Wave XL460 Monitor

USER'S MANUAL

WA460-01.MON.01-0001

October 2014

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1. Foreword

Thanks for purchasing a North Invent Wave Monitor. Our series of rugged TFT LCD Display Monitors are conceived and built with the greatest care and state of the art electronic and software features. North Invent focuses its full expertise in offering dedicated display solutions, matching with your highest requirements and use.

Before starting operating the Monitor, we would like to suggest that you carefully read through the present document, as our aim with this User's Manuel is to give you the best experience in using our Monitors.

May you have any suggestions for improvements, or any feedbacks about this manual, the Monitor and/or its features, feel free to contact us. We will be pleased to oblige.

This User's Manual is for use only with our Wave Monitors. To assess which series of Monitor you are in possession of, please check the Serial Number plate at the back of the screen. The mention shall bear WA460. May you have a different series of Monitor, please contact us, so to have the proper manual sent to your attention.

1.0 Terms and abbreviations

DVI	Digital Visual Interface
DVI-A	- Analog
DVI-I	-Integrated
HMI	Human- Machine Interface
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
OSD	On-Screen Display
RGB	Red-Green-Blue
TFT	Thin Film Transistor
VGA	Video Graphics Array

1.1 Monitor description

- *Each Wave Monitor is designated as below:*

WA XL460		WA	460	01	MON	01	xxxx

Where "WA" stands for Wave, "460" for the display's Size, "01" in third coulomb for the hardware Revision, "MON" for Monitor, "01" in fifth coulomb for standard version of Wave and "xxxx" for identification of minor variants (flash logo, OEM labels etc.).

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Wave XL460 Monitor

- *Each Monitor is constituted by the following set of components:*

- Front glass with multi touch
- Display Frame and all necessary electronic components
- Rear cover and Terminal plate
- 1 x Power AC Cable / 1 x DC plug / 1 x DVI Cable/ 1 x USB cable

(optional)

- RS232 cable
- Tilting unit

- *Each Monitor presents the following materials and features:*

- The Front, Display Frame and Cover are made of Marine Grade Aluminium allowing to reduce weight while eliminating corrosion problems.

- The electronic set of components includes a specifically designed Power Supply, a high quality Display Controller, an integrated backlight LED driver and a custom-made Interface Board.

- All our Monitors use identical Power Supply and User Panel. The Power Supply can be supplied with 90-264 VAC and/or 18-36 VDC, and even be used as a part of an UPS.

- All our Monitors come with VGA, DVI, S-Video and Composite video inputs, and a RS232 input for remote control purposes.

- Pixel pitch is 0,17675 mm (horizontal) x 0,53025 mm (vertical). Pixel pitch equals 1,82 m viewing distance with a viewing angle of 1 minute of arc as required in IEC 62.288 section 7.5.1.

- *Each Monitor complies with the following international Standards and Requirements:*

- The XL460 monitor has been tested by the testing body “SP” (SP Technical Research Institute of Sweden A/S, Copenhagen) and found to comply with the requirements of the International Association of Classification Societies (IACS) (IEC 60945, IEC 60533, IEC 60529 and as well as the selected requirements of MIL-STD-810F).
- The 46" Wave XL monitor is also tested according to IEC 62288, IEC 62388 and IEC 61174 and thereby ECDIS approved (pending).

- The XL460 monitor is approved in compliance with the international standard IEC 60945 : 2002 (Clause 4.4 Equipment category b, protected from the weather (formerly class B)), Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results.

  The compass safe distance indication is placed on the rear label (see figure 1.) and is valid for the Monitor only.

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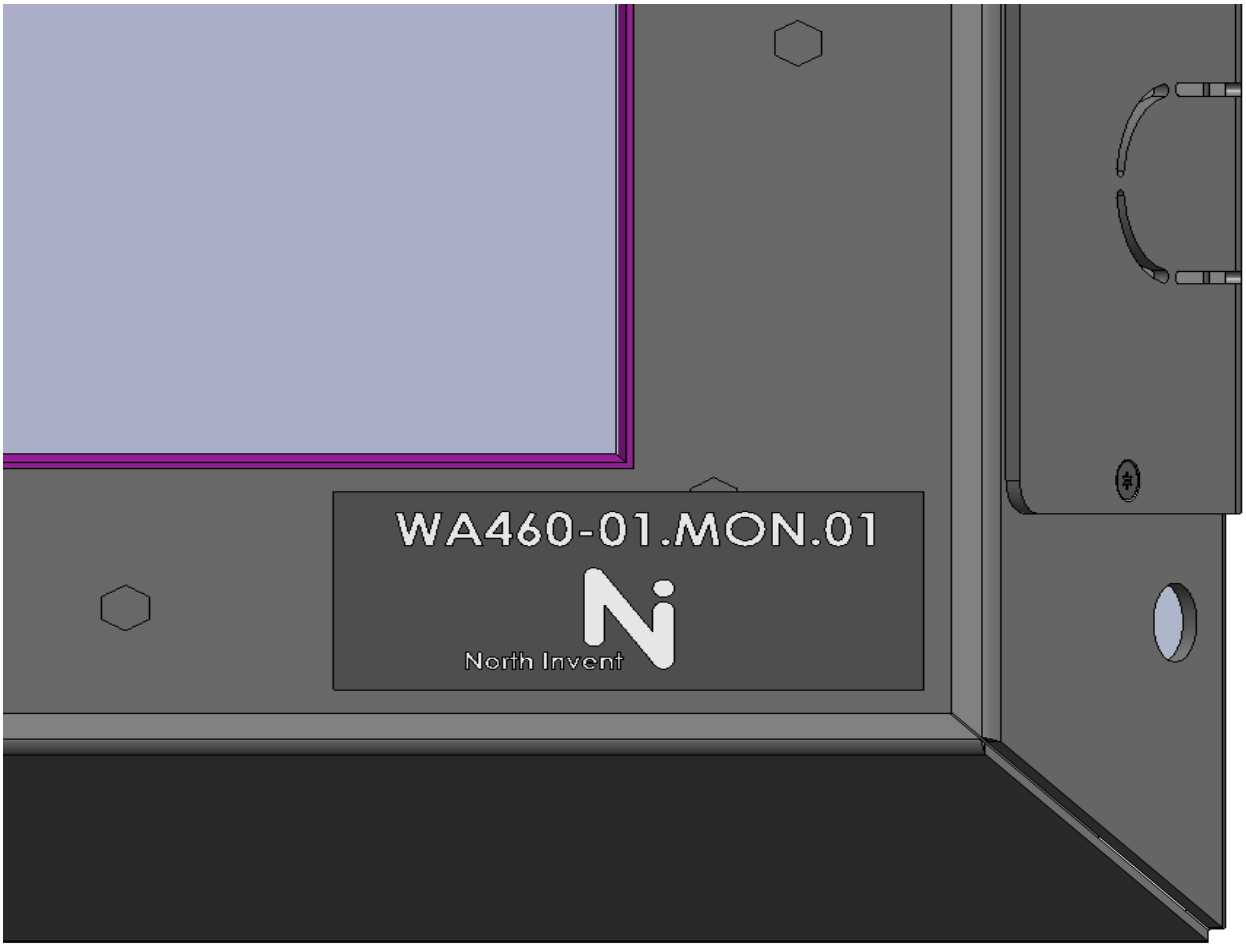
1.2 Product identification

On the front lower right a label with productidentification is placed. See example on picture below.



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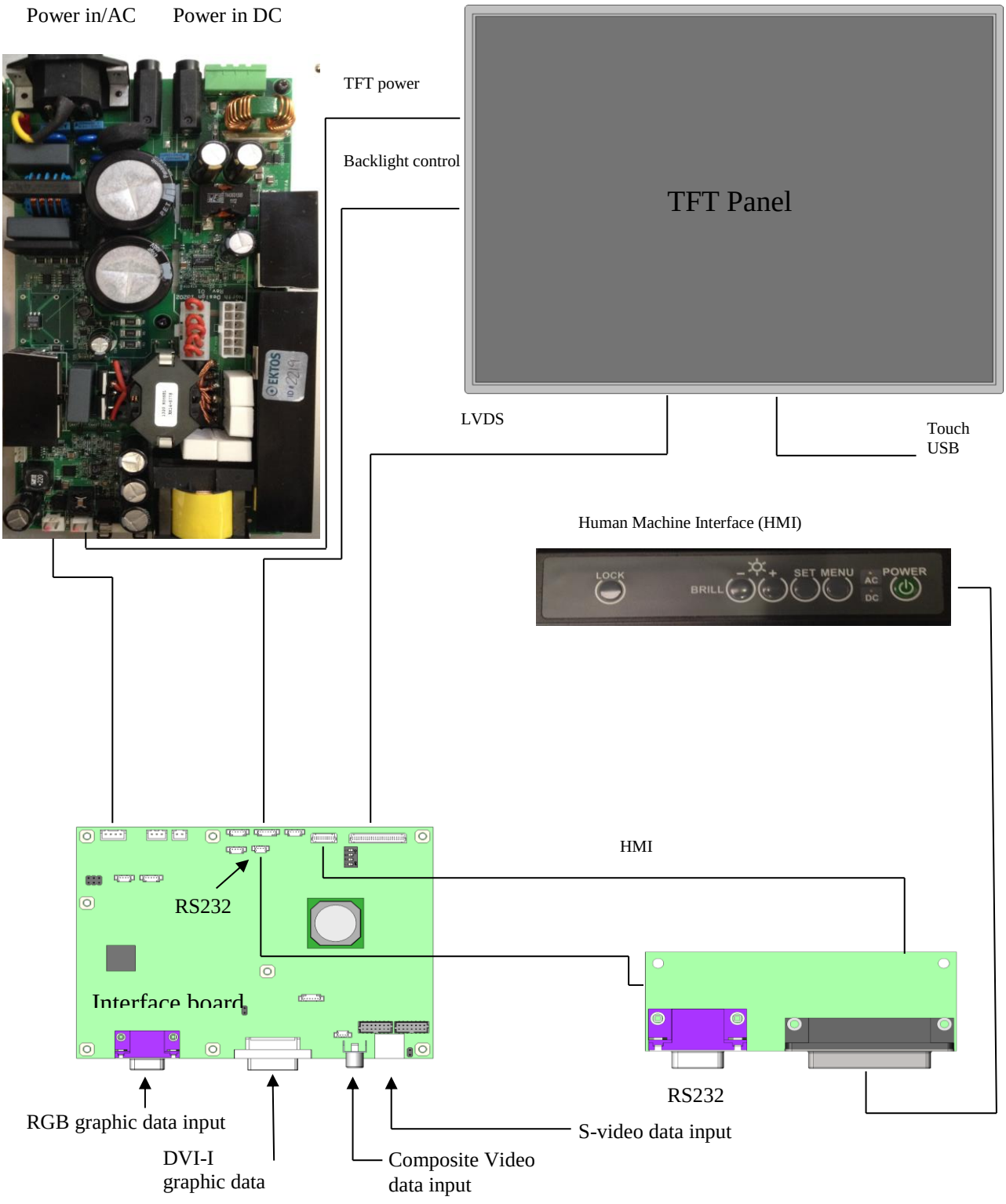
1.3 Main schematic overview



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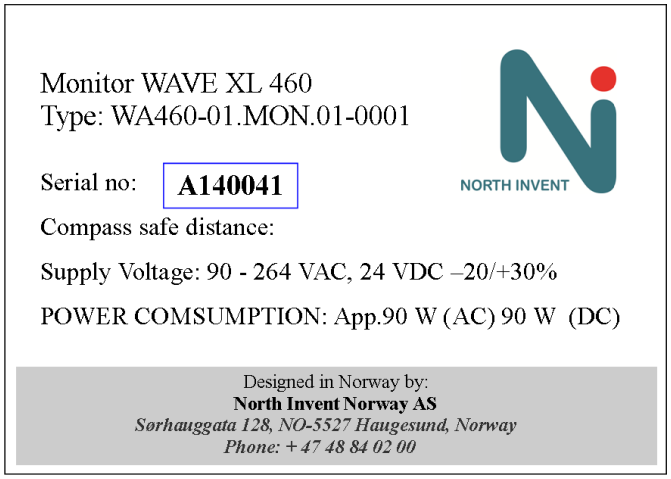
1.4 Packaging and delivery

Please check the delivered goods immediately on receipt with respect to damages caused by transportation and inform the delivering freight carrier immediately, on site, about any visible transport damages. Additionally, inform us immediately in writing, at the latest within 5 work days, about any visible transport damages. At reception, the delivery includes the following items:

- Wave Monitor
- Wave User's Manual
- DVI cable
- AC power cable
- DC power plug
- USB cable for touch

- RS232 cable (optional)



Label on the backside of monitor with product identification and serial number

1.5 Mechanical Dimensions

For panel cut out drawings and mechanical dimensions of monitors see data sheets.

1.6 Electrical installation

- All electrical connections are to be found on the lower back side of the Monitor. All necessary electrical indications are to be found on the Terminal Plate at the bottom of the Monitor's backside.

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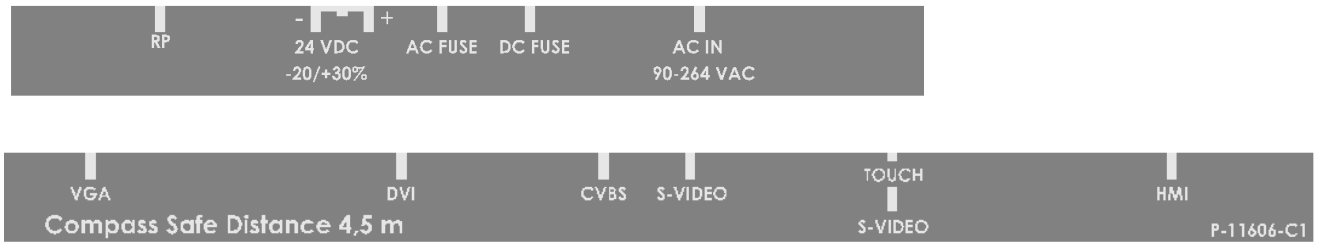

Figure 1. Left and right side of Terminal Label.

- **Power supply**

- The Monitor can be supplied with 90-264 VAC and/or 18-36 VDC.
- The Monitor is connected to AC voltage by means of the standard AC power cable included in the delivery. The AC current to the Monitor must be limited by a 3A fuse or similar.
- The Monitor is connected to DC voltage by means of the DC power plug included in the delivery and wires suitable for up to 8 A. The Monitor will not be damaged by reversed polarity, may it occur.

- **VGA cable (Analog RGB)**

- The VGA cable is not included in the delivery.
- Remember to fasten the VGA cable's fixing screws for adequate connection.

- **DVI cable (Digital RGB)**

- The DVI cable is included in a standard delivery.
- The DVI cable is to be connected to the DVI-I terminal. Be sure to use a high quality DVI cable with correct termination of shield.
- Remember to fasten the DVI cable's fixing screws for adequate connection.

- **Video cables**

- Video signals can be obtained by connecting the Monitor to the S-VHS (S-Video) and CVBS (composite video) terminals. The video cables must be of high quality in order to avoid signal's interference.

- **USB cable**

- An F/M USB cable to connect touch to PC is included. Cable can be fixed with a wire strap at the terminal plate.

- **RS232 cable**

- The Monitor is equipped with a standard 9-pin D-SUB female connector for RS232 remote control.

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- Further information about this interface and the remote control is to be found in the Remote Control section.

- **Compass safe-distance**

- Every component of type approved equipment is tested in order to determine the minimum safe distances at which it should be installed from both the steering and the standard magnetic compasses, so not to significantly affect the accuracy of these compasses. The safe compass distances are mentioned on every Monitor or in the accompanying handbook. A safe distance takes into account both the constant effect on a magnetic compass, of the presence of magnetic material but also any variable effect due, for instance, to electrical circuits or the opening/closing of drawers or panels. Thus, provided that a Monitor is not placed in a position nearer to the centre of the bowl of a magnetic compass than the recommended safe distance, the Monitor may be installed or removed without any need for adjustment of that compass.

- WA460-01.MON.01 4,50 m

- The compass safe distance is also indicated on the terminal label of every Monitor as shown on Figure 1.

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2. Operating Instructions

The following instructions assume that the Monitor has been correctly installed and that the commissioning work has been finalised.

2.1 Controls and indicators

- Controls and Indicators are placed on the User Panel in the lower right side of the Monitor.
- Normal functioning of the Control knobs and Indicators are explained in the following table:

Control / Indicator	Function
POWER	Press once to switch the Monitor ON. Press for 5 sec to switch the Monitor OFF.
AC	Indicates that the Monitor is supplied with 90-264 VAC.
DC	Indicates that the Monitor is supplied with 18-36 VDC
LOCK	Press once to activate the OSD in unlocked state. Press LOCK and MENU for 5 sec to unlock and activate the OSD in locked state.
MENU	Press once to activate the OSD in unlocked state. Press once to deactivate the OSD again. Press once to change from sub to main menu.
SET	Press to indicate/change the video input source (OSD not active). Press once to go to the selected sub menu (OSD active). Press once to set or unset the selected sub menu (OSD active).
+	Press and hold to increase the indicator brightness (OSD not active). Press once to select the next menu (OSD active). Press or hold to increase values (OSD active).
–	Press or hold to decrease the indicator brightness (OSD not active). Press once to select the previous menu (OSD is active). Press or hold to decrease values (OSD active).

Figure 2. Front Panel with controls and indicators.

2.2 Start-up

- Ensure that power and a valid video signal are supplied to

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the Monitor. Standard video signals are listed in the Mode Table section below.

- Press the Power control once – the Power, LOCK and relevant AC/DC indicators will light up. The control and indicator backlight can be adjusted using the +/− controls. When Locked (e.g. ECDIS mode) the indicator and the control panel backlight will follow dimming of the display backlight. In ECDIS mode the backlight, control and indicator are preset to Day, Dusk and Night (controlled via RS232).

- The Monitor will search for a video signal on the last selected input source. If the Monitor states “No Input Signal – Going to Sleep”, the correct source can be selected using the OSD (see below). The default source is the standard VGA input.

- The screen brightness can now be adjusted using the +/− controls on the Front Panel and the picture positioning and size can be adjusted using the OSD (see below).

2.3 Source Input Messages

- After start-up of the Monitor a short message will appear in the same space provided for the OSD (see below). The different messages are explained in the following table.

Message	Explanation
Analog RGB searching	The Monitor is searching for a valid video signal connected to the VGA input
Digital RGB searching	The Monitor is searching for a valid video signal connected to the DVI input
S-Video searching	The Monitor is searching for a valid video signal connected to the S-VHS input
Composite Video searching	The Monitor is searching for a valid video signal connected to the CVBS input
No Input Signal - Going to Sleep	The Monitor did not find any video signal on the selected input source
Out of range	The video signal on the selected input source is out of range
BW Limit exceeded	Input signal exceeds bandwidth (when PIP/SBS) or instead of “Out of range”

- When the Monitor detects a valid video signal it will shortly indicate the source input, resolution and frequency of the input signal, as well as the video mode number.

- The input source can be selected using the OSD (see below).

- If the video signal is out of range either the resolution or frequency is too high for the Monitor. The message is also given if the current video mode is not included in the Mode Table (see below).

- Additional video modes can be added upon request.

2.4 On Screen Display (OSD)

- Most functions of the Monitor can be controlled using the OSD.

- The OSD is activated by pressing the LOCK or MENU control. The monitor is equipped with a lock function which prevents accidental use of the OSD. The lock function does not affect the indicator brightness and backlight controls. The status of the lock function is controlled by the OSD and remote control. The monitor is always

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locked when a valid RS232 signal is available. If the Monitor is in locked state the OSD can only be activated by pressing the LOCK and MENU buttons at the same time for 5 sec.

- The screen backlight (brightness) can be adjusted using the +/− controls on the front panel but it can also be adjusted using the OSD and remote control. Normal operation shall be backlight 100%.
- The next and previous menu can be selected using + / − controls.
- The sub menus are selected using the SET control and values can be increased/decreased using + / − controls. The SET control is also used to set the value and leave the sub menu.
- Press the MENU control once to return to the main menu and once again to leave the OSD.
- The OSD will be deactivated the selected period after the last control has been pressed (OSD timeout).

2.4.1 OSD division into folders, menus, sub-menus

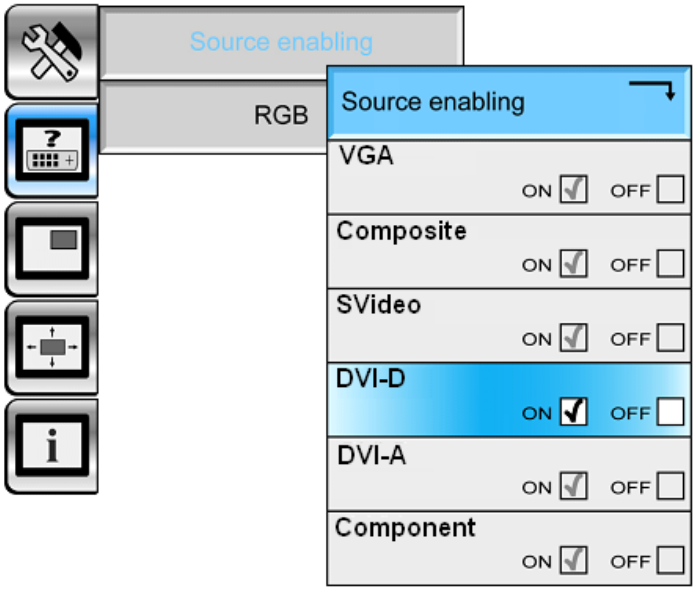

Figure 3. On Screen Display

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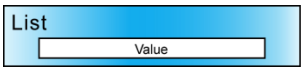
2.4.2 OSD items

- Depending on the menu chosen, different types of items can appear:

Push button - activates a sub-menu or a function



List - a value can be chosen from a list

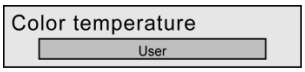
Slide bar – slide the bar to choose the desired level from 0-100%

ON/OFF - turns the settings On or Off

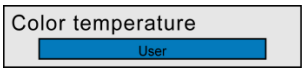
Information - contains pure text or value information

2.4.3 OSD items stages

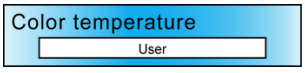
- Folder items, menu items, and sub-menu items exist in three different stages:



Inactive - when the OSD is opened all folders, menus, and sub-menus are by default inactive, and the only item that is selected is the 'Tools' folder.



Selected - when the user navigates through the OSD, part of the selected item is blue. It can not be adjusted before activated (Press ENTER).



Activated - the item is activated and can be adjusted. To activate an item, push the ENTER button on the HMI (Human Machine Interface).

2.4.4 Entering and adjusting the OSD

- The OSD menu can always be opened and closed by pressing the MENU button on the HMI (except when locked, see 2.4 on page 16). Once the menu has been opened it can be navigated up/down and right/left using '+' and '-' buttons. To be able to adjust the settings, an item has to be active, which is effectuated by pressing the ENTER button.
- To make adjustments in the OSD, follow these steps:

1. Press the MENU button on the HMI to activate the OSD.
2. Navigate up and down in the different folders with '+' and '-' buttons.
3. When the desired folder is partly highlighted, press the SET button to activate the menu.
4. Navigate with the + and - buttons until the desired control has been reached (and partly highlighted). To gain adjustment control, press SET. The control will be highlighted and can now be adjusted.
5. Press + to increase the value or - to decrease the value.
6. When the right level has been reached, press SET once again to activate the adjustment and automatically jump one level back.
7. To exit the OSD, press MENU.

- The following exemplifies how to adjust the settings for Saturation:

1. Press MENU to activate the OSD

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2. Use + or - to navigate up or down until you have selected the Functions folder (the icon will be coloured).
3. Press SET to activate the folder (the folder will turn blue, and automatically the first menu item in the sub-menu will be selected - in this case the 'Source enabling' button)
4. Use '+' to navigate to DVI-A (or other Source input) and press 'SET' to activate
5. Navigate down with the + button until you have selected the menu item 'Saturation'
6. Press SET to activate the menu item.
7. Use + or - to set the desired value for the saturation
8. Press SET to validate the change - the OSD automatically jumps one level back

2.4.5 OSD content

- The OSD is designed with 6 different folders: Tools, Functions, Source, Picture, RGB mode wizard, and Info, each of which has their own menu. Several of the menu items furthermore have sub-menus to be navigated through. In the following pages, the different settings will be described:

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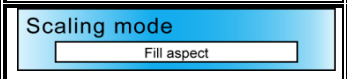
Tools

Control	Function
	Backlights are used to illuminate displays. In small displays they are often used to increase readability in low light conditions. The OSD allows for the backlight to be dimmed from 100 – 0%. At 0%, the backlight is turned off. Value: 0-100%
	LED brightness
	When showing a graphic signal or video signal, the following scaling modes exists: *Fill aspect*: Scaling mode depends on panel and source signal aspect ratio. This mode preserve the correct aspect ratio of the input signal, so if a 4:3 signal is to be displayed on a 16:9 display this adds black bars on both sides. *One to one*: 1:1 representation of the input signal. If a 640x480 signal is to be displayed on a 1024x768 panel, you will see the picture centered using 640x480 pixels shown with a black frame around it. *Fill all:* Regardless of input and output resolutions the input picture is scaled to fit the screen. *Auto:* This means that for Composite or S-Video signals, provided Wide Screen Signalling (WSS) is available, input signal is automatically scaled depending on the ancillary data transmitted. This is usually sent by TV broadcasters or by DVD players according to the aspect ratio of the video. *Anamorphic*: For 16:9 signals generated by DVD players (the signal is 16:9 but is stretched to fill the screen with no black bars, so the picture, if displayed on a 4:3 screen, would result in tall people). This will de-stretch the picture so that the given correct aspect ratio is restored. Auto and Anamorphic will only appear if video input has been chosen. Value: Fill aspect, One to one, Fill all, Auto and Anamorphic
	If a still picture is needed, the present frame can be frozen by selecting ON in this property. Value: ON/OFF

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OSD timeout 20 sec	Sets the duration for the time-out of the OSD menu, that is, how many seconds should pass with menu inactivity before the menu closes. Value: 5-20 sec, No timeout
Logo timeout 20 sec	How many seconds the logo will be shown on the display at start-up is adjusted here. Value: 1-20 sec, No logo
Monitor timeout 20 min	Sets the time that should pass before the display changes state to power save after input signal is removed. Value: 1-20 min, No timeout.
Keypad lock ON ☑ OFF ☐	Locks the keypad. To unlock the keypad again, press the LOCK and the MENU buttons for 5 seconds. Value: ON/OFF WARNING: Do not lock keypad if only IR remote is used. The access is only granted through keypad or RS232, NOT through the IR remote
Factory default	Reinstalls the settings provided by the factory. Note: The OSD menu will automatically close after choosing 'Factory Default'
Setup selection 2	A setup is a combination of settings adjusted by the user. It is possible to save up to 3 different setup combinations (0, 1, and 2). The procedure is: 1) Adjust the desired settings 2) Enter the 'Setup selection' and choose 0, 1, or 2 3) Choose the 'Save Monitor setup' Value: 0, 1, or 2
Save monitor setup	Saves the present settings entered by the user (See explanation above).
Recall monitor setup	Recalls the settings depending on which 'Setup Selection' is chosen: 1) Choose the desired setup under 'Setup selection' 2) Activate the 'Recall Monitor setup' button
OSD position 100	Horizontal position of the OSD menu on the display. Value: 0-100

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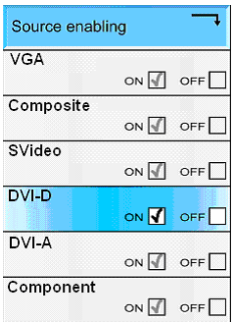
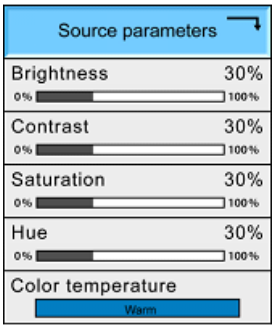
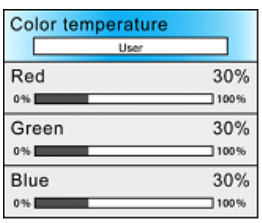
Functions

Control	Function
Source enabling	The ‘Source enabling’ control decides which input sources should be enabled and which should not. By activating the ‘Source enabling’ button, a sub-menu appears where input sources can be activated or deactivated by choosing the ON or OFF setting. A source has to be set to ON to be able to be adjusted. The list below is for Marlin Basic scalar boards. If a Marlin Single scalar board with extension module is used the list will reflect the inputs present on the Marlin Single plus the extension board. 
DVI-D	Which source will be shown here depends on which component is set for the ‘Source A’ value under the menu ‘Picture’ (And eventually Source B in case of PIP and Side By Side). A sub-menu will appear with the following parameters:  By setting the ‘Color temperature’ to User, a new sub-menu appears: 

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	Brightness specifies the darkness or lightness of a color. It is measured in percent from black (0) to white (100). At 0% brightness, both hue and saturation are meaningless. Value: 0-100%
	Contrast is the difference in light intensity between the brightest white and the darkest black. Value: 0-100%
	Saturation sets the brilliance and purity of a color, that is how much grey is in the color. A highly saturated hue (pure color) has a vivid, intense color, while a less saturated hue appears more muted and grey. At 0% saturation, hue is meaningless. Value: 0-100%
	Hue is what most people refer to as color. A blue button has the hue blue. It is the dominant wavelength of a color. Value: 0-100%
	The color can be set to Default, User, Cold, or Warm: Cold: The predominant tones are blue and violet. Warm: The predominant tones are red and orange. User: Activates the menu items Red, Green, and Blue, where the value can be set between 0-100 %. Value: Default, User, Cold, or Warm
Warning !	Manual setting of above parameters away from the factory default or ECDIS settings may inhibit visibility of information, particularly when using the night color tables. Factory default settings of Brightness, Contrast, Saturation, Hue, Red, Green and Blue are 50%

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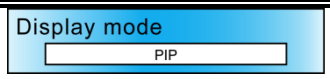
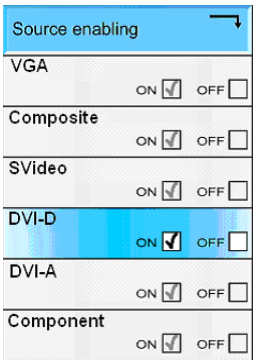
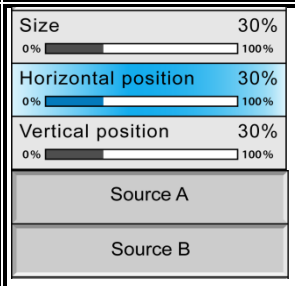
Picture

	How the picture should be presented on the display is adjusted here. There are three different display modes: *Single*: A single picture is shown on the display (default) *PIP*: Picture In Picture, where a small sub-window shows a second picture (Source A or source B) within a larger picture (the opposite source) *Side by Side*: The display is divided into two pictures representing Source A and Source B Value: Single, PIP, or Side by Side
If 'Single' is chosen as display mode, the following menu appears: 	It is possible to adjust the settings for one input source at a time. If 'Source A' is activated, a sub-menu appears:  In this sub-menu the user chooses which input should be active .Their settings are adjusted under the 'Functions' menu.
If 'PIP' is chosen as display mode, the following menu will appear:	 Source A has already been explained and Source B decides which input should be the second input.

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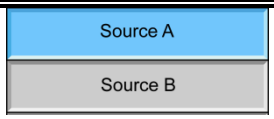
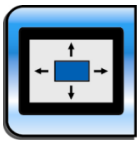
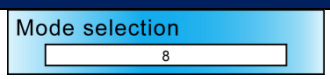
	Size: The size of the PIP picture is chosen here. *Horizontal position:* The chosen value decides where the PIP picture is placed horizontally on the display starting from the upper left corner. *Vertical position:* The value decides where the PIP picture is placed vertically on the display from the upper left corner.
If 'Side by side' is chosen, the following menu is displayed:	 See above for further explanation.



RGB mode wizard

- This folder is only shown when an RGB signal is present on a RGB input.
- For a detailed explanation of the technology behind a RGB signal, for a deeper understanding of how to adjust the Marlin scalar board to accept non standard RGB signal detection.

Control	Function
	Mode selection is a set of parameters telling the display where and how to display the picture (horizontal total, phase, horizontal resolution, vertical resolution, horizontal position, and vertical position). It is possible to enter up to 10 different mode selections: 1) Activate the 'Mode selection' 2) Choose the desired no. 3) Adjust settings under horizontal total, phase, horizontal resolution, vertical resolution, horizontal position, and vertical position. 4) Enter and activate the 'Save mode parameters' Value: 0-9
	Pure information stating the current resolution and Hz. value: No value - pure text.
	Automatically sets the resolution, position, and phase of the picture on the display.
	Loads the current mode parameters.

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Clear	If new mode parameters have been entered it is possible to delete them by using the 'Clear' button.
Horizontal total 1700	The Horizontal Total should be equal to, or higher than, the horizontal resolution plus horizontal position (See explanation under 'Horizontal position').
Phase 50	The phase settings stabilize the picture by removing horizontal noise and sharpening the image of characters.
Horizontal resolution 1600	The value for the horizontal resolution of the display is adjusted here.
Vertical resolution 1200	The vertical resolution of the display is adjusted here.
Horizontal position 100	The chosen value decides where the picture is placed horizontally on the display. Horizontal position is equal to the horizontal front porch + horizontal back porch, which is the field used to specify the number of dummy pixel clocks to insert at the beginning (pulsing the line clock pin) and end of each line or row of pixels before. After the line clock for the previous line has been negated, the value in horizontal back porch is used to count the number of pixel clocks to wait before starting to output the first set of pixels in the next line.
Vertical position 50	The value decides where the picture is placed vertically on the display.

Info

Control	Function
Firmware revision 0.9	Information about the software version.
Temperature 36	Information about the temperature in the Monitor.
12V supply 12.1	Information about the voltage entering the print.
5V supply 5.1	Information about the voltage internally generated on the print.

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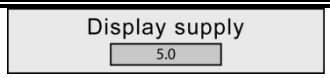
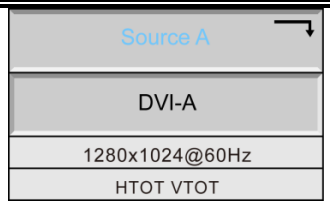
	Information about the voltage supplied for the display.
	The name and input signal data of the source enabled will be informed here.
Info box showing backlight time	Time (in hours) the backlight enable mode has been turned on
Info box showing power on time	Time (in hours) the Marlin scalar board has been turned on

2.5 Mode Table

The table below lists the basic video modes currently set in the Monitors.

	Monitor (LCD resolution)
Video resolution	**46" (1920 x 1080)**
512 x 384	√
640 x 200	√
640 x 350	√
640 x 400	√
640 x 480	√
640 x 870	√
720 x 350	√
720 x 400	√
720 x 480	√
720 x 576	√
800 x 600	√
832 x 624	√
852 x 480	√
960 x 720	√
1.024 x 768	√
1.024 x 1.024	√
1.053 x 754	√
1.056 x 768	√
1.120 x 750	√
1.152 x 864	√
1.152 x 870	√
1.152 x 900	√
1.184 x 884	√
1.280 x 960	√

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Video resolution	Monitor (LCD resolution) 46" (1920 x 1080)
1.280 x 1.024	√
1.360 x 1.024	√
1.600 x 1.024	√
1.600 x 1.200	√
1.920 x 1.080	√
1.920 x 1.200	√

- For each video resolution the most common picture frequencies will be available – typically in the frequency range 30-55 Hz for the 46" monitor.
- Additional modes can be added upon request.

2.6 Remote control

The remote control uses the RS232 interface on the video controller.

ELECTRICAL CONNECTION

9 pin D-SUB female connector with the following pin assignment:

Pin 1	2	3	4	5	6	7	8	9
+5 V	TX	RX	-	GND	-	-	-	GND

Interface parameters

Baud rate: 9.600
Parity: no
Data bits: 8
Start bits: 1
Stop bits: 1
Handshake: no

COMMUNICATION PROTOCOL

The communication protocol complies with IEC 61162-1 (NMEA):

Byte 0	1	2 to 4	5	6	7 to LEN+6	LEN+7
ATT	ADR	CMD	LEN	IHC	DAT	IDC

The min message length is 7 bytes and the max message length is 82 bytes.

The different bytes are described below

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Attention (ATT) byte

This byte identifies the message start:

ATT	Description
0x07	Command
0x06	Acknowledge (OK)
0x15	Acknowledge (error)

Address (ADR) byte

ADR	Description
0xFF	All controllers (0-15)
0x00	Controller 0
0x01	Controller 1
-	etc.
0x0F	Controller 15

Command (CMD) bytes

CMD0	CMD1	CMD2	ASCII	Description
0x42	0x52	0x54	BRT	Brightness
0x4D	0x41	0x4E	MAN	Manufacturer
0x56	0x45	0x52	VER	Version (Monitor)
0x4D	0x43	0x43	MCC	Controller
0x54	0x59	0x50	TYP	Type

Data length (LEN) byte

Length of DAT in bytes (0-74 bytes)

Inverse Header Checksum (IHC) byte

It is a simple 8 bit checksum of the header data (bytes 0 to 5) where a bit-wise inversion has been performed. The checksum must be initialised to 0. The 8 bit sum (without carry) of bytes 0-6 must be 0xFF.

IHC = 0xFF – (ATT+ADD+CMD0+COM1+COM2+LEN), where only 8 bits are used.

If a message checksum fails the controller will reply with the attention byte 0x15 and no data bytes.

Data (DAT) bytes

The data bytes will only be send if data length (LEN) is greater than 0.

The data bytes are designated DAT0, DAT1, DAT2, etc.

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Inverse Data Checksum (IDC) byte

This byte will only be send if data length (LEN) is greater than 0. It is an 8 bit checksum of the data bytes (bytes 7 to LEN+6) where a bit-wise inversion has been performed. The checksum is initialised to 0. The 8 bit sum (without carry) of bytes 7 to LEN+7 is be 0xFF.

IDC = 0xFF – (DAT0+DAT1+DAT2+….), where only 8 bits are used

If a message checksum fails the controller will reply with the attention byte 0x15.

MESSAGE EXAMPLES

The following examples are the typical messages used:

Brightness command (BRT)

This command is used to change the brightness of the Monitor.

Change brightness from 40% to 60% on all controllers (default address setting):

ATT	ADR	CMD			LEN	IHC	DAT	IDC
0x07	0xFF	0x42	0x52	0x54	0x01	0x10	0x99	0x66

The brightness data is one byte where 0x00 is min and 0xFF is max.

Acknowledge (OK):

ATT	ADR	CMD			LEN	IHC	DAT	IDC
0x06	0xFF	0x42	0x52	0x54	0x01	0x11	0x99	0x66

The controller returns the new brightness data – in this case 0x99 = 60%.

Acknowledge (error):

ATT	ADR	CMD			LEN	IHC	DAT	IDC
0x15	0xFF	0x42	0x52	0x54	0x01	0x02	0x66	0x99

The controller returns the previous brightness data - in this case 0x66 = 40%.

Manufacturer command (MAN)

This command is used to identify the manufacturer of the Monitor.

Ask for manufacturer:

ATT	ADR	CMD			LEN	IHC
0x07	0xFF	0x4D	0x41	0x4E	0x00	0x1D

No data must be sent.

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Acknowledge (OK):

ATT	ADR	CMD			LEN	IHC	DAT		IDC
0x06	0xFF	0x4D	0x41	0x4E	0x03	0x1B	0x4E	0x49	0x68

The controller returns the ASCII string value for the manufacturer – in this case NI (North Invent).

Version command (VER)

This command is used to identify the controller model and protocol version.

Ask for model/version:

ATT	ADR	CMD			LEN	IHC
0x07	0xFF	0x56	0x45	0x52	0x00	0x0C

No data must be sent.
Acknowledge (OK):

ATT	ADR	CMD			LEN	IHC	DAT			IDC
0x06	0xFF	0x56	0x45	0x52	0x03	0x0A	0x73	0x01	0x00	0x8B

The controller returns the controller model (DAT0) and protocol version (DAT1.DAT2) – in this case controller model 115 and protocol version 1.0.

Controller command (MCC)

This command is used for remote control of the display controller menu functions, e.g. the contrast settings.

Ask for 50% contrast:

ATT	ADR	CMD			LEN	IHC	DAT				IDC
0x07	0xFF	0x4D	0x43	0x43	0x04	0x22	0x82	0x41	0x38	0x30	0xD4

The menu function is included in the data bytes:

DAT0	0x82 = contrast command
DAT1	0x41 = “a” = all colours
DAT2	0x38 = “8” = first digit of contrast value 0x80 = 50% of 0xFF
DAT3	0x30 = “0” = second digit of contrast value (se above)

Acknowledge (OK):

ATT	ADR	CMD			LEN	IHC	DAT						IDC
0x06	0xFF	0x4D	0x43	0x43	0x06	0x21	0x82	0x41	0x38	0x30	0x38	0x30	0x6C

The data field is extended with the new contrast values (DAT4 and DAT5).

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A complete list of remote control functions can be provided on request.

Type command (TYP)

This command is used to identify the Monitor type.

Ask for display type:

ATT	ADR	CMD			LEN	IHC
0x07	0xFF	0x54	0x59	0x50	0x00	0xFC

No data must be sent.

Acknowledge (OK):

½	ADR	CMD			LEN	IHC	DAT					IDC
0x06	0xFF	0x54	0x59	0x50	0x05	0xF8	0x53	0x4C	0x32	0x31	0x33	0xCA

The controller returns the ASCII string value for the Monitor type – in this case SL213 (Sea Line 21.3 inch).

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3. Technical specifications

3.1 Summary

LVDS display	46”
Max. resolution	1.920 x 1.080
Active area	1018,08 x 572,67 mm
Pixel pitch	0.17675 (H) x 0.53025 (V) mm
Synchronisation Frequency	15-100 kHz(H), 30-100 Hz(V) up to 1.280x1.024 15-100 kHz(H), 30-55 Hz(V) up to 1.920x1.200
Contrast ratio	4000:1
Brightness	700 cd/m²
Response time	6,5 ms
Colours	16.7 Millions depending on graphics card
View angle	±89º
Backlight life	Typ. 50,000 hours
Power supply Voltage	90-264 VAC, 18-36 VDC
Power Consumption	90W (AC) 90W (DC)
OSD	Controls: Power, Brightness, Menu, Set, +, - & Lock with dimmable backlight Indicators: Input power AC & DC with LED
Input connectors	DVI-I Female, D-SUB 15pin female, AC power IEC Inlet & DC screw terminal
Control Input	RS232 D-SUB 9 pin female
Monitor Compatibility	Plug & Play
Dimming range	0-100% (Dimming ratio 1000:1)
Operation Temperature	-15°C/+55°C – +5°F /+131°F (IEC 60945)
Storage Temperature	-20°C/+60°C - -4°F/+140°F
Glass Type	Hardened, Laminated, anti-glare coated
Colour of bezel	Front and back: RAL 9005 structure.
Dimension & Weight **Weight**	1175,0 x 762,6 x 69,0 mm WxHxD 36 Kg
Dimension & Weight (with tilting unit) **Weight**	TBD WxHxD TBD
Enclosure protection	IP42
Standards & Approvals	IEC 60945, MIL-STD-810F, IACS E10, DNV

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3.2 Firmware Revision table

Monitor Rev.	Software Rev.	Description	Date	Signed by
01				

3.3 Troubleshooting

- There are several possible solutions to the same problem – please try the first one on the list and then move on to the next if the problem persists.

PROBLEM	POSSIBLE SOLUTION
No AC or DC indication and no picture on the screen	Press the POWER control shortly, then press and hold the + control for a while
No AC or DC indication and no picture on the screen	Check the AC and/or DC power cable and make sure that voltage is present at the terminals
No picture on the screen but AC and/or DC indication is on	Press the + pad for full (brightness
No picture on the screen but AC and/or DC indication is on	Press the MENU control (or press and hold the LOCK control for 5 sec) and select the correct video source with the OSD
No picture on the screen but AC and/or DC indication is on	Check that a valid video signal is present on the selected source – use e.g. another Monitor
The picture do not fit the screen size	Adjust the picture positions and frequency with the OSD
The picture cannot be adjusted to fit the screen size	Check if the video solution and frequency are included in the *Mode Table* above
The backlight cannot be adjusted from totally darkness to full brightness using the KNOB control	Adjust the backlight to 50 % with the OSD.
The backlight cannot be adjusted from totally darkness to full brightness using the remote control	Set the KNOB control in its calibrated setting (little mark above the KNOB)
Part of or whole picture is blurred	Adjust the picture phase with the OSD

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3.4 Cleaning

- Dust and dirt which typically accumulates on the front of the Monitor, can easily be removed using a soft cloth moistened with hot water.
- A solvent can also be used but never use any kind of abrasive compound.
- Oil and grease can be removed using pure alcohol.
- The front glass can be cleaned with any solvent suitable for glass.

3.5 Update

- The technical documentation is subject to change. For an updated version please visit our website www.northinvent.com.

4. Maintenance and service

- Wave monitors are conceived so to be almost maintenance free.
- If the Monitor malfunctions, please check if the problem can be solved with *troubleshooting* (3.3).
- If the problem persists, please contact North Invent for service instructions.

Allow app. 1 hour stabilization time before measuring luminance and colors.

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