

NAVITRON SYSTEMS LTD

NT1750 EPR & ESCORT TUG ELECTRONIC INCLINOMETER

INSTALLATION & TECHNICAL MANUAL



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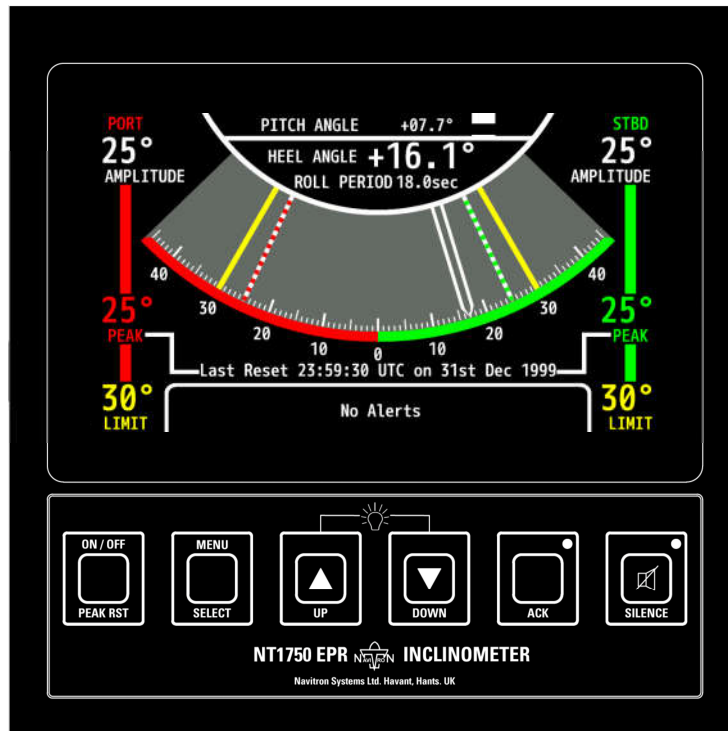
CONTENTS.

This Manual contains Installation & Calibration Instructions for both the MSC.363(92) Inclinometer Type Approved by TUV and the Escort Tug Inclinometer as recommended by Bureau Veritas (BV).

- General: System Description & Specification.
- Section 1: Standard Unit Dimensions and Installation.
- Section 2: System Configurations and Connections.
- Section 3: Installation Adjustments & Set Up Menu Parameters.
- Section 4: Operating Instructions.
- Section 5: IEC 61162 Serial Data Interfaces & Failure Alert Messages.
- Section 6: Demonstration Mode.
- Appendix A: Terms & Abbreviation Definitions.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

General.



Standard Inclinometer Display Type Approved to MSC363(92)

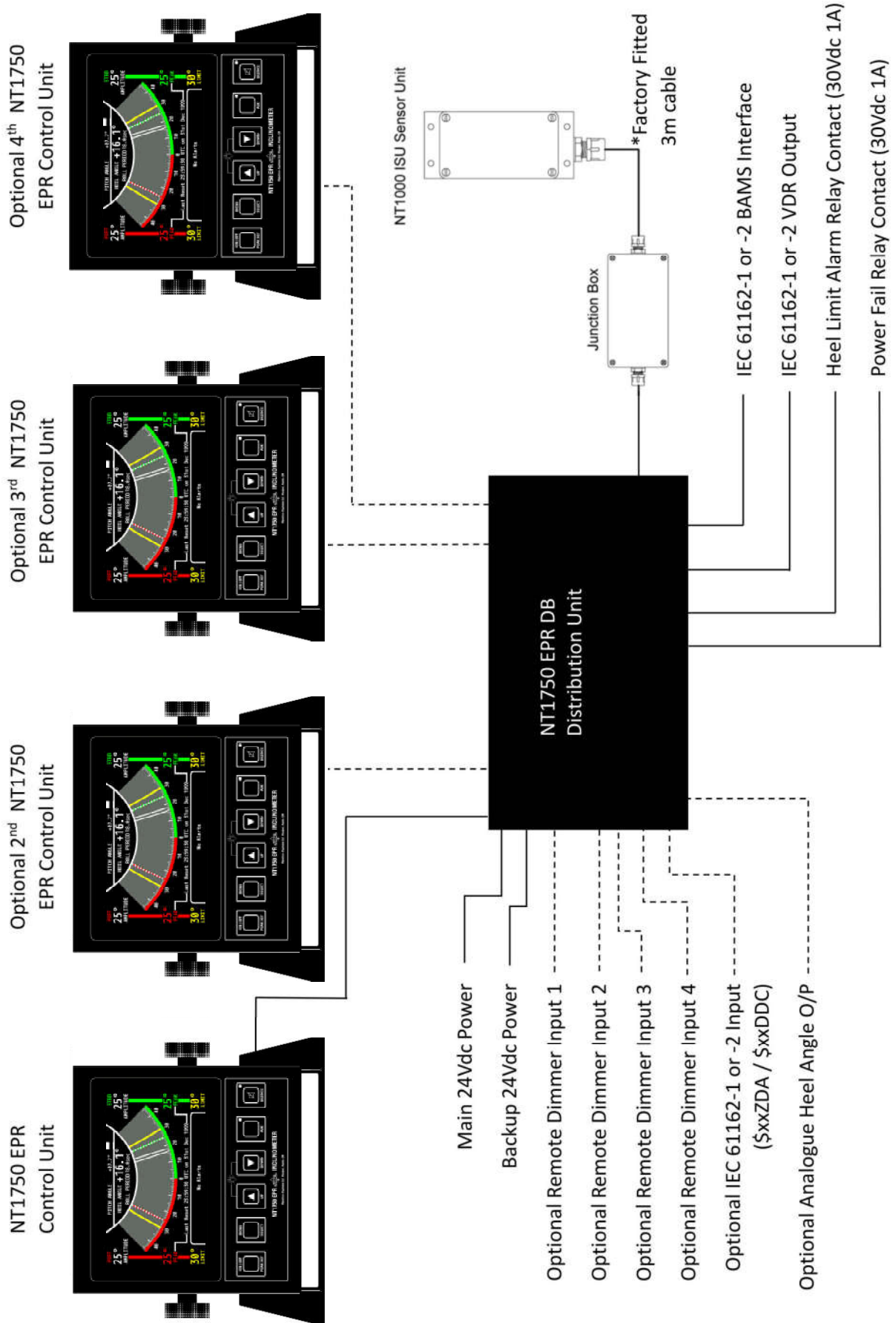
The Navitron NT1750 EPR Electronic Inclinometer is Type Approved and Certificated by TUV as fully compliant with all aspects of MSC.363(92), IEC 60945, ISO 19697:2016(E) in addition to the general requirements contained in resolution A.694 (17).

Suitable for bracket and panel mounting the NT1750 EPR CU Inclinometer display unit is simply and easily installed with single or multi head display capabilities and results in full colour real time display of Heel, Roll Period (and Pitch Data) – all of which (except for Pitch Data) is available for serial data transmission to external “listeners” such as VDR and with bidirectional communication with BAMS etc.

Operator adjustable heel angle alarm levels, and inspection / display of historical dynamic performance (last 3 mins / last 30 mins) are easily read from the “analogue” colour presentation which features adjustable illumination to suit all operating conditions.

The Inclinometer Sensor Unit is supplied as a sealed unit with 3m of fitted cable for termination to a 2 Entry Junction Box (supplied).

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION



Inclinometer System Configuration.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

NT1750 EPR INCLINOMETER SYSTEM SPECIFICATION

POWER SUPPLY	
Main Power	18-40Vdc
Backup Power	18-40Vdc
Power Consumption	
System comprising DB, SENSOR & 1x CU.	12W max
Additional CUs (up to 3)	8W max

BAMS SERIAL DATA INTERFACE	
IEC 61162/1 OR IEC 61162/2	4800 Baud 38400 Baud
Output Sentences	\$IIALF \$IIALC \$IIHBT \$IITXT \$IIACN
Input Sentences	\$xxACN \$xxTXT

APPLICABLE SPECIFICATIONS
ISO 19697 (2016)
IEC 60945 (2002) inc Cor 1:2008
IEC 61162-1 (2016)
IEC 61162-2 (1998)
IEC 62288 (2022)
IEC 62923-1 (2018)
IEC 62923-2 (2018)

ZDA / DDC SERIAL DATA INPUT	
IEC 61162/1 or IEC 61162/2	4800 baud or 38k4 baud
Sentences	\$xxZDA or \$xxDDC

MECHANICAL DATA	CONTROL UNIT	DISTRIBUTION UNIT	SENSOR UNIT
Width	260mm	170mm	145mm
Height	225mm	175mm	65mm
Depth	95mm	65mm	59mm
Weight	1.7kg	1.2kg	0.6kg
IP Rating	IP41	IP20	IP54

Nominal Viewing Distance	0.7m
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MEASUREMENT ACCURACY	
Pitch / Roll Accuracy	±1° or 5% whichever is greater
Roll Period	4 - 40seconds
Roll Period Accuracy	1 second or 5% whichever is greater.

VDR SERIAL DATA INTERFACE	
IEC61162/1 OR IEC61162/2	4800 Baud 38400 Baud
Output Sentences	\$IIHRM \$IIHBT \$IITXT

HEEL ALARM RELAY CONTACT	
30Vdc	1A

REMOTE DIMMING CONTROL	
Number of analogue input channels (non-isolated)	4
Potentiometer resistance range	1-5 kohm
Input voltage range	0-12Vdc

ISOLATED ANALOGUE HEEL ANGLE OUPUT	
Voltage output	±10V
Current Output	4-20mA

Section 1: Standard Unit Dimensions and Installation.

- 1.1 The NT1750 EPR Control Unit.**
- 1.2 The NT1750 EPR DB Distribution Box.**
- 1.3 The NT1000 ISU Inclinator Sensor Unit.**
- 1.4 The ISU Junction Box.**

Installation Note – Radio Frequency Interference (RFI).

The NT1750 EPR Inclinator system exhibits high levels of RFI rejection and minimal levels of radiated interference by virtue of careful decoupling, suppression and screening measures exercised as a standard Navitron Systems design function and is fully compliant with the statutory requirements of EN 60945 (IEC 60945).

However, any potential risk of cross coupling should be minimised where possible by ensuring that Inclinator components and associated cable routing is afforded the greatest separation possible from high power transmitters, couplers and other RF carrying cables.

1.1 The NT1750 EPR Control Unit.

Compass Safe Distance – 0.26m. Nominal viewing distance 0.7m.

The Control Unit is the principal element from the viewpoint of the operator and contains the display and operator controls is via a tactile membrane with 6 keypads.

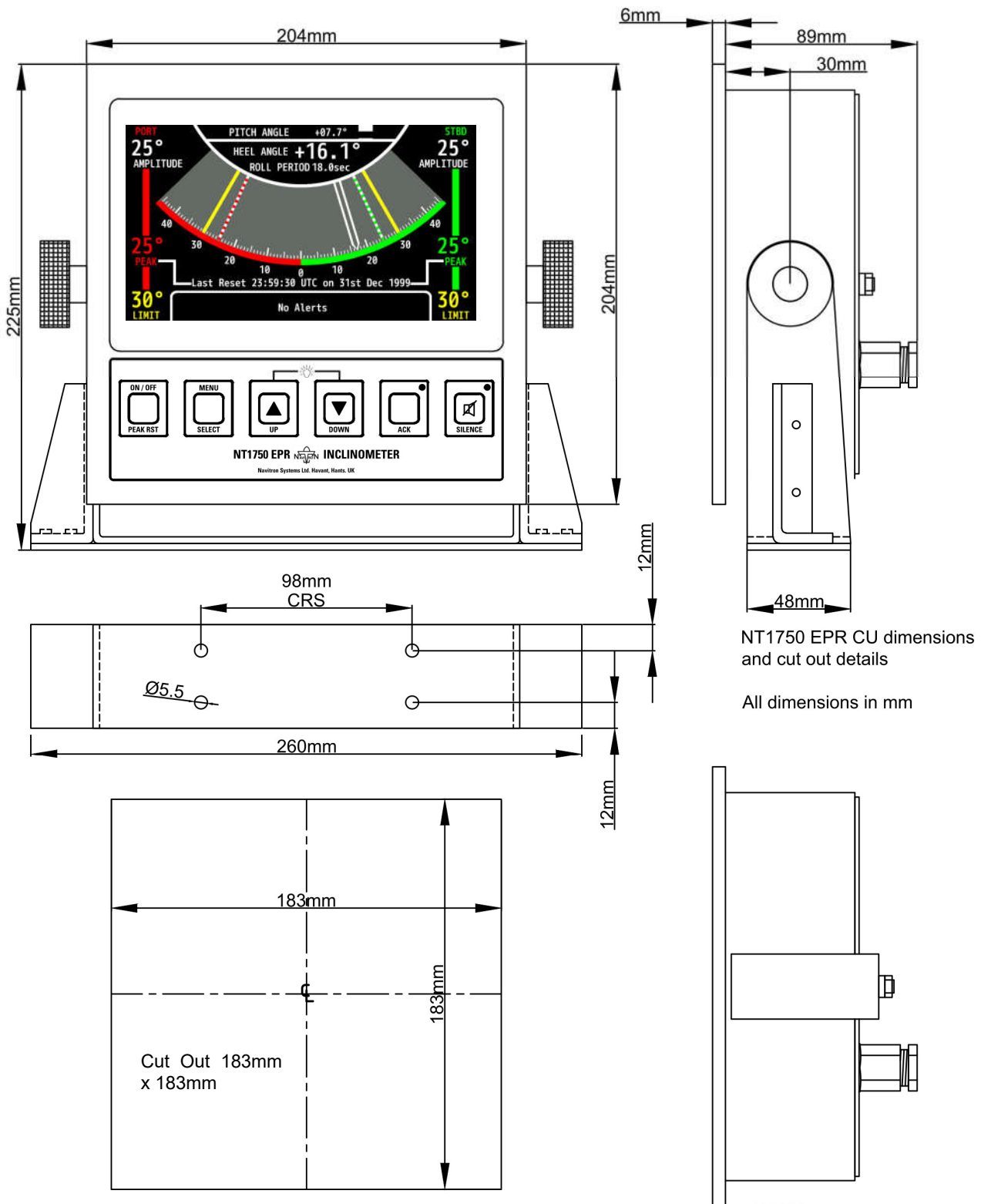
The Control Unit is not suitable for external location and should be installed in an enclosed bridge or wheelhouse at, or close to, the main steering position and commensurate with clear field of operator vision.

The unit may be panel or foot bracket mounted as required with allowance made for cable access at the rear of the unit.

Outline dimensions and mounting details are shown in Fig 1.1.1 and flush / panel U bracket assembly instructions are shown in Fig 1.1.2.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

1.1 The NT1750 EPR Control Unit (continued).



NT1750 EPR CU dimensions and cut out details
All dimensions in mm

NOTE:-
Unit can also be flush mounted using U-bracket and accessory pack supplied

Fig 1.1.1 NT1750 EPR CU Dimensions & Mounting Details.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

1.1 The NT1750 EPR Control Unit (continued).

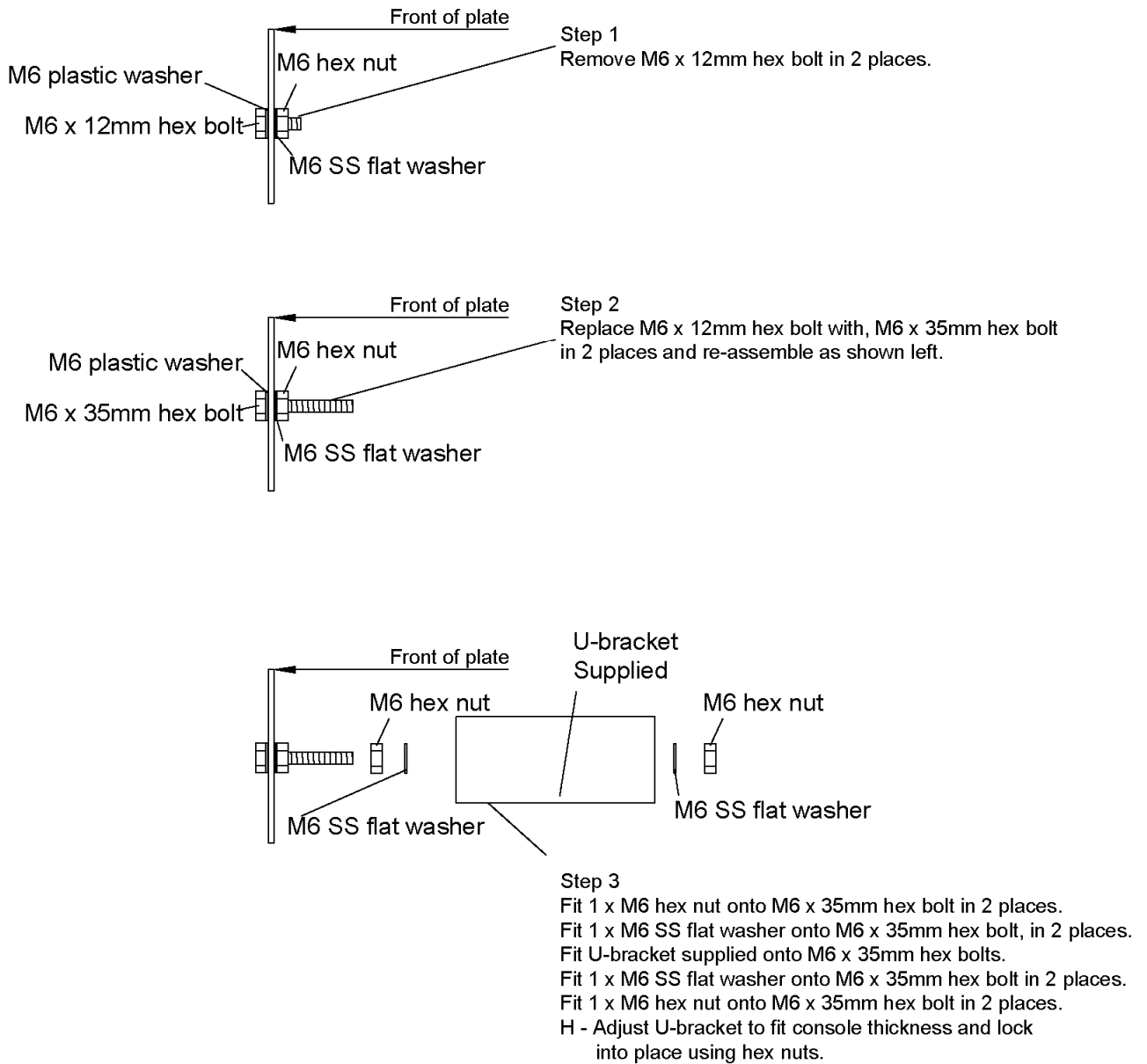


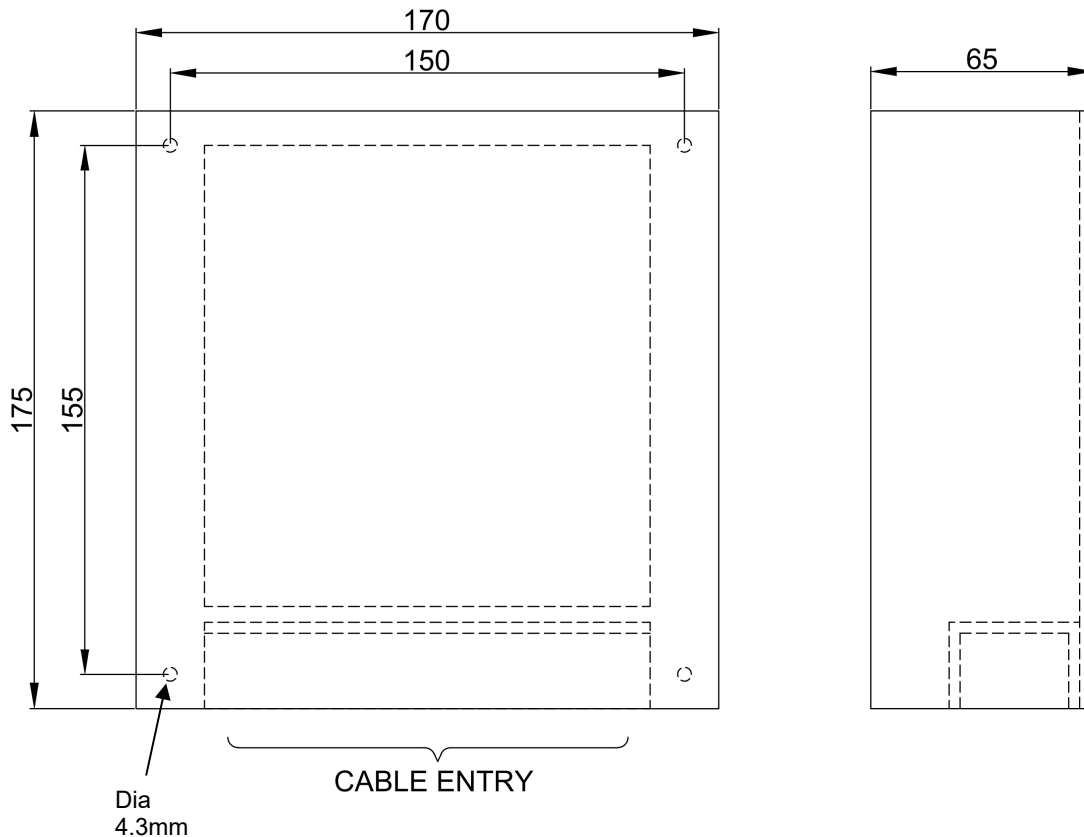
Fig 1.1.2 NT1750 EPR CU Flush / Panel Mounting Assembly Instructions.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

1.2 The NT1750 EPR DB Distribution Box.

Compass safe distance - 0.15m.

This unit is the central distribution point of the NT1750 EPR Incliner system and contains the voltage filtering / regulation, IEC 61162 serial data interfaces and alert relay contacts.



NT1750 EPR DB dimensions

All dimensions in mm

Fig 1.2 NT1750 EPR DB Dimensions & Mounting Details.

1.3 The NT1000 ISU Incliner Sensor Unit.

Compass Safe Distance – 0.21m

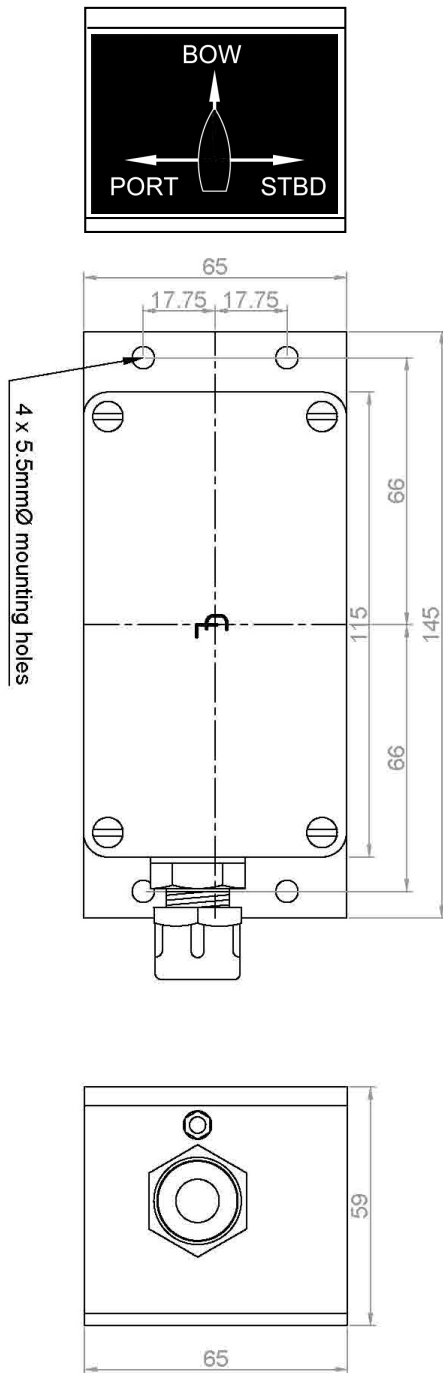
The NT1000 ISU Incliner Sensor Unit uses advanced solid state sensor devices to measure the Pitch and Roll angle of the vessel.

The NT1000 ISU unit is factory fitted with a 3m 4 core twisted pair cable for connection to the supplied Junction Box.

The unit is not suitable for external location and should ideally be located near the centre of the vessel on the roll axis. The mounting site should be carefully considered as the unit is sensitive to vibration. The orientation must be as detailed in Fig 1.3 with the BOW, PORT & STBD arrows facing the correct direction.

1.3 The NT1000 ISU Inclinometer Sensor Unit (continued).

Carefully follow Method 1 or Method 2 detailed in Section 1.3.1 to ensure the unit is installed vertically aligned with the vessel.



Installation Note.

The installation location of NT1000 ISU Inclinometer Sensor Unit must be recorded and made available for the configuration of the voyage data recorder.

Fig 1.3 NT1000 ISU Inclinometer Sensor Unit Dimensions & Mounting Details.

NOTE: The sensor vertical calibration can be “fine tuned” by $\pm 5^\circ$ during installation Set Up Menu adjustments. See Section 3.12.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

1.3.1 NT1000 ISU Sensor Unit Vertical Alignment.

NOTE: The NT1000 ISU Inclinator Sensor Unit is a precision sensing instrument that is factory calibrated in all 3 axis (x, y & z) prior to shipment. This calibration is not user adjustable. **DO NOT** remove the ISU PCB mounting screws as this will adversely affect the unit accuracy and will necessitate factory re-calibration.

Method 1. Using a Mechanical Inclinator as a Reference.

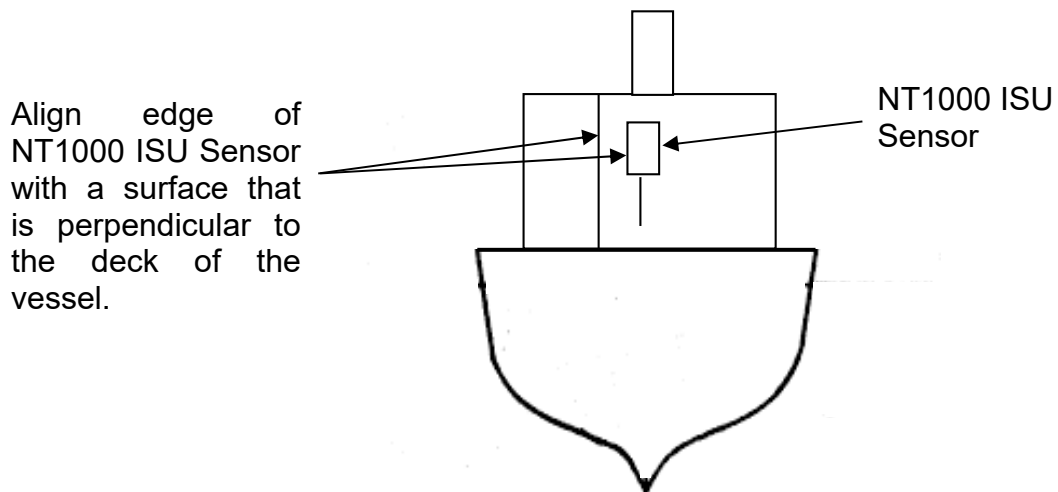
If the vessel is equipped with an approved and accurate mechanical inclinometer this can easily be used to ensure the NT1000 ISU sensor unit is accurately vertically aligned with the vessel.



- i) Note the vessel Heel Angle indicated on the mechanical inclinometer.
- ii) Switch on the NT1750 EPR Display Unit and note the Heel Angle indicated.
- iii) Adjust the ISU Sensor position until the indicated Heel Angle agrees with mechanical inclinometer; securely fix the Sensor Unit to the vessel.

Note: Small corrections ($\pm 5^\circ$) can subsequently be applied via the Set Up Menu, Section 3.12 refers.

Method 2. Align the Sensor with a perpendicular (vertical) surface.

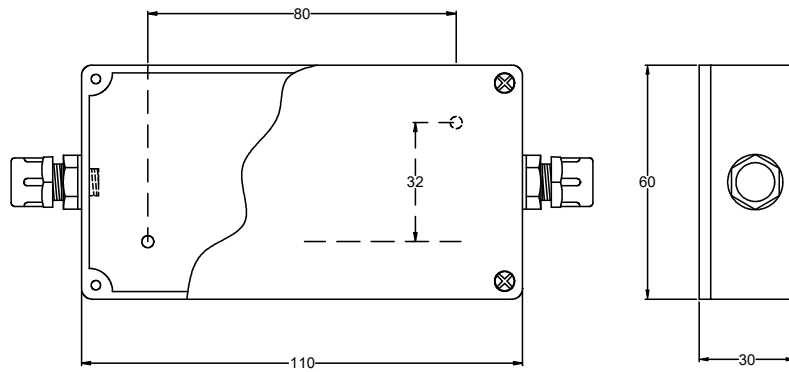


Note: Small corrections ($\pm 5^\circ$) can subsequently be applied via the Set Up Menu, Section 3.12 refers.

1.4 The ISU Junction Box.

This unit has no electronic component content, housing only a terminal block to facilitate electrical connection between the Control Unit and the Inclinator Sensor Unit.

The Junction Box should be located and secured in the vicinity of the ISU and within the scope of the 3m cable length fitted to the ISU. Whilst the box is splash proof it should be mounted in an accessible but sheltered position.



All dimensions in mm

FIG 1.4 ISU Junction Box Outline Dimensions.

Section 2. System Configurations and Connections.

The basic NT1750 EPR Inclinator system consists of a Control Unit (CU) a Distribution Unit (DB) and a Pitch and Roll Sensor Unit type NT1000 ISU. The system may be expanded to include additional Control Units.

2.1 System Configuration and Connections.

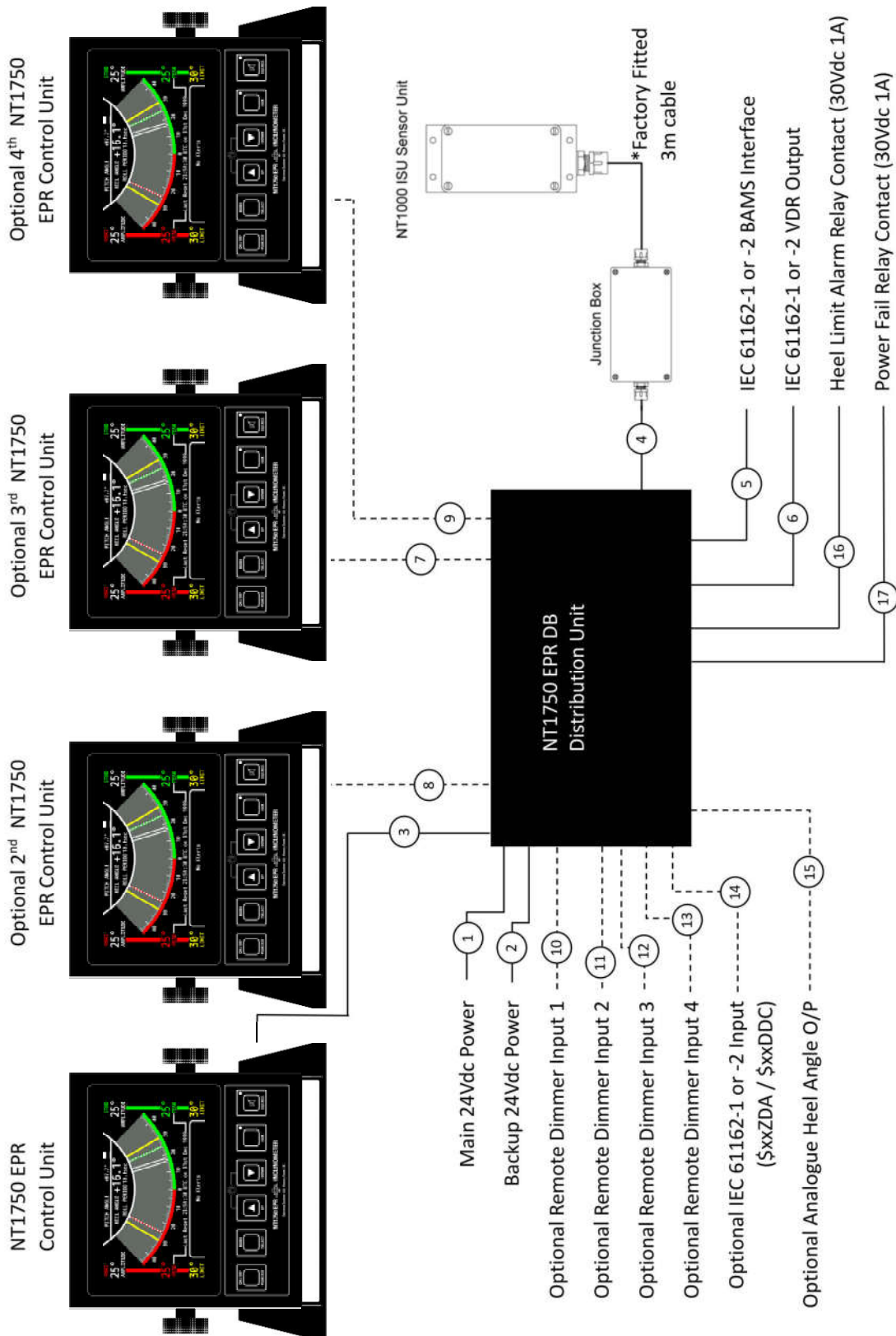


Fig 2.1.1 Basic system configuration

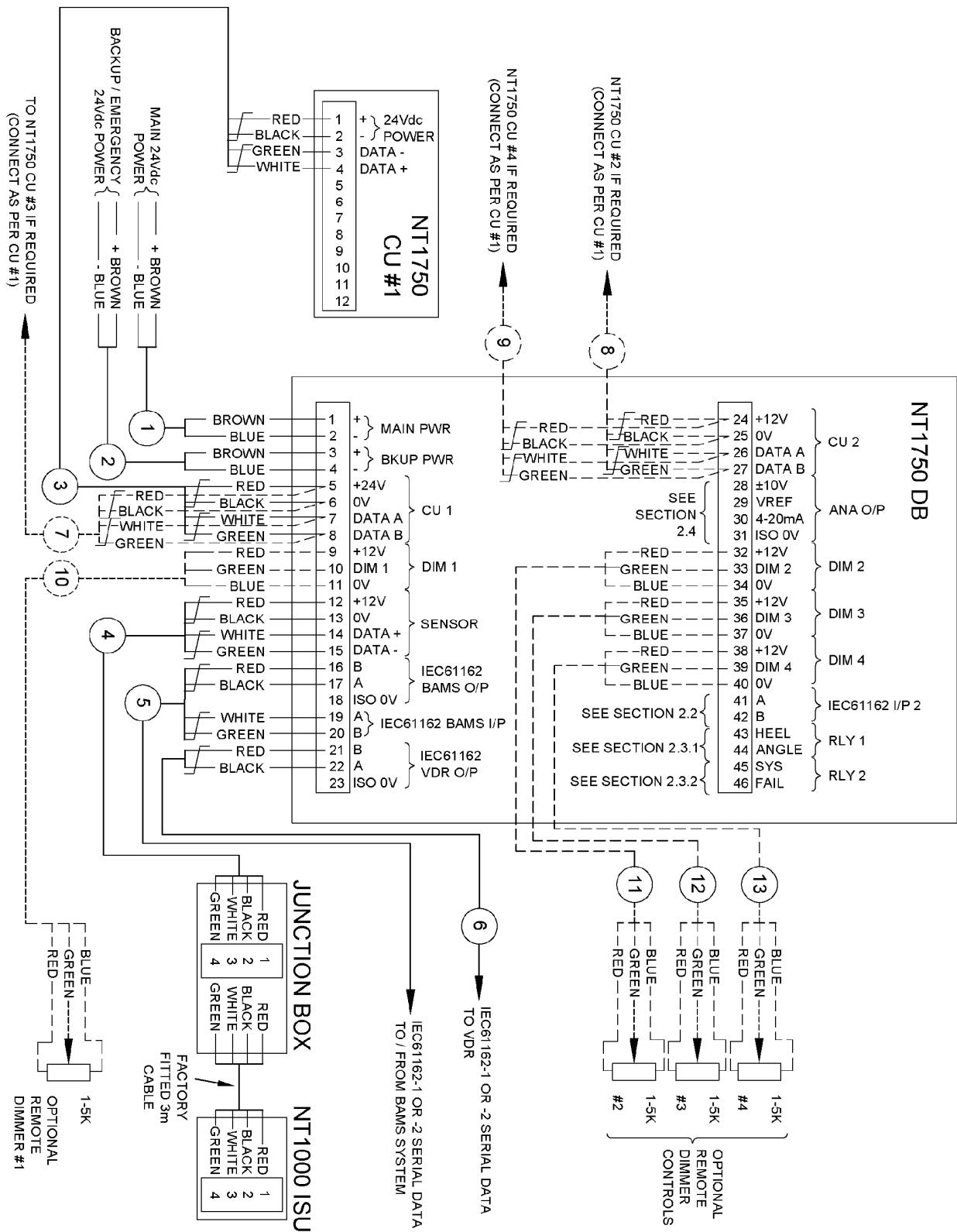
NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

2.1 System Configuration and Connections (continued).

Cable No.	Cable Type	Cable Size	Function
1	2 Core screened	1.0mm ² 32/0.2mm	18-40Vdc Main Ship's Supply
2	2 Core screened	1.0mm ² 32/0.2mm	18-40Vdc Backup / Emergency Ship's Supply
3	4 Core twin twisted pair screened	0.5mm ² 16/0.2mm	NT1750 EPR CU #1 power & data.
4	4 Core twin twisted pair screened	0.5mm ² 16/0.2mm	NT1000 ISU Sensor Unit
5	4 Core twin twisted pair screened	0.22mm ² 7/0.2mm	BAMS IEC 61162-1 or -2 interface
6	2 Core twin twisted pair screened	0.22mm ² 7/0.2mm	IEC 61162-1 or -2 output to VDR
7	4 Core twin twisted pair screened	0.5mm ² 16/0.2mm	Optional NT1750 EPR CU #3 power & data.
8	4 Core twin twisted pair screened	0.5mm ² 16/0.2mm	Optional NT1750 EPR CU #2 power & data.
9	4 Core twin twisted pair screened	0.5mm ² 16/0.2mm	Optional NT1750 EPR CU #4 power & data.
10	3 Core screened	0.22mm ² 7/0.2mm	Optional remote dimmer #1
11	3 Core screened	0.22mm ² 7/0.2mm	Optional remote dimmer #2
12	3 Core screened	0.22mm ² 7/0.2mm	Optional remote dimmer #3
13	3 Core screened	0.22mm ² 7/0.2mm	Optional remote dimmer #4
14	2 Core twin twisted pair screened	0.22mm ² 7/0.2mm	Optional IEC 61162-1 or -2 ZDA / DDC input
15	2 Core screened	0.22mm ² 7/0.2mm	Optional Analogue ($\pm 10V$ or 4-20mA) output
16	2 Core screened	0.22mm ² 7/0.2mm	Heel Limit relay contact (1A 30Vdc)
17	2 Core screened	0.22mm ² 7/0.2mm	Power monitor relay contact (1A 30Vdc)

Table 2.1.2 Cable Details.

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Connect cable screens to the earth terminals provided on the DB cable support extrusion. Secure cables to the cable support extrusion with cable ties provided.

Fig 2.1.2 System Connections.

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2.2 IEC 61162-1 or -2 Input, Cable 14 (DB Terminals 41 & 42).

This optional serial data input can be configured via the set up menu for 4800 baud (IEC 61162-1) or 38k4 baud (IEC 61162-2). The input accepts the ZDA – Time and Date sentence which can be used to automatically set the system time and date to UTC. The input also accepts the DDC Central Dimming control sentence which can be selected as the dimming source for any / all control units.

2.3 Volt Free Relay Connections.

2.3.1 N.O. (normally open) or N.C. (normally closed) selection for relays RLY1 (Heel Angle Alert) and RLY2 (System Failure).

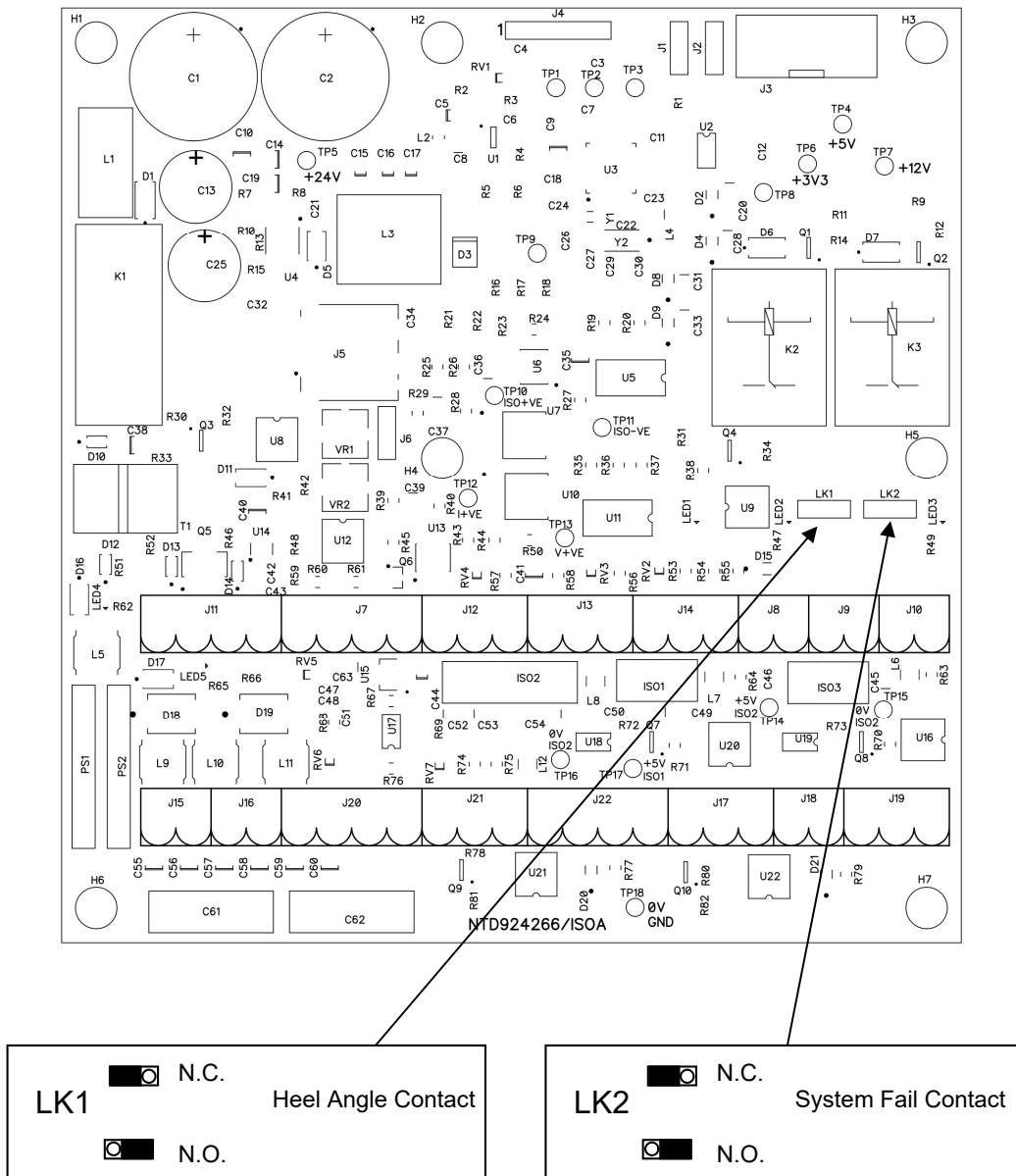
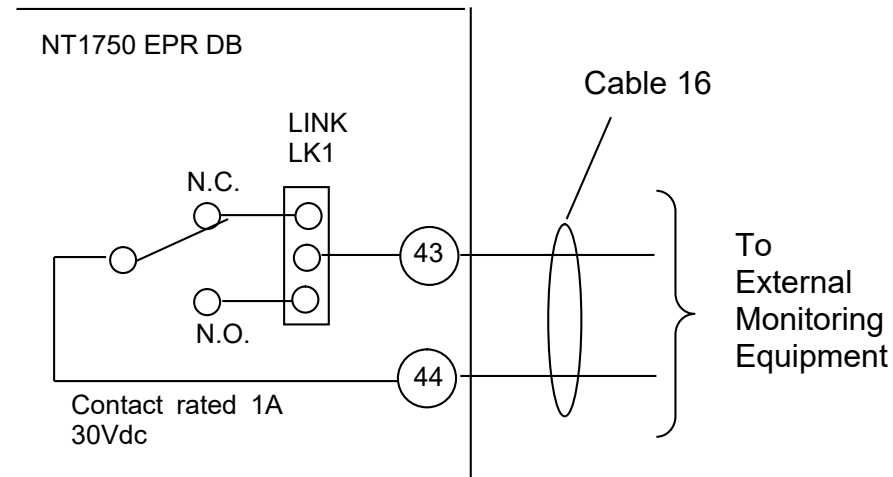


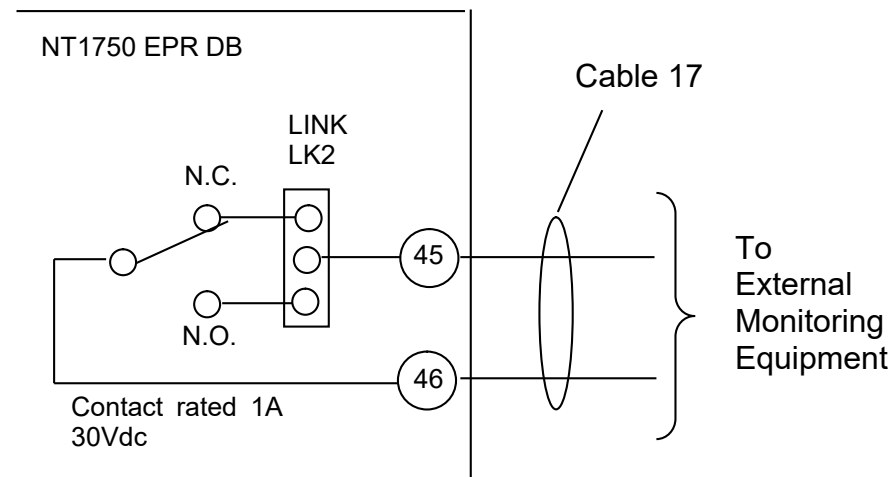
Fig 2.3.1 NT1750 EPR DB Relay Contact Type Selection Link Positions.

2.3.2 Heel Limit Alert Relay Contact.



The relay will activate when the NT1750 EPR system detects that the actual Heel Angle of the vessel has attained / exceeded the Heel Limit threshold value and the alarm has not been acknowledged.

2.3.3 Power Monitor Relay Contact.

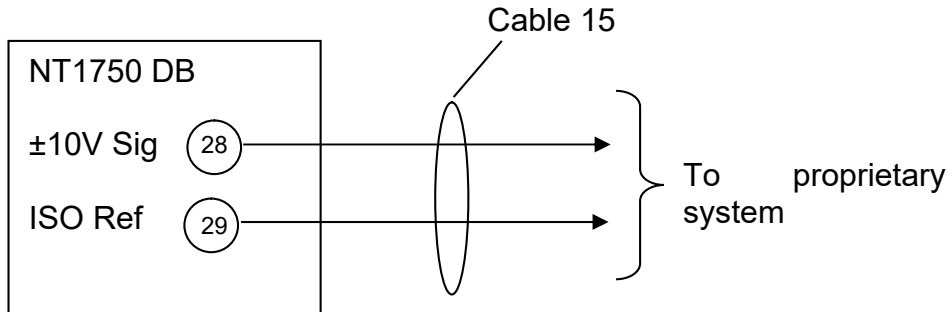


The relay will activate when the NT1750 EPR system is connected to 24Vdc power.

2.4 Analogue Heel Angle Output.

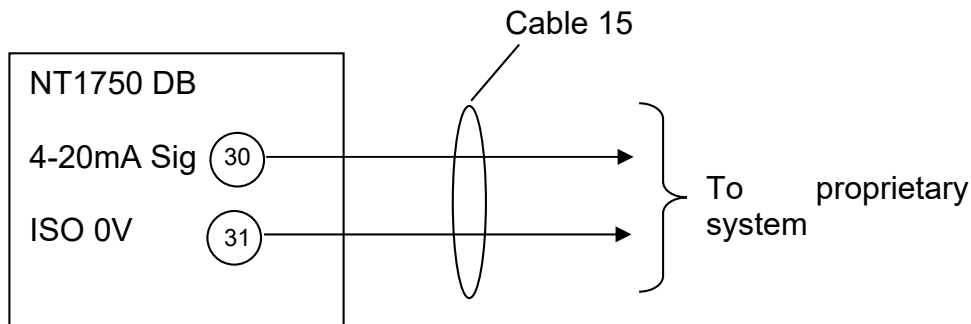
The NT1750 DB provides an isolated analogue $\pm 10V$ or 4-20mA output that is proportional to the actual heel angle of the vessel.

2.4.1 $\pm 10V$ Isolated Analogue Output.



The output voltage offset and gain ($111mV/^\circ$ to $222mV/^\circ$) can be adjusted via the set up menu, see Section 3.11 for details.

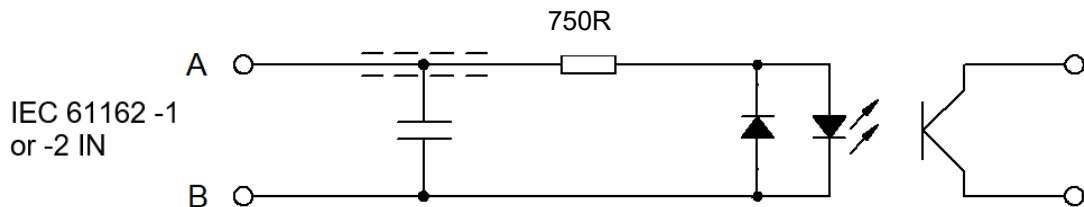
2.4.2 4-20mA Isolated Analogue Output.



The output current offset, gain ($88\mu A/^\circ$ to $177\mu A/^\circ$) and direction can be adjusted via the set up menu, see Section 3.11 for details.

2.5 IEC 61162-1 or -2 Input Connections.

Two 4800 / 38400 baud selectable IEC 61162-1 or -2 data input ports are available in the NT1750 EPR DB. The inputs are opto isolated thus no common mode problems will be experienced when connecting to data sources.



IEC 61162-1 or -2 Opto Isolated Input Stage.

Section 3: Installation Adjustments & Menu Parameters.

3.1 Set Up Menu Mode.

The Set Up Mode is used at installation to adjust the Set Up Parameter values.

3.2 Set Up Menu Entry.

The Installation Set Up Menu is accessed by pressing the MENU / SELECT key for 5 seconds. The MAIN MENU PARAMETERS will be shown as detailed in Fig 3.2.1.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

Fig 3.2.1. The Set Up Menu.

3.3 Selecting Set Up Menus.

The selected menu is indicated by the blue highlight bar. To move the select bar down press the DOWN key. To move the select bar up press the UP key. An example screen is shown in Fig 3.3.1 with the **Communication Settings** menu selected.

Main Menu	
Exit	Section
Display Settings	3.7
Limit Settings	3.8
Communication Settings	3.9
Analogue Output Settings	3.10
Sensor Settings	3.11
Time Settings	3.12

Fig 3.3.1. Communication Settings Menu Selected.

The selected menu is entered by pressing the MENU / SELECT key.

3.4 Adjusting Set Up Parameter Values.

Move the highlight bar until the desired parameter is selected, press the MENU / SELECT key to confirm that the value is to be changed. The highlight bar will move to the parameter value. See Fig 3.4.1.

Limits Settings	
Return to Main Menu	
Display Peak Hold	ON
Heel Limit	30.0°
Tug Mode	OFF
Tug Limit Warning	20.0°
Tug Limit Alarm	30.0°
Tug Cancel	OFF

Fig 3.4.1. Heel Limit Alarm Value Selected.

Once the parameter value has been highlighted it may be adjusted using the UP & DOWN keys.

3.5 Saving Set Up Parameter Values.

When the parameter has been adjusted to the desired value confirm / save the new value by pressing the MENU / SELECT key. The value will be stored and the highlight bar will return to the parameter selection column.

3.6 Set Up Menu Exit.

Providing no parameter values are being adjusted, an immediate exit from the Set Up Menu is accomplished by pressing the ACK key.

If a parameter value is being adjusted, pressing the ALARM TEST / ACK key will deselect the parameter and its value will revert to the last saved value.

If no parameter value is being adjusted and no keys are pressed for a period of 30 seconds the Set Up Menu will automatically exit.

If a parameter value has been adjusted but not saved / confirmed (by pressing the MENU / SELECT key) after a period of 30 seconds, the parameter is automatically deselected and its value will revert to the last saved value.

3.7 Display Settings

- i) Enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.
- ii) Press the DOWN key to step to the **Display Settings** menu.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

- iii) Press the MENU / SELECT key to enter the display settings menu.

Display Settings		
Return to Main Menu		
CU Address	1	Section 3.7.1
Dimmer Source	Local	3.7.2
Remote Dimmer Direction	Normal	3.7.3*
Port / Starboard Reverse Mode	OFF	3.7.4

* NOTE: The “Remote Dimmer Direction” parameter is only available from NT1750 EPR CU Software Version V1.01.

3.7.1 CU Address.

If there are multiple NT1750 EPR CU control units in the system each one must be set to a different CU address.

- i) Press the DOWN key and select the CU Address parameter.
- ii) Press the MENU / SELECT key to select the CU Address value.
- iii) Use the UP and / or DOWN key to set the desired CU address value.
- iv) Press the MENU / SELECT key to confirm the value.

3.7.2 Dimmer / Illumination Control Source.

The source of the dimmer / illumination control can be set to the following values:-

Local - Illumination level set using the CUs local UP & DOWN keys.

Dim 1 – Illumination level set using remote dimmer potentiometer 1.

Dim 2 – Illumination level set using remote dimmer potentiometer 2.

Dim 3 – Illumination level set using remote dimmer potentiometer 3.

Dim 4 – Illumination level set using remote dimmer potentiometer 4.

DDC - Illumination Level set by DDC sentence.

- i) Press the DOWN key and select the Dimmer Source parameter.
- ii) Press the MENU / SELECT key to select the Dimmer Source value.
- iii) Use the UP and / or DOWN key to set the desired dimmer source for this CU.
- iv) Press the MENU / SELECT key to confirm the value.

3.7.3 Remote Dimmer Direction.

The remote dimmer inputs are configured as follows:-

Normal - 0V = maximum brightness, +12Vdc = minimum brightness.

Reversed - +12Vdc = maximum brightness, 0V = minimum brightness.

- i) Press the DOWN key and select the Remote Dimmer Direction parameter.
- ii) Press the MENU / SELECT key to select the Remote Dimmer Direction value.
- iii) Use the UP and / or DOWN key to set the desired value.
- iv) Press the MENU / SELECT key to confirm the value.

3.7.4 Port / Starboard Reverse Mode.

For aft facing units the display can be reversed so port is on the right and starboard on the left.

- i) Press the DOWN key and select the Reverse Mode parameter.

3.7.4 Port / Starboard Reverse Mode (continued).

- ii) Press the MENU / SELECT key to select the Reverse Mode value.
- iii) Use the UP and / or DOWN key to set Reverse Mode ON or OFF.
- iv) Press the MENU / SELECT key to confirm the value.

3.7.5 Returning to the Main Menu.

- i) Press the UP key to highlight the Return to Main Menu selection.
- ii) Press the MENU / SELECT key to select the Reverse Mode value.

NOTE: Pressing the ACK whilst in the Set Up menus will exit the set up mode and return the unit to normal display operation.

3.8 Limits Settings

- i) If required enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.
- ii) Press the DOWN key to step to the **Limits Settings** menu.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

- iii) Press the MENU / SELECT key to enter the Limits Settings menu.

Limits Settings		
Return to Main Menu		
Display Peak Hold	ON	3.8.1
Heel Limit	30.0°	3.8.2
Tug Mode	OFF	3.8.3
Tug Limit Warning	20.0°	3.8.4
Tug Limit Alarm	30.0°	3.8.5
Tug Cancel	OFF	3.8.6

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3.8.1 Display Peak Hold.

The display mode for the peak hold values can be set to one of the following options:-

- OFF - No peak hold value shown.
- ON - Peak hold value and time / date of last reset shown.
- ON (No Reset Time) - Only peak hold value shown.
- ON (Time Since) - Time since last peak hold reset shown instead of time and date.

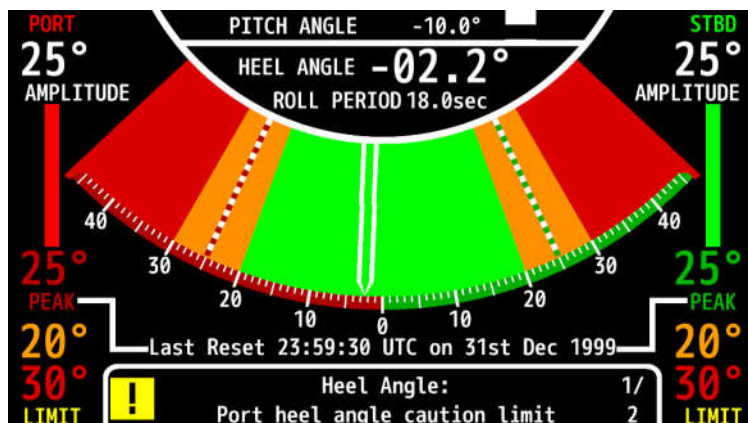
3.8.2 Heel Limit

The Heel Limit value can be set from $\pm 5^\circ$ to $\pm 45^\circ$ as required.

3.8.3 Tug Mode.

In addition to the conventional Sea going electronic display configuration associated with MSC.363(92) a second screen display is operator selectable and accords with Bureau Veritas (BV) Rules in respect of Escort Tugs etc.

BV Rules for the Classification of Steel Ships, part E-Service Notations for Offshore Service Vessels and Tugs, Ch1 Sect 2, specifies Inclinerometer requirements wherein Escort Tugs are to be equipped with a calibrated Heeling Angle measurement system (Inclinerometer) which continuously displays the real time angle of vessel heel in the Wheelhouse near the control desk or other appropriate location.



Escort Tug Mode Inclinerometer Display Screen

Accordingly, the NT1750 EPR Escort Tug work mode screen monitors and displays Safe (Green) Warning (Amber) & Danger (Red) zones which are simply and independently adjustable by the Tug Master to reflect current operating conditions such as towing loads / speed etc (see Section 3.8.4 & 3.8.5).

Permanent and continuous display of Heel Angle is supported by visual and audible alarms which are automatically activated on entry into a prohibited heel zone and last 3 minute and 30-minute Heel Angle history can be inspected by the Tug Master / Operator at all times.

3.8.3 Tug Mode (continued).

Tug Mode can be set to On or OFF as required.

ON – Tug Mode display mode.

OFF – Normal display mode.

3.8.4 Tug Limit – Warning

The Tug mode warning limit (green zone) can be set between $\pm 5^\circ$ and $\pm 30^\circ$ as required.

3.8.5 Tug Limit – Alarm

The Amber Zone adjustment from end of Green Zone to $\pm 40^\circ$ (max).

3.8.6 Tug Cancel

Heel angle increase from the Green to Amber zone will initiate an audible and visual alert. The audible alert can be silenced by manual ACK key operation or can be automatically cancelled when the heel angle returns to the green zone:-

ON – Automatic cancellation of heel angle warning on returning to green zone.

OFF – manual cancellation of heel angle warning by ACK key press.

3.9 Communication Settings

- i) If required enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.
- ii) Press the DOWN key to step to the **Communication Settings** menu.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

3.9 Communication Settings (continued).

- iii) Press the MENU / SELECT key to enter the Communication Settings menu.

Communication Settings		
Return to Main Menu		Section
VDR Baud	4800	3.9.1
VDR Rate	5Hz	3.9.2
BAMS Baud	4800	3.9.3
ZDA Baud	4800	3.9.4

3.9.1 VDR Baud.

The VDR baud rate can be set to 4800 (IEC 61162-1) or 38k4 (IEC 61162-2) as required.

3.9.2 VDR Rate.

The VDR output rate can be set to 5Hz or 10Hz as required.

3.9.3 BAMS Baud.

The BAMS baud rate can be set to 4800 (IEC 61162-1) or 38k4 (IEC 61162-2) as required.

3.9.4 ZDA Baud.

The ZDA / DDC serial data input baud rate can be set to 4800 (IEC 61162-1) or 38k4 (IEC 61162-2) as required.

3.10 Analogue Output Settings

- i) If required enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.
- ii) Press the DOWN key to step to the **Analogue Output Settings** menu.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

3.10 Analogue Output Settings (continued).

- iii) Press the MENU / SELECT key to enter the Analogue Output Settings menu.

Analogue Output Settings		
Return to Main Menu		Section
Voltage Offset	0.0%	3.10.1
Voltage Gain	222mV/°	3.10.2
Current Offset	0.0%	3.10.3
Current Gain	177uA/°	3.10.4
Current Direction	STBD	3.10.5

3.10.1 Voltage Offset.

The heel angle voltage output offset value can be adjusted from -100% to +100% as required.

3.10.2 Voltage Gain.

The heel angle voltage output gain value can be adjusted from 111mV/° (10V = 90°) to 222mV/° (10V = 45°) as required.

3.10.3 Current Offset.

The heel angle 4-20mA current output offset value can be adjusted from -100% to +100% as required.

3.10.4 Current Gain.

The heel angle 4-20mA current output gain value can be adjusted from 88uA/° (4mA / 20mA = 90°) to 177uA/° (4mA / 20mA = 45°) as required.

3.10.5 Current Direction.

The sense of increasing current output signal can be set to either PORT or STBD as required.

3.11 Sensor Settings

Ensure the sensor is aligned with the vessel and securely mounted as detailed in Section 1.3.

Any offset angle that exists between the Heel and / or Pitch Angle indicated on the NT1750 EPR and the Actual Heel or Pitch Angle of the vessel can be corrected / adjusted as follows:-

- i) If required enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.
- ii) Press the DOWN key to step to the **Sensor Settings** menu.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

- iii) Press the MENU / SELECT key to enter the Sensor Settings menu.

Sensor Settings		
Return to Main Menu		
Pitch Offset	0.0°	Section 3.11.1
Heel Offset	0.0°	3.11.2

3.11.1 Pitch Offset.

Any pitch offset angle that exists after installation can be corrected up to $\pm 5^\circ$.

3.11.2 Heel Offset.

Any heel offset angle that exists after installation can be corrected up to $\pm 5^\circ$.

3.12 Time Settings

- i) If required enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.

3.12 Time Settings (continued).

- ii) Press the DOWN key to step to the **Time Settings** menu.

Main Menu
Exit
Display Settings
Limit Settings
Communication Settings
Analogue Output Settings
Sensor Settings
Time Settings

- iii) Press the MENU / SELECT key to enter the Time Settings menu.

Time Settings				
Return to Main Menu				
Time Source	Internal			Section
Date	2025	Mar	26th	3.12.1
Time (hh:mm:ss)	17	21	33	3.12.2
				3.12.3

3.12.1 Time Source.

The time source can be set to either INTERNAL or to UTC input via the ZDA sentence.

3.12.2 Date.

- i) Use the DOWN key to select the DATE parameter. Press the MENU / SELECT key to select the year field. Use the UP and or DOWN keys to set the required year.
- ii) Press the MENU / SELECT key to step to the month field. Use the UP and or DOWN keys to set the required month.
- iii) Press the MENU / SELECT key to step to the day field. Use the UP and or DOWN keys to set the required day.

3.12.3 Time.

- i) Use the DOWN key to select the TIME parameter. Press the MENU / SELECT key to select the hour field (24h). Use the UP and or DOWN keys to set the required hour.
- ii) Press the MENU / SELECT key to step to the minute field. Use the UP and or DOWN keys to set the required minute.
- iii) Press the MENU / SELECT key to step to the second field. Use the UP and or DOWN keys to set the required second.

4.0 Operating Instructions.

4.1 Turning the NT1750 EPR System ON / OFF.

4.2 The Normal Display Interface.

4.3 Keypad Functions.

4.4 The Stored Data Display.

4.5 Alerts & Warnings.

4.6 Silencing & Acknowledging an Audible Alert.

4.7 Resetting the Peak Heel Values.

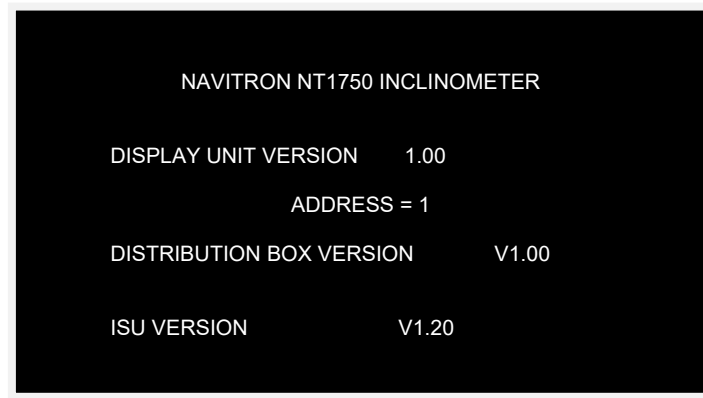
4.8 Adjusting the Heel Angle Limit.

4.9 Illumination Level Adjustment.

4.10 System Diagnostic Guide.

4.1 Turning the NT1750 EPR System ON / OFF.

Ensure main and backup 24Vdc power is applied to the NT1750 EPR DB. Switch the NT1750 EPR Control Unit **ON** by pressing the ON / OFF / PEAK RST key. The power up splash screen shown below will be seen for 5 seconds:-



The normal Heel Angle display will then be shown. See Fig 4.2.

The NT1750 EPR Control Unit is switched **OFF** by pressing the ON / OFF / PEAK RST key for 5 seconds.

NOTE: A single press of the ON / OFF / PEAK RST key when the unit is powered on will reset the Peak Heel Values. See Section 4.7.

4.2 The Normal Display Interface.

Refer to Fig 4.2 for details of the normal Heel Angle display and the function of each display area.

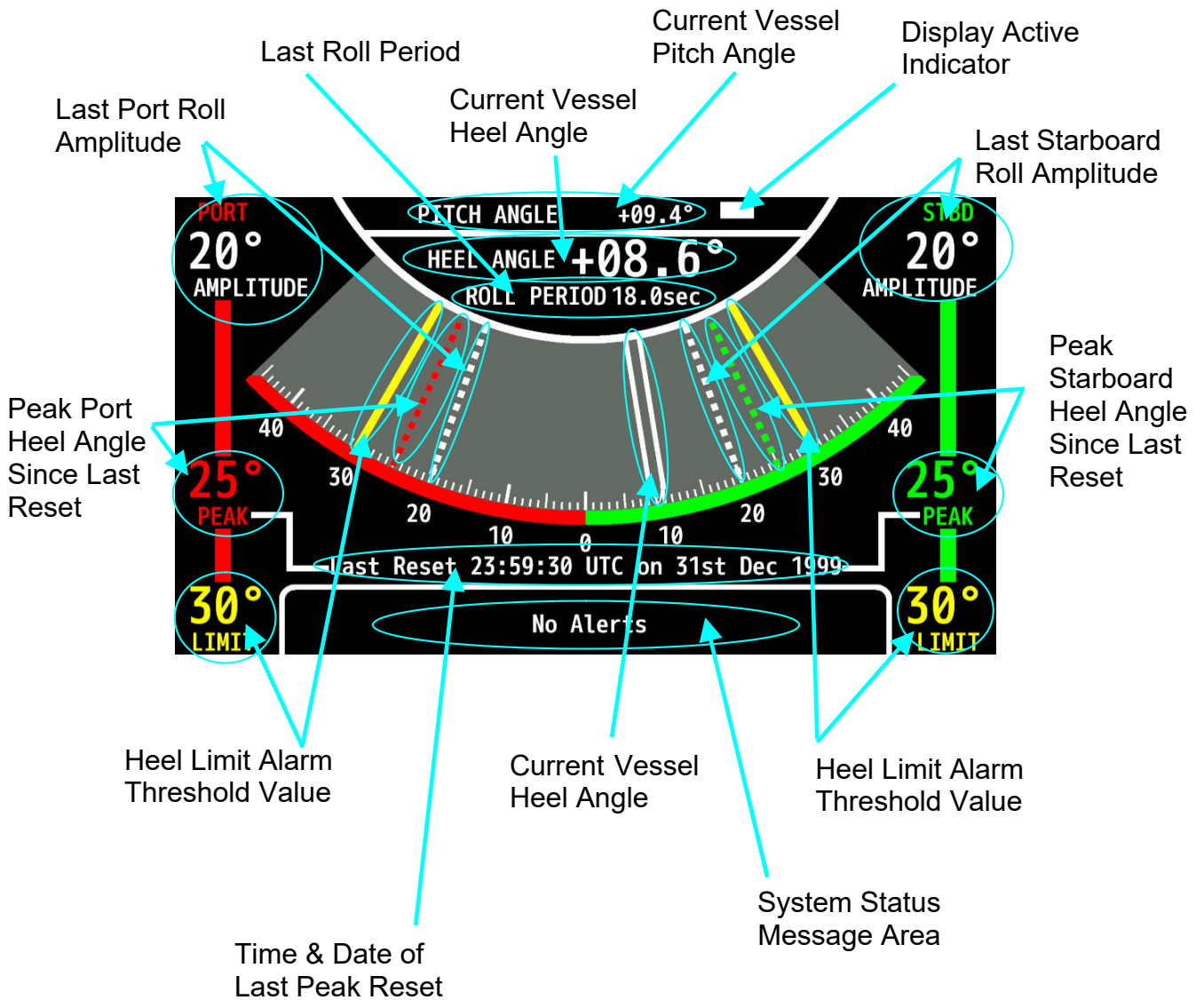


Fig 4.2 The Normal Display Interface.

4.3 Keypad Functions.

The NT1750 EPR Control / Display Unit features a membrane keypad with 5 tactile keys. See Fig 4.3 for key location and function.

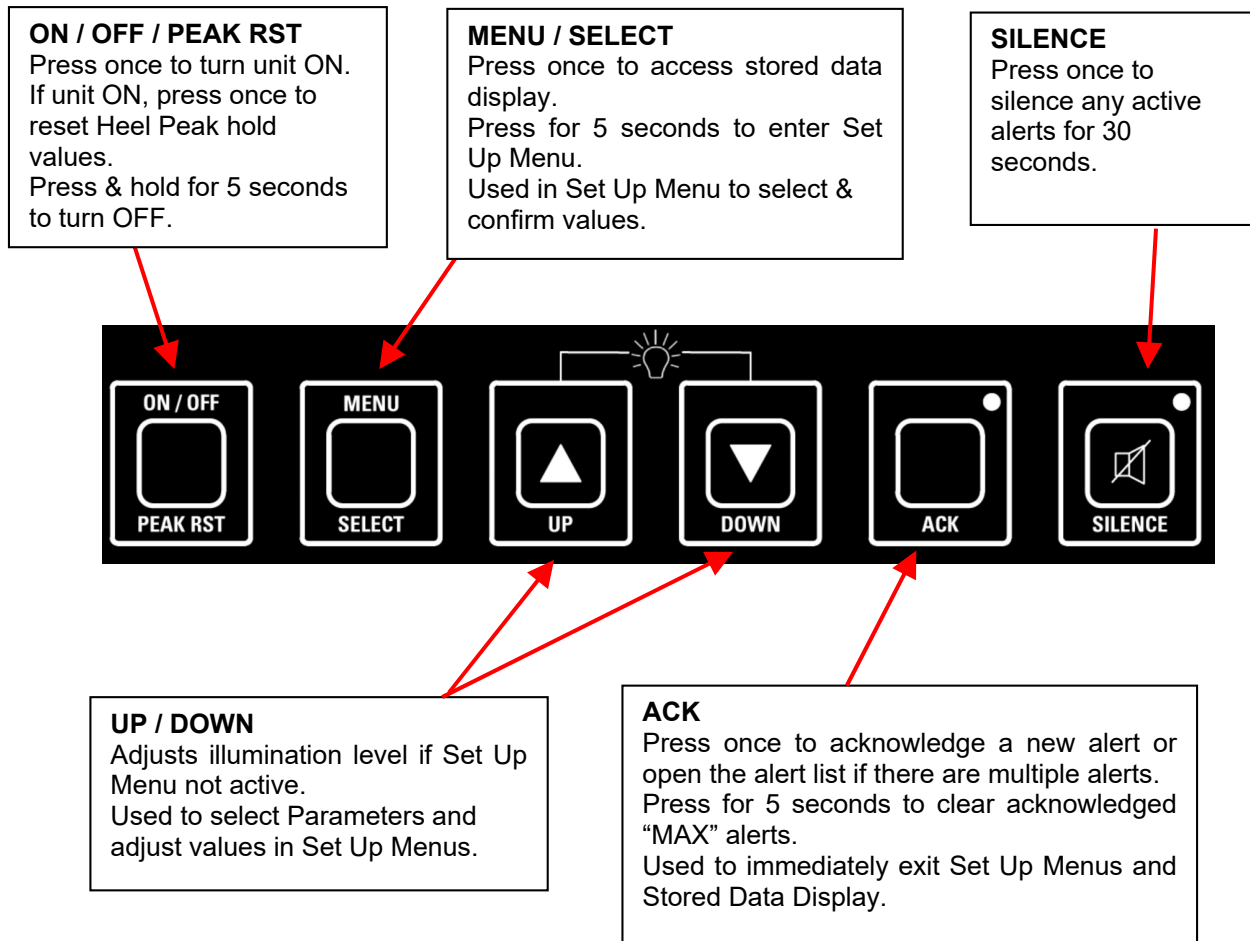


Fig 4.3 Key Location & Function.

4.4 The Stored Data Display.

The Stored Data display is accessed by pressing the MENU key from the normal screen.

To exit Recorded Data and return to the normal screen press the MENU or ACK key. The Recorded Data screen shows the last 3 minutes of Heel Angle data and the last 30 minutes of Roll Period data. See Fig 4.4.1.

4.4 The Stored Data Display (continued).

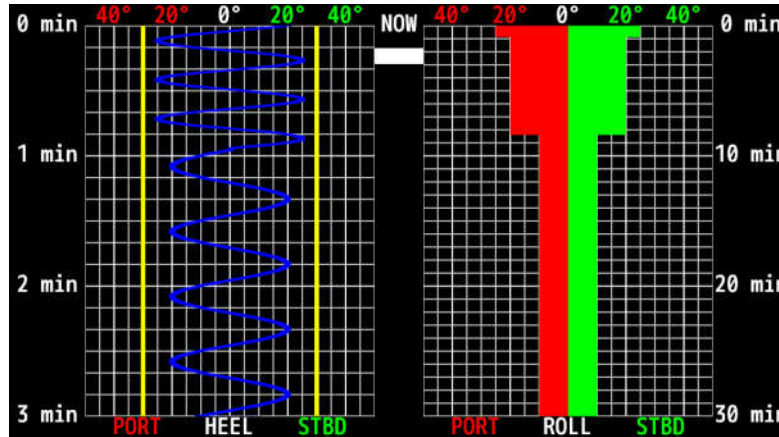


Fig 4.4.1 The Recorded Data Screen.

NOTE: If a new (Active Unacknowledged) alert condition is activated, the Recorded Data Screen will automatically exit and return to the standard screen thereby enabling the alert condition to be viewed and appropriate action to be taken.

4.5 Alerts & Warnings.

The alert messages listed in Table 4.5.1 will be displayed (if appropriate) in the alarm box at bottom of the display and will be accompanied by the appropriate alert management icon listed in Table 4.5.2. An example alert is shown in Fig 4.5.1.

Warnings and alarms are accompanied by an audible signal.

The alert messages are also transmitted to Bridge Alert Management (BAM) system if applicable.

Alerts are acknowledged by pressing the **ACK** key or via the BAM system.

Alert Identifier	Instance	Alert Title	Alert Description	Priority	Category	Escalation
		No alert	None			
3023	1	Power fail	Working normally on Backup Power only	C	B	-
	2	Power fail	Working normally on Main Power only	C	B	-
3061	1	System fault	Sensor Failed	A	B	-
3065	1	Heel angle	Port heel angle exceeded	W	B	W
3065	2	Heel angle	Stbd heel angle exceeded	W	B	W
3065	3	Heel angle	Port heel angle caution limit (Tug mode only)	C	B	
3065	4	Heel angle	Stbd heel angle caution limit (Tug mode only)	C	B	

Table 4.5.1 Alert Display Messages.

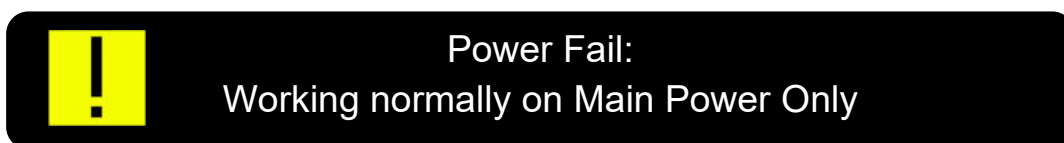


Fig 4.5.1 Example Alert Display Message.

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Alert State	Icon Graphic
Active –unacknowledged alarm	 Flashing
Active – silenced alarm	 Flashing
Active – acknowledged alarm	
Rectified – unacknowledged alarm	 Flashing
Active – unacknowledged warning	 Flashing
Active – silenced warning	 Flashing
Active – acknowledged warning	
Rectified – unacknowledged warning	 Flashing
Caution	

Table 4.5.2 Alert Icons.

4.6 Silencing & Acknowledging an Audible Alert .

Silencing all alerts.

Alerts of type Warning or Alarm will be accompanied by an audible signal and the yellow “**ACK**” (acknowledge) and “**SILENCE**” corner LEDs will flash.

All audible alert signals are silenced for 30 seconds by a single press of the “**SILENCE**” key. The icon accompanying the alert in the notification area will change as follows:-



Active silenced warning.



Active silenced alarm.

To silence all audible alerts:-

- (i) Press the “**SILENCE**” key.



Acknowledging a Single Alert.

A single alert of type Warning or Alarm is acknowledged by a single press of the “**ACK**” key. The icon accompanying the alert in the notification area will change as follows:-



Active acknowledged warning.



Active acknowledged alarm.

To acknowledge a single alert:-

- (i) Press the “**ACK**” key..



Acknowledging / Viewing Multiple Alerts.

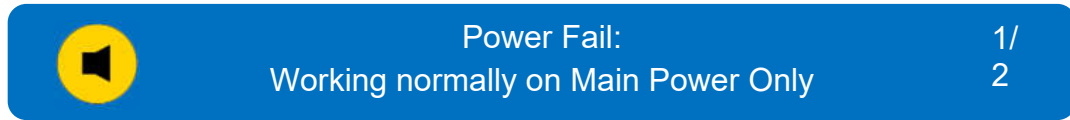
If there are multiple alerts then only the highest priority alert will be displayed.

The number of active alerts is shown on right side of the notification area.

Each alert must be individually acknowledged via the alert list function or via the BAM interface.

Acknowledging / Viewing Multiple Alerts (continued).

The alert list is accessed by pressing the “**ACK**” key. The alert notification area will be highlighted blue and the alert list will be presented on the right of the screen, see below.



To access the multiple alert list:-

- (i) Press the “**ACK**” key.



Whilst in the alert list mode use the “UP” or “DOWN” membrane keys to scroll through the alert list.

To acknowledge a highlighted alert:-

- (i) Press the “**ACK**” key..



NOTE: If there is no user activity the alert list mode will exit automatically after 30 seconds.

Once an alert has been rectified and acknowledged it will be removed from the list.

NOTE: The “Heel Angle” alert will be held once acknowledged in order to prevent repeated alert activation due to the vessel yawing from side to side. Press the ACK key for 5 seconds to reset an acknowledged “Heel Angle” alert.

4.7 Resetting the Peak Hold Heel Angle Values.

The Peak hold Heel Angle values are reset by a single press of the ON / OFF/ PEAK RST key. If enabled the time and date of last reset or time since last reset is shown near the bottom of the normal display screen.

4.8 Adjusting the Heel Angle Limit.

- i) Enter the Set Up Menu by pressing the MENU / SELECT key for 5 seconds. The Set Up Menu will be shown with the EXIT line highlighted.
- ii) Press the DOWN key to step to the **Limits Settings** menu.

Main Menu	
Exit	
Display Settings	
Limit Settings	
Communication Settings	
Analogue Output Settings	
Sensor Settings	
Time Settings	

- iii) Press the MENU / SELECT key to enter the Limits Settings menu.
- iv) Press the DOWN key twice to select the Heel Limit parameter.

Limits Settings	
Return to Main Menu	
Display Peak Hold	ON
Heel Limit	30.0°
Tug Mode	OFF
Tug Limit Warning	20.0°
Tug Limit Alarm	30.0°
Tug Cancel	OFF

- v) Press the MENU / SELECT key to select the Heel Limit value.
- vi) Use the UP and / or DOWN key to set the desired Heel Limit.
- vii) Press the MENU / SELECT key to confirm the value.

NOTE: The new HEEL LIMIT VALUE is transmitted to the BAMS and VDR via the IEC 61162 serial interfaces. See Section 5 for details.

4.9 Illumination Level Adjustment.

Providing the control unit is set to local illumination control and the menu screen and/or alert list is not active the LCD and key legend backlight is adjusted through 20 levels using the UP / DOWN keys.

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4.10 System Diagnostic Guide.

Failure / Alarm Condition	Probable Cause	Remedial Action
No response from NT1750 EPR when "ON / OFF" key pressed. Display is blank.	No power supply to NT1750 EPR DB.	Check 24Vdc Main Power and Backup Power to DB (terminals 1/2 and 3/4).
"Power Fail: Working normally on Backup Power only" shown on display.	No Main Power supply to NT1750 EPR.	Check 24Vdc power supply to DB (terminals 1 / 2).
"Power fail: Working normally on Main Power only" shown on display.	No Back Up Power supply to NT1750 EPR.	Check 24Vdc power supply to DB (terminals 3 / 4).
"System fault: Sensor failed" shown on display.	The NT1750 EPR is not receiving data from the NT1000 ISU Sensor Unit.	Check sensor connection to DB (terminals 12 - 15) and ISU junction box if fitted. See Fig 2.1.2 for connection details.

5.0 IEC 61162 Serial Data Interfaces & Failure Alert Messages.

5.1 VDR Output Sentences (Standard & Tug Heel Incliner Modes).

The following sentences are transmitted via the VDR output (DB Terminals 21 / 22):

\$IIHBT,x.x,A,y*hh<cr><lf>

Where: x.x -- Repeat interval usually 10 (seconds)
 y -- Sequential sentence identifier (0-9)

\$IIHRM,x.x,y.y,z.z,a.a,A,b.b,c.c,hhmmss.ss,dd,ee*hh<CR><LF>

Where:

x.x	--	Actual Heel Angle, degrees
y.y	--	Roll Period, seconds
z.z	--	Roll Amplitude, Port side, degrees
a.a	--	Roll Amplitude, Starboard side, degrees
b.b	--	Roll Peak hold value, Port side, degrees
c.c	--	Roll Peak hold value, Starboard side, degrees
hhmmss.ss	--	Peak hold value reset time UTC hour / min / sec
dd	--	Peak hold value reset day, 01 to 31
ee	--	Peak hold value reset month, 01 to 12

\$IITXT,01,01,01,EI_RollThresholdAngle_xx_deg*hh<CR><LF>

Where: xx -- Heel Threshold Angle.

This sentence is only sent on power up and when the Heel Threshold Value is changed via the Set Up Menu.

Tug Mode Incliner Only:-

\$IITXT,01,01,01,E1_RollCautionAngle_xx-deg*HH<CR><LF>

Where xx -- Roll Caution Angle.

This sentence is only sent on power up and when the Heel Caution Threshold Value is changed.

5.2 BAMS Interface.

5.2.1 Transmitted BAMS Sentences (Standard & Tug Display Modes):-

The following sentences are transmitted via the BAMS output (DB Terminals 16 / 17):

\$IIHBT,x.x,A,y*hh<cr><lf>

Where: x.x -- Repeat interval usually 10 (seconds)
 y -- Sequential sentence identifier (0-9)

\$IIALF, 1, 1, 0, hhmmss.ss, B, a, d,NSL,e,,f, g, c---c*hh <CR><LF>

Where:

hhmmss.ss -- Time of last change
 a -- Alert priority, A or W
 d -- Alert state, A, S, N, O, U or V
 e -- Alert Identifier, See Table 5,.2.1
 f -- Revision counter, 1 to 99
 g -- Escalation counter, 0 to 9
 c---c -- Alert Title / Description, See Table 5,.2.1

Alert Identifier	Inst-ance	Alert Title	Alert Description	Prior-ity	Cate-gory	Esca-lation
		No alert	None			
3023	1	Power fail	Working normally on Backup Power only	C	B	-
	2	Power fail	Working normally on Main Power only	C	B	-
3061	1	System fault	Sensor Failed	A	B	-
3065	1	Heel angle	Port heel angle exceeded	W	B	W
3065	2	Heel angle	Stbd heel angle exceeded	W	B	W
3065	3	Heel angle	Port heel angle caution limit	C	B	
3065	4	Heel angle	Stbd heel angle caution limit	C	B	

Table 5.2.1 Alert Details.

Alert 1
Additional alerts if applicable

\$IIALC,01,01,00, w.w, NSL, x.x , ,y.y,....,NSL, x.x,, y.y*hh <CR><LF>

Where:

w.w -- Number of alert entries 0-8
 x.x -- Alert identifier see Table 5.2.1
 y.y -- Revision counter 1-99

5.2.2 Received BAMS Sentences:-

The following sentences are accepted via the BAMS input (DB Terminals 19 / 20):

\$xxACN,hhmmss.ss,NSL, x.x,,d,C*hh <CR><LF>

Where:

hhmmss.ss	--	Time
x.x	--	Alert identifier
d	--	Alert command, A, Q, O or S
hh	--	Checksum

\$xxTXT,01,01,01,EI_ChangeToNormalState*hh<CR><LF>

This sentence is used to remotely reset the Heel Angle alert state from Active Acknowledged to Normal.

5.3 DDC & ZDA Input Sentence Details.

The following sentences are accepted via IEC 61162 Input 2 (DB Terminals 41 & 42):-

\$xxDDC,a,xx,b,C*hh<CR><LF>

Where:-

a	--	Display dimming preset (not used).
xx	--	Brightness percentage (00 to 99).
b	--	Colour Palette (not used)
hh	--	Checksum

\$xxZDA,hhmmss.ss,dd,ee,yyyy,lh,lm*hh<CR><LF>

Where:-

hhmmss	--	UTC time.
dd	--	UTC day.
ee	--	UTC month.
yyyy	--	UTC year.
lh	--	Local hour (not used).
lm	--	Local minute (not used).

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6.0 Demonstration Mode.

The NT1750 EPR Inclinerometer features an inbuilt demonstration mode for training / exhibition purposes applicable to both the Standard (MSC.363 (92)) and Escort Tug Mode Inclinerometer display screens.

Demonstration mode is activated by powering down the system and moving link J14 to the bottom, see Fig 6.0. De-activate demonstration mode and return the CU to normal operation by powering down the system and moving J14 to the top.

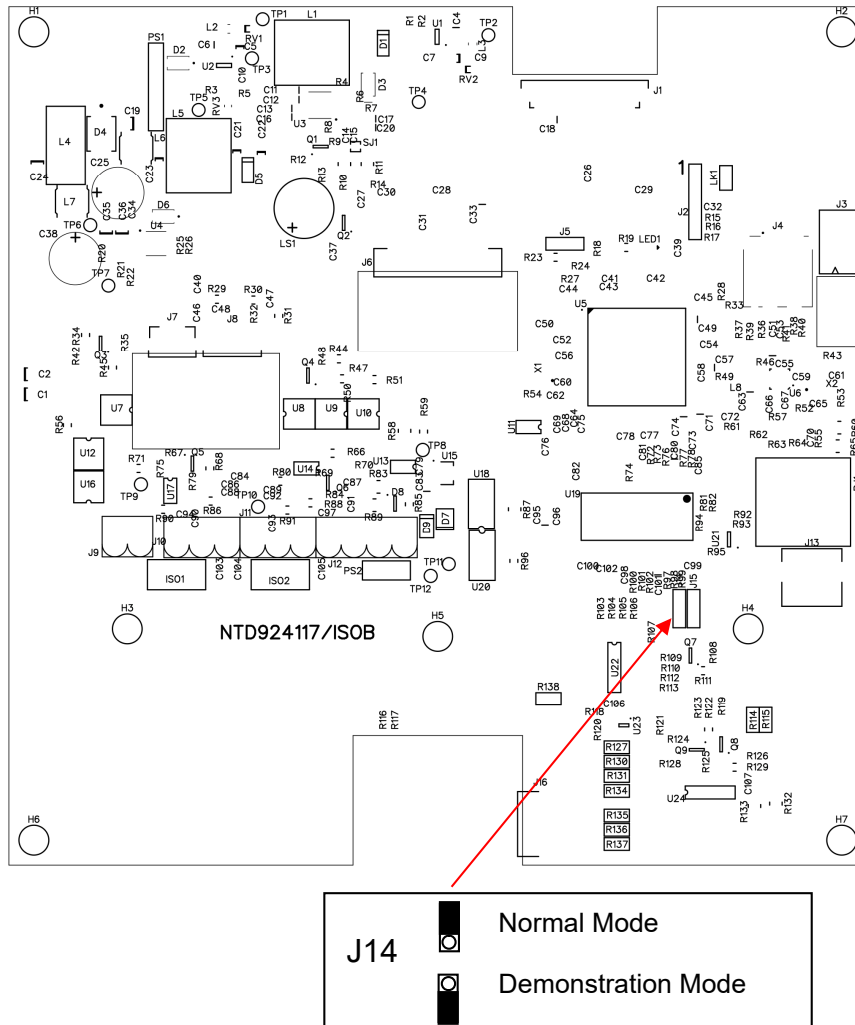


Fig 6.0. Location of Link J14 – Demonstration Mode Enable.

During the demonstration mode the Heel and Pitch angles are simulated internally. The Heel Angle will vary $\pm 25^\circ$ with a Roll Period of 18 seconds & the Pitch Angle will vary $\pm 10^\circ$ with a period of 18 seconds. All other functions will work normally except for the VDR serial data output where the Heel and Roll data are marked as invalid.

NT1750 EPR & ESCORT TUG INCLINOMETER INSTALLATION & CALIBRATION

Appendix A: Terms & Abbreviation Definitions.

Abbreviations:

BAMS - Bridge Alert Management System

CU - NT1750 EPR Control Unit.

DB - NT1750 EPR Distribution Unit.

ISU - Inclinator Sensor Unit.

VDR - Voyage Data Recorder.

UTC - Coordinated Universal Time.

Terms.

actual heel angle: momentary angle of roll referenced to a levelled ship to port or starboard side.

roll amplitude: maximum values of heel angle to port or starboard side.

roll period: time between two successive maximum values of heel angle on the same side of the ship.

roll peak hold value: maximum values of roll amplitude to port or starboard side from the last reset.