Wave II Monitors

USER'S MANUAL

October 2021

Please note that the content of this document is subject to continuous revision.

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NORTH INVENT

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Foreword

Thanks for purchasing a North Invent Wave Monitor. Our series of rugged TFT LCD Display Monitors are developed 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 your highest requirements and use.

Before starting to operate 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 II Monitors. To assess which series of Monitor you are in possession of, please check the Service Tag label at the back of the monitor. The label must contain WExxx (see below). May you have a different series of Monitor, please contact us, so to have the proper manual sent to your attention.

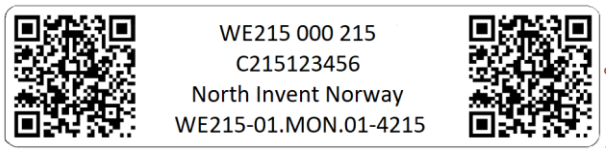

Figure: *Service Tag label for Wave II Monitor.*

1. Terms and Abbreviations

DVI	Digital Visual Interface
DVI-A	- Analogue
DVI-I	- Integrated
DP	DisplayPort
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
DIU	Display Unit
ELU	Electronics Unit
P/N	Part Number
DC	Direct Current
AC	Alternating Current
DDC	Display Data Channel
CI	Command Interface

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2. Monitor Description

The Wave II monitors are a series of rugged TFT LCD Display Monitors available in 18.5", 19", 21.5", 24", 27" and 32" display sizes. All our Monitors are built following a modular approach and can be console mounted or equipped with a stand (hinge).

Each Monitor is constituted by the following set of components:

Display Unit (DIU) - Front end of the monitor consisting of the glass (optionally: touch) and display panel in the aluminum frame.

Electronics Unit (ELU) - Back end of the monitor consisting mainly of the power supply and the controller board.

DIU and ELU are modular and easily separable in order to ensure efficient configuration, maintenance and repair.

Optional accessories are a hinge (tiltable stand), panel mounting kits and HMI units (operator panels).

Each Monitor presents the following materials and features:

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

The electronics include a specifically designed Power Supply, a high-quality Display Controller, a Backlight LED driver and a custom-made Interface Board.

The Wave II Monitors use identical Power Supply which can be supplied with 90-264 VAC, 18-36 VDC or as a multipower combination depending on configuration. The Wave II Monitors come with DVI, Display Port, RS232, 2 x USB, LAN, HMI port and SD slot. Optionally you can get a second DVI, DVI out, a second Display Port, a second LAN and 2 x RS422 ports.

Pixel pitch on all displays varies from 0.213 to 0.311 mm both in X and Y direction depending on the display size (see data sheet). Pixel pitch equals 1.07 m viewing distance with a viewing angle of 1 arc minute as required in IEC 62288 section 7.5.1 for the 27" monitor, 0.96 m for the 24" monitor, 0.86 m for the 21" monitor, 1.02 m for the 19” monitor and 0.74 m for the 18.5" monitor. Nominal viewing distance in a normal environment is 1.0 m.

Each Monitor complies with the following international Standards and Requirements:

All our Monitors has been tested by international accredited testing labs and found to comply with the requirements of the International Association of Classification Societies (IACS) as well as selected requirements of IEC 60945, IEC 60533, IEC 60529 and selected MIL standards.

The 19", 21″, 24" and 27" monitors have also been tested according to IEC 62288, IEC 62388 and IEC 61174 for navigational display, radar and ECDIS approvals.

All our Monitors are 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 radio communication equipment and systems - General requirements - Methods of testing and required test results.

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3. Product Identification

On the backside there are three markings identifying the monitor.

Display Unit (DIU) P/N and serial number
Electronics Unit (ELU) P/N and serial number
Complete Monitor P/N and service tag number

Upon request we can assign an additional customer specific P/N.

Please see separate document for details about product numbering.

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 workdays, about any visible transport damages. The delivery includes the following items:

Wave Monitor
AC power cable
DC power plug (optional)
DVI cable (optional)
DP cable (optional)
USB cable (optional for touch)

5. Mechanical Dimensions

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

6. Compass Safe-distance

Every monitor 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. A safe distance takes into account both the constant effect on a magnetic compass by the presence of magnetic material, but also any variable effect due e.g., electrical circuits or the opening/closing of drawers or panels. Thus, provided that a Monitor is not placed in a position nearer to the center of the magnetic compass than the recommended safe distance, the Monitor may be installed or removed without any need for adjustment of that compass.

The safe compass distances are mentioned on every Monitor and/or in the corresponding datasheet.

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7. Electrical Installation

All electrical connections are to be found on the lower backside of the Monitor. The connectors are clearly labelled on the Terminal Plate at the bottom of the Monitor's backside.

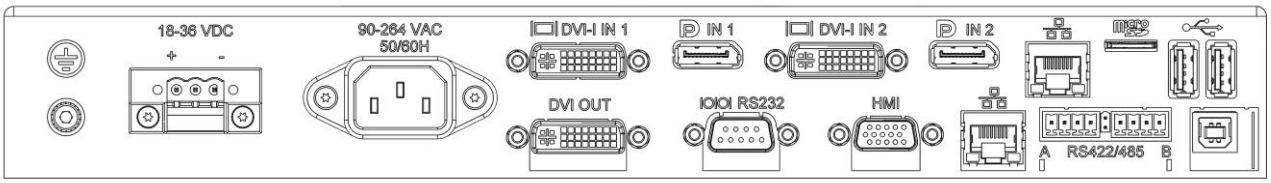
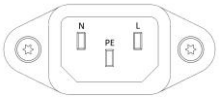


Figure: *Terminal Plate for a full version Wave II Monitor.*

7.1. Pin-Assignments

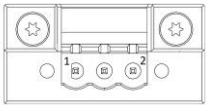
AC Power



Pin	Description	Pin	Description	Pin	Description
N	Neutral (90-264 V)	PE	Protective Earth	L	Line (90-264 V)

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 is limited by a 3.15 A internal fuse.

DC Power



Pin	Description	Pin	Description	Pin	Description
1	Supply voltage, positive 18-36 V	2	NC	3	Supply voltage, negative 0 V

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 continuous load. The Monitor will not be damaged by reversed polarity; may it occur. The DC current to the Monitor is limited by a 10 A internal fuse.

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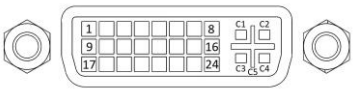
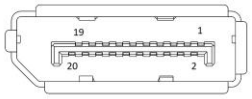
DVI-I



Pin	Description	Pin	Description	Pin	Description
1	TMDS Data 2-	11	TMDS Data 1 Shield	21	TMDS Data 5+
2	TMDS Data 2+	12	TMDS Data 3-	22	TMDS Clock Shield
3	TMDS Data 2 Shield	13	TMDS Data 3+	23	TMDS Clock +
4	TMDS Data 4-	14	+5V Power	24	TMDS Clock -
5	TMDS Data 4+	15	GND (for +5V)	C1	Analog Red
6	DDC Clock	16	Hot Plug Detect	C2	Analog Green
7	DDC Data	17	TMDS Data 0-	C3	Analog Blue
8	Analog V-sync	18	TMDS Data 0+	C4	Analog H-sync
9	TMDS Data 1-	19	TMDS Data 0 Shield	C5	Analog RGB GND
10	TMDS Data 1+	20	TMDS Data 5-		

Remember to fasten the DVI cable's fixing screws for adequate connection.

DisplayPort



Pin	Description	Pin	Description	Pin	Description
1	ML_3LN (Lane 3-)	8	GND	15	AUXP (Auxiliary Channel+)
2	GND	9	ML_LN1P (Lane 1+)	16	GND
3	ML_L3P (Lane 3+)	10	ML_LN0N (Lane 0-)	17	AUXN (Auxiliary Channel-)
4	ML_L2N (Lane 2-)	11	GND	18	Hot Plug Detect
5	GND	12	ML_LN0P (Lane 0+)	19	POR (Return for Power)
6	ML_L2P (Lane 2+)	13	Config1 (connected to GND)	20	PO (Power 3.3V / 500mA)
7	ML_L1N (Lane 1-)	14	Config2 (connected to GND)		

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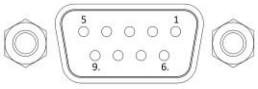
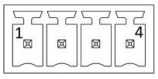
RS232 – DB9 receptable



Pin	Description	Pin	Description	Pin	Description
1	Not connected	4	Not connected	7	Not connected
2	TxD (Transmit Data)	5	GND	8	Not connected
3	RxD (Receive Data)	6	Not connected	9	Not connected

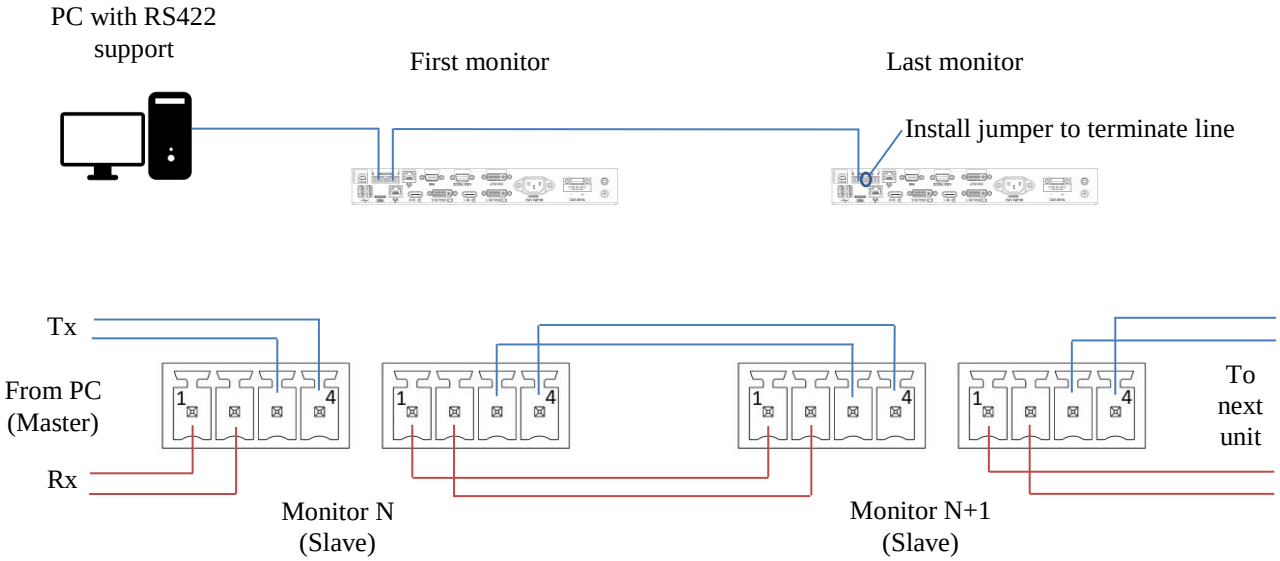
The Monitor is equipped with a standard 9-pin D-SUB female connector for RS232 remote control. Further information about this interface and the remote control is to be found in *section 10*.

RS422 (optional)



Pin	Description	Pin	Description
1	Tx+ (RS422)	3	Rx+ (RS422)
2	Tx- (RS422)	4	Rx- (RS422)

Left and right connectors carry same signals and are connected in parallel internally. This allows for easy and more reliable wiring in daisy-chain configurations as both incoming and out-going wires can be terminated in separate connectors**.**



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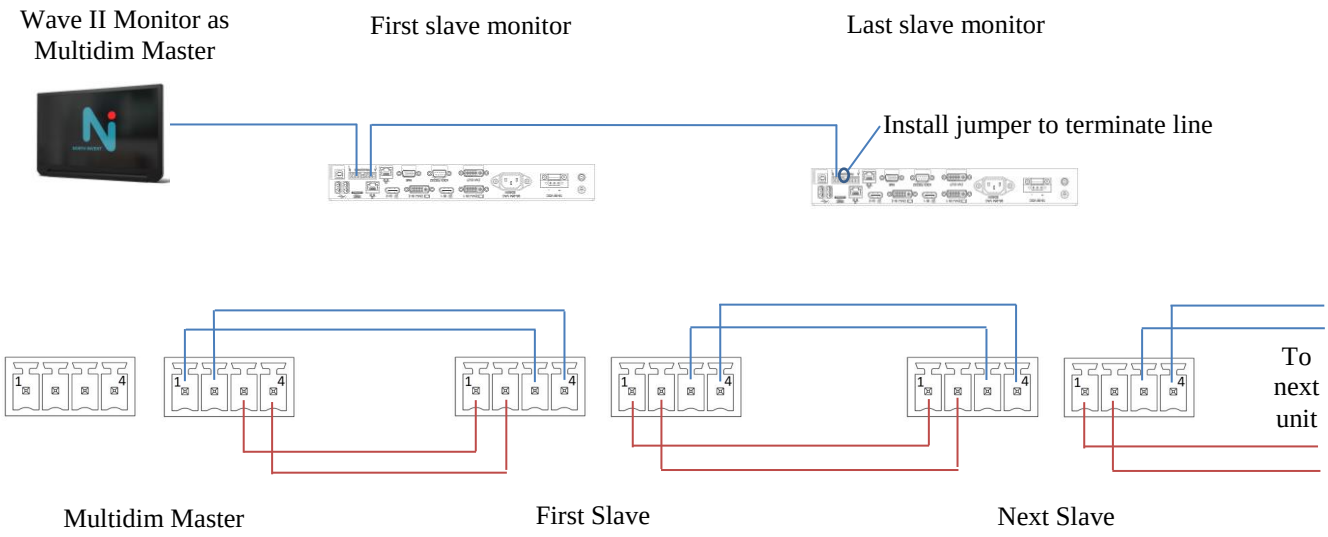
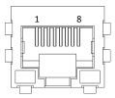
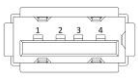


LAN (RJ45)



Pin	Description	Pin	Description
1	DA+	5	DC-
2	DA-	6	DB-
3	DB+	7	DD+
4	DC+	8	DD-

USB A



Pin	Description	Pin	Description
1	GND	3	Data +
2	Data -	4	V_{cc}

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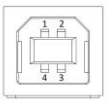
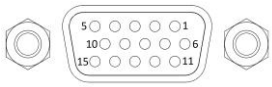
USB B (optional for touch)



Pin	Description	Pin	Description
1	Vcc	3	Data +
2	Data -	4	GND

HMI



Pin	Description	Pin	Description	Pin	Description
1	+ key	6	POT_REF	11	BUZZER
2	- key	7	POT	12	5V
3	ESC key	8	GREEN LED	13	PSU A Indicator
4	Menu key	9	RED LED	14	PSU B Indicator
5	Power key	10	LED PWM	15	GND

Activate the ESC signal to indicate/change the video input source (OSD not active).
Activate the ESC signal to go back one level in the OSD or to exit the OSD entirely if at top level.
Activate the + signal to increase the indicator brightness (OSD not active).
Activate the + signal to increase values (OSD active).
Activate the – signal to decrease the indicator brightness (OSD not active).
Activate the – signal to decrease values (OSD active).

Refer to wiring diagram on next page for recommended used of the HMI port.

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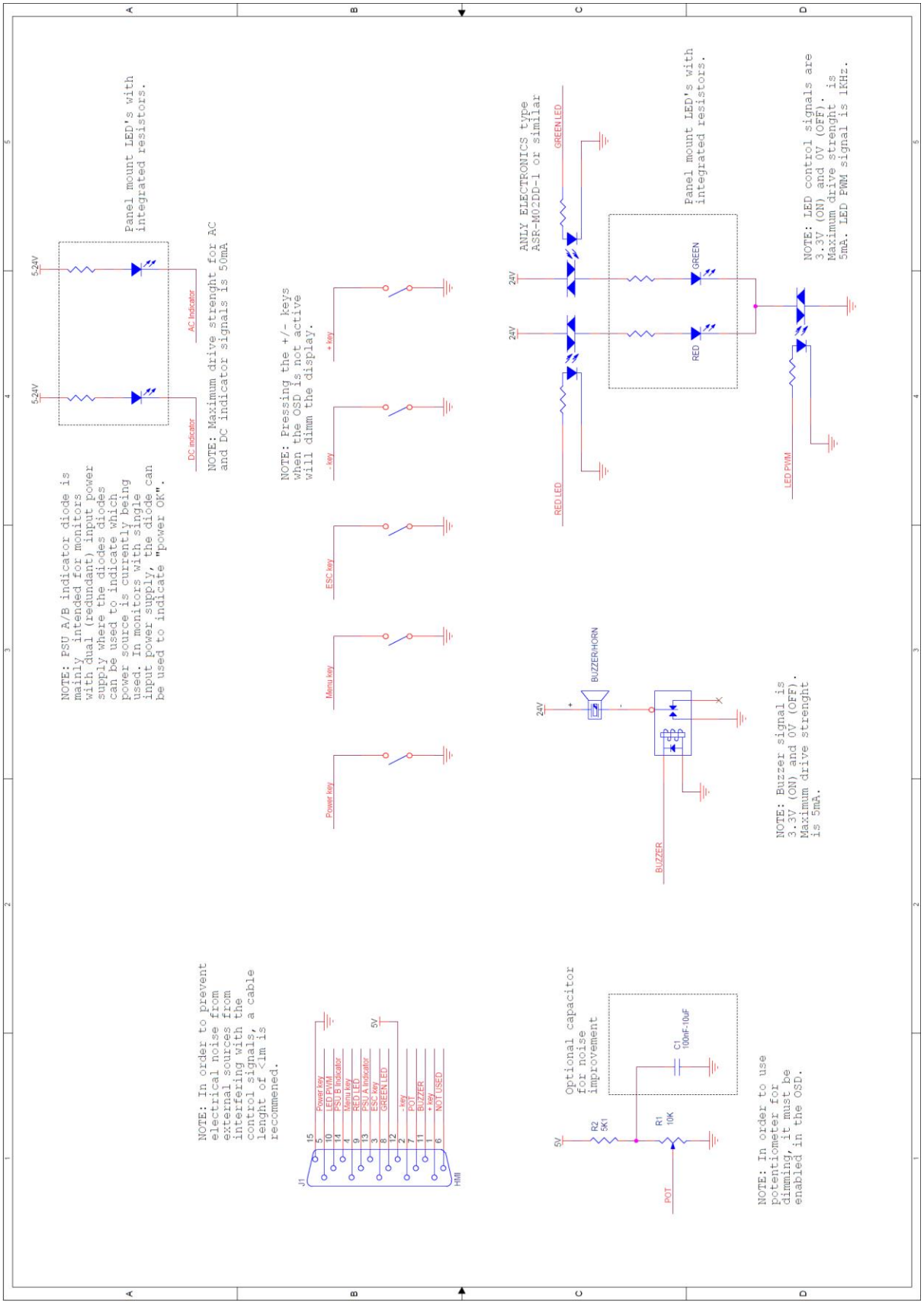

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Manual name and version???

8. Operating Instructions

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

8.1. Start-up

Ensure that power and a valid video signal are supplied to the Monitor.

Either insert power cable or, if HMI unit is connected, press the Power control once and the Power and relevant AC/DC indicators will light up.

There are three ways of controlling the monitor:

- Using a USB mouse connected to one of the USB ports on the backside of the monitor. After the monitor has completed booting (approximately 10 sec), press right button to bring up OSD.
- Using a HMI (if available) as described below.
- Remote control by connecting to a serial (RS232/422) or Ethernet port.

8.2. Firmware Update

For **FW OSD: 1.8 LPC: 3.0 FPGA: 1.7 or newer** please apply the following process in order to update monitor firmware:

1. Open monitor OSD (Menu) either by HMI unit or by right clicking on a mouse connected to the monitor USB port and verify that the firmware versions in the "Status" tab are FW OSD: 1.8 LPC: 3.0 FPGA: 1.7 or newer.
2. Make sure you have a FAT32 formatted USB stick.
3. Create a sub-folder on the USB stick and rename it "Recovery".
4. Copy the relevant firmware image (two files) to the \Recovery\ subfolder on the USB stick.
5. Insert the USB stick into the powered monitor.
6. A dialogue box will be displayed asking if you want to update firmware.
7. Click yes and follow instructions on screen.
8. Once the "Update complete" show on the screen, the process is complete, and you can remove the USB stick.
9. Verification: Open monitor OSD (Menu) either by HMI unit or by right clicking on a mouse connected to the monitor USB port and verify that the firmware versions in the "Status" tab have updated to new values.

NB! To update from firmware versions older than **FW OSD: 1.8 LPC: 3.0 FPGA: 1.7**, please contact North Invent service personnel.

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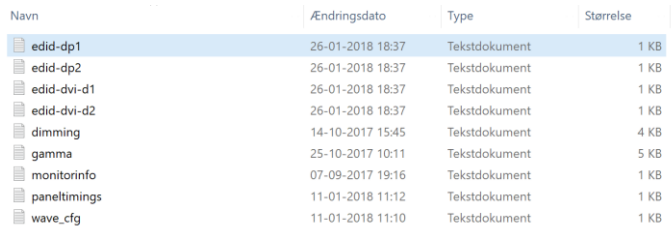
8.3. Configuration Data

Key set-up parameters such as color table, dimming curve etc. are read by the monitor from a MicroSD card inserted in the SD-card slot. As default, the following files are located on the SD-card:



Navn	Ændringsdato	Type	Størrelse
edid-dp1	26-01-2018 18:37	Tekstdokument	1 KB
edid-dp2	26-01-2018 18:37	Tekstdokument	1 KB
edid-dvi-d1	26-01-2018 18:37	Tekstdokument	1 KB
edid-dvi-d2	26-01-2018 18:37	Tekstdokument	1 KB
dimming	14-10-2017 15:45	Tekstdokument	4 KB
gamma	25-10-2017 10:11	Tekstdokument	5 KB
monitorinfo	07-09-2017 19:16	Tekstdokument	1 KB
paneltimings	11-01-2018 11:12	Tekstdokument	1 KB
wave_cfg	11-01-2018 11:10	Tekstdokument	1 KB

The four EDID files are compatible with the format used by "Phoenix" EDID editing tool.
The other files are clear text and may be edited using a text editor like Notepad++
The clear text must not include any spaces.

WARNING: Manipulating the files on the SD-card may change monitor behavior ultimately rendering the monitor useable!

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8.4. OSD Navigation Using HMI

Controls and Indicators are found on the optional HMI Unit (operators panel) either mounted on the monitor or in connection with the Monitor.

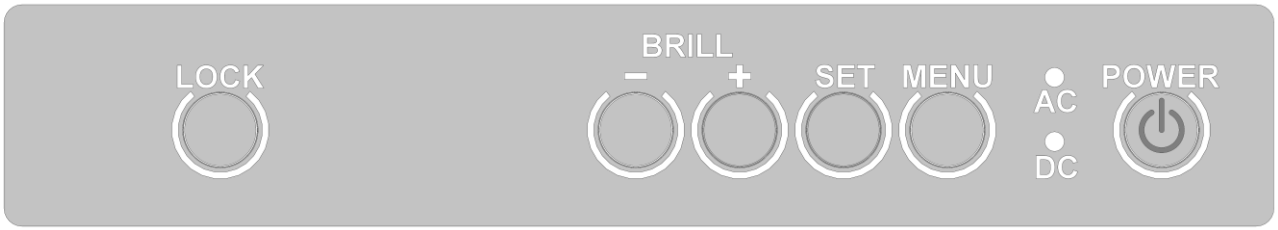

Figure: *HMI Panel with controls and indicators.*

Normal functioning of the Keypads 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	No function on standard version
MENU	Press once to activate the OSD. Press to advance to next control within the OSD.
SET	Press to indicate/change the video input source (OSD not active). Press to go back one level in the OSD or to exit the OSD entirely if at top level.
BRILL +	Press and hold to increase the indicator brightness (OSD not active). Press or hold to increase values (OSD active).
BRILL –	Press or hold to decrease the indicator brightness (OSD not active). Press or hold to decrease values (OSD active).

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8.5. Source Input Selection

The input source can be selected using the OSD (see below) or by pressing the SET button on the HMI (if available). The Monitor will search for a video signal on all inputs or on the last selected input source if Input Mode was set to "Manual" before powering off (see below).

To select an input, mark the corresponding radio-button in the left column. Note that some monitor versions may have only 1 DVI and 1 DP input, in which case the input list will be reduced to two lines.

If no valid video signal is present the monitor will indicate “No Signal” in the middle of the screen.

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8.6. On Screen Display (OSD)

The OSD can be activated approximately 10 seconds after monitor power on (boot period) by means of a mouse or a HMI module. Most functions of the Monitor can be controlled using the OSD.

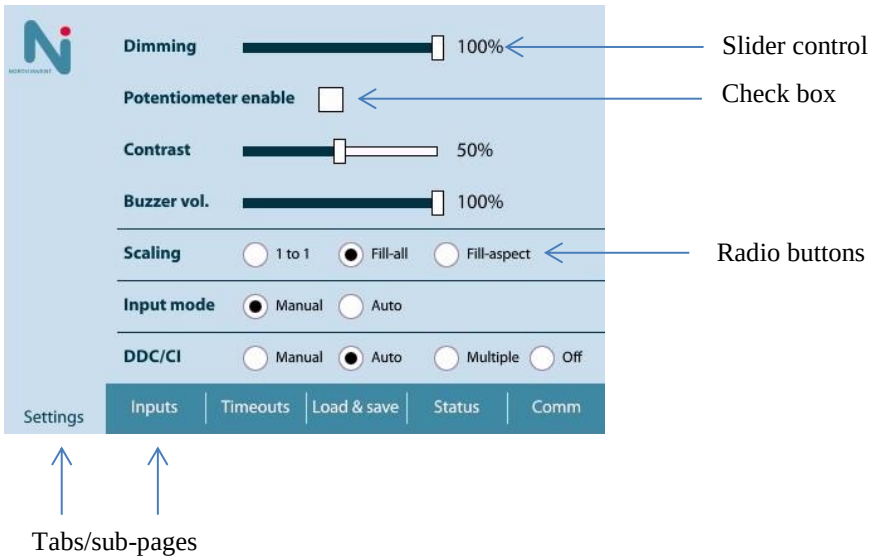
The OSD is activated by pressing the MENU keypad if you have an HMI module connected. Else you can open the OSD via a USB mouse by right clicking. Be aware of that the lock keypad on the HMI has no function on a standard monitor.

The screen backlight (brightness) can be adjusted using the +/− keypads on the HMI module but it can also be adjusted using the OSD and remote control. Normal operation shall be backlight 100%.

The OSD will be deactivated according to the selected period after the last control has been pressed (OSD timeout).

8.7. OSD Division into Folders, Menus, Sub-menus

OSD main page:



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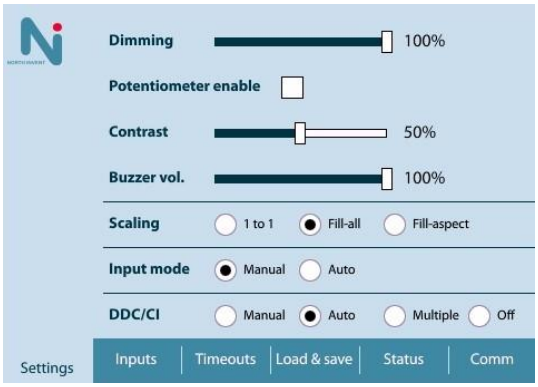

Function	Setting	Description
Dimming	0 – 100 % Default value: 50	Adjust the backlight brightness. At 0 % the backlight is turned off.
Potentiometer enable	Checked Not checked Default value: not checked	Enable the use of an analogue potentiometer connected to the monitor HMI connector.
Contrast	0 – 100 % Default value: 50	Adjust the picture contrast. Contrast is the difference in light intensity between the brightest white and the darkest black.
Buzzer vol.	0 – 100 % Default value: 50	Adjust the volume of the integrated buzzer. The buzzer will activate during adjustment to allow user to set to desired level.
Scaling	On-to-one Fit-all Fill-aspect Default value: One-to-one	*One-to-one:* 1:1 representation of the input signal. If e.g., a 640x480 signal is to be displayed on a 1920x1080 panel, you will see the picture centered using 640x480 pixels shown with a black frame around it. *Fit all:* Regardless of input and output resolutions the input picture is scaled to fit the screen. *Fill aspect:* Scaling mode depends on panel and source signal aspect ratio. This mode preserves 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.
Input mode	Manual Auto Default value: Auto	*Manual:* All signal inputs must be chosen manually, see “Inputs“. *Auto:* Automatic search for an active signal source on the inputs present in the hardware. Full range is DVI 1, DVI 2, DP 1 and DP 2.
DDC/CI	ManualAutoOff	*Manual:* Enable remote control of the monitor by use of the DDC/CI protocol through a manually selected signal input, see "Inputs" *Auto:* The monitor will listen for DDC/CI commands on all inputs simultaneously. *Off:* DDC/CI communication disabled.

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Function	Setting	Description
Manual input selection	"Current" box checked "Current box" not checked	If "Input Mode" is set to "Manual" in the "Settings" tab, set active input by checking the "Current" box. Note that some monitor versions may have only one DVI and one DP input, in which case the input list will be reduced to two lines.
Auto input selection	Not applicable, see "Settings" tab.	If "Input Mode" is set to "Auto" in the "Settings" tab, the monitor will scan for an active signal source on the inputs present in the hardware. Full range is DVI 1, DVI 2, DP 1 and DP 2. Priority can be set by utilizing the up and down arrows. In case of several active inputs, the monitor will display the signal from the highest priority with active input. If signal is lost on the active input, the monitor will switch to the next priority input with valid signal (if any). If valid signal reappears on a higher priority input, the monitor will switch back to displaying this signal.
Manual DDC/CI selection	"DDC/CI" box checked "Current box" not checked	If "DDC/CI" is set to "Manual" in the "Settings" tab, set active DDC/CI input by checking the "DDC/CI" box.

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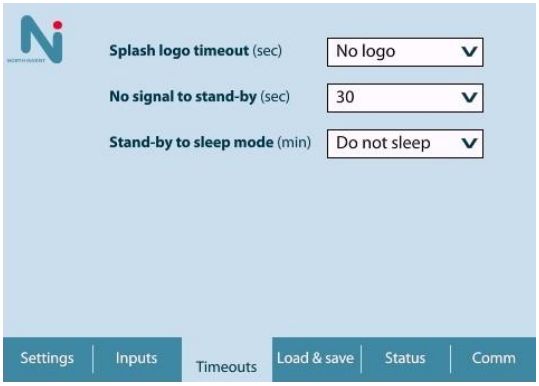

Function	Setting	Description
Splash logo timeout (sec)	No logo 1, 2, 3, 4, 5, 10, 30, 60 sec. Persistent	The monitor can display a logo during startup (boot logo) based on a .png file located on the MicroSD card.
No signal to stand-by (sec)	3, 5, 10, 30, 60 seconds Stay on	Set the time from signal lost to standby mode. In standby mode the monitor is put low power state while still maintaining ability to detect if an input signal becomes active.
Stand-by to sleep mode (min)	3, 5, 10, 30, 60 minutes Do not sleep	Set the time from standby mode to sleep mode. In sleep mode the monitor is put in the lowest possible power state while still maintaining ability to receive and respond to a MCCS power mode command and HMI power button.

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Function	Setting	Description
Save settings	Activate button	Activate "Save settings" button to store all settings in the OSD except those from the status tab.
Recall saved settings	Activate button	Activate "Recall settings" button to recall saved settings.
Load factory settings	Activate button	Activate "Load factory settings" button to recall factory default settings.

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Function	Setting	Description
Monitor serial	Read only	Monitor serial number as read from the "monitorinfo.txt" file on the MicroSD card.
Software ID	Read only	Software identification number as read from the "monitorinfo.txt" file on the MicroSD card.
Run time (BL ON time)	Read only	Accumulated time for "power on" state on the monitor backlight.
Current temperature	Read only	Reads out current temperature inside the monitor.
Max. temperature	Read only	Maximum temperature readout since last Reset counters.
Min. temperature	Read only	Minimum temperature readout since last Reset counters.
Reset counters	Activate button	Activate button to reset "Run time" and temperature counters.

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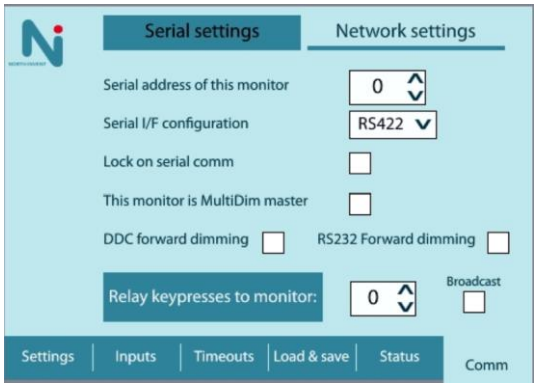
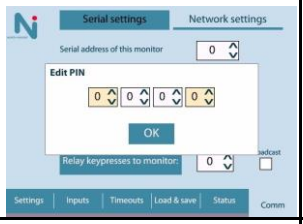


Function	Setting	Description
Serial address of this monitor	1 – 254	Set the serial address of the monitor by utilizing the up and down arrows. The monitor will listen for and respond to SCOM commands on all serial interfaces and the Ethernet interface only if a received command matches this address or if the command is broadcast. The monitor will not send a response to a broadcast command.
Serial I/F configuration	RS422 RS485	Configure the RS422 (full duplex) / 485 (half duplex) dual connector to either RS422 or RS485 protocol by utilizing the dropdown menu. **NOTE: RS485 (half duplex) is currently not implemented.**
Lock on serial comm	Checked Not checked 	By activating the checkbox, the OSD cannot be activated if under serial control. When the checkbox is first checked, the operator will be presented with a dialog that allows him to set a 4-digit pin code. Later, if the operator tries to open the menu, he must input the same pin code to do so.
This monitor is MultiDim master	Checked Not checked	Activate checkbox to set monitor to MultiDim master. This feature will allow an array of monitors to be dimmed and controlled from a single monitor (the "MultiDim master"). When changing the dimming level on the MultiDim master using +/- keys of a connected HMI, the monitor will also transmit a BRT broadcast command on the RS422 interface reflecting the new setting of the backlight level. An active video input is required for this feature to be active.
DDC & RS232 forward dimming	Checked Not checked	Activate to forward dimming commands from DDC and/or RS232 to the RS422 interface.

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Relay keypresses to monitor	1 – 254 "Broadcast" checkbox: Checked Not checked	Set the serial address of another monitor on the same network in order to remote control such monitor. This feature allows the operator to relay the keypresses on a local HMI to a remote monitor by RS422 to control it. Keypresses are forwarded when the "broadcast" button is checked. To stop relaying keypresses, the operator may uncheck the "broadcast" button using a mouse or press and hold the SET button for 5 sec.

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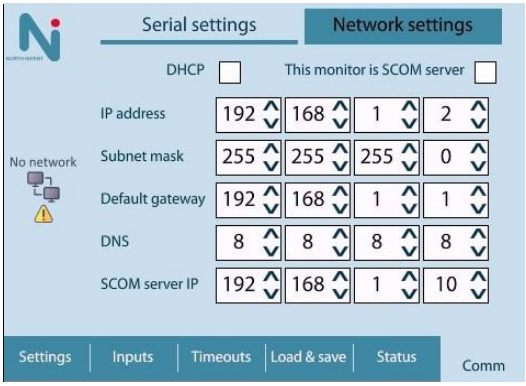

Function	Setting	Description
DHCP	Checked Not checked	With this option checked, the monitor will search the network for a DHCP server and if found acquire network settings from this server.
This monitor is SCOM server	Checked Not checked	Currently no function (not yet implemented).
IP address	0-255;0-255;0-255;0-255	IP address of the monitor.
Default gateway	0-255;0-255;0-255;0-255	IP address of the network gateway.
DNS	0-255;0-255;0-255;0-255	IP address of the Domain Name Server.
SCOM server IP	0-255;0-255;0-255;0-255	Currently no function (not yet implemented).

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9. Use of monitors on Ships Bridge and ECDIS Compliance

Monitors to be installed on Ships Bridge shall comply with the IEC 62288 standard. North Invent Wave II monitors fulfil this requirement provided that the following prerequisites are met:

- A HMI (Operating panel) is connected, *ref section 8.4*. The monitor may be (re)set to default brightness setting (100%) by pressing and holding the + key for at least 5 sec.
  or
- The monitor is connected to an external system that provide physical controls for manually adjusting monitor brightness and to (re)set the brightness level to default value (100%).

An external system may control the monitor by RS232, RS422 or Ethernet using the SCOM protocol, *ref section 10*. If buttons are used for manually controlling brightness, the external system shall transmit command "07 FF 4D 43 43 01 25 FC 03" when the Plus/Up/Inc. button is pressed and command "07 FF 4D 43 43 01 25 FD 02" when the Minus/Down/Dec. button is pressed. To (re)set brightness to default value (100%), the external system shall transmit command "07 FF 42 52 54 01 10 FF 00". If a potentiometer or encoder is used for controlling brightness, the "BRT" command shall be used to set the monitor brightness according to the setting of the control. The external system shall transmit command "07 FF 42 52 54 01 10 00 FF" when the control is at minimum setting and "07 FF 42 52 54 01 10 FF 00" when at maximum setting.

The North Invent Wave II monitors are also eligible for use in ECDIS systems provided that the following prerequisites are met:

- ECDIS compliant sizes are 19" (5:4), 21.3" (4:3), 24" (16:9), 27" (16:9) and 32" (16:9). These monitors have been tested and verified according to the IEC 62288, IEC 62388, and IEC 61174 standards.
- All available digital video inputs are eligible for ECDIS usage.
- The official color tables corresponding to the monitor of choice must be uploaded to the ECDIS computer. Such color tables are provided by maker North Invent Norway AS.
- If HMI (Operating panel) is connected, ref section 8.4, the "Lock on Serial" command must be activated to avoid unintended operation of the monitor while in ECDIS mode.
- Ensure that the "Stand-by to sleep mode" in the "Timeouts" tab of the OSD is set to "Do not sleep".

Furthermore, the host ECDIS system shall provide physical controls for manually:

- Adjusting monitor brightness.
- Activate "day mode" color palette and set brightness to calibrated setting for this mode.
- (Re)setting brightness to calibrated setting for the current mode.

Implementing manual brightness adjustment may be done as described above for monitor to be used at Ships Bridge in general. Switching between the color palettes is handled by the host ECDIS computer and does not require any action on the monitor. However, when switching between the color palettes, the brightness shall be set accordingly which is done using the "BRT" SCOM command, *ref section 10*. The brightness value to set for the current palette can be found in the colour tables provided by North Invent as .csv files as shown below.

Calibrated brightness setting for "day" palette in decimal

Palette →

Mode	R	G	B	dLvmin	dLvmax	x nominal	y nominal	Lv nominal
Day	222							
UIBCK,DEPDW,CHWHT	173	206	221	64	96	0.28	0.31	80
OUTLW,UINFD,PSTRK,SHIPS,SNDG2,CHBLK	3	1	1	0	0.1	0.28	0.31	0
BKAJ1	18	22	24	0.48	0.72	0.28	0.31	0.6
BKAJ2	29	35	37	1.28	1.92	0.28	0.31	1.6

In this case, the host ECDIS system shall transmit command "07 FF 42 52 54 01 10 DE 21" when activating the palette for daylight ambient conditions.

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Wave II Monitors

In ECDIS mode, the following will be valid to identify monitor power state and video input:

A. Monitor showing designated video stream indicates "Active power input / active video input"
B. Monitor showing a dialog stating "No video input" indicates "Active power input / no video input"
C. Monitor showing black screen indicates "No power input"

Should you have any questions regarding the use of monitors in ECDIS systems, please contact your North Invent Service Partner.

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10. SCOM Support

The monitor supports remote control by SCOM command on RS232 and RS422 interfaces as well as the LAN interface (*refer to 7.1* for pin assignments of the different connectors).

10.1. Interface Parameters:

Parameter	Value
Baud rate	9.600
Parity	No
Data bits	8
Start bits	1
Stop bits	1
Handshake	No

10.2. 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.

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

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Command (CMD) bytes:

ASCII	Byte0	Byte1	Byte2	Data	Description
TMP	0x54	0x4D	0x50	0x52	Return current temperature
MAN	0x4D	0x41	0x4E	-	Return manufacture ID "NIN".
TYP	0x54	0x59	0x50	-	Return monitor type as defined in the monitorinfo.txt file located at the microSD-card. Syntax for setting TYP value in monitorinfo.txt: MONITOR_TYPE={string up to 16 characters}
BRT	0x42	0x52	0x54	1 byte	Set BL level.
SLI	0x53	0x4C	0x49	1 byte	Set current input: 0x03 = DVI1, 0x0F = DP1, 0x04 = DVI2 and 0x10 = DP2.
SWI	0x53	0x57	0x49	-	Return SW version as defined in the monitorinfo.txt file located at the microSD-card. Syntax for setting SW value in monitorinfo.txt: SOFTWARE_ID={string up to 16 characters}
ETC	0x45	0x54	0x43	-	Return system run time
SNB	0x53	0x4E	0x42	-	Return Serial number
LFD	0x4C	0x46	0x44	-	Commands monitor to Load factory defaults
BZZ	0x42	0x5A	0x5A	1 byte	Buzzer control (note that both 0xFF and 0x01 turn on buzzer, 0x00 turn off buzzer)

Furthermore, commands for simulating HMI keypresses are available:

Corresponding HMI key	Command syntax (complete command)
Menu button	07 FF 4D 43 43 01 25 F7 08
ECS button	07 FF 4D 43 43 01 25 FB 04
+ button	07 FF 4D 43 43 01 25 FC 03
- Button	07 FF 4D 43 43 01 25 FD 02

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 initialized 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 sent 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:

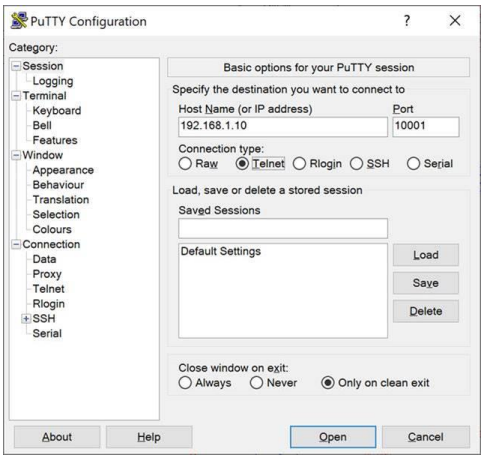
This byte will only be sent if data length (LEN) is greater than 0. It is an 8-bit checksum of the data bytes (bytes 7 to LEN+6) where a bit-wise inversion has been performed. The checksum is initialized to 0. The 8-bit sum (without carry) of bytes 7 to LEN+7 must be 0xFF.

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.

10.3. SCOM over LAN

The SCOM commands may be transmitted over LAN. To do so, open a Telnet session to the monitor IP @ port 10001 to send commands as described above.



Example of using PuTTY to connect to a monitor with ip = 192.168.1.10

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11. DDC/CI support

The monitor supports remote control by DDC/CI over DVI/DP (refer to 7.1 for pin assignments of the different connectors). The DDC/CI uses the MCCS protocol, and we propose downloading the softMCCS software to get started and learn more about this.

Command	Description
0x04	Restore Factory defaults
0x10	Back light control: Range: 0-100
0x12	Contrast: Range: 0-100
0x60	Input select: Shall be used to select active input: 1 = DVI-D (DVI2) 2 = DP (DP2) 3 = DVI-D (DVI1) 4 = DP (DP1)
0xD6	Power mode
0xE1	Power off: Same function as 0xD6
0xE2	Backlight: Same function as 0x10
0xE4	Zoom: Set scaling mode: 0 = One-to-one 1 = Fill-all 2 = Fill-to-aspect
0xE5	Buzzer: Control buzzer state (J25 pin 20) 0 = Buzzer OFF (pin20=low) 1 = Buzzer ON (pin 20=high)
0xE6	Touch control 0 = Touch disabled 1 = Touch enabled
0xEB	Input select: Shall be used to select active input: 1 = DVI-D (DVI2) 2 = DP (DP2) 3 = DVI-D (DVI1) 4 = DP (DP1)
0xF0	Actual temperature: Use SMARC based temp sensor or sensor in the i.MX CPU.
0xF1	Min temperature: Lowest temperature measured.
0xF2	Max temperature: Highest temperature measured.
0xF3	Run time: Accumulated run time for the system defined as hours:minutes where the back light has been active.
0xFD	Software version.
0xFE	Serial number.

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12. Technical Specifications

Please refer to the relevant datasheet for the technical specifications for your product of choice.

13. Troubleshooting

If you encounter any trouble with your monitor, please check if your problem is listed below and follow the given instructions.

If the problem persists, please contact North Invent for service instructions.

Problem	Instructions
No power on	Check if the AC or DC voltage supplied to the monitor is within the specification (90-264 VAC or 18-36 VDC). Check if the AC or DC power LED is lit and if not press the power on control (HMI connected). Connect a mouse to one of the USB inputs and right click to turn on the monitor and display the OSD (no HMI connected).
No picture displayed	Check if the video cable is rigidly connected and the correct video input is selected using the OSD. Check if the Dimming control (brightness) is set to 100% using the OSD (right click the mouse). Brightness is set to minimum 20% when the OSD is activated. Try changing the video source properties (resolution and frequency).
Picture is too dark	Increase the Dimming setting using the OSD or the + key of the HMI.
Firmware update fail	Make sure to follow the instructions given in *section 8.2 Firmware Update* to the letter. If you have FW OSD 1.7 LPC 2.9 FPGA 1.6 and earlier remember first to use the Transitional Update before using the Final Update.
MultiDim do not work	First check that the cabling between the PC and monitors are according to the drawing in the description of the RS422 interface (page 8). If MultiDim is relayed from a Monitor, the checkbox for “This monitor is MultiDimm master” must be checked for this monitor only. If MultiDim is relayed from a PC, the checkbox for “This monitor is MultiDimm master” must not be checked for any monitors.

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14. 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.

15. Maintenance and Service

Wave II monitors are conceived so to be almost maintenance free.

If the Monitor malfunctions, please check if the problem can be solved with *troubleshooting*.

If the problem persists, please contact North Invent for service instructions.

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

16. Update

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

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