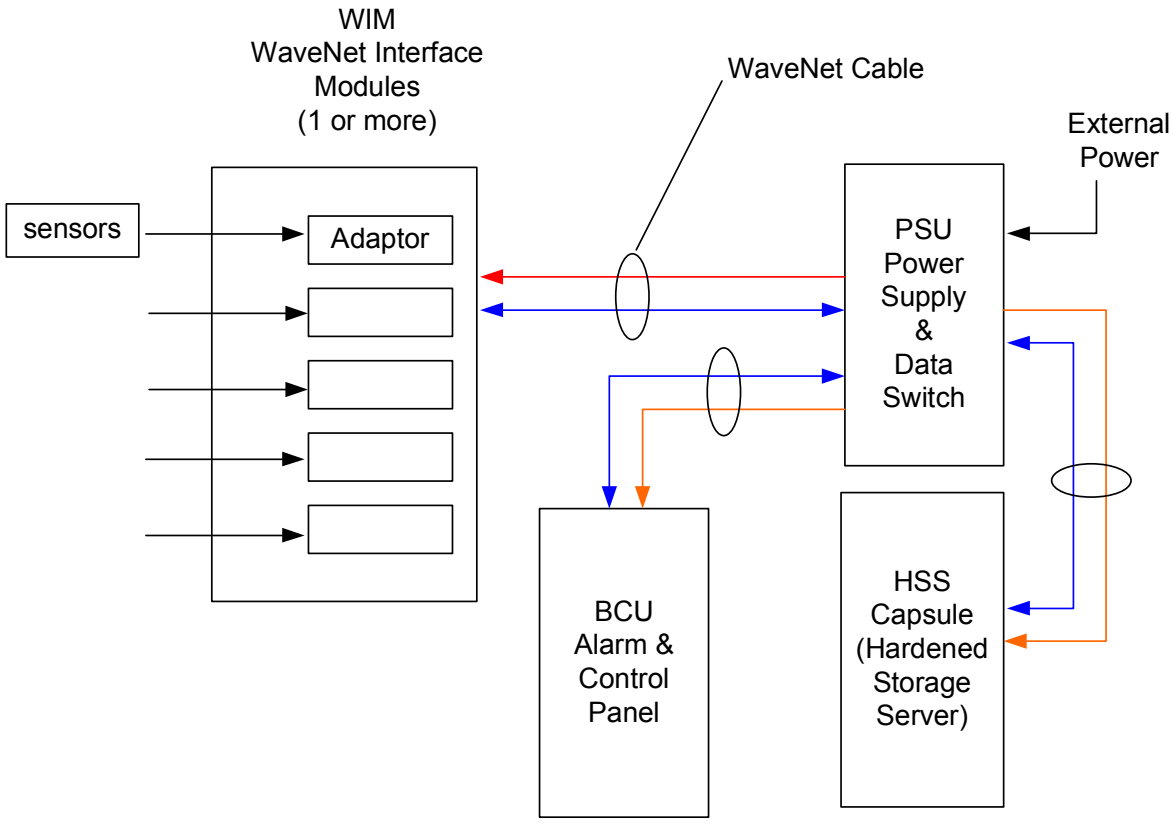


Figure 2.1 WaveNet - Single wire interconnection example

All units (apart from the HSS which only has 1 network connection) have 2 network connections (input/output), so they may be 'daisy chained' to minimise cabling efforts during installation. The maximum distance between the PSU unit and any of the units where the WaveNet cable ends, is 100 meters. The maximum number of units to 'daisy chain' on a single port from the PSU is 3.

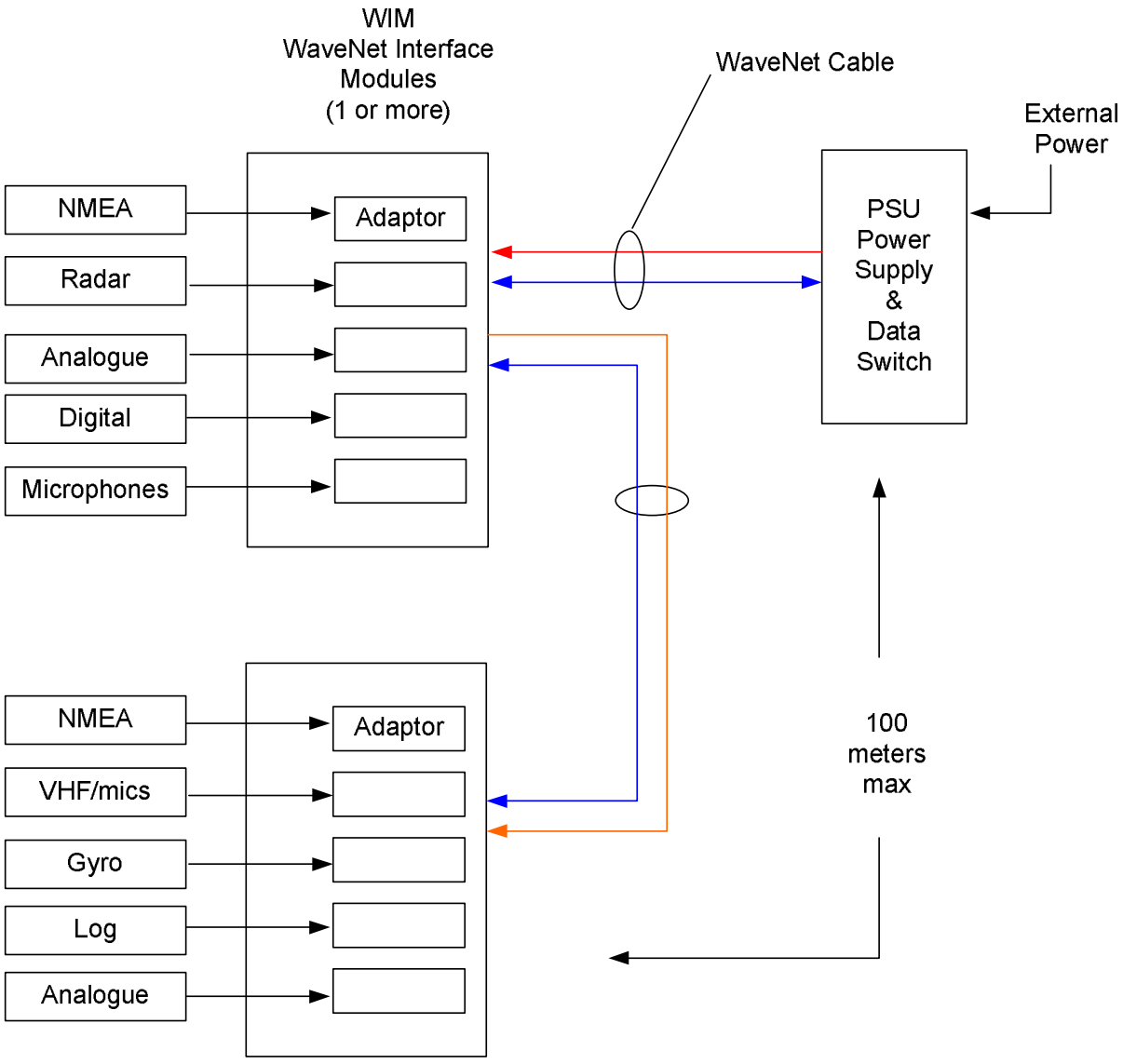


Figure 2.2 daisy chaining VDR units

The WaveNet Interface Modules (WIMs) contain one ore more WaveNet Adaptor Modules (WAMs), the characteristics of which may be intermixed (within the system's constraints as explained in elsewhere this manual) within one WIM. This allows data acquisition close to the sensor, thereby minimising cabling efforts and cost. There is a different (often multichannel) WaveNet adaptor available for all normal shipboard signals, so that external (third party) interfaces are not normally required.

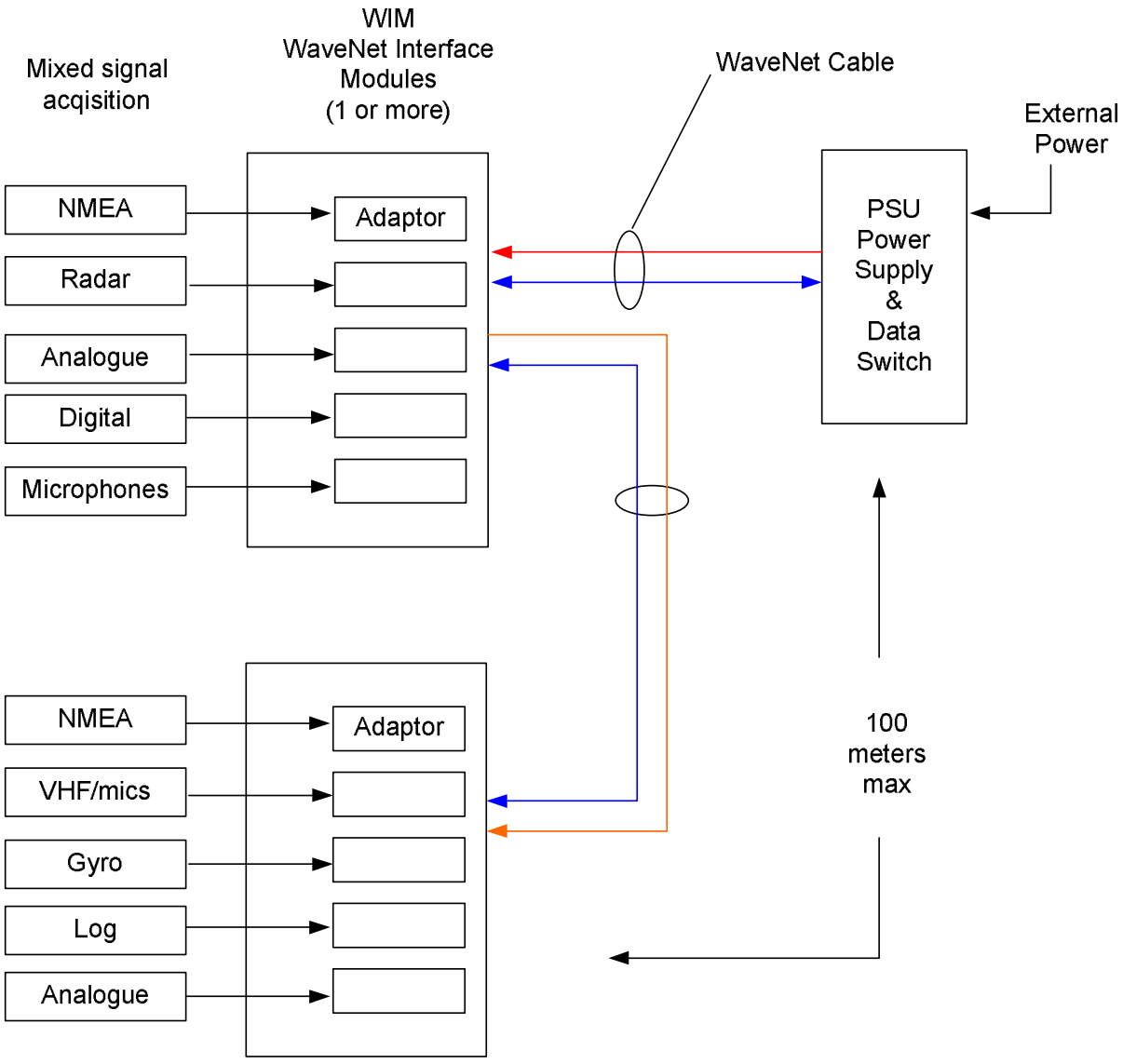


Figure 2.3 WaveNet Interface Modules (WAM) contain WaveNet adaptor Modules (WIM) and may be daisy-chained)

When carefully planned, due to the unique cabling characteristics of the NetWave VDR, substantial savings in time and material may be achieved.

Additional Signal Acquisition

Bridge Control Unit

Apart from data acquisition thru the WIMs, the Bridge Control Unit has two serial (NMEA) ports which may be used for signal acquisition as well. Since the BCU is normally positioned in the vicinity of the position from where the ship is normally navigated, GPS and AIS signals are most likely readily available at that location.

The COM1 NMEA port may both be used for standard NMEA at 4800 Bd, as well as for "high-speed' NMEA at 38k4 Bd. The COM2 port may only be used up to 4800 Bd.

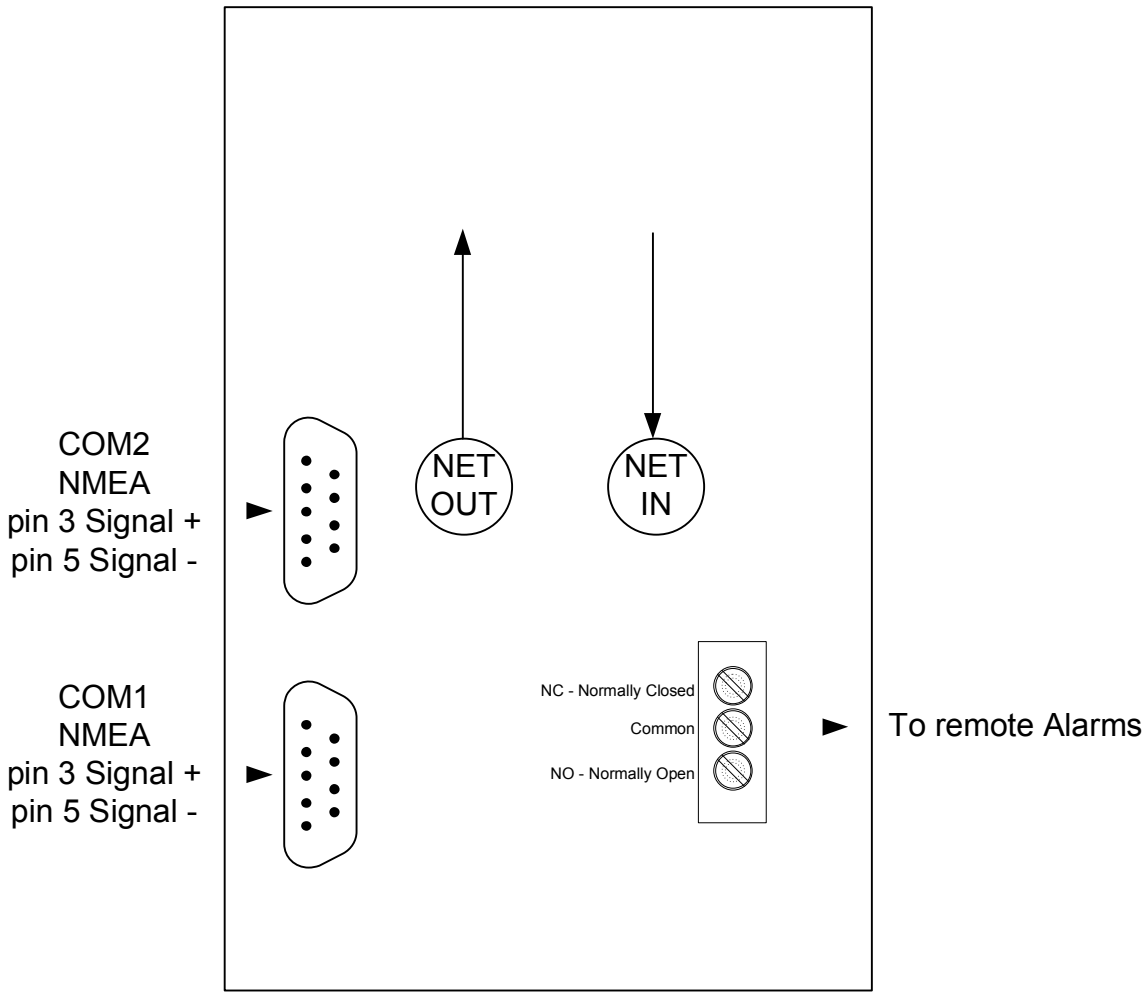


Fig 2.4 Bridge Control Unit (rear view)

Additional Signal Acquisition (continued)

Multiplexers & Concentrators

Furthermore serial data concentrators/multiplexers may be used to feed NMEA data to any of the serial input ports, being it at the WaveNet Adaptor Modules, or those on the Bridge Control Unit.

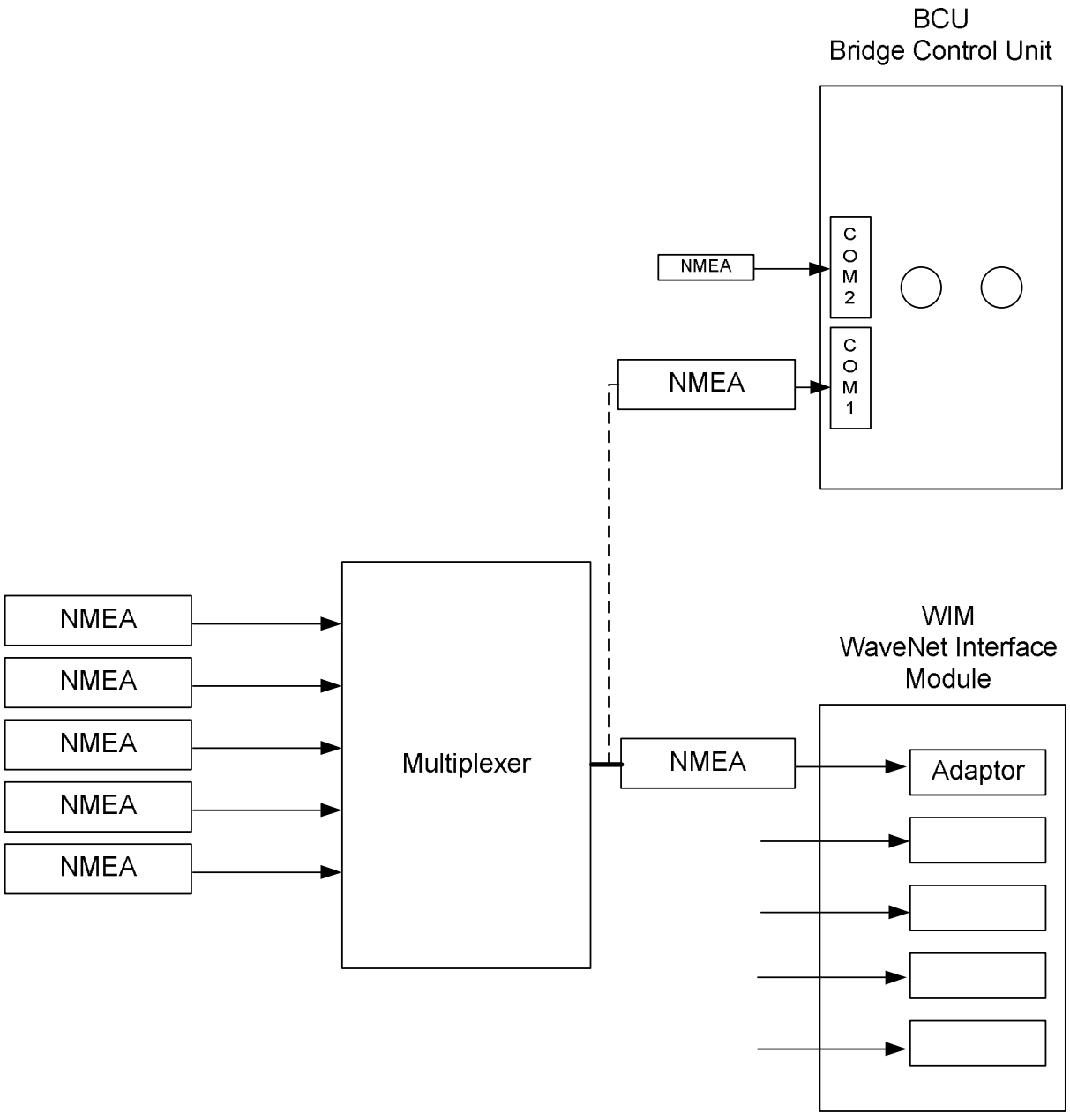


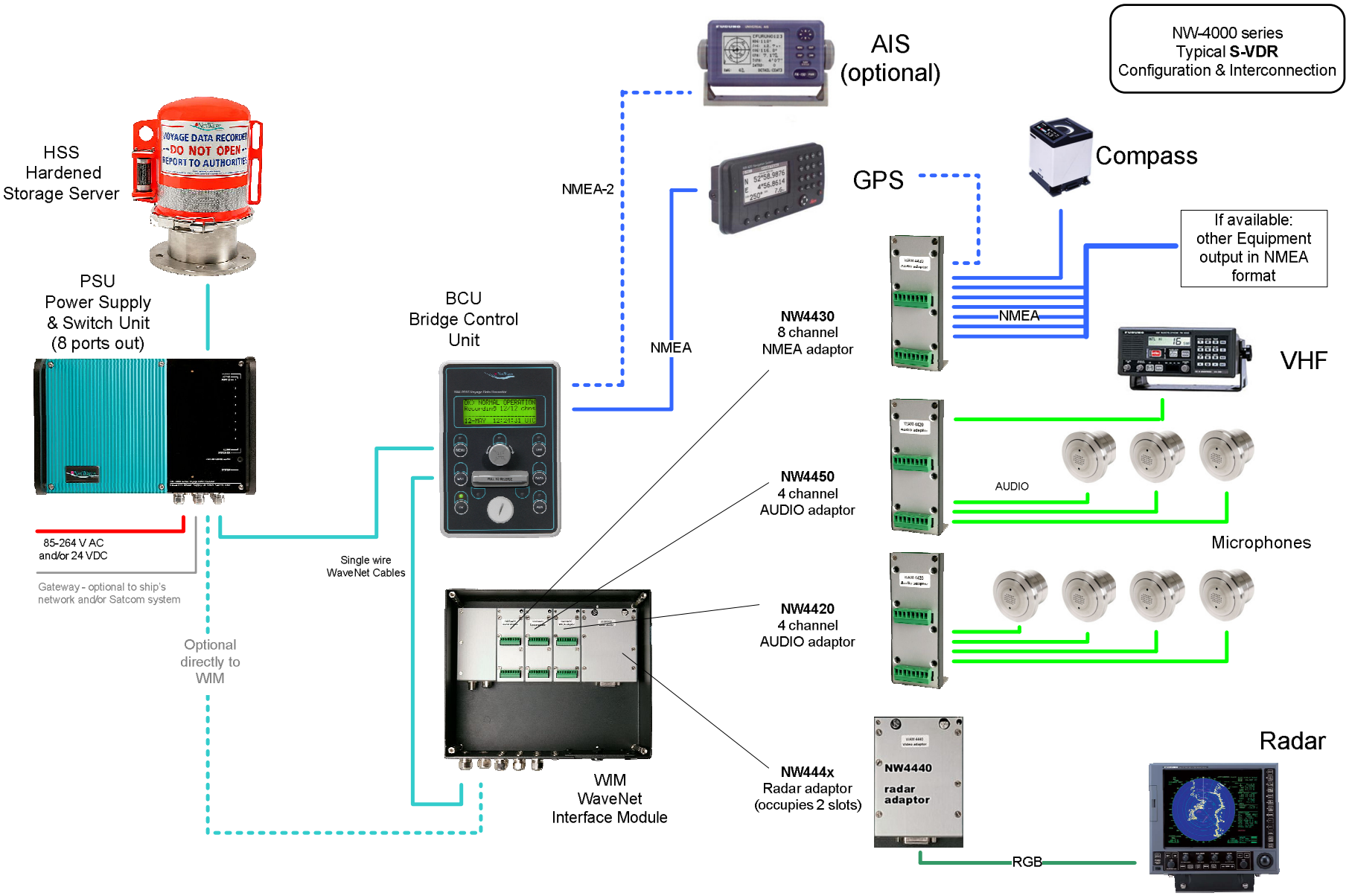
Fig 2.5 NMEA data input options

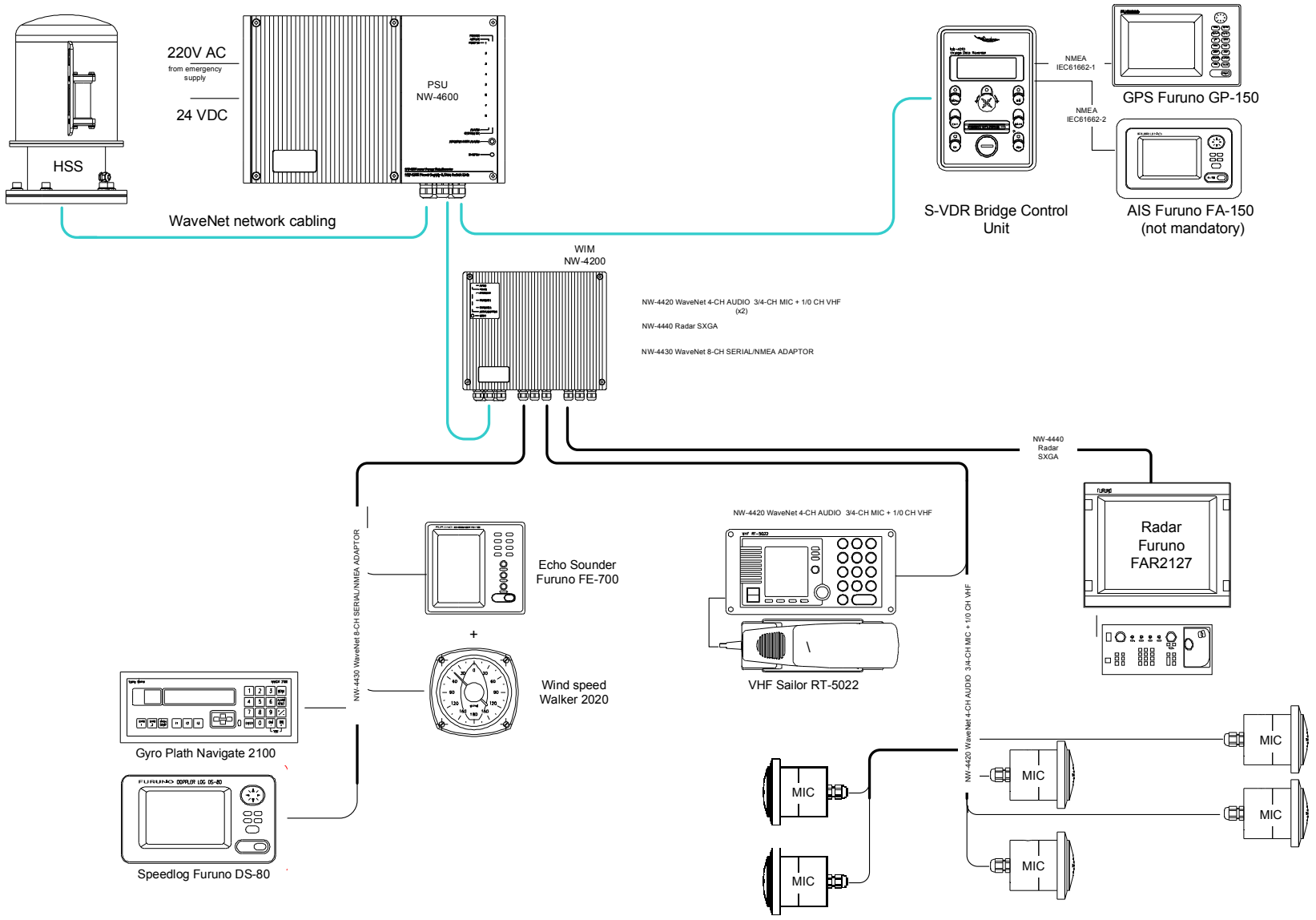
2.2 Installation Planning

The planning and installation shall be carried out in the following steps;

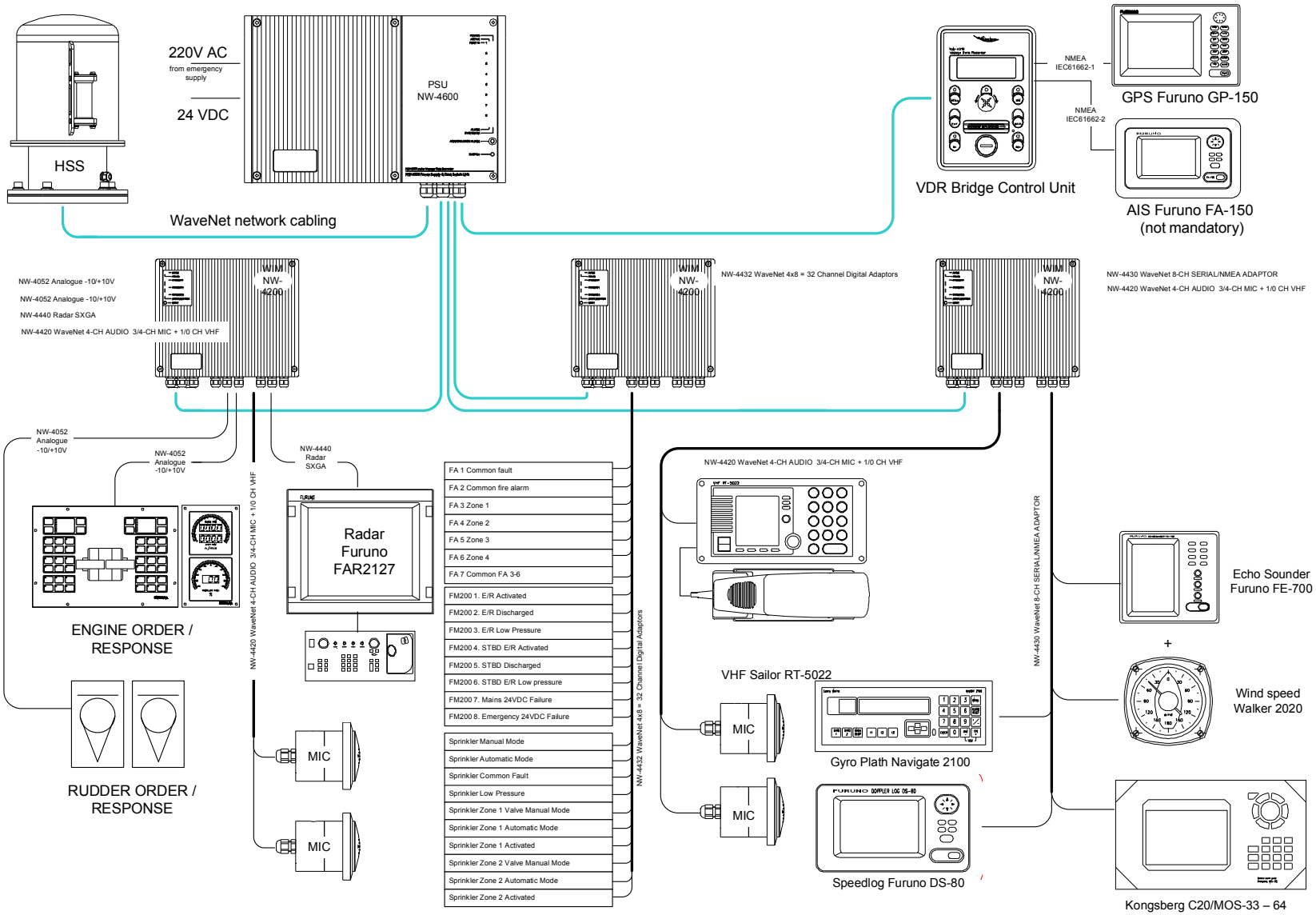
- Determine which shipboard equipment (sensors) need to be connected, taking into account the relevant IMO resolutions. (also refer to the1.0 Introduction section of this manual)
- Determine which adaptors are required to acquire the data form these sensors
- Determine where the WIM(s) are to be positioned to minimise the cable length between the WIM and the sensor, and determine which adaptors will be placed in which WIM(s)*
- Determine the layout of the interconnection (network cable) between the WIM, BCU, Capsule and the PSU
- Carry out the physical installation, interconnect the units by means of the Wavenet cable provided.
- Power the VDR and name the recording channels which are to be recorded by the VDR.(the VDR will auto-configure itself by recognising the WIMs and WAMs available on the network)
- Enter the compulsory vessel data
- Name the recording channels
- Adjust the radar settings
- Check the recorded data against the settings by means of the functionality within the web-interface and/or replaying the channels recorded by means of the replay software.

* S-VDR systems may be delivered with pre-installed adaptors.


NW-4000 series
Typical S-VDR
Configuration & Interconnection
AIS
(optional)
HSS
Hardened
Storage Server
VOYAGE DATA RECORDER
DO NOT OPEN
REPORT TO AUTHORITIES
NMEA-2
GPS
Compass
If available:
other Equipment
output in NMEA
format
PSU
Power Supply
& Switch Unit
(8 ports out)
BCU
Bridge Control
Unit
NMEA
NW4430
8 channel
NMEA adaptor
NMEA
VHF
NW4450
4 channel
AUDIO adaptor
AUDIO
Microphones
85-264 V AC
and/or 24 VDC
Gateway - optional to ship's
network and/or Satcom system
Single wire
WaveNet Cables
Optional
directly to
WIM
NW4420
4 channel
AUDIO adaptor
WIM
WaveNet
Interface Module
NW444x
Radar adaptor
(occupies 2 slots)
NW4440
radar
adaptor
Radar
RGB



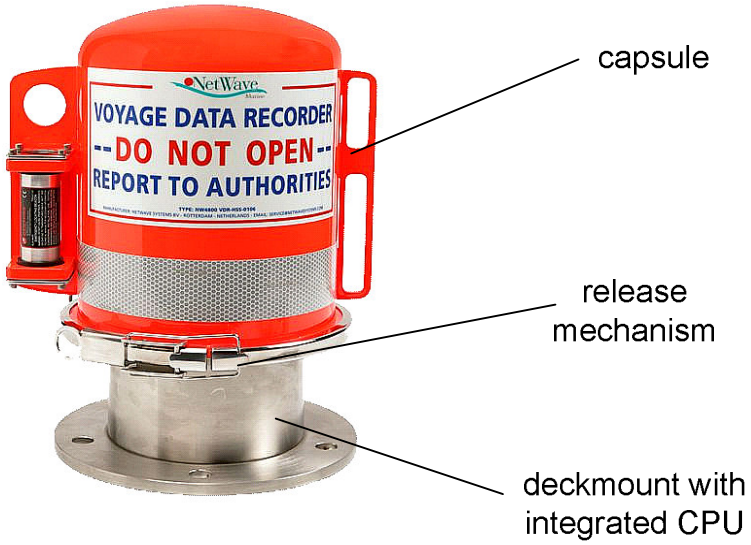
NetWave **S-VDR** NW-4400 Typical Installation Example



NetWave VDR NW-4400 Typical Installation Example

2.3. System Components and functions

2.3.1 HSS – Hardened Storage Server



2. 3.1.1. General

The HSS forms the “Black Box” storage medium and is coloured bright orange for ease of location in the event of an incident.

The HSS is designed to be mounted externally close to the bridge - typically on the ´monkey island´ - and is fitted with an acoustic beacon to aid underwater recovery by an Remotely Operated Vehicle (ROV) or diver in the event of an incident.

The unit is designed to withstand the extreme shock, impact, pressure and heat exposure requirements of the IEC Performance standars which mirror those enforced by the maritime and aerospace authorities.

The deckmount part contains the server-CPU (central processing unit) and the protected memory resides within the capsule. These two parts are interconnected by a quick-release cable-connector assembly.

An ROV may recover the upper (orange) part of the capsule, including the recorded data.

A VDR may only have one HSS within its system configuration.

2.3.1.2. Location of the protective capsule (HSS)

The protective capsule must be sited in the vicinity of the bridge on the external deck area of the vessel so as to maximize the probability of its survival and recovery following an incident. The capsule shall be positioned clear of rigging and other potential obstructions **and as near to the centreline of the ship as practically possible**. Criteria to be considered when assessing the optimum position shall include but not be limited to the following:

- separation from fuel or other potential fire sources,
- separation from probable sources of mechanical damage,
- operational environment for continued serviceability,
- accessibility for copying of recorded data and for routine maintenance,
- facilitation of underwater removal and retrieval by both divers and ROVs.
- there shall be a clear unobstructed space in the vicinity of the capsule to allow an ROV or diver to work.

2.3.1.3. Data Storage

The HSS has the capacity to store audio, radar video and other data for a rolling 12 hour (minimum) period as defined in the regulations. All power and data are passed to the HSS via one single WaveNet cable. Connection is via a waterproof connector.

2.3.1.4. Data Retrieval

The HSS has a release mechanism to facilitate underwater recovery both by a diver or a ROV. Suitable handles are provided to ensure that the capsule may be retrieved safely after release.

When the HSS has been damaged after an incident, e.g. the HSS was exposed to fire or the ship has sunk, it may be returned to NetWave Systems for the data to be extracted. Alternatively, authorities may apply for instructions on how to extract the recorded data.

2.3.1.5. HSS Installation

The HSS consists of two sub-assemblies. A deckmount sub-assembly is directly fastened to the ship and provides two (alternative) water tight cable entries for the single wire WaveNet connection.

A removable sub-assembly (the capsule) is attached to the mounting base with a unique quick release mechanism for recovery by either a diver or ROV. The HSS has an externally mounted underwater location beacon (ULB) with an activation sensor to avoid inadvertent activation due to spray/rain/hosing off.

The HSS (memory module) protective capsule is painted a highly visible fluorescent orange with the required text: VOYAGE DATA RECORDER, DO NOT OPEN and REPORT TO AUTHORITIES.

2.3.1.6. HSS Technical Specifications

The HSS is designed to meet the following specification;

- Fully meets IMO Resolution A.861(20) and all applicable Safety Of Life At Sea (SOLAS) Regulations.
- Fully compliant to the IEC 61996 Shipborne Voyage Data Recorder Performance Requirements and IEC60945, Maritime navigation and Radio communication systems - General requirements
- Records a minimum of 12 hours of voyage data: bridge audio, VHF communications audio, radar, and NMEA 0183 serial data channels (IEC61162).
- Single wire Power and high speed (100BaseT) Ethernet communications.
- Simplified (IMO mandated) annual maintenance routines
- Reliable solid state recording (2+ years data retention unpowered).
- Fitted with an acoustic underwater location beacon operating in the frequency band of 25 kHz to 50 kHz with a battery life of at least 30 days, which meets SAE AS 8045.
- Tamper resistant capsule design.
- The final storage medium within the HSS retains the recorded data for a period of at least two years, following termination of recording, under the specified operational and storage conditions.

Power Consumption:	12 W
Data Link:	Ethernet 100BaseT
Data Write Rate:	>20 Mbytes/second
Data Read Rate:	>20 Mbytes/second

Storage specification as follows:

2.3.1.6.1 Storage Capacity technical specifications

Capacity : 4 Gb

- Exceptional read, write and erase performance
- Built-in proprietary technology for full hard-disk emulation, high data reliability and maximum flash lifetime.
- Data integrity with Error Detection Code/Error Correction Code (EDC/ECC) based on a combination of BCH and Hamming algorithms
- Data protected in hardware with digital signature: RSA with 64-byte key
- 4-bit Error Detection Code/Error Correction Code (EDC/ECC), based on a patented combination of BCH and Hamming code algorithms
- Guaranteed data integrity even after power loss
- Transparent bad-block management
- Dynamic and static wear-levelling
- Wear levelling algorithm that provides more than 5 million write / erase cycles for reliable data storage over an extended period

The Hardened Storage Server (HSS) design ensures survivability of critical voyage data to the following severe environmental conditions:

- Impact shock - 50 g half sine-wave pulse for 11 milliseconds.
- Penetration - 250 kg mass dropped 3 metres impacting with 100 mm diameter pin.
- Fire exposure – 1100 ˚C for 1 hour and 260 ˚ C for 10 hours.
- Deep sea pressure - 30 days in sea water at 60 MPa (an equivalent depth of 6000m)

The capsule and its reflective materials comply with IMO regulations and may not be painted/coloured with other materials other than those included in the NetWave supplied Overhaul Kit NW-9800-980.

Cabling: NW4001 NetWave approved network cable.

2.3.2 PSU – Power Supply and Switch Unit

2.3.2.1 General description

The PSU consists of a bulkhead mounted cabinet, with the functionality to

- provide power to the system and all of its units
- perform the function of an UPS (uninterruptible power supply)
- serve as a data-interconnection device
- provides access port (RJ-45) to the VDR network
- provides a remote alarm contact

All power supplies to the all of the VDR units are derived from the PSU. In the event of power failure, the PSU's internal batteries provide power to those connected units which are involved in recording audio, enabling at least 2 hours of audio to be recorded. (as per the IEC61996 VDR Performance Standard)

2.3.2.2 Power Supply

The PSU is connected to the ship's main power supply which may either be within 85-264 VAC (auto-sensing) range and/or 24 V DC, and has a built-in uninterruptible battery-back-up unit with batteries.

The maximum power consumption is 100 Watt.

The PSU normally operates from 110 V/220 V AC ship's mains. This supply is from the normal ship's power supply, but in the event of power failure, external switching in the ship should ensure the emergency ship's mains (110 V/220 V) is supplied to the unit.

Furthermore - optionally - the PSU may (also in conjunction) be powered from the 24 V DC ship's supply.

Where the AC and DC supplies are both connected to the PSU, the AC supply will normally be used to power the unit. However, in the event of failure of the AC power,

this is detected by the PSU, and the DC supply (if connected) is automatically switched in to ensure continued operation. In the event both power sources fail, the PSU's internal batteries will provide 2 hours of continued operation of the VDR, given the limitation of the characteristics of the recording channels as per the performance standard.

In practise, while the PSU is in battery back-up mode, the WIMs containing audio adaptors will continue to operate normally, however any video adaptor – if present - will automatically be switched off.

2.3.2.3 Network ports

The PSU has 8 network ports, 7 of which are 'powered' and may be connected to any of the other VDR units (NW1-NW7). One RJ-45 connector (NET8) provides a transparent link into the VDR network and is (optionally) used to be connected to the ship's network or a PC.

2.3.2.4 UPS

The PSU has ‘standby’ batteries to ensure recording of all available data is maintained for a period of 2 hours in the event of loss of all external power supplies to the PSU. During normal operation the batteries are charged from one of the main power sources (AC or DC).

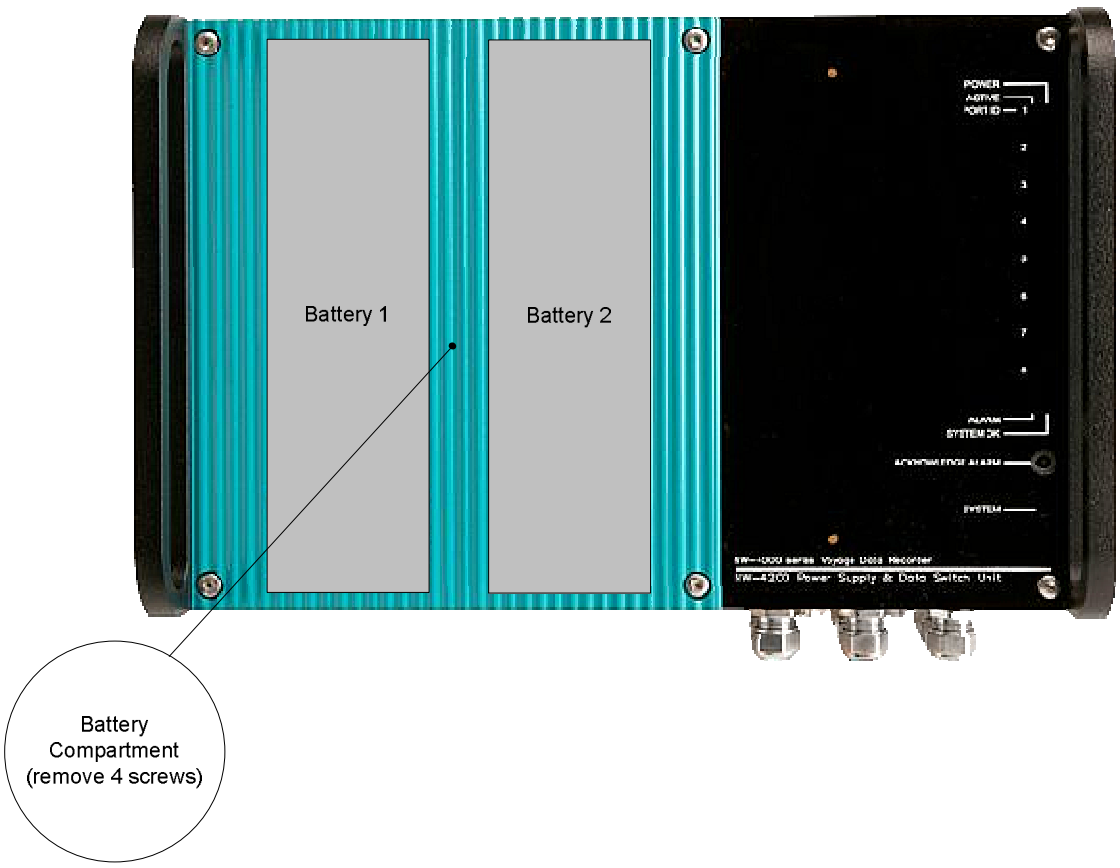
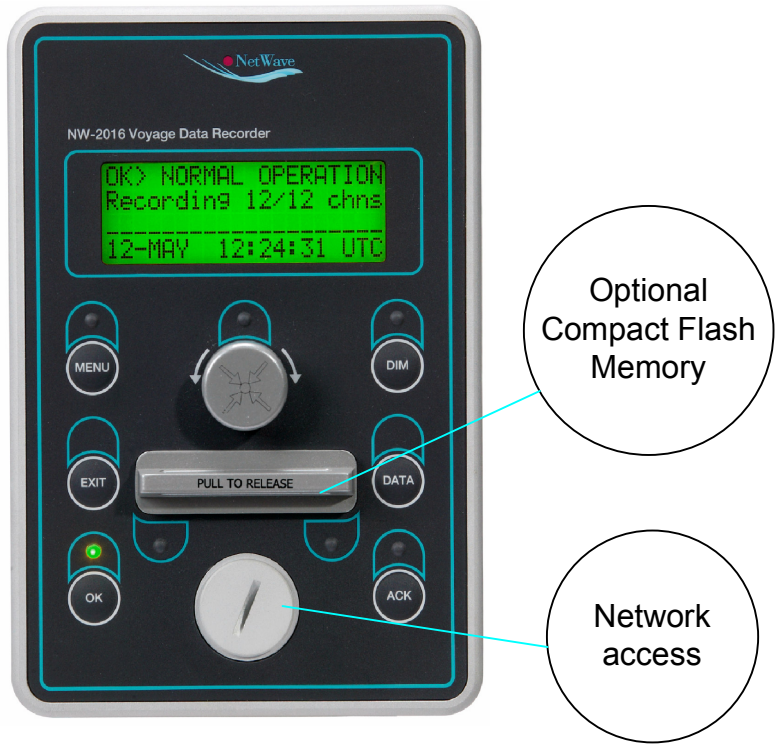


Figure 3.1 Battery compartment

2.3.3 BCU - Bridge Control Unit



2.4.1 General Description

The BCU is a console mountable display & control unit and is the primary user-interaction device. The BCU also serves to monitor the status of the VDR and functions as the primary alarm unit.

An alphanumeric display, together with pushbuttons and LED indication is provided on the front of the BCU to allow easy access and control of specific user-functions.

2.4.2 BCU Network access

Additionally the BCU provides an RJ-45 user-access Ethernet port to be connected to a (laptop/notebook) PC for system access (service and maintenance) as well as data retrieval of recorded data.

2.4.3 Incident recording

In order to comply with the regulations, the unit as a push-button incident recording function, allowing for 12 hours of additional storage.

2.4.4 Retrievable memory

The BCU (model 4016) optionally contains a user retrievable Compact Flash to allow for easy data transportation to off-site facilities.

2.4.5 Additional interfacing options

The BCU has 2 NMEA serial ports to allow data-collection from external devices (GPS/AIS) for subsequent recording in the VDR.

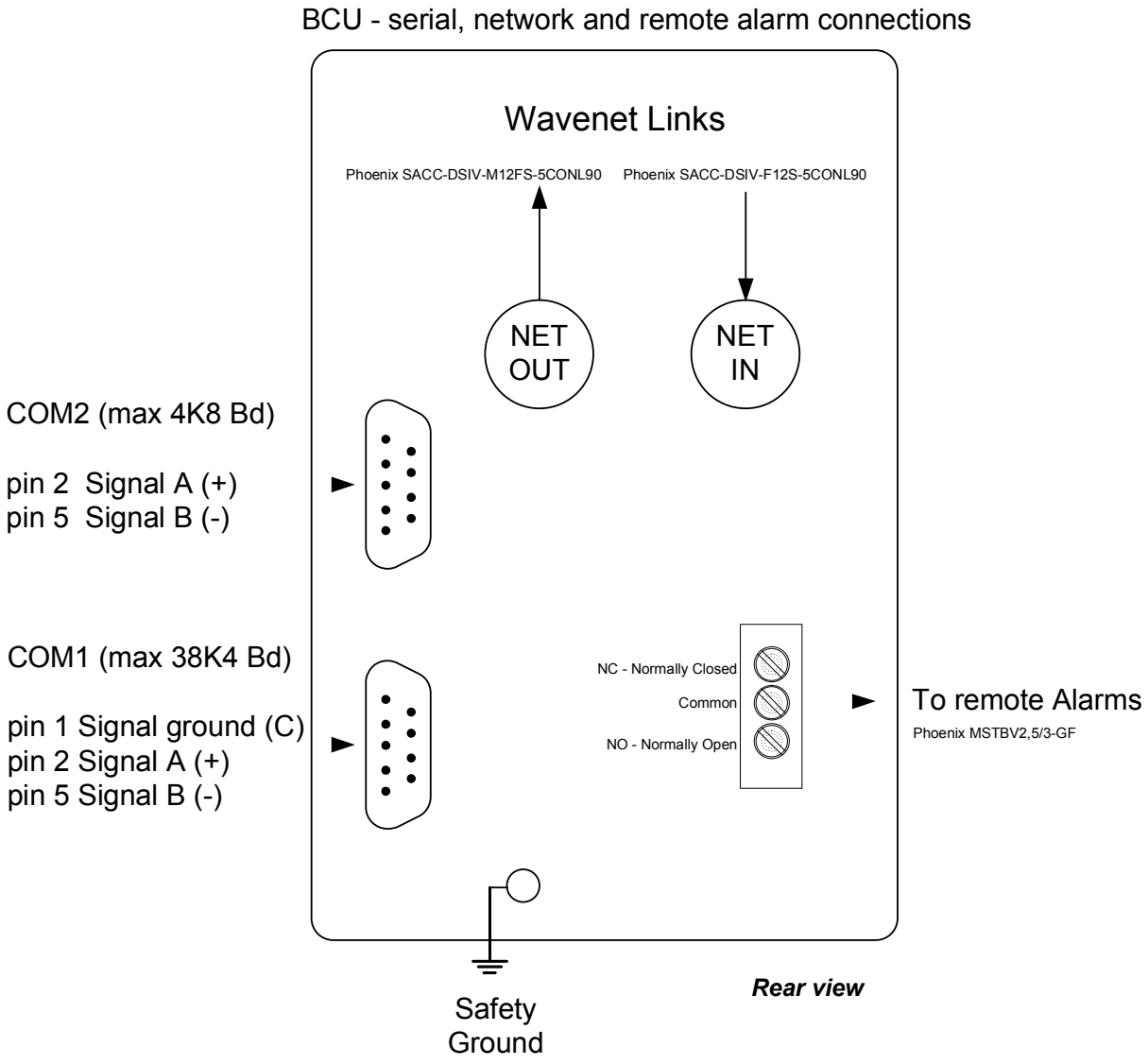


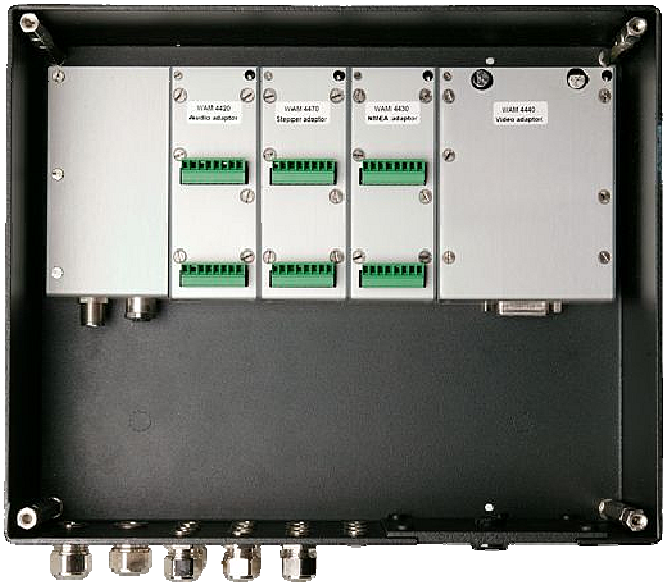
Figure 2.4.5.1 BCU connections

The COM1 NMEA port may both be used for standard NMEA at 4800 Bd, as well as for "high-speed' NMEA at 38k4 Bd (normally for AIS). The COM2 port may only be used up to 4800 Bd.

COM1 may be configured between 4800Bd and 38400Bd (typical AIS)
COM2 only supports 4800Bd

Com Port Settings are made via the the VDR Administrator web-interface via the pages Devices>BCU.

2.3.4 WIM - WaveNet Interface Modules

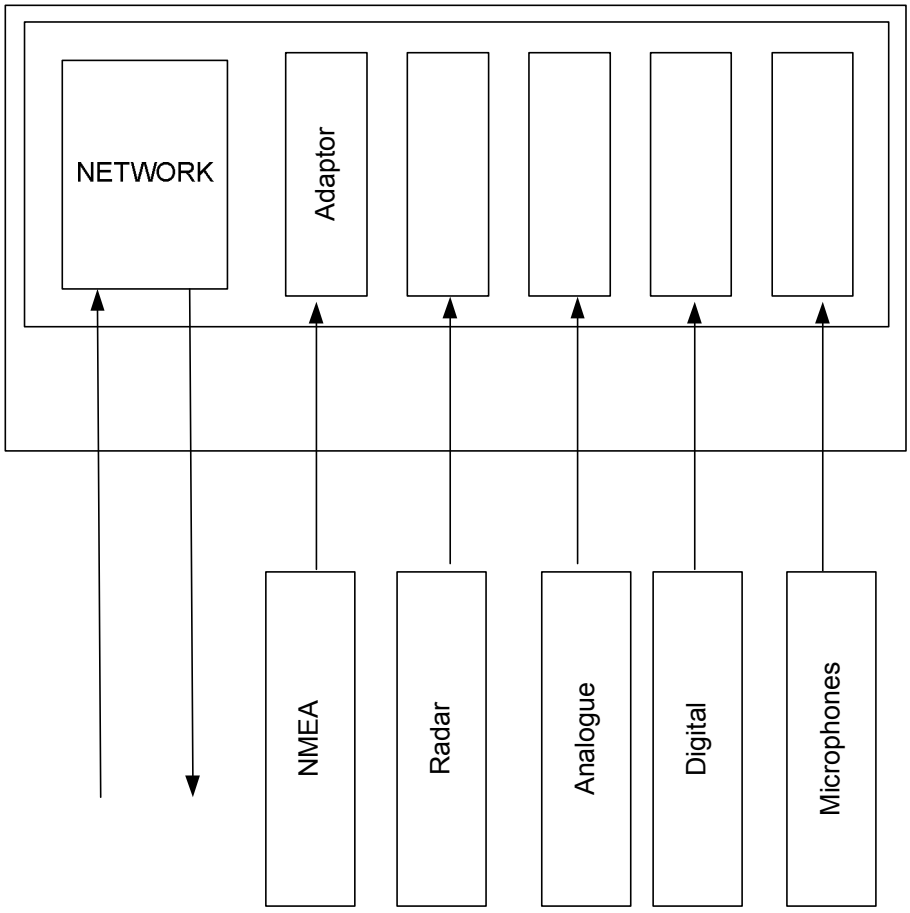


2.6.1 General description

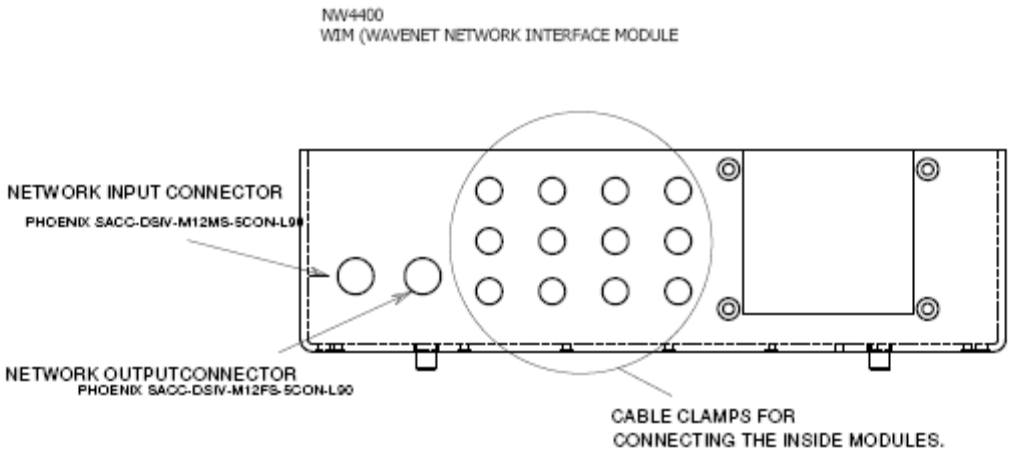
Fitted near or in the vicinity of the sensors (external equipment to be interfaced to), this unit takes the incoming signals from the ship's sensors in various formats, processes them for use within the VDR, then compresses and timestamps them for storage in the HSS.

Essentially, these WIMs act as the receiving hub for all video, audio, analogue and digital signals. The WIM backplane board is contained in a bulkhead mounted case and contains various input/output modules(adaptors) for data collection and processing, depending upon the installer's decision and foreseen configuration. Appropriate cable entry facilities are provided to accommodate the ship's cabling that may be connected to the unit.

The WIM units accept a variety of WAM-devices (WaveNet Adaptor Modules) to allow all required external equipment to be connected to the VDR.



Most modern bridge sensors have provision for data output in accordance with IEC61162 (NMEA) protocols. However, there is a large quantity of older equipment, particularly speed logs, echo sounders, compasses, etc. that require their outputs to be converted into a suitable format for processing within the VDR. In addition, when installing a full fledged VDR (rather than an S-VDR) there are a number of control / sensor circuits that have to be monitored to provide status signals to the VDR, for example engine order and response, thruster controls, watertight door indicators, rudder order and response and main alarms.



2.3.5 WIM – Wavenet Adaptor Modules

The following NetWave adaptor Modules are available at the time of publication of this manual.

- NW-4420 WaveNet 4-Channel Audio 3/4-CH MIC + 1/0 CH VHF adaptor
- NW-4430 WaveNet 8-Channel Serial/NMEA adaptor
- NW-4432 WaveNet 8-Channel Digital adaptor
- NW-4445 Wavenet Radar video adaptor VGA>UXGA
- NW-4450 Wavenet 4-Channel analogue adaptor 4-20 ma
- NW-4452 Wavenet 4-Channel analogue adaptor -10v/+10v
- NW-4454 Wavenet 4-Channel analogue adaptor 0-10v

Furthermore the microphones are identified as follows;

1. NW-4422 NetWave Microphones Ø60mm (for internal & exterior, IP66)

2.3.6 Adaptor Slot Allocation Table

IMPORTANT

The first table gives the possible configurations only with Digital and Serial(NMEA), (D/S-IM) adaptors or Audio modules. The second table gives the possible mixed configurations. Please bear in mind that if an NW-4445 Radar Video adaptor is placed, slots 4 and 5 are occupied by that adaptor.

Table 1.

1	2	3	4	5
D/S-IM	D/S-IM	D/S-IM	D/S-IM	----
D/S-IM	D/S-IM	D/S-IM	----	D/S-IM
AUDIO	----	AUDIO	----	----
----	AUDIO	----	AUDIO	----

AUDIO, as well as NMEA, and Digital (D/S-IM) adaptors may be arranged (into each WIM) as follows;

1	2	3	4	5
AUDIO	D/S-IM	AUDIO	D/S-IM	----
AUDIO	D/S-IM	AUDIO	----	D/S-IM
AUDIO	D/S-IM	D/S-IM	D/S-IM	----
AUDIO	D/S-IM	D/S-IM	----	D/S-IM
GIM	GIM	AUDIO	D/S-IM	----
D/S-IM	D/S-IM	AUDIO	----	D/S-IM
D/S-IM	AUDIO	D/S-IM	AUDIO	D/S-IM
D/S-IM	AUDIO	D/S-IM	D/S-IM	----
D/S-IM	AUDIO	D/S-IM	----	D/S-IM
D/S-IM	D/S-IM	D/S-IM	AUDIO	D/S-IM
D/S-IM	D/S-IM	D/S-IM	D/S-IM	AUDIO

= maximum configuration

Legend:

D/S-IM (Digital/Serial Interface module) stands for any of two adaptors:

NW-4430 WaveNet 8-Channel Serial/NMEA adaptor
NW-4432 WaveNet 8-Channel Digital adaptor

AUDIO stands for:

NW-4420 WaveNet 4-Channel Audio 3/4-CH MIC + 1/0 CH VHF adaptor

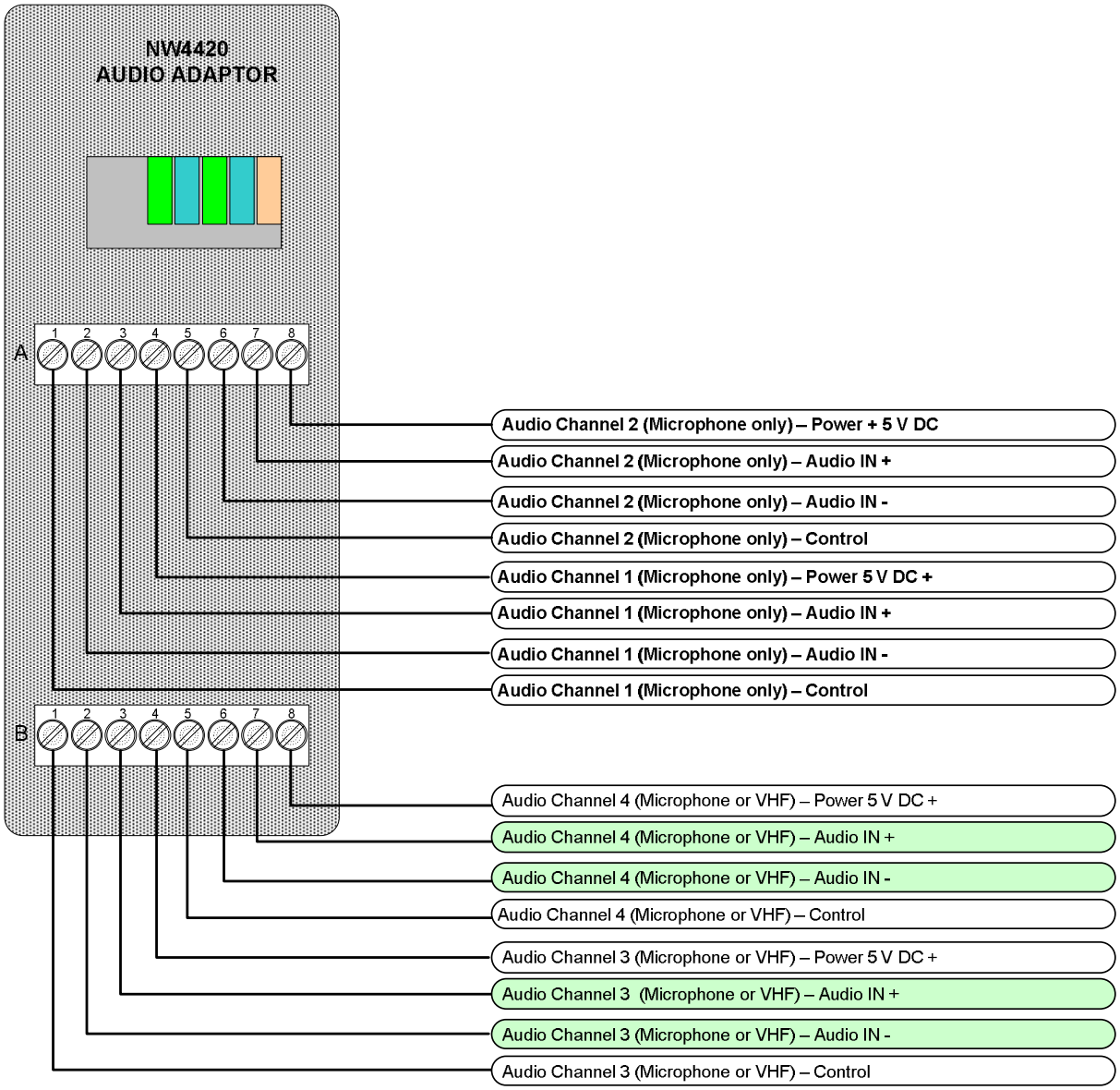
----- = "not occupied"

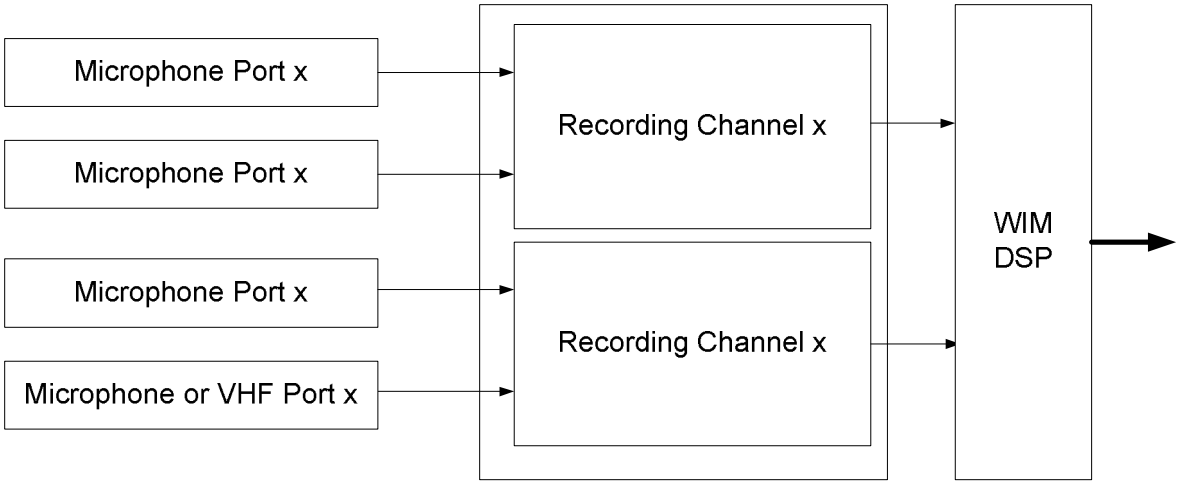
2.3.7 NW-4420 WaveNet 4-Channel Bridge Microphone & 2 Ch VHF adaptor

This adapter provides four separate audio ports. Two of these ports are configured as microphones (fixed) and the other two ports may be selected to be VHF inputs or microphone inputs (default). Since these ports 3 and 4 are mixed, and VHF audio should not be mixed with microphone audio, both DIP switches should be in the same position.

Up to 8 audio recording ports (2 x 4420 adaptor) may be digitized and compressed into 4 recording channels per WIM. Connection is with pluggable screw terminals.

The audio adaptor may be placed in slot 1 and/or 3 of the WaveNet Interface Modules. Alternatively, these may be placed in slots 2 and 4. In other words, if there is more than one AUDIO adaptor in any WIM, they must be one adaptor - slot apart.





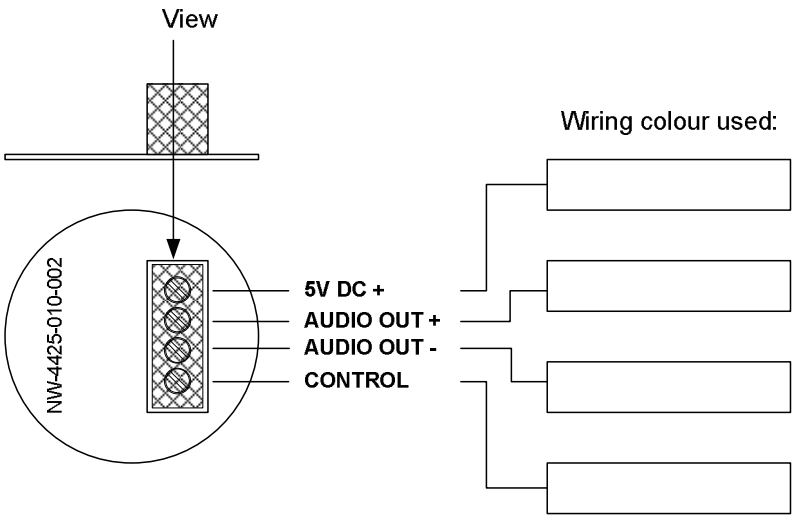
Depending upon the vessel's bridge architecture, in conjunction with minimum VDR performance specifications, a minimum of 1 WM4420 is required, however typically 2 will be used for 8 microphones and 1 VHF to be connected.

In each WAM 4420, two ports are optionally provided for use with designated VHF radio equipment, both inputs are in accordance with the requirements of IEC 61097-7.

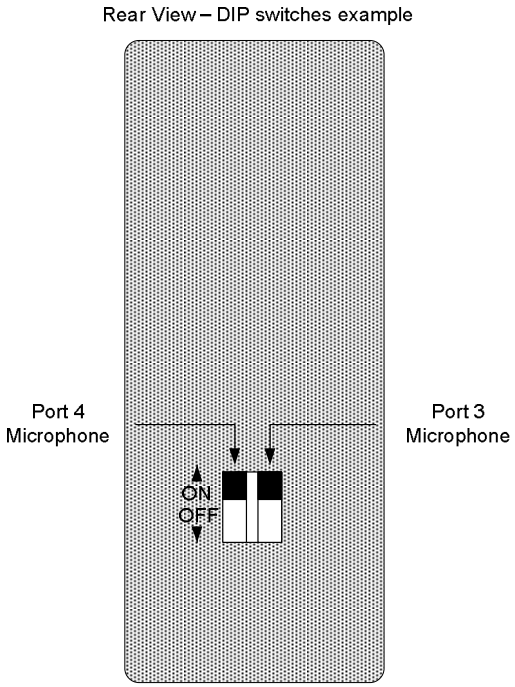
All inputs of the audio adaptor expect line levels (0.775 V RMS), whereas the VHF inputs are galvanically separated once selected as such by means of setting of the DIP-switches on the rear of the adaptor.

Both transmitted and received audio from the VHF radio are to be recorded.

Typically, within the VDR, one VHF audio channel is used for the main VHF station.


View
Wiring colour used:
NW-4425-010-002
5V DC +
AUDIO OUT +
AUDIO OUT -
CONTROL

2.3.7.1 Connecting VHF transceivers



For ports 3 and 4 the DIP switches may be (both!) set to OFF to galvanically separate the ports and enable them for VHF line input.

Please pay attention, while to configuring (via the web-interface), to the audio channels to be recorded since the microphone test-signal should not be activated on VHF inputs. Although no harm can be done to the system, In that event, an alarm will be generated since the VDR system erroneously presumes a microphone to be present on that port!

2. For microphones connected ports (1 or 2) DIP-switches to ON (default)
3. For VHF both DIP-switches to OFF

2.3.7.2 Microphones and VHF recording configuration

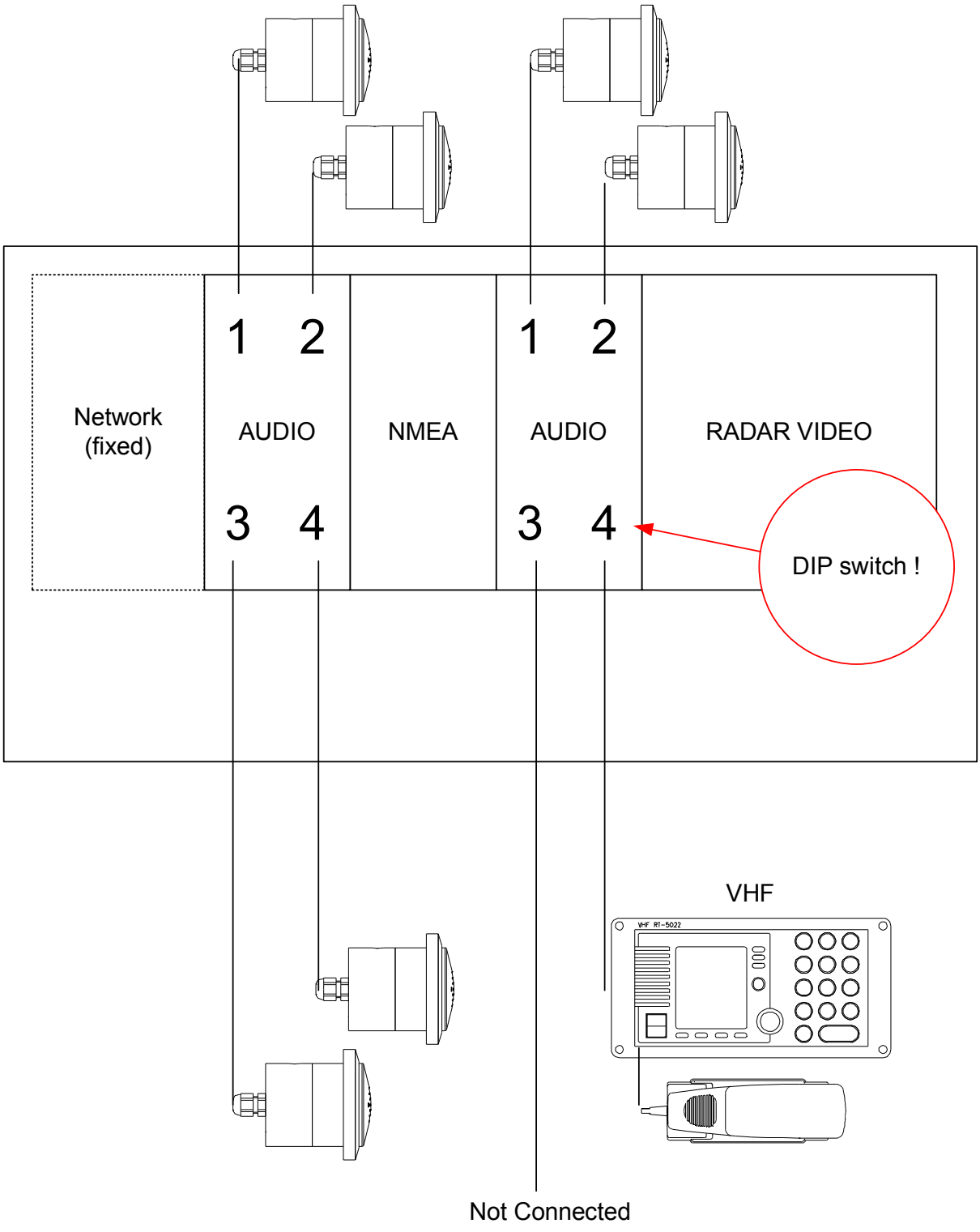
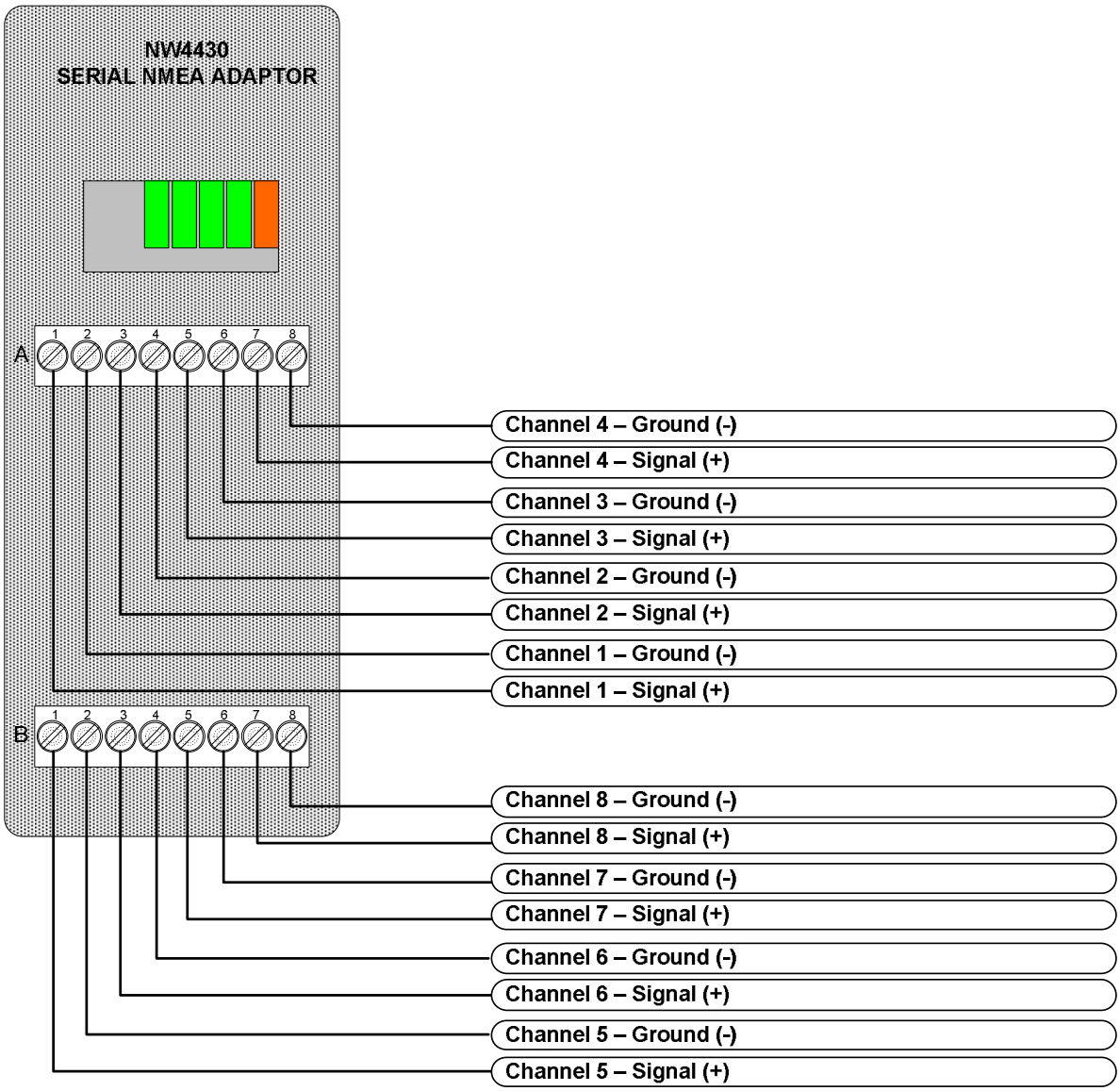


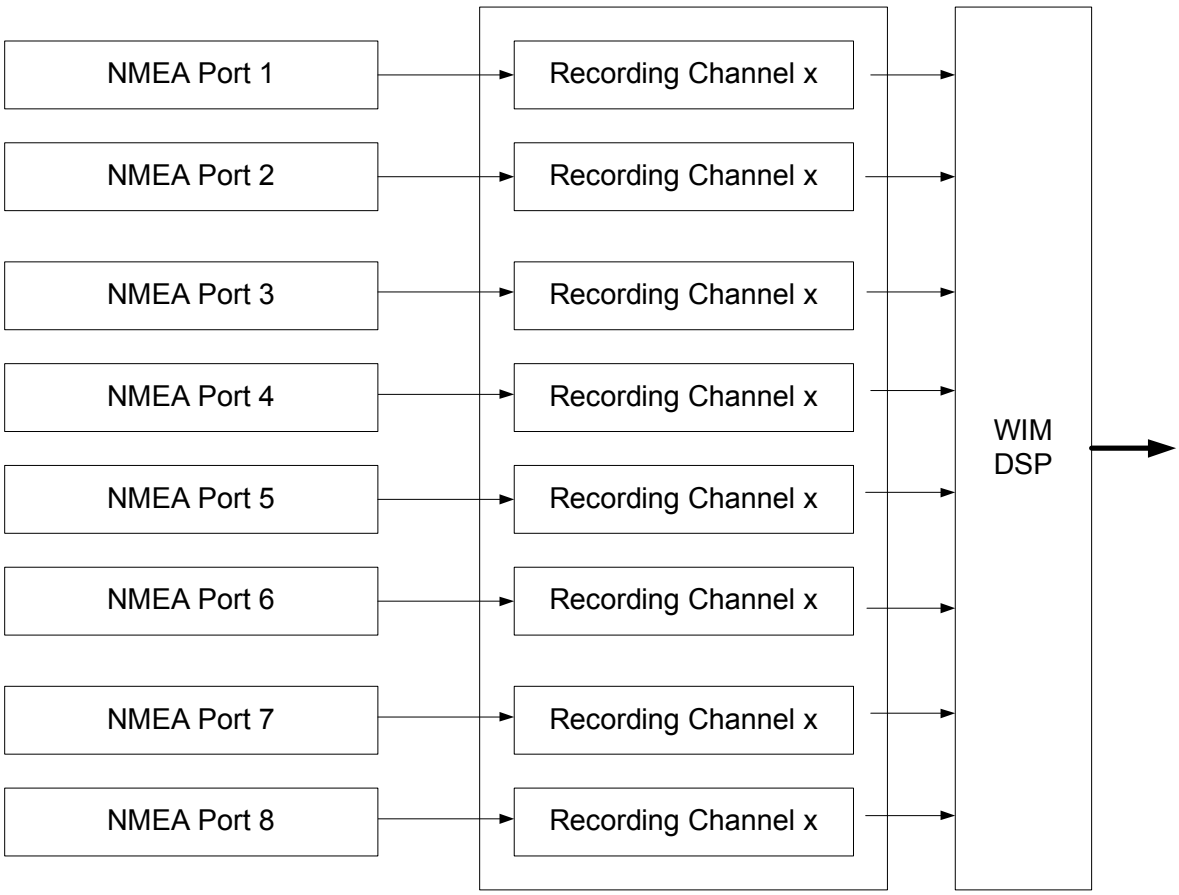
Figure 2.3.9 Microphones and 1 VHF configuration

2.3.10 NW-4430 - WaveNet 8-Channel Serial/NMEA adaptor

This NW4430 microprocessor powered adapter provides 8 serial NMEA input ports (separate recording channels) adhering to the IEC 61162-1 standard, which is typical for shipboard equipment providing compatible output signals like GPS, etc.
All inputs are galvanically separated from the VDR and from one another.
Maximum of 64 NMEA channels per (S)VDR system.

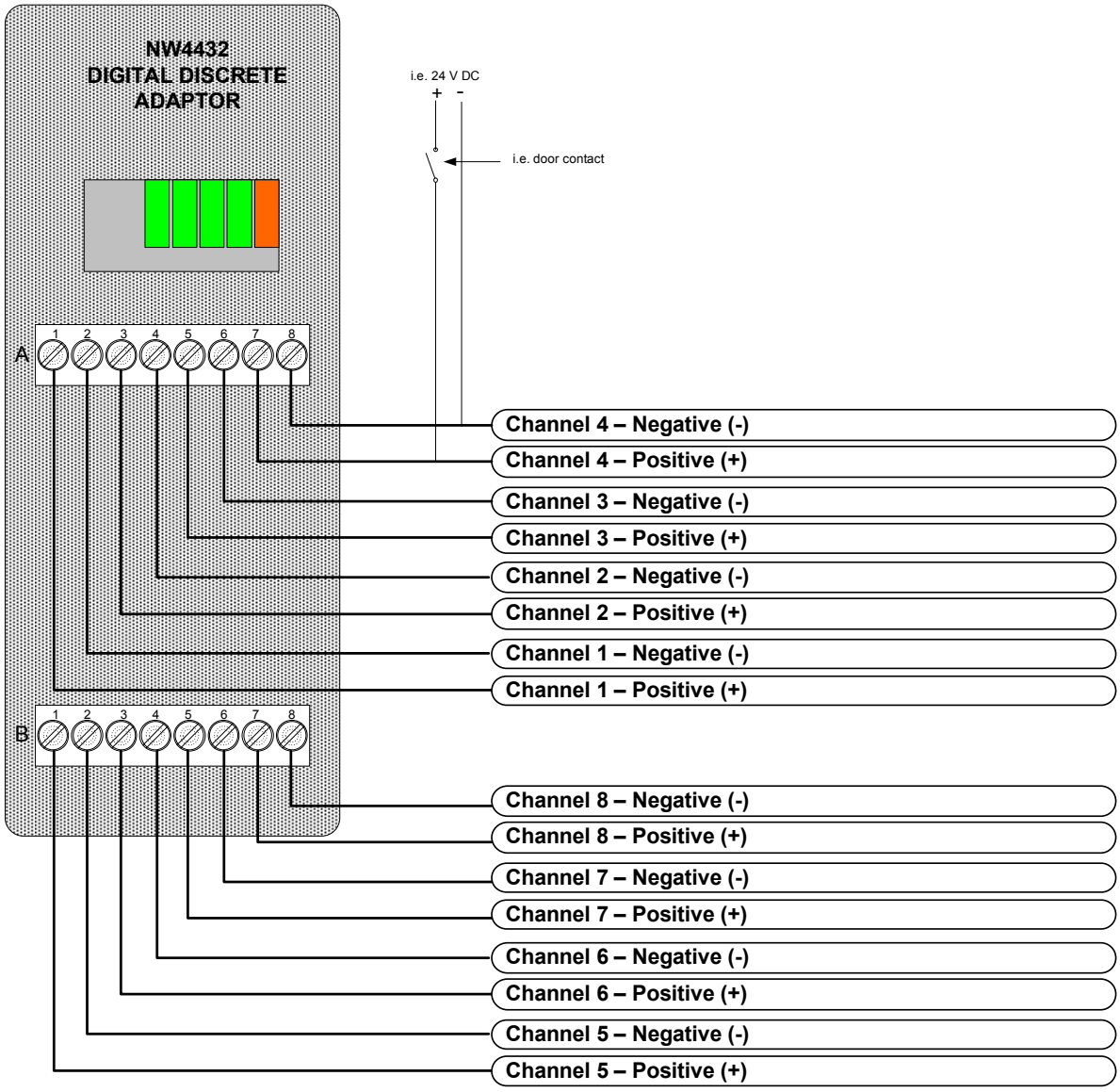
A single WIM can hold a **maximum of 4 NW4430 NMEA adaptors**, therefore 32 channels.

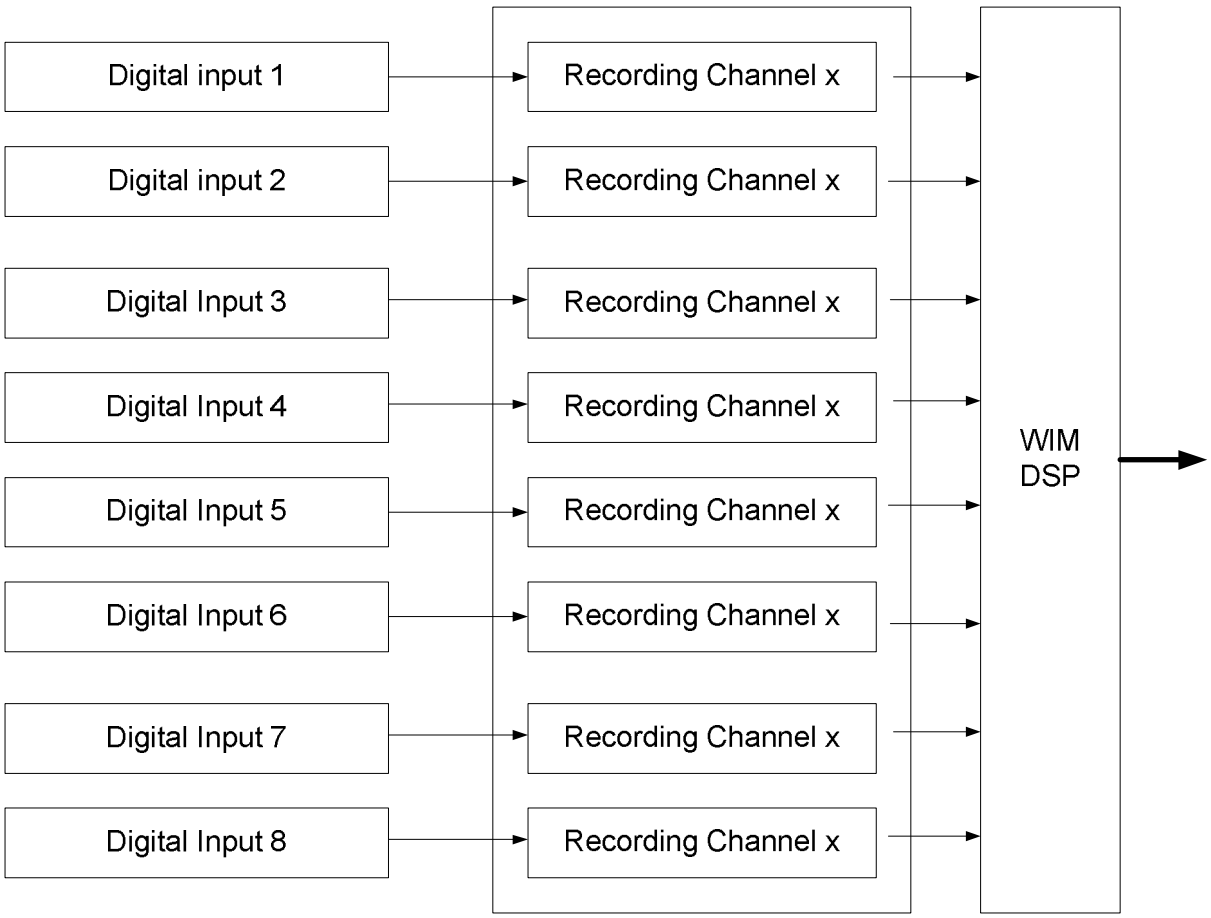



NMEA Port 1
NMEA Port 2
NMEA Port 3
NMEA Port 4
NMEA Port 5
NMEA Port 6
NMEA Port 7
NMEA Port 8
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
WIM
DSP

2.3.11 NW-4432 WaveNet 8-Channel Digital adaptor

This interface adaptor has eight digital inputs to which discrete (on/off) signals can be connected. All inputs are galvanically separated from the VDR and from one another. An input is active between 10 VDC and 36 VDC and is considered to be inactive below 5 VDC. Each 4432 adaptor provides 8 universal digital inputs, which should be powered from (10-36 VDC) 'wet contacts' or connected to unpowered sensors ('dry contacts') via an external voltage source. One WIM can hold a maximum of 4 NW4432 adaptors, therefore 32 discrete recording channels.




Digital input 1
Digital input 2
Digital Input 3
Digital Input 4
Digital Input 5
Digital Input 6
Digital Input 7
Digital Input 8
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
WIM
DSP

2.3.12 NW-4445 RADAR VIDEO VGA, SVGA, SXGA

These video adaptors/frame grabbers have one input and are capable of reading the radar image up to the indicated resolutions.

The VDR meets the requirements of IEC61996 with buffered outputs meeting the electrical requirements of VESA DMTS, where that standard refers to display monitors having resolutions of 640 x 480, 800 x 600, 1024 x 768, 1280 x 1024 or 1600 x 1200 pixels and having refresh rates between 60 and 85 Hz.

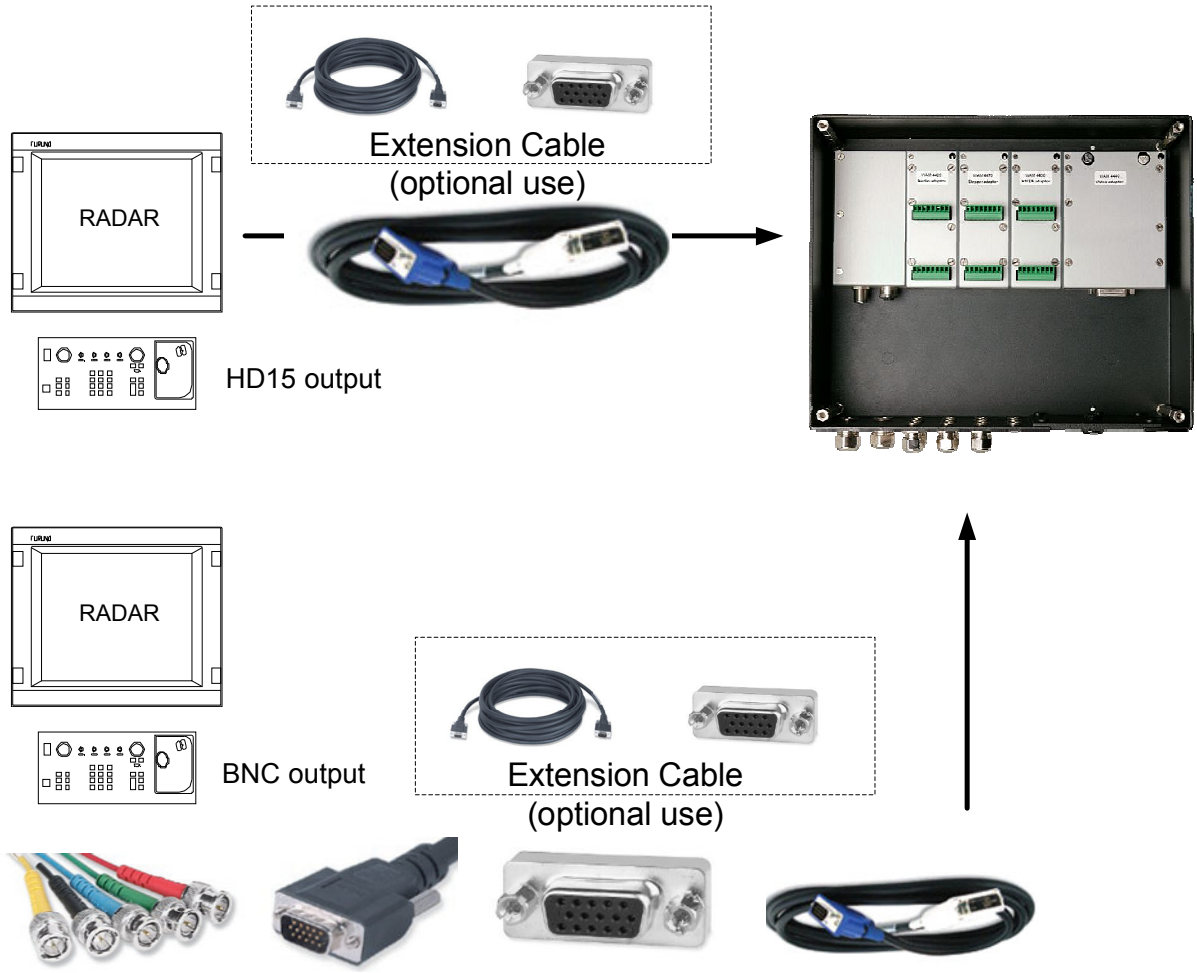
Red, green, blue, hsync and vsync inputs are provided for interconnection to the radar video.

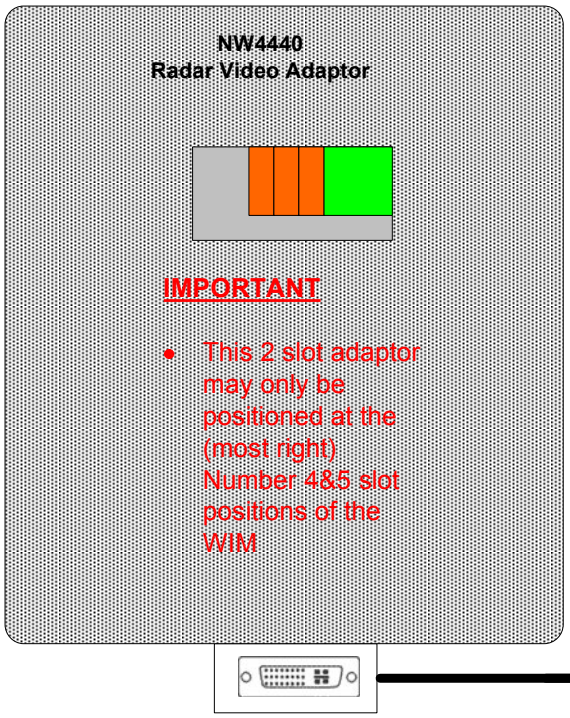
The input-connector on the adaptor is a DVI connector but it can accept both digital video signals as well as analogue video signals.

This module is a double sized adaptor (it takes the space of two other standard adaptors) and can only be placed at the utmost right-hand side of a WIM Interface Module.

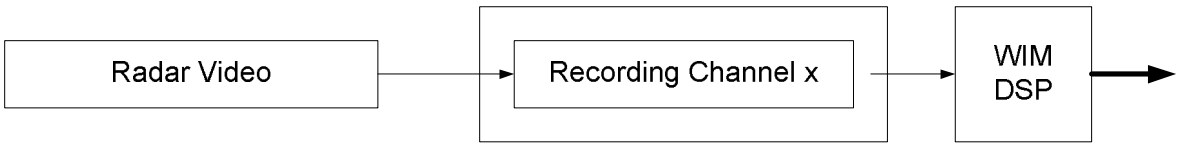
Per VDR there can be multiple video adaptors, but only one single video-source will be stored on the protected memory, other video channels may be, as a result of memory limitations within the protected capsule, stored on other storage media connected to the VDR, if any.

For interconnection to the radar, which is supposed to provide the signals required, standard cables are supplied, including a conversion cable for BNC connectors.


Extension Cable
(optional use)
RADAR
HD15 output
RADAR
BNC output
Extension Cable
(optional use)



1 TMDS Data2-
2 TMDS Data2+
3 TMDS Data2/4 Shield
4 TMDS Data4-
5 TMDS Data4+
6 DDC Clock [SCL]
7 DDC Data [SDA]
8 Analog vertical sync
9 TMDS Data1-
10 TMDS Data1+
11 TMDS Data1/3 Shield
12 TMDS Data3-
13 TMDS Data3+
14 +5 V Power
15 Ground(for +5 V)
16 Hot Plug Detect
17 TMDS Data0-
18 TMDSData0+
19 TMDS Data0/5 Shield
20 TMDS Data5-
21 TMDS Data5+
22 TMDS Clock Shield
23 TMDS Clock +
24 TMDS Clock-
C1 Analog Red
C2 Analog Green
C3 Analog Blue
C4 Analog Horizontal Sync
C5 Ana log GND Return: (analog R, G, B)

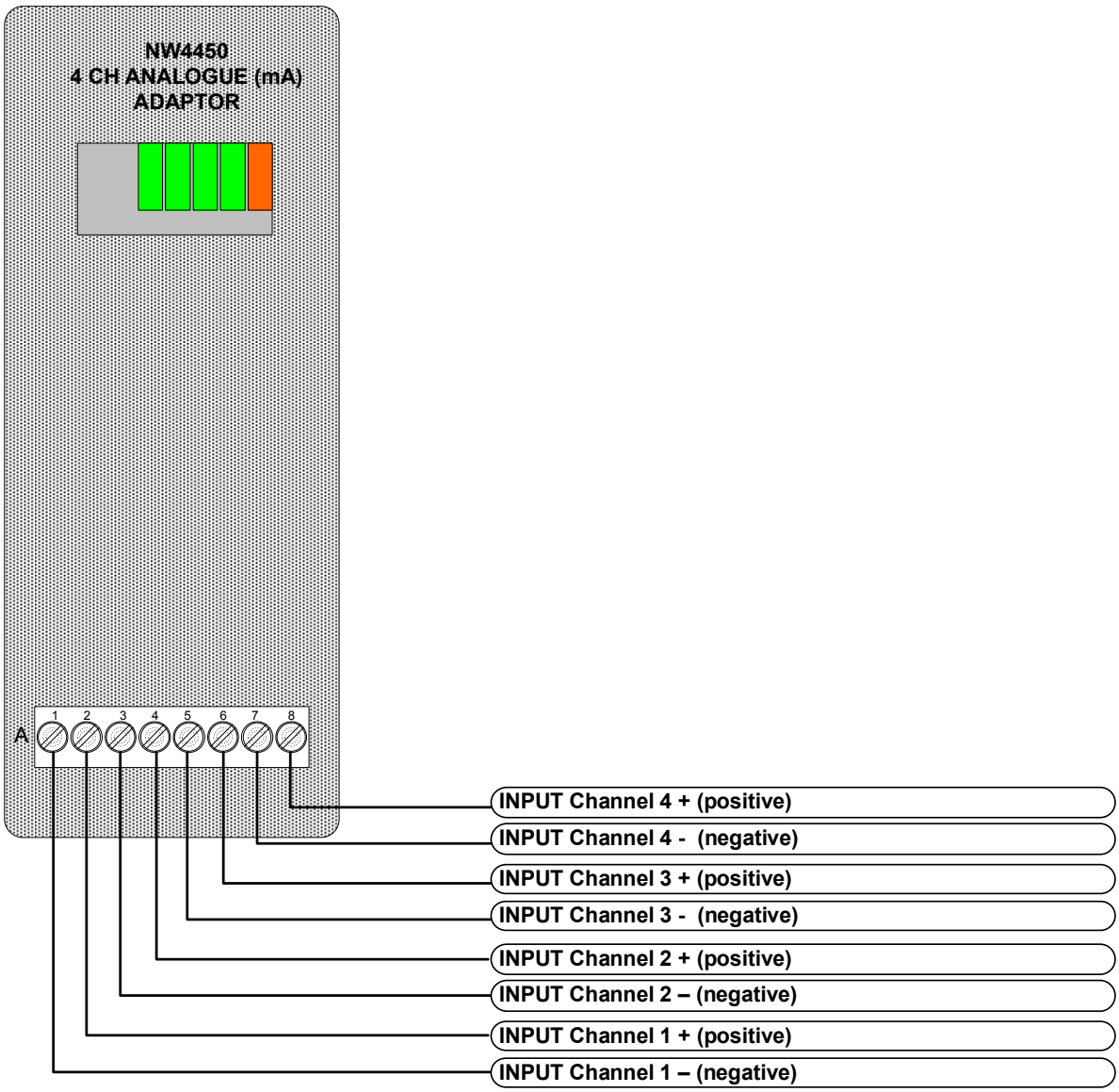


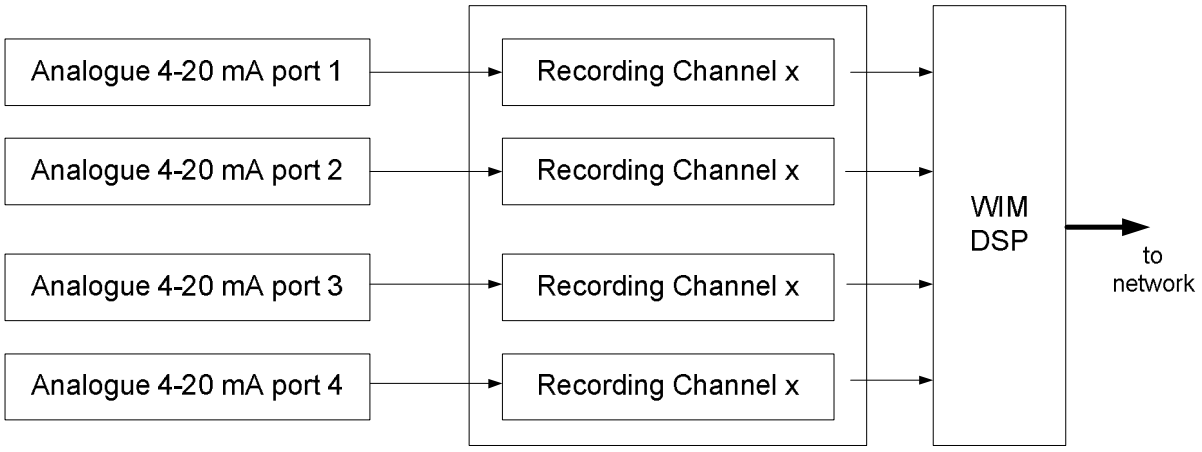
2.3.13 NW-4450 Wavenet 4-Channel analogue adaptor 4-20 ma

The Analogue adapter is a microprocessor based interface. 4 input channels per adaptor, each accept 4-20mA. Each input channel is able to detect the presence or absence of a current while maintaining complete opto-isolation from the source.

In addition, the WaveConnect™ Analogue adapter incorporates full DC-DC electrical isolation in its input power supply.

Per WIM you can have up to four analogue adaptors, they can be placed in the slots 1 to 4, therefore providing 16 channels per WIM.



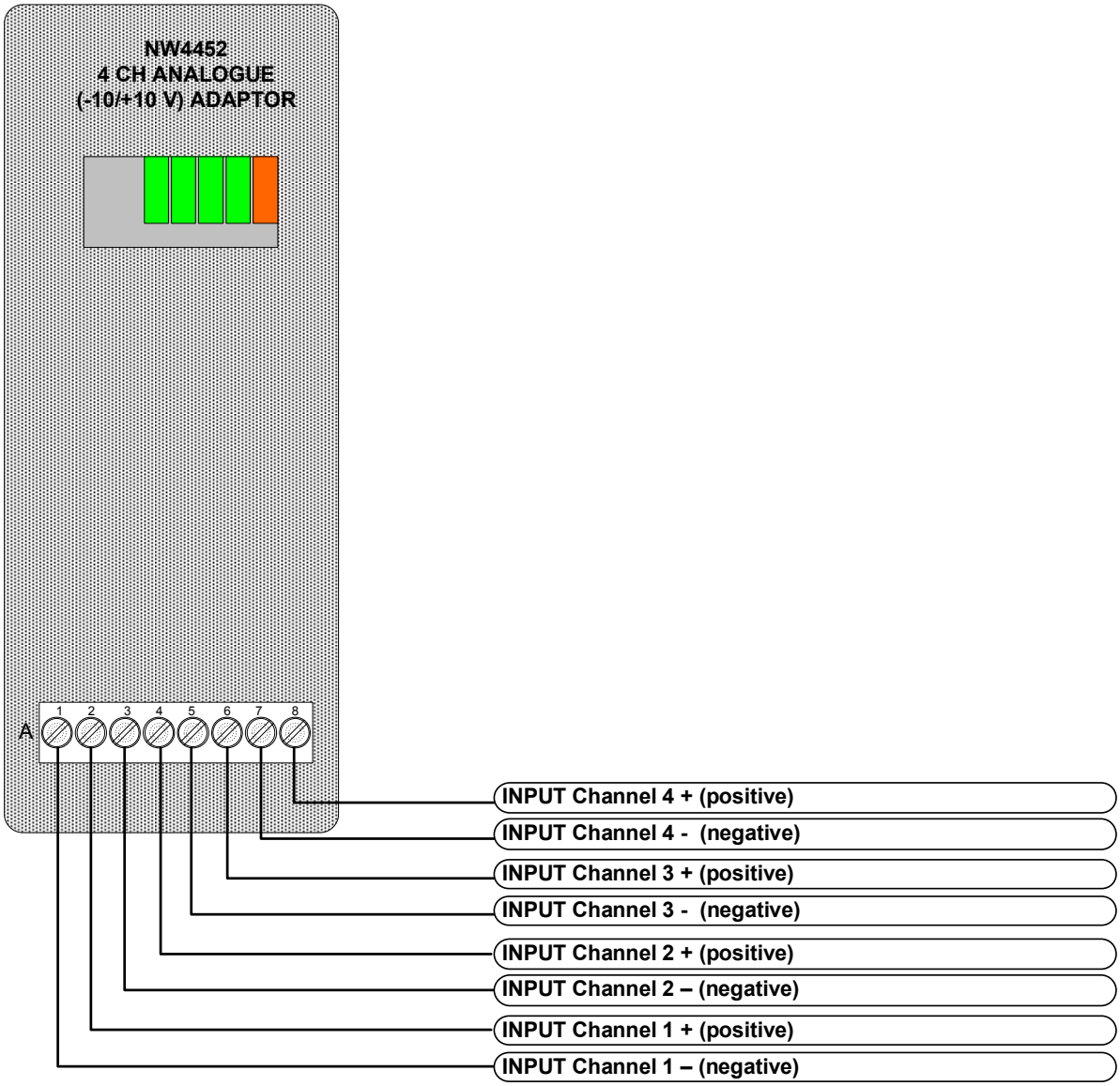

Analogue 4-20 mA port 1
Analogue 4-20 mA port 2
Analogue 4-20 mA port 3
Analogue 4-20 mA port 4
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
WIM
DSP
to
network

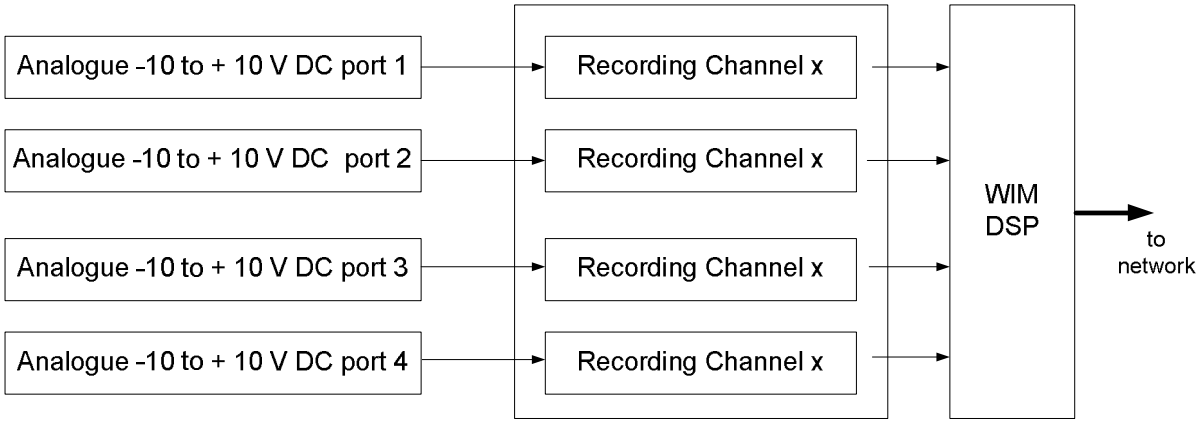
2.3.14 NW-4452 Wavenet 4-Channel analogue adaptor -10v/+10v

The Analogue adapter is a microprocessor based interface, 4 input channels per adaptor, each accepting -10 V to +10V.

Each input channel is able to detect a voltage level within the specified range while maintaining complete opto-isolation from the source.

In addition, the WaveConnect™ Analogue adapter incorporates full DC-DC electrical isolation in its input power supply.



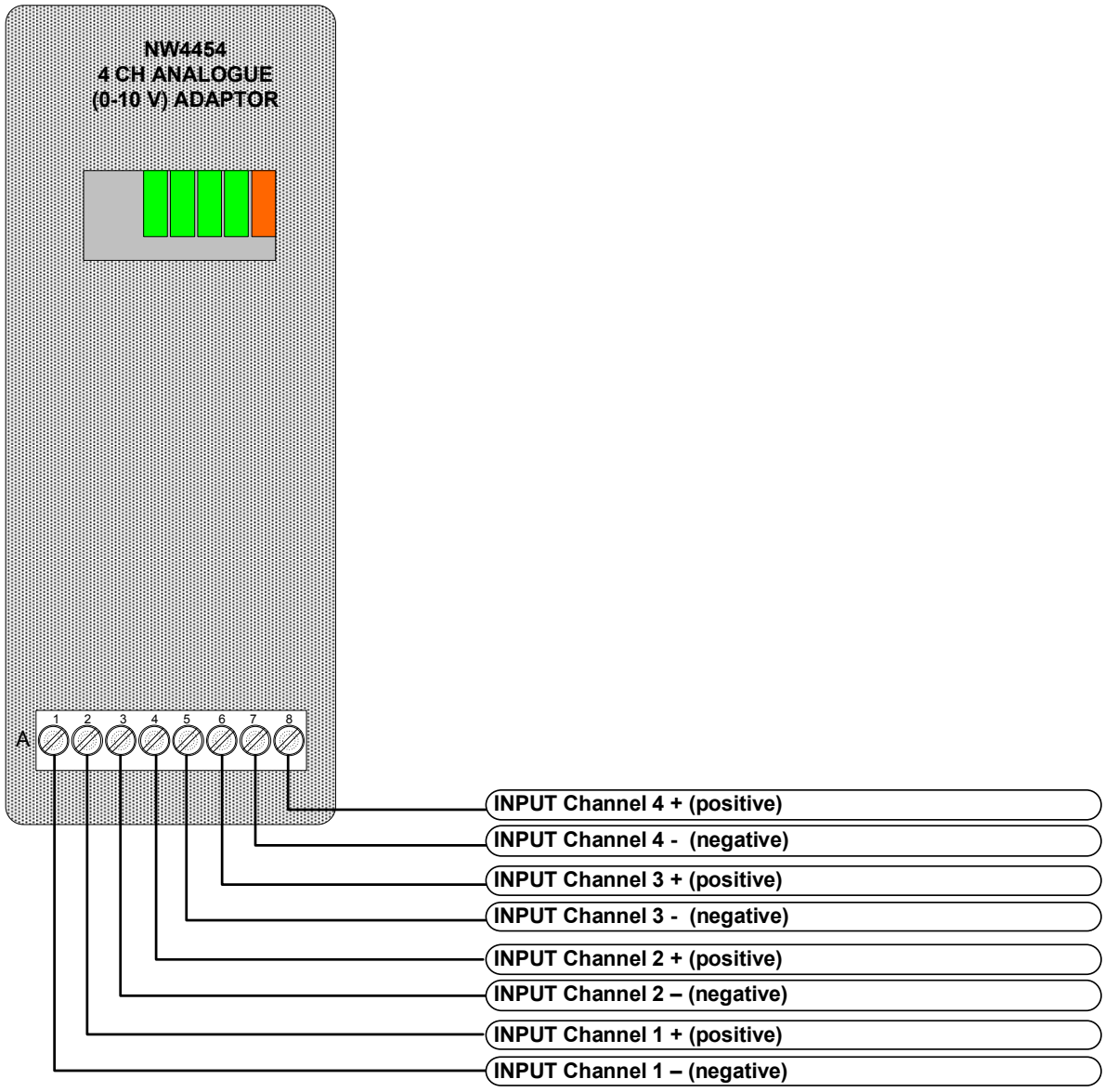

Analogue -10 to + 10 V DC port 1
Analogue -10 to + 10 V DC port 2
Analogue -10 to + 10 V DC port 3
Analogue -10 to + 10 V DC port 4
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
WIM
DSP
to
network

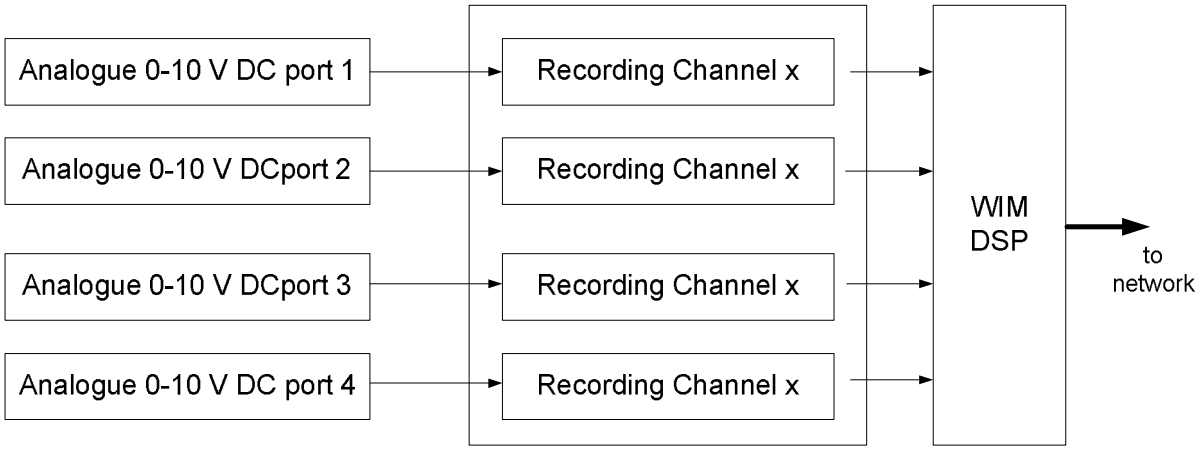
2.3.14 NW-4454 Wavenet 4-Channel analogue adaptor 0-10v

The Analogue adapter is a microprocessor based interface, 4 input channels per adaptor, each accepting 0 V to +10V.

Each input channel is able to detect a voltage level within the specified range while maintaining complete opto-isolation from the source.

In addition, the WaveConnect™ Analogue adapter incorporates full DC-DC electrical isolation in its input power supply.

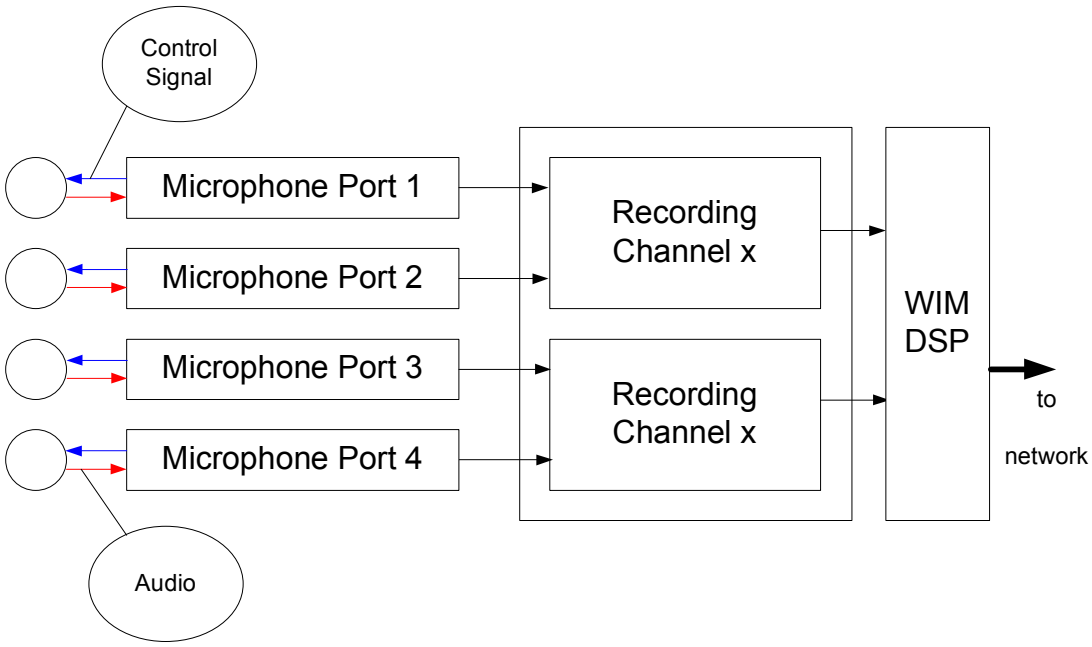



Analogue 0-10 V DC port 1
Analogue 0-10 V DCport 2
Analogue 0-10 V DCport 3
Analogue 0-10 V DC port 4
Recording Channel x
Recording Channel x
Recording Channel x
Recording Channel x
WIM
DSP
to
network

2.3.15 Microphone tests

The microphones, forming the main bridge audio data source, are a formal part of the VDR.

Interconnection to the WIM is via the Wavenet Audio Adaptor Module WAM-4420.



The NetWave Systems internal and external microphones are identical; the difference is that the microphone to be used externally is made weatherproof by adding specific parts (o-rings and internal cover) according to the assembly instructions provided.

A test facility is provided (making use of the Control Signal) to ensure the correct operation of the microphones.

2.7.12.2 Microphone tests

An internal element, located within each microphone, allows reliable, automatic, testing of the entire microphone operation. The volume of this function is designed to be unobtrusive in operation. The piëzo-element is located within the microphone such that the microphone receives signals within a particular dynamic range.

The specific frequency and duration of the generated audio is detected and analysed by the Digital Signal Processor within the WIM.

If the test fails an alarm / warning is generated on the Bridge Control Unit.

Since the microphones are powered from the (battery back-up) power source in the PSU, recording of audio continues even in the event of (main) power failure.

The input frequency response and dynamic range for each microphone input (including the interface unit) meet the following:

6 dB to -45 dB (with respect to reference level).
Better than 3 dB from 150 to 6000 Hz.

The quality of recording for single and multiple microphone inputs is as follows:

For single microphones the quality of the recording for each microphone is the electrical equivalent of 75 dBA. This index is not less than that corresponding to the quality value for the speech transmission index of 0.85 with no signal being simultaneously applied to other microphone ports.

For multiple microphones the quality of the recording for each of the microphone ports is the electrical equivalent of 75 dBA. This is not less than that corresponding to the quality value for the speech transmission index of 0.60 with all the other microphone ports having inputs at the electrically equivalent level of 65 dBA.

With no signal applied to any microphone port, the reproduced signal at any replay output is at least 48 dB below the output level, which would be produced by an input level equal to the reference signal level. This requirement is met across the frequency band with the inputs both open and short circuited. The signal - to no signal - performance is met in the presence of out-of-band input signals and also at the reference signal level.

With all other audio input ports, except the one in use, short-circuited, the reproduced signal to noise and distortion ratio is at least 24 dB across the frequency band and with input levels in the range of 0 dB to -20 dB relative to the reference signal level for all inputs.

3.0 System functions and features

3.1 Data Compression

Data compression is used to reduce the data storage requirements for the bridge and communications audio and radar video.

3.2 Data Time Stamping

To ensure that relative timings can be determined within a resolution of 0.1 seconds, all data items are recorded with a time index derived from a VDR system clock with a resolution of better than 0.05 seconds. The drift of the system clock does not exceed 1 second in one hour. The system clock is synchronized from an external source, e.g. GPS.

3.3 Design and Construction

The design and construction is in accordance with the requirements of resolution A 694(17) and international Maritime Orgnisation standards. All units are designed to operate under conditions required by the appropriate classification of IEC 60945. In addition there are special environmental survivability requirements for the Hardened Storage Server (HSS).

3.4 Resistance to Tampering

The equipment is designed so that, as far as is practical, it is not possible to tamper with the selection of data being input to the equipment, the data itself, or recorded data. Any attempt to interfere with the integrity of the data or the recording is recorded.

3.5 Operation

The unit is entirely automatic in normal operation. Means are provided to ensure that the recorded data is saved by an appropriate method following an incident, with minimal interruption to the recording process and without requiring opening of the protective capsule.

3.6 Data Storage and Format

To permit subsequent analysis of factors surrounding an incident, the method of recording ensures that the various data items can be co-related in date and time during playback on suitable equipment.

The recording method is such that the timing of all recorded data items can be derived on playback with a resolution normally sufficient to reconstruct the history of an incident.

3.7 Data Block

The following system configuration information is included in the data-block residing within the memory of the protected capsule (in the HSS):

- Type approval authority and reference.
- IMO vessel identification number.
- Software version(s) used.
- Microphone locations and recording port allocation.
- VHF communications - which VHF(s) recorded.
- Date and time - from which source obtained.
- Ship's position - from which electronic position-fixing system (EPFS) obtained and relative position on the vessel.
- Other data inputs - identification of which equipment is supplying recorded data
- Automatic insertion of date and time of last amendment.
- Integrity of Recorded Data

3.8 Recording method

The recording method is such that each item of the recorded data is checked for integrity, i.e. it is identical to the data being received, and an alarm given if a non-correctable error is detected.

3.9 System Integrity

The PSU and HSS, in conjunction, automatically continuously monitor the integrity of the following

- Power supply
- Record function
- Bit error rate
- Microphone functionality

Malfunction of any of the above generates an audible and visual alarm on the Bridge Control Unit, located at the position from which the vessel is normally navigated. It is possible to mute the alarm but a visual indication remains until the alarm is resolved.

3.10 Data Saving

The recording process to the final recording medium is not interrupted during the saving process. The data recorded in the final recording medium in the HSS capsule cannot be erased by the system other than via a properly protected password algorithm.

The saved data is automatically checked to ensure that it is identical to the recorded data on the final recording medium. Any failure is indicated.

3.11 Power Supplies - Normal Operation

The VDR operates from 110 to 230 V AC to 50/60 Hz (120W) or 24 VDC (6 Amp) with auto-switching.

To ensure that the VDR continues to record events during an incident, it is capable of operating from the ship's emergency source of electrical power. Whenever such electrical power is available the VDR will operate.

3.12 Reserve Power Source

An (internal battery) uninterruptible power supply is provided. If the ship's emergency source of electrical power supply to the VDR fails, the VDR continues to record all available data from this dedicated reserve source of power for a period of 2 hours.

3.13 Recording Period and Duration

The time for which all stored data items are retained within the HSS is at least 12 hours. Data items which are older than this may be overwritten with new data.

Recording is continuous (taking into account the IEC61996 Performance Standard specifics) or terminated due to exhaustion of the reserve power source.

Other than by using passwords there is no means to terminate the recording by the system without using tools.

4.0 Data Items to be Recorded for S-VDR

4.1 Date and Time

Date and time referenced to Universal Time Constant (UTC), are obtained from a source external to the ship (e.g. an electronic position-fixing system (EPFS) or radio time signal), if available, or from an internal clock at least once per hour. The recording indicates which source is in use. The recording method is such that the timing of all other recorded data items can be derived on playback with a resolution (sufficient to reconstruct the history of the incident in detail, not worse than 1 second.

4.2 Ship's Position

Latitude and longitude, and the datum used, are derived from a designated electronic position-fixing system (EPFS) or integrated navigation system (INS), if available. The recording ensures that the identity and status of the source can always be etermined on playback. The ship's position is recorded, up to a resolution of 0.0001 min of arc, as available on the ship.

4.3 Speed

Speed through the water, or speed over the ground (transverse as well as longitudinal in either case, as available on the ship), including an indication from which it is derived, from the ship's designated speed and distance measuring equipment, is recorded up to a resolution of 0.1 knot.

4.4 Heading

As indicated by the gyro system in use. The ship's heading is recorded with up to a resolution of 0.1 deg as available on the ship.

4.5 Bridge Audio

Provision for up to 4 audio channels, each channel having a maximum of 2 Microphones or VHF, located on the bridge, such that conversation at or near the conning positions, radar displays, chart table etc., may be adequately recorded. As far as is practicable, the positioning of microphones also captures the input and output of intercom, public address systems and the audible alarms of any bridge mounted equipment.

The audio signals at all workstations are recorded continuously.

4.6 Communications Audio

VHF communications relating to ship operations are recorded independently of the microphone audio. The recording includes both transmitted and received audio signals and is continuous from a directly connected fixed VHF set to be designated at installation.

The reference signal for both transmitted and received communications audio is defined as 0.775 V RMS.

4.7 Radar Data, Post-Display Selection

This includes electronic signal information from within one of the ship's radar installations (X or S band) which records all the information which was actually being presented on the master display of that radar at the time of recording. This includes any range rings or markers, bearing markers, electronic plotting symbols, radar maps, whatever parts of the System Electronic Navigation Chart (SENC) or other electronic chart or map that were selected, the voyage plan, navigational data, navigational alarms and the radar status data that were visible on the display. The recording method is such that, on playback, it is possible to present a faithful replica of the entire radar display that was on view at the time of recording, albeit within the limitations of any bandwidth compression techniques that are essential to the working of the VDR.

4.8 Echo Sounder

This includes depth under keel, up to a resolution of 0.1 m as available on the ship, The depth scale currently being displayed and other status information are recorded if available.

5.0 Data Items to be Recorded for VDR (additional)

5.1 Main Alarms

This includes the status of all IMO mandatory alarms on the bridge. Where suitable serial message sentences are unavailable, WAM's (Wavenet Adaptor Modules) with the appropriate interfaces are fitted. For S-VDR installations it is only mandatory to recoird those alarms readily available in NMEA format according to IEC61662-1 standard.

5.2 Rudder Order and Response

Both rudder order and response angles are recorded up to a resolution of 1 degree as permitted on the ship. Status and settings of heading controller, if fitted, are also recorded. Where suitable serial message sentences are unavailable WAM's (Wavenet Adaptor Modules) with the appropriate interfaces are fitted.

5.3 Engine Order and Response

This includes the positions of any engine telegraphs or direct engine/propeller controls, including shaft(s) RPM (or equivalent), and feedback indications, if fitted, including ahead/astern indicators. This also includes status of bow and stern thrusters if fitted. RPM is recorded up to a resolution of 1 RPM and pitch is recorded up to a resolution of 1 degree. Where suitable serial message sentences are unavailable WAM's (Wavenet Adaptor Modules) with the appropriate interfaces are fitted.

5.4 Hull Openings (Doors) Status

This includes all IMO mandatory status information required to be displayed on the bridge. Where suitable serial message sentences are unavailable WAM's (Wavenet Adaptor Modules) with the appropriate interfaces are fitted.

5.5 Watertight and Fire Door Status

This includes all IMO mandatory status information required to be displayed on the bridge. Where suitable serial message sentences are unavailable WAM's (Wavenet Adaptor Modules) with the appropriate interfaces are fitted.

5.6 Accelerations and Hull Stresses

Where a ship is fitted with IMO mandated hull stress and response monitoring equipment, all the data items that have been pre-selected within that equipment and are available are recorded. Where suitable serial message sentences are unavailable WAM's (Wavenet Adaptor Modules) with the appropriate interfaces are fitted.

5.7 Wind Speed and Direction

This is applicable where a ship is fitted with a suitable sensor. Either relative or true wind speed and direction may be recorded, but an indication of which it is shall be recorded.

Where suitable serial message sentences are unavailable, WaveNet adaptors with the appropriate interfaces will be fitted.

6.0 IEC 61162 Sentence Formats

Parameter to be recorded	Sentence format Notes
Date and time	ZDA
Ship's position and Datum used	GNS, DTM, GGA, GLL
Speed (water and/or ground)	VBW, VHW, VTG
Heading (true)	HDT, VHW
Heading (magnetic)	HDG
Depth (echo sounder)	DPT
Alarms	ALR
Rudder order/response manual	RSA Note 1
Rudder order/response auto	HTC and HTD
Engine order/response	RPM and XDR Notes 1 and 2
Hull openings, watertight doors	XDR Note 2
Accelerations and Hull stress	XDR, ALR Note 2
Wind speed and direction	MWV

VDR alarm output $VRALR

1 The current specifications for RSA and RPM do not have fields for 'order', only 'response'
2. The table of transducer types in the current specification for XDR does not specifically include these uses.
3. There is no requirement for the VDR to send alarm messages. If, as an option, such messages are sent, then the appropriate sentence format is VRALR.

7.0 System Installation

7.1 General

This chapter provides installation and configuration information for the Voyage Data Recorder.

NetWave Systems, or appointed agents, contracts only to supply the equipment, supervise the installation and final connection of the equipment. The installation must be made by a qualified engineer.

Forward planning for *positioning* the various units of the VDR must be made before any installation work is carried out. In the case of installing a VDR it is recommended that a pre-installation survey is carried out in order to establish the vessel's fitment.

This may be arranged with thru the Technical Department of NetWave Systems or one of the approved distributors or agents. Details of agencies worldwide can be found on www.netwavesystems.com

The exact configuration depends on the specific fit on the vessel.

The procedures in this manual provide information on installing individual units, and configuring the entire system.

There will be one PSU, BCU and HSS in any ship fit, however, the number of WIM's (WaveNet Interface Modules) and WAM's (WaveNet adaptor Modules) and optional equipment, e.g. additional microphones or an remote Alarm Module, depends on the ship requirements.

Although software configuration data is stored within the system memory at the configuration stage, it is recommended that a copy log of the installation is made, which function is available thru the web-interface.

Once the physical installation is finished, the VDR automatically configures the available interface modules, adaptors and channels to (or may to) be recorded, to be subsequently be completed and dis- or enabled by the installer.

The individual unit location is predetermined by the IMO requirements according to IEC61996 paragraph 5.5.1., and – where applicable - is mentioned in this manual where the location of the installation of these units is relevant in this respect.

8.0 Installation guidelines

8.1 HSS - Hardened Storage Server (Capsule)

The protective capsule should be sited in the vicinity of the bridge on the external deck area of the vessel so as to maximise the probability of its survival and recovery following an incident. **The capsule should be placed clear of rigging and other potential obstructions and as near to the centre line of the ship as practically possible**. In order to ensure that the beacon operates correctly, ensure the HSS is mounted away from sound absorbing materials such as honeycomb structure, tarpaulin fabrics, clothing, cargo, etc.

The HSS must be mounted in a compartment that is expected to flood as direct contact between the beacon case and water is necessary for actuation and acoustic radiation. Where possible, the selection of a mounting location should provide for convenient access during inspection intervals. The mounting location should also provide clearance for removing the beacon from its mounting cradle.

Criteria to be considered when assessing the optimum position shall include but not be limited to the following:

1) separation from fuel or other potential fire sources,
2) separation from probable sources of mechanical damage,
3) operational environment for continued serviceability,
4) accessibility for copying of recorded data and for routine maintenance,
5) facilitation of underwater removal and retrieval by both divers and ROVs.

There shall be a clear unobstructed space in the vicinity of the capsule to allow an ROV or diver to work. Typically, the HSS capsule is sited on the compass deck.

Cabling: WaveNet Ethernet cable from PSU to HSS, 24 AWG 2 twisted pairs, CAT5 enhanced cable acc. to EIA/TIA 568. Outside diameter: 7,6 mm (supplied)

8.2.2. Methods for fixing the HSS capsule to the deck

Two methods may be used to fix the capsule to the deckmount, and the deckmount to the deck.

- Welding the supplied mild/steel (or aluminium when specifically ordered with the –A option of the installation package) deckplate to the deck and subsequently fastening the HSS deckmount thereto by means of the 5 x M12 bolts supplied. The rubber insulating plate should always be used to avoid corrosion issues.
- Drilling 5 holes into or thru the deck, optionally tapping M12 holes, and fixing the HSS capsule by means of the bolts provided. The rubber insulating plate should always be used to avoid corrosion issues.

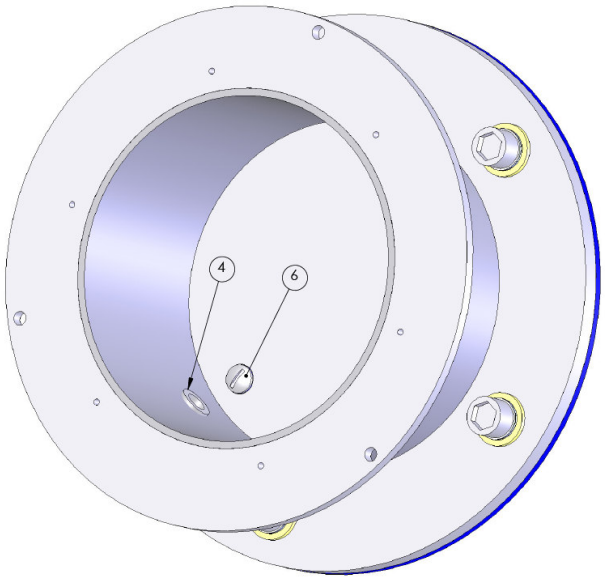


Figure 8.2.2 Alternative cable entries may be used (4 / 6)

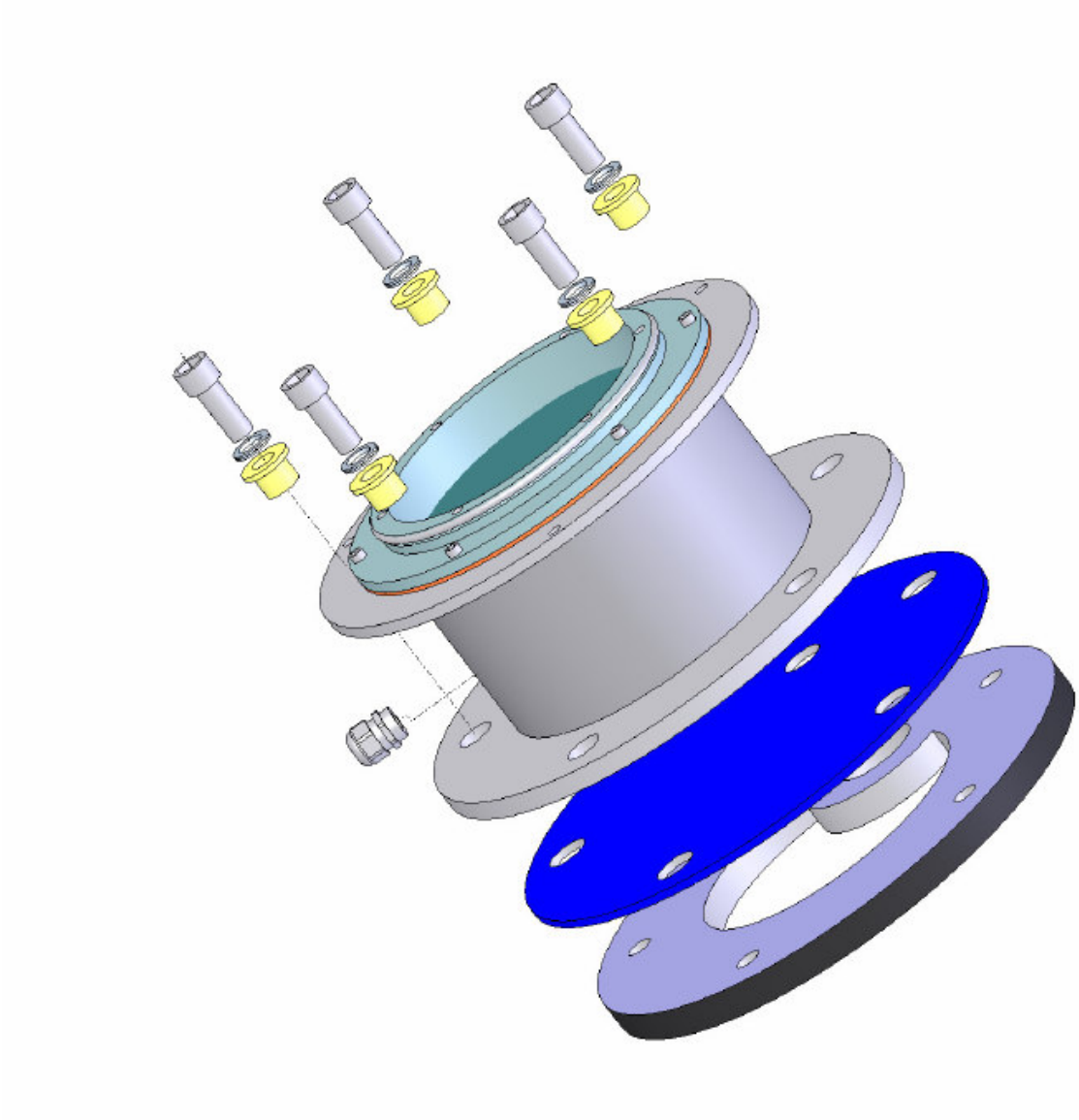


Figure 8.2.3 Fastening the deckmount assembly to the deck

8.2 PSU - Power Supply and (data) Switch Unit

Fitted on or near the bridge, this unit is designed for bulkhead mounting in a **protected** environment. The actual siting of the equipment is generally shown on the approved compartment layout for the particular ship. Cable entry facilities have been provided to accommodate the ship's cabling that is connected to this unit. Ensure adequate space is provided for **ventilation**, cable access and maintenance access.

Step 1.

Determine the location of the PSU, allowing space for wiring to enter the cabinet and batteries to be replaced, as well as connectors and switches to be accessible.

Step 2

Mount the bracket of the PSU with your choice of bolts we supplied. Make sure the bracket is mounted with the slotted holes in the correct vertical direction. Make sure it's horizontal. Keep 50 mm of free space above the bracket to allow the unit to slide in from above, as well as to provide sufficient ventilation for this power supply.

Step 3

Mount the PSU on the mounting bracket by making use of the hinges and screw/tighten the 2 bolts at the back to secure the unit.

Step 4

Open the PSU by unscrewing 2 bolts for the right-side access panel

Step 5

Connect Mains power (110-230 VAC, 120 W) to the plug provided by feeding the cable thru the cable gland and attach to the connector/plug provided.

AND/OR

Connect DC power (24 V - 6 Amp) to the plug provided by feeding the cable thru the cable gland and attach to the connector provided.

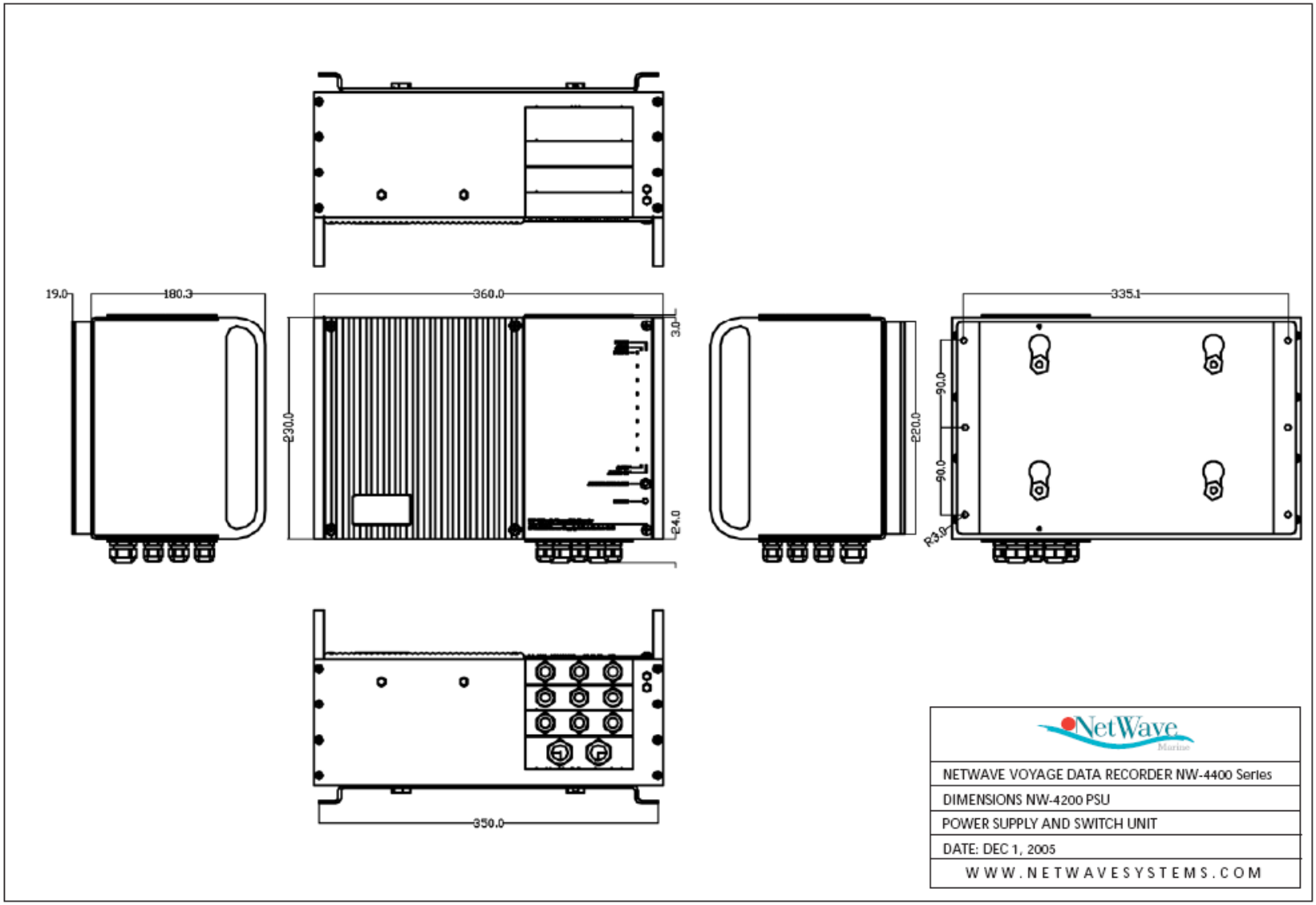
Cable types: (supplied, refer to Pre-installation Package)

Mains power cables: type: 3-core mains, 3x1,5 mm2, braided, flame retardant, halogen free.

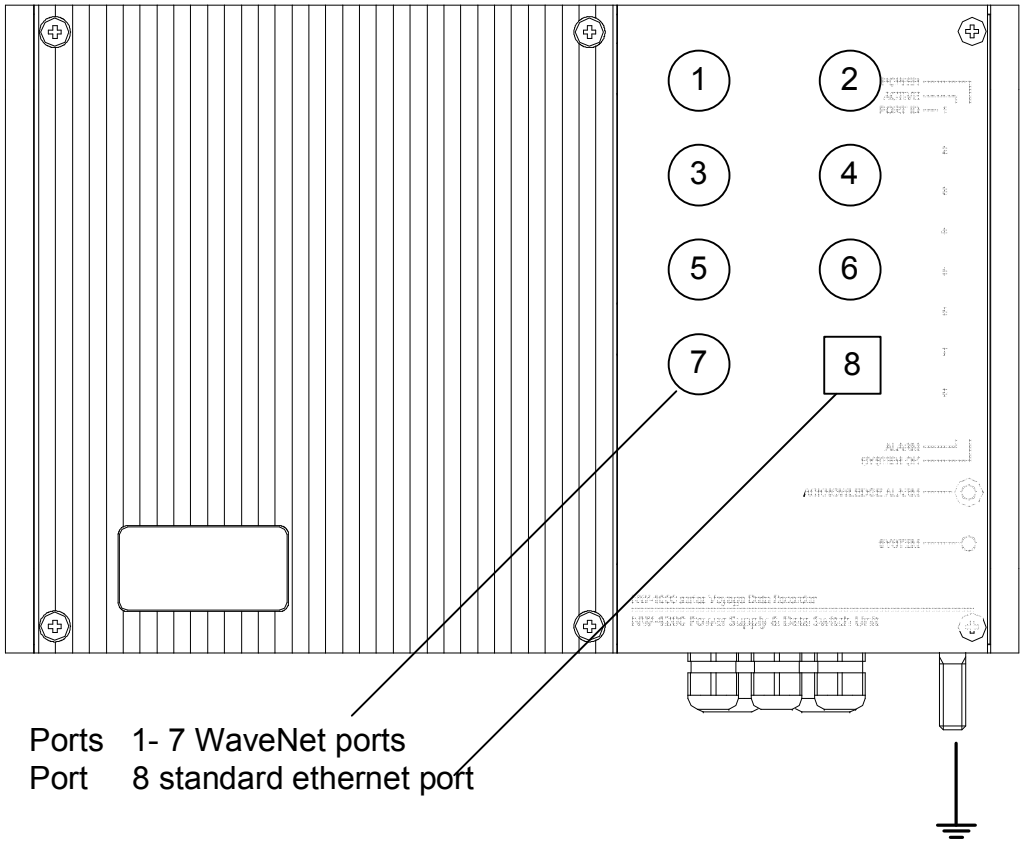
DC 24 V power cables: type: 2-core mains, 2x2,5 mm2, braided, flame retardant, halogen free.

Step 7

Connect the Ground stud to a suitable safety ground.


19.0
180.3
360.0
3.0
230.0
24.0
335.1
90.0
90.0
220.0
R3.0
350.0
NetWave
Marine
NETWAVE VOYAGE DATA RECORDER NW-4400 Series
DIMENSIONS NW-4200 PSU
POWER SUPPLY AND SWITCH UNIT
DATE: DEC 1, 2005
WWW.NETWAVESYSTEMS.COM

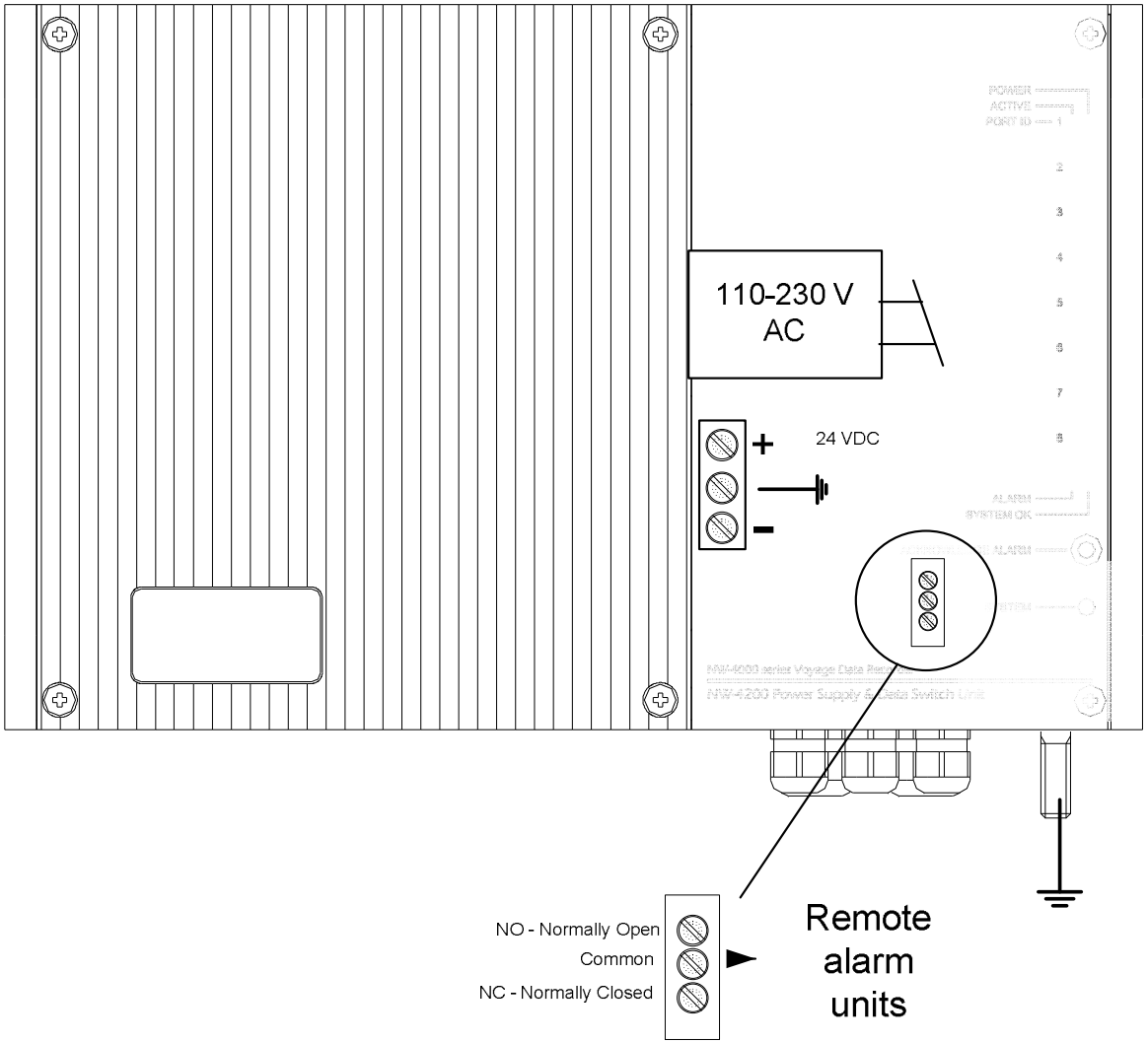
PSU – Network connections



Ports 1- 7 WaveNet ports
Port 8 standard ethernet port

connect to Ground

PSU – Power and Alarm contacts



8.3 BCU - Bridge Control and Alarm Unit

The Bridge Control and Alarm Unit (BCU) provides the primary user interface for monitoring and control of the VDR functions. Fitted on or near the bridge, the BCU is designed for console mounting in a **protected** environment. The unit may be surface mounted, or flush mounted within a panel or console. The unit should be positioned at a location from where the audible alarm will be heard by the crew on watch.

Sufficient clearance is required for maintenance access, ventilation and cable access.

Proceed as follows:

For flush-mounting, use the BCU bracket to position and draw the holes to be provided**.**

Make sure there is at least 120 mm of free space below the panel to allow connector / cable access.

In the panel. cut out the area required for fixing the BCU by making a rectangular hole of dimensions 114 x 179 mm where the BCU will enter into the panel, and drill 8 round holes to fix the bracket to the panel. Cut out or drill an additional 4 slots to allow the bracket-springs to sink into or thru the panel.

Install the cabling to the unit as required for the system and fix the BCU to the bracket within the panel by applying sufficient force onto the frontpanel of the unit for the springs to lock. Take care not to apply excessive force at the lcd-display.

Removal of the BCU unit may be done by inserting (at the bottom side of the BCU) a flat screwdriver between the bracket and the BCU-front panel, gently squeezing the unit out while the springs are unlocking.

Cable type:

WaveNet cable to any port of the PSU or WIM

Type: 24 AWG 4 twisted pair, CAT5 enhanced cable to EIA/TIA 568
Outside diameter: 7,5 mm (supplied)

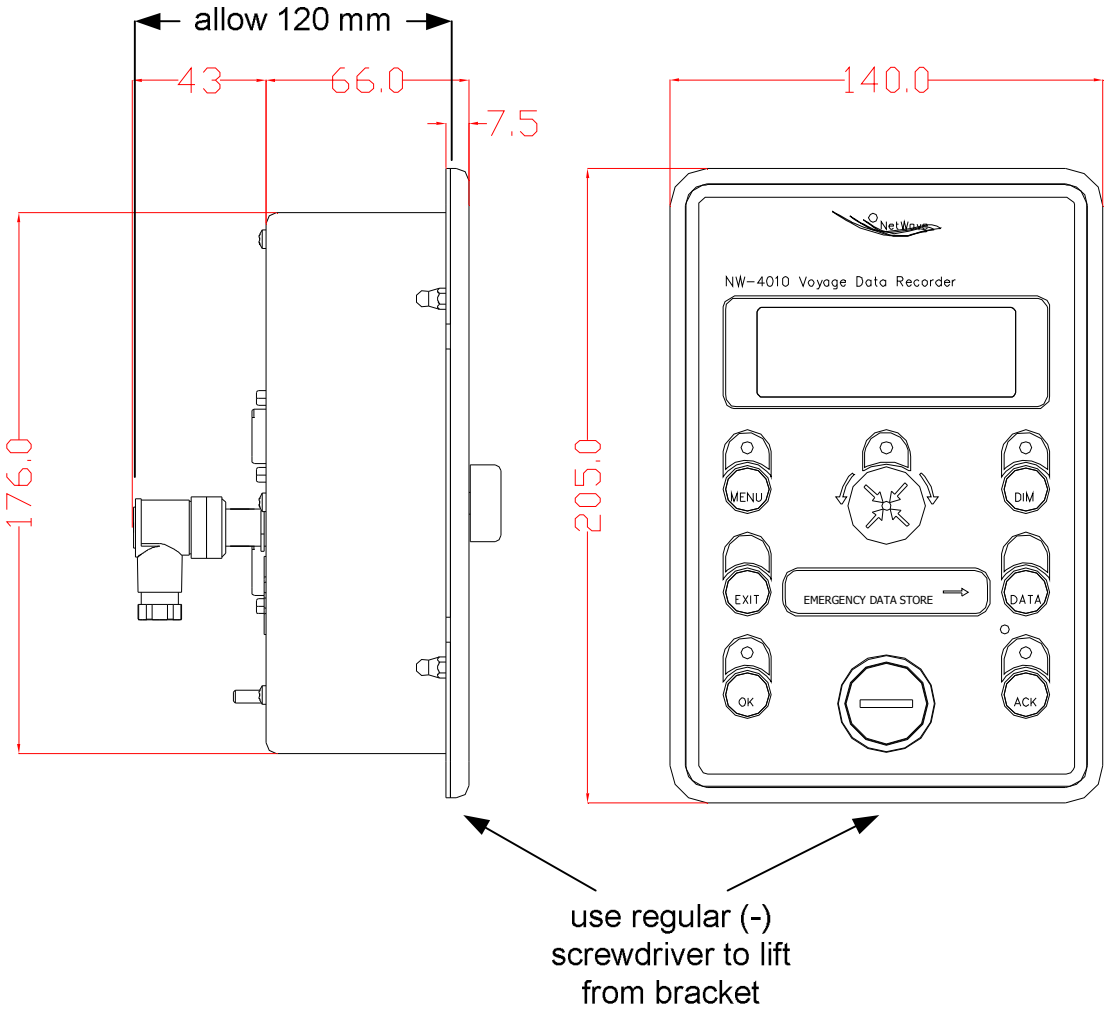


Figure 8.3.1 BCU mechanical drawing

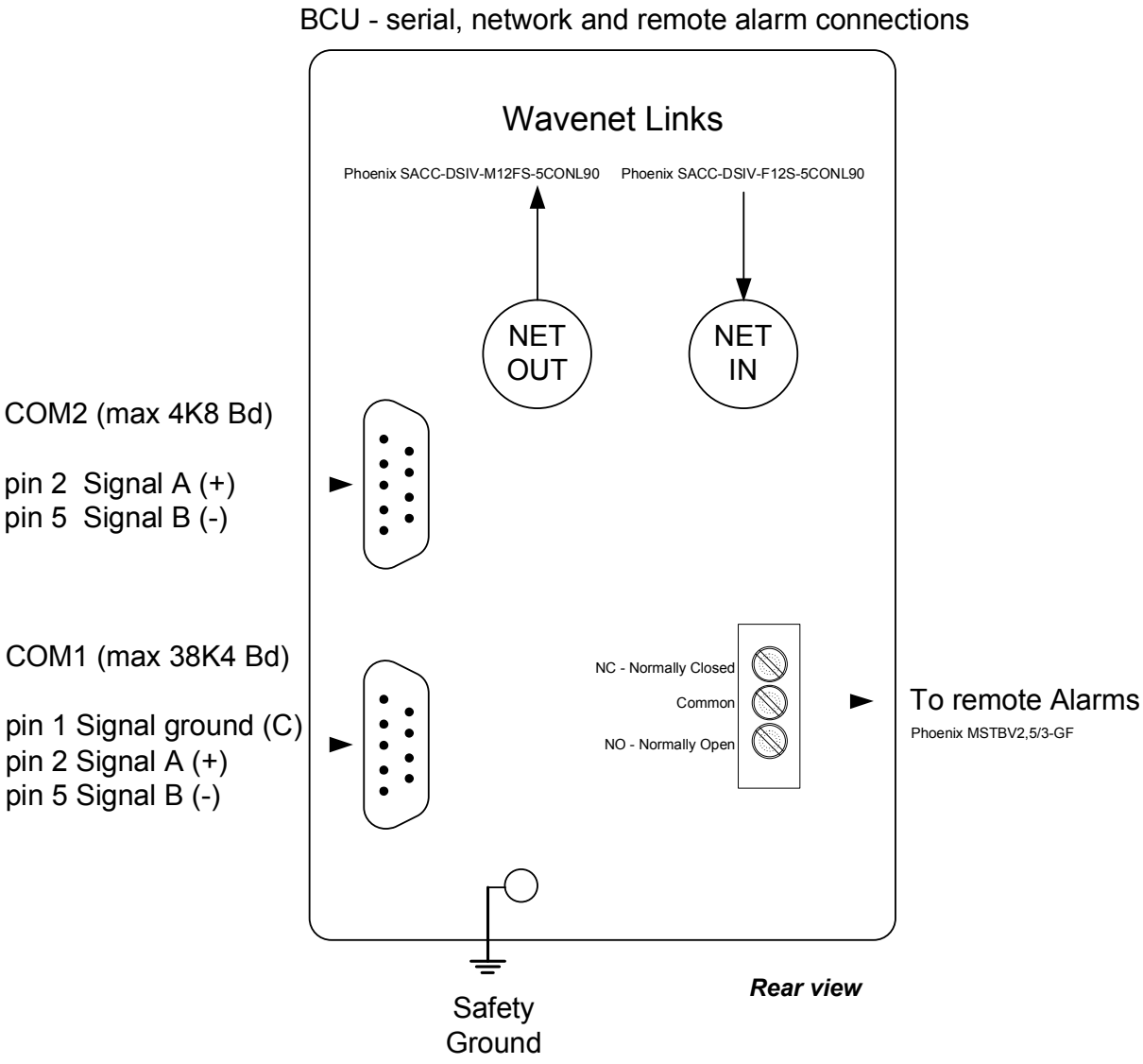


Figure 8.3.2 BCU connections (rear view)

8.4 WIM - WaveNet Interface Modules

The WIMs should be mounted in a **protected** environment and be located as close to a central position in-between the equipment providing the signals to be recorded, i.e. Microphones, Radar, GPS, AIS, etcetera, in order to minimise cabling labour.
Take the length of the radar cable provided into account.

- Determine the location of the WIM and mount the bracket according to the instructions provided. Make sure the bracket is mounted with the slotted holes in the correct vertical direction.
- Make sure there is sufficient room to allow for cable entry, leaving a minimum of 20-30 centimetres from the bottom of the unit
- Mount all of the WIM-adaptors required at that WIM location, referring to the information provided with each individual Adaptor. **Note that audio modules may NOT be placed in every slot, where other adaptors may only be used in position (left>right) 1 to 4. The radar adaptor always occupies positions 4 and 5. Refer to section 2.3.6.**
- Hook the WIM into the bracket **and secure with two screws at the inside** of the WIM
- Connect the equipment according to the instructions as provided for each Adaptor separately in this manual.

8. 5 WaveNet Interface Modules – led indicators

WIM LED Indicators

LED1; (green) Power good

LED2; (green) indication of the amount of active adaptors in the WIM (binary info together with LED3 and LED4)

LED3; (green) indication of the amount of active adaptors in the WIM (binary info together with LED2 and LED4)

LED4; (green) indication of the amount of active adaptors in the WIM (binary info together with LED2 and LED3)

LED5; (red) error (when the system discovers a malfunction)

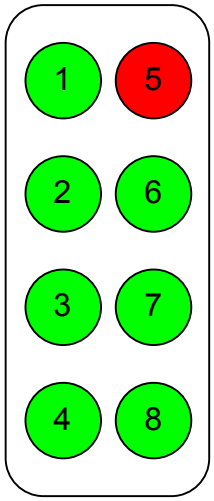
LED6; (green) streaming activity

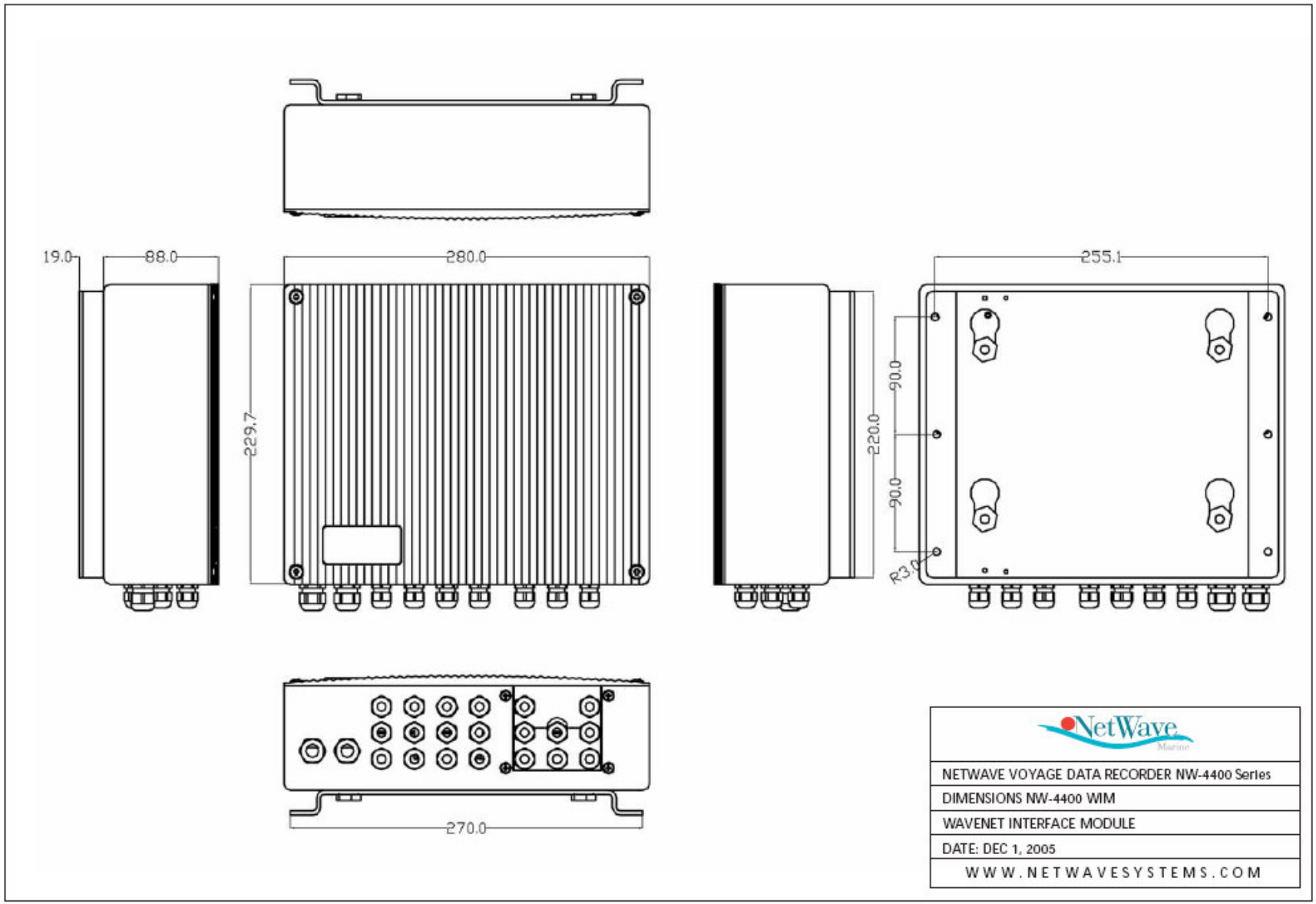
LED7; (green) ethernet port 1 activity

LED8; (green) ethernet port 2 activity

Where adaptors are fitted with LEDs these indicate failure (red) or proper functioning (green).

There is a delay for the LEDs to turn Green at start-up while the WIM establishes a 'streaming' recording channel




19.0
88.0
280.0
229.7
220.0
90.0
90.0
R3.0
255.1
270.0
NetWave Marine
NETWAVE VOYAGE DATA RECORDER NW-4400 Series
DIMENSIONS NW-4400 WIM
WAVENET INTERFACE MODULE
DATE: DEC 1, 2005
WWW.NETWAVESYSTEMS.COM

8.5 Microphones

One or more microphones positioned on the bridge (wings) shall be placed, such that conversation at or near the conning stations, radar displays, chart tables, etc. may be adequately recorded. As far as is practicable, the positioning of microphones shall also capture the input and output of intercom, public address systems and the audible alarms on the bridge (bridge mounted equipment)

The microphones are of a sea-water resistant, durably anodised type of aluminium and are of a single, universal type, may be used in both a protected and unprotected environment. They may either be flush- or bulkhead mounted, which is determined by the way the microphone is assembled at installation time.

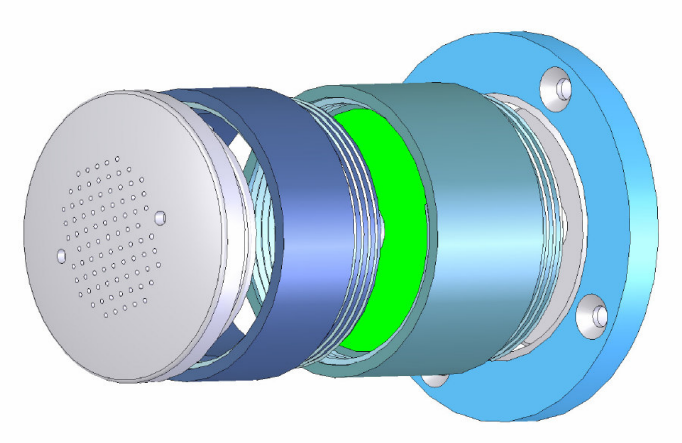


Figure 8.51 – Microphone

Four different microphone types may be assembled from the microphone kit provided;

11 Flush mounted – internal (protected environment)
12 Bulkhead mounted – internal (protected environment)
13 Flush mounted – exterior (i.e. bridge wings) unprotected environment
14 Bulkhead mounted – exterior, unprotected environment

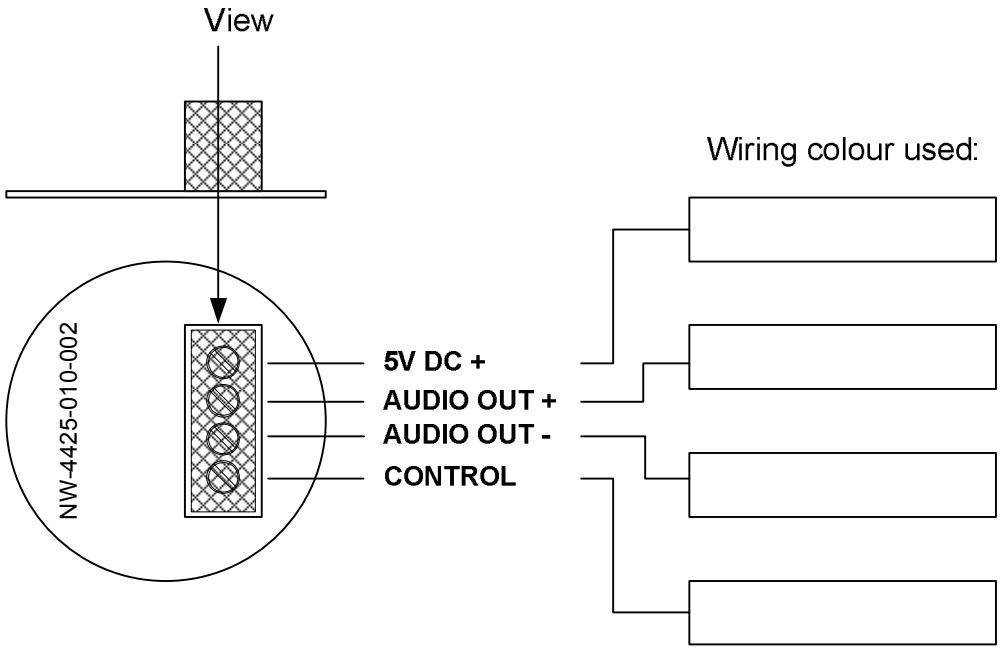
Please refer to the installation guidelines provided with each microphone to determine the assembly.

To install the microphones proceed as follows:

- Ensure adequate access space is provided at the installation position for the microphone. Sufficient clearance is required for maintenance access and cable access.

- Mark out the position of the fixing points at the required installation position and drill te necessary holes as per the drilling plan provided.

- Connect the cabling – coming from the WIM / WAM adaptor NW-4420 as follows:



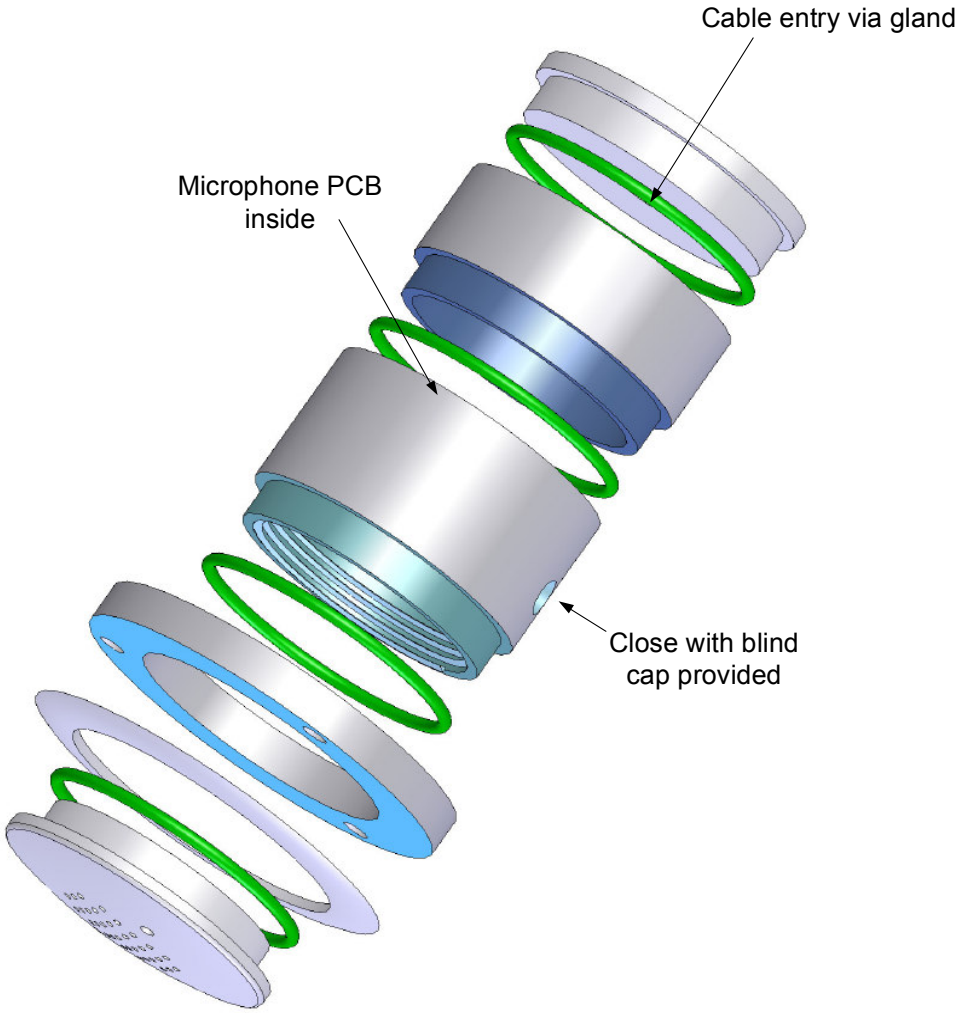
Cable type: Audio cables from microphones and VHF radio:
Shielded twisted pair, insulated, braided, 22AWG (0,025mm)

4. Note the wiring colours used into this manual at the Installation Record.

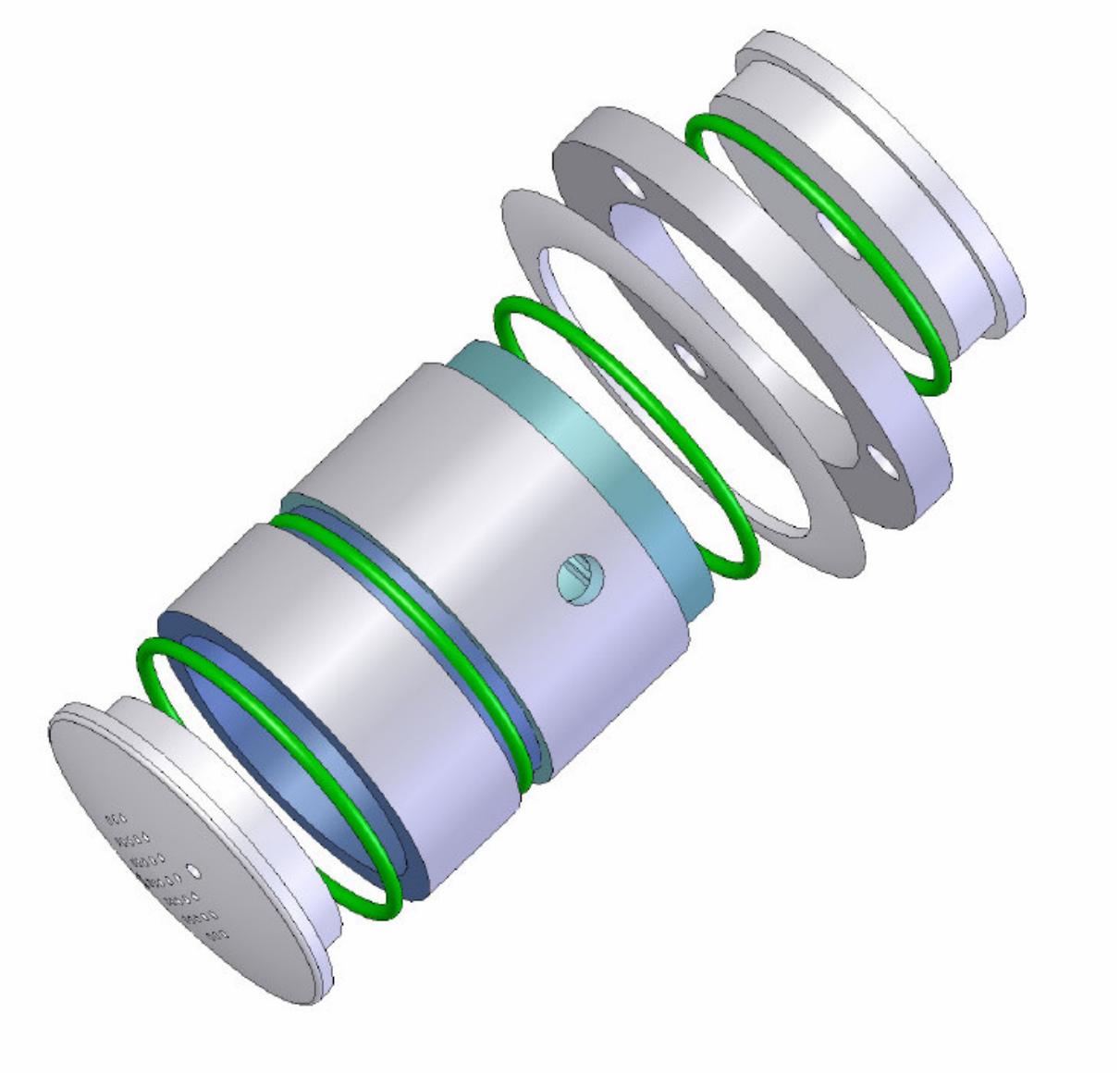
5. Test the microphones after assigning the appropriate recording channels during the configuration process.

8.5.2 Microphone assembly Instructions

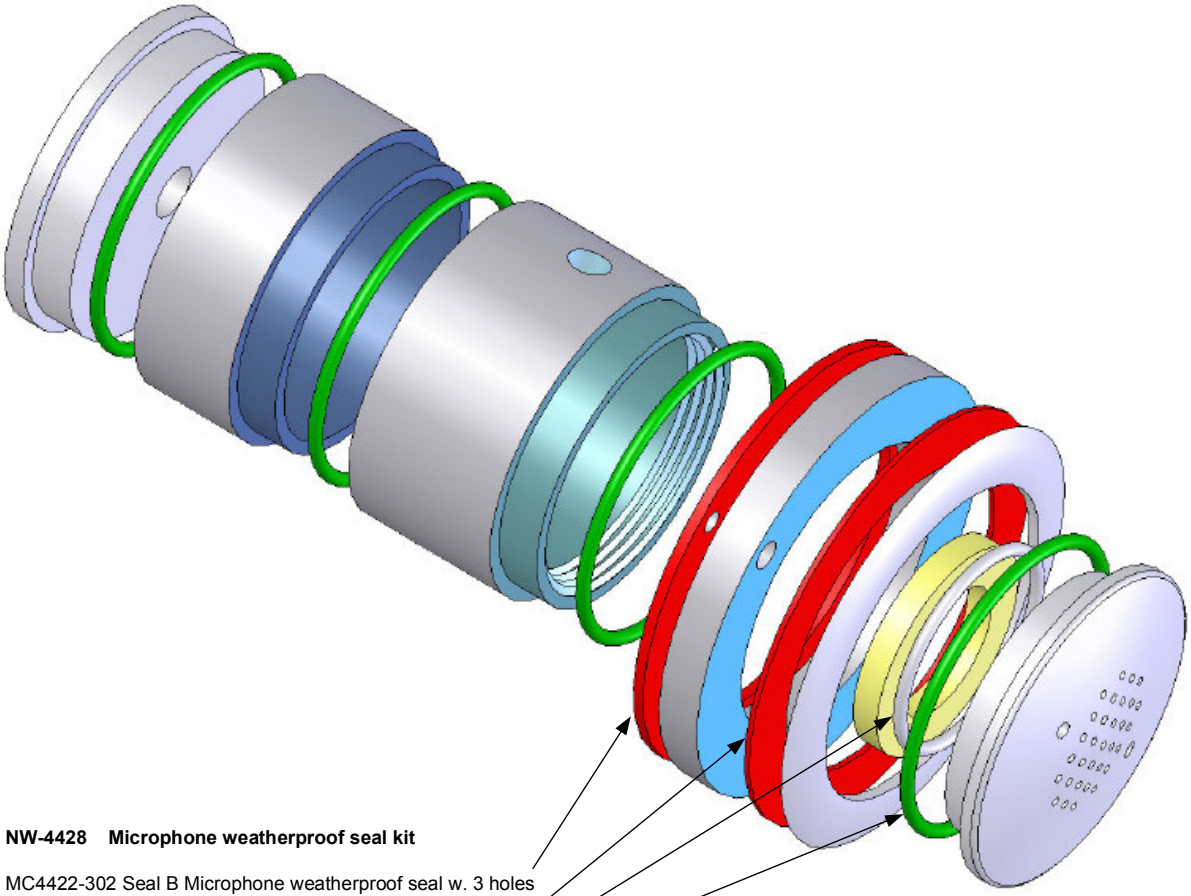
8.5.3 Flush mounted – interior (protected environment)



Bulkhead mounted – interior (protected environment)



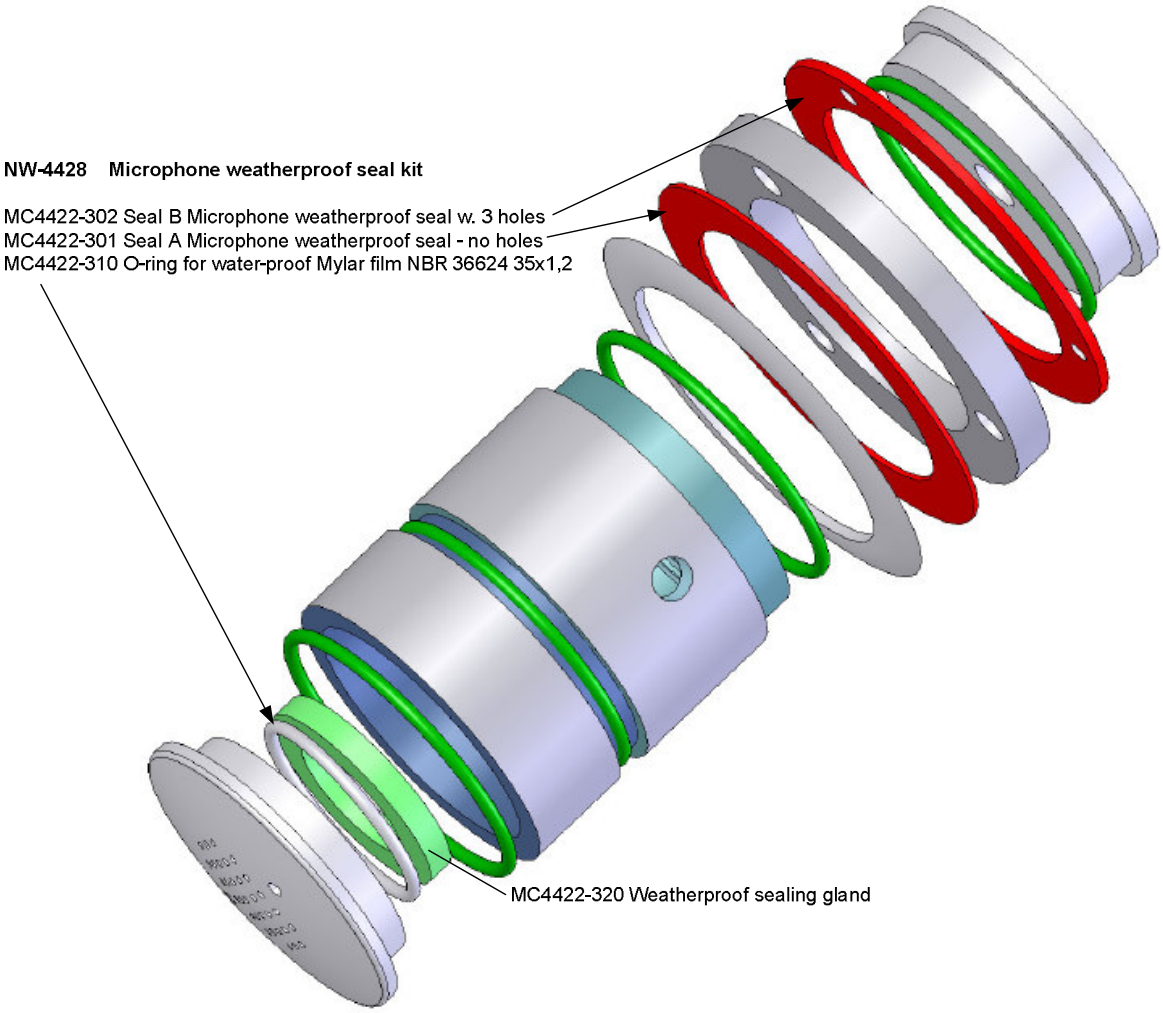
Flush mounted – exterior (i.e. bridge wings) unprotected environment



NW-4428 Microphone weatherproof seal kit

MC4422-302 Seal B Microphone weatherproof seal w. 3 holes
MC4422-301 Seal A Microphone weatherproof seal - no holes
MC4422-310 O-ring for water-proof Mylar film NBR 36624 35x1,2
MC4422-320 Weatherproof sealing gland

Bulkhead mounted – exterior, unprotected environment



8.6 VDR Units Interconnection

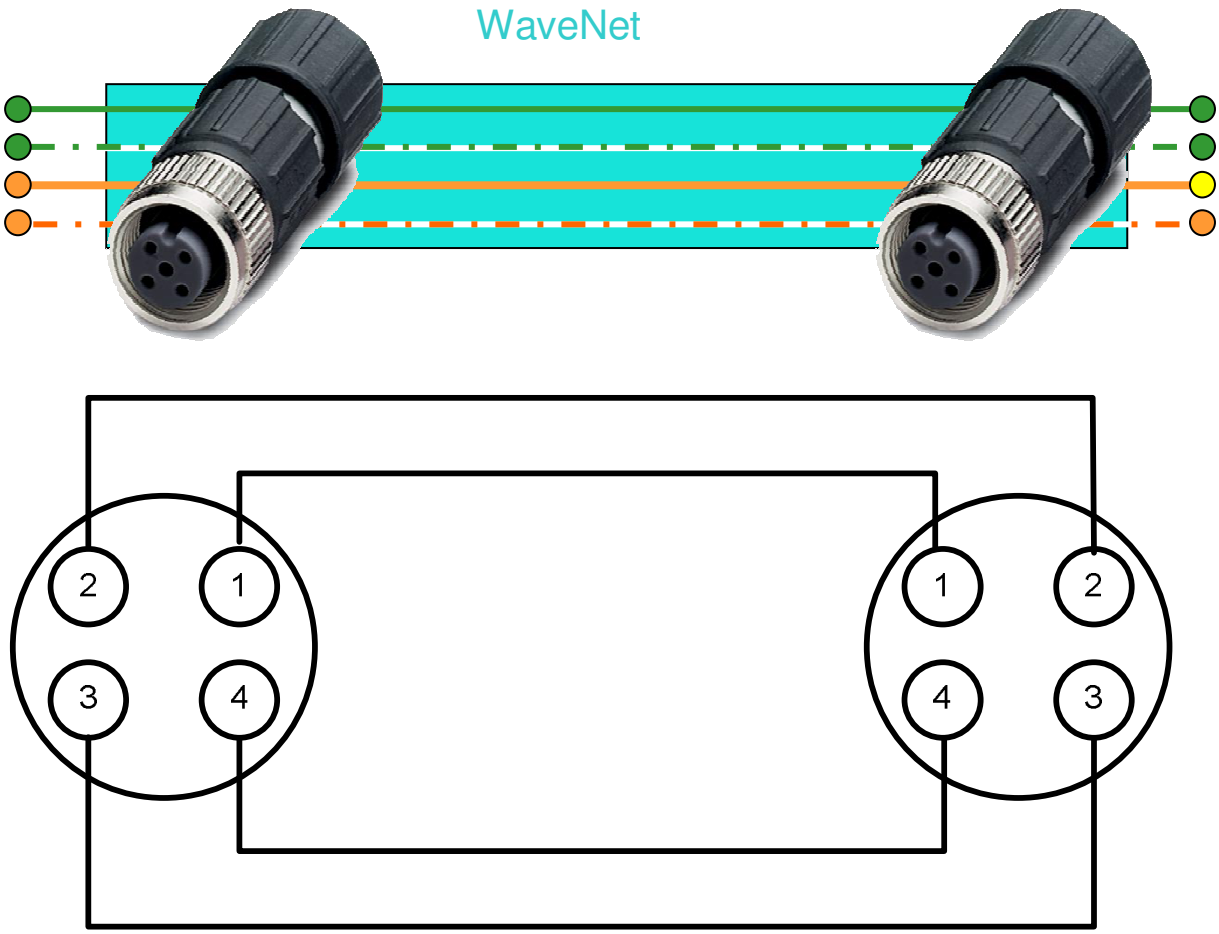


Figure 8.6 wiring diagram

The inter-unit connection of the VDR consists of a 4-core WaveNet cable provided.

Within the connectors the following wiring scheme is applicable;

1 orange-white
2 orange
3 green-white
4 green

Please pay attention to the following:

The shield of the network-cables must only be connected within the PSU, whereas within the WIM, this shield remains unconnected.

The ferrite beads provided need to be clamped onto all cables, being it network cables coming from the PSU or from external apparatus (at the WIM-side only).

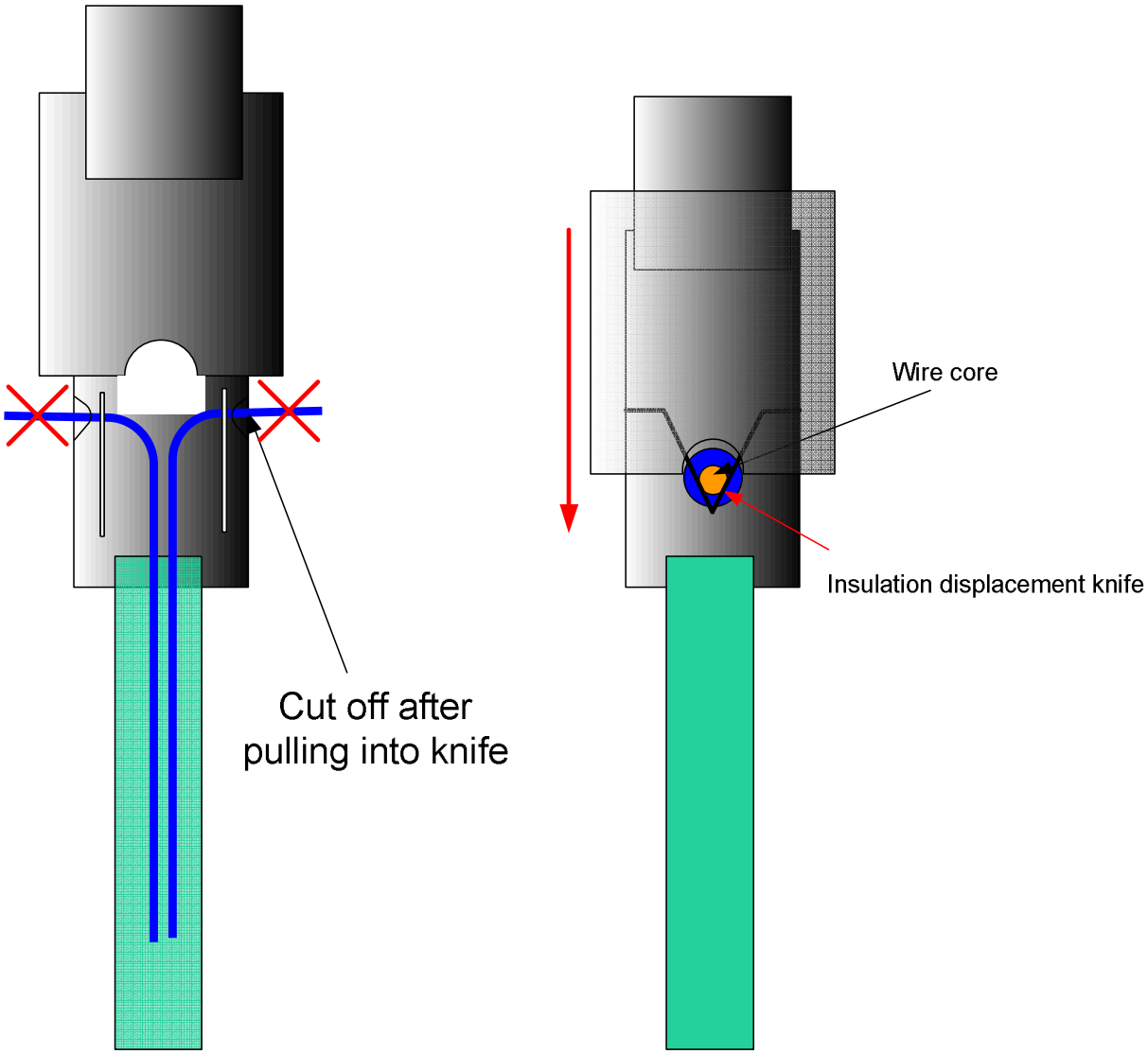


Figure 8.6.0 Quickon connector assembly

The connectors provided (pay attention to PSU-male/WIM/BCU-female sides) are of an insulation displacement type, allowing fast assembly without soldering or screws.

8.6.1 Cabling connections - network

From the PSU, the network cables are to be connected to the HSS, WIMs and BCU.

The shielding of the cables is to be connected on the PSU side as per the following drawing. Furthermore, on the PSU side, the supplied ferrite beads should be clamped onto every network cable, about 30 mm from the outer cabinet.

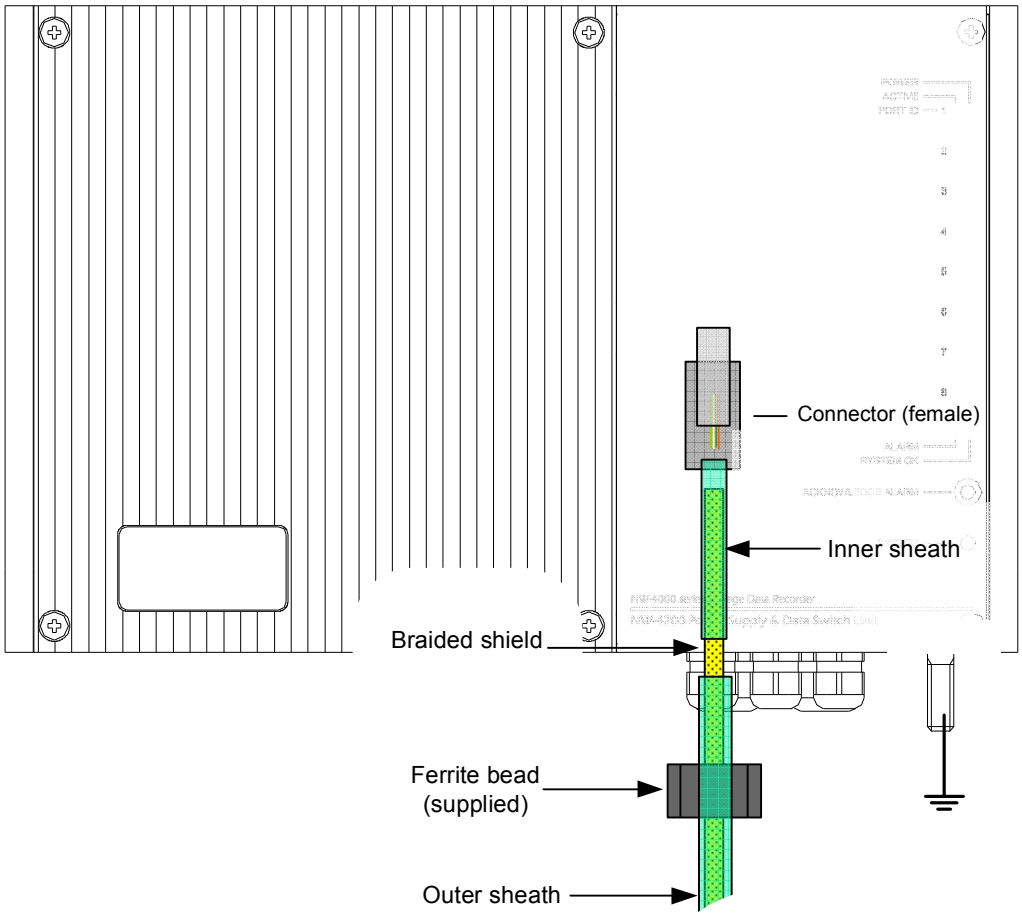


Figure 8.6.1 PSU with network cable and ferrite beads

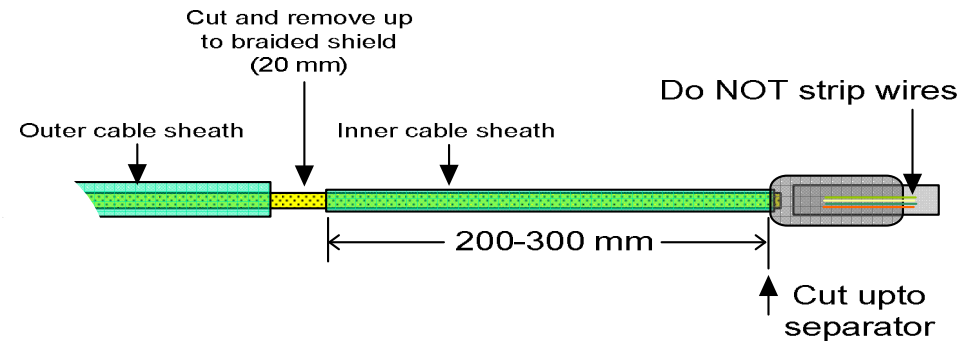


Figure 8.6.1.1 Preparation of network cable

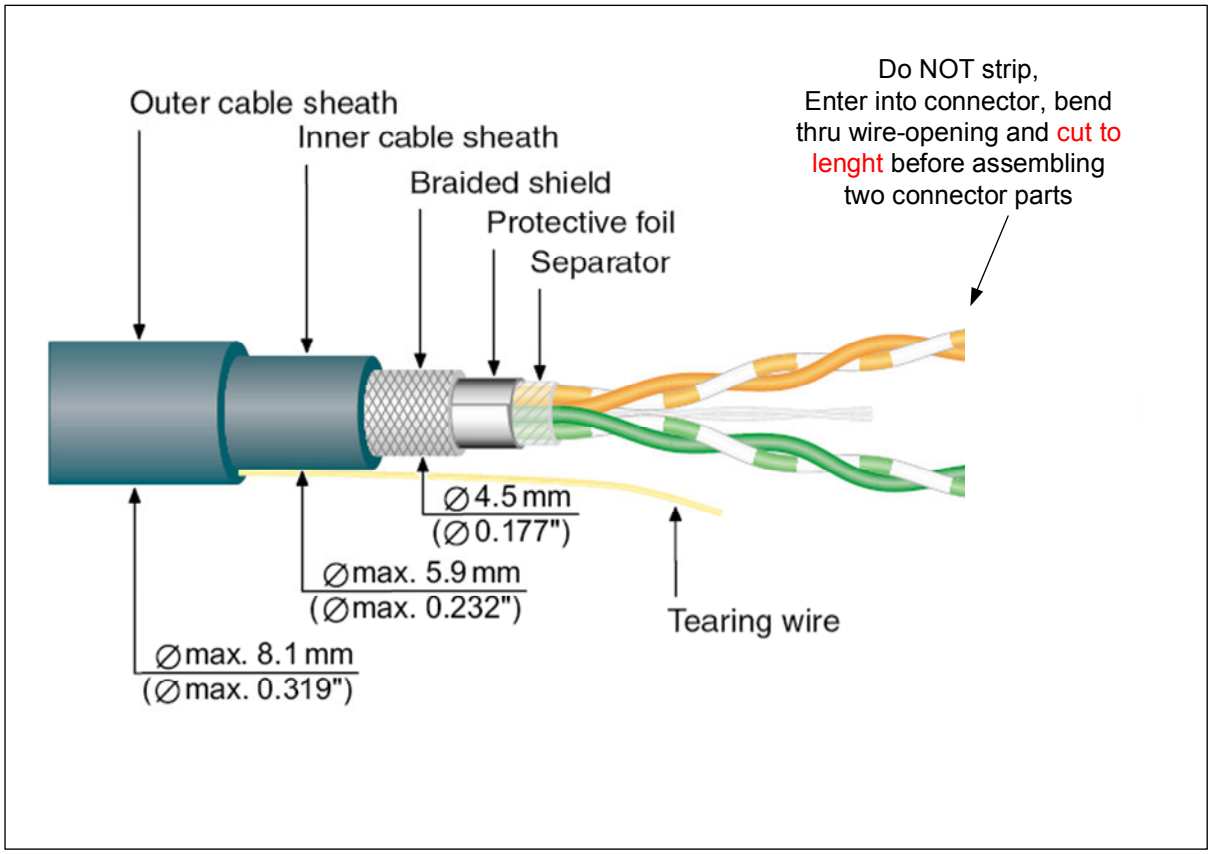


Figure 8.6.1.2 Naming conventions of NW-4001 - CAT5 heavy network-cable

8.6.2. Cabling connections – external equipment

All cabling to and from external equipment must be fitted with a ferrite bead on the WIM (or BCU) side.

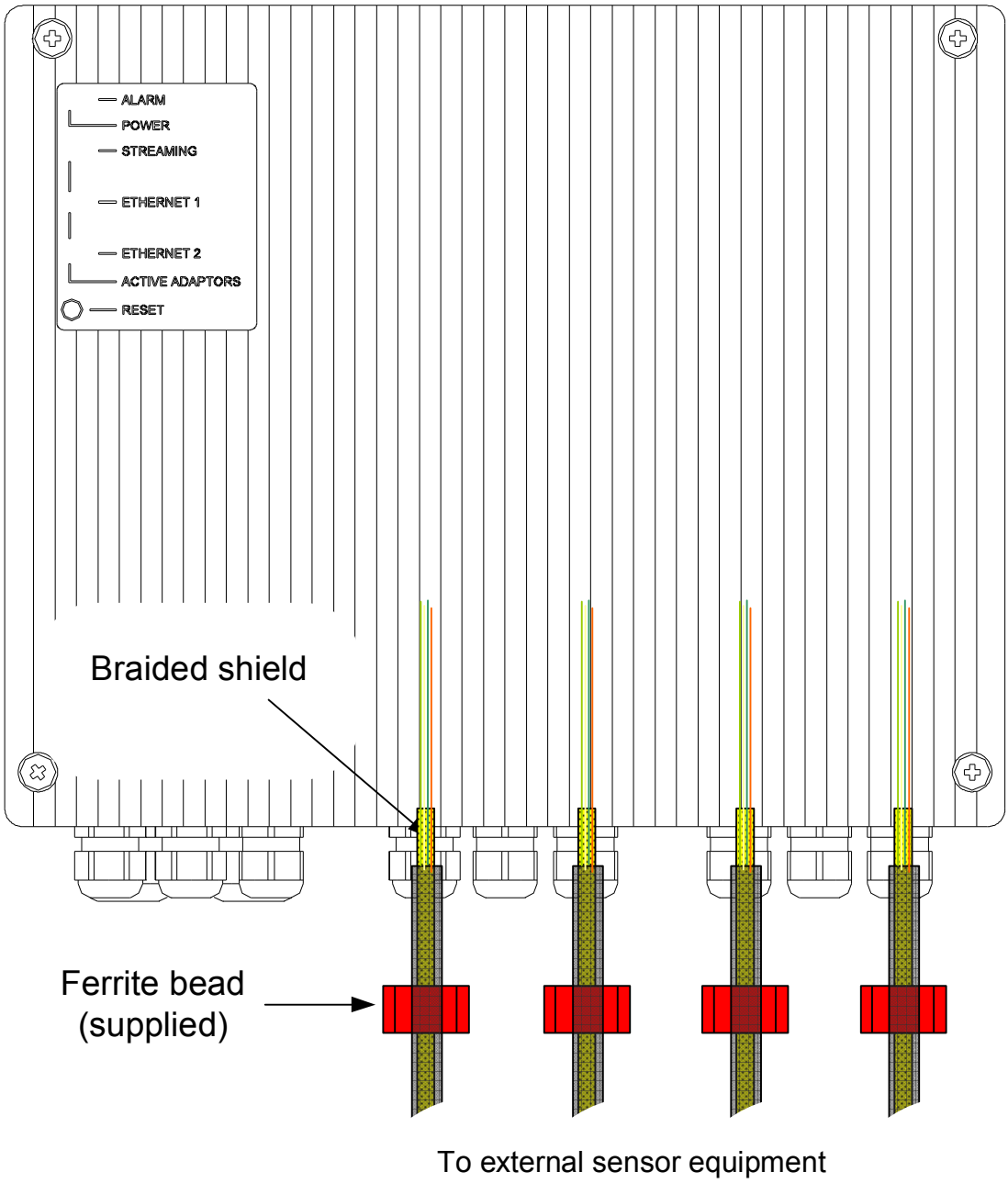


Figure 8.6.2 WIM with external cabling to external equipment (or sensors) and ferrite bead

9. System Configuration

System Configuration is performed after physical installation and connection of all hardware devices.

Important

Since the NetWave VDR largely auto-configures itself, before completing the configuration of the VDR it is of importance that;

a. all external equipment is hooked up and in their 'ON' state.
b. all external (data-providing 'sensor') equipment is configured (output ports enabled) to be providing the necessary signals to be recorded by the VDR

Configuring the VDR basically consists of the following steps;

a. Connecting a (portable) PC to the VDR
b. Obtain access to the VDR-server thru a standard internet browser like Internet Explorer or Mozilla Firefox.
c. Check if all available (hardware) Units are active within the VDR network
d. Check if all Adaptors within the WIM are recognised properly
e. Check if the connected sensors (GPS, microphones, digital or analogue signals, gyro, etc. are providing data to the VDR (some may be checked thru the web-interface)
f. Provide Channel names and or other data for active sensors on their recording channels and disable any (spare) adaptor ports/channels which are not connected to external equipment (and therefore are not to be recorded)
g. Provide vessel data and store this within the capsule

System Delays:
Consider the Voyage Data Recorder to be a device intended for long-term continuous 'background' operation, with minimal crew disturbance. As such, at start-up, the system performs numerous checks, including a complete storage memory integrity check, therefore taking 4-5 minutes to complete the initialisation, come on-line, and be user accessible (i.e. via the Web-administrator or Bridge Control Unit)

Furthermore, the overall system integrity monitoring functions, i.e. the number of channels available and those actually recorded, the generation of alarms, and other signalling functions, which, once activated, will require operator attention or intervention are purposely delayed to minimise crew disturbance in the event of a rare and/or minor irregularity which may be expected to return to a normal state within an acceptable time-frame. As such it is normal for the system to provide accurate system 'status data' after several minutes of stabilisation.

Example: the VDR must – by virtue of the IEC61996 Performance Standard – continuously record the vessel's position from a designated device, i.e. a GPS. If the GPS would (erroneously) be switched off, this will lead to a (signal lost) Warning within a matter of seconds, however without an audible signal to minimise crew disturbance. If the GPS remains disconnected however, the VDR will generate an Alarm (i.e. GPS – Position lost), including an audible signal, only after 180 seconds, having given the GPS sufficient opportunity to return to a normal state without having required operator attention and/or intervention.

Step
1

9.1 Network connection

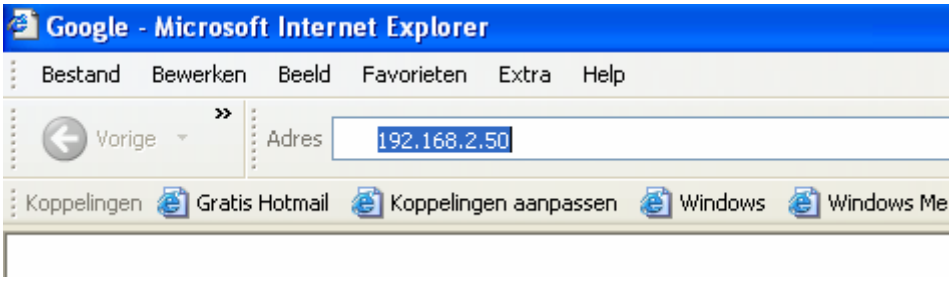
The BCU and PSU each have independent data-switches (hubs) incorporated, reason for which a laptop computer may be connected to the network via the ports provided.

By means of a standard Ethernet cable (with two male RJ-45 jacks), connect a Laptop Computer or PC to the Ethernet port in the BCU by opening the round access hole with a coin.

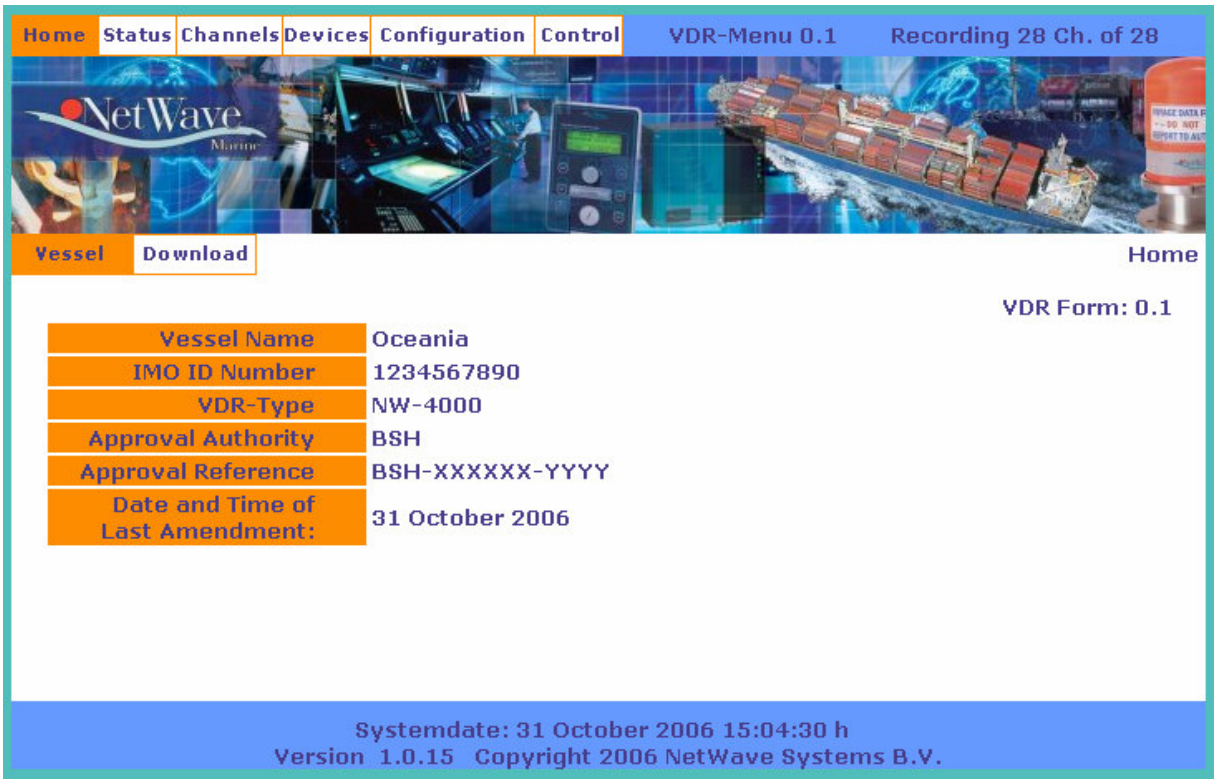
Alternatively; by means of the Ethernet cable (with two male RJ-45 jacks), connect a Laptop Computer or PC to the Ethernet NET8 port in the PSU.

At the PC, open the browser utility (Internet Explorer, Mozilla Firefox, etc.) and in the address-bar of the browser, enter the unique IP-address of the VDR system and press Enter

192.168.2.50



You will arrive at Form 0.0, the 'HOME-page" of the VDR

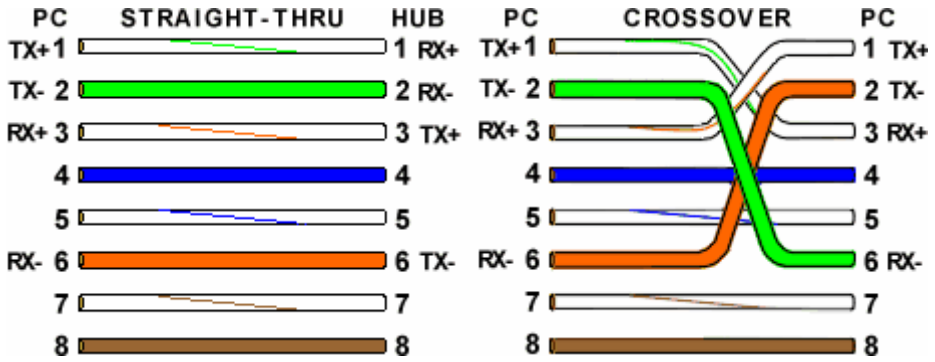


9.2 VDR Access solutions

The VDR's Ethernet ports are auto-sensing and you should not have to change your Ethernet cable, however, if you encounter problems obtaining access to the VDR server, check the following:

a. the Ethernet cable between the PC(Laptop, notebook computer) and the BCU or PSU should be the cable supplied with the VDR to overcome potential straight-thru vs. crossover Ethernet cabling issues. Change the cable if required.

- A straight-thru cable has identical ends.
- A crossover cable has different ends.
- A straight-thru is used as a patch cord in Ethernet connections.
- A crossover is used to connect two Ethernet devices without a hub or for connecting two hubs.
- A crossover has one end with the Orange set of wires switched with the Green set.
- Odd numbered pins are always striped, even numbered pins are always solid coloured.
- Looking at the RJ-45 with the clip facing away from you, Brown is always on the right, and pin 1 is on the left.
- No more than 1/2" of the Ethernet cable should be untwisted otherwise it will be susceptible to crosstalk.



b. if connected to the BCU (Ethernet), check that the BCU is connected to the PSU and that the BCU is functioning properly when the VDR is powered up by the BCU showing the acquisition of an IP-adress in the range 192.2.168.xx and the BCU screen showing functional Status messages.

c. if the BCU is not connected properly or dysfunctional, connect the PC to the Ethernet port [NET8] provided at the PSU, this port's functionality is similar to the port provided on the BCU until the problem is resolved.

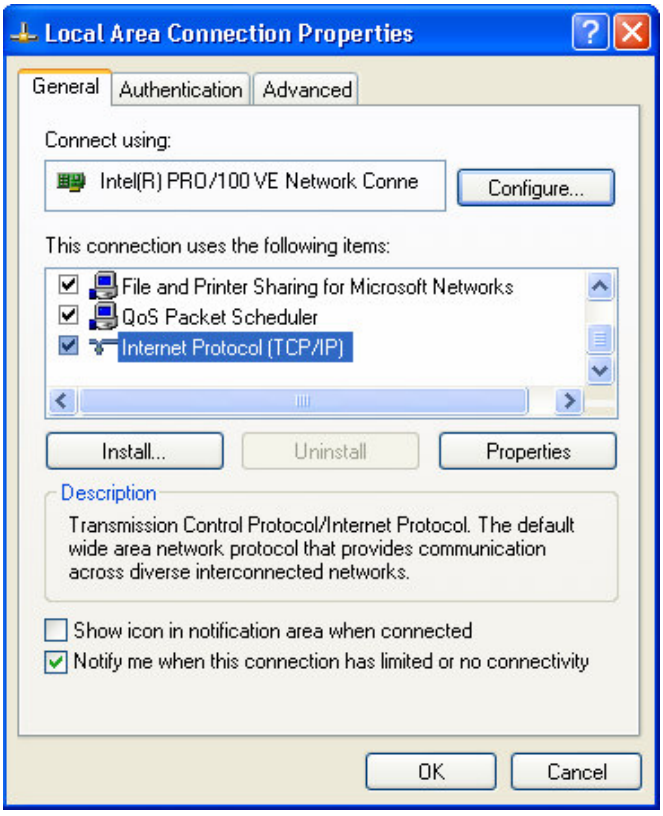
d. Check and correct your computer's LAN settings to be supporting the TCP/IP protocol (as normally used for Internet access), and to be within the correct IP-range.

9.2.1 IP-range requirements

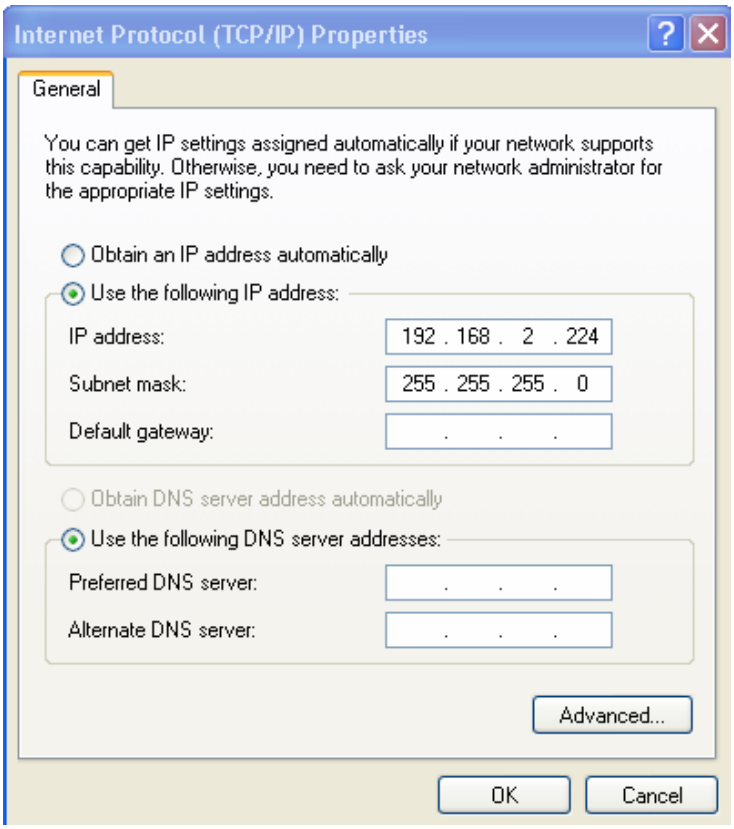
If you encounter problems to get access to the VDR check the network settings on the PC/laptop by going to the Windows Start>Connections section and selecting the active physical connection's Properties.

Name	Type	Status	Device Name
LAN or High-Speed Internet			
Wireless Network Connection	LAN or High-Speed Internet	Not connected, Firewalled	Intel(R) PRO/Wireless 3945ABG Network Connection
Local Area Connection 3	LAN or High-Speed Internet	Disabled, Firewalled	Cisco Systems VPN Adapter
Local Area Connection	LAN or High-Speed Internet	Connected, Firewalled	Intel(R) PRO/100 VE Network Connection
1394 Connection	LAN or High-Speed Internet	Connected, Firewalled	1394 Net Adapter

Select the TCP/IP properties



You will arrive at the following screen where you must set the PC/laptop to a fixed IP address of 192.168.2.224 with a 255.255.255.0 subnet-mask.



Once you have Clicked OK twice (and closed all related windows) restart the internet browser and return to perform the actions as described in section 9.1.

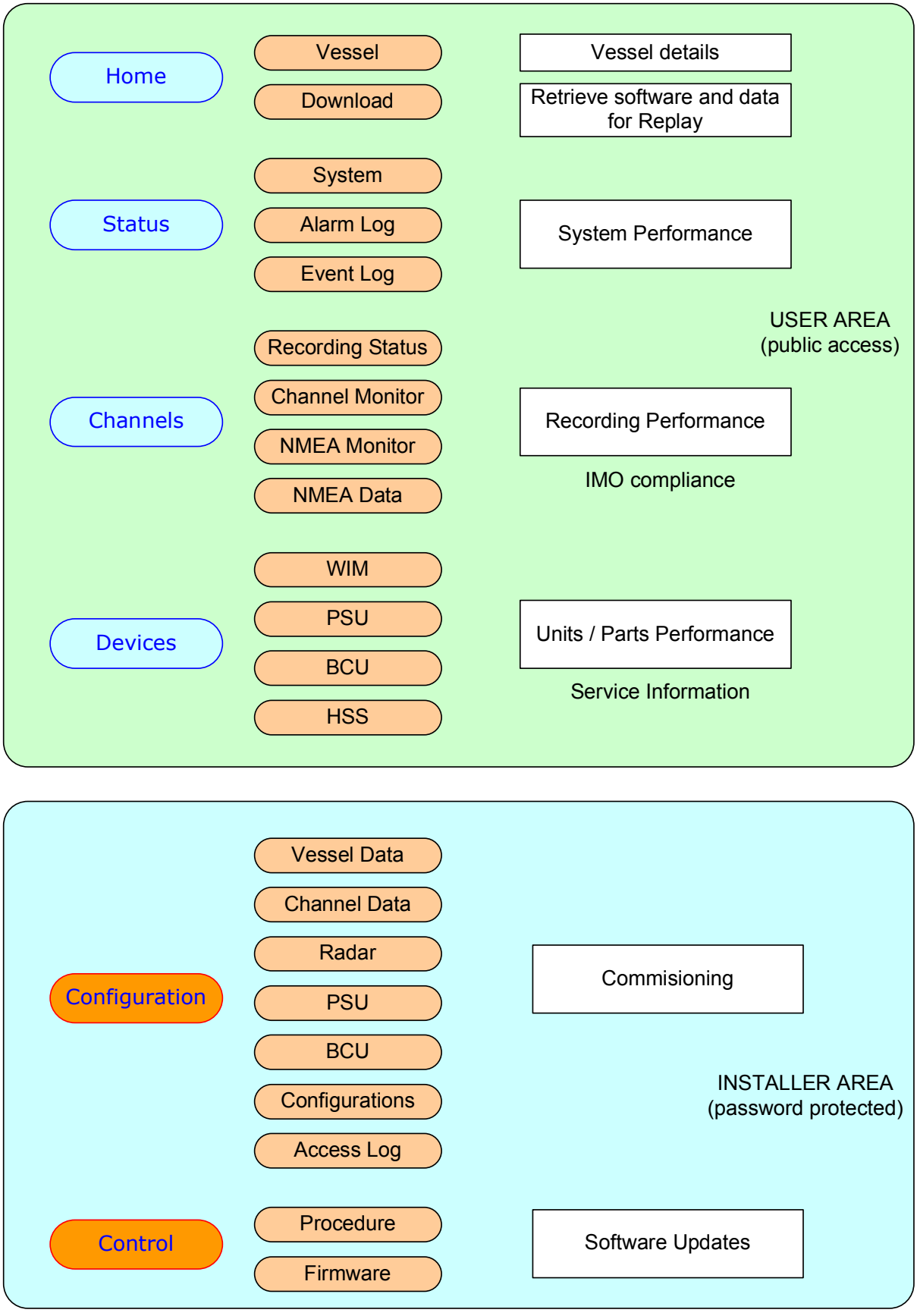
9.3 VDR-Administrator Menu Structure

Basically there are two areas, one for the standard user, which may be anybody since it's access is unrestricted, whereas the other area is intended for certified engineers only, and which is password protected.

The reason for giving unrestricted access to some parts of the system are to allow unrestricted downloading of recorded data, as well as to provide information about the VDR system when (remote) service or support is required.

In order to obtain access to the restricted Configuration and Control sections, you must provide the password 'NW220654' or 'nw220654'

WARNING: Making changes (i.e. like disabling recording channels) to the configuration of the VDR may lead to non-compliance to IMO resolutions and/or IEC61996 Performance Standards for Voyage Data Recorders**.**


Home
Vessel
Download
Vessel details
Retrieve software and data for Replay
Status
System
Alarm Log
Event Log
System Performance
USER AREA
(public access)
Channels
Recording Status
Channel Monitor
NMEA Monitor
NMEA Data
Recording Performance
IMO compliance
Devices
WIM
PSU
BCU
HSS
Units / Parts Performance
Service Information
Configuration
Vessel Data
Channel Data
Radar
PSU
BCU
Configurations
Access Log
Commisioning
INSTALLER AREA
(password protected)
Control
Procedure
Firmware
Software Updates

9.4 Installation and Operational Modes

9.4.1. General

Although not always required during the commissioning process for a (S) (simplified) VDR, the feature to place the system in 'Installation mode' will temporarily prohibit the sounding of Alarms and provides access to specific functionality not normally available during Normal Operation.

Within Installation Mode, Channel monitoring is available, and, depending upon the password provided, additional low-level Control functions may be performed.

One of the functionalities available in Installation Mode is the possibility to view some of the the recorded data in real time to allow you to check if the sensors and subsequent data compression, forwarding, storing and reading back is properly working.

Since this requires additional processing and functionality not normally required during Operational mode, this mode is only used while performing more complex (full VDR, not S-VDR) Installation or Commissioning work by a NetWave certified engineer.

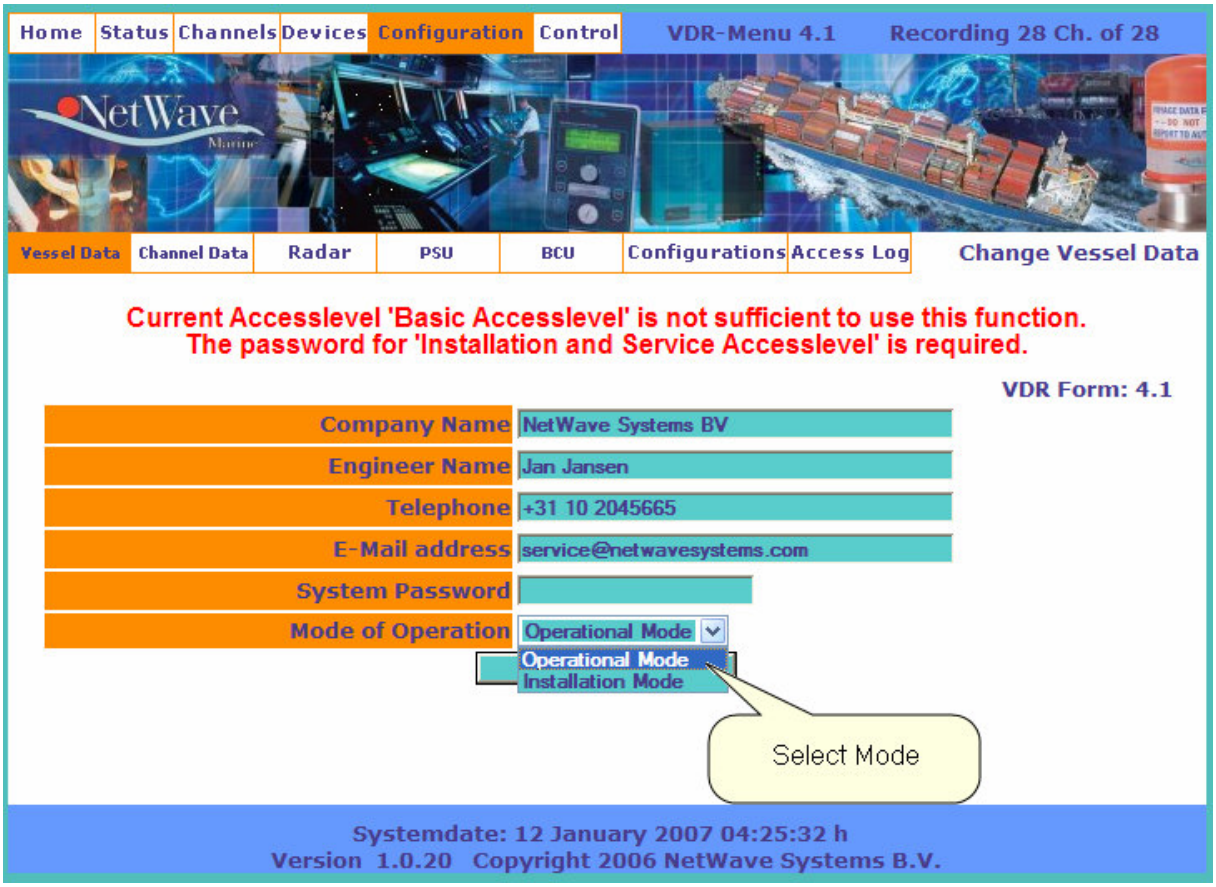
If required, Mode changes between the Operational and Installation modes are made via the Menu option Configuration.

In order to access the Login and Mode selection screen (if already logged in), select the HOME page first, and then the CONFIGURATION page. This will also (automatically) occur if you attempt to access the restricted area for the first time.

9.4.2 Login Password and (optional) Mode switching

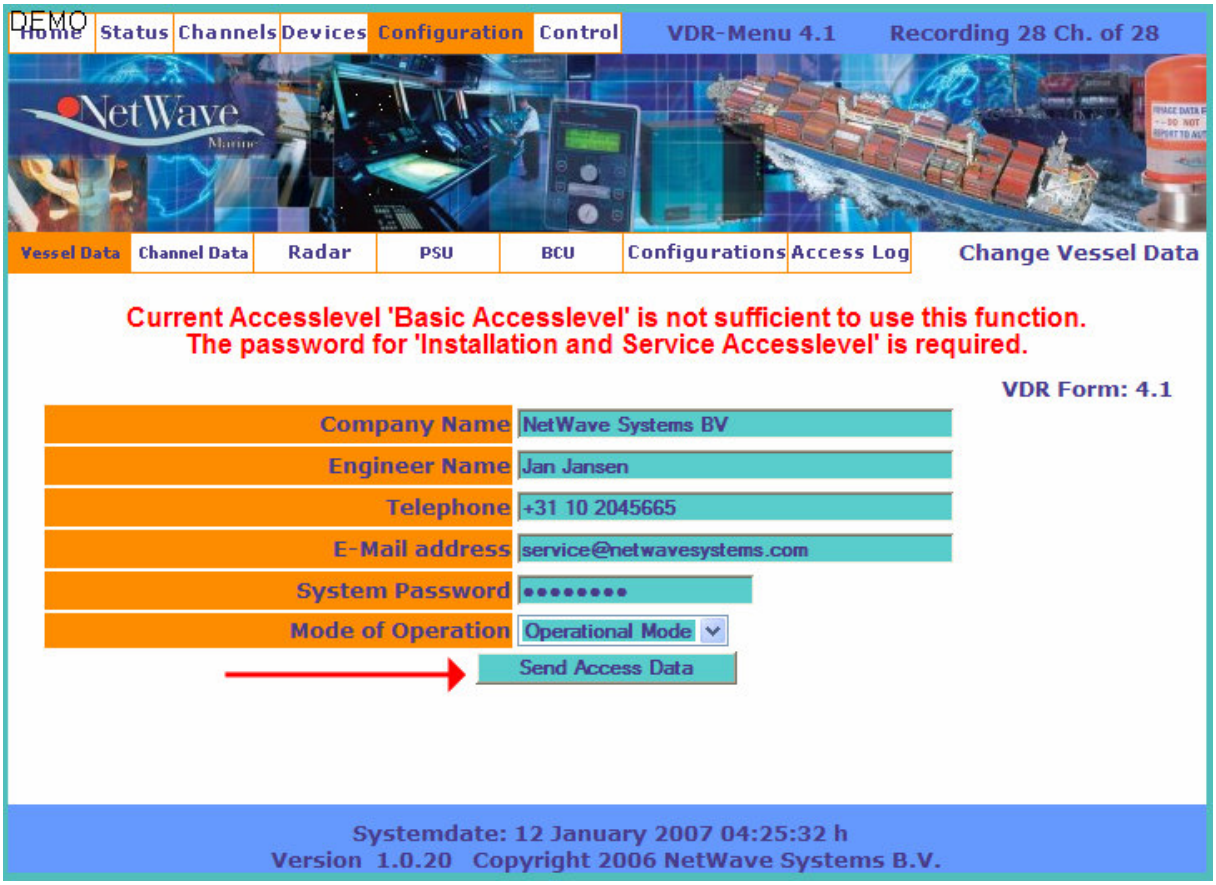
Switching between Installation Mode and Operational Mode may only be performed while providing the password within the Login screen. The Login Screen becomes available when the HOME page has been initiated, and subsequently an access attempt is made into the restricted area (the Configuration or Control pages), or when the restricted pages are accessed for the first time.

The "System Password" is 'nw220654'



The System Mode may also be observed on the Bridge Control Unit which will indicate "Installation Mode" on the top line of the display.

Make sure the system is returned in Operational Mode when the configuration of the system is finished!



Once the correct Mode of Operation is chosen, Click the “Send Access Data” button to perform the login.

9.5 System Network Check

Step 3

Goto the Status>System Page

Check if all devices are present and therefore have been automatically connected to the HSS. Allow 5 minutes delay if the system performs a power-cycle or restart, since the VDR performs a complete memory integrity check then.

9.6 Device Identification

In the column ‘Device Identification‘ the following devices should be present as a minimum;

- HSS (Capsule, Hardened Storage Server)
- BCU (Bridge Control Unit)
- PSU (Power Supply & Switch Unit)
- One or more WIMs (WaveNet Interface Modules)

In the event one of the devices is missing, take the following action;

- On the PSU, all ports connected should show the POWER and LINK to be ON, check cabling and connections between the devices if not so.
    - If you do not see any leds ON, check the setting for the brightness of the leds on the Configuration>PSU page. Select the brightness to be 100% and Click the button “Save PSU Parameters and Update PSU”.

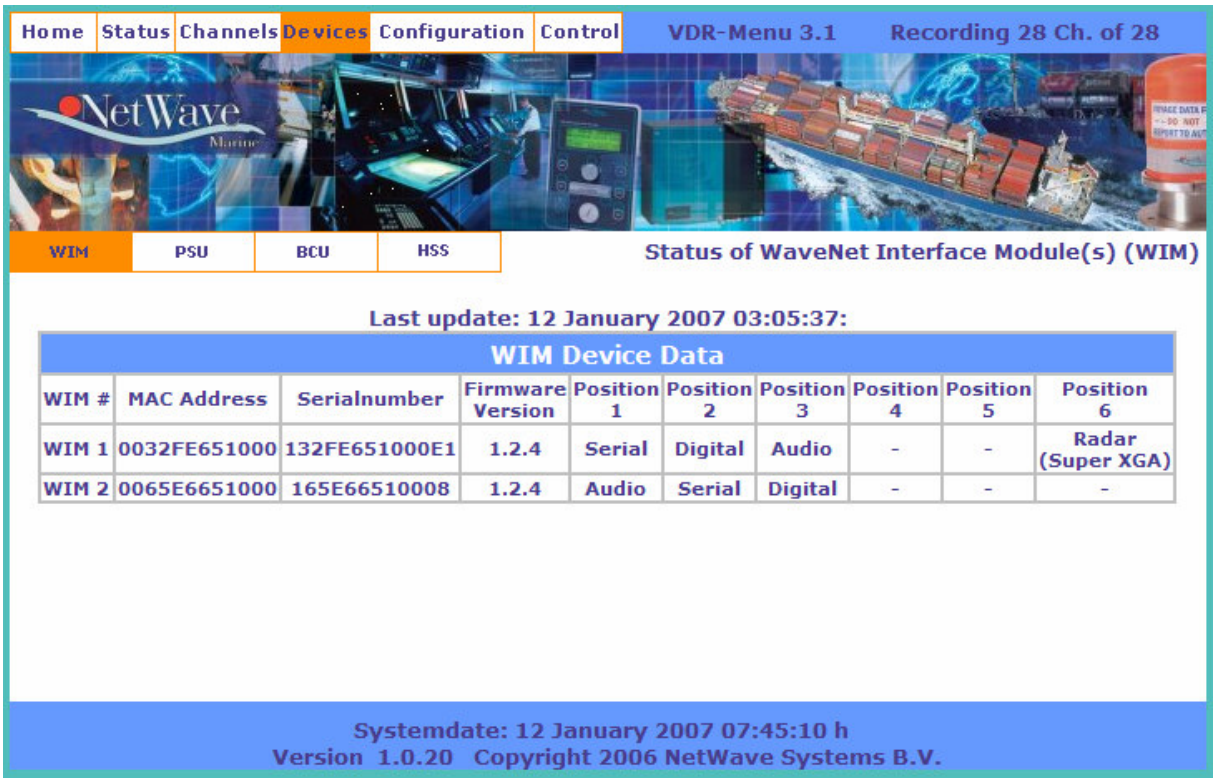
- Reset the PSU by pushing the System-reset switch (not the ACK button) for 2 seconds and wait for the system to fully re-initialise (4-5 minutes).
- Reconnect the web-browser (refer to Section 9.1)
- Search for cabling faults until all available devices are present in the Status Page.
- Check the proper functioning of the device by using a temporary cable, directly connecting to another port of the PSU.

- If the problem persists, establish a connection to the HSS only by disconnecting BCU and WIMs. Devices PSU and HSS should already show their presence once approached thru the browser.

9.7 System Interface Check

Step 4

Go to the ‘Devices’ Page and check all WIMs (WaveNet Interface Modules) to show the correct amount and type of adaptors mounted within each WIM.



Please note – in writing – the observed configuration by filling out the appropriate forms in section 30 of this manual.

In the event there is a discrepancy between the actual hardware and the adaptors presented, that WIMs configuration is not functioning properly. This may be caused by changes made (to the hardware- and or PSU-port configuration) after the VDRs first power-up, when the system is auto-configuring itself. If in doubt, perform a factory-reset from the Control>Procedure page.

To restore the VDRs default settings and perform a full system reset, push the Reset button on the PSU for several seconds until all lamps are OFF.

If problems persist;

- check if the adaptor is properly positioned and connected by re-installing it
- check if the adaptor resides in the correct slot (some adaptors may not reside in the most right adaptor (slot number 4/5) which is for radar-video adaptors, for more information refer to Section 2.3.6
- dismount the adaptor and perform a system reset
- provide a different position for that adaptor
- disconnect the adaptor from external signal sources and retry
- if all else fails, goto Control>Procedures and perform a Factory reset, where after the configuration should be reinstated by starting at Section 9.1.

IMPORTANT

Auto-Configuration

The VDR, when powered-up for the first time – will register the WIMs factual port-connections (port-number) within the PSU including the WIMs adaptor configurations, serial numbers, MAC-adresses, etc.

The VDR will also register on which port the HSS (Port 1) and BCU are on, and designate the relevant software functionality to this specific port(s), including an automatic Reset in the event of a detected malfunction.

As such, after power-up, it is not advisable to change the physical network-port-number (within the PSU) any of the devices are physically connected to (with the network-cable) without performing a deletion of the WIMs and a factory Reset. (refer to Control>Procedures)

In other words: Once powered-up, don't change the network-cabling to a different PSU port without performing a full factory reset.

NB. A full factory reset will lead to a re-initialisation (blanking) of the channel-names (Configuration>Channel data)

9.8 Power Supply & Data Switch Check

Step 5

Check proper functioning of the PSU by choosing Devices>PSU)

PSU Port Connection Status	
Port #	Status
Port #1	Connected
Port #2	Connected
Port #3	Connected
Port #4	Connected
Port #5	Connected
Port #6	Connected
Port #7	Connected
Port #8	Disabled

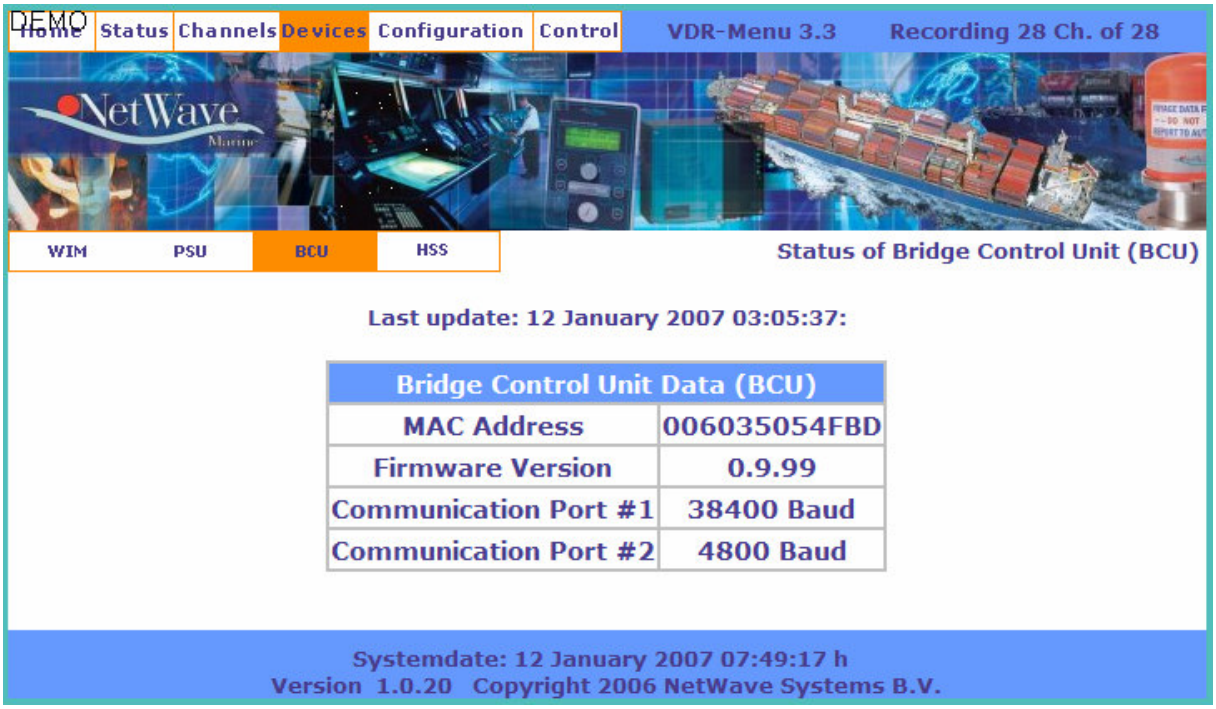
PSU Port Network State		
Port #	Port Speed	Port Duplex
Port #1	100 MegaBit	Full Duplex
Port #2	100 MegaBit	Full Duplex
Port #3	No network	No network
Port #4	100 MegaBit	Full Duplex
Port #5	100 MegaBit	Full Duplex
Port #6	No network	No network
Port #7	No network	No network
Port #8	100 MegaBit	Full Duplex

Systemdate: 12 January 2007 07:51:42 h
Version 1.0.20 Copyright 2006 NetWave Systems B.V.

9.9 Bridge Control Unit Check

Step 6

Check proper functioning of the BCU by choosing Devices>BCU



Note that the BCU serial ports default to 4800 Bd. In the event an AIS is connected (normally at 38k4 Bd), this setting needs to be changed to 38k4, which is performed via the **Configuration>BCU** page.

Please note that the COM1 port on the BCU is the lower one of the two SUB-D connectors.

On the Bridge Control Unit itself, perform the BCU test (consisting of Display, Keyboard, Led, Jog dial, and Buzzer tests by entering the **Menu>Test>BCU Test**.

9.10 Hardened Storage Server (capsule) Check

Step 7

Check proper functioning of the HSS by choosing Devices>HSS, particularly the presence of the 2 Storage Directories. This means that the protected memory (in the Capsule) was properly connected to the CPU unit without the deckmount.

Last update: 12 January 2007 03:05:37:

Hardened Storage Server Data (HSS)	
IP Address	192.168.2.50
MAC Address	008066103E87
Serialnumber	00000EC594E5
VDR-COMMANDER Version	1.0.102
VDR-COMMANDER Build	Dec 19 2006 12:42:10
VDR-STREAMER Version	1.0.74
VDR-STREAMER Build	Dec 17 2006 17:19:28
Current System Load Index	1.60
System Load Index 5 Min	1.65
System Load Index 15 Min	1.63
CPU Load	50.5%

HSS Storage Space		
Storage Directory	Max Space Available	Space Used
/mnt/hss1/	1,982 MBytes	1,072 MBytes (54.1 %)
/mnt/hss2/	1,982 MBytes	963 MBytes (48,6 %)
/	32 MBytes	20 MBytes (64.3 %)
/mnt/compactflash/	3,856 MBytes	902 MBytes (23.4 %)

In the event the Storage directories are not present, check the cabling and connector between the Capsule's deckmount CPU unit and the (orange) capsule protected memory part.

Note the presence of the Compact flash within the HSS to serve as the volume where the Incident data will be stored in the event the Data button on the BCU is pressed.

10. Interfacing

10. 1 General

Note:

From the first initialisation (power-up), the VDR is recording on all physically present channels (in hardware) in the system by default, even those which are unused by virtue of not being connected to any data-providing external equipment (sensors).

This is to preserve the systems recording capabilities in the event of (configuration) data loss or other abnormalities.

To perform proper commissioning and configuration of the VDR;

a. The unused recording channels should remain ‘unchecked’ to preserve memory space and, by doing so, also minimise memory wear.

b. The channels used – in other words connected to external equipment providing actual data – should be named and other characteristics should be provided where required.

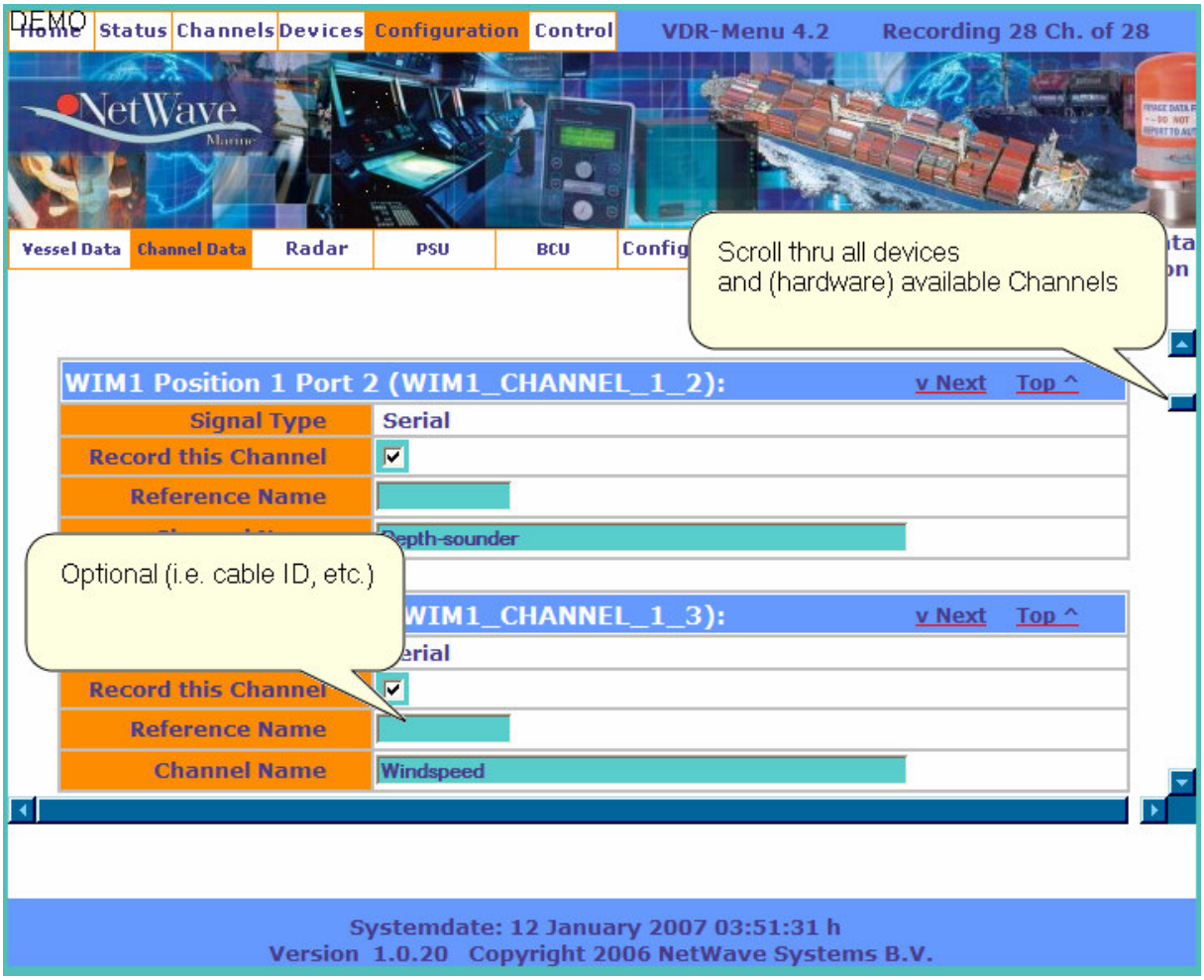
10.2 Configuration of Recording Channels

Step 9

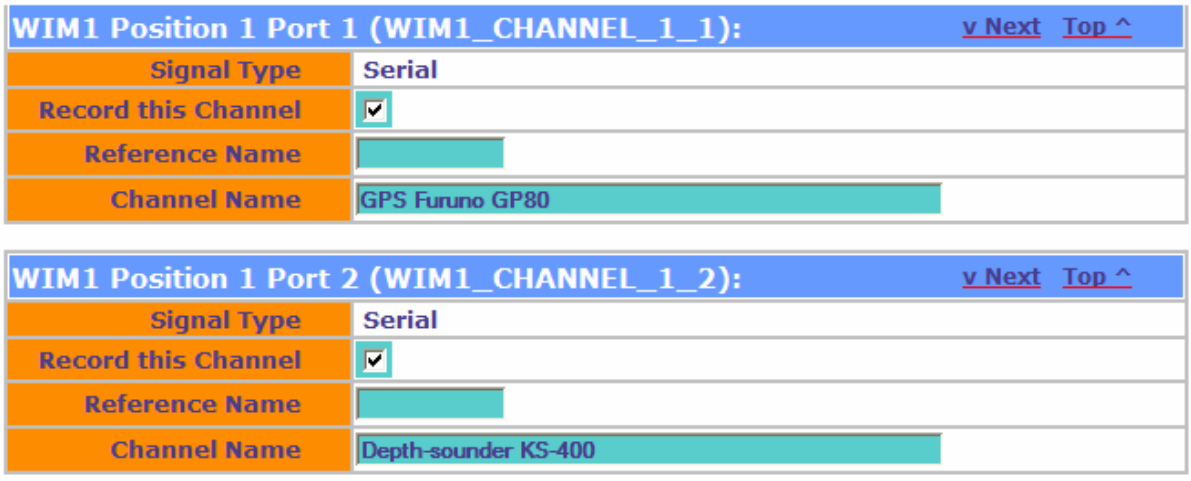
The **Configuration>Channel Data** page allows the selection of the recording requirements of the system, either by addressing a specific recording device (WIMs or BCU) or a specific channel.

The channels are presented in the order of connected devices.

The easiest way to navigate thru the channels is by using the top-part of the screen where all devices and channels are presented.


DEMO
Home
Status
Channels
Devices
Configuration
Control
VDR-Menu 4.2
Recording 28 Ch. of 28
NetWave
Vessel Data
Channel Data
Radar
PSU
BCU
Scroll thru all devices
and (hardware) available Channels
WIM1 Position 1 Port 2 (WIM1_CHANNEL_1_2):
v Next
Top ^
Signal Type
Serial
Record this Channel
Reference Name
Depth-sounder
Optional (i.e. cable ID, etc.)
WIM1_CHANNEL_1_3):
v Next
Top ^
Record this Channel
Reference Name
Channel Name
Windspeed
Systemdate: 12 January 2007 03:51:31 h
Version 1.0.20 Copyright 2006 NetWave Systems B.V.

10.2.2 Configuring NMEA serial Channels and Vessel Data



Record this Channel (Check-box)

If the VDR-System should capture and store the data of the signal received, then this Check-box should be selected.

Reference Name (Text-box)

Optionally some reference to drawings, cabling, etc. may be entered here.

Channel Name (Text-box)

The name of the Channel, describing the signal-source must be entered here. Regulations require that this textbox has to be filled in with a proper unambiguous description of the signal being recorded. If more than one unit performing the same function or providing the same output signal (NMEA string) is available on board, make sure the text contains a means of identifying which unit is connected to the VDR.

NB. NMEA ports on the WIM are IEC61162-1 compliant. Data is received in serial asynchronous form in accordance with the standards referenced in IEC 61162-1(2.1). The first bit is a start bit and is followed by data bits, least-significant-bit first.

The following parameters are used:

baud rate 4 800;
data bits 8 (D7 = 0),
parity none
stop bits 1

Once finished identifying all serial NMEA channels and continue by editing the Vessel Data block on the page Configuration>Vessel Data

IEC61996 states:A data block, defining the configuration of the VDR and (some of the compulsory) sensors to which the system is connected shall be written into the final recording medium during commissioning of the VDR. This configuration data shall be permanently retained in the final recording medium and protected from modification other than by a duly authorised person following any change to the configuration. Any change to the configuration of this data block shall not affect the recording of the mandatory items.

Step
10

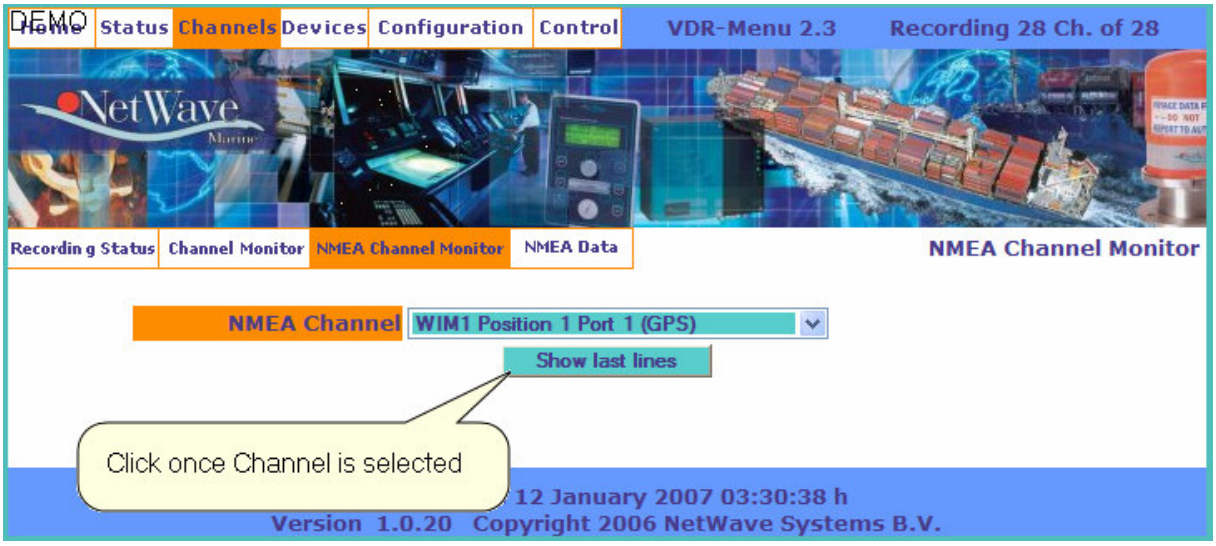
In the Configuration>Vessel Data page, provide the vessel's details as well as the serial (NMEA) channels where the Date/Time, Position and Heading information is derived from.

In order to secure providing correct input channels channels for Date, Time Position and Heading, you may choose to select the connected NMEA channels for them to contain the correct sentences.

To perform this check, refer to page Channels>NMEA monitor and select the appropriate channel and their contents.

From the NMEA sentences you may derive if you have selected the correct incoming NMEA channel to provide the VDR with the necessary data for Date & Time ($GPZDA), Position ($GPGGA or $GPGLL) and Heading ($xxHDT, $xxHDG, $xxOSG, or $xxVTG)

(xx= IEC61162-1 “Type of talker”, i.e. GPS, Compass, etc.)


DEMO
Home
Status
Channels
Devices
Configuration
Control
VDR-Menu 2.3
Recording 28 Ch. of 28
NetWave
Marine
Recordin g Status
Channel Monitor
NMEA Channel Monitor
NMEA Data
NMEA Channel Monitor
NMEA Channel
WIM1 Position 1 Port 1 (GPS)
Show last lines
Click once Channel is selected
12 January 2007 03:30:38 h
Version 1.0.20 Copyright 2006 NetWave Systems B.V.


Home
Status
Channels
Devices
Configuration
Control
VDR-Menu 2.3
Recording 28 Ch. of 28
NetWave
Marine
Recordin g Status
Channel Monitor
NMEA Channel Monitor
NMEA Data
NMEA Channel Monitor
NMEA Channel
WIM1 Position 1 Port 1 (GPS)
Show last lines
$GPGLL,0459.80145,N,00500.66525,W,033634.38,A*1B
$SDDPT,0.3,0.0*54
$WIMWV,0.0,T,0.0,N,A*25
$VWVLW,385.237,N,385.237,N*4C
testmessage*09
$GPRMC,033634.76,A,0459.80145,N,00500.66525,W,5.0,315.0,080107,0.0,W*53
$GPVTG,315.0,T,315.0,M,5.0,N,9.3,K*41
$GPZDA,033634.00,12,01,2007,00,00*60
$GPGGA,033634.08,0459.80145,N,00500.66525,W,1,12,2.0,100,M,100.0,M,,*5F
$HEHDT,000.0,T*2F
$RATTM,01,0.0,0.0,T,0.0,0.0,T,0.0,0.0,N,TARGET1,T,,033640.26,A*20
$GPGSA,A,3,01,02,03,04,05,06,07,08,09,10,11,12,2.0,2.0,2.0*3E
testmessage*09
$VWVLW,385.237,N,385.237,N*4C
$SDDPT,0.3,0.0*54
$WIMWV,0.0,T,0.0,N,A*25
$RATTM,01,0.0,0.0,T,0.0,0.0,T,0.0,0.0,N,TARGET1,T,,033641.41,A*20
$HEHDT,000.0,T*2F
$GPGLL,0459.80341,N,00500.66722,W,033636.58,A*1C
$GPRMC,033636.69,A,0459.80341,N,00500.66722,W,5.0,315.
Are the correct NMEA sentences within this channel ?
Systemdate: 12 January 2007 03:36:36 h
Version 1.0.20 Copyright 2006 NetWave Systems B.V.

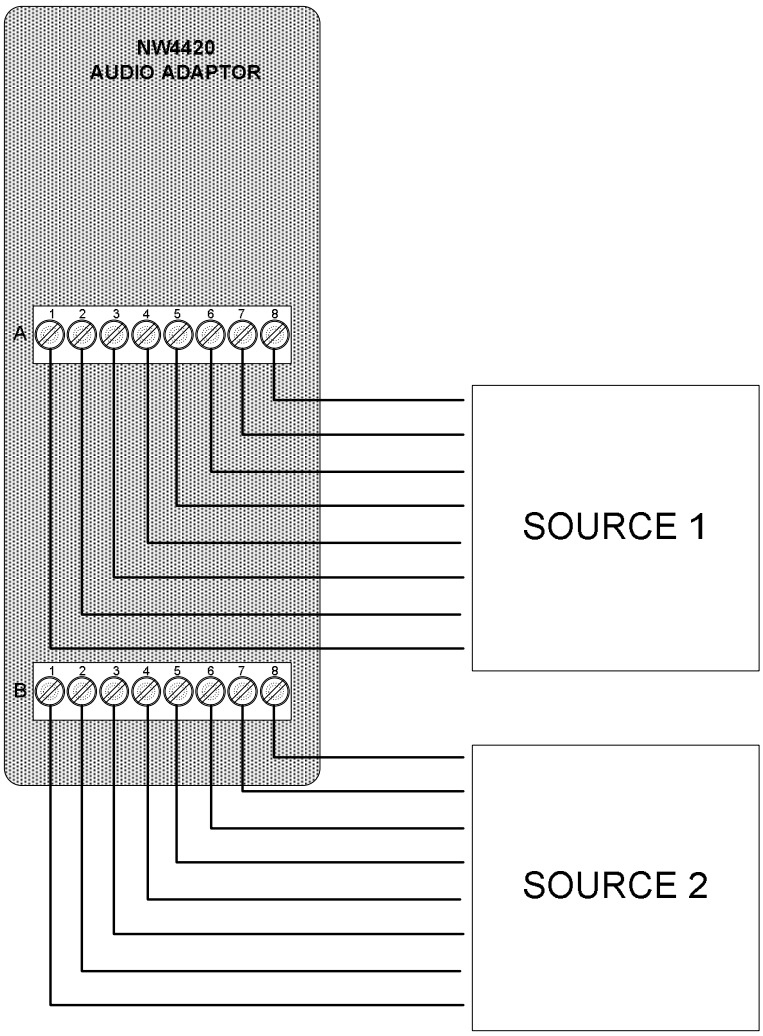
10.2.1 Configuring Audio Channels

Two audio generating sensors (Microphones or VHF line inputs) are paired into a single audio recording channel.

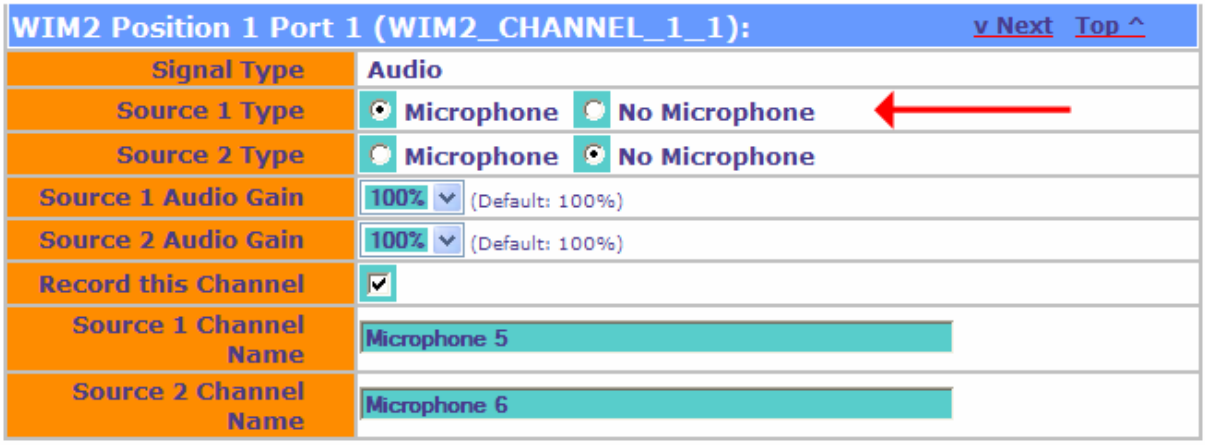
Microphones and VHF line inputs may not be intermixed, reason for which every recording channel is either defined to be of either a Microphone or of a VHF/Line input source type. Pay attention to the setting of the dip-switches on the printed-circuit board of the Audio adaptor, refer to section 2.7.1.1.

Source 1 Type, Source 2 Type

In order to perform Microphone-tests and monitor the working of the Microphones the Radio-Button has to be set to **Microphone** ONLY if a Microphone is connected to that particular audio-adaptor port.



If a Line Input is connected, such as for a VHF signal, **No Microphone must be selected** to avoid automatic testing of any non-existent microphones on this channel (and generating a subsequent alarm since no response is received from the microphone).



Record this Channel (Check-box)

If the VDR-System should capture and store the data of the signals received, then this Check-box should be selected.

Audio Gain (Combo-box)

The recording level of the Audio signal can be adjusted using the Audio Gain box. It can be set to the maximum value of 100% and the minimum value of 5%. The recording volume may be checked though the Playback software.

Channel Name (Text-box)

The name of the Channel, describing the source should be entered here. Regulations specify that this has to be filled in with a proper unambiguous description of the location from where this audio channel is being recorded. E.g. Bridge Wing Portside Microphone, Above Radar, Charttable, etc.

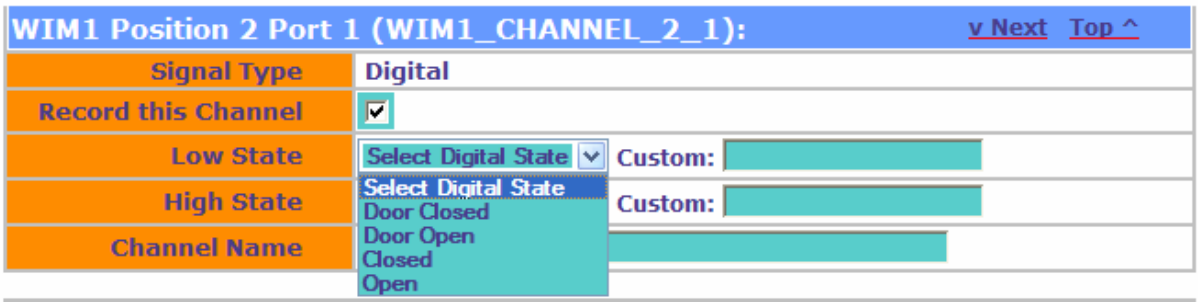
Remember to Save the configuration from time to time by scrolling to the bottom of the page and Clicking on the button

Save Channel Data Configuration

10.2.2 Configuring Digital Channels

Each digital channel records the discrete state (high,low,open,close, etc.) of any sensor-contact connected to it, with a sampling rate of more than once a second.

The naming of each discrete state is freely chosen by the installer, although some examples are already pre-defined (Door Closed, Door Open, Closed, Open)



The discrete state's Name will be presented upon playback of the recorded data.

As soon as a new name is defined for a discrete state (in the Custom field), that name becomes available in the drop-down list for future use within this VDR.

Record this Channel (Check-box)

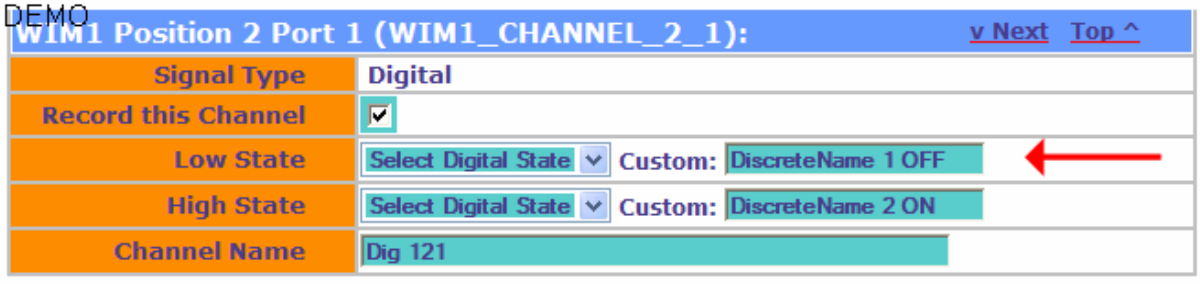
If the VDR-System should capture and store the data of the signal received, then this Check-box should be selected.

Low State – High State (Combo-boxes)

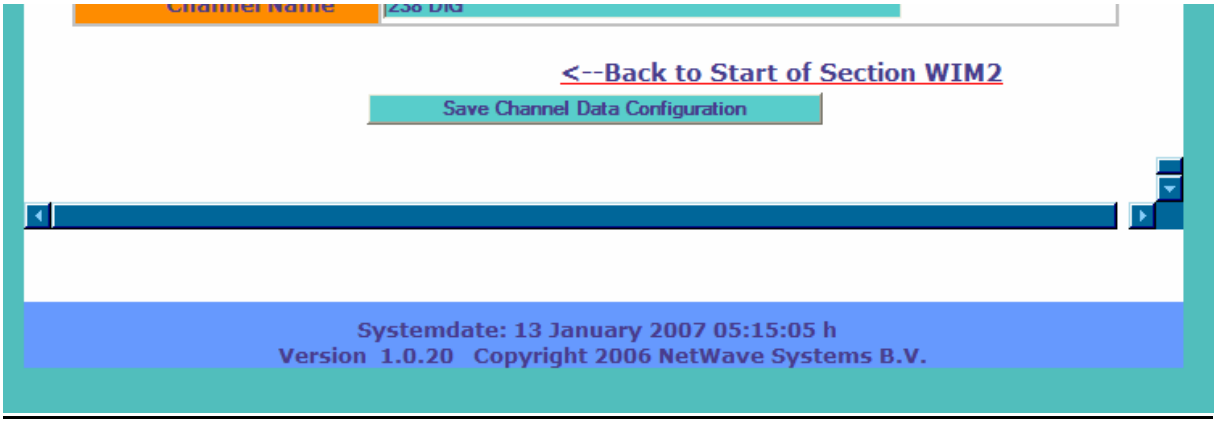
To indicate what the value (High/Low) of a digital state represents, this Combo-box contains a standard set of standard 'states'. If required this list can be extended by filling out the Custom field to the right side of it. Once a Custom field is added it will be added to the selectable 'standard set of states'.

Defining a new Name for a discrete state

Type the name into the Custom field



Save the new name(s) by going/scrolling to the bottom of the screen and Click “Save Channel Data Configuration”.



A message will appear, confirming that the data has been saved, where after the original screen will re-appear, and the newly defined names may be selected from the (now extended) drop-down table. These new entries cannot be removed.

Channel Name (Text-box)

The name of the Channel, describing the source can be entered here. Regulations specify that this has to be filled in with a proper unambiguous description of the signal being recorded. E.g. Fire Door 23

Remember to Save the configuration from time to time by scrolling to the bottom of the page and Clicking on the button

10.2.3 Configuring Analogue Channels

Analogue adaptors are available in different variations, i.e. 0-20 mA, -10/+10V, 0-10 V etcetera. Please refer to section 2.3.5 for the respective type-numbers

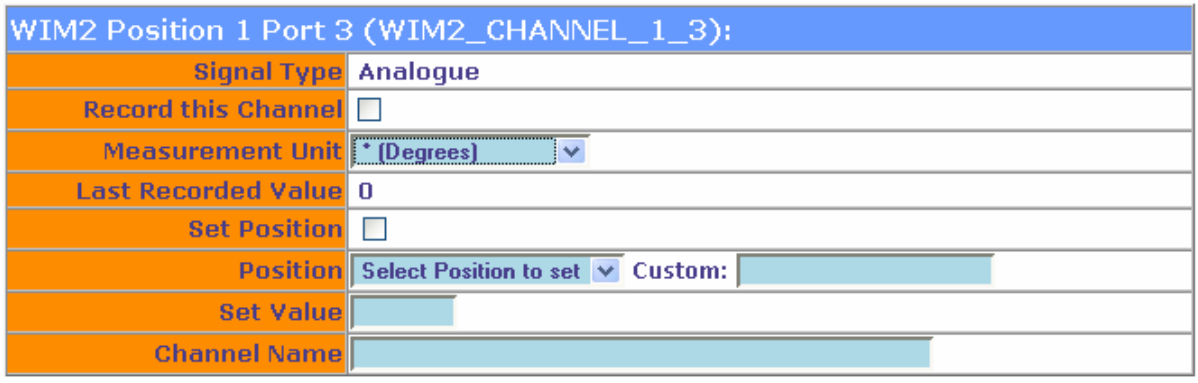
In order to accommodate analogue inputs for various types of sensors, the purpose and use of each analogue channel may (optionally) be defined.

In order to secure proper representation of the recorded signal levels, as well as the actual state of the equipment connected at any given value received, a definition may be entered by 'modeling' each channel.

On top of the above, in order to further enhance proper representation during playback, pre-determined values may be set at any given state of the equipment, thereby eliminating any non-lineair sensors being misinterpreted during the replay process.

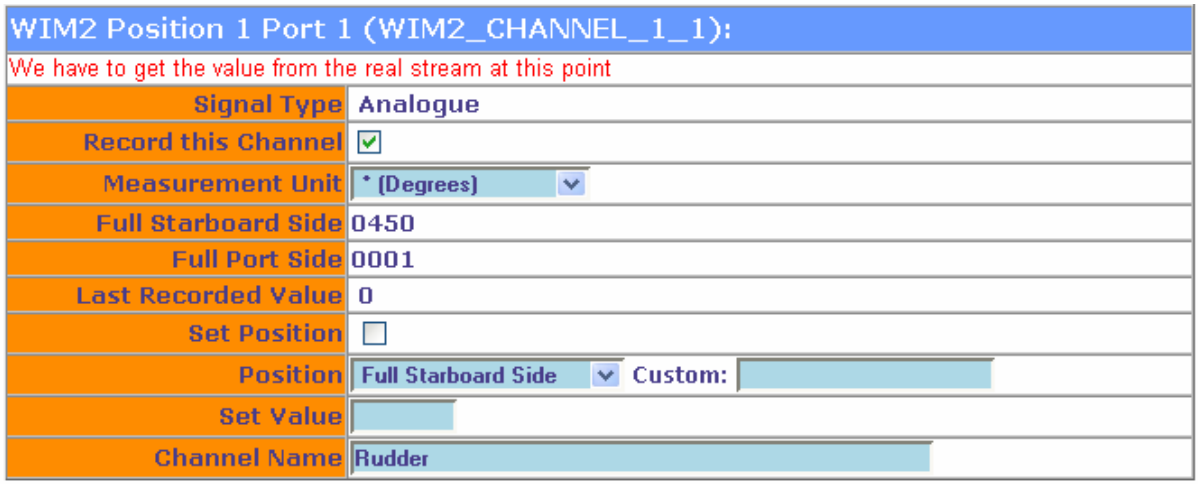
Example: a voltage is taken from an analogue rudder indicator. That voltage is applied to Port 3 of the analogue WaveNet adaptor within WIM2, mounted in adaptor position 1.

- By selecting Degrees as measurement unit, we indicate the Rudder position.
- Fill in the Channel Name to be 'Rudder'.



- Physically move the real rudder to Full Starboard
- Set Position to ON to indicate we will be fixing the rudder positing to the value received.
- Choose the Position drop-down table to be Full Starboard Side (or prepare a new Custom name for this setting),
- Set Value (belonging to the actual position of the Rudder) to the Last recorded value (as we now measure it) and Save that data by pressing the 'Save Channel Data Configuration' button at the bottom of the screen.

The system will check if any real values are being received during the saving process. An error message will occur if this is not the case.



Record this Channel (Check-box)

If the VDR-System should capture and store the data concerning the signal received, then this Check-box should be selected.

Measurement Unit (Combo-box)

The unit of measurement can be selected here with a Combo-box. Options are e.g. Knot, rpm, m/sec.

Last Recorded Value

The contents of the field displayed shows the last value that was recorded at the moment the Page was opened. Real-time values are maintained while in Installation Mode, while the page is refreshed.

Set Position (Check-box)

In order to relate a particular measured analogue value to a particular position of the measured sensor, this Check-box has to be selected as a confirmation that this has to be done. The relations are stored and are later used at replaying the recorded channels. The extremes of the Rudder Position can e.g. be captured here and also the middle-position. By interpolation in between the values the intermediate positions can be calculated. If required more reference-points can be set for enhanced precision at the moment of playback and analysis of the Channel data.

Position (Combo-box)

To indicate the relation in between a measured analogue value to a real position the right item can be selected in the Position Combo-box. If required other values indicated can be added in the Custom field behind it.

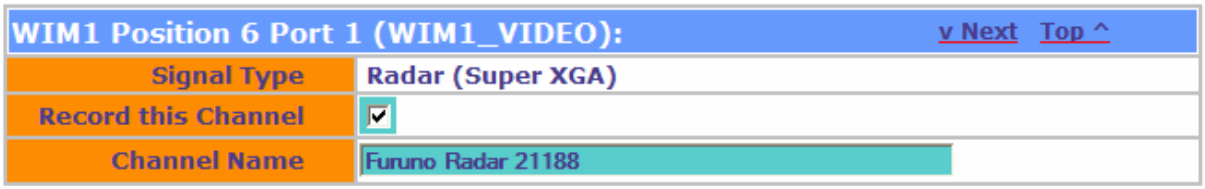
Set Value (Text-box)

The analogue value that corresponds to the Position Combo-box or Custom value has to be filled in. The value as displayed in *Last Recorded Value* can be used here, or the current value of the Channel as shown in the *Channel Value Monitor*, which is displayed when in 'Installation Mode'.

Channel Name (Text-box)

The name of the Channel, describing the source can be entered here. Regulations specify that this has to be filled in with a proper unambiguous description of the signal being recorded. E.g. Rudder.

10.2.4 Configuring the Radar channel



Record this Channel (Check-box)

If the VDR-System should capture and store the data of the radar video received, then this Check-box should be selected.

Channel Name (Text-box)

The name of the radar, describing the source can be entered here. Regulations specify that this has to be filled in with a proper unambiguous description of which radar is being recorded.

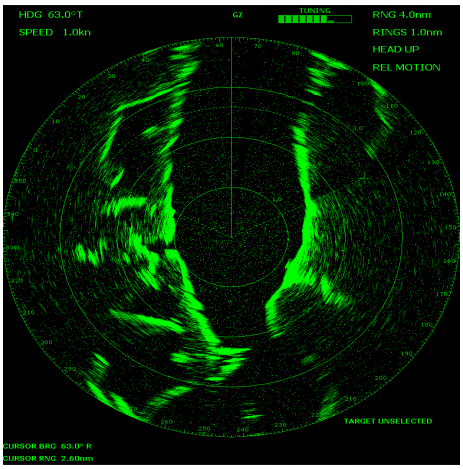
Remember to Save the configuration from time to time by scrolling to the bottom of the page and Clicking on the button

Save Channel Data Configuration

Step
11

10.3 Radar Video selection and tuning

The Radar Configuration page is used to select and configure the radar or other video inputs connected to the system. The Radar Configuration page allows the VDR to be configured to capture an accurate representation of the radar picture displayed on the primary ship's radar by setting various timing-, gain- and offset-parameters.



Many standard video modes used by radar manufacturers are supported directly by the VDR Setup and can be selected from a drop down list. However, if the radar video is not currently available from this list it may take around half an hour to optimise the capture parameters. In either case it will be necessary to adjust some of the configuration options to obtain optimal picture quality.

In the event a new type of radar is specified by the installer, the Radar-definitions file (RDEF.txt) may be downloaded (from the VDR) by the installer and uploaded to the NetWave website. For access to this website a password may be obtained by sending an email to:

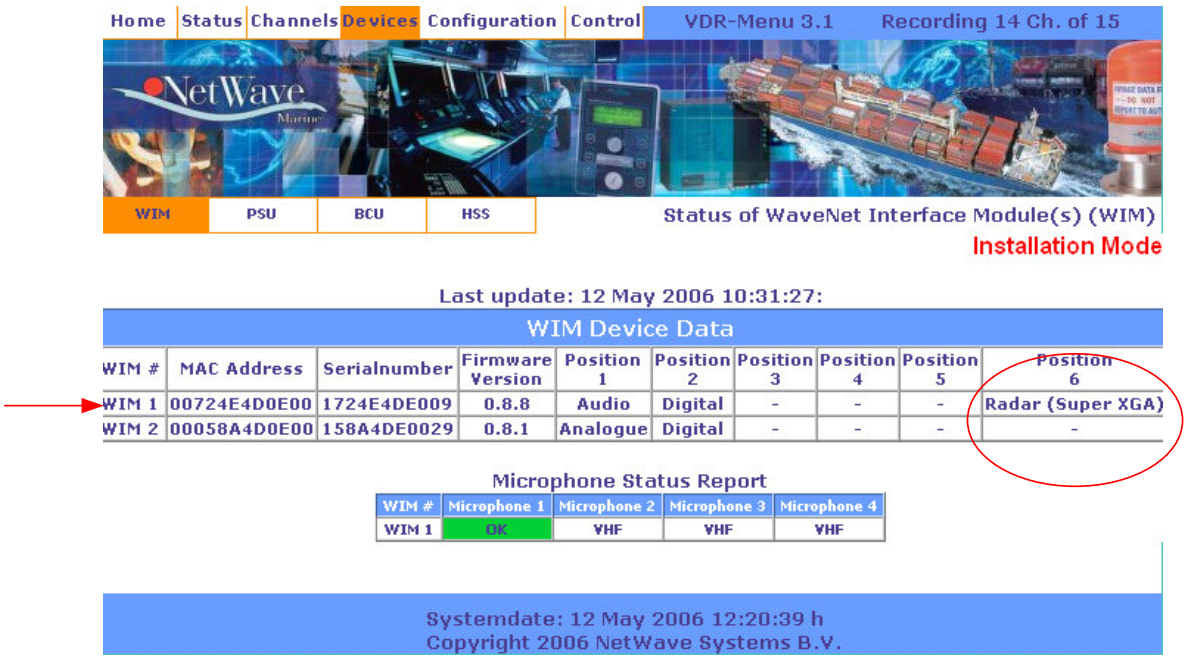
techsupport@netwavesystems.com

Also, the latest versions of these files may be obtained there, to be used for subsequent installations.

10.2.4.1 Radar Configuration Page

NOTE:The video capture is best set-up when the radar video to be captured is displaying a test-card image.

To configure the radar interface, first check in which WIM the radar-video adaptor is installed



Note the WIM_number where the radar adaptor is mounted (in this example WIM1)

Goto the ***Configuration>Radar page***, and, from the drop-down table, select the WIM where the Radar Video adaptor is located.

10.2.4.2 Obtaining a captured image

To obtain a captured image, it is necessary to first set the fundamental capture parameters to allow a image of the radar video to be captured, as follows:

Select the proper radar video signal resolution in the line 'Video Mode' to

VGA	800 x 600 dpi (dots per inch)
XGA	1024 x 768 dpi
S(upper) XGA	1280 x 1024
U(ltra) XGA	1600 x 1200

Press the ***Save Parameters and Update WIM*** button

Wait while the server instructs the WIM to upload an uncompressed video image to the browser. This may take up to 20 seconds depending upon the resolution set and the complexity of the image.

This image is decompressed from the recorded file, therefore represents the quality and correctness of the image whenever replayed on the playback software.

This function eliminates the need to use the playback software and to download subsequent images in order to adjust the settings.

NOTE: Due to minor variations in the timing of the video signals it may be necessary to adjust the horizontal and vertical offsets even if the radar video is providing a standard video mode. The objective is to adjust the time at which samples of the radar video are taken so that individual pixels are captured and to adjust brightness and colour balance of the entire image. Ideally the radar should be set to display a test image consisting of alternate black and white single pixel wide vertical lines (this often forms part of a generic test image).

Several attempts will be required but it is good practise to use the following sequence;

Video Mode

VESA standard resolutions for the specific radar.

Divisor

PLL Divisor (Def. 1687)

The PLL divisor is dependant upon the horizontal resolution.

Typical value for 1280x1024 is 1687. For 1600x1200, start with 2100

PLL Timing Chart					
		Horizontal[2]			
Mode	Resolution	Nominal Frequency Hs	Sync Polarity	PLL Divider[1] N+1	Nominal Pixel Clock (MHz)
VGA	640x480 @ 60 Hz	31.469	N	800	25.175
	640x480 @ 72 Hz	37.861	N	832	31.500
	640x480 @ 75 Hz	37.500	N	840	31.500
	640x480 @ 85 Hz	43.269	N	832	36.000
SVGA	800x600 @ 56 Hz	35.156	N/P	1024	36.000
	800x600 @ 60 Hz	37.879	P	1056	40.000
	800x600 @ 72 Hz	48.077	P	1040	50.000
	800x600 @ 75 Hz	46.875	P	1056	49.500
	800x600 @ 85 Hz	53.674	P	1048	56.250
XGA	1024x768 @ 60 Hz	48.363	N	1344	65.000
	1024x768 @ 70 Hz	56.476	N	1328	75.000
	1024x768 @ 75 Hz	60.023	P	1312	78.750
	1024x768 @ 80 Hz	64.000	P	1336	85.500
	1024x768 @ 85 Hz	68.677	P	1376	94.50
SXGA	1280x1024 @ 60 Hz	64.000	P	1688	108.000
	1280x1024 @ 75 Hz	80.000	P	1688	135.000

Offset

Red Offset (Def. 128)
Green Offset (Def. 128)
Blue Offset (Def. 128)

Adjust where required to obtain the best clarity and sharpness.

Gain

The following definitions are applicable for the Gain settings to be made;

Red Gain (Def. 128)
Green Gain (Def. 128)
Blue Gain (Def. 128)

The gain is to be manually adjusted to the highest level of brightness without distorting the image.

Other settings

Phase Adjust (Def. 80)
Clamp Placement (Def. 20)
Clamp Duration (Def. 20)

These 3 settings are normally not to be adjusted. Refer to the radar manual to obtain the correct settings when required.

Switch Columns (Def. No)

This setting is only relevant at frequencies of 85Hz. If text parts of the images are unreadable, some columns may be erroneously switched. This may be corrected by this setting. In later s/w versions this option will not be available in which case this function will be performed fully automated by the VDR.

11. Saving or Retrieving the VDR Configuration

Once the Commissioning process is finished, you may save the then current configuration by proving a unique name to it in the Configuration Description line, and Clicking on the butten Save Current Configuration in Repository".

If required, any previous configuration may be restored by selecting it from the drop-down list and Clicking "Reset Configuration".

12. Alarms and Warnings

12.1 General

Alarms and/or Warnings are visually generated on the Bridge Control Unit.

When an Alarm condition occurs, the display changes to indicate the cause of the alarm, the ALARM LED (at the ACK(knowledge button) lights and an audible buzzer is activated to call for the crew's attention.

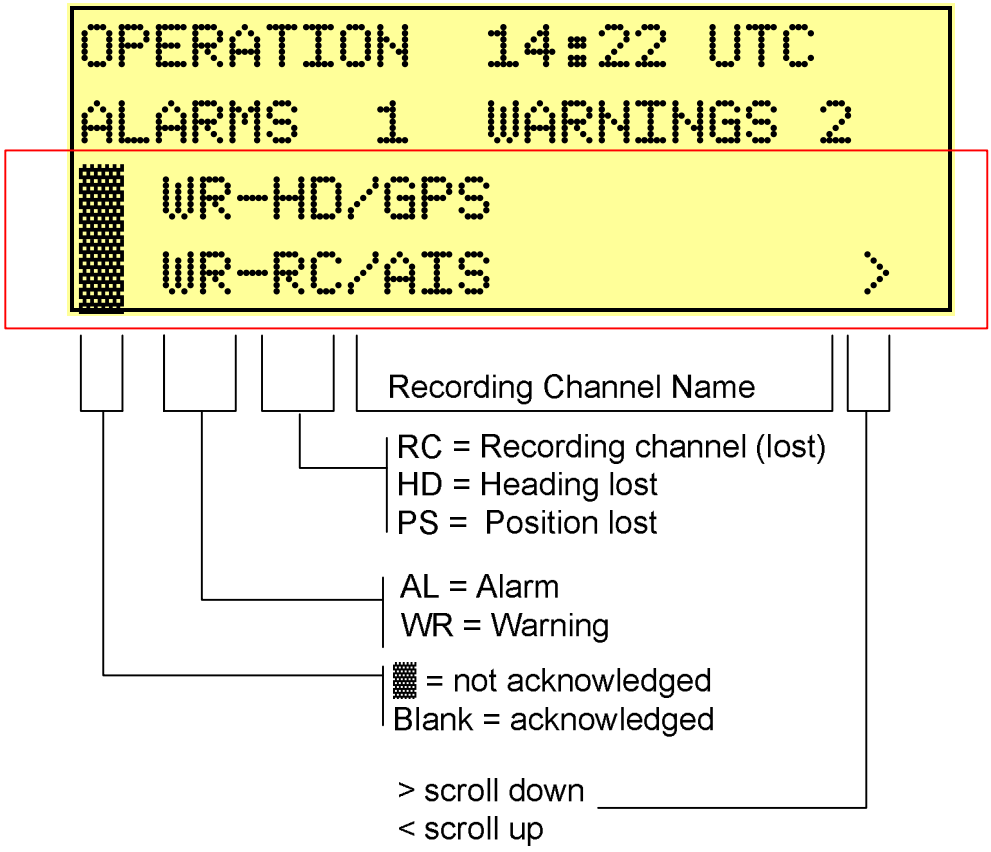
To silence the buzzer, press the ALARM ACKNOWLEDGE (ACK) button.

Until the cause for the Alarm is resolved, the ALARM led remains lit and the display will continue to show the relevant Message.
Once the Warning or Alarm is acknowledged by the crew, the display will delete a black square ay the left-hand side of that specific Alarm or Warning message to indicate the receipt.

The Alarm or Warning message will disappear automatically once this Message is both Acknowledged as well as the cause for the Alarm or Warning is resolved (the cause is non-existent anymore).

12.2 Alarm and Warnings display

The alarm messages, displayed in the 2 bottom lines of the display are constructed as follows;



12. 3 Navigating thru the Alarms and Warnings

By using the jog-dial button, two functions are available if any alarm or warning is active:

Turning the jog-dial will scroll thru the list of current warnings or alarms if there are more then two available which is visible by the presence or absence of the **>** sign in the bottom right hand corner of the display.
Pressing the jog-dial button, more detailed information about the alarm becomes available in a secondary display screen-page.

NB. If the BCU keys or the jog-dial button are not active for more than 20 seconds the display will return to it's normal state.

12. 4 Alarms and Warnings messages

12.4.1 Power Failure (ALARM)

Any power source which has been available at system start-up and which is disconnected (or looses its power) thereafter will generate a Power Failure alarm.

If both of the primary power sources (230 VAC or 24VDC) are lost, the battery-backup mechanism will secure continued operation of the VDR. In order to preserve power, after a short delay the WIMs not serving any audio-recording function will be switched off, as will the video-adaptor in (any) WIM will simultaneously be switched off.

In battery-backup mode, the VDR will continue to operate for 2 hours, after which time the VDR will switch off until normal power is restored.

12.4.2 Recording Channels (WARNING)

If any of the ***designated channels*** looses its signal a Warning will be presented, including the source (channel name) of that signal.

Designated Channels are those which have been set to active and therefore have to be recorded. (at the Configuration>Channel Data page by selecting the "Record this channel" box with a checkmark)

Warnings will be generated for each individual serial NMEA channel, audio channels (microphones), as well as for radar video, whereas for analogue and digital channels, a Warning will be generated when the hardware-adaptor becomes dysfunctional.

12.4.3 Units or devices (WARNING)

In the event of network-absence or malfunction of any hardware device a Warning s generated. These Warnings relate to communications errors (HSS server), temperature overflow, absence of power, memory storage space, etc.

12.4.4 Radar video data (WARNING)

In the event of absence or malfunction of the video adaptor or the radar video signal, a Warning s generated with the exception of the instance where the VDR is in the battery-back-up mode and the video adaptor is automatically switched off by the system.

12.4.5 Time reference (ALARM)

In the event the designated external Time reference (as set in the Configuration>Vessel Data – Date or Time Source channel) is lost, an Alarm will be generated. The VDR will continue to operate from its internal system-clock, which is regularly synchronised with the Time reference when available.

12.4.6 Position Information (ALARM)

In the event the designated external Position reference (as set in the Configuration>Vessel Data – Position Source channel) is lost, an Alarm will be generated.

12.4.7 Heading Information lost (ALARM)

In the event the designated external Heading device's signal (as set in the Configuration>Vessel Data – Heading Source channel) is lost, an Alarm will be generated.

12.4.8 Microphone errors (ALARM)

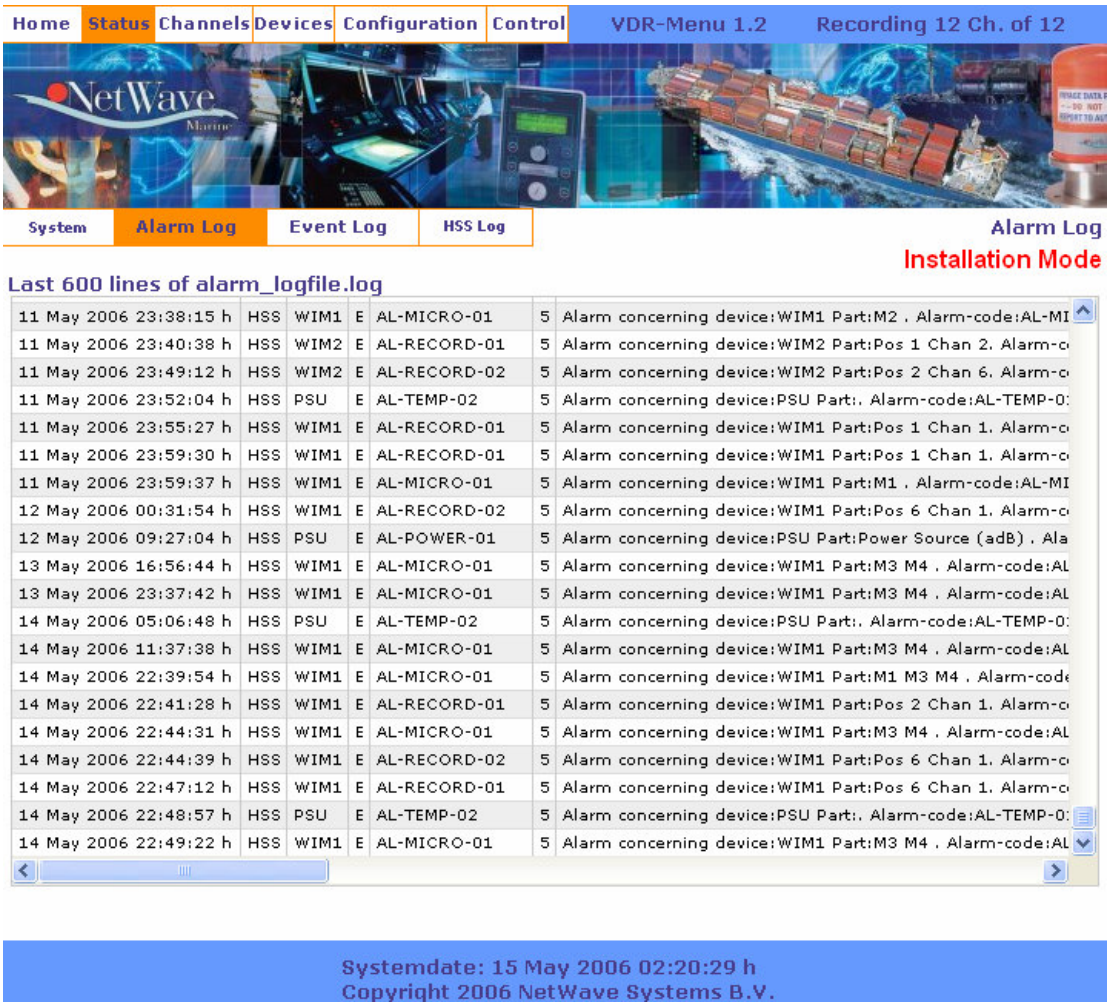
Will occur if any of the microphones becomes dysfunctional. Every microphone is automatically tested every 12 hours.

12.4.9 Recording function / Memory Storage errors (ALARM)

In the event the system is either unable to read from data recently written into the protected memory (HSS server-capsule), a data volume becomes unavailable, or any data volume has an overflow, an Alarm will be generated.

13. Alarms and Warnings Log

The Alarms log is accessible from the Status>Alarm Log page and provides an overview of the Alarms generated on the Bridge Control Unit*. This log is mainly intended to support Service and/or Annual survey activities.



*in order to preserve storage space, the number of lines is limited to the 600 most recent alarm- or warning messages.

14. System Monitoring

The VDR systems maintains records of all relevant events in separate files stored within the protected memory capsule, which may be viewed thru the browser or downloaded by making use of the functionality on the Home Page.

Recording- and/or incoming data may be monitored by making use of the Channel Monitor for Analogue and Digital Data, or the NMEA Channel and Data Monitor.

In order to monitor values of any Analogue or Digital channels, the system must be placed in Installation Mode. (refer to section 9.4.2)

14.1 Event Log

The event log provides information about specific occurrences of defined events;

1. Start/Stop of the system and booting sequences
2. Operator initiated status changes (Normal vs. Installation mode)
3. Microphone checks performed (every 12 hours)

14.2 Access Log

The access log shows which successful access instances have occurred to enter into the restricted area of the VDR system.

15. Security

IMO regulations require the VDR to be protected against tampering and to administer all access and configuration attempts. This implemented is as follows;

- Everyone has access the “HOME’ and ‘Status’ pages without providing any password.
- Everyone is able to download Replay software
- The pages Configuration are accessible by providing the Installer password, which defaults to ‘nw220654’.
- Any higher level Control functions may only be performed after consultation with the factory.

15.1 Password Protection

Some functions and screens are password protected. If access is required you will see the message

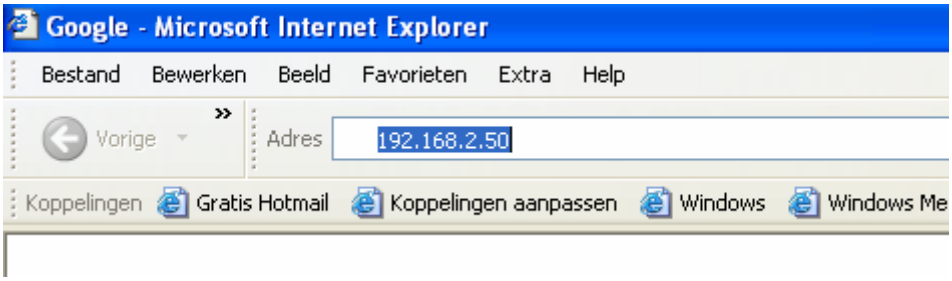
Current Accesslevel 'Basic Accesslevel' is not sufficient to use this function.
The password for 'Installation and Service Accesslevel' is required.

In this case use the password: *nw220654*

16. Downloading Recorded Data

At the PC, open the browser utility (Internet Explorer, Mozilla Firefox, etc.) and in the address-bar of the browser, enter the IP-address of the NetWave VDR system and press “Enter.

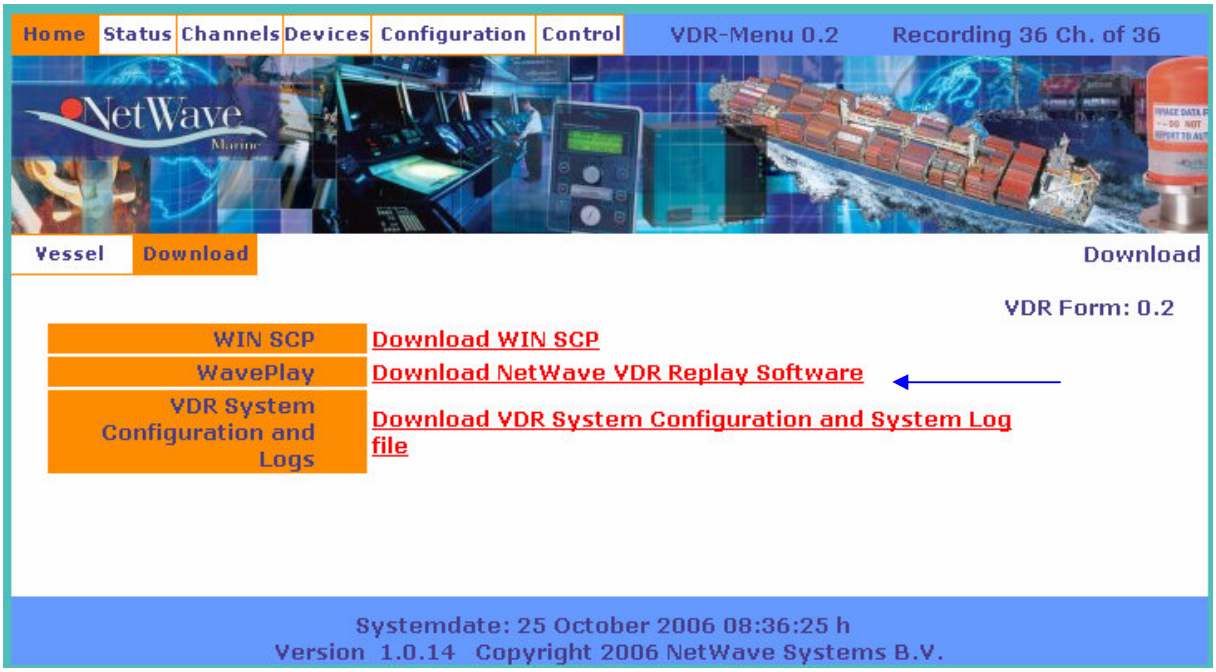
192.168.2.50



You will arrive at Form 0.0, the ‘HOME-page” of the VDR

16.1 Downloading WavePlay replay software

Refer to the Page Home>Download



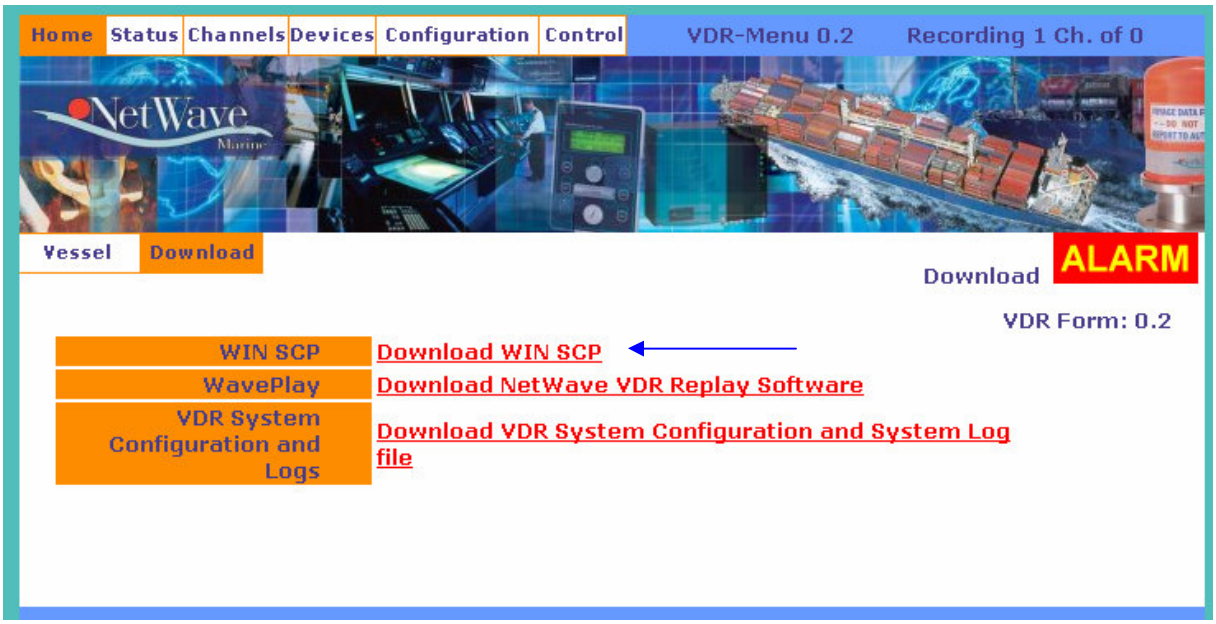
Choose to “Download NetWave VDR Replay software”

Execute the file, the software will install automatically on the connected PC/laptop.

16.2 Downloading data from the VDR

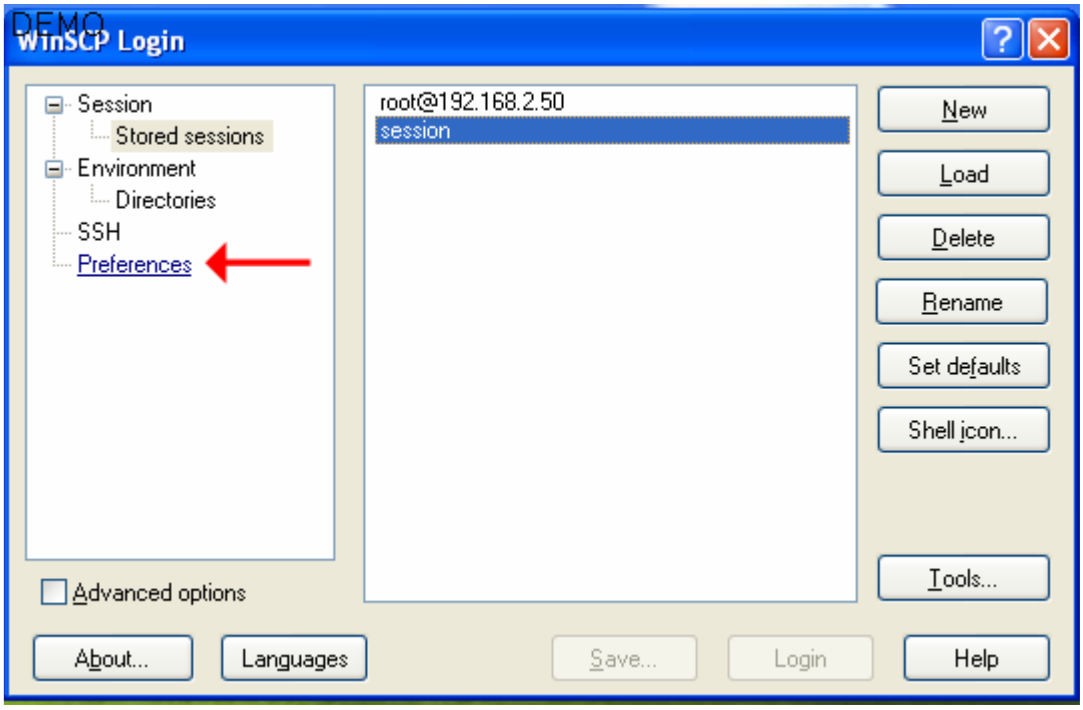
Before you can do any Replay activities, you need to transfer the data from the VDR onto the PC/laptop.

To download recorded data from the VDR, you need to use an installable program called “WinSCP” which is also to be downloaded from the HOME>DOWNLOAD page.

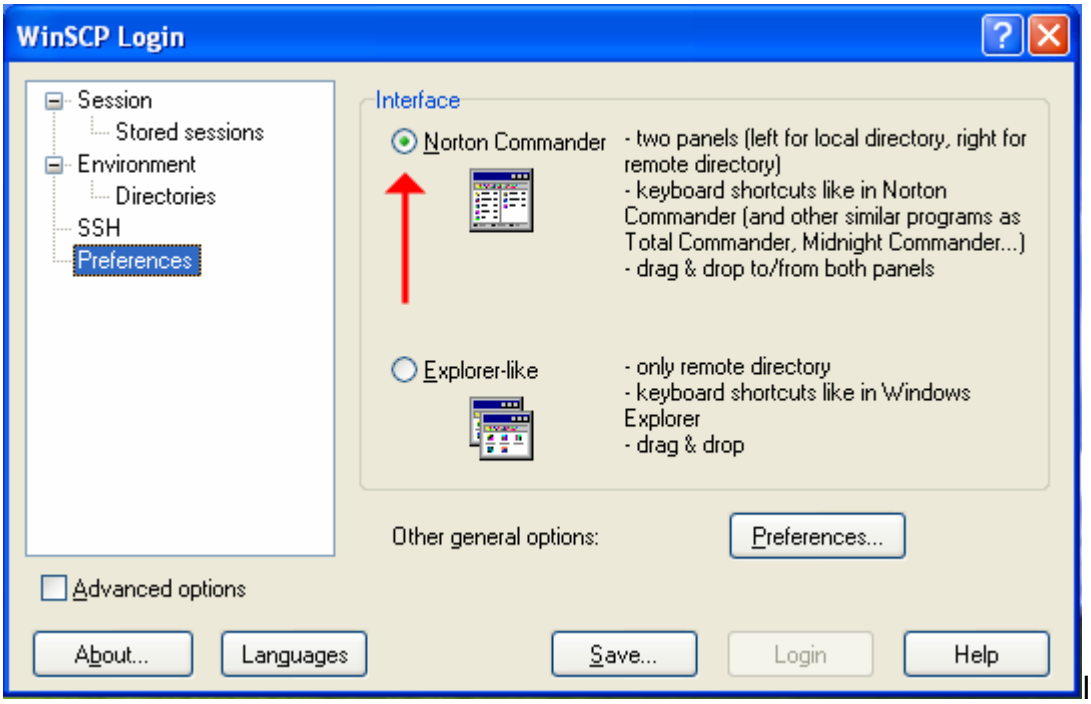


Download and execute this program by choosing “Download WIN SCP” from the HOME>DOWNLOAD page.

Run the installation program and you will arrive at the login screen (as shown below)

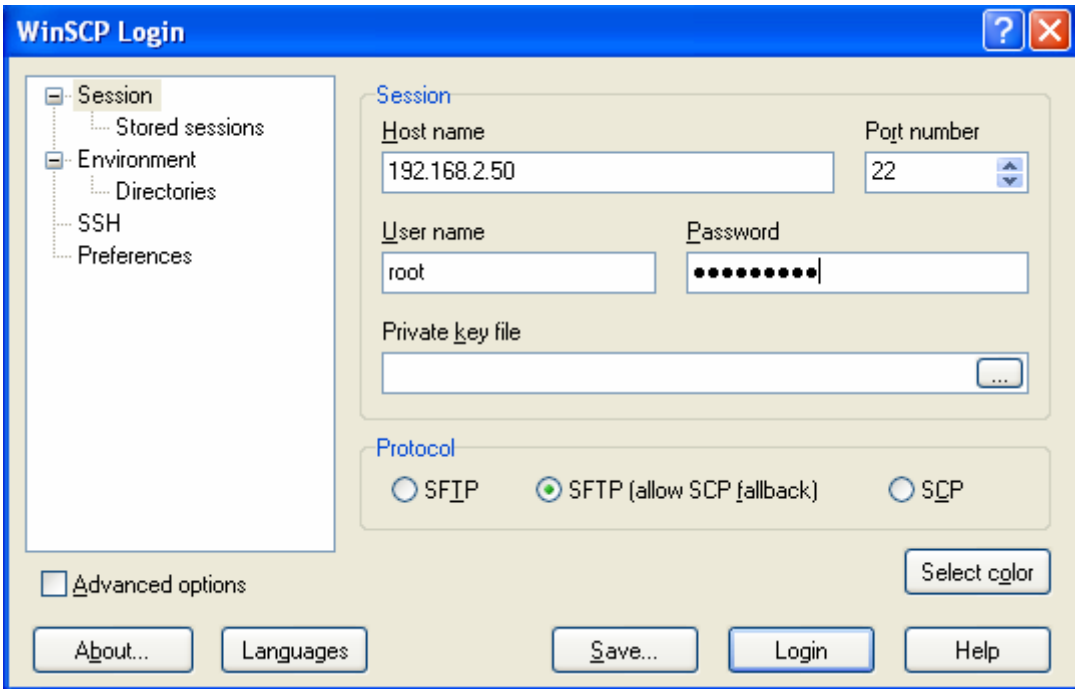


By selecting ‘Preferences”at the left side of the screen, you will have the option to select Norton Commander to obtain 2 panels with disk volumes. Save this setting for future use.



If you

When use this program for the first time, Select “New”” and you will arrive on the following screen:

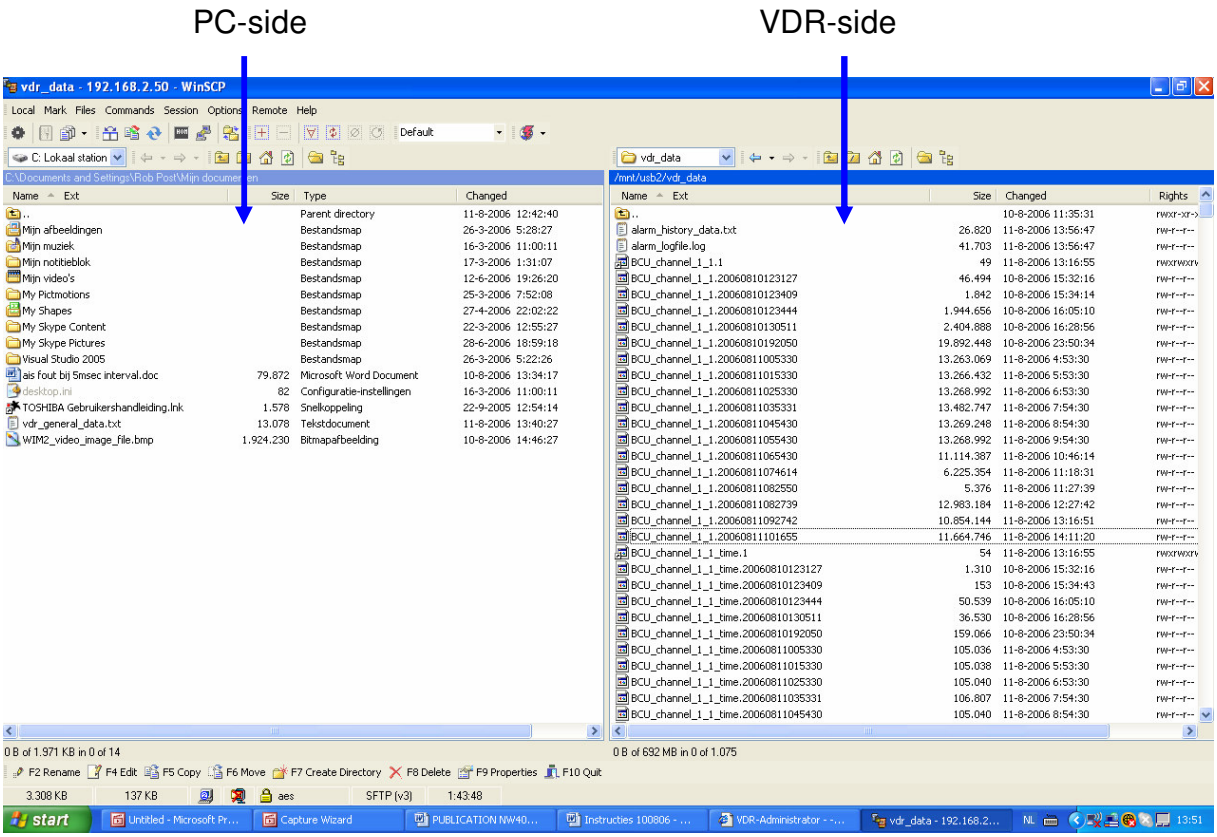


In the field “Host name”, enter the (VDR) IP address: 192.168.2.50 and provide the

User name: root
Password: nwstorage

Select “SFTP (allow SCP fallback)” as Protocol and press “Login”

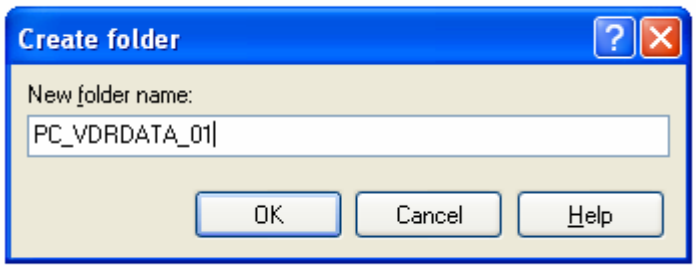
You will arrive in the VDR data storage directories, which are visible on the following screen;



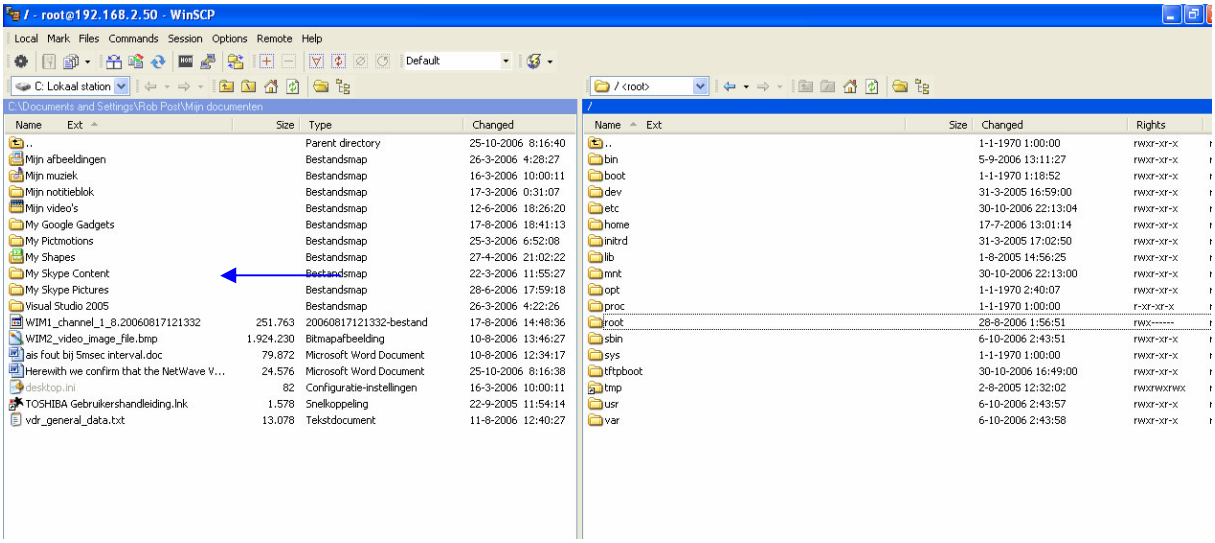
The left hand side of the screen represents your local (PC)directory, the right hand side shows the data and directory structure on the VDR.

Select the left hand side (where you see your PC's subdirectories) by mouse-clicking anywhere into this area, and prepare a dedicated subdirectory where you will store the recorded VDR files by pressing (function-key) F7.

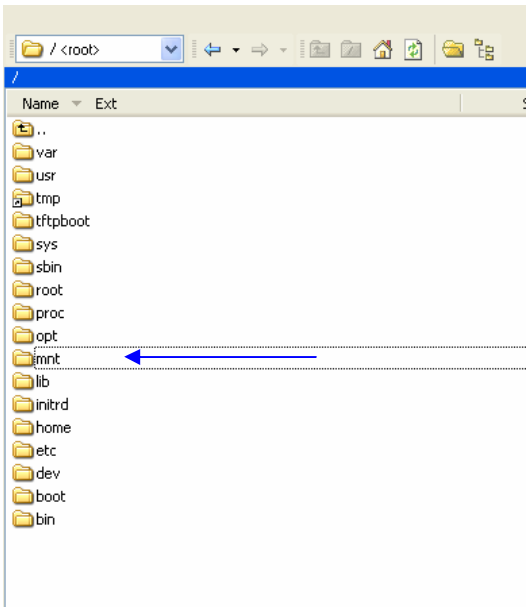
An example name could be "PC_VDRDATA_01"

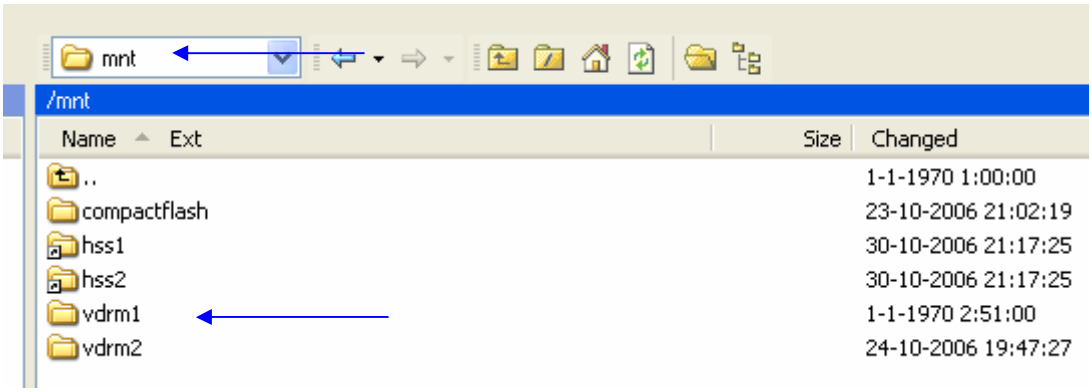


On your PC, you should now be able to see these directories.



On the (right hand) VDR screen, now select the primairy data volume which is stored in the subdirectory: **/root/mnt/vdrm1/vdr_data** by double-clicking with the mouse on the directory structure.

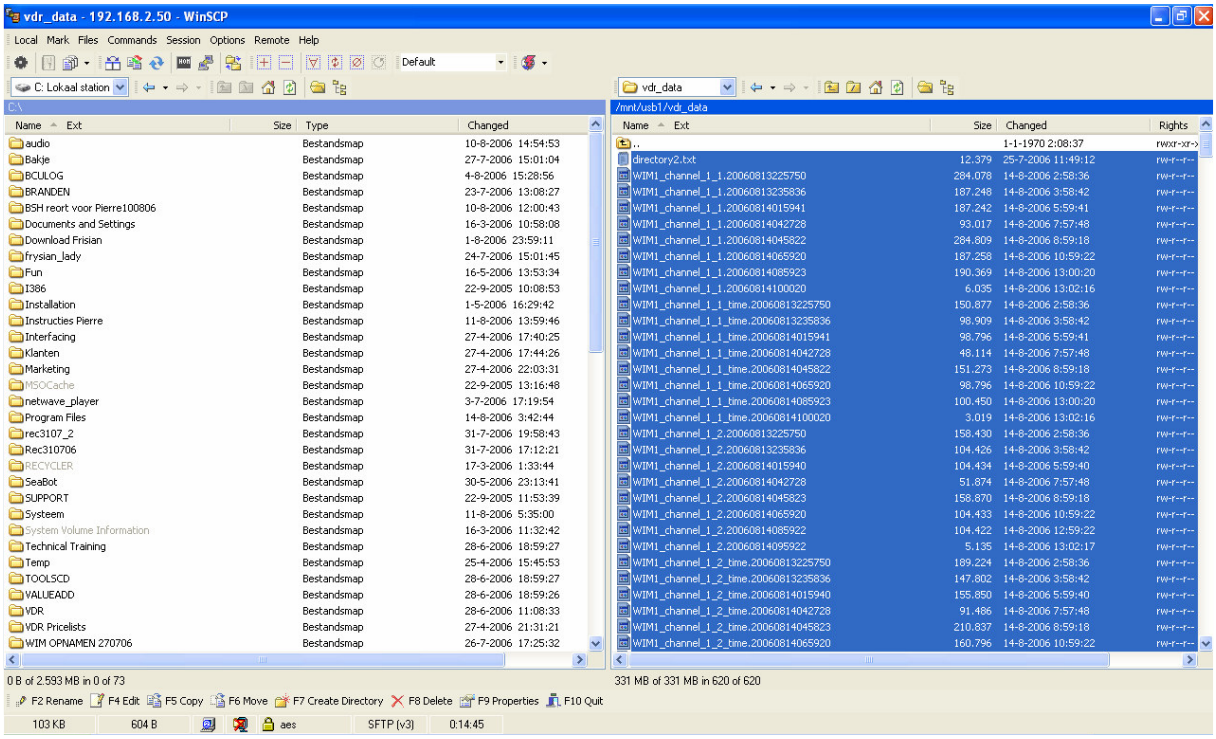




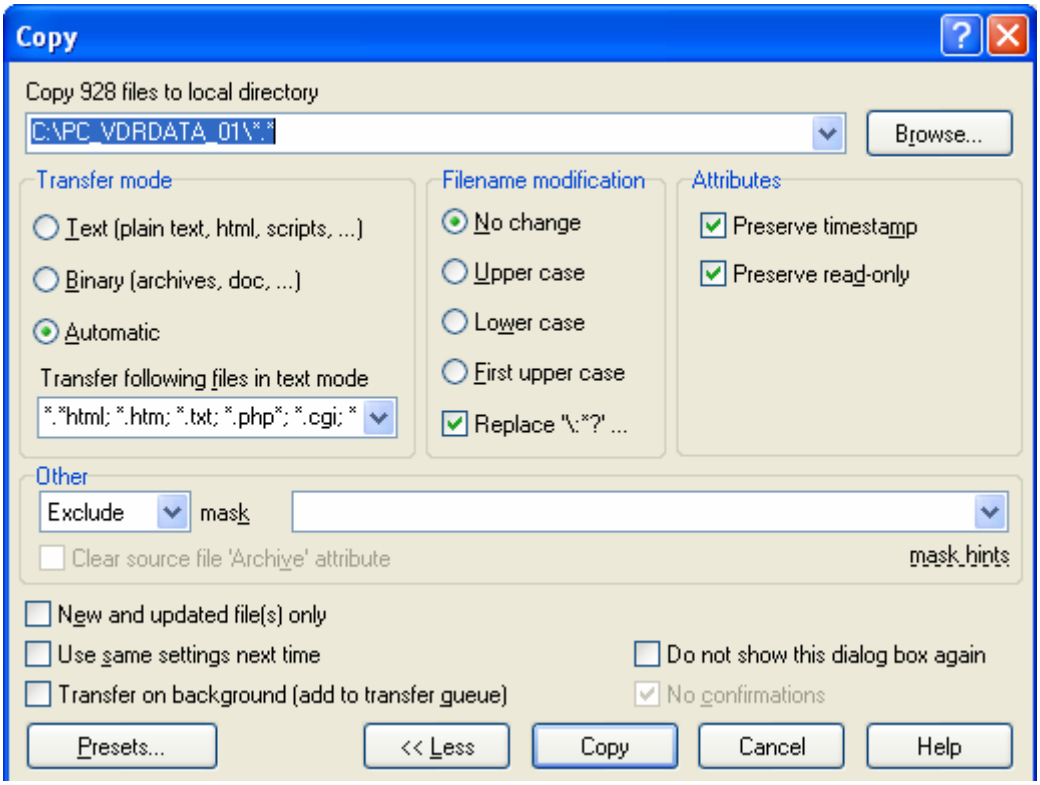
NB. You will repeat this process on the secondary data volume called **/root/mnt/vdrm2/vdr_data** later.

Once you arrive into in the subdirectory **mnt/vdrm1/vdr_data**, select **all** files at the right hand side of the screen and drag them to the left hand portion of the screen, into the new subdirectory you have created, to copy them to your local PC.

You may select **all** files from the Menu Bar by choosing Mark and Select Files



Drag all selected files (now in blue color) into the subdirectory you have created to store the VDR Data on your PC. The following screen will open, and you must select Copy to start this process.



Once the copying process, which may take up to 60 minutes, depending upon the data volume (number and characteristics of channels recorded) within the capsule is finished, you will continue by repeating these steps with the secondary volume called **/root/mnt/vdrm2/vdr_data.**

Copy this volume into the same subdirectory on the PC.
(the example: PC_VDRDATA_01)

Once you have finished both the primairy **(/root/mnt/vdrm1vdr_data)** and secondairy data volume **(/root/mnt/vdrm2/vdr_data)** from the capsule onto the PC you may start to review the data with the WavePlay replay software.

Refer to the Manual NW-4000-50 “WavePlay – VDR replay software User Manual”

17. Bridge Control Unit – Operator Manual

17.1 General

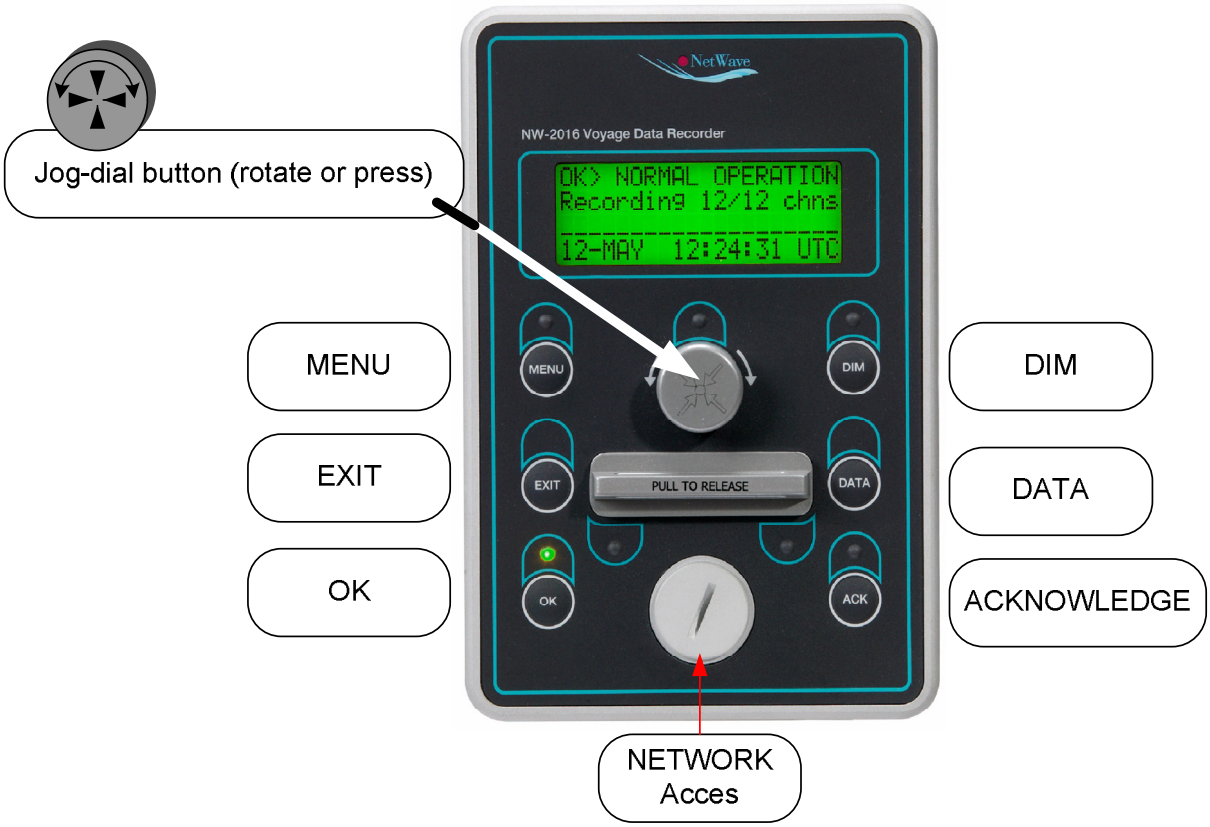
This Operation Manual assumes the VDR to be fully installed and commissioned, and therefore merely relates to units which may be operated – by the crew - during normal navigation.

Therefore, contrary to informative day-to-day user-interaction, any functionality which might interrupt (i.e. perform a system reset) or change the normal recording functionality is password protected.

The Bridge Control Unit (BCU) has the following functionality;

- Alarm device
- Test functions
- Report System Events History
- Report VDR Alarms History
- Reset VDR Devices
- Check VDR Alarm history

17.2.1 BCU Display and Keyboard functionality



17.2.2 BCU display

The BCU has a dot matrix display, buttons and indicator lamps (LED) of which the functionality is as follows;

Display: During Normal Operation (the VDR is recording) the display indicates the recording status, the number of channels from which the VDR is currently recording, as well as the time as received from the GPS.

When the User chooses to perform actions, the display serves as the User Interface.

17.2.3 VDR Network Access Port

The BCU incorporates one network port (standard RJ-45 ethernet connector) to which any PC may be connected to perform installation and commissioning activities, or to download data recorded by the VDR. Refer to the relevant pages relating to Installation or Data download for further information.

17.2.4 Push-button functions

Press

MENU	- selects to go into the system Menu
EXIT	- single function, return to Normal display
OK	- confirmation of choice or re-confirm 'high impact' operation
DIM	- to set light intensity and contrast for the display and keyboard
DATA	- to make a 'snapshot' of the memory within the protected capsule
ACK	- to acknowledge / confirm any Alarm generated by the VDR

17.2.5 Rotating Button functions (Jog-dial)

Turn and Press to Select

The round middle button may both be turned to select from multiple values presented on the display, and may also be pressed in order to select ('Enter') the desired value.

17.2.6 Indicator lamp functions

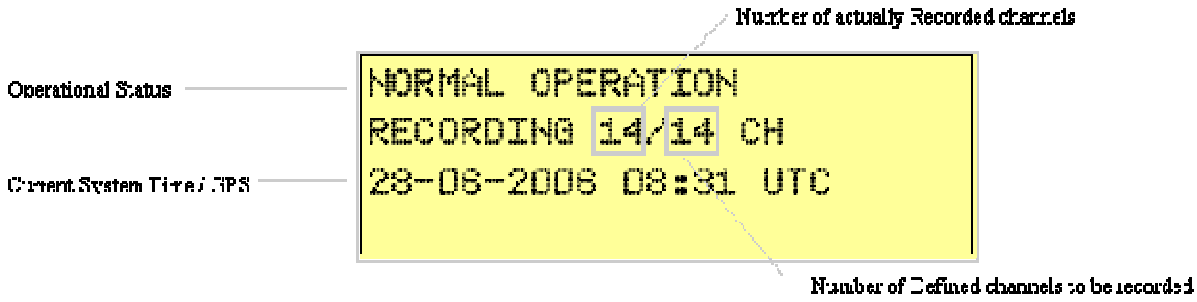
MENU	- indicates the System Menu to be active and selectable
OK	- blinks if re-confirmation from the user is required
DIM	- is lit when the light intensity of the keyboard or the display are being set by the user
ACK	- This LED is lit continuously when an alarm requires user acknowledgement (blinks) or the VDR system has unresolved alarms currently active (fixed ON)

The indicator lamp above the rotating (jog-dial) button indicates this button to be active and ready for the user to dial and/or press.

17.3. Operating the Bridge Control Unit

During Normal operation, the VDR operates fully automatic, even in the case where a power failure has occurred (lasting not longer than the prescribed power battery back-up time, being two hours).

As a result, no user interaction is required, other than to ACK(nowlegde) any Warning or Alarm occurring, if at all. These messages are generated whenever the recording function – of relevant signals - is not operating as normal, or the system encounters any other malfunction or irregularity.

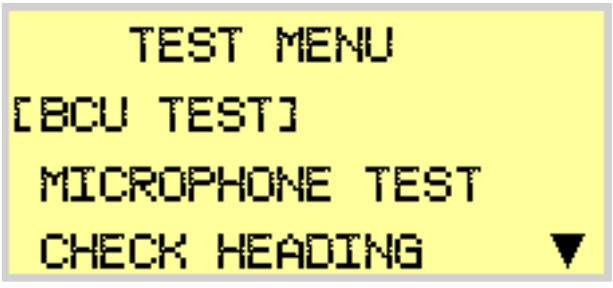


17.4. Bridge Control Unit Menu selection

Press the Menu Button

The display will change to:

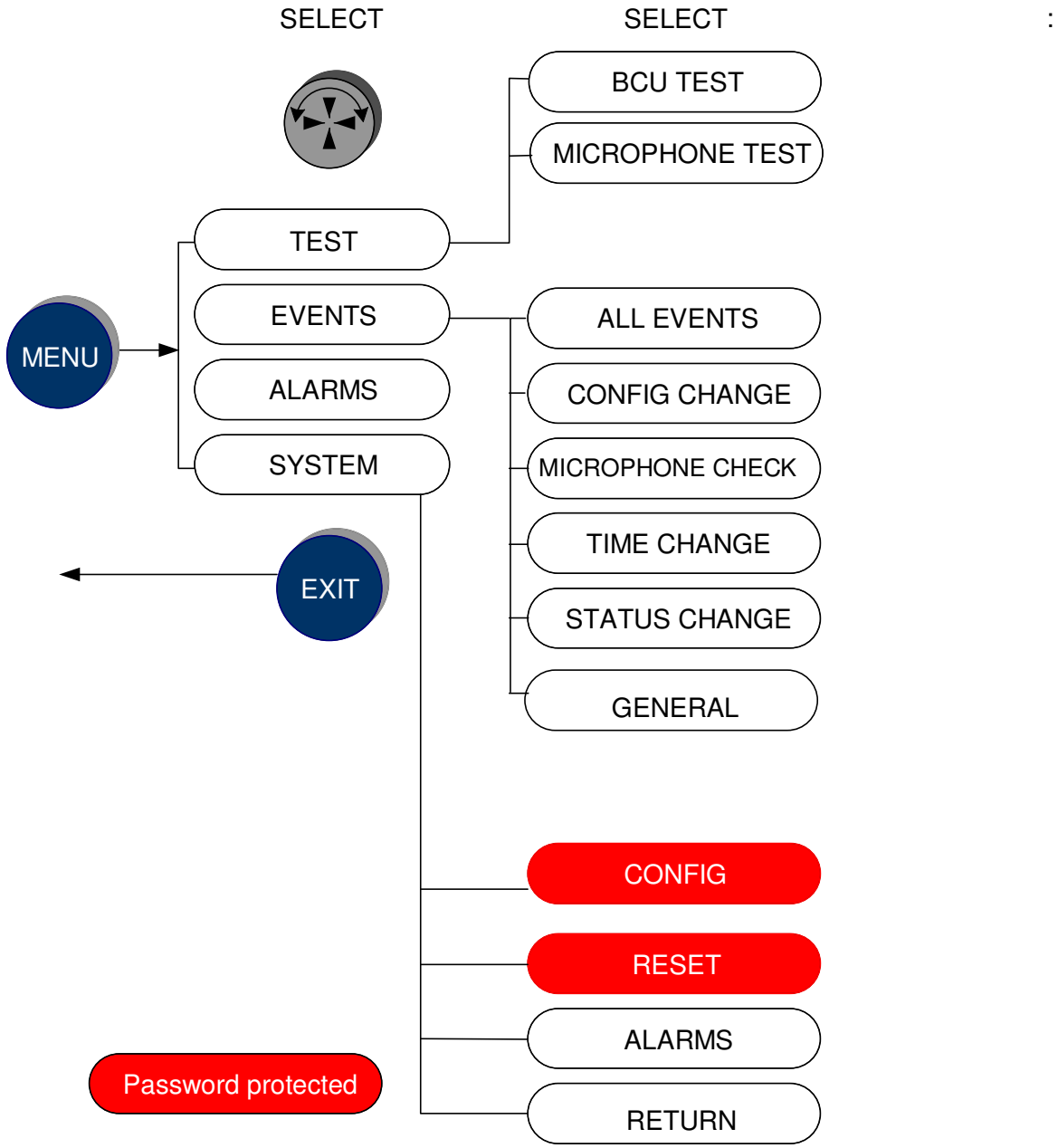
Select the Menu of choice between the [brackets] by turning the jog-dial button to select a different Menu choice, and/or press that button to go into the selected item.



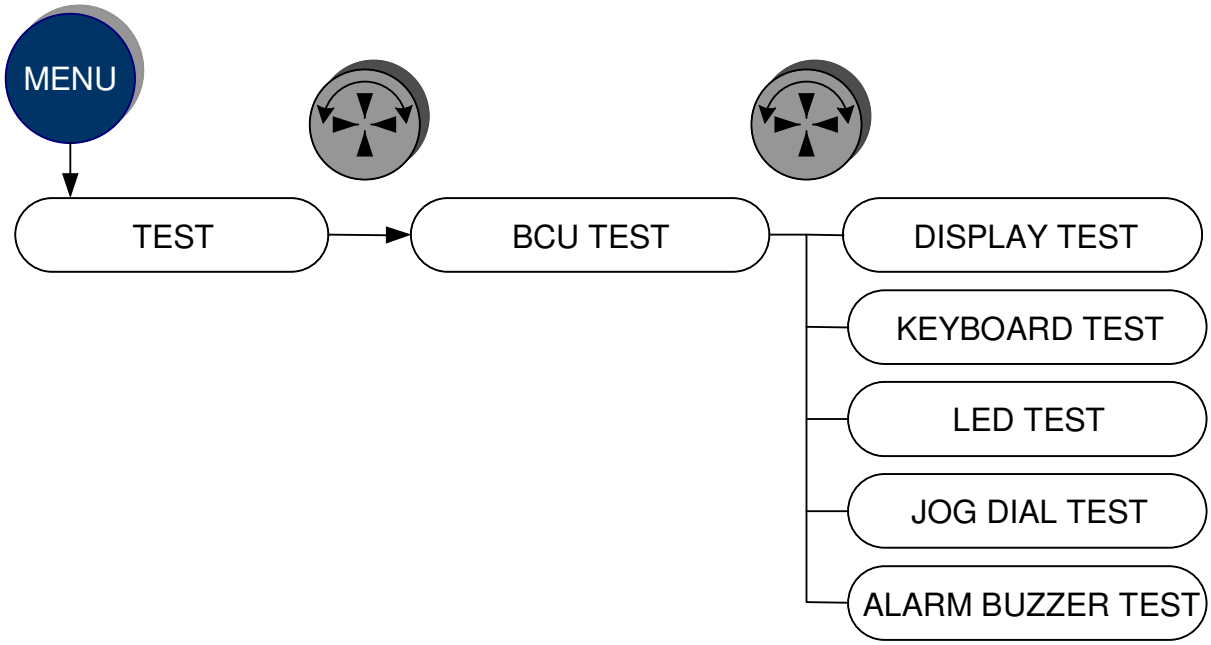
If the number of lines in the display is limiting the then visible number of choices, a ‘scroll’ arrow (on the right bottom side of the display) will appear.

If you want to return to the Normal screen, exiting all Menus, then press EXIT

17.5. Bridge Control Unit Menus and Functionality Overview

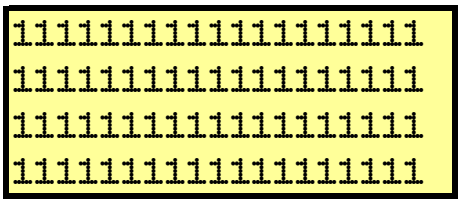


17.5.0 Test Menu - BCU Test



17.5.1 Display Test

The display test allows checking of each characters' presentation to be verified on every position of the 4x20 line display. Dial the Jog-dial to present all characters from the alphabet and check if all positions on the display are correctly representing the character.



17.5.2 Keyboard Test

The display shows which buttons to press to verify proper functioning of the keyboard.
Press each button to verify that the BCU asks for the next button. If the test fails, replace the BCU.

17.5.3 LED Test

By showing each LED to be lit in consecutive order, it may be verified that all leds are functional. If the test fails, replace the BCU.

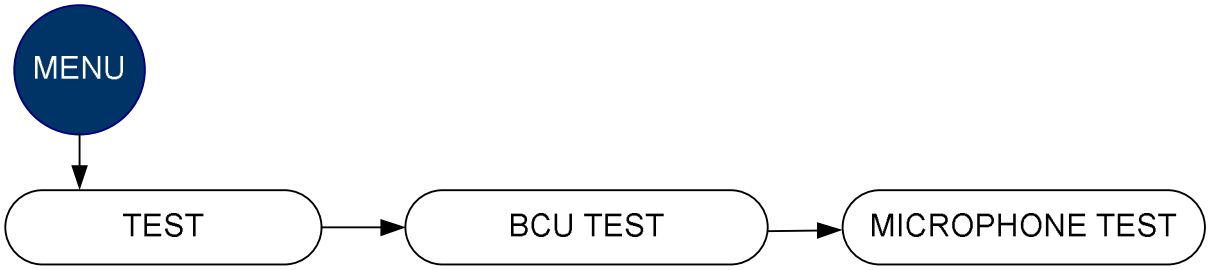
17.5.4 Jog Dial Test

Rotate the Jog-dial into the indicated direction to verify proper functioning. If the test fails replace the BCU.

17.5.5 Audible Alarm test

In order to test the audible buzzer on the BCU, choose the last menu option in the row by turning the jog/dial clock/wise and press this Menu option. If you do not hear the buzzer, replace the BCU. The volume is IEC60945 compliant and cannot be changed.

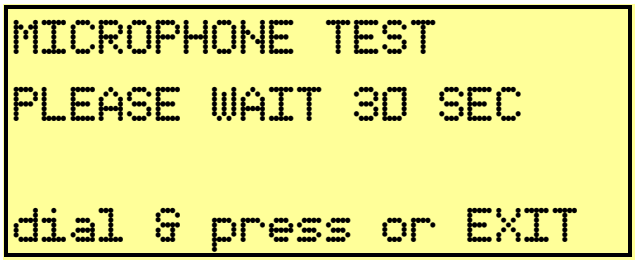
17.5.1 Menu Test - Microphone test



The microphone test checks if all microphones physically present and defined as to be recorded during Configuration to be recording (refer to Section 10.2 of the Installation Manual to select/unselect recording channels), are available and functioning properly.

The test is performed as follows;

The BCU instructs the VDR system to start to 'manually' perform this check immediately, which is normally (as per the IEC61996 Performance Standards) carried out automatically every 12 hours as well.



The test checks if the microphone is present and functioning properly by sending a (short, unobtrusive, hardly audible) test-tone to the microphone, which has a small loudspeaker integrated into its casing.

The tone received by the microphone is analysed for the correct frequency and duration and – provided the test is successful - the system will report the microphone(s)to be present and to be functioning normally.

Any errors will be reported on the same display screen.

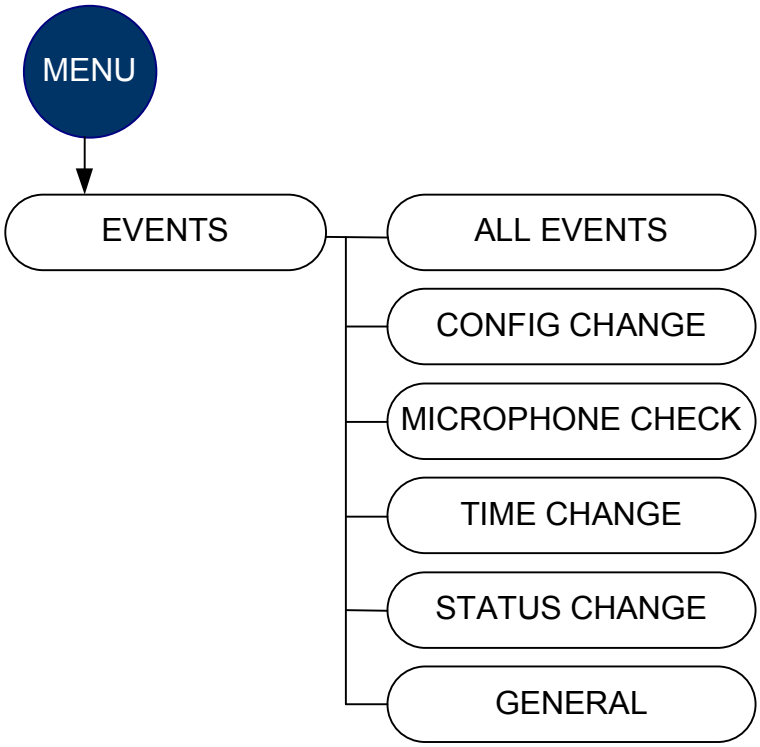
```
MICROPHONE TEST
WIM1   MIC 1 OK
       MIC 2 OK
dial or EXIT
```

If any microphones fail, it will be indicated which recording channels and specific microphones are affected.

Any malfunctions should be reported for service!

In any case; check wiring from the microphone to the relevant WaveNet Interface module and audio adaptor.

17.5.3 Menu Events



This Menu options allows a quick-view of several occurrences within the VDR. It is mainly intended for Service and quick fact finding.

17.5.3.1. All Events

All Events sequentially lists all events in an intermixed fashion (as itemised below). Events are presented in a backwards time order, latest events are presented first.

17.5.3.2 Config(uration) Change

Configuration Change reports when the VDRs configuration was last changed.

17.5.3.3 Microphone check

reports the last time when this test was performed, either automatically or initiated Manually (see chapter 5.1)

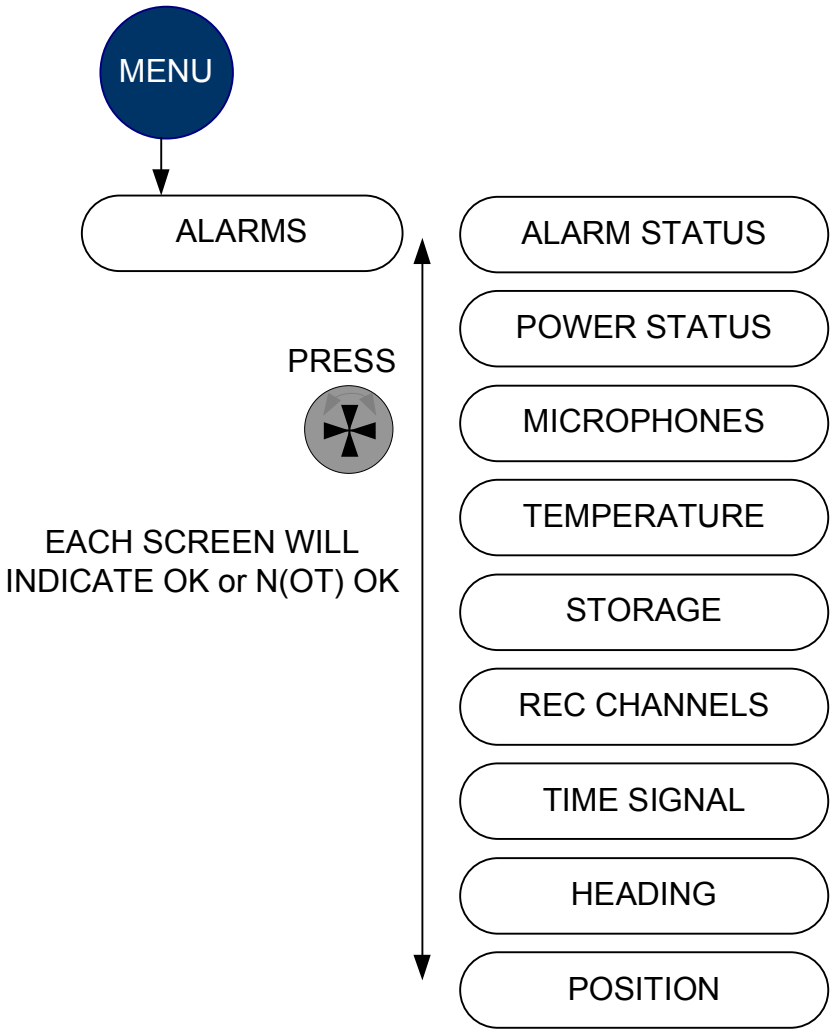
17.5.3.4 Time change

Time Change reports when the VDR system Clock was updated (corrected) by the connected GPS (or other EPFS).

17.5.3.4 Status change
shows when the VDR was placed from Installation Mode in Operational Mode or the other way around.

17.5.4 Menu Alarms

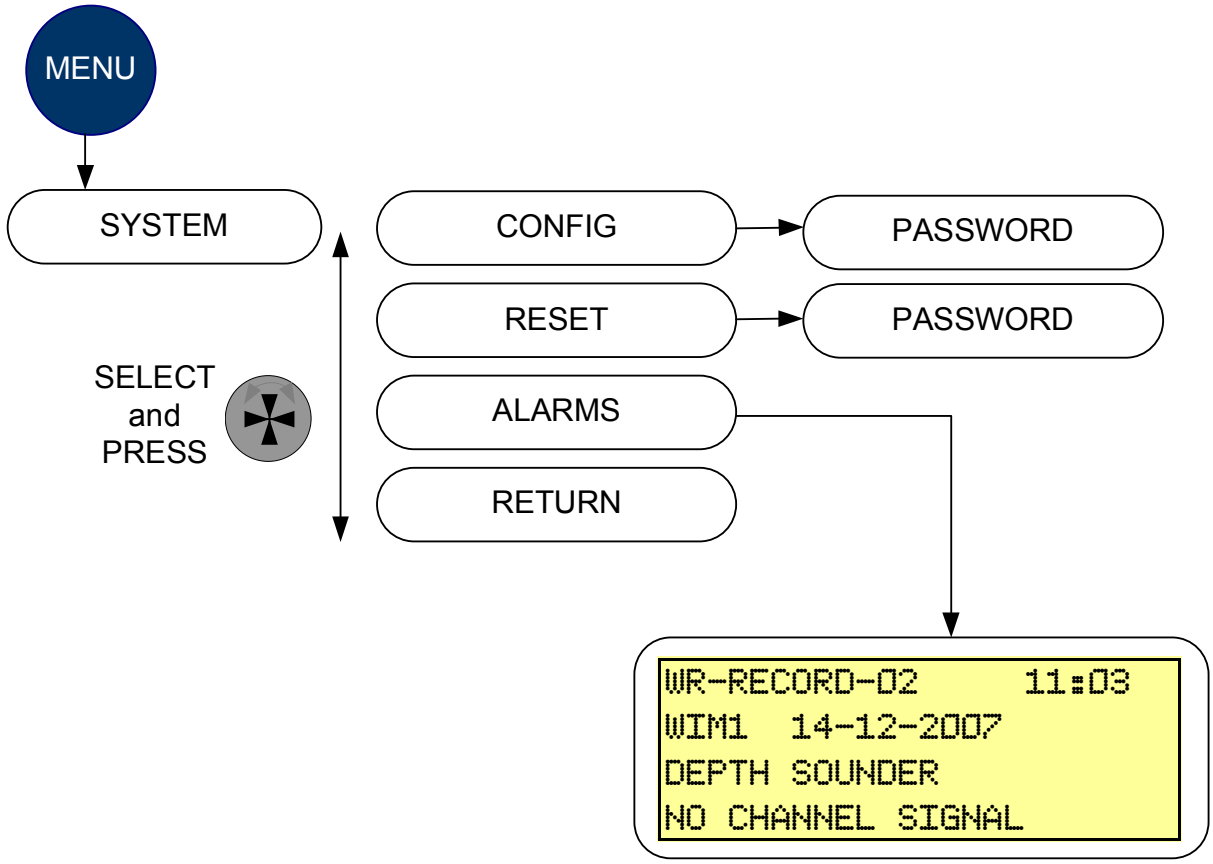
In this Menu-option, each individual Alarm **current status** is shown by an OK or N(ot) OK indicator. Scrolling thru the (available items for) Alarms is performed by pressing the jog-dial button.



17.5.5 Menu System

In this Menu-option, system access is provided for the following functions which are partially password protected*. The Password is **TER**, which may be entered by dialing the jog-dial and pressing it once the correct characters are selected.

CONFIG* - allows to configure several devices
RESET* - allows to reset individual devices
ALARMS - provides detailed information on (past) Alarms
RETURN - returns to previous Menu



18. Software version control

Although the VDR consists or various software parts, the complete set of the firmware residing in the system refers to the VDR software -version or –package.

The current software version (package) of the VDR system may always be checked by pushing the OK button on the BCU.

To perform software updates of specific items (firmware), refer to specific Service Bulletin accompanying the software package.

19. Maintenance

The VDR requires a minimum of maintenance, but batteries and some mechanical issues relating to the HSS capsule must be attended to on an annual basis.

19.1 Batteries (PSU)

The batteries reside in the PSU and require to be tested annually.

1. Remove both covers from the PSU
2. Disconnect the VDR from any primary power source (220VAC and/or 24 DC. Wait for the Power failure alarm and acknowledge this by pressing the ACK button on the BCU.
3. Wait 5 minutes
4. Measure (by making use of a DC volt-meter) the voltage over the + and – poles of the (set of) batteries not to be lower than 23,5 Volts. If the voltage reads lower, replace the batteries.
5. To replace the batteries, ensure the mains power input to the PSU is switched off or disconnected by other means

19.2 Glands and seals (HSS)

The capsule-assembly needs to be visually inspected for signs of corrosion or water ingress and for proper colourisation.

1. Check if the colourisation (bright orange) and adhesives on the capsule are clearly visible and in proper order. If not, use spare-kit NW411
2. Remove the capsule form the deckmount by unleashing the release mechanism
3. Check for water-ingress on top of the CPU unit and remove the connector from the top of the CPU assembly. An alarm will be generated on the BCU (Storage unavailable), which may be acknowledged.
    a. If any water-ingress is detected, replace the seals with spare-kit NW4112, making use of the accompanying instructions.
4. Remove the CPU unit from the deckmount by removing the 6 screws and lifting the unit up.
    a. If any water-ingress into the deckmount is detected, replace the seals with spare-kit NW4112, making use of the accompanying instructions.

19.3 Underwater Locator beacon (HSS)

The beacon must be inspected for corrosion and battery fitness and/or expiration date.

1. For the maintenance and survey of the beacon, refer to the manual for the specific beacon, which is one of three models;
    a. DUKANE DK480 or DK485
    b. BENTHOS ELP-362 D

19.4 Annual Performance Test

19.4.1 General

In accordance with Regulation 18 of SOLAS Chapter V, NetWave Systems BV or one of their agents will need to attend the vessel to carry out an Annual Performance Test (APT) on either the VDR or the S-VDR system. Regardless of Flag State the NetWave VDR Annual Performance Test is carried out in accordance with the Marine Coastguard Agency (MCA) tests detailed in their Marine Guidance Note MGN 272(M).

The APT is comprised of a comprehensive test of the VDR's performance, including the integrity of the connected sensors and recording channels.

The APT is largely to be performed from within the web-interface of the VDR.

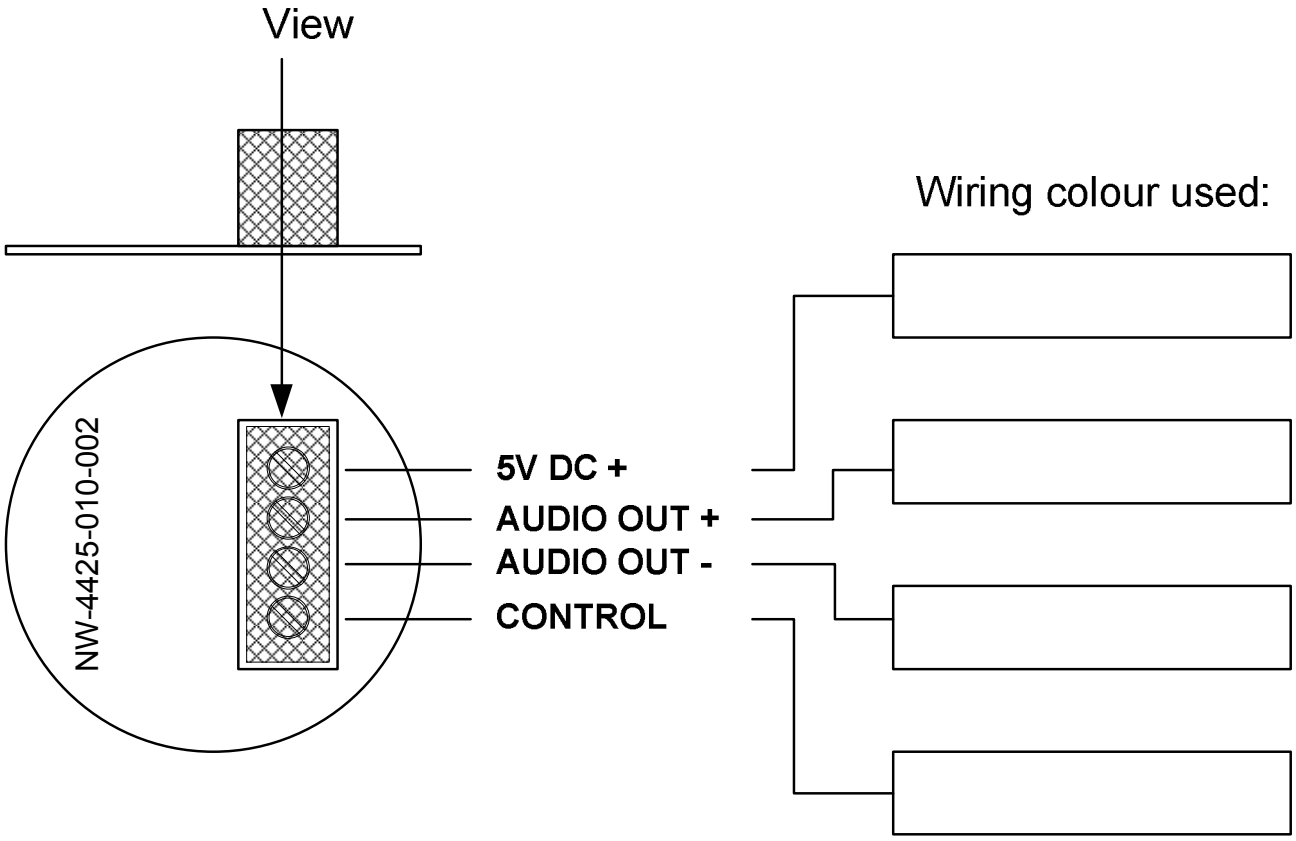
19.4.2 Reference documents

Please refer to document NW4000-20 VDR Annual Performance Test where both the actions to be performed, as well as the reporting sheets are included.

20. Installation record (forms)

20.1 Microphones

Microphone wiring colour scheme:



20.2 WaveNet adaptors

Adaptor layout of individual WaveNet Interface Modules
Vessel Name:

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

Adaptor layout of individual WaveNet Interface Modules
Vessel Name:

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number (1-5) >		Location:
Slot number (left to right)	Adaptor Type	Adaptor Description
1		
2		
3		
4		
5		

WIM number	Slot-number **(1 or 3)**		**NW-4420 4 Port / 2 Channel Audio Adaptor**		
Port 1	**A1**	**Control**	Wiring ID	Microphone location / VHF	**Channel 1**
	A2	**AUDIO -**			
	A3	**AUDIO +**			
	A4	**Power 5V+**			
Port 2	**A5**	**Control**		Microphone location / VHF	
	A6	**AUDIO -**			
	A7	**AUDIO +**			
	A8	**Power 5V+**			
Port 3	**B1**	**Control**		Microphone location / VHF	**Channel 2**
	B2	**AUDIO -**			
	B3	**AUDIO +**			
	B4	**Power 5V+**			
Port 4	**B5**	**Control**		Microphone location / VHF	
	B6	**AUDIO -**			
	B7	**AUDIO +**			
	B8	**Power 5V+**			

WIM number	Slot-number **(1 or 3)**		**NW-4420 4 Port / 2 Channel Audio Adaptor**		
Port 1	**A1**	**Control**	Wiring ID	Microphone location / VHF	**Channel 1**
	A2	**AUDIO -**			
	A3	**AUDIO +**			
	A4	**Power 5V+**			
Port 2	**A5**	**Control**		Microphone location / VHF	
	A6	**AUDIO -**			
	A7	**AUDIO +**			
	A8	**Power 5V+**			
Port 3	**B1**	**Control**		Microphone location / VHF	**Channel 2**
	B2	**AUDIO -**			
	B3	**AUDIO +**			
	B4	**Power 5V+**			
Port 4	**B5**	**Control**		Microphone location / VHF	
	B6	**AUDIO -**			
	B7	**AUDIO +**			
	B8	**Power 5V+**			

WIM number	Slot-number **(1 or 3)**		**NW-4420 4 Port / 2 Channel Audio Adaptor**		
Port 1	**A1**	**Control**	Wiring ID	Microphone location / VHF	**Channel 1**
	A2	**AUDIO -**			
	A3	**AUDIO +**			
	A4	**Power 5V+**			
Port 2	**A5**	**Control**		Microphone location / VHF	
	A6	**AUDIO -**			
	A7	**AUDIO +**			
	A8	**Power 5V+**			
Port 3	**B1**	**Control**		Microphone location / VHF	**Channel 2**
	B2	**AUDIO -**			
	B3	**AUDIO +**			
	B4	**Power 5V+**			
Port 4	**B5**	**Control**		Microphone location / VHF	
	B6	**AUDIO -**			
	B7	**AUDIO +**			
	B8	**Power 5V+**			

WIM number	Slot-number **(1 or 3)**		**NW-4420 4 Port / 2 Channel Audio Adaptor**		
Port 1	**A1**	**Control**	Wiring ID	Microphone location / VHF	**Channel 1**
	A2	**AUDIO -**			
	A3	**AUDIO +**			
	A4	**Power 5V+**			
Port 2	**A5**	**Control**		Microphone location / VHF	
	A6	**AUDIO -**			
	A7	**AUDIO +**			
	A8	**Power 5V+**			
Port 3	**B1**	**Control**		Microphone location / VHF	**Channel 2**
	B2	**AUDIO -**			
	B3	**AUDIO +**			
	B4	**Power 5V+**			
Port 4	**B5**	**Control**		Microphone location / VHF	
	B6	**AUDIO -**			
	B7	**AUDIO +**			
	B8	**Power 5V+**			

WIM number	Slot-number (1 or 3)		NW-4420 4 Port / 2 Channel Audio Adaptor		
Port 1	A1	Control	Wiring ID	Microphone location / VHF	Channel 1
	A2	AUDIO -			
	A3	AUDIO +			
	A4	Power 5V+			
Port 2	A5	Control		Microphone location / VHF	
	A6	AUDIO -			
	A7	AUDIO +			
	A8	Power 5V+			
Port 3	B1	Control		Microphone location / VHF	Channel 2
	B2	AUDIO -			
	B3	AUDIO +			
	B4	Power 5V+			
Port 4	B5	Control		Microphone location / VHF	
	B6	AUDIO -			
	B7	AUDIO +			
	B8	Power 5V+			

WIM number	Slot-number (1 or 3)		NW-4420 4 Port / 2 Channel Audio Adaptor		
Port 1	A1	Control	Wiring ID	Microphone location / VHF	Channel 1
	A2	AUDIO -			
	A3	AUDIO +			
	A4	Power 5V+			
Port 2	A5	Control		Microphone location / VHF	
	A6	AUDIO -			
	A7	AUDIO +			
	A8	Power 5V+			
Port 3	B1	Control		Microphone location / VHF	Channel 2
	B2	AUDIO -			
	B3	AUDIO +			
	B4	Power 5V+			
Port 4	B5	Control		Microphone location / VHF	
	B6	AUDIO -			
	B7	AUDIO +			
	B8	Power 5V+			

30.2.3 NMEA and Digital Adaptors

WIM number	Slot-number	Select adaptor type ☐ NW-4432 8 Channel Digital Adaptor ☐ NW-4430 8 Channel NMEA Adaptor	
Channel 1	**A1 +**	Wiring ID	Sensor / Channel Name:
	A2 -		
Channel 2	**A3 +**	Wiring	Sensor / Channel Name:
	A4 -		
Channel 3	**A5 +**	Wiring	Sensor / Channel Name:
	A6 -		
Channel 4	**A7 +**	Wiring	Sensor / Channel Name:
	A8 -		
Channel 5	**B1 +**	Wiring	Sensor / Channel Name:
	B2 -		
Channel 6	**B3 +**	Wiring	Sensor / Channel Name:
	B4 -		
Channel 7	**B5 +**	Wiring	Sensor / Channel Name:
	B6 -		
Channel 8	**B7 +**	Wiring	Sensor / Channel Name:
	B8 -		

WIM number	Slot-number	Select adaptor type ☐ NW-4432 8 Channel Digital Adaptor ☐ NW-4430 8 Channel NMEA Adaptor	
Channel 1	**A1 +**	Wiring ID	Sensor / Channel Name:
	A2 -		
Channel 2	**A3 +**	Wiring	Sensor / Channel Name:
	A4 -		
Channel 3	**A5 +**	Wiring	Sensor / Channel Name:
	A6 -		
Channel 4	**A7 +**	Wiring	Sensor / Channel Name:
	A8 -		
Channel 5	**B1 +**	Wiring	Sensor / Channel Name:
	B2 -		
Channel 6	**B3 +**	Wiring	Sensor / Channel Name:
	B4 -		
Channel 7	**B5 +**	Wiring	Sensor / Channel Name:
	B6 -		
Channel 8	**B7 +**	Wiring	Sensor / Channel Name:
	B8 -		

WIM number	Slot-number	Select adaptor type ☐ NW-4432 8 Channel Digital Adaptor ☐ NW-4430 8 Channel NMEA Adaptor	
Channel 1	**A1 +**	Wiring ID	Sensor / Channel Name:
	A2 -		
Channel 2	**A3 +**	Wiring	Sensor / Channel Name:
	A4 -		
Channel 3	**A5 +**	Wiring	Sensor / Channel Name:
	A6 -		
Channel 4	**A7 +**	Wiring	Sensor / Channel Name:
	A8 -		
Channel 5	**B1 +**	Wiring	Sensor / Channel Name:
	B2 -		
Channel 6	**B3 +**	Wiring	Sensor / Channel Name:
	B4 -		
Channel 7	**B5 +**	Wiring	Sensor / Channel Name:
	B6 -		
Channel 8	**B7 +**	Wiring	Sensor / Channel Name:
	B8 -		

WIM number	Slot-number	Select adaptor type ☐ NW-4432 8 Channel Digital Adaptor ☐ NW-4430 8 Channel NMEA Adaptor	
Channel 1	**A1 +**	Wiring ID	Sensor / Channel Name:
	A2 -		
Channel 2	**A3 +**	Wiring	Sensor / Channel Name:
	A4 -		
Channel 3	**A5 +**	Wiring	Sensor / Channel Name:
	A6 -		
Channel 4	**A7 +**	Wiring	Sensor / Channel Name:
	A8 -		
Channel 5	**B1 +**	Wiring	Sensor / Channel Name:
	B2 -		
Channel 6	**B3 +**	Wiring	Sensor / Channel Name:
	B4 -		
Channel 7	**B5 +**	Wiring	Sensor / Channel Name:
	B6 -		
Channel 8	**B7 +**	Wiring	Sensor / Channel Name:
	B8 -		

WIM number	Slot-number	Select adaptor type ☐ NW-4432 8 Channel Digital Adaptor ☐ NW-4430 8 Channel NMEA Adaptor	
Channel 1	**A1 +**	Wiring ID	Sensor / Channel Name:
	A2 -		
Channel 2	**A3 +**	Wiring	Sensor / Channel Name:
	A4 -		
Channel 3	**A5 +**	Wiring	Sensor / Channel Name:
	A6 -		
Channel 4	**A7 +**	Wiring	Sensor / Channel Name:
	A8 -		
Channel 5	**B1 +**	Wiring	Sensor / Channel Name:
	B2 -		
Channel 6	**B3 +**	Wiring	Sensor / Channel Name:
	B4 -		
Channel 7	**B5 +**	Wiring	Sensor / Channel Name:
	B6 -		
Channel 8	**B7 +**	Wiring	Sensor / Channel Name:
	B8 -		

30.2.4 Analogue Adaptors

WIM number	Slot-number	Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA	
			☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt	
			☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt	
Channel 1	A1 -	Wiring ID	Sensor / Channel Name:	
	A2 +			
Channel 2	A3 -	Wiring	Sensor / Channel Name:	
	A4 +			
Channel 3	A5 -	Wiring	Sensor / Channel Name:	
	A6 +			
Channel 4	A7 -	Wiring	Sensor / Channel Name:	
	A8 +			

WIM number	Slot-number	Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA	
			☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt	
			☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt	
Channel 1	A1 -	Wiring ID	Sensor / Channel Name:	
	A2 +			
Channel 2	A3 -	Wiring	Sensor / Channel Name:	
	A4 +			
Channel 3	A5 -	Wiring	Sensor / Channel Name:	
	A6 +			
Channel 4	A7 -	Wiring	Sensor / Channel Name:	
	A8 +			

WIM number	Slot-number	Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
			☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
			☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:
	A2 +		
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:
	A4 +		
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:
	A6 +		
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:
	A8 +		

WIM number	Slot-number	Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
			☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
			☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:
	A2 +		
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:
	A4 +		
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:
	A6 +		
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:
	A8 +		

WIM number	Slot-number		Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
				☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
				☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:	
	A2 +			
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:	
	A4 +			
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:	
	A6 +			
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:	
	A8 +			

WIM number	Slot-number		Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
				☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
				☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:	
	A2 +			
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:	
	A4 +			
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:	
	A6 +			
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:	
	A8 +			

WIM number	Slot-number	Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
			☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
			☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:
	A2 +		
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:
	A4 +		
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:
	A6 +		
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:
	A8 +		

WIM number	Slot-number	Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
			☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
			☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:
	A2 +		
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:
	A4 +		
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:
	A6 +		
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:
	A8 +		

WIM number	Slot-number		Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
				☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
				☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:	
	A2 +			
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:	
	A4 +			
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:	
	A6 +			
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:	
	A8 +			

WIM number	Slot-number		Select adaptor type	☐ NW-4450 4 Channel Analogue Adaptor 4-20 mA
				☐ NW-4452 4 Channel Analogue Adaptor -10/+10 Volt
				☐ NW-4454 4 Channel Analogue Adaptor 0-10 Volt
Channel 1	**A1 -**	Wiring ID	Sensor / Channel Name:	
	A2 +			
Channel 2	**A3 -**	Wiring	Sensor / Channel Name:	
	A4 +			
Channel 3	**A5 -**	Wiring	Sensor / Channel Name:	
	A6 +			
Channel 4	**A7 -**	Wiring	Sensor / Channel Name:	
	A8 +			

WIM number	Slot-number			
		Select adaptor type	☐	**NW-4450 4 Channel Analogue Adaptor 4-20 mA**
			☐	**NW-4452 4 Channel Analogue Adaptor -10/+10 Volt**
			☐	**NW-4454 4 Channel Analogue Adaptor 0-10 Volt**
Channel 1	**A1 -**	Wiring ID		Sensor / Channel Name:
	A2 +			
Channel 2	**A3 -**	Wiring		Sensor / Channel Name:
	A4 +			
Channel 3	**A5 -**	Wiring		Sensor / Channel Name:
	A6 +			
Channel 4	**A7 -**	Wiring		Sensor / Channel Name:
	A8 +			

WIM number	Slot-number			
		Select adaptor type	☐	**NW-4450 4 Channel Analogue Adaptor 4-20 mA**
			☐	**NW-4452 4 Channel Analogue Adaptor -10/+10 Volt**
			☐	**NW-4454 4 Channel Analogue Adaptor 0-10 Volt**
Channel 1	**A1 -**	Wiring ID		Sensor / Channel Name:
	A2 +			
Channel 2	**A3 -**	Wiring		Sensor / Channel Name:
	A4 +			
Channel 3	**A5 -**	Wiring		Sensor / Channel Name:
	A6 +			
Channel 4	**A7 -**	Wiring		Sensor / Channel Name:
	A8 +			

21. NOTES

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Annual Performance Test documentation

Refer to document NW4000-18