

**[EAV W/O GYRO]**

The echo averaging feature can be used without a gyrocompass. Select [ON] to use the feature without a gyrocompass (default: [OFF]).

**[ECDIS]**

Select the ECDIS communication method, [SERIAL] or [LAN]. Select [OFF] for no ECDIS connection (default: [OFF]).

**[EXT BRILL CONTROL]**

Select [ON] to adjust the brilliance of the monitor unit from external equipment.

**[SSD SUB OUTPUT]**

**Note:** Not used with magnetron radars.

For solid state radars, select [ON] to output the analog signals from TB803 #11 to 16 and TB804 in the antenna unit (default: [OFF]).

**[OVERLAY1 (2)]**

**Note:** This menu is **NOT** available for C-type radars.

When an ECDIS is connected, the radar picture can be overlaid on the ECDIS. Set the items on this menu to correctly overlay the radar picture on ECDIS.

**Note:** The overlay output is less accurate than the sub monitor output from the Antenna Unit, especially in the areas mentioned below. Therefore, only use the overlay with an ECDIS.

- Distance accuracy/resolution
- Bearing accuracy/resolution
- Sweep
- Echo picture
- Range

When the echo image is **NOT** used with ECDIS, use the signal from the Antenna Unit.

| OVERLAY1 |                           |
|----------|---------------------------|
| 1        | BACK                      |
| 2        | HDG ALIGNMENT<br>000.0°   |
| 3        | BEARING PULSE<br>360/8192 |
| 4        | HDG POLARITY<br>LOW/HIGH  |
| 5        | TRIG WIDTH<br>SHORT/LONG  |

**[RP UPDATE]**

**For C-type and A/B/W radars with Radar Plotter functionality**, conduct updates for the RP board (CC6).

- [APPLICATION]: Update the RP board (CC6) software.
- [OS]: Update the RP board (CC6) OS (operating system).
- [CHART SYMBOL]: Update the RP board (CC6) chart symbols.
- [REMOVE USB MEMORY]: Remove a USB flash memory from the RP board (CC6).

| RP UPDATE |                   |
|-----------|-------------------|
| 1         | BACK              |
| 2         | APPLICATION       |
| 3         | OS                |
| 4         | CHART SYMBOL      |
| 5         | REMOVE USB MEMORY |

**[SHUTTLE FERRY SWITCH]**

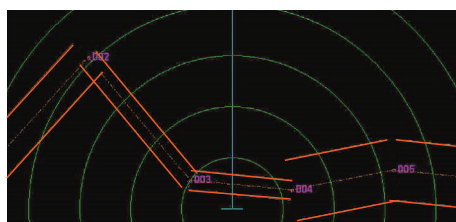
**Note:** This menu is **NOT** available for C-type radars.

Select a port to detect a navigation direction of a shuttle ferry (default: [RS-232C]).

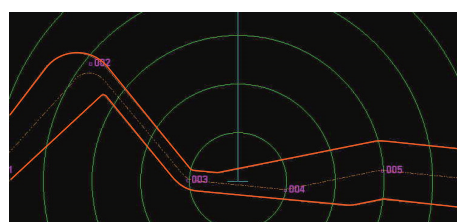
**[ECDIS ROUTE DISPLAY]**

**Note:** This menu is **NOT** available for C-type radars.

Select [NORMAL] to show the routes with a straight lines, [LEGACY] to show the routes with a curve lines.



[NORMAL]  
(Straight line)



[LEGACY]  
(Curve line)

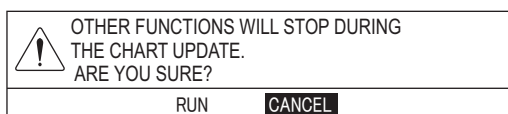
## 3.6 How to Control Charts

This section shows you how to install or update charts for C-type and A/B/W radars with Radar Plotter functionality.

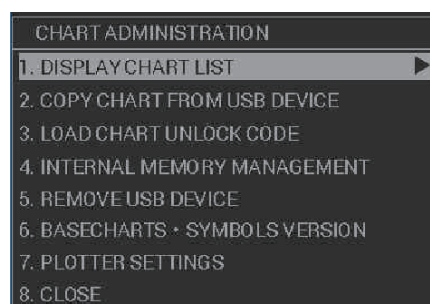
### 3.6.1 How to install charts

**Note:** Save the chart data to a USB flash memory first. You do not need to create a folder.

1. Connect the USB flash memory with chart data to the USB drive from the RP board.
2. Press the **MENU** key to open the main menu.
3. Select [INITIAL SETTINGS].
4. Select [UPDATE CHART]. The following message appears.



5. Select [RUN]. The message "PROCESSING. PLEASE WAIT." appears, then the [CHART ADMINISTRATION] menu appears.



6. Select [COPY CHART FROM USB DEVICE] to display the list for data in the USB flash memory.

7. Select the chart data to copy.
8. Select [SELECT CHART TO COPY]. The confirmation message appears.
9. Select [RUN] to copy the chart data.
10. Click the left button.

11. Do one of the following methods to unlock the chart data.

How to unlock the chart data automatically

**Note:** Save the unlock code to the USB flash memory first. The file extension is "uc".

- 1) Select [LOAD CHART UNLOCK CODE] in the [CHART ADMINISTRATION] menu to display the list for data in the USB flash memory.
- 2) Select the file for the unlock code. The confirmation message appears.
- 3) Select [RUN]. The message "UNLOCK CODE VERIFIED." appears.
- 4) Click the left button.

How to unlock the chart data manually

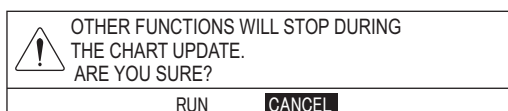
- 1) Select [1. DISPLAY CHART LIST] in the [CHART ADMINISTRATION] menu to display the chart list.
  - 2) Select the locked chart data (displayed with yellow letters), then click the left button to display the character entry window.
  - 3) Set the unlock code as described below.  
Operate the trackball or the wheel to select a character, then click the left button to confirm selection. Repeat this step to select all other characters. Select [ENTER] then click the left button.  
The message "UNLOCK CODE VERIFIED." appears.
  - 4) Click the left button.
12. When unlocking the chart data automatically, select [5. REMOVE USB DEVICE]. The message "USB DEVICE CAN BE SAFELY REMOVED." appears. Click the left button then remove the USB device.
  13. Select [CLOSE]. The confirmation message appears.
  14. Select [RUN]. The system restarts.

### 3.6.2 How to update charts

**Note 1:** Save the chart data to a USB flash memory first. You do not need to create a folder.

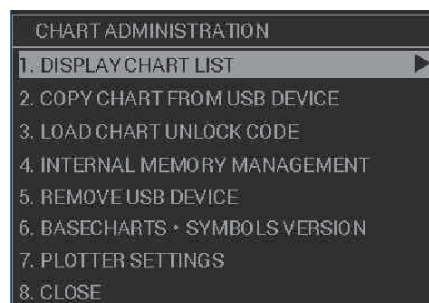
**Note 2:** Before updating charts, delete the old chart data. If needed, take backups for an unlock code.

1. Connect the USB flash memory with chart data on it in the USB drive from the RP board.
2. Press the **MENU** key to open the main menu.
3. Select [INITIAL SETTINGS].
4. Select [UPDATE CHART]. The following message appears.



5. Select [RUN]. The message "PROCESSING. PLEASE WAIT." appears, then the [CHART ADMINISTRATION] menu appears.

After restarting, the unlock code is saved in the USM flash memory. The file name is 20 characters of this system ID, file extension: uc.



6. Select [DISPLAY CHART LIST] to display the chart list.
7. Select the chart data to delete then press the **F1** key.
8. Select [RUN]. The message "CHART DELETION COMPLETE" appears.
9. Click the left button.
10. Follow steps 6 to 14 in paragraph 3.6.1.

## 4. INPUT/OUTPUT DATA

### NOTICE

IMO-type radar(s) must be interconnected to the following type approved sensors.

For other radar types, it is recommended to connect the following type approved sensors:

- EPFS meeting the requirements of the IMO resolution MSC.112(73).
- Gyrocompass (or equivalent devices) meeting the requirements of the IMO resolution A.424(XI).
- SDME meeting the requirements of IMO resolution MSC.96(72).

The radar may be interconnected via HUB-3000 to other FURUNO processing units having approved LAN ports.

### 4.1 Processor Unit

Input and output data are shown in the table below.

**Note:** This radar accepts position data fixed by WGS-84 geodetic datum only. Set the datum to WGS-84 on the EPFS (GPS, etc.) connected to this radar. If other type of datum is input, the error message "DATUM" appears and the AIS feature is inoperative.

#### Input

| Data                  | Specification               | Contents                                                                                                 | Remarks                                                   |
|-----------------------|-----------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Heading signal        | AD-10 format                | External AD-100                                                                                          | AD-10 and IEC 61162 are switched by menu setting.         |
|                       | IEC 61162-2*, IEC 61162-450 |                                                                                                          |                                                           |
| Speed signal          | IEC 61162-1, IEC 61162-450  |                                                                                                          |                                                           |
| Navaid data           | IEC 61162-1                 | Position, course, speed, waypoint, route, time, wind data, current data, depth, temperature, roll, pitch | For IMO-type, IEC-61162-1 Edition 5 is required.          |
|                       | IEC 61162-450               |                                                                                                          |                                                           |
| Alarm handling signal | Contact closure             |                                                                                                          | Input from bridge alert management system (BAMS)          |
|                       | IEC 61162-1, IEC 61924-2    | ACK, ACM, HBT                                                                                            | Input from BAMS ACK and ACM are switched by menu setting. |
| AIS signal            | IEC 61162-2, IEC 61162-450  |                                                                                                          |                                                           |
| Consort signal**      | NMEA0183                    |                                                                                                          |                                                           |
| GPS buoy signal**     | NMEA0183                    |                                                                                                          |                                                           |

\*: Data input cycle must be more than 40 Hz (high speed craft) or 20 Hz (conventional ships).

\*\*: For C-type radars only

#### 4. INPUT/OUTPUT DATA

##### **Output**

| Data                        | Specification                           | Contents                                    | Remarks                                               |
|-----------------------------|-----------------------------------------|---------------------------------------------|-------------------------------------------------------|
| Radar system data           | IEC 61162-1, RS-232C, IEC 61162-450     | RSD, OSD, TLL                               | For ECDIS, PC plotter                                 |
| TT data**                   | IEC 61162-1, IEC 61162-450              | TTD, TTM, TLB                               | For ECDIS                                             |
| Alert handling signal       | IEC 61162-1, IEC 61924-2, IEC 61162-450 | ALR, ALF, ALC, ARC, HBT, EVE                | For BAMS<br>ALR and ALF are switched by menu setting. |
| Sub monitor signal          | HD, BP Trigger, Video                   |                                             | 1 port for radar<br>2 ports for ECDIS                 |
| External LCD monitor signal | DVI                                     | Same as main display unit                   | 2 systems in total                                    |
| VDR                         | R, G, B, H, V, IEC 61162-450            | Same as main display unit                   | 1 port                                                |
| Alert signal                | Contact closure                         | Output to alarm system by using photo-relay | 4 systems, Output contents are selected by menu.      |

\*\* : These sentences are output in order of targets close to the own ship. The output sentence and mode can be set at the [TT PRESET] menu (See section 3.5.5). The baudrate can be set at the [BAUD RATE] menu (See section 3.5.6).

##### **IEC 61162 input sentence and priority**

| Contents                                 | Sentence and priority                 |
|------------------------------------------|---------------------------------------|
| Heading (True)*1                         | THS>HDT*1*2>VHW*4>HDG*5               |
| Heading (Magnetic)*5                     | HDG*5>HDM*5>VHW*4                     |
| Magnetic deviation*5                     | HDG*5>RMC                             |
| AIS target message, alert                | VDM, VDO, VSD, ABK, ALR               |
| Date, Time                               | ZDA                                   |
| Position*3                               | GNS>GGA>RMC>GLL<br>or GLL>GNS>GGA>RMC |
| Datum                                    | DTM                                   |
| Course over the ground                   | VTG>RMC                               |
| Speed over the ground (SOG)(GPS)         | VTG>RMC                               |
| Speed over the ground (LOG (BT))         | VBW                                   |
| Speed through the water (STW)            | VBW>VHW                               |
| Alert handling                           | ACK, ACN, HBT                         |
| Waypoint                                 | RMB>BWR>BWC                           |
| Route                                    | WPL, RTE                              |
| Wind Speed and angle (Theoretical, True) | MWV>VWT*2                             |
| Wind Speed and angle (relative)          | MWV>VWR*2                             |
| Depth                                    | DPT >DBT>DBS*2>DBK*2                  |
| Water Temperature                        | MTW                                   |
| Current                                  | VDR, CUR                              |
| Rate of turn                             | ROT                                   |
| Monitor Setting                          | DDC, RAQ                              |

\*1: THS and HDT are IEC 61162-2. All other sentences are IEC 61162-1 ed5.

\*2: For retrofit.

\*3: To priority of GLL data, see "[PRIORITIZE GLL]" on page 3-21.

\*4: This is **NOT** available for IMO-type radars installed with software version "01.\*\*".

\*5: For C-type radars.

### **IEC 61162 output sentence**

| Contents                  | Sentence and priority   |
|---------------------------|-------------------------|
| Target L/L                | TLL * <sup>6</sup>      |
| Radar system data         | RSD                     |
| Own ship data             | OSD                     |
| TT target data            | TTD, TLB, TTM           |
| Alert handling            | ALR, ALF, ALC, ARC, HBT |
| Activity information      | EVE                     |
| AIS target message, alert | ABM, BBM, ACK, VSD      |
| Monitor Setting           | DDC                     |

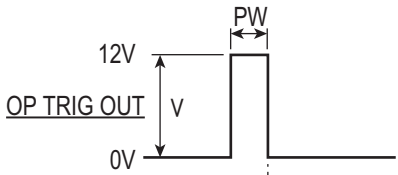
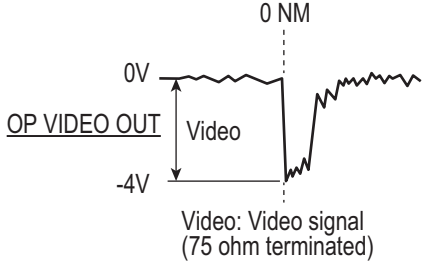
\*<sup>6</sup>: This is **NOT** available for IMO/A/R-type radars installed with software version "01.\*\*".

## 4.2 Sub Monitor

The specifications and timing of sub monitor signals are shown below.

| Signal Name   | Specification                                                                                                                                                                                                                                                                                                                          | Signal and timing |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| OP_HD_<br>OUT | <ul style="list-style-type: none"> <li>Voltage (V): 0 to 12 V</li> <li>Impedance: 110 <math>\Omega</math></li> <li>Pulse width (PW):<br/>216 to 432 ms<br/>0.625 s (24 rpm, ECDIS overlay)<br/>0.357 s (42 rpm, ECDIS overlay)</li> <li>Pulse interval (PI):<br/>2.5 s (24 rpm)<br/>1.4 s (42 rpm)</li> <li>Logic: Negative</li> </ul> |                   |
| OP_BP_<br>OUT | <ul style="list-style-type: none"> <li>Voltage (V): 0 to 12 V</li> <li>Impedance: 110 <math>\Omega</math></li> <li>Interval (t):<br/>6.9 ms (24 rpm)<br/>4.0 ms (42 rpm)</li> </ul>                                                                                                                                                    |                   |

4. INPUT/OUTPUT DATA

| Signal Name  | Specification                                                                                                                                                                                                                                                       | Signal and timing                                                                                                                                                                                                                                                                                      |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OP_TRIG_OUT  | <ul style="list-style-type: none"><li>Voltage (V): 0 to 12 V</li><li>Impedance: 110 Ω</li><li>Pulse width (PW):<ul style="list-style-type: none"><li>5 to 15 μs (magnetron radar)</li><li>8 μs (solid state radar)</li><li>5 μs (ECDIS overlay)</li></ul></li></ul> |  <p>Timing diagram for OP TRIG OUT. The signal is a pulse from 0V to 12V. The pulse width is labeled PW. The signal is labeled OP TRIG OUT.</p>                                                                      |
| OP_VIDEO_OUT | <ul style="list-style-type: none"><li>Video: 4 Vp-p/100 dB</li><li>Impedance: 75 Ω</li></ul>                                                                                                                                                                        |  <p>Timing diagram for OP VIDEO OUT. The signal is a video signal from 0V to -4V. The signal is labeled OP VIDEO OUT. The signal is labeled Video: Video signal (75 ohm terminated). The signal is labeled 0 NM.</p> |

# APPENDIX 1 JIS CABLE GUIDE

Cables listed in the manual are usually shown as Japanese Industrial Standard (JIS). Use the following guide to locate an equivalent cable locally.

JIS cable names may have up to 6 alphabetical characters, followed by a dash and a numerical value (example: DPYC-2.5).

For core types D and T, the numerical designation indicates the *cross-sectional Area (mm<sup>2</sup>)* of the core wire(s) in the cable.

For core types M and TT, the numerical designation indicates the *number of core wires* in the cable.

## 1. Core Type

D: Double core power line

T: Triple core power line

M: Multi core

TT: Twisted pair communications  
(1Q=quad cable)

## 2. Insulation Type

P: Ethylene Propylene Rubber

## 3. Sheath Type

Y: PVC (Vinyl)

## 4. Armor Type

C: Steel

## 5. Sheath Type

Y: Anticorrosive vinyl sheath

## 6. Shielding Type

SLA: All cores in one shield, plastic tape w/aluminum tape

-SLA: Individually shielded cores, plastic tape w/aluminum tape



DPYC



TPYC



MPYC-4



TTYCSLA-4

EX: <sup>1 2 3 4 5 6</sup> TTYCSLA - 4  
Designation type      # of twisted pairs

<sup>1 2 3 4</sup> MPYC - 4  
Designation type      # of cores

The following reference table lists gives the measurements of JIS cables commonly used with Furuno products:

| Type      | Area                | Core Diameter | Cable Diameter | Type       | Area                | Core Diameter | Cable Diameter |
|-----------|---------------------|---------------|----------------|------------|---------------------|---------------|----------------|
| DPYC-1.5  | 1.5mm <sup>2</sup>  | 1.56mm        | 11.7mm         | TTYCSLA-1  | 0.75mm <sup>2</sup> | 1.11mm        | 9.4mm          |
| DPYC-2.5  | 2.5mm <sup>2</sup>  | 2.01mm        | 12.8mm         | TTYCSLA-1T | 0.75mm <sup>2</sup> | 1.11mm        | 10.1mm         |
| DPYC-4    | 4.0mm <sup>2</sup>  | 2.55mm        | 13.9mm         | TTYCSLA-1Q | 0.75mm <sup>2</sup> | 1.11mm        | 10.8mm         |
| DPYC-6    | 6.0mm <sup>2</sup>  | 3.12mm        | 15.2mm         | TTYCSLA-4  | 0.75mm <sup>2</sup> | 1.11mm        | 15.7mm         |
| DPYC-10   | 10.0mm <sup>2</sup> | 4.05mm        | 17.1mm         | TTYCY-1    | 0.75mm <sup>2</sup> | 1.11mm        | 11.0mm         |
| DPYCY-1.5 | 1.5mm <sup>2</sup>  | 1.56mm        | 13.7mm         | TTYCY-1T   | 0.75mm <sup>2</sup> | 1.11mm        | 11.7mm         |
| DPYCY-2.5 | 2.5mm <sup>2</sup>  | 2.01mm        | 14.8mm         | TTYCY-1Q   | 0.75mm <sup>2</sup> | 1.11mm        | 12.6mm         |
| DPYCY-4   | 4.0mm <sup>2</sup>  | 2.55mm        | 15.9mm         | TTYCY-4    | 0.75mm <sup>2</sup> | 1.11mm        | 17.7mm         |
| MPYC-2    | 1.0mm <sup>2</sup>  | 1.29mm        | 10.0mm         | TTYCY-4SLA | 0.75mm <sup>2</sup> | 1.11mm        | 19.5mm         |
| MPYC-4    | 1.0mm <sup>2</sup>  | 1.29mm        | 11.2mm         | TTYCYSLA-1 | 0.75mm <sup>2</sup> | 1.11mm        | 11.2mm         |
| MPYC-7    | 1.0mm <sup>2</sup>  | 1.29mm        | 13.2mm         | TTYCYSLA-4 | 0.75mm <sup>2</sup> | 1.11mm        | 17.9mm         |
| MPYC-12   | 1.0mm <sup>2</sup>  | 1.29mm        | 16.8mm         |            |                     |               |                |
| TPYC-1.5  | 1.5mm <sup>2</sup>  | 1.56mm        | 12.5mm         |            |                     |               |                |
| TPYC-2.5  | 2.5mm <sup>2</sup>  | 2.01mm        | 13.5mm         |            |                     |               |                |
| TPYC-4    | 4.0mm <sup>2</sup>  | 2.55mm        | 14.7mm         |            |                     |               |                |
| TPYCY-1.5 | 1.5mm <sup>2</sup>  | 1.56mm        | 14.5mm         |            |                     |               |                |
| TPYCY-2.5 | 2.5mm <sup>2</sup>  | 2.01mm        | 15.5mm         |            |                     |               |                |
| TPYCY-4   | 4.0mm <sup>2</sup>  | 2.55mm        | 16.9mm         |            |                     |               |                |

# APPENDIX 2 DIGITAL INTERFACE

## Digital Interface

### • Input sentence

ABK, ACK, ACN, ALR, BWC, BWR, CUR, DBK\*<sup>1</sup>, DBS\*<sup>1</sup>, DBT, DDC, DPT, DTM, GGA, GLL, GNS, HBT, HDG\*<sup>2</sup>, HDM\*<sup>2</sup>, HDT\*<sup>1</sup>, MTW, MWV, OSD, RAQ, RMB, RMC, ROT, RTE, THS, TLL\*<sup>3</sup>, TTM\*<sup>2</sup>, VBW, VDM, VDO, VDR, VHW, VSD, VTG, VWR\*<sup>1</sup>, VWT\*<sup>1</sup>, WPL, ZDA

### • Output sentences

ABM, ACK, AIQ, ALC, ALF, ALR, ARC, BBM, DDC, EVE, HBT, OSD, RSD, TLB, TLL\*<sup>3</sup>, TTD, TTM, VSD

\*<sup>1</sup>: For retrofit.

\*<sup>2</sup>: For C-type radars.

\*<sup>3</sup>: NOT for IMO/A-type radars installed with software version "01.\*\*".

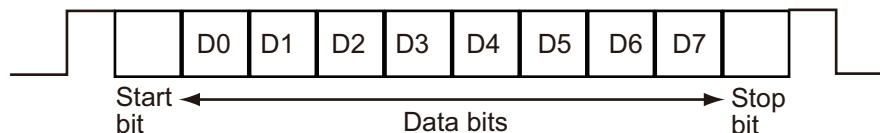
## Data reception

Data is received in serial asynchronous form in accordance with the standard referenced in IEC 61162-2 or IEC 61162-1 Ed.5.

The following parameters are used:

Baud rate: 38,400 bps (HDT, THS, !AIVDM, !AIVDO, !AIABK, \$AIALR). The baud rate of all other sentences is 4800 bps

Data bits: 8 (D7 = 0), Parity: none, Stop bits: 1



## Data Sentences

### Input sentences

ABK - AIS addressed and binary broadcast acknowledgement

\$\*\*ABK,xxxxxxxx,x,x,x,x,x,\*hh<CR><LF>  
1 2 3 4 5

1. MMSI of the addressed AIS unit (No use)
2. AIS channel of reception (No use)
3. Message ID (No use)
4. Message sequence number (No use)
5. Type of acknowledgement (See below.)

0 = Message (6 or 12) successfully received by the addressed AIS unit

1 = Message (6 or 12) was broadcast, but no acknowledgement by the addressed AIS unit

2 = Message could not be broadcast (i.e. quantity of encapsulated data exceeds five slots)

3 = Requested broadcast of message (8, 14, or 15) has been successfully completed.

4 = Late reception of a message 7 or 13 acknowledgement that was addressed to this AIS unit (own-ship) and referenced a valid transaction.

5 = Message has been read and acknowledged on a display unit.

**ACK - Acknowledge alarm**

\$\*\*ACK,xxx,\*hh<CR><LF>  
                   1

1. Unique alarm number (identifier) at alarm source (000 to 999)

**ACN - Alert command**

\$\*\*ACN,hhmmss.ss,aaa,x.x,x.x,c,a\*hh<CR><LF>  
                   1          2  3  4  5 6

1. Time (No use)
2. Manufacturer mnemonic code (3 digit alphanumeric code, null)
3. Alert identifier (0 to 999999)
4. Alert instance (1 to 999999, null)
5. Alert command (A=Acknowledge, Q=Request /Repeat information, O=Responsibility transfer, S=Silence)
6. Sentence status flag (C)

**ALR - Set alarm state**

\$\*\*ALR,hhmmss.ss,xxx,A,A,c—c,\*hh<CR><LF>  
                   1          2 3 4  5

1. Time of alarm condition change, UTC (No use)
2. Unique alarm number (identifier) at alarm source (000 to 999, null)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=not acknowledged)
5. Alarm description text (alphanumeric)

**BWC - Bearing and distance to waypoint – Great circle**

\$\*\*BWC,hhmmss.ss,llll.ll, a,yyyyy.yy,a,x.x,T,x.x,M,x.x,N,c--c,a\*hh<CR><LF>  
                   1          2 3      4  5  6 7 8  9 10 11 12 13

1. UTC of observation (No use)
2. Waypoint latitude (0000.0000 to 9000.0000)
3. N/S
4. Waypoint longitude (00000.0000 to 18000.0000)
5. E/W
6. Bearing, degrees true (No use)
7. Unit, True (No use)
8. Bearing, degrees magnetic (No use)
9. Unit, Magnetic (No use)
10. Distance, nautical miles (No use)
11. Unit, N (No use)
12. Waypoint ID (Max. 15 characters)
13. Mode Indicator (A=Autonomous, D=Differential, null\*)  
     \*: For IMO-type or R-type radar, null is invalid.

## APPENDIX 2 DIGITAL INTERFACE

### BWR - Bearing and distance to waypoint – Rhumb line

\$\*\*BWR,hhmmss.ss,lll.ll,a,yyyy.yy,a.x.x,T,x.x,M,x.x,N,c--c,a,\*hh<CR><LF>  
1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of observation (No use)
2. Waypoint latitude (0000.0000 to 9000.0000)
3. N/S
4. Waypoint longitude (00000.0000 to 18000.0000)
5. E/W
6. Bearing, degrees true (No use)
7. Unit, True (No use)
8. Bearing, degrees magnetic (No use)
9. Unit, Magnetic (No use)
10. Distance, nautical miles (No use)
11. Unit, N (No use)
12. Waypoint ID (Max. 15 characters)
13. Mode Indicator (A=Autonomous, D=Differential, null\*)

\*: For IMO-type or R-type radar, null is invalid.

### CUR - Water current layer – Multi-layer water current data

\$\*\*CUR,A,x.x,x.x,x.x,x.x,a,x.x,x.x,x.x,a,a,\*hh<CR><LF>  
1 2 3 4 5 6 7 8 9 10 11

1. Validity of data (A=Valid)
2. Data set number (No use)
3. Layer number (1 to 5)
4. Current depth in meters (No use)
5. Current direction in degrees (0.0 to 359.9)
6. Direction reference in use (true or relative)
7. Current speed in knots (0.0 to 99.9)
8. Reference layer depth in meters (No use)
9. Heading (No use)
10. Heading reference in use (No use)
11. Speed reference (No use)

### DBK - Depth below keel

\$\*\*DBK,x.x,f,x.x,M,x.x,F,\*hh<CR><LF>  
1 2 3 4 5 6

1. Water depth (0.00 to 99999.99)
2. feet
3. Water depth (0.00 to 99999.99)
4. Meters
5. Water depth (0.00 to 99999.99)
6. Fathom

### DBS - Depth below surface

\$\*\*DBS,x.x,f,x.x,M,x.x,F,\*hh<CR><LF>  
1 2 3 4 5 6

1. Water depth (0.00 to 99999.99)
2. feet
3. Water depth (0.00 to 99999.99)
4. Meters
5. Water depth (0.00 to 99999.99)
6. Fathom

**DBT - Depth below transducer**

\$\*\*DBT,x,x,f,x,x,M,x,x,F,\*hh<CR><LF>  
 1 2 3 4 5 6

1. Water depth (0.00 to 99999.99)
2. feet
3. Water depth (0.00 to 99999.99)
4. Meters
5. Water depth (0.00 to 99999.99)
6. Fathoms

**DDC - Display dimming control**

\$\*\*DDC,a,xx,a,a\*hh<CR><LF>  
 1 2 3 4

1. Display dimming preset (D=Daytime, K=Dusk, N=Nighttime, null)
2. Brightness percentage (00 to 99, null)
3. Color palette (No use)
4. Sentences status flag (C)

**DPT - Depth**

\$\*\*DPT,x,x,x,x,x,\*hh<CR><LF>  
 1 2 3

1. Water depth relative to the transducer, meters (0.00 to 99999.99)
2. Offset from transducer, meters (-99.99 to 99.99)
3. Minimum range scale in use (No use)

**DTM - Datum reference**

\$\*\*DTM,ccc,a,x,x,a,x,x,a,x,x,ccc,\*hh<CR><LF>  
 1 2 3 4 5 6 7 8

1. Local datum (W84=WGS84, W72=WGS72, S85=SGS85, P90=PE90, three characters)
2. Local datum subdivision code (No use)
3. Lat offset, min (No use)
4. N/S (No use)
5. Lon offset, min (No use)
6. E/W (No use)
7. Altitude offset, meters (No use)
8. Reference datum (No use)

**GGA - Global positioning system fix data**

\$\*\*GGA,hhmmss.ss,lll.lll,a,yyyyy.yyy,a,x,xx,x,x,x,M,x,x,M,x,x,xxxx,\*hh<CR><LF>  
 1 2 3 4 5 6 7 8 9 10 11 12 13 14

1. UTC of position (No use)
2. Latitude (0000.0000 to 9000.0000)
3. N/S
4. Longitude (00000.0000 to 18000.0000)
5. E/W
6. GPS quality indicator (1 to 8)
7. Number of satellite in use (No use)
8. Horizontal dilution of precision (0.00 to 999.99)
9. Antenna altitude above/below mean sealevel (No use)
10. Unit, m (No use)
11. Geoidal separation (No use)
12. Unit, m (No use)
13. Age of differential GPS data (0 to 999, null)
14. Differential reference station ID (No use)

## APPENDIX 2 DIGITAL INTERFACE

### GLL - Geographic position, latitude/longitude

\$\*\*GLL,llll.ll,a,yyyy.yy,a,hmmss.ss,A,a,\*hh<CR><LF>  
1 2 3 4 5 6 7

1. Latitude (0000.0000 to 9000.0000)
2. N/S
3. Longitude (00000.0000 to 18000.0000)
4. E/W
5. UTC of position (No use)
6. Status (A=data valid, V=data not valid)
7. Mode indicator (A=Autonomous, D=Differential, E=Estimated, M=Manual input, S=Simulator)

### GLL - Future position

\$\*\*GLL,llll.ll,a,yyyy.yy,a,hmmss.ss,A,x.x,\*hh<CR><LF>  
1 2 3 4 5 6 7

1. Future Latitude (0000.0000 to 9000.0000)
2. N/S
3. Future Longitude (00000.0000 to 18000.0000)
4. E/W
5. UTC of Future position (No use)
6. Display Status (A=Display, V=Hide)
7. Future Heading (0.0 to 360.0)

### GNS - GNSS fix data

\$\*\*GNS,hmmss.ss,llll.ll,a,yyyy.yy,a,c--c,xx,x.x,x.x,x.x,x.x,x.x,x.x,a\*hh<CR><LF>  
1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of position (No use)
2. Latitude (0000.0000 to 9000.0000)
3. N/S
4. Longitude (00000.0000 to 18000.0000)
5. E/W
6. Mode indicator (A, D, E, F, M, N, P, R, S)  
A=Autonomous, D=Differential, E=Estimated Mode, F=Float RTK, M=Manual Input Mode, N=No fix, P=Precise, R=Real Time Kinematic, S=Simulator Mode
7. Total number of satellites in use (No use)
8. HDOP (0.00 - 999.99)
9. Antenna altitude, meters (No use)
10. Geoidal separation, meters (No use)
11. Age of differential data (0 to 999, null)
12. Differential reference station ID (No use)
13. Navigational status indicator (S=Safe, C=Caution, U=Unsafe, V=Not valid, null)

### HBT - Heartbeat supervision sentence

\$\*\*HBT,x.x,A,x\*hh<CR><LF>  
1 2 3

1. Configured repeat interval (1 to 999(s))
2. Equipment status (No use)
3. Sequential sequence identifier (0 to 9)

### HDG - Heading, Deviation and Variation

\$--HDG,x.x,x.x,a,x.x,a\*hh<CR><LF>  
1 2 3 4 5

1. Magnetic sensor heading, degrees (0.0 to 359.9)
2. Magnetic deviation, degrees (0.00 to 180.00)
3. E/W
4. Magnetic variation, degrees (0.00 to 180.00)
5. E/W

**HDM - Heading, Magnetic**

\$--HDM,x.x,M\*hh<CR><LF>

1 2

1. Heading, degrees (0.0 to 359.9)
2. Magnetic (M)

**HDT - Heading, true**

\$\*\*HDT,x.x,T\*hh<CR><LF>

1 2

1. Heading, degrees (0.0 to 359.9)
2. True (T)

**MTW - Water temperature**

\$\*\*MTW,x.x,C<CR><LF>

1 2

1. Water temperature (-9.99 to 99.99)
2. Degrees C

**MWV - Wind speed and angle**

\$\*\*MWV,x.x,a,x.x,a,A\*hh<CR><LF>

1 2 3 4 5

1. Wind angle, degrees (0.0 to 359.9)
2. Reference (R/T)
3. Wind speed (0.0 to 999.9)
4. Wind speed units (K=km/h, M=m/s, N=knots, S=SM/h)
5. Status (A)

**OSD - Own ship data**

\$\*\*OSD,x.x,A,x.x,a,x.x,a,x.x,x.x,a\*hh<CR><LF>

1 2 3 4 5 6 7 8 9

1. Heading, degrees true (No use)
2. Heading status (No use)
3. Vessel course, degrees true (0.0 to 359.9)
4. Course reference (B=Bottom tracking log, M=Manually entered, W=Water referenced, P=Positioning system ground reference)
5. Vessel speed (0.0 to 999.9)
6. Speed reference (B=Bottom tracking log, W=Water referenced, P=Positioning system ground reference)
7. Vessel set, degrees true, manually entered (No use)
8. Vessel drift (speed), manually entered (No use)
9. Speed units (K=km/h, N=knots, S=statute mile/h)

**RAQ - Query sentence**

\$\*\*RAQ,ccc\*hh<CR><LF>

1

1. Request sentence (DDC)

## APPENDIX 2 DIGITAL INTERFACE

### RMB - Recommended minimum navigation information.

```
$**RMB,A,x,x,a,CCCC,CCCC,lll.ll,a,yyyy.yy,a,x,x,x,x,x,A,a*hh <CR><LF>
      1 2 3 4      5 6 7 8 9 10 11 12 13 14
```

1. Data status (A=Data valid)
2. Cross track error (NM) (No use)
3. Direction to steer (No use)
4. Origin waypoint ID (No use)
5. Destination waypoint ID (Max. 15 characters)
6. Destination waypoint latitude (0000.0000 to 9000.0000)
7. N/S
8. Destination waypoint longitude (00000.0000 to 18000.0000)
9. E/W
10. Range to destination, nautical miles (No use)
11. Bearing to destination, degrees true (No use)
12. Destination closing velocity, knots (No use)
13. Arrival status (No use)
14. Mode indicator (A= Autonomous, D= Differential mode, E=Estimated (dead reckoning mode), M=Manual input mode, S= Simulator)

### RMC - Recommended minimum specific GNSS data

```
$**RMC,hhmmss.ss,A,lll.ll,a,yyyy.yy,a,x,x,x,xxxxxx,x,x,a,a*hh<CR><LF>
      1 2 3 4 5 6 7 8 9 10 11 12 13
```

1. UTC of position fix (No use)
2. Status (A=data valid)
3. Latitude (0000.0000 to 9000.0000)
4. N/S
5. Longitude (00000.0000 to 18000.0000)
6. E/W
7. Speed over ground, knots (0.0 to 999.9)
8. Course over ground, degrees true (0.0 to 359.9)
9. Date (No use)
10. Magnetic variation, degrees E/W (No use)
11. E/W (No use)
12. Mode indicator (A= Autonomous mode, D= Differential mode, E=Estimated (DR), F=Float RTK, M=Manual, P=Precise, R=Real time kinematic, S= Simulator)
13. Navigational status indication (S=Safe, C=Caution, U=Unsafe, V=Navigational status not valid, null)

### ROT- Rate of turn

```
$**ROT,x.x,A*hh<CR><LF>
      1 2
```

1. Rate of turn, deg/min, "-"=bow turns to port (No use)
2. Status (No use)

### RTE - Routes

```
$**RTE,x,x,x,x,a,c--c,c--c, . . ,c--c*hh <CR><LF>
      1 2 3 4 5 . . n
```

1. Total number of sentences being transmitted (1 to 50, null)
2. Sentence number (1 to 50, null)
3. Sentence mode (c:complete route, all waypoints, w:working route, first listed waypoint is "FROM", second is "TO" and remaining are rest of route)
4. Route identifier (Max. 15 characters, null)
5. Waypoint "n" identifier (Max. 15 characters, null)
  - • Additional waypoint indentifiers

**THS - True heading and status**

\$\*\*THS,x.x,a\*hh<CR><LF>

1 2

1. Heading, degrees True (0.0 to 359.9)
2. Mode indicator (A=Autonomous, E=Estimated (dead reckoning))

**TLL - Target Latitude and Longitude**

\$\*\*TLL,x.x,IIII,II,a,yyyy.yy,a,c--c,hhmmss.ss,a,a\*hh<CR><LF>

1 2 3 4 5 6 7 8 9

1. Target number (No use)
2. Target latitude (0000.0000 to 9000.0000)
3. N/S
4. Target longitude (00000.0000 to 18000.0000)
5. E/W
6. Target name (No use)
7. UTC of data (No use)
8. Target status (No use)
9. Reference target (No use)

**TTM - Tracked Target Message**

\$\*\*TTM,xx,x.x,x.x,a,x.x,x.x,a,x.x,x.x,a,c--c,a,a,hhmmss.ss,a\*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1. Target number (00 to 99)
2. Target distance from own ship (0.000 to 99.999)
3. Bearing from own ship, degrees true/relative (0.0 to 359.9)
4. True or Relative (T, R)
5. Target speed (0.00 to 102.00, null)
6. Target course, degrees true/relative (0.0 to 359.9, null)
7. T=True or R=Relative
8. Distance of closest point of approach (0.00 to 99.99)
9. Time to CPA, min., "-" increasing (-99.99 to 99.99, null)
10. Speed/distance units (K=km, km/h, N=NM, kn, S= SM, mph)
11. Target name (other than null)
12. Target status (L=Lost, tracked target has been lost, Q=Query, target in the process of acquisition, T=Tracking)
13. Reference target (No use)
14. UTC of data (numeric in six digits, null)
15. Type of acquisition (other than null)

**VBW - Dual ground/water speed**

\$\*\*VBW,x.x,x.x,a,x.x,x.x,a,x.x,a,x.x,a,\*hh<CR><LF>

1 2 3 4 5 6 7 8 9 10

1. Longitudinal water speed, knots (-999.9 to 999.9)
2. Transverse water speed, knots (-999.9 to 999.9, null)
3. Status: water speed (A=data valid)
4. Longitudinal ground speed, knots (-999.9 to 999.9)
5. Transverse ground speed, knots (-999.9 to 999.9, null is invalid for IMO/R-Type radars)
6. Status: ground speed (A=data valid)
7. Stern transverse water speed, knots (No use)
8. Status: stern water speed (No use)
9. Stern transverse ground speed, knots (No use)
10. Status: stern ground speed (No use)

## APPENDIX 2 DIGITAL INTERFACE

### VDM - AIS VHF data-link message

!\*\*VDM,x,x,x,a,s--s,x,\*hh<CR><LF>  
1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 to 9)
2. Sentence number (1 to 9)
3. Sequential message identifier (0 to 9, null)
4. AIS channel Number (A, B, null)
5. Encapsulated ITU-R M.1371 radio message (1 to 63 bytes)
6. Number of fill-bits (0 to 5)

### VDO - AIS VHF data-link own-vessel report

!\*\*VDO,x,x,x,a,s--s,x,\*hh<CR><LF>  
1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 to 9)
2. Sentence number (1 to 9)
3. Sequential message identifier (0 to 9, null)
4. AIS channel Number (A, B, C, D, null)
5. Encapsulated ITU-R M.1371 radio message (1 to 63 bytes)
6. Number of fill-bits (0 to 5)

### VDR - Set and drift

\$\*\*VDR,x.x,T,x.x,M,x.x,N,\*hh <CR><LF>  
1 2 3 4 5 6

1. Direction, degrees (0.0 to 359.9, null)
2. T=True (fixed)
3. Direction, degrees (No use)
4. M=Magnetic (No use)
5. Current speed (0.0 to 99.9)
6. N=Knots (fixed)

### VHW - Water speed and heading

\$\*\*VHW,x.x,T,x.x,M,x.x,N,x.x,K,\*hh <CR><LF>  
1 2 3 4 5 6 7 8

1. Heading, degrees (0.0 to 359.9)
2. T=True (fixed, No use)
3. Heading, degrees (No use)
4. M=Magnetic (fixed, No use)
5. Speed, knots (-999.9 to 999.9)
6. N=Knots (fixed)
7. Speed, km/hr (-999.9 to 999.9)
8. K=km/hr (fixed)

### VSD - AIS voyage static data

\$\*\*VSD,x.x,x.x,x.x,c--c,hmmss.ss,xx,xx,x.x,x.x\*hh<CR><LF>  
1 2 3 4 5 6 7 8 9

1. Type of ship and cargo category (No use)
2. Maximum present static draught (No use)
3. Persons on-board (0 to 8191)
4. Destination (No use)
5. Estimated UTC of arrival at destination (No use)
6. Estimated day of arrival at destination (No use)
7. Estimated month of arrival at destination (No use)
8. Navigational status (No use)
9. Regional application flags (No use)

**VTG - Course over ground and ground speed**

\$\*\*VTG,x.x,T,x.x,M,x.x,N,x.x,K,a,\*hh <CR><LF>  
 1 2 3 4 5 6 7 8 9

1. Course over ground, degrees (0.0 to 359.9)
2. T=True (fixed)
3. Course over ground, degrees (No use)
4. M=Magnetic (No Use)
5. Speed over ground, knots (0.0 to 999.9)
6. N=Knots (fixed)
7. Speed over ground (0.0 to 999.9)
8. K=km/h (fixed)
9. Mode indicator (A=Autonomous, D=Differential, E=Estimated (dead reckoning), M=Manual input, P=Precision, S=Simulator )

**VWR - Wind relative Bearing and Velocity**

\$\*\*VWR,x.x,a,x.x,N,x.x,M,x.x,K<CR><LF>  
 1 2 3 4 5 6 7 8

1. Measured wind angle relative to the vessel, degrees (0.0 to 180.0)
2. L=Left semicircle, R=Right semicircle
3. Velocity, knots (0.0 to 999.9)
4. Unit (N, fixed)
5. Velocity (0.0 to 999.9)
6. Unit (M, fixed)
7. Velocity, km/h (0.0 to 999.9)
8. Unit (K, fixed)

**VWT - True wind speed and angle**

\$\*\*VWT,xxx,a,xx.x,N,xx.x,M,xxx.x,K<CR><LF>  
 1 2 3 4 5 6 7 8

1. Calculated wind angle, degrees (0.0 to 180.0)
2. L=Left semicircle, R=Right semicircle
3. Calculated with speed, knots (0.0 to 999.9)
4. Unit (N, fixed)
5. Wind speed (0.0 to 999.9)
6. Unit (M, fixed)
7. Wind speed, km/h (0.0 to 999.9)
8. Unit (K, fixed)

**WPL - Waypoint location**

\$\*\*WPL,lll.ll,a,yyyy.yy,a,c--c\*hh<CR><LF>  
 1 2 3 4 5

1. Waypoint latitude (0000.0000 to 9000.0000)
2. N/S
3. Waypoint longitude (00000.0000 to 18000.0000)
4. E/W
5. Waypoint identifier (Max. 15 characters)

**ZDA - Time and date**

\$\*\*ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx,\*hh<CR><LF>  
 1 2 3 4 5 6

1. UTC (000000.00 to 235959.99, 235960.00 to 235960.99, 240000.00 to 240000.99, 240001.00 to 240001.99)
2. Day (01 to 31)
3. Month (01 to 12)
4. Year (UTC) (0000 to 9999)
5. Local zone, hours (No use)
6. Local zone, minutes (No use)

## Output sentences

### ABM - AIS addressed binary and safety related message

! \*\*ABM,x,x,x,xxxxxxxx,x,xx,s--s,x,\*hh<CR><LF>  
 1 2 3 4 5 6 7 8

1. Total number of sentences needed to transfer the message (1 to 9)
2. Message sentence number (1 to 9)
3. Message sequence identifier (0 to 3)
4. The MMSI of destination AIS unit for the ITU-R M.1371 message (9 digits, null)
5. AIS channel for broadcast of the radio message (0 to 3, null)
6. VDL message number (6 or 12, null), see ITU-R M.1371
7. Encapsulated data (1 to 63 bytes)
8. Number of fill-bits (0 to 5)

### ACK - Acknowledge alarm

\$ \*\*ACK,xxx,\*hh<CR><LF>  
 1

1. Unique alarm number (identifier) at alarm source (000 to 999)

### AIQ - Query sentence

\$ \*\*AIQ,ccc,\*hh<CR><LF>  
 1

1. Requested sentence (VSD)

### ALC - Cyclic alert list

\$ \*\*ALC,xx,xx,xx,xx,aaa,x.x,x.x,x.x,"",\*hh<CR><LF>  
 1 2 3 4 5 6 7 8 9

1. Total number of sentences this message (01 to 16)
2. Sentence number (01 to 16)
3. Sequential message identifier (00 to 99)
4. Number of alert entries (0 to 3)
5. Manufacturer mnemonic code (FEC, null) \_\_\_\_\_
6. Alert identifier (0 to 999999) \_\_\_\_\_
7. Alert instance (1 to 999999, null) \_\_\_\_\_
8. Revision counter (1 to 99) \_\_\_\_\_
9. Additional alert entries (see Note)

Alert entry 1  
 See Note

Note: Alert entry 0 - n: Each alert entry consists of

- Manufacturer Identifier (see ALF Manufacturer)
- Alert Identifier (see ALF Alert identifier)
- Alert instance (see ALF instance)
- Revision counter (see ALF revision counter)

Each entry identifies a certain alert with a certain state.

It is not allowed that an alert entry is split between two ALC sentences.

**ALF - Alert sentence**

\$\*\*ALF,x,x,x,hmmss.ss,a,a,a,aaa,x,x,x,x,x,c--c,\*hh<CR><LF>  
           1 2 3      4      5 6 7 8 9 10 11 12 13

1. Total number of ALF sentences this message (1, 2)
2. Sentence number (1, 2)
3. Sequential message identifier (0 to 9)
4. Time of last change (000000.00 to 235959.99, 235960.00 to 235960.99, 240000.00 to 240000.99, 240001.00 to 240001.99, null)
5. Alert category (A=Alert category A, B=Alert category B, null)
6. Alert priority (A=Alarm, W=Warning, C=Caution, null)
7. Alert state (A=active-acknowledged or active, S=active-silenced, O=active-responsibility transferred, U=rectified-unacknowledged, V=active-unacknowledged, N=normal, null)
8. Manufacturer mnemonic code (FEC, null)
9. Alert identifier (0 to 999999)
10. Alert instance (1 to 999999, null)
11. Revision counter (1 to 99)
12. Escalation counter (0 to 9)
13. Alert text (max. 16 characters)

**ALR - Set alarm state**

\$\*\*ALR,hmmss.ss,xxx,A,A,c—c,\*hh<CR><LF>  
                   1      2 3 4 5

1. Time of alarm condition change, UTC (000000.00 to 235959.99, 235960.00 to 235960.99, 240000.00 to 240000.99, 240001.00 to 240001.99, null)
2. Unique alarm number (identifier) at alarm source (000 to 999, null)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=not acknowledged)
5. Alarm description text (alphanumeric)

**ARC - Alert command refused**

\$\*\*ARC,hmmss.ss,aaa,x,x,x,x,c\*hh<CR><LF>  
                   1      2 3 4 5

1. Release time of the alert command refused (000000.00 to 235959.99, 235960.00 to 235960.99, 240000.00 to 240000.99, 240001.00 to 240001.99, null)
2. Used for proprietary alerts, defined by the manufacturer (FEC, null)
3. The alert identifier (0 to 999999)
4. The alert instance (1 to 999999, null)
5. Refused alert command (A=acknowledge, O=responsibility transfer)

**BBM - AIS broadcast binary message**

\$\*\*BBM,x,x,x,x,xx,s--s,x,\*hh<CR><LF>  
           12 3 4 5 6 7

1. Total number of sentences needed to transfer the message (1 to 9)
2. Sentence number (1 to 9)
3. Sequential message identifier (0 to 9)
4. AIS channel for broadcast of the radio message (0 to 3, null)
5. VDL message number, see ITU-R M.1371 (8 or 14, null)
6. Encapsulated data (1 to 63 bytes)
7. Number of fill-bits (0 to 5)

**DDC - Display dimming control**

\$\*\*DDC,a,xx,a,a\*hh<CR><LF>  
           1 2 3 4

1. Display dimming preset (D=Daytime, K=Dusk, N=Nighttime)
2. Brightness percentage (00 to 99)
3. Color palette preset (null)
4. Sentences status flag (R)

## APPENDIX 2 DIGITAL INTERFACE

### EVE - General event message

\$\*\*EVE,hhmmss.ss,c--c,c--c\*hh<CR><LF>  
1 2 3

1. Event time (000000.00 to 235959.99, 235960.00 to 235960.99, 240000.00 to 240000.99, 240001.00 to 240001.99, null)
2. Tag code used for identification of source of event (six alphanumeric characters, two English characters, four digits)
3. Event description (OPERATION)

### HBT - Heartbeat supervision sentence

\$\*\*HBT,x.x,A,x\*hh<CR><LF>  
1 2 3

1. Configured repeat interval (60.0(s))
2. Equipment status (A=Normal)
3. Sequential sequence identifier (0 to 9)

### OSD- Own ship data

\$\*\*OSD,x.x,A,x.x,a,x.x,a,x.x,x.x,a\*hh<CR><LF>  
1 2 3 4 5 6 7 8 9

1. Heading, degrees true (0.0 to 359.9, null)
2. Heading status (A:data valid, V:data invalid)
3. Vessel course, degrees true (0.0 to 359.9, null)
4. Course reference (B=Bottom tracking log, M=Manually entered, W=Water referenced, R=Radar tracking (of fixed target), P=Positioning system ground reference, null)
5. Vessel speed (0.0 to 99.9, null)
6. Speed reference (B=Bottom tracking log, M=Manually entered, W=Water referenced, R=Radar tracking (of fixed target), P=Positioning system ground reference, null)
7. Vessel set, degrees true, manually entered (0.0 to 359.9, null)
8. Vessel drift (speed), manually entered (0.0 to 19.9, null)
9. Speed units (K=km/h, N=knots, S=statute mile/h, null)

### RSD - Radar system data

\$\*\*RSD,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,a\*hh <CR><LF>  
1 2 3 4 5 6 7 8 9 10 11 12 13

1. Origin 1 range, from own ship (0.000 to 9.999, 10.00 to 99.99, 100.0 to 999.9, 1000 to 9999, null) (see note)
2. Origin 1 bearing, degrees from 0 (0.0 to 359.9, null) (see note)
3. Variable range marker 1 (VRM1), range (0.000 to 9.999, 10.00 to 99.99, 100.0 to 999.9, null)
4. Bearing line 1 (EBL1), degrees from 0 (0.0 to 359.9, null)
5. Origin 2 range (0.000 to 9.999, 10.00 to 99.99, 100.0 to 999.9, 1000 to 9999, null) (see note)
6. Origin 2 bearing (0.0 to 359.9, null) (see note)
7. VRM2, range (0.000 to 9.999, 10.00 to 99.99, 100.0 to 999.9, null)
8. EBL2, degrees (0.0 to 359.9, null)
9. Cursor range, from own ship (0.000 to 9.999, 10.00 to 99.99, 100.0 to 999.9, null)
10. Cursor bearing, degrees clockwise from 0 (0.0 to 359.9, null)
11. Range scale in use (0.125 to 120.0)
12. Range units (K=km, N=NM, S=statute miles, null)
13. Display rotation (C, H, N, null)  
C=Course-up, course-over-ground up, degrees true  
H=Head-up, ship's heading(center-line) 0 up  
N=North-up, true north is 0 up

NOTE: Origin 1 and origin 2 are located at the stated range and bearing from own ship and provide for two independent sets of variable range markers (VRM) and electronic bearing lines (EBL) originating away from own ship position.

**TLB - Target label**

\$\*\*TLB,x,x,c--c,x,x,c--c,...,x,x,c--c\*hh<CR><LF>  
           1  2      3                  3

1. Target number "n" reported by the device (1 to 1023)
2. Label assigned to target "n" (TT=000 to 999, AIS= 000000001 to 999999999)
3. Additional label pairs

**TLL - Target latitude and longitude**

\$\*\*TLL,xx,lll.ll,a,yyyy.yy,a,c--c,hhmmss.ss,a\*hh<CR><LF>  
           1  2  3  4      5  6          7      8  9

1. Target number (null)
2. Target Latitude (0000.0000 to 9000.0000)
3. Target N/S (N/S)
4. Target Longitude (00000.0000 to 18000.0000)
5. Target E/W (E/W)
6. Target name (null)
7. UTC of data (000000.00 to 235959.99, 235960.00 to 235960.99, 240000.00 to 240000.99, 240001.00 to 240001.99, null)
8. Target status (null)
9. Reference target (null)

**TTD - Tracked target data**

!\*\*TTD,hh,hh,x,s--s,x\*hh<CR><LF>  
           1  2  3  4  5

1. Total hex number of sentences need to transfer the message (h'01)
2. Hex sentence number (h'01)
3. Sequential message identifier (null)
4. Encapsulated trancked target data (6 bit binary-converted data)
5. Number of fill bits (0 to 5)

**TTM - Tracked target message**

\$\*\*TTM,xxx,x,x,x,x,a,x,x,x,x,a,x,x,x,a,c--c,a,a,hhmmss.ss,a\*hh<CR><LF>  
           1  2  3  4  5  6  7  8  9  10 11 1213      14     15

1. Target number (000 to 999)
2. Target distance from own ship (0.000 to 99.999)
3. Bearing from own ship,degrees (0.0 to 359.9)
4. True or Relative (T)
5. Target speed (0.00 to 999.99, null)
6. Target course, degrees (0.0 to 359.9, null)
7. T=True or R=Relative
8. Distance of closest point of approach (0.00 to 99.99, null)
9. Time to CPA, min., "-" increasing (-99.99 to 99.99, null)
10. Speed/distance units (N=NM, kn)
11. Target name (null)
12. Target status (L: Lost, tracked target has been lost, Q: Query, target in the process of acquisition, T: Tracking)
13. Reference target (R, null)
14. UTC of data (null)
15. Type of acquisition (A=Automatic, M=Manual )

## APPENDIX 2 DIGITAL INTERFACE

### VSD - AIS voyage static data

\$\*\*VSD,x.x,x.x,x.x,c--c,hhmmss.ss,xx,xx,x.x,x.x\*hh<CR><LF>  
1 2 3 4 5 6 7 8 9

1. Type of ship and cargo category (null)
2. Maximum present static draught (0 to 25.5 meters, null)
3. Persons on-board (0 to 8191, null)
4. Destination (1 to 20 characters, null)
5. Estimated UTC of arrival at destination (000000.00 to 235959.99, 246000.00, null)
6. Estimated day of arrival at destination (UTC) (00 to 31, null)
7. Estimated month of arrival at destination (UTC) (00 to 12, null)
8. Navigational status (0 to 15, null)
9. Regional application flags (null)

## A-1

コード番号末尾の[\*\*]は、選択品の代表コードを表します。  
CODE NUMBER ENDING WITH "\*\*" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

C3616-Z01-B

## A-2

コード番号末尾の[\*\*]は、選択品の代表コードを表します。  
CODE NUMBER ENDING WITH "\*\*" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL

型式/コード番号が2段の場合、下段より上段に代わる過渡期品であり、どちらかが入っています。なお、品質は変わりません。

TWO TYPES AND CODES MAY BE LISTED FOR AN ITEM. THE LOWER PRODUCT MAY BE SHIPPED IN PLACE OF THE UPPER PRODUCT. QUALITY IS THE SAME.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

C3616-Z02-A

## A-3

コード番号末尾の[\*\*]は、選択品の代表コードを表します。  
CODE NUMBER ENDING WITH "\*\*" INDICATES THE CODE NUMBER OF REPRESENTATIVE MATERIAL.

型式/コード番号が2段の場合、下段より上段に代わる過渡期品であり、どちらかが入っています。なお、品質は変わりません。

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

C3616-Z03-A

A-4<sup>1</sup>

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)