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Ships and marine technology — Guidelines for the operation and installation of voyage data recorder (VDR)

Navires et technologie maritime — Lignes directrices pour le fonctionnement et l'installation des enregistreur de données de voyage (VDR)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation and ship operations*.

This second edition cancels and replaces the first edition (ISO 22472:2006), which has been technically revised.

Ships and marine technology — Guidelines for the operation and installation of voyage data recorder (VDR)

1 Scope

The purpose of this International Standard is to provide guidance for the planning, installation and operational testing of voyage data recorder (VDR) installations according to specifications of IMO Resolution MSC.333 (90) and associated IEC 61996-1. This International Standard mainly covers interfaces between VDR and external sensors, which are the main subject for technical agreements among users, shipyards, VDR suppliers and/or sensor manufacturers when installations are planned. In addition, matters of performance test and playback are described as well. Furthermore, details for checking of items related to the interfaces and the installation are introduced. This International Standard is not intended for the standardization of performance factors and functional requirements related to VDR.

When whole or partial replacement of an existing simplified VDR (S-VDR) is required, this International Standard provides guidance according to the requirements of IMO Resolution MSC.163 (78) and IEC 61996-2 for installation of the items concerned.

NOTE Texts of this International Standard that are identical to that of IMO Resolution MSC.333 (90) and/or IEC 61996–1 are formatted in *italics*, and the regulation and associated performance standard clause numbers are indicated in brackets, where necessary.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems — General requirements — Methods of testing and required testing results*

IEC 61097-7, *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 61162-1, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part2: Single talker and multiple listeners, high-speed transmission*

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 450: Multiple talkers and multiple listeners — Ethernet interconnection*

IEC 61996-1, *Marine navigation and radiocommunication equipment and systems — Shipborne voyage data recorder (VDR) — Performance requirements — Methods of testing and required test results*

IMO Resolution MSC.333 (90):2012, *Performance standards for shipborne voyage data recorders (VDRs)*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

3.1 Terms and definitions

3.1.1
alert
announcement of abnormal situations and conditions requiring attention

Note 1 to entry: *Alerts are divided in four priorities: emergency alarms, alarms, warnings and caution.*

3.1.2
alarm
condition requiring immediate attention and action, to maintain the safe navigation and operation of the ship

Note 1 to entry: *An alarm is a high priority of an alert.*

3.1.3
bridge work station
position at which a person is expected to be when performing one of the normal bridge duties

EXAMPLE *The following work stations* as described in MSC/Circ.982:

— workstation for navigating and manoeuvring;

— workstation for monitoring;

— workstation for manual steering;

— workstation for docking;

— workstation for planning and documentation;

— workstation for safety; and

— workstation for communication.

3.1.4
combined EPIRB/VDR capsule
single unit which meets all the requirements of a satellite EPIRB (as required by the carriage requirements of SOLAS IV) and all the relevant requirements of a VDR (as required by the carriage requirements of SOLAS V)

Note 1 to entry: *Combined EPIRB/VDR capsule was defined by IMO COMSAR 8.*

3.1.5
configuration data
describes the vessel's equipment, its installation on the vessel and its relation to the VDR

Note 1 to entry: *The storage and playback software uses this data to store the data record and to convert the data record into information that assists casualty investigation during playback.*

3.1.6
data
any item of information received by the VDR for recording, including numerical values, text and audio or radar signals and including all configuration data, except where specifically stated or where the context dictates otherwise

3.1.7
dedicated reserve power source
battery, with suitable automatic charging arrangements, dedicated solely to the VDR, of sufficient capacity to operate it as required by IMO Resolution MSC.333 (90):2012, 5.4.2

3.1.8
final recording medium
items of hardware on which the data is recorded such that access to any one of them would enable the data to be recovered and played back by use of suitable equipment

Note 1 to entry: *The combination of a fixed recording medium* (3.1.9) *and float-free recording medium* (3.1.10) *and long-term recording medium* (3.1.11)*, together, is recognized as the final recording medium.*

3.1.9
fixed recording medium
part of the final recording medium (3.1.8) *which is protected against fire, shock, penetration and a prolonged period on the ocean floor*

Note 1 to entry: to entry: *It is expected to be recovered from the deck of the vessel that has sunk. It has a means of indicating location.*

3.1.10
float-free recording medium
part of the final recording medium (3.1.8) *which should float-free after a sinking*

Note 1 to entry: *It has a means of indicating location.*

3.1.11
long-term recording medium
permanently installed part of the final recording medium (3.1.8)

Note 1 to entry: *It provides the longest record duration and has a readily accessible interface for downloading the stored data.*

3.1.12
playback equipment
any data medium with the playback software, the operational instructions and any special parts required for connecting a commercial-off-the-shelf laptop computer to the VDR

3.1.13
playback software
copy of the software program to provide the capability to download the stored data and play back the information

Note 1 to entry: *The software should be compatible with an operating system available with commercial-off-the-shelf laptop computers and where non-standard or proprietary formats are used for storing the data in the VDR, the software should convert the stored data into open industry standard formats.*

3.1.14
playback system
system including the playback equipment that is capable of downloading and playing back the recorded data

3.1.15
voyage *data recorder*
VDR
complete system, including any items required to interface with the sources of input signals, their processing and encoding, the final recording medium, the playback equipment, the power supply and dedicated reserve power source

3.1.16
resolution
smallest detectable increment between two values

3.1.17
signal source
any sensor or device external to the VDR, to which the VDR is connected and from which it obtains signals and data to be recorded

3.2 Abbreviated terms

EPFS Electronic Position Fixing System

IMO International Maritime Organization

IEC International Electrotechnical Commission

INS Integrated Navigation System

LAN Local area network

ROV Remotely operated vehicle

UTC Coordinated universal time

VHF Very high frequency

4 VDR interface

4.1 General

According to IMO Resolution MSC.333 (90):2012, Clause 8 and IEC 61996-1:2013, 4.3.5, *interfacing between the various sensors and VDR shall be in accordance with the relevant international interface standard (IEC 61162 series), where possible.* As a minimum, the sentences that VDR is to support are given in IEC 61996-1:2013, Annex A.

In case there is no free interface port available for the connection to the VDR, a "data splitter"-interface should be added for providing the additionally required output port of a sensor. A "data splitter"-interface shall comply with IEC 60945.

It is also specified that *any connection to any item of the ship's equipment shall be such that operation of that equipment suffers no deterioration, even if the VDR system develops faults.* [IMO Resolution MSC.333 (90):2012, Clause 8].

It may be noted that the use of signals defined under common standards results in fewer problems for the installation of any VDR, even if the interfaces of several mandatory shipborne equipment are (still) not internationally standardized, such as VHF communication signals, radar image, watertight door/fire door/hull opening (door) status signals and alert signals. It is therefore desired on the installation planning phase that equipment output signals should at least be in accordance with the alternative signals that are specified in Clause 5.

4.2 Input signals required for VDR interfaces

To promote common understanding among equipment manufacturers, ship builders and operators, the signals used for the interfaces between sensors and the VDR are described in 4.2.1 to 4.2.6, 4.3 and 4.4. Forms for filling in and checking the details for each individual input to the VDR are provided in 5.2 to 5.21.

4.2.1 Signals defined in applicable parts of IEC 61162 series

The characteristics of "talkers" and "listeners" referred to IEC 61162-1. With regard to VDR interfacing, the VDR is considered the "listener" and the sensors are considered the "talkers". Thus, when planning VDR installation, care shall be taken to ensure that sensors and VDR are compatible in terms of interface signal types.

a) IEC 61162-1 and IEC 61162-2

IEC 61162-1 and IEC 61162-2 are of the single-talker and multi-listener type communication. The difference between types is the communication speed, i.e. 4 800 bps by IEC 61162-1 and 38,4 kbps

by IEC 61162-2. At present, IEC 61162-1 is normally used for communications between marine equipment, except that IEC 61162-2 is used for AIS interfaces and sometimes gyro compass.

Table 1 — Sentences used for interface of VDR (referred to in IEC 61996–1:2013, Annex A)

	Parameter to be recorded	IEC 61996-1:2013 clause(s)	Sentence format
1	Date and time	4.6.1	ZDA
2	Ship's position and datum used	4.6.2	GNS, DTM, GLL, GGA, RMC, NSR
3	Speed (water and/or ground)	4.6.3	VBW, VLW, VTG
4	Heading (true)	4.6.4	THS, HDT
5	Heading (magnetic)	4.6.4	HDG
6	Depth (echo sounder)	4.6.9	DPT
7	Alarms	4.6.10	ALR, ALA, FIR, WAT, ACM, HBT, ALC, ALF
8	Rudder order/response manual	4.6.11	RSA, ROR
9	Rudder order/response automatic	4.6.11	HTC, HTD
10	Engine order/response	4.6.12	ETL, PRC, TRC, TRD, RPM, XDR, ROR, RSA
11	Hull openings, watertight doors, Fire doors	4.6.13, 4.6.14	DOR, GEN, XDR
12	Accelerations and hull stress	4.6.15	HSS, XDR
13	Wind speed and direction	4.6.16	MWV, MWD
14	AIS	4.6.17	VDM, VDO, ALR
15	VDR alert output		ALC, HBT
NOTE No. 15 is a "talker" and not recording data for VDR.			

b) IEC 61162-450

IEC 61162-450 is based on the application of an appropriate suite of existing international standards to provide a framework for implementing data transfer between devices on a shipboard Ethernet network. IEC 61162-450 provides a higher speed and higher capacity alternative to the IEC 61162-1 and IEC 61162-2 standards while retaining these standards' basic data format.

Sentences available for use for VDRs are listed in Table 1.

NOTE 1 Appropriate methods to ensure network safety and security may be applied.

NOTE 2 IEC 61162-460 is published.

4.2.2 Signals other than IEC 61162 format

Any interface units which may be required to convert non-IEC 61162 signals, shall conform to the requirements of IEC 60945 (IEC 61996-1:2013, 4.3.5).

According to the requirement that *any connection to any item of the ship's equipment shall be such that operation of that equipment suffers no deterioration, even if the VDR system develops faults* [IMO Resolution MSC.333 (90):2012, Clause 8], interface signals shall be provided by the sensors in such a way, that failures of the VDR or of cables connecting the VDR cannot hamper the functionality of the source equipment, i.e. contacts or signals of equipment for primary ship manoeuvring functions shall be provided as "dry contacts" or through isolation amplifiers.

Signal formats not specified in IEC 61996-1 such as "contact" signal and analogue signals (e.g. voltage, current, synchro and pulse, etc.) except Bridge and Communications audio signals, have to be converted to a "serial signal" before they can be interfaced to VDR.

In some VDR units, a signal converter will be included. In other instances, it will be possible to insert a converter between the sensor and the VDR. Thus in most instances of non-standard signals, it should still be possible to achieve an interface. However, there are still many sensors which output analogue signals and it is recommended that operators, shipbuilders and owners ensure that interface between specific equipment is possible.

4.2.3 Bridge audible sound captured by microphones

In accordance with IEC 61996-1:2013, 4.6.5 [IMO Resolution MSC.333 (90):2012, 5.5.5], requirement of microphone is as follows. *Microphones shall be positioned on the bridge covering all work stations as described in MSC/Circ.982 so that conversation is recorded. The recording shall be such that, on playback, a normal speaking voice shall provide adequate intelligibility while the ship is performing its normal operations. This performance shall be maintained at all work stations while there is a single audio alarm anywhere on the bridge or any noise, including noise from faulty equipment or mounting, or wind. This shall be achieved through the use of at least two channels of audio recording. Microphones positioned outside on bridge wings, shall be recorded on at least one additional separate channel.*

In addition, it is stated in IEC 61996-1:2013, 5.6.1 that *the microphones forming the bridge audio data source are to be considered to be parts of the VDR. The form of the connections, signal levels and impedances, are at the option of the manufacturer.*

4.2.3.1 Location of microphones

Microphones shall be installed to cover certain areas around main workstations on the bridge, and also at each wing or other manoeuvring workstation outside the wheelhouse, whereby suitable locations shall be selected considering ambient noise and work area's circumstances, which shall also include their proximity to forced air flow, ventilation systems and speakers. Even on an enclosed bridge, attention shall be paid not only to main workstations but also to wing sides as well.

4.2.4 VHF radio connection

In accordance with IEC 61996-1:2013, 4.6.6 Communications audio[IMO Resolution MSC.333 (90):2012, 5.5.6], *VHF communications relating to ship operations* shall *be recorded, VHF communications relating to ship operations shall be recorded on an additional separate channel to those referred to in 4.4.5, independently of the bridge audio. The recording shall include both transmitted and received audio signals and shall be continuous from a directly connected fixed VHF set to be designated at installation.* Although more than one VHF communication equipment may normally be installed on the bridge, the IMO requirements do not define which VHF shall be interfaced to the VDR. Where the bridge workstation design or standard bridge operation makes two VHF radio readily available for navigating and manoeuvring communications, the receive and transmit audio of each may connect to the VDR by wire on a separate channel if available, or else they may be share a channel provided they are the only inputs on a channel. Other VHF transceivers may be connected by wire or monitored with microphone(s).

4.2.5 Radar display connection

In accordance with IEC 61996-1:2013, 4.6.7 [IMO Resolution MSC.333 (90):2012, 5.5.7], *the electronic signals of the main displays of both ship's radar installations as required by SOLAS regulations* shall be recorded. *The recording method shall be 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.*

NOTE In the case of a ship fitted with an INS, "Radar display" signifies "collision avoidance task with related information".

4.2.6 ECDIS display connection

In accordance with IEC 61996-1:2013, 4.6.8 [IMO Resolution MSC.333 (90):2012, 5.5.58], *where a vessel is fitted with an ECDIS installation, the VDR shall record the electronic signals of the ECDIS display in use*

at the time as the primary means of navigation. The recording method shall be such that, on playback, it is possible to present a faithful replica of the entire ECDIS 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 and in addition the source of the chart data and the version used.

NOTE 1 Only the ECDIS, either standalone unit(s) or part of INS, installed on board and type approved in accordance with IEC 61174 needs to comply with the above requirement.

NOTE 2 In the case of a ship fitted with an INS, "ECDIS display" signifies "route monitoring task or voyage planning task with related information".

4.3 Main alarms

In accordance with IEC 61996-1:2013, 4.6.10 [IMO Resolution MSC.333 (90):2012, 5.5.10], this shall *include the status of all* IMO *mandatory alarms on the bridge* as given in Resolution A.1021 (26) Table 10.1.1 (see Annex A) *or as received from the Bridge Alert Management system, if installed, recorded as individually identified alarms.*

NOTE The Bridge Alert Management is defined in IMO Resolution MSC.302 (87). The Central Alert Management defined on MSC.302 (87) does not transmit all received alerts to VDR.

4.4 AIS

In accordance with IEC 61996-1:2013, 4.6.17 [IMO Resolution MSC.333 (90):2012, 5.5.17], *all AIS data shall be recorded.*

4.5 Bridge alert management interface

In accordance with IEC 61996-1:2013, 5.13, t*he VDR shall output alerts to a bridge alert management system if fitted.*

NOTE The Bridge Alert Management system means the Central Alert Management system in this paragraph.

5 Details of interfaces between sensors and VDR

5.1 General

By using the following sections for each system, the factors related to the interfaces between VDR and sensors can be confirmed between the parties involved.

5.2 Date and time (IEC 61996-1:2013, 4.6.1)

a) Standard: *Date and time, referenced to UTC, shall be obtained from a source external to the ship and an internal clock shall be synchronized with valid date and time data.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Date and UTC	5.4.1	4.6.1	ZDA	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Date and UTC	IEC 61162–1	GNS, GGA	
Ship's common time reference			
EPFS			

5.3 Ship's position (IEC 61996-1:2013, 4.6.2)

Standard: *Latitude and longitude, and the datum used, shall be derived from a designated EPFS or INS if available. The recording shall ensure that identity and status of the source can always be determined on playback. The ship's position shall be recorded, as available on the ship, up to a resolution of 0,000 1 min of arc.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Ship's position	5.4.2	4.6.2	[GNS]/DTM/ GLL/[GGA]/ RMC/NSR	

5.4 Speed (IEC 61996-1:2013, 4.6.3)

a) Standard: *Speed through the water and speed over the ground (transverse and longitudinal), including an indication of which it is, derived from the ship's speed and distance measuring equipment, as required by SOLAS regulations shall be recorded, as available on the ship, up to a resolution of 0,1 knot.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Speed	5.4.3	4.6.3	VBW/VLW/ VTG	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Speed	IEC 61162–1	VHW (to the water)	
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Pulse signal		200 p/nm, 400 p/nm, etc.	

5.5 Heading (IEC 61996-1:2013, 4.6.4)

a) Standard: *As indicated by a designated ship's heading source. The ship's heading shall be recorded, as available on the ship, up to a resolution of 0,1°.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Heading (true)	5.4.4	4.6.4	THS/HDT	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Synchro signal		360×, 180×, 90×, 36×, 1×, etc. Primary voltage: ___V, ___Hz	
Step signal		360×, 180×, 90×, 36×, 1× Voltage: 24 V, 35 V, 50 V, 70 V, etc.	

5.6 Bridge audio (IEC 61996-1:2013, 4.6.5)

Standard: *Microphones shall be positioned on the bridge covering all work stations as described in MSC/Circ.982 so that conversation is recorded. The recording shall be such that, on playback, a normal speaking voice shall provide adequate intelligibility while the ship is performing its normal operations. This performance shall be maintained at all work stations while there is a single audio alarm anywhere on the bridge or any noise, including noise from faulty equipment or mounting, or wind. This shall be achieved through the use of at least two channels of audio recording. Microphones positioned outside on bridge wings, shall be recorded on at least one additional separate channel.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Bridge Audio (Audio signal)	5.5.5	4.6.5	None	

5.7 VHF communication audio (IEC 61996-1:2013, 4.6.6)

a) Standard: *VHF communications relating to ship operations shall be recorded on an additional separate channel to those referred to in 5.6, independently of the bridge audio. The recording shall include both transmitted and received audio signals and shall be continuous from a directly connected fixed VHF set to be designated at installation.*

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
VHF communication (Audio signal)	5.4.6	4.6.6	None	
Sentence	None			
VHF output signal	IEC 61097–7	0,775 V RMS (600 ohm)		

5.8 Radar data-post-display selection (IEC 61996-1:2013, 4.6.7)

a) Standard: *The electronic signals of the main displays of both ship's radar installations as required by SOLAS regulations. The recording method shall be 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.*

Where the VDR and Radar are capable of being connected together through a LAN interface, this shall be done according to IEC 61162-450 and/or according to IEC 62388:2007, H.2 (IEC 61996-1:2013, 5.8.1.1.2).

Where the radar system installed uses multi-function displays, the screen image shall be captured from each display that is showing the radar required by SOLAS according to IEC 61996-1:2013, 5.8, using a LAN display output when provided as described above. The identity of the display from which the image was captured shall be recorded by the method described in IEC 61996-1:2013, Annex E.

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Radar display image (image) recording interval: 1 time/15 s or less (referred to in IEC 61996–1:2013, 5.8.1.1.1 or 5.8.1.1.2)	5.5.7	4.6.7, 5.9	None	
Resolution of image (pixel)	640 × 350 to 1 280 × 1 024/1 600 × 1 200 1 900 × 1 280 and 1 920 × 1 200 are as options			IEC 61996–1:2013, 5.8.1.1.1
Refresh rate	60 Hz to 85 Hz/60 Hz			IEC 61996–1:2013, 5.8.1.1.1
Signals	R, G, B, V, H			IEC 61996–1:2013, 5.8.1.1.1
Level of signal	Below 1 V			IEC 61996–1:2013, 5.8.1.1.1
Protocol	TCP/IP — (IEC 62388) UDP — (IEC 61162–450)			IEC 61996–1:2013, 5.8.1.1.2
Formats	.bmp — (Microsoft GDI — Bitmap reference) .png — (ISO/IEC 159748) .jpg — (ISO/IEC 10918) .jp2 — (JPEG 2000 — ISO/IEC 15444 in lossless format)			IEC 61996–1:2013, 5.8.1.1.2

b) Where standalone radar is fitted, alternative signals may be used. Specifications of radar display are specified in VESA DMTS or in manufacturer's standards. Therefore, there may be many specimens of radar displays that are briefly summarized in the table below.

Method of Scanning		Signal Type	Remarks
1	Non-interlaced[a]	R, G, B V/H each independent signal	
2	Non-interlaced[a]	R, G, B each independent signal V/H are composited on G	
3	Interlaced[b]	R, G, B V/H each independent signal	
4	Interlaced[b]	R, G, B each independent signal V/H are composited on G	
5	Others	Composite signal	@NTSC (scanning of Japan, USA TV) @PAL (scanning of European TV), etc.

[a] Non-interlaced: This method is VESA DMTS method which is used for display of personnel computer. Scanning from the top of display to the bottom of display.

[b] Interlaced: This method of scanning is normally used for TV. Even lines and odd lines scanning separately moved in turn from the top of display to the bottom of display.

5.9 ECDIS (IEC 61996-1:2013, 4.6.8)

a) Standard: *Where a vessel is fitted with an ECDIS installation, the VDR shall record the electronic signals of the ECDIS display in use at the time as the primary means of navigation. The recording method shall be such that, on playback, it is possible to present a faithful replica of the entire ECDIS 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 and in addition the source of the chart data and the version used.*

Where the VDR and ECDIS are capable of being connected together through a LAN interface this shall be done according to IEC 61162-450 and/or according to IEC 62388:2007, H.2 (IEC 61996-1:2013, 5.8.1.1.1).

Where the ECDIS system installed uses multi-function displays, the screen image shall be captured from each display that is showing the navigation ECDIS required by SOLAS according to IEC 61996-1:2013, 5.8 using a LAN display video output when provided as described above. The identity of the display from which the image was captured shall be recorded by the method described in IEC 61996-1:2013, Annex E. The information about charts used by ECDIS shall be recorded by VDR using the method described in IEC 61996-1:2013, Annex G where LAN interface is available.

Within each class with type "X-band", "S-band" and "ECDIS" (see Annex E) one image shall be stored at an interval not exceeding 15 s. The most recent image from each location shall be stored in turn (IEC 61196-1:2013, 5.1.1.4).

For post-display selection, the location names of the sources (e.g. ECDIS, radar and multifunction displays) shall be non-identical names.

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
ECDIS display image (image) and the source of the chart data and the version used re-cording interval: image: 1 time/15 s or less (referred to in IEC 61996–1:2013, 5.8.1.1.3) ECDIS display source: every 10 min	5.4.8	4.6.8, 5.10	None	
Protocol	TCP/IP — (IEC 62388) UDP — (IEC 61162–450)			
Formats	.bmp — (Microsoft GDI — Bitmap reference) .png — (ISO/IEC 159748) .jpg — (ISO/IEC 10918) .jp2 — (JPEG 2000 — ISO/IEC 15444 in lossless format)			

b) Where standalone ECDIS is fitted, alternative signals may be used.

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
ECDIS display image (image) recording interval: 1 time/15 s or less (referred to in IEC 61996–1:2013, 5.8.1.1.1)	5.5.8	4.6.8	None	
Resolution of image (pixel)	Including but not limited to 640 × 350 to 1 280 × 1 024/1 600 × 1 200			
Refresh rate	60 Hz to 85 Hz/60 Hz			
Signals	R, G, B, V, H			
Level of signal	Below 1 V			

5.10 Depth (Echo sounder) (IEC 61996-1:2013, 4.6.9)

a) Standard: This shall include 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 shall be recorded where available.

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Depth	5.5.9	4.6.9	DPT	

b) Alternative signals may be used, if the signal required by the standard above is not available

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	

5.11 Main alarms on the bridge (IEC 61996-1:2013, 4.6.10)

a) Standard: *This shall include the status of all IMO mandatory alarms on the bridge as given in Resolution A.1021 (26) Table 10.1.1 (see Annex B) or as received from the Bridge Alert Management system, if installed, recorded as individually identified alarms.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Alarm, Date and Time	5.5.10	4.6.10	ALR/ALA/FIR/ WAT/ACM/ HBT/ALC/ALF	

b) Alternative signals may be used, if the signal required by the standard above is not available

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Contact signal		No voltage contact signal	
Voltage		AC/DC: ___V (voltage of alarm signal, etc.)	

c) Due consideration shall be taken for the requirements of SOLAS, the appropriate classification society and any flag country requirements for alarms.

d) Table of alarm described in IEC 61996-1:2013, Table B.1 (ship-specific availability of bridge alarms to be confirmed).

5.12 Rudder order and response (IEC 61996-1:2013, 4.6.11)

5.12.1 Rudder order and response from HCS or TCS (if installed)

a) Standard: *Status and settings of heading or track controller, if fitted, shall also be recorded. Both rudder order and response angles shall be recorded up to a resolution of 1° as available and permitted on the ship* (IEC 61996-1:2013, 4.6.11).

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Rudder order/response (Automatic)	5.5.11	4.6.11	HTC/HTD	

b) Alternative signals may be used, if the signal required by the standard above is not available

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Synchro signal		360×, 180×, 90×, 36×, 1× Primary voltage: ___V, ___Hz	
Step signal		360×, 180×, 90×, 36×, 1× Voltage: 35 V, 50 V, 70 V, etc.	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	
Operation mode		Contact, etc.	

5.12.2 Rudder order and response from steering system

a) Standard: *Both rudder order and response angles shall be recorded up to a resolution of 1° as available and permitted on the ship* (IEC 61996-1:2013, 4.6.11).

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Rudder order/ response (Manual)	5.5.11	4.6.11	RSA/ROR	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Synchro signal		360×, 180×, 90×, 36×, 1× Primary voltage: ___V, ___Hz	
Step signal		360×, 180×, 90×, 36×, 1X Voltage 35 V, 50 V, 70 V, etc.	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	
Operation Mode		Contact, etc.	

5.13 Engine and thruster order and response (IEC 61996-1:2013, 4.6.12)

Standard: *This shall include the positions of any engine telegraphs or direct engine/propeller controls, including shaft(s) rpm (or equivalent), and feedback indications on the bridge, if fitted, including ahead/astern indicators and indicate the control station in use. This shall also include status of bow and stern thrusters if fitted and indicate the control station in use. The rpm shall be recorded up to a resolution of 1 rpm and pitch shall be recorded up to a resolution of 1°.*

5.13.1 Engine order and response

a) Standard

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Main Engine order/response	5.5.12	4.6.12	ETL/PRC/TRC/ TRD/RPM/XDR/ ROR/RSA	

b) Alternative signals may be used, if the signal required by the standard above is not available

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	
Contact signal		No voltage contact	

5.13.2 Thruster order and response

a) Standard

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Thruster order/response	5.5.12	4.6.12	ETL/PRC/TRC/ TRD/RPM/XDR/ ROR/RSA	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	
Contact signal		No voltage contact	

5.14 Hull openings (doors) status (IEC 61996-1:2013, 4.6.13)

a) Standard: *This shall include all IMO mandatory status information required to be displayed on the bridge.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Hull opening	5.5.13	4.6.13	DOR/GEN/XDR	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Contact signal		No voltage contact	

5.15 Watertight and fire door status (IEC 61996-1:2013, 4.6.14)

5.15.1 Watertight and fire door status

a) Standard: *This shall include all IMO mandatory status information required to be displayed on the bridge.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Watertight and fire door status	5.5.14	4.6.14	DOR/GEN/XDR	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Door status	IEC 61162–1		
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Contact signal		No voltage contact	

5.16 Accelerations and hull stresses (IEC 61996-1:2013, 4.6.15)

a) Standard: *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 shall be recorded.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Accelerations and hull stresses	5.5.15	4.6.15	HSS/XDR	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Accelerations and hull stresses	IEC 61162–1		
Manufacturer's sentence		Proprietary sentence Signal voltage: ___V	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	

5.17 Wind speed and direction (IEC 61996-1:2013, 4.6.16)

a) Standard: This shall be applicable *where a ship is fitted with a suitable sensor, wind speed and direction shall be recorded, including its true or relative status. The wind speed shall have a resolution of 1 unit (knot, m/s, etc.) and the wind direction shall have resolution of 1°.*

Data to be recorded	Relevant Standard		IEC 61162–1	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Wind speed and direction	5.5.16	4.6.16	MWV/MWD	

b) Alternative signals may be used, if the signal required by the standard above is not available.

Data to be recorded	Standard	Signal Specification	Confirmed type of signal
Synchro signal		360×, 180×, 90×, 36×, 1× Primary voltage: ___V, ___Hz	
Analogue signal		Voltage: ±10 V, etc. Current: 4 mA to 20 mA, etc.	

5.18 AIS data (IEC 61996-1:2013, 4.6.17)

Standard: *All AIS data shall be recorded.*

Data to be recorded	Relevant Standard		IEC 61993–2:2012, B.2.13	Remarks (Confirmed type of signal)
	IMO Resolution MSC.333 (90):2012	IEC 61996–1:2013		
Other ship's data/ own ship data	5.5.17	4.6.17	VDM/VDO/ALR	

5.19 Rolling motion (IEC 61996-1:2013, 4.6.18)

Standard: *The VDR shall be connected to an electronic inclinometer if installed. The recording method shall be such that the rolling motion can be reconstructed during playback.*

5.20 Configuration (IEC 61996-1:2013, 4.6.19)

Standard: *In addition to the data items specified in IEC 61996-1:2013, 5.6.1 to 5.6.18, a data block defining the configuration of the VDR and the sensors to which it is connected shall be written into the final recording medium during commissioning of the VDR. The data block shall be maintained up to date with respect to the vessel installation. It shall include details on the manufacturer, type and version number of a sensor the identification and location of the sensor and the interpretation of the sensor data. This configuration data shall be permanently retained in the final recording media and protected from modification other than by a duly authorized person following any change to the configuration.*

The following system configuration information and data source identity shall be included in this data block (IEC 61996-1:2013, 4.4.2):

a) *type approval authority and reference*;

b) *IMO vessel identification number*;

c) *software version(s) used and date and time of installation*;

d) *automatic insertion of date and time of last configuration data amendment*;

e) *microphone locations, recording channel allocation, and ID (two character identification for example M1, M2, etc.)*;

f) *VHF communications — location of connected VHF installation(s) and recording port allocation, and ID (two character identification, for example V1, V2, etc.)*;

g) *for each sensor — the manufacturer, type and version number of the sensor and the interpretation of the sensor data*;

h) *screen display output(s) location and ID (two character identification, for example R1, R2, etc. for Radar, E1, E2 for ECDIS, D1, D2 for non-dedicated displays). For dedicated displays the function of the display, for example radar X-band, S-band, navigational ECDIS*;

i) *date and time — from which source obtained*;

j) *ship's position — from the INS if fitted and from which EPFS obtained and relative positions on the vessel according to the method defined for the IEC 61162 POS sentence*;

k) *other data inputs, at the minimum for all data required by IEC 61996:2013, 4.6*:

   1) *identification of which equipment is supplying the data*;

   2) *identification of the sentence (IEC 61162) which is carrying the information (see Annex A)*;

   3) *if received as proprietary sentences according to IEC 61162 (for example containing converted analogue or discrete signals), information to include the location of the information within the sentence and the specification of the relations between sensor values (rpm, rudder angles, state of alert or indicator, etc.) and received values.*

5.21 Electronic logbook (IEC 61996-1:2013, 4.6.20)

Standard: *Where a ship is fitted with an electronic logbook in accordance with the standards of the organization, the information from this shall be recorded.*

6 Installation

6.1 Required VDR equipment

VDR consists of the *complete system, including any items required to interface with sources of input signals, their processing and encoding, final recording medium, playback equipment, the power supply and dedicate reserve power source*. Installation shall be in accordance with requirements of IMO Resolution MSC.333 (90) and IEC 61996-1. Interface between VDR and sensors must be confirmed according to each item of preceding Clause 5.

In case of a combined EPIRB/VDR capsule (see 3.1.4), this shall, in addition to the requirements of this International Standard, meet the requirements of IEC 61097-2 (IEC 61996-1:2013, 5.2.2.4).

The relevant components of VDR should be installed in locations that offer reasonable access for executing Operational Performance Test and Annual Performance Tests and verifying the results of these.

6.2 Power supply of the VDR and interfaces

6.2.1 Power supply from the ship's emergency source of electrical power

The VDR shall be capable of operating from the ship's main and emergency source of electrical power (IEC 61996-1:2013, 4.5.2). However, regarding the power supply to sensors to be interfaced to VDR, the requirement for power supply of each sensor shall be referred to respectively.

Interfaces which are part of the VDR installation shall also be powered under the control of the VDR, i.e. their activation/deactivation shall be controlled by the same control which is used for activating/deactivating the VDR.

Interfaces which are not part of the VDR installation then logically belong to the sensor which provides data to the VDR. The power supply for such interfaces shall be controlled by the same control which is used for activating/deactivating the sensor.

6.2.2 Power supply from the reserve power source

If the ship's source of electrical power supply to the VDR fails, the VDR shall as a minimum continue to record Bridge Audio (see 5.6) from the dedicated reserve power source for a period of 2 h. At the end of this 2 h period all recording shall cease automatically. It shall be possible to recharge the dedicated reserve power source within a period of 10 h (IEC 61996-1:2013, 4.5.4).

Consequentially, it shall be verified during installation, that at least the main processor of the VDR, the final recording medium, the interface for receiving the audio signals from the microphones, and the microphones are supplied with power from the reserve power source if the ship's emergency source of electrical power supply fails.

6.3 Installation of the protective capsule and float free capsule (IEC 61996-1:2013, 5.1.1)

The protective capsule shall 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:

a) *separation from fuel or other potential fire sources*;

b) *separation from probable sources of mechanical damage*;

c) *operational environment and accessibility for continued serviceability*;

d) *accessibility for copying of recorded data and for routine maintenance*;

e) *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*;

f) *in the case of float-free configuration, minimization of the risk of obstruction after release*.

6.4 Positions of microphones (IEC 61996-1:2013, 4.6.5)

Microphones shall be positioned on the bridge covering all work stations as described in MSC/Circ.982 so that conversation is recorded. The recording shall be such that, on playback, a normal speaking voice shall provide adequate intelligibility while the ship is performing its normal operations. This performance shall be maintained at all work stations while there is a single audio alarm anywhere on the bridge or any noise, including noise from faulty equipment or mounting, or wind. This shall be achieved through the use of at least two channels of audio recording. Microphones positioned outside on bridge wings, shall be recorded on at least one additional separate channel.

For the installation, particular consideration to a noise-free environment around the microphones is required. Often the ship is in a different sound environment when underway compared to when in harbour. Therefore pay attention to avoid loose materials behind the microphone, things that can rattle nearby due to vibration, etc. Whenever practical, a test recording should be obtained from underway, during docking and when using thrusters. Microphones should not be co-located with fire and emergency alarm sirens, such that voice can still be heard in case of a sounding alarm.

6.5 Cable connections

Where critical connections to devices for manoeuvring of the ship cannot be avoided, these shall be as short as possible and the risk of short circuits or cable breaks shall be minimised by appropriate cable routeing and safe distances of connections. It is highly recommended to provide proper isolation between the signal circuitry of the manoeuvring devices and VDR.

6.6 Ship specific documentation

6.6.1 Planning and approval documentation

For planning and coordinating of the VDR installation with the parties involved, i.e. owner, shipyard, flag state authority and classification society, the following documents shall be provided and updated during the states from planning to final commissioning.

6.6.1.1 **List of interfaces, for each data item,** including:

a) data item according to IMO requirements, type of signal (e.g. voltage, current, normally open/closed contact, serial data string, IEC 61162 sentence(s), etc.;

b) sensor providing the data including type, designation, manufacturer, location of installation;

c) update rate of the information (normally 1 s or instantaneous upon the relevant change of status).

6.6.1.2 Plan of locations of bridge equipment

This is typically a general arrangement plan of the bridge and bridge wings covering all workstations and including markings of locations where microphones, connected radar(s), ECDIS(s), VHF radio(s), electronic inclinometer (in fitted), and VDR operation and alert unit are installed.

6.6.1.3 Plan of the fixed capsule location

This plan is typically a general arrangement plan of the deck area where the capsule is installed, including location of the capsule and all other ship structures and installed devices around and above the capsule.

The plan should also include an outline of a concentric circle of 3 m diameter around the capsule (as seen from the top) and a side view of the capsule installation and mounting parts.

The capsule is typically installed on wheel house top (magnetic compass deck).

6.6.1.4 Plan of the float free capsule location

This is typically a plan of the area where the float free capsule is installed, covering at least ±1 m in height and ±1 m in width around the capsule.

In addition to the marking of the location of the float free capsule, the plan should include all other ships structures and installed devices around and above the float free capsule.

The plan should include a side view of the capsule installation and mounting parts.

The float free capsule shall be installed at the suitable location to minimize the risk of obstruction after release.

7 Acceptance test (Commissioning)

A final acceptance test shall be provided after the completion of the VDR installation. The test shall include an operational performance test (IEC 61996-1:2013, 5.2) and be conducted following a prepared test protocol to be provided by the VDR supplier. The content of the test shall be principally the same as shown in Annex E for the annual performance test, but it shall also verify the correct connection and signal transfer of all interfaces within their full scope of functionality. Additionally it shall be verified that critical interface connections, such as to devices for steering and propulsion, do not produce limitations or malfunctions of the relevant equipment.

As IMO Resolution MSC.333 (90) does require playback equipment to be provided on-board the ship, the test shall verify that the playback equipment, using the configuration data, accurately replays all the information represented by the data and that the recorded data contains all the data items required to be recorded.

8 Performance Tests

8.1 General

When VDR is in operation, both Operational Performance Test and Annual Performance Test should be carried out when appropriate.

8.2 Operational Performance Test (IEC 61996-1:2013, 5.12)

The purpose of the Operational Performance Test is to verify that VDR is properly recording all the configured signals. This test may typically be carried out by ship's crew and may be executed for example to verify that signals are properly recorded to VDR from an equipment that has been newly serviced.

8.3 Annual Performance Test

Annual performance test ("Annual Re-certification") of each VDR is required in SOLAS V regulation 18, Clause 8 to verify the accuracy, duration and recoverability of the recorded data. In addition, the condition of all protective enclosures and devices is required to be confirmed through test

and inspection. The test shall include an operational performance test (IEC 61996-1:2013, 5.12). Recommended items to be confirmed are shown in Annex E. The annual testing of VDR/S-VDR required by SOLAS regulation V/20 should be carried out by the manufacturer or a person authorized by the manufacturer (IMO Circular MSC.1/Circ.1222).

9 Download and playback equipment for investigation authorities

9.1 General

The VDR should provide an interface for downloading the stored data and play back the information to an external computer. The interface should be compatible with an internationally recognized format, such as Ethernet, USB, FireWire, or equivalent. It should be possible to perform a download of the recorded data for a user-defined period of time [IMO Resolution MSC.333 (90):2012, 9.1].

9.2 Information for use by an investigation authority (IEC 61996-1)

The following information shall be available:

a) *instruction to enable an investigation authority to manufacture any special tools or interface equipment required for retrieval of recorded data from the recorder*;

b) *details of the necessary actions to be followed for data retrieval from an undamaged final recording medium*;

c) *details of the necessary actions to be followed for data retrieval from a final recording medium that has been damaged in an incident*;

d) *details of the necessary actions to be followed to determine, prior to an attempted replay, whether the storage medium has been subjected to an excessive level of heat, where the survival of the stored data may be uncertain*;

e) *playback equipment required to enable the download and playback of recorded data*.

Annex A
(informative)

Mandatory alarms (IEC 61996-1:2013, Annex B)

IMO Resolution MSC.333 (90):2012, 5.5.10 requires the recording of mandatory alarms on the bridge as given in Resolution A.1021 (26), Table 10.1.1. This table is reproduced for information as Table A.1.

NOTE Table A.1 includes only the priority of alert specified by "A" (alarm) in A.1021 (26) Table 10.1.1.

Table A.1 — Mandatory alarms on the bridge

IMO Instrument	Function
SOLAS II-1	
29.5.2	Steering gear power unit power failure
29.8.4	Steering control system power failure
29.12.2	Low steering gear hydraulic fluid level
30.3	Steering system electric phase failure/overload
31.2.7, 49.5	Propulsion machinery remote control failure
31.2.9, 49.7	Low propulsion starting air pressure
31.2.10	Imminent slowdown or shutdown of propulsion system
52	Automatic shutdown of propulsion machinery
51.1.3	Fault requiring action by or attention of the officer on watch (machinery alarm including automatic change-over alarm and alarm for all important pressures, temperatures, fluid levels and other essential parameters)
13.7.3.1	Watertight door low hydraulic fluid level
13.7.3.1 13.7.3.2	Watertight door low gas pressure Loss of stored energy
13.7.8	Watertight door electrical power loss
35–1.2.6.2	High water level alarm
17–1.1.2, 17–1.1.3	Opening indicator
25.4	Water level pre-alarm
25.4	Water level main-alarm
51.2.2	Alarm system normal power supply failure
SOLAS II-2	
4.5.10.1.3	Hydrocarbon gas detection in tanker cargo pump rooms
7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely controlled machinery space
20.3.1.3	Loss of required ventilation
10.5.6.4	Fixed local application fire-extinguishing system activation
SOLAS XII	
12.2	Water level pre-alarm
12.2	Water level main-alarm
Resolution A.481(XII)	
Annex 2, paragraph 7.3	Personnel alarm

Table A.1 *(continued)*

IMO Instrument	Function
Resolution MSC.128(75)	
Annex 4.1.2.3, 5.2.3	BNWAS first stage audible alarm
Gas or chemical codes	
IBC 15.2.4 BCH 4.19.4	High and low temperature of cargo and high temperature of heat-exchanging medium
IBC 15.5.1.6 BCH 4.20.6	High temperature in tanks
IBC 15.5.1.7 BCH 4.20.7	Oxygen concentration in void spaces
IBC 15.8.23.1 BCH 4.7.15(a)	Malfunctioning of temperature controls of cooling systems
IGC 13.4.1 GC 13.4.1	High and low pressure in cargo tank
IGC 13.6.4, 17.9 GC 13.6.4, 17.11	Gas detection equipment
IGC 13.5.2 GC 13.5.2	Hull or insulation temperature
IGC 17.18.4.4 GC 17.12.2(d)(iv)	Cargo high pressure, or high temperature at discharge of compressors
IGC 17.14.4.3 GC 17.12.5(d)(iii)	Gas detecting system monitoring chlorine concentration
IGC 17.14.4.4 GC 17.12.5(d)(iv)	High pressure in chlorine cargo tank
IBC 15.5.2.5 BCH 4.20.19	High temperature in tanks
IBC 15.5.2.6 BCH 4.20.20	Oxygen concentration in void spaces
IBC 15.10.2 BCH 4.3.1(b)	Failure of mechanical ventilation of cargo tanks
IGC 5.2.1.7, GC 5.2.5(b)	Liquid cargo in the ventilation system
IGC 8.4.2.1, GC 8.4.2(a)	Vacuum protection of cargo tanks
IGC 9.5.2, GC 9.5.2	Inert gas pressure monitoring
IGC 13.6.11 GC 13.6.11	Gas detection equipment
IGC 17.14.1.4 GC 17.12.5(a)(iv)	Gas detection after bursting disk for chlorine
IGS	
3.14.11	Low water level alarm
2000 HSC Code	
7.7.1.2	Fixed fire detection and fire alarm systems‘ power loss or fault condition
7.7.1.4	Fire detection signal
7.7.1.6	Fire detection manually operated call point section unit indicator
7.7.2.1	Fire detection for periodically unattended machinery spaces
7.8.5.3	Loss of required ventilation

Table A.1 *(continued)*

IMO Instrument	Function
9.1.14	Liquid cooling system failure
9.2.1	Automatic fire detection system
9.2.1	Bilge alarm
9.2.1	Remote machinery alarm system
9.4.2	Fuel line failure
9.4.5	Lubricating oil pressure or level falling below a safe level
9.5.6	Lubricating fluid supply failure or lubrication fluid pressure loss
10.3.12	Unattended space bilge alarm
11.2.1	Failure of any remote or automatic control system
11.4.1	Malfunction or unsafe condition
11.4.1.1	Indication of conditions requiring immediate action
12.5.1	Steering system electric overload
12.5.2	Steering system electric phase failure
12.6.3	Electrical distribution system low insulation level
2009 MODU Code	
7.4.2.7, 8.5.7	Propulsion machinery remote control failure
7.4.2.9, 8.5.9	Low starting air pressure
7.4.2.10	Imminent slowdown or shutdown of the propulsion
7.6.3	Steering gear phase failure/overload alarm
8.7.1	Fault requiring attention
8.7.3	Alarm system normal supply failure
9.10.1	Fire detection system alarm
9.11.1, 9.12.1	Gas detection and alarm system
FSS Code	
8.2.5.2.1, 9.2.5.1.2, 9.2.5.1.3	Fire detection or automatic sprinkler operation
8.2.5.2.1, 9.2.5.1.5, 9.2.5.1.2	Fire detection system fault
10.2.4.1.4	Smoke detection system power loss
10.2.4.1.3, 10.2.2.3	Smoke detection

Annex B
(informative)

LAN image protocol (IEC 61996-1:2013, Annex E)

B.1 Overview

There are two possible protocols used for sending an image over a LAN:

— TCP/IP based (IEC 62388:2007, Annex H);

— UDP based (IEC 61162-450).

In order to avoid important issues with timestamps for UDP, and to make it possible to record all radar displays and ECDIS display in turn possible, the following addition to the LAN protocols are necessary.

Implementing this should facilitate installation and integration between image transmitting equipment and the VDR. If equipment carriage requirements change or if it is wished to add more instruments to the recording, this protocol will also accommodate this.

Information on network design is given in Annex C.

B.2 Image status and information text

B.2.1 General

In order to distinguish signals coming from multiple monitors, the image transmitter shall identify itself in the "Status and information text" field (included in the header of IEC 62388:2007, Table H.4) or the "Status and information text" field (included in the binary image descriptor format of IEC 61162-450:2011, Table 10).

The characters of the field shall be 7-bit ASCII text. Each line of the field shall be terminated by a <CR><LF>.

B.2.2 General identifier

The first line of the status and information text field should be as follows:

```
"VDRI" "/" 1-digit "." 1-digit
```

This indicates the version which shall be "VDRI/1.0" for the version described in this Annex. A receiver shall accept all "1.*y*" subversions, but issue an alert for "*x.y*", when $x > 1$.

If this line is not received, the receiver shall treat this as an unspecified image, and store it or discard it according to an installation-specific configuration.

B.2.3 Timestamp

Timestamp is required for IEC 61162-450 only. The timestamp or delay for a stream according to IEC 62388:2007, H.2 is indicated in the standard header structure with the Data items timeSec and TimeNsec or with the Data item difftime.

The second line indicates the time the image appeared for the user as follows:

"Time" ":" <time>

"Time-ms" ":" <integer of milliseconds>

The timestamp is always in UTC format but given without indicator. The millisecond gives the number of milliseconds in addition to the second to the best of the ability of the sender.

EXAMPLE

Time: Sun, 04 Nov 2012 08:49:37

Time-ms: 230

NOTE 1 This timestamp is made at source immediately at data recording, e.g. just before the screenshot. The milliseconds are needed due to required time resolution of 0,05 s for VDR.

It is only practicable to use this value if the synchronization between the VDR and the source device (e.g. radar) is sufficiently precise (in the range of milliseconds). The Delay data item may be used as an alternative method for synchronisation as follows:

"Delay" ":" <ms>

Delay gives the milliseconds, as an integer, from the screen capture to the first package sent accurate to the best of the ability of the sender.

If Delay is inserted, the timestamp value shall not be inserted.

NOTE 2 The destination device (e.g. VDR) uses this Delay value together with its system time to determine the timestamp for the transmitted data. Time tolerances between VDR and source device may be neglected, because the time reference of the VDR is always the system time of the VDR.

B.2.4 Class of image

The third line indicates the class of image as follows:

"Source" ":" <class>

where

<class> = <type> ["." <identifier>]

<type> = "Xband" | "Sband" | "ECDIS" | "Conning" | "Combined" | "Alarm" | "Machine" | "AIS" | "Other" …

<identifier> = unsigned integer number

If a ship is fitted with two separate but otherwise identical systems, they shall be identified by <identifier>, for example:

— where a ship carries two X-band radar transceivers they may be designated as: "Source: Xband.1" and "Source: Xband.2".

— where a ship carries two ECDIS, the ECDIS master computer may be designated as "Source:ECDIS.1", while the ECDIS backup may be designated as "Source:ECDIS.2".

Where an INS is fitted the route monitoring tasks and functions display shall be <type> "ECDIS", and the collision avoidance tasks and functions display shall be <type> "Xband" or "Sband" depending upon the transceiver selected.

B.2.5 Display location

The fourth line is used as a reference to the full location information of the corresponding display in the configuration data as follows:

"Location" ":" <location >

<location> = <string>, the maximum string length is 32 characters

The string is free text, for example, "Display no 2 from port" or "A2". The location string shall be unique and remain constant for each physical display.

A VDR may choose to interpret "New" at the start of location string as a signal that the VDR configuration should be updated and issue an alert.

B.2.6 Active status

The fifth line is an optional message that may be used for ships with many workstations as follows:

["Active" ":" "yes" | "no" | "unknown" | "standby"]

"yes" — indicates the controls on this location recently have been used.

"no" — indicates the controls have not detected any use recently.

"unknown" — no control use indicator is available, which is the default if the sentence is omitted.

"standby" — this station does not show any active content (for instance, radar is in standby) or is off.

B.2.7 Examples of status and information text

For a typical bridge with two radars and two ECDISs:

X-band Radar:

DRI/1.0

Time: Thu, 16 Feb 2012 23:28:00

Time-ms: 230

Source: Xband

Location: No1

Active: yes

S-band Radar:

VDRI/1.0

Delay: 7103

Source: Sband

Location: No4

Active: standby

Master ECDIS:

VDRI/1.0

Time: Thu, 16 Feb 2012 23:28:08

Time-ms: 0

Source: ECDIS.1

Location: No2

Backup ECDIS:

VDRI/1.0

Delay: 2034

Source: ECDIS.2

Location: No3

Active: no

B.2.8 Transmitter configuration

A transmitter sending a display for VDR purposes according to IEC 61162-450 shall only use “RrUdP” (retransmittable).

It is recommended that the transmitter default from the manufacturer should be configured as in Table B.1.

Table B.1 — Default values for transmitting equipment

Item	Configuration	Default
Transmission	Transmission to VDR	If it is a dedicated radar or ECDIS the transmission shall be on.
UDP transmission mode (for IEC 61162–450 only)	“RrUdP” (retransmittable) (“RaUdP” is not permitted for any mandatory data)	“RrUdP” (retransmittable)
IP destination for image	Any IP address and port	172.16.8.2, Port 7096 for transfer according to IEC 62388:2013, H.2 239.192.0.26, Port 60026 for transfer according to IEC 61162–450
Source	“Xband”,“Xband.1”, “Xband.2”,“S-band”,“ECDIS”, “ECDIS.1”, “ECDIS.2”, etc.	As appropriate
Location	Any string up to a maximum of 32 characters	“New” <brand> <model>, for example, “New InCom T-65”
Active		For dedicated displays: Omitted (“unknown”). For multi-function displays: As appropriate.

Table B.1 *(continued)*

Item	Configuration	Default
Number of transmissions per 15 s period	1 to 15	1
Synchronization of message start send (according to satellite time or internal clock)	00,0 s to 14,5 s (within the 15 s slot)	00 s for X-band, 04 s for S-band, 08 s for ECDIS, 12 s for ECDIS backup, odd numbers for minor stations (navigation planning, bridge wings), 02 s/06 s/10 s or 14 s for other displays
Speed	Auto-negotiate, 100 Mbit/s, …	Auto-negotiate 10 Mbit/s shall not be accepted as a result of auto-negotiation.

B.2.9 Receiver configuration

It is recommended the VDR receiver default settings from the manufacturer should be configured as shown in Table B.2.

Table B.2 — Default values for receiving equipment

Item	Configuration	Default
IP address	DHCP or 172.16.0.1–172.31.255.254	172.16.8.2 (port 7096 for receiving TCP/IP images)

Annex C
(informative)

Network for image transmission (IEC 61996-1:2013, Annex F)

C.1 General

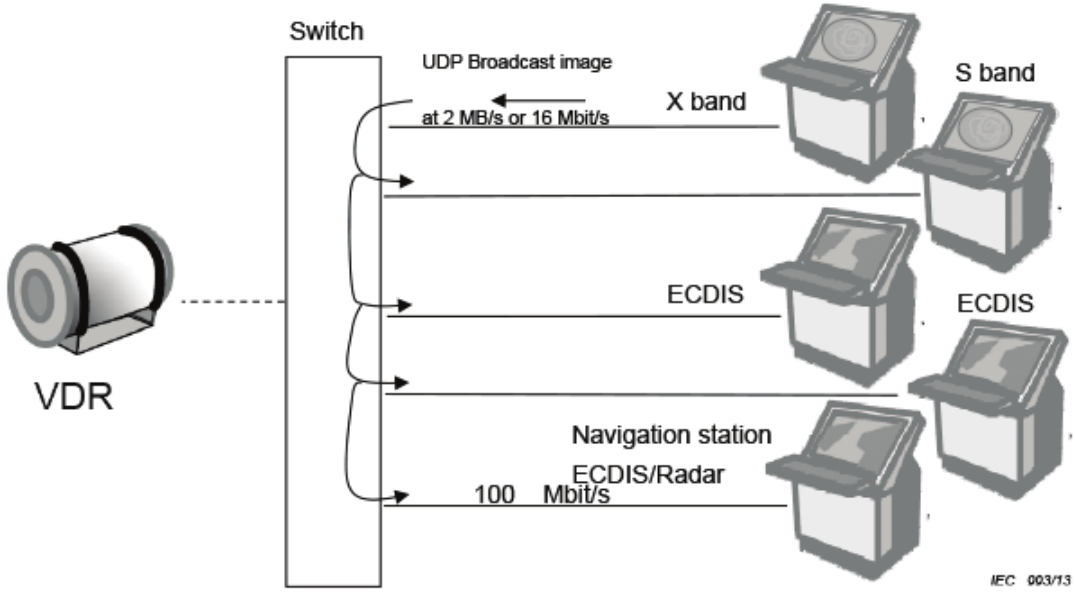
This Annex provides guidance on network design in relation to image transmission to the VDR.

C.2 Network choice

There are two standards for network image transmission, namely TCP/IP type described in IEC 62388 and the UDP type described in IEC 61162-450. The TCP/IP image transmission will retransmit packets on the protocol layer automatically that did not arrive error-free to the receiver. The UDP retransmission protocol will also secure a retransmission for packets with errors but on the application layer and controlled by application. The UDP non-retransmission protocol is not recommended as packet losses are likely.

C.3 Network topology examples

Figure C.1 shows a network with a switch.



NOTE Total theoretical traffic maximum on each workstation line 4 × 16 Mbit/s = 64 Mbit/s. The average is 6 Mbit/s for 2 MB images transmitted once per 15 s.

Figure C.1 — Network with a switch

IEC 61162-450 dictates a maximum transmission rate of 2 MB/s per image transmitter. This has consequences for how quickly the network can become full. The simplest possible network with a switch would look like Figure C.1.

Due to the multicasts, that each station will transmit, the network can quickly fill up, if all stations decide to transmit at the same time, especially for more than six stations at the speed 100 Mbit/s. This can have consequences for the navigational data in the same network, causing the bridge to function badly in times of peak traffic (such as chart updates).

Another simple way to connect the stations to the VDR is to use direct connections, removing the switch as a source of failure and eliminating the multicast extra traffic, as shown in Figure C.2.

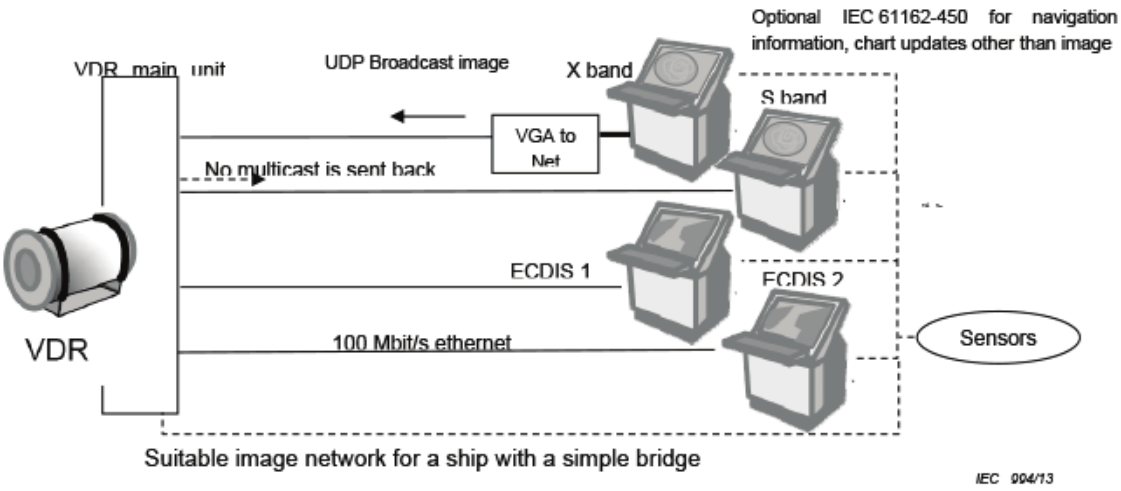


Figure C.2 — Network with direct connections

Ships with an extensive bridge (bridge wings, multiple stations, etc.) will have to use 1 000 Mbit/s Ethernet as shown in Figure C.3.

C.4 Service and installation

Care should be taken to ensure that all locations/stations that should transmit a mandatory image do so (even if not mandatory at current setting). In order to avoid situations, where the network will be slow or overload only at sea, a test or stress function should be implemented on stations, from which traffic can vary significantly (such as high AIS traffic, chart updates/consolidation, radar information).

Ethernet 1 000 Mbit/s links connections should not be set to auto-negotiate, so that they do not auto-negotiate to 100 Mbit/s.

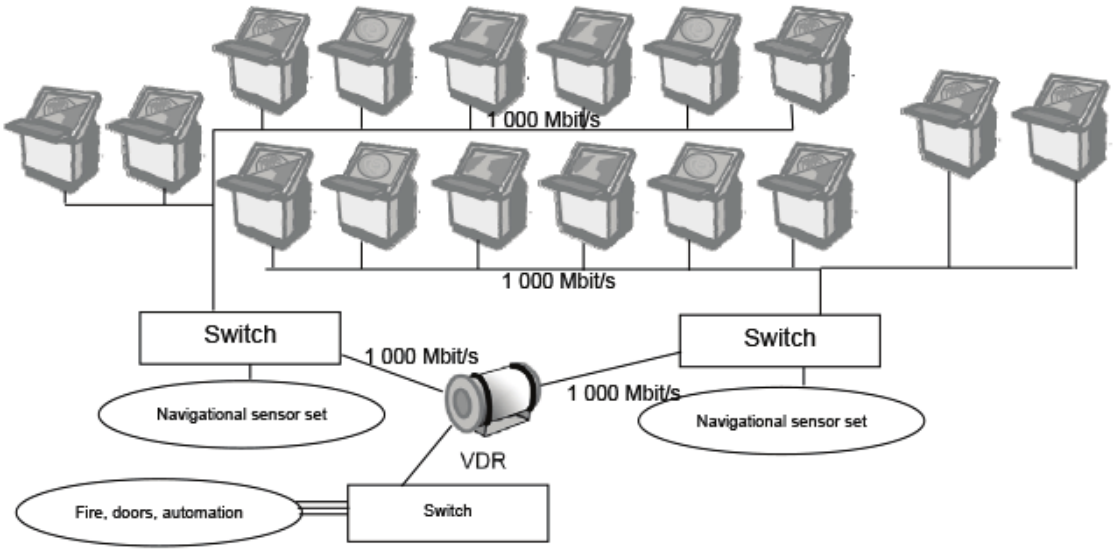


Figure C.3 — Network for a ship with an extensive bridge

Annex D
(informative)

ECDIS display source information (IEC 61996-1:2013, Annex G)

D.1 Overview

For the ECDIS, the charts used (cell name, edition and update number) are required to be recorded (IEC 61996-1:2013, 4.6.8). In addition, settings not visible on the recorded image that affect what is shown on the ECDIS display may be recorded.

The ECDIS display source information message shall be sent a minimum of every 10 min. If a change is made to the relevant information, a message shall be sent up to at least a rate of one message per 2 s.

The message is sent as a data block ("binary image", retransmittable form) according to IEC 61162-450, where the datatype is set to "text/plain".

If IEC 62388:2007, H.2 protocol is used, this information is sent as an H.2 image, where the "datatype" is set to "ITEXT".

All relevant display source information data blocks shall be recorded.

A radar display may optionally send out a similar message.

D.2 Data block status and information text field

The status and information text field shall contain the same fields as for an ordinary image as defined in Annex E, except the "active" field, which shall be omitted. The time indicator or delay time shall indicate the time, when the parameters were sampled.

D.3 Data text

The data shall be plain 7-bit ASCII characters following on from the fields defined in Annex E with lines separated by <CR><LF>. The text shall contain a sequence of data identifiers of the form:

```
<level data name> "=" <data value>
```

where

```
<level data name> = [<level> "." [<level> "." ] …] <dataname>
```

If two level data names are identical, they shall be concatenated in order of appearance. The levels shall be used to show a collapsible view of information, when played back in the VDR.

A level or dataname shall not contain spaces, but can contain "_" underscore, which may be replaced by a space when presented. For identification, level data names are case insensitive. A level and dataname can be identical. A level or dataname can start with "-" (hyphen) to indicate a proprietary or non-standard dataname or level, in order to distinguish from future standard names.

D.4 Level data names

Possible units are "m","ft", "fm", "nm", "mi", "kn", "km", "km/h", "mi/h", "s", "min", "h". A <no> indicates a sequence of levels (for example chart.chart1, chart.chart2, etc.). A flag shall be indicated by flag-set or flag-unset (for automated presentation). If a feature is not available for this equipment, the parameter

may be omitted. If other features such as alternative chart presentations, automatic cautionary warnings or vessel guidance exist, and those are not completely displayed including parameters, they shall also be added to this list.

D.5 Required information to be recorded

The chart information required to be recorded is given in Table D.1.

Table D.1 — Required chart information

Configuration	Level data name	Example data value
Identifier (for verification of the file type only)	Identifier identifier.version	VDRI 1.0
Chart name	chart.chart<no.>	IT50074.000
Chart edition	chart.chart<no>.edition	1
Chart update number	chart.chart<no>.update	3

Example:

```
identifier=VDRI
identifier.version=1.0
chart.chart1=IT50074.000
chart.chart1.edition=1
chart.chart1.update=4
chart.chart2=IT400119.000
chart.chart2.edition=1
chart.chart2.update=3
```

D.6 Optional information to be recorded

Additional optional chart information which may be recorded is given in Table D.2.

Table D.2 — Additional chart information

Configuration	Level data name	Example data value
Chart issuing HO	chart.chart<no>.issuer	Italian Hydrographic Office
Chart comment	chart.chart.comment	(if available)
Safety contour	ownship.safety_contour	10m
Safety depth	ownship.satefy_depth	10m
Shallow contour	ownship.shallow_contour	2m
Deep contour	ownship.deep_contour	30m
Two shades (flag)	presentation.two_shades	flag-set
Safe contour only (flag)	presentation.safe_contour_only	flag-set
Isolated dangers in unsafe waters shown (flag)	presentation.isolated_danger_in_unsafe_waters_shown	flag-set
Shallow pattern (flag)	presentation.shallow_pattern	flag-unset
Safe depths shown (flag)	presentation.safe_depths_shown	flag-unset
Plain depth contour (flag)	presentation.plain_depth_contour	flag-unset
Quality symbol (flag)	presentation.quality_symbol	flag-unset
Low accuracy indicator (flag)	presentation.low_accuracy_indicator	flag-unset
NOAA aids shown (flag)	presentation.NOAA_aids_shown	flag-unset
ENC boundary (flag)	presentation.ENC_boundary	flag-unset
Chart boundary (flag)	presentation.chart_boundary	flag-unset

Table D.2 *(continued)*

Configuration	Level data name	Example data value
Use SCAMIN (flag)	presentation.use_SCAMIN	flag-set
INFORM symbol (flag)	presentation.INFORM_symbol	flag-unset
Picture symbol (flag)	presentation.picture_symbol	flag-unset
Text description symbol shown (flag)	presentation.text_description_symbol_shown	flag-unset
Overscale id (flag)	presentation.overscale_id	flag-set
Scale boundary shown (flag)	presentation.scale_boundary_shown	flag-set
Lat/Lon grid (flag)	presentation.lat/lon_grid	flag-unset
Mariners' objects are shown on this image (flag)	presentation.mariners_objects_are_shown	flag-unset
Text light info shown (flag)	presentation.text.light_info_shown	flag-unset
Text (important) (flag)	presentation.text.important	flag-set
Text (other) (flag)	presentation.text.other	flag-unset
National text shown (flag)	presentation.text.national	flag-unset
Periodic dates shown (flag)	presentation.text.periodic_dates	flag-unset
Text generic shown (flag)	presentation.text.generic	flag-set
Aids to navigation tooltips active (flag)	presentation.ui.aids_to_navigation_tooltips_active	flag-set
Light sectors (flag)	presentation.light.sectors	flag-unset
Light shown with real length (flag)	presentation.light.real_length	flag-unset
Highlight light sectors chosen (flag)	presentation.light.highlight_chosen_sectors	flag-unset
Highlight light sectors all (flag)	presentation.light.highlight_all_sectors	flag-unset
Highlight white sectors (flag)	presentation.light.highlight_white_sectors	flag-unset
Route shown on image (flag)	route.any	flag-unset
Route name shown	route.route<no>	Civitavecchia-Savona
Route checked (flag)	route.route<no>.checked	flag-set
Route charts used in check	route.route<no>.chart<no> and chart<no>associated sublevels	
Route name for voyage underway (if active)	route.underway	Civitavecchia-Savona
Waypoint shown (flag)	waypoint.waypoint<no>	name or ID
Waypoint position	waypoint.waypoint<no>.position	4220.02N, 01057.58E
Radar overlay shown (flag)	presentation.radar	flag-unset
Radar overlay source (if available)	Presentation.radar.source	Xband
Actual AIS data shown on image (flag)	presentation.ais.actual_AIS_data_shown	flag-unset
Actual ARPA data shown on image (flag)	presentation.arpa.actual_ARPA_data_shown	flag-unset
Tides shown (flag)	presentation.tides	flag-unset
Weather or other specific data layer shown (flag)	presenation.layer.layername<no> presentation.layer.layername<no>.issuer	pirate data Jeppesen

Table D.2 *(continued)*

Configuration	Level data name	Example data value
List of active alerts (alarms or caution), date set	alarm.alert<no> alarm.alert<no>.datetime	Position device not compliant 01 March 2012, 02:33:00
Anti-ground alarm time of prediction	alarm.antiground.time_of_prediction	5s
Dangers safety distance (grounding alarm)	alarm.dangers.safety_distance	200m
Guard zone sector	alarm.collision.guard_zone	90
Danger objects inside guard zone (flag)	alarm.collision.danger_objects_in-side_zone	flag-unset
Depth alarm, more than, if active	alarm.depth.more_than	2m
Depth alarm, less than, if active	alarm.depth.less_than	11m
Target lost alarm active (flag)	alarm.arpa.target_lost	flag-unset
AIS target lost alarm active (flag)	alarm.ais.target_lost	flag-unset
AIS auto activation (flag)	alarm.ais.auto_activation	flag-set
AIS distance to dangerous	alarm.ais.distance_to_dangerous	0.5nm
AIS distance to activation	alarm.ais.distance_to_activation	0.5nm
AIS CPA/TCPA	alarm.ais.cpa alarm.ais.tcpa	0.5nm 15min
AIS visibility	alarm.ais.visibility	25nm
AIS past track time	presentation.ais.past_track	30s
ARPA past track if active in seconds	presentation.arpa.past_track	30s
ARPA distance to dangerous	alarm.arpa.distance_to_dangerous	0.5nm
ARPA Lost target alarm range	alarm.arpa.lost_target_alarm_range	0.5nm
ARPA CPA/TCPA	alarm.arpa.cpa alarm.arpa.tcpa	0.5nm 15min
Sonar past track if active in seconds	presentation.sonar.past_track	30s
Sonar distance to dangerous	presentation.sonar.distance_to_dangerous	0.5nm
Sonar Lost target alarm range	presentation.sonar.lost_target_alarm_range	0.5nm
Sonar CPA/TCPA	presentation.sonar.cpa presentation.sonar.tcpa	0.5nm 15min
Mode version	software.display_source_version	V1
Application name, version and version date release information	software.application <no > software.application <no> .version software.application <no> .date	ECDIS 1.2.234 1 March 2012
Brightness setting (xx/yy where yy is max)	presentation.brightness	5/100

EXAMPLE:

```
identifier=VDRI
identifier.version=1.0
chart.chart1=IT50074.000
chart.chart1.edition=1
chart.chart1.update=4
chart.chart2=IT400119.000
chart.chart2.edition=1
chart.chart2.update=3
chart.chart1.issuer=Italian Hydrographic Office
chart.chart2.issuer=Italian Hydrographic Office
ownship.safety_contour=10m
ownship.satefy_depth=10m
ownship.shallow_contour=2m
ownship.deep_contour=30m
presentation.two_shades=flag-set


……..

software.application1=ECDIS presentation application
software.application1.version=1.123.1
software.application1.date=20 March 2011
software.application2=Collision application
software.application2.version=1.123.1
software.application2.date=12 March 2011
software.application2=ENC import tool
software.application2.version=1.124.1
software.application2.date=13 March 2011
```

Annex E
(informative)

Manufacturer's documentation (IEC 61996-1:2013, 5.5)

E.1 Installation guidelines (IEC 61996-1:2013, 5.5.1)

The following installation guidelines shall be included.

a) Siting of the fixed recording medium and float-free recording medium.

   The protective capsule shall 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:

   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 routine maintenance;

   5) facilitation of underwater removal and retrieval by both divers and ROVs. There should be a clear unobstructed space in the vicinity of the capsule to allow an ROV or diver to work;

   6) in the case of float-free recording medium, minimization of the risk of obstruction after release.

b) Siting of microphones to achieve the requirements of IEC 61996-1:2013, 4.6.5.

c) Siting of the data interface (IEC 61996-1:2013, 4.3.5.2).

d) Siting of the playback equipment (IEC 61996-1:2013, Annex C).

e) Siting of all other components of the VDR system.

f) Entering and updating the configuration data of IEC 61996-1:2013, 4.4.2.

g) The requirement for interface units to comply with IEC 61996-1:2013, 4.3.5.

h) The requirement to record ship specific interface information to be recorded and the record to be left on-board.

E.2 Operation and maintenance manual (IEC 61996-1:2013, 5.5.2)

[IMO Resolution MSC.333 (90):2012, Clause 7] *Information describing the location of the long-term recording medium interface (see 4.4.5.2) and instructions describing the means of interfacing with it as referred to in Annex C shall be provided in at least the English language. The equipment documentation shall include guidance for the placement of the information and instructions at a prominent position as close to the long-term recording medium interface as practicable.*

The manual shall include the following:

a) instructions on normal operation of the VDR;

b) instructions on how to copy data from the equipment (see Annex C);

c) instructions on the action to be taken following the activation of any VDR alert;

d) instructions for downloading and verification of the data from each part of the final recording medium;

e) instructions for verification of each recorded sensor data through playback;

f) instructions on maintenance tasks required to ensure the serviceability and continued seaworthiness of the VDR including analysis to identify those sensors or transducers where the serviceability or accuracy could be degraded and remain undetected;

g) instructions to update the records of ship specific-interface information as necessary.

E.3 Information for use by an investigation authority (IEC 61996-1:2013, 5.5.3)

The following information shall be available:

a) instructions to enable an investigation authority to manufacture any special tools or interface equipment required for retrieval of recorded data from the recorder;

b) details of the necessary actions to be followed for data retrieval from an undamaged final recording medium;

c) details of the necessary actions to be followed for data retrieval from a final recording medium that has been damaged in an incident;

d) details of the necessary actions to be followed to determine, prior to an attempted replay, whether the storage medium has been subjected to an excessive level of heat, where the survival of the stored data may be in doubt;

e) playback equipment required to enable the download and playback of recorded data (see IEC 61996-1:2013, Annex C).

Annex F
(informative)

Performance test report (IMO Circular MSC.1/Circ.1222 Appendix)

Voyage Data Recorder Performance Test Report

Modified for IMO Resolution MSC.333 (90)

NOTE Insert **Yes,** for success; **No,** for failure; or **N/A,** for non-fitted interfaces in these boxes, as appropriate.

Ship's details		**Yes**	**No**	**N/A**
Ship's name				
Flag				
IMO number				
Date keel laid				
Gross tonnage				

Voyage data recorder details

Manufacturer	
Model	
System serial number	
Software version number	
Date fitted	

Inspection details

Name person conducting testing	
Company	
Inspection date	
Inspection location	

1. Pre-existing alarms

Confirm that no alarms were present at start of procedure			

2. Power supply alarm check

Remove source of external power. Confirm that alert is activated.			
Record time (hh.mm)			

3. Reserve power source check

Allow VDR to continue running for 1 hour 55 minutes from "2" above

Confirm that equipment is still operating at this time, with no additional alerts.			
Record time (hh.mm)			

4. Reserve power source shutdown check

2 hours 05 minutes from "2" above confirm that the VDR has automatically stopped recording.			
Record time (hh.mm)			

5. Battery expiry dates

Battery	Expiry date (where applicable)			
Acoustic beacon				
EPIRB battery				
Reserve power source				

6 Acoustic beacon and EPIRB test

Using manufacturer's test equipment confirm that acoustic beacon is functional or by the substitution of a certified fully operational unit.			
Following the instructions by manufacturer's conduct a self-test of the EPIRB.			

7. Overall condition of equipment

Inspect equipment and record condition, tick if satisfactory:

Sub unit	Notes on condition			
Protective capsule				
Float free capsule				
External cables				
Main unit				

8. Interfaces: Operation and recording

Date and time	Preferably external to ship (e.g. GPS)				
Ship's position	Electronic Positioning System				
Speed (through water or over ground)	Ship's designated speed and distance measuring equipment				
Heading	Ship's compass				
Bridge audio	2 or more bridge and 1 or more wing microphones				
Communications Audio	VHF				
Radar data-post display selection	Master and No.2 Radar				
ECDIS	Primary ECDIS				
Water depth	Echo sounder				
Main alarms	All mandatory alarms on bridge				
Rudder order and response	Steering gear and autopilot				
Engine order and response	Telegraphs, controls and thrusters				
Hull opening status	All mandatory status information displayed on bridge				
Watertight and fire door status	All mandatory status information displayed on bridge				
Acceleration and hull stresses	Hull stress and response monitoring equipment, **where fitted**				
Wind speed and direction	Anemometer, **where fitted**				
AIS	AIS				
Polling motion	Electronic inclinometer, **where fitted**				
Configuration data	Information of VDR and sensors				
Electric logbook	Electronic logbook, **where fitted**				

9. Change and repair of sensors

Check maintenance records of VDR				
Confirm any defects properly rectified				
Person authorized by Manufacturer	**Ship's representative**			
Date	**Date**			

If the manufacturer does not complete a review and issue a completed test report within 45 days, this test report should go forward for certification.

10. Manufacturer's analysis

Note This confirms the endorsement by the manufacturer of the tests and that the master record/database has been checked.

Manufacturer's analysis of 48-hour log is attached and in accordance with IEC 61996-1:2013, 4.6 [IMO Resolution MSC.333 (90):2012, 5.5]. Confirmation that all data is available throughout the 12-hour recording.			
Data and time of above log.			

11. Playback equipment

Inspect equipment and record condition, tick if satisfactory:

Data medium			
Playback software			
Operational instructions			
Special parts required if needed			
Connection and playback achieved on a commercial-off-the-shelf laptop computer laptop			
Confirmation of replay of data as information useful to investigating authorities (raw data is not information)			
Conversion of data into open industry formats (IEC 61996-1:2013, Annex C)			

12. Documentation

Inspect documentation and record presence and suitability, tick if satisfactory:

Siting of the fixed recording medium and float-free recording medium			
Siting of microphones			
Siting of the data interface			
Siting of the playback equipment			
Siting of all other components of the VDR system			
Operation and maintenance manual			
Information for the use by an investigation authority			

13. Observations and additional manufacturer's requirements

NOTE This specifically provides for the logging of significant events that may have occurred on board since the previous test, including the refitting of equipment or major unit change to existing equipment. Any or all of which may have an impact on the availability or quality of the VDR input signal.

This performance test was conducted in accordance with SOLAS regulation V/18.8 and forms part of the procedure for the issue of the Annual Performance Test Certificate. The results, information and any comments should be relayed to the manufacturer in accordance with the instructions contained within the Operation Manual. Subject to satisfactory results, an Annual Performance Test Certificate will then be issued.

In accordance with the principles of harmonization of Certificates, the Certificate, when issued, will remain valid until the next annual re-validation of that Certificate, subject to the equipment being maintained in appropriate operational condition.

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