Smart-Interface-Board

Product specification

This document might be changed without prior notice

Revision: 000

Date: 2025-06-27

Revision History

Rev.	Date	Author	Modifications
000	27.06.2025	J. Nestmeier, E. Kurz	First official release

Table of contents

1. Preamble

1.1. Intention of the Document

This document describes the technical parameters, the electrical connections and the mechanical dimensions of the Smart-Interface-Board.

The Smart-Interface-Board is used as protocol translator between following interfaces: Ethernet (LAN), I2C, SPI, UART and optional WLAN, Bluetooth and Bluetooth LE.

Main application of the Smart-Interface-Board is controlling scaler boards from DATA MODUL (eMotion series) by SNMPv2.

Main component on the Smart-Interface-Board is a dual-core Xtensa LX6 CPU-system out of the ESP32-series from Espressif company.

1.2. Abbreviations

EMI	ELECTRO MAGNETIC INTERFERENCE
EMC	ELECTRO MAGNETIC COMPATIBILITY
EN	EUROPEAN NORM
ESD	ELECTRO STATIC DISCHARGE
UL	UNDERWRITER LAB
PCB	PRINTED CIRCUIT BOARD
SMT	SURFACE MOUNT TECHNOLOGY
ROHS	RESTRICTION FOR THE USE OF HAZARDOUS SUBSTANCES
NC	NOT CONNECTED
TBD	TO BE DEFINED
LAN	LOCAL AREA NETWORK
GPIO	GENERAL PURPOSE INPUT OUTPUT
ADC	ANALOG DIGITAL CONVERTER
PHY	PHYSICAL LAYER
USB	UNIVERSAL SERIAL BUS
I²C	INTER-IC
SPI	SERIAL PERIPHERAL INTERFACE
UART	UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER
SNMP	SIMPLE NETWORK MANAGEMENT PROTOCOL
JTAG	JOINT TEST ACTION GROUP
OTA	OVER THE AIR
OID	OBJECT INDENTIFIER

1.3. Further Applicable Documentation

- esp32-wroom-32e_esp32-wroom-32ue_datasheet.pdf

2. Description of the Component

2.1. Intention of the Smart-Interface-Board

As market leader for visual solutions the DATA MODUL AG offers, amongst others, graphic interface boards (so called eMotion boards) to drive TFTs with different sizes and resolutions.

The main component of the eMotion boards is a scaler-chip which can be controlled to make adjustments on the monitor. E.g. brightness, contrast can be set to desired values and video input source can be selected. Additionally parameters like temperature or hours of operation can be read out from the scaler-chip.

For controlling and read out functionality following possibilities are given up to now:

- Controlling over On Screen Display (OSD) using a 4 button key board
- Controlling over IR remote control by IR sensor on OSD key board
- Communication over UART interface on eMotion-boards
- Communication over DDC/CI-channel from video interface (VCP)

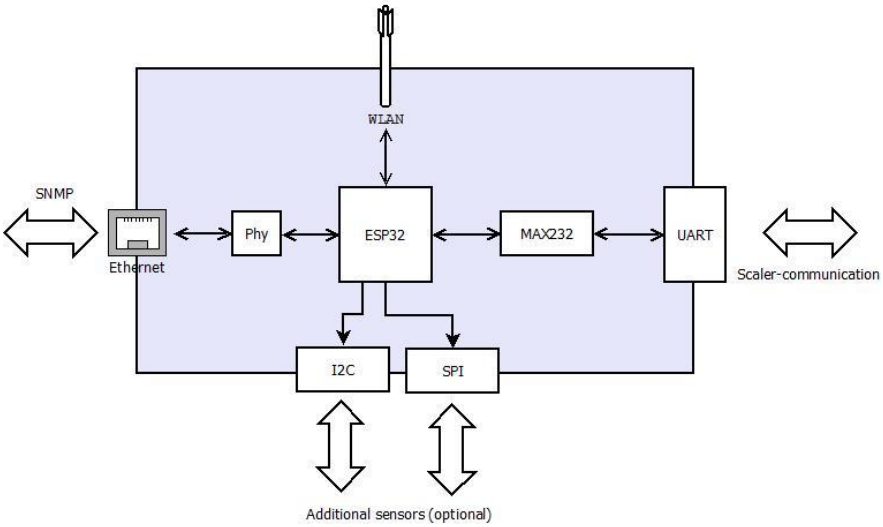
As an additional possibility for communication with eMotion boards, a control-/read out-functionality was realized by a network connection over SNMPv2. Due to there is no network connection on eMotion boards available, an additional board with network interface connector was developed which can communicate with eMotion boards over UART.

Important note: Currently only the eMotion UHD-II does support the Smart-Interface-Board functions. The implementation for the other eMotion boards is done on request.

2.2. Functional Description of the System

The ESP-32-WROOM-32UE-module from Espressif Company has a larger functional range than translation between SNMPv2 and UART. The controller also supports SPI and I²C protocol and even a communication over WLAN, Bluetooth and Bluetooth LE is possible.

Therefore connectors for SPI and I²C are implemented on the Smart-Interface-Board. On the ESP32 controller module there is a plug available for connecting an external WLAN antenna. Bluetooth is already implemented on the PCB of the controller module.



2.3. Power Supply

There is an internal connector available for power supply. Input Voltage can be in the range from +5VDC to +24VDC

2.4. Reverse Voltage Protection

There is no reverse voltage protection on the board.

2.5. EMV Filter

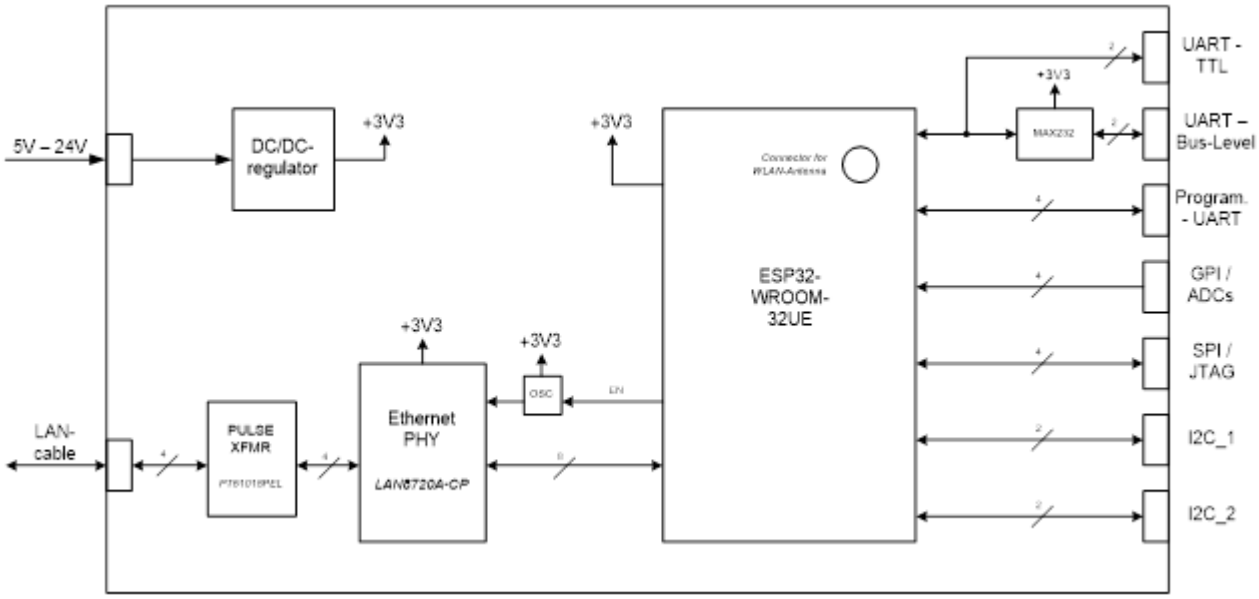
There is an EMC filter for power supply and ESD protection for network interface available on the board.

2.6. Software update

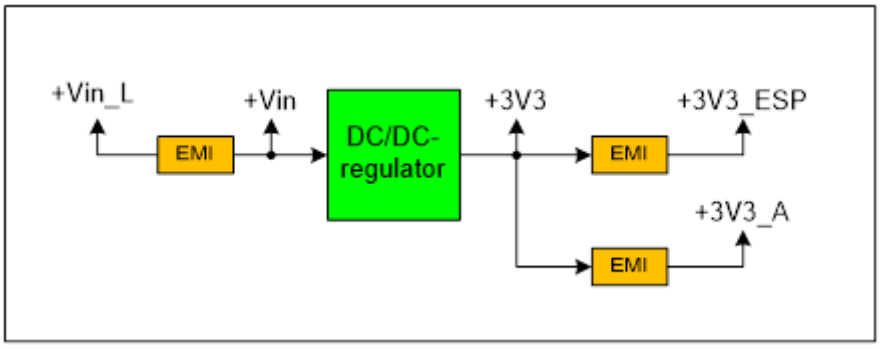
Update via OTA is not available yet, will be implemented at a later stage.

3. Realization of the Smart-Interface-Board

3.1. Block diagram of the Smart-Interface-Board



3.2. Power concept of the Smart-Interface-Board



+Vin_L: +5VDC up to +24VDC (+/- 10%)

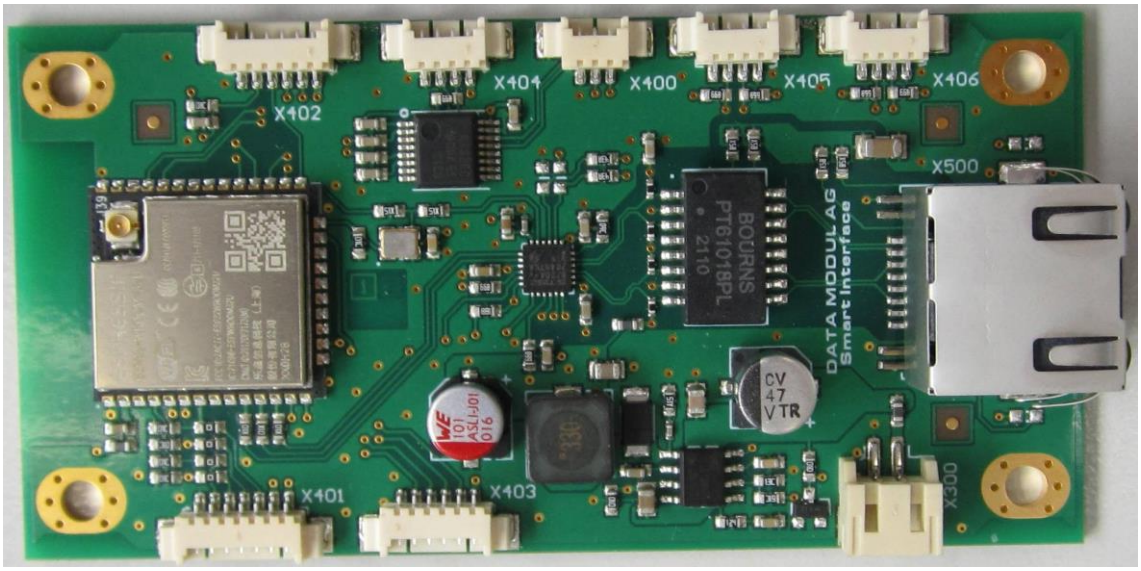
4. Dimension of the Smart-Interface-Board

4.1. PCB Size

Dimensions of the Smart-Interface-Board are 90mm x 45mm. Top component is an ethernet plug with ~14mm.

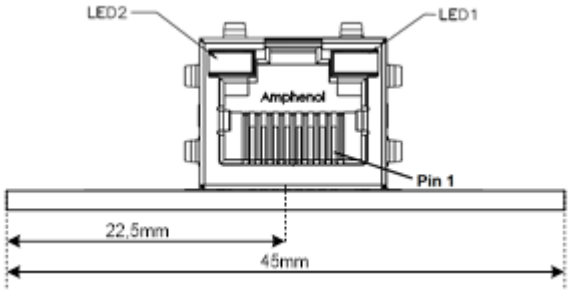
The PCB has 4 layers with thickness of 1.6mm.

All components are mounted on the top side.



4.2. Connector Panel

End user only has access to the ethernet plug.



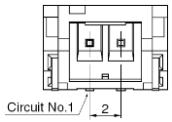
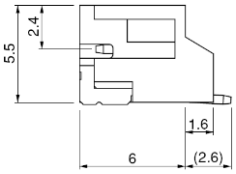
5. Technical Details

Connector designators are visible on the silkscreen of the board.

5.1 X300, Power Input

There is one connector intended for power Input.

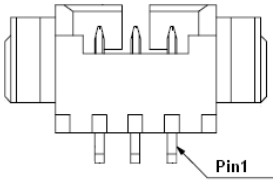
Type JST: S2B-PH-SM4-TB, SMT, Side entry type, pitch 2.0mm; or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Front-View	1	GND	I/O	GND
 Side View	2	+Vin	I	+5V ... +24V (+/- 10%), 2A max. *

*: for more details see chapter 6.1.

5.2 X400, RS232-connector – Bus-Level

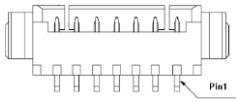
Type: Molex-Ref.-No: 53261-0371 or YEONHO: 12505WR-03, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	RS232_TX	O	Transmit Data *
	2	RS232_RX	I	Receive Data *
	3	GND	I/O	Ground

*: signals have bus level with inverted logic (+/-12V)

5.3 X401, GPI/ADC-connector, currently not supported by firmware

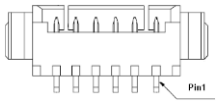
Type: Molex-Ref.-No: 53261-0771 or YEONHO: 12505WR-07, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	GND	I/O	Ground
	2	GPI_A	I	General Purpose In – A*
	3	GPI_B	I	General Purpose In – A*
	4	GPI_C	I	General Purpose In – A*
	5	GPI_D	I	General Purpose In - A*
	6	GND	I/O	Ground
	7	GND	I/O	Ground

*: all pins are input with 3V3-high level

5.4 X402, Programming/UART Connector

Type: Molex-Ref.-No: 53261-0671 or YEONHO: 12505WR-06, or equivalent

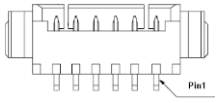
Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	GND	I/O	Ground
	2	UART0_TXD	O	Transmit Data*
	3	UART0_RXD	I	Receive Data*
	4	EMAC.TXCLK		Bootloader enable**
	5	ESP_EN	I	Enable*
	6	GND	I/O	Ground

*: level of signals is 3V3

**: strap pin: when EMAC.TXCLK is low at power up => chip enters bootloader mode

5.5 X403, SPI/JTAG Connector, currently not supported by firmware

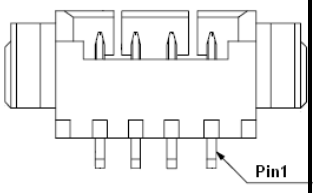
Type: Molex-Ref.-No: 53261-0671 or YEONHO: 12505WR-06, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	GND	I/O	Ground
	2	SPI_CS	O	Chip Select*
	3	SPI_MISO	I	Master In / Slave Out*
	4	SPI_MOSI	O	Master Out / Slave In*
	5	SPI_SLK	O	Clock*
	6	GND	I/O	Ground

*: level of signals is 3V3

5.6 X404, TTL UART connector

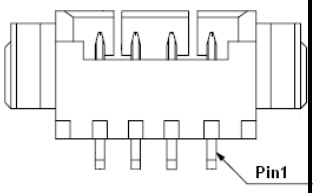
Type: Molex-Ref.-No: 53241-0471 or YEONHO: 12505WR-04, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	+3V3	O	+3V3-Supply
	2	UART2_TXD	O	Transmit Data *
	3	UART2_RXD	I	Receive Data *
	4	GND		Ground

*: signals have 3V3 level

5.7 X405, I2C_2 Connector, Currently not supported by firmware

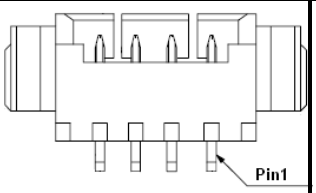
Type: Molex-Ref.-No: 53241-0471 or YEONHO: 12505WR-04, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	GND		Ground
	2	I2C2_SCL	O	Serial Clock*
	3	I2C2_SDA	I/O	Serial Data*
	4	+3V3	O	+3V3-Supply

*: signals have 3V3 level

5.8 X406, I2C_1 Connector, currently not supported by firmware

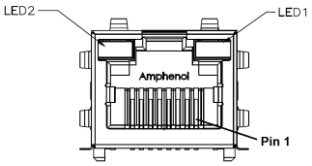
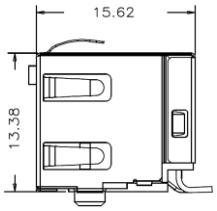
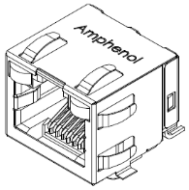
Type: Molex-Ref.-No: 53241-0471 or YEONHO: 12505WR-04, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
 Top-View	1	GND		Ground
	2	I2C2_SCL	O	Serial Clock*
	3	I2C2_SDA	I/O	Serial Data*
	4	+3V3	O	+3V3-Supply

*: signals have 3V3 level

5.9 X500, Ethernet Connector (10/100Mbit/s)

Type: RJCSE-5381-01 from Amphenol, or equivalent

Pin arrangement	Pin	Signal	I/O	Description
	1	LAN2_TX_P	O	LAN2 transmit positive
	2	LAN2_TX_N	O	LAN2 transmit negative
	3	LAN2_RX_P	I	LAN2 receive positive
	4	NC1		
	5	NC1		
	6	LAN2_RX_N	I	LAN2 receive negative
	7	NC2		
	8	NC2		
	9	LED1_K		
	10	LED1_A		
	11	LED2_K		
	12	+3V3		
	SHD1	Shield		Connected to GND
Front-, Side-View	SHD2	Shield		Connected to GND

6 Technical Details

6.1 Supply voltages and current consumption

Supply voltage	Nominal value	Regulation	Ripple & noise
+5V ... +24V	-	+/-10%	0.3V

Power consumption in normal operation mode

Vin	Current consumption @ Vin	Power consumption @ Vin
+5V	‹ 120mA	‹ 0.6W
+12V	‹ 60mA	‹ 0.8W
+24V	‹ 35mA	‹ 0.9W

6.2 Supply voltages and current consumption

6.2.1 UART on X400

UART on X400 has bus level with inverted logic (+/-12V)

Max. baud rate is 115.200.

6.2.2 UART on X402, X404

UART on X402 and X404 have TTL-level, non inverted logic (+3V3/GND)

Max. baud rate depends on distance to connected host/device and has to be evaluated in application. In theory max. baud rate of 5.000.000 is possible.

6.3 I²C Speed on X405 and X406

Max. speed of I²C-bus on X405 and X406 is 400 KHz.

7 Software features

7.1 Default network configuration

By default the static IP 192.168.4.66/24 is used for communication (DHCP is enabled, so refer DHCP-Server to determine assigned IP, if available). Refer Chapter 7.2.3.1 to change this configuration. After changing configuration a restart is required (you may use OID 8 to restart the board).

Note: The Smart-Interface-Board is independent from OSD settings of the display (a reset here doesn't affect network-configuration).

7.2 SNMP OIDs

7.2.1 Base OID

Base-OID is **1.3.6.1.4.1.30329.1.5** which is extended by OIDs given in chapter 2.3 followed by trailing 0. So to change backlight you need to set OID 1.3.6.1.4.1.30329.1.5.20.0.

7.2.2 Used communities

Basically SNMP uses different community-strings for accessing read and write-operations.

Read-community: **public** (needed for read-operations)

Write-community: **private** (needed for write-operations)

7.2.3 Available OIDs

There's an MIB-file which can be used in third-party-applications supporting this. The MIB-file will be provided by Data Modul on request.

7.2.3.1 Smart-Interface-Board settings

OID	Name	Type	Description
1	Uptime	Integer RO	Total runtime in 15min steps
2	Power On Counter	Integer RO	Power on counter
3	Enable DHCP	Integer RW	Enable (1) or Disable (0) DHCP client
4	IP address	String RW	Set/Get IP address (default: 192.168.4.66)
5	Subnet mask	String RW	Set/Get subnet mask (default: 255.255.255.0)
6	Default gateway	String RW	Set/Get default gateway (default: 192.168.4.254)
7	Network status	String RO	Displays current network-settings (for example "IP:192.168.4.66 Netmask:255.255.255.0 Gateway:192.168.4.254"
8	Restart	Integer WO	Write 1972 to restart board. Applies network configuration
9	Reserved		Do not use
10	Software version	String RO	Returns software version info

7.2.3.2 Special functions

11	UART Passthrough	String RW	Write/Read directly to/from UART (needs to implement UART-protocol, used by scaler-board, on sender side)
12	Reserved		Do not use
13	UART Rx clear	WO	Clear UART Rx-Buffer
14	Community read string	RW	Set/Get Community read string
15	Community write string	RW	Set/Get Community write string

7.2.3.3 Accessible user OSD settings

20	Backlight	Integer RW	Adjust backlight (0-100)
21	Contrast	Integer RW	Adjust contrast (0-100)
22	Brightness	Integer RW	Adjust brightness (0-100)
23	Sharpness	Integer RW	Adjust sharpness (0-8)
24	Colortemp	Integer RW	Adjust colortemp (0-4)
25	Colortemp R gain	Integer RW	User colortemp red (0-100)
26	Colortemp G gain	Integer RW	User colortemp green (0-100)
27	Colortemp B gain	Integer RW	User colortemp blue (0-100)
28	Gamma	Integer RW	Select gamma-table (0;2)
29	Aspect ratio	Integer RW	Select aspect ratio (0-3)
30	Overscan	Integer RW	Enable/Disable overscan (0;1)
31	Source	Integer RW	Select input source (9-12)
32	Source scan	Integer RW	Enable/Disable source-scan (0;1)
33	OSD language	Integer RW	0: English, 1: German, 2: Espanol, 3: Francais, 4: Italiano
34	H OSD position	Integer RW	Horizontal OSD position (0-100)
35	V OSD position	Integer RW	Vertical OSD position (0-100)
36	OSD transparency	Integer RW	OSD transparency (0-4)
37	OSD timeout	Integer RW	OSD timeout (5s-60s)
38	OSD rotation	Integer RW	OSD rotation (0:0°, 1:90°, 2:180°, 3:270°)
39	OSD size	Integer RW	OSD size (0: small, big)
40	Ext. source select	Integer RW	External source select switch (0: disabled; 1-2: enabled)
41	Factory reset	Integer WO	Execute factory reset (1)

7.2.3.4 Accessible service OSD settings (internal use only)

200	Software Version	String RO	Returns software-version string
201	Software Revision	String RO	Returns software-revision
202	Build date	String RO	Returns build date of software
203	Build time	String RO	Returns build time of software
204	Software PA-number	String RO	Returns ProAlpha-number of software
205	Panel info	String RO	Returns panel-info
206	STM32 revision	String RO	Returns STM32 subversion revision
207	ALC sensor status	String RO	Returns status of ALC-sensor (0: not available, 1: available)
208	Current temperature	Integer RO	Returns currently measured temperature
209	Min temperature	Integer RO	Returns maximum measured temperature
210	Max temperature	Integer RO	Returns minimum measured temperature
211	Timing info	String RO	Returns input-timing-info-string
212	Vertical resolution	Integer RO	Returns input vertical resolution
213	Horizontal frequency	Integer RO	Returns input horizontal frequency
214	Vertical frequency	Integer RO	Returns input vertical frequency
215	Dot clock frequency	Integer RO	Returns input dot-clock
216	Runtime	Integer RO	Returns runtime [h]
217	Panel runtime	Integer RO	Returns panel runtime [h]
218	Service tim	Integer RO	Returns runtime since last service
219	Power on counter	Integer RO	Returns power-on-counter
220	Panel on counter	Integer RO	Returns panel-power-on counter
221	Fan speed	Integer RO	Returns current fan-speed
222	cDPM status	Integer RO	Returns cDPM-status
223	cDPM black value	Integer RO	Returns cDPM measured value for black square
224	cDPM white value	Integer RO	Returns cDPM measured value for white square
225	Power status	Integer RO	Returns power status
226	Serial number	String RO	Returns serial number

7.2.3.5 Special features (availability depends on software version)

300	Buzzer enable	Integer RW	Enable / Disable buzzer (0: disabled, 1: enabled)
301	USB link select	Integer RW	USB-Link-Select (0: disabled, 1: enabled)

7.2.4 Examples

The following examples are based on Debian Linux with installed snmp-packet (use “sudo apt install snmp” to install package).

Set backlight to 100%: snmpset –v2c –cpublic 192.168.4.66 1.3.6.1.4.1.30329.1.5.20 i 100

Set backlight to 50%: snmpset –v2c –cpublic 192.168.4.66 1.3.6.1.4.1.30329.1.5.20 i 50

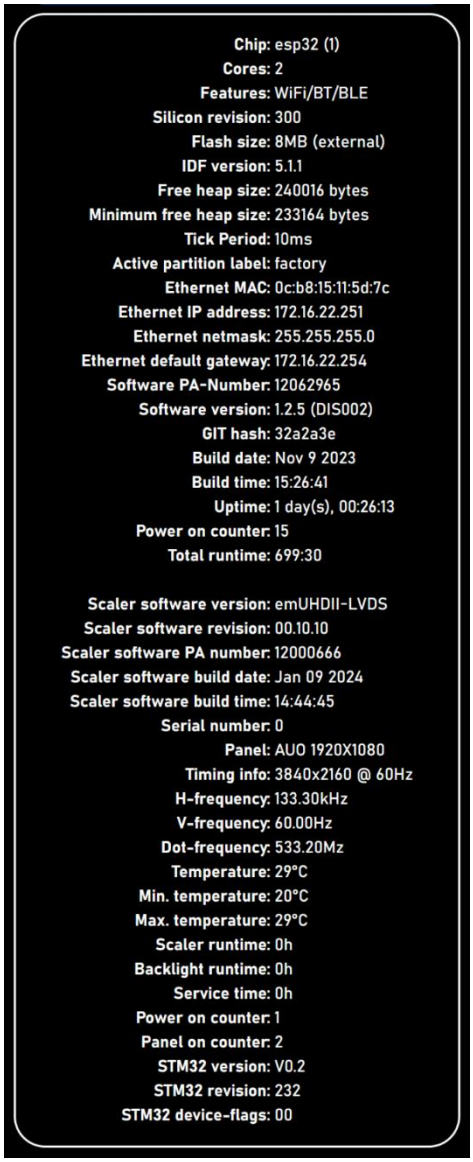
Read backlight value: snmpget –v2c –cprivate 192.168.4.66 1.3.6.1.4.1.30329.1.5.20

Set IP: snmpset -v2c -cprivate 192.168.4.66 1.3.6.1.4.1.30329.1.5.4.0 s "192.168.4.128"

Read all values: snmpwalk -v2c -cpublic 192.168.4.66 1.3.6.1.4.1.30329

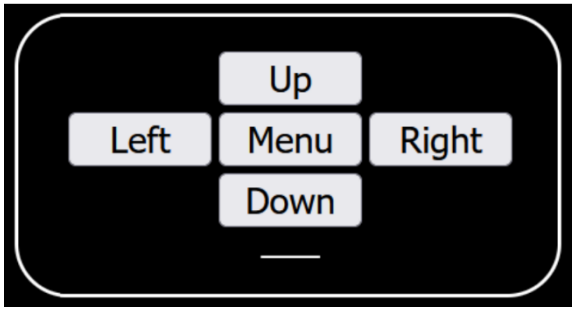
7.3 Webserver

Calling smart-interface-IP with a browser will give some basic information.



The upper block displays information from the Smart-Interface-Board itself. The lower block displays information gathered from the connected scaler board (the displayed information will differ between different scaler boards software versions).

7.4 Webinterface



Calling /control.html will display a lightweight-web-interface which provides basic OSD-operation (keyboard-emulation).

7.5 Software Update

Calling /update.html will display a software-update-dialog. Simply select firmware-file and then start update.

8 Qualification

8.1 Environmental conditions

- Temperature (operating): -20°C .... +60°C (- 4°F... +140°F)
- Temperature (storage) : -20°C ... +70°C (-4°F ... +158°F)
- Relative humidity: ‹ 80%
- Tolerable air-pressure: › 708 hPa (approx. altitude 3000m)

8.2 EMI/EMC-Standards

Designed to meet EMC (Electro-Magnetic Compatibility): Immunity for industrial environments, according to EN 61000-6-2:

Description	Requirements	Test parameter	Criteria
Electrostatic discharge immunity test	EN 61000-4-2	4kV contact, 8kV air	criteria B
Radiated, radio frequency, electromagnetic field immunity test	EN 61000-4-3	80-1000MHz 10V/m, 1.4 – 2GHz 3V/m 2-2.7GHz 1V/m 80% AM (1kHz)	criteria A
Electrical fast transient/burst immunity test	EN 61000-4-4	2kV on mains AC, 2kV on mains DC, 2kV on I/O lines	criteria B
Surge immunity test	EN 61000-4-5	Mains AC/DC L-PE 0.5kV, Mains AC/DC L-L 0.5kV, I/O 1kV	criteria B
Immunity to conducted disturbance, induced by radio-frequency fields	EN 61000-4-6	0,15 – 80 MHz 10V 80% AM (1kHz)	criteria A
Immunity to magnetic field	EN 61000-4-8	30 A/m	criteria A

Note: To ensure that the board meets the standards mentioned above, an adequate shielding cover must be added. Alternatively, the housing of the monitor must act as shielding cover (e.g. aluminium enclosure).

8.3 Safety

- Designed to meet: IEC 62368-1
- Designed to meet UL 62368-1

8.4 Shock and Vibration

MECHANICAL STRESS

Shock:	20G, 11ms, half sine (x/y direction)
	15G, 11ms, half sine (z direction)

Vibration:	1.2G, 10 – 55Hz, sinus
Sweep:	1 minute/octave
Amplitude:	0.35mmp-p (x-direction)
	0.35mmp-p (y direction)
	0.175mmp-p (z-direction)
Time :	30 minutes
Standard:	Conform to EN60605

9 Warranty, Quality and Environmentalism

9.1 Warranty

- Manufacturer warranty: 24 months after delivery

9.2 Quality

The producing process of the board is aligned with the guideline according to the DIN ISO 9001 certification.

AQL 0.65% for function test; AQL 1.00% for cosmetic.

Workmanship standard: IPC-A-610D Class2

9.3 Environmentalism

The PCB is produced under lead free soldering conditions.

All components are produced according to European RoHS (RoHS-1 = 2002/95/EU, RoHS-2 = 2011/65/EU) and REACh (2006/1907/EU) regulations. The board is designed and manufactured to meet ISO 14001.

The packing complies to directive 1994/62/EU.

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