DATA MODUL
DISPLAYS AND EMBEDDED SOLUTIONS

eMotionST1:3

Final Specification

Hardware Revision 05

This document might be changed without prior notice

Revision	1.3
Date	16.01.2015
Name	M. Schmidt

Table of contents

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1. Revision History

Rev.	Date	Chapter	Description	by
1.0	24.03.2012	All	First draft	MS
1.1	30.07.2012	All	Cosmetic changes	MS
1.2	04.04.2014	9.4 OSD Status LED 9.5 OSD Structure	LED state power off changed Color menu changed	MS
1.3	15.01.2015	7. Overview of connectors and jumpers	CN104 connector family corrected	MS

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2. General Description

The eMotionST1:3 is an advanced TFT-LCD controller board to connect LCDs standard VGA, DVI, and DisplayPort sources. All necessary timings and voltages to support the connected display and backlight are generated on the eMotionST1:3.

3. Features

Scaler	STMicroelectronics STDP6036
Input resolution	Up to WUXGA (1920x1200@60Hz)
Output resolution	VGA up to WUXGA
Colors	16.7M
Power Supply	Single power supply +12V / +24V DC
Operating temperature	0 ...60 °C
Inputs	VGA, DVI, DisplayPort 1.1a
Panel voltage	3.3V, 5.0V, 12.0V (selectable with jumpers)
LVDS output	JEIDA or VESA mapping selectable by panel file
Backlight support	Analog & PWM dimming
Power safe mode	VESA DPMS compatible
DDC CI	Support of DDC / CI
Remote Control	RS232 remote control
Software update	- RS232 - Smart ISP - VGA-input using VGA to DDC adapter

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4. Electrical Specification of inputs and outputs

4.1 Power Supply voltage

The eMotionST1:3 can handle 12V or 24V DC input voltage. The board is designed for a single power supply. All other supply voltages are generated on the eMotionST1:3. If the input supply voltage is used for backlight supply (jumper CN202, CN203, CN204 position2-3) then the input voltage of the board must fit with the backlight supply voltage.
An additional SMPS on the eMotionST1:3 is used to generate +12V supply voltage for the backlight inverter. Therefore the jumper CN202, CN203 and CN204 have to be placed in position 1-2. In this position the max. backlight current is limited to 3A.

Supply voltage	Nominal value	Regulation	Ripple &noise	Comment
+12V	+12.0V	+/-10%	0.3V	
+24V	+24.0V	+/-10%	0.3V	

4.2 Panel supply voltage

The panel supply voltage is generated on the eMotionST1:3. The eMotionST1:3 can generate 3.3V, 5.0V or 12.0V panel supply voltage. The max current is limited to 3.0A. Select the panel supply voltage with jumper CN200.
Note: 12.0V panel supply can only be used if the supply voltage of the board is 24V.

Panel supply voltage	Nominal value	Regulation	max Current	Comment
+ 3.3V	+3.3V	+/-5%	3.0 A	CN200 Pin 1-2 closed
+ 5.0V	+5.0V	+/-5%	3.0 A	CN200 PIN 3-4 closed
+12.0V	+12.0V	+/-5%	3.0 A	CN200 PIN 5-6 closed

4.3 LVDS

PARAMETER	MIN	TYP	MAX	UNIT	Remark
Differential Output Voltage	300	500	700	mV	
Common Mode Voltage		1.25		V	
Clock Frequency			100 90	MHz	Single Channel Dual Channel
Bits per Color	6		8	bit	6/8bit selectable in panel file

4.4 Backlight

The backlight supply voltage can be selected by the jumper CN202, CN203, CN204. All three jumpers must be set in the same position.
In position 2-3 the backlight supply voltage is equal the input voltage of the board. The max. backlight current is limited to 6A.
In position 1-2 the backlight supply voltage is generated by a 12V SMPS on the board (do only use it with 24V board supply voltage). Using this configuration, the max. backlight current is limited to 3A.

Signal	Description
V dimm A	Analog dimming voltage 0 to 5.0V / 0 to 3.3V selectable with jumper CN600
V dimm PWM	3,3V / 5.0V level selectable with jumper CN600
Enable	3,3V / 5,0V level selectable with jumper CN601, polarity selectable with jumper CN602
VDD	Operating voltage of the backlight. **Jumper CN202-204 in position 2-3:** The backlight voltage is the same as board supply

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	voltage Max current is limited to 6A. **Jumper CN202-204 in position 1-2:** The backlight voltage is set to +12V. Use it only with +24V board supply voltage. The max backlight current is limited to 3A.

4.5 DVI input

TMDS receiver compliant with DDWG DVI 1.0 specification

PARAMETER	MIN	TYP	MAX	UNIT	Remark
Differential Input Voltage	150		1200	mV	
Input Common Mode Voltage	-300		-37	mV	
Input Clockfrequency	20		165	MHz	

4.6 DisplayPort Input

DisplayPort 1.1a compliant receiver. 4-lane DisplayPort input

PARAMETER	MIN	TYP	MAX	UNIT	Remark
Peak-to-peak input differential voltage	0.12		1.4	V_{p-p}	
Rx DC Common Mode Voltage	0		V_{DD}	V	
R_T Termination Resistance	45	50	55	Ω	

4.7 VGA input

PARAMETER	MIN	TYP	MAX	UNIT	Remark
Conversion rate	10		205	MHz	
ADC resolution	8		10	bit	Up to 165MHz sample rate 10 bits per color are used, up to 205MHz sample rate 8 bits per color are used
Input levelrange	0,64	0,7	0,9	Vpp	at 75R
Band width	9		290	MHz	
SOG level		0,3		V	at 75R

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5. Qualifications

5.1 Environmental conditions

Parameter	Min	Max
Operating Temperature	0°C	+60°C
Storage Temperature	-20°C	+80°C
Relative humidity		80%
Tolerable air-pressure	708 hPa (apporx. Altitude 2000m)	

5.2 EMI Standards

		Criteria
EMI/EMC:	EN55022-B (appendix A1:2007 from Oct., 1st 2011 on), highest internal frequency on the board is below 400MHz (DDR data lines).	D
ESD:	EN61000-4-2 contact discharge 4kV EN61000-4-2 air discharge 8kV	B
Radiated RF (80-1000MHz):	EN61000-4-3 (20V/m 80% modulation level from 80 – 1000MHz)	A
Conducted disturbances induced by RF fields:	EN61000-4-6 (10Veff, AM 80%, 1kHz from 150kHz – 80MHz)	A
Radiated RF:	EN50204:1995; 900MHz, 20V/m, pulse 50%	A

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

5.3 Safety

- EN60950-1:Latest edition
- Designedtomeet UL60950-1

5.4 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:	Conformto EN60605

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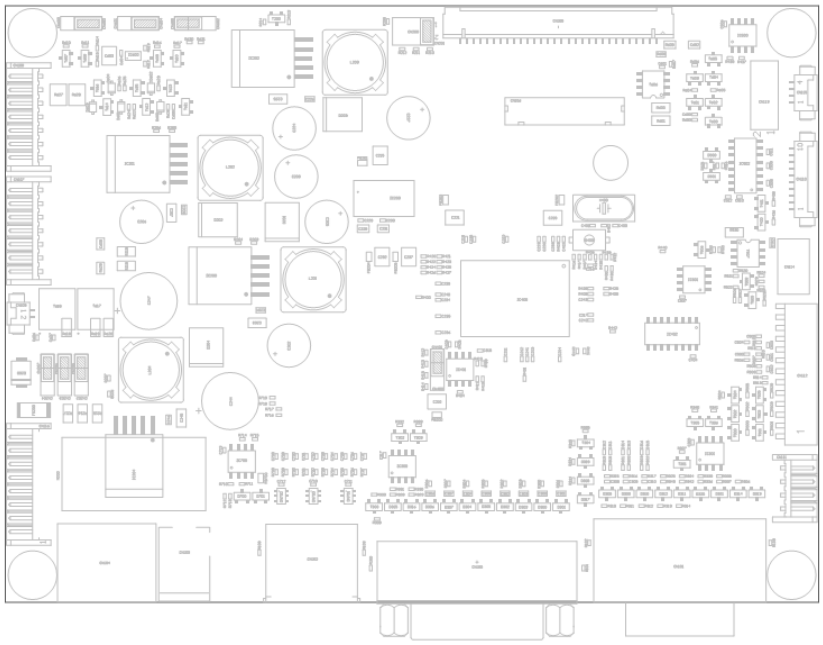
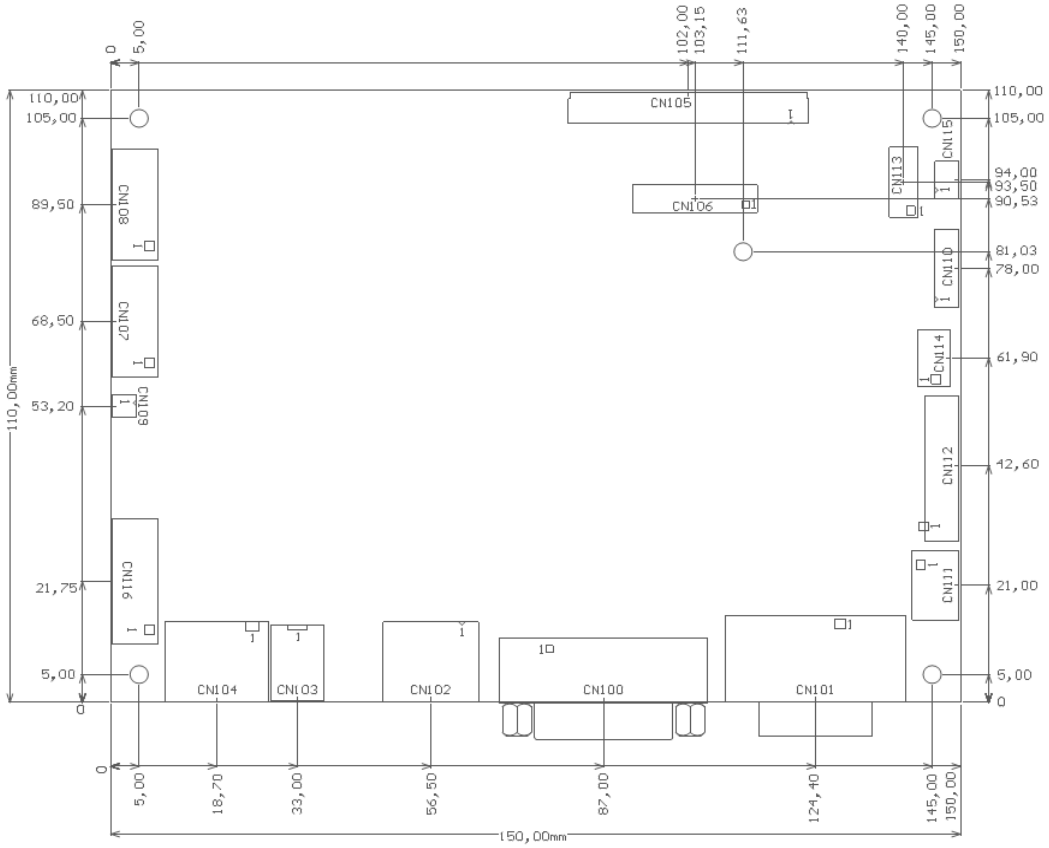
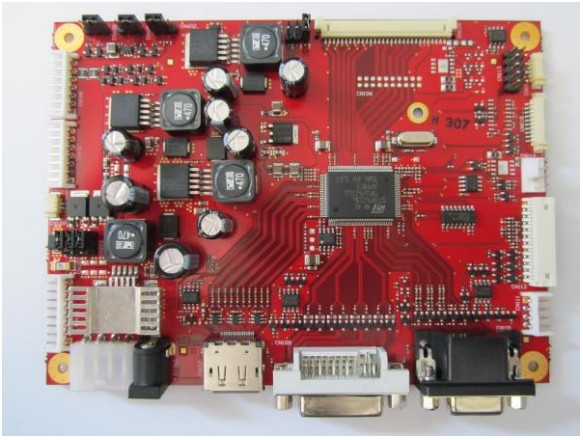
6. Outline dimensions

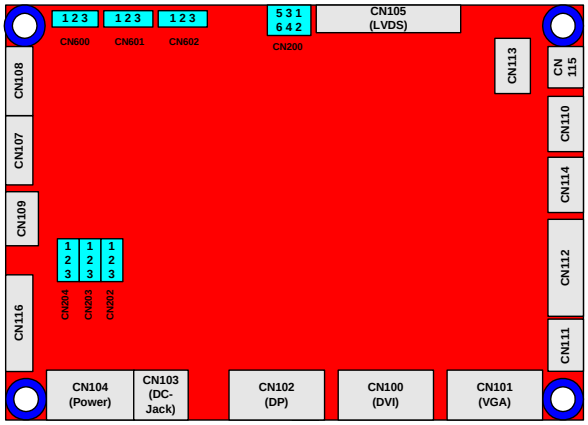
Dimensions: 150mm (L) x 110 mm (W) x 17mm (H)





7. Overview of Connectors and Jumpers





Item	Description	Remarks
CN103	Power	DC-Jack 2.5mm
CN104	Power	Molex Series 5569
CN116	Power (internal)	JST S8B-EH
CN100	DVI input	24 pin DVI-D connector, female
CN101	VGA input	15 pin HD-Sub connector, female
CN102	DP input	DisplayPort connector
CN105	LVDS Dual link output	Hirose DF14-30P-1.25H
CN107	Backlight connector	JST S7B-EH
CN108	Backlight connector	JST S7B-EH
CN109	Inverter Switch	Inverter switch signal
CN110	GPIO connector	10pin multi functions connector
CN111	Systembus	JST S4B-EH
CN112	OSD	Molex 53015-1210
CN113	RS232	10 pin double row connector RS232 LVTTL Signal
CN114	FAN	Fan connector
CN115	RS232	RS232 LVTTL Signal (MOLEX 53261-0471)
CN200	Jumper Block for Panel VCC	6pin double row connector
CN202 CN203 CN204	Jumper block for Backlight supply voltage	6pin double row connector Note: Same position must be set for all three jumpers.
CN600	Backlight PWM voltage select	3pin row connector
CN601	Backlight EN voltage select	3pin row connector
CN602	Backlight EN polarity	3pin row connector

7.1 Power Input Connector

Connector: CN104 - MOLEX 0039303045

Pin No.	Signal	Description
1	GND	Ground
2	GND	Ground
3	+12V / +24V DC	VDD / max 4A per pin
4	+12V / +24V DC	VDD / max 4A per pin

Connector: J101 - 2.5mm DC Jack

Pin No.	Signal	Description
1	+12V / +24V DC	VDD / max 5A
2	GND	Ground

Connector: CN116 - JST S8B-EH

Pin No.	Signal	Description
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	+12V / +24V DC	VDD / max 3A per pin
6	+12V / +24V DC	VDD / max 3A per pin
7	+12V / +24V DC	VDD / max 3A per pin
8	+12V / +24V DC	VDD / max 3A per pin

7.2 VGA Input Connector

Connector: CN101 - 15pin HD-Sub, female

Pin No.	Signal	Description
1	Red	Red analog input
2	Green	Green analog input
3	Blue	Blue analog input
4	NC	Not connected (GND)
5	GND (Red)	Ground
6	GND (Green)	Ground
7	GND (Blue)	Ground
8	GND	Ground
9	VGA 5V	+5V DC
10	GND	Ground
11	NC	Not connected
12	SD	Serial Data Line for DDC
13	HSYNC	Horizontal Sync
14	VSYNC	Vertical Sync
15	SCL	Serial clock input for DDC

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7.3 DVI Input Connector

Connector: CN100 - DVI-D24P

Pin No.	Signal	Description
1	TMDS DATA2-	TMDS DATA2 Differential negative signal
2	TMDS DATA2+	TMDS DATA2 Differential positive signal
3	TMDS DATA2 Shield	Shield for TMDS channel 2
4	NC	Not connected
5	NC	Not connected
6	DDC Clock	Clock DDC Interface
7	DDC Data	Data DDC Interface
8	NC	Not connected
9	TMDS DATA1-	TMDS DATA1 Differential negative signal
10	TMDS DATA1+	TMDS DATA1 Differential positive signal
11	TMDS DATA1 Shield	Shield for TMDS channel 1
12	NC	Not connected
13	NC	Not connected
14	+5V Power	+5V for EDID (un-powered monitor)
15	GND (for +5V)	Ground
16	HPD	Hot Plug Detect
17	TMDS DATA0-	TMDS DATA0 Differential negative signal
18	TMDS DATA0+	TMDS DATA0 Differential positive signal
19	TMDS DATA0 Shield	Shield for TMDS channel 0
20	NC	Not connected
21	NC	Not connected
22	TMDS Clock Shield	Shield for TMDS clock
23	TMDS CLOCK+	TMDS Clock Differential positive signal
24	TMDS CLOCK-	TMDS Clock Differential negative signal

7.4 DisplayPort Input Connector

Connector: CN102 – W+P: 8470-2-2-1-80-TR

Pin No.	Signal	Description
1	ML_L3N	Main Link Ch. 3 Differential Input negative
2	GND	Ground
3	ML_L3P	Main Link Ch. 3 Differential Input positive
4	ML_L2N	Main Link Ch. 2 Differential Input negative
5	GND	Ground
6	ML_L2P	Main Link Ch. 2 Differential Input positive
7	ML_L1N	Main Link Ch. 1 Differential Input negative
8	GND	Ground
9	ML_LN1P	Main Link Ch. 1 Differential Input positive
10	ML_LN0N	Main Link Ch. 0 Differential Input negative
11	GND	Ground
12	ML_LN0P	Main Link Ch. 0 Differential Input positive
13	Config 1	Config Pin1, connect to GND with 1M
14	Config 2	Config Pin2, connect to GND with 1M
15	AUXP	Auxiliary Ch. Differential Input positive
16	GND	Ground
17	AUXN	Auxiliary Ch. Differential Input negative
18	HPD	Hot Plug Detect
19	POR	Connected toGround
20	PO	Not Connected to internal circuits

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7.5 LVDS Output

Connector: CN105 - Hirose DF14-30P-1.25H

Pin No.	Signal	Description
1	VCC	Panel VCC *
2	VCC	Panel VCC*
3	VCC	Panel VCC*
4	VCC	Panel VCC*
5	GND	Ground
6	3.3V	3.3V permanent for LVDS select
7	GND	Ground
8	TX3+O	TX3 odd positive
9	TX3-O	TX3 odd negative
10	TXCLK+O	Clock odd positive
11	TXCLK-O	Clock odd negative
12	TX2+O	TX2 odd positive
13	TX2-O	TX2 odd negative
14	GND	Ground
15	TX1+O	TX1 odd positive
16	TX1-O	TX1 odd negative
17	TX0+O	TX0 odd positive
18	TX0-O	TX0 odd negative
19	GND	Ground
20	TX3+E	TX3 even positive
21	TX3-E	TX3 even negative
22	TXCLK+E	Clock even positive
23	TXCLK-E	Clock even negative
24	TX2+E	TX2 even positive
25	TX2-E	TX2 even negative
26	GND	Ground
27	TX1+E	TX1 even positive
28	TX1-E	TX1 even negative
29	TX0+E	TX0 even positive
30	TX0-E	TX0 even negative

* Note: Pin1, 2, 3, 4: Output voltage 3.3V / 5.0V / 12.0V - selectable with jumper CN200

7.6 Inverter / Backlight

Connector: CN107, CN108 – JST S7B-EH

Pin No.	Signal	Description
1	V dimm A	Analog dimming voltage Analog dimming range is selectable with jumper CN600
2	V dimm PWM	PWM diming output Signal level is selectable with jumper CN601
3	Enable	ON/OFF Polarity is selectable with jumper CN602
4	VDD	Operating voltage +12V / +24V VDD is selectable with the jumpers CN202, CN203, CN204. All jumpers must be set in the same position!
5	VDD	Operating voltage +12V / +24V VDD is selectable with the jumpers CN202, CN203, CN204. All jumpers must be set in the same position!
6	GND	Ground
7	GND	Ground

7.7 OSD Connector

Connector: CN112 – Molex 53015-1210

Pin No.	Signal	Description
1	LED1	LED Green
2	LED2	LED RED
3	IR /n.c.	IR remote / not connected
4	3.3V	
5	GND	Ground
6	SW3	Button3 (UP)
7	SW2	Button2 (DOWN)
8	SW4	Button4 (SELECT)
9	SW6	Button6 (POWER)
10	SW1	Button1 (MENU)
11	n.c.	Not connected
12	GND	Ground

7.8 GPIO Connector

Connector: CN110 – Molex 53261-1071

Pin No.	Signal	Description
1	3.3V	3.3V (max 200mA)
2	5.0V	5.0V (max 200mA)
3	FAN PWM	PWM signal for FAN speed
4	FAN Tacho	N.C
5	FAN VCC	
6	GPIO34	GPIO from STDP6036 (LVTTL)
7	GPIO45	GPIO from STDP6036 (LVTTL)
8	SCL	I2C SCL (5V level)
9	SDA	I2C SDA (5V level)
10	GND	Ground

Signals on the GPIO connector are not used at the moment. Reserved for custom options!

7.9 Systembus

Connector: CN111 – JST S4B-EH

Pin No.	Signal	Description
1	GND	Ground
2	SCL	I2C SCL (5V level)
3	SDA	I2C SDA (5V level)
4	5V	5.0V (max 200mA)

7.10 RS232 Connector

Connector: CN115 – MOLEX 53261-0471

Pin No.	Signal	Description
1	3.3V	3.3V (max 200mA)
2	TxD	Transmit Data (LVTTL)
3	RxD	Receive Data (LVTTL)
4	GND	Ground

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Connector: CN113 – 10pin double row

Pin No.	Signal	Description
1	NC	
2	NC	
3	RxD	Receive Data (LVTTL)
4	NC	
5	TxD	Transmit Data (LVTTL)
6	NC	
7	NC	
8	NC	
9	GND	Ground
10	NC	

7.11 Fan Connector

Connector: CN114 – MOLEX 47053-1000

Pin No.	Signal	Description
1	GND	Ground
2	Fan VCC	Fan Supply (same as board supply voltage)
3	Fan Tacho	NC
4	Fan PWM	PWM Signal for Fan speed

7.12 Inverter Switch

Connector: CN109 – MOLEX 53261-0271

Pin No.	Signal	Description
1	Inverter Switch	Inverter ON / OFF
2	GND	Ground

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8. Jumper settings and configuration

WARNING! Do not change the jumper settings and configuration of the board! Changing the jumpers and configuration may cause fatal damage to the board and to the connected display or cause malfunction.

8.1. Panel supply voltage (CN200)

The supply voltage of the panel can be selected with the Jumper CN200.
Note: Do only use one jumper cab at the same time. Combinations of jumper cabs are not allowed.

	CN200		
Panel Voltage	1-2	3-4	5-6
3.3V	**closed**	open	open
5.0V	open	**closed**	open
12.0V	open	open	**closed**

Table 1: Panel power supply

8.2. Backlight Power Supply (CN202, CN203, CN204)

Select the backlight supply voltage with the jumper CN202 to CN204.
Note: All jumper cabs of the jumper CN202-CN204 must be set in the same position!

CN202 CN203 CN204	Backlight supply voltage (CN107 and CN108 Pin4 and Pin5)	Comment
1-2	+12V / max 3A	Use this setting if the input voltage of the board does not match the backlight supply voltage.
2-3	Equal to board supply voltage / max 6A	This setting should be used if the input voltage of the board matches with the backlight supply voltage. The max backlight current is limited to 6A.

8.3. Backlight Dimming (CN600)

The range of the analog dimming voltage and the signal high level of the digital PWM dimming signal can be selected with the jumper CN600.

CN600	Analog Dimming (CN107 und CN108 Pin1)	Digital Dimming (CN107 and CN108 Pin 2)
1-2	0V – 5.0V	High level: 5.0V
2-3	0V - 3.3V	High level 3.3V

Note: Signal polarity can be changed in the panel file.

8.4. Backlight Enable Signal (CN601, CN602)

Select the level of the backlight enable signal (CN107 and CN108 Pin3) with the jumper CN601.

CN601	Backlight enable signal (CN107 und CN108 Pin3)
1-2	High level 5.0V
2-3	High level 3.3V

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Select the polarity of the enable signal with jumper CN602.

CN602	Backlight enable signal (CN107 und CN108 Pin3)
1-2	High active
2-3	Low active

8.5. Panel file configuration

The panel timing is defined in a panel file. To modify the panel file you have to use the Data Modul BoardProgrammer.exe.
The board is shipped out with the correct panel and inverter configuration.

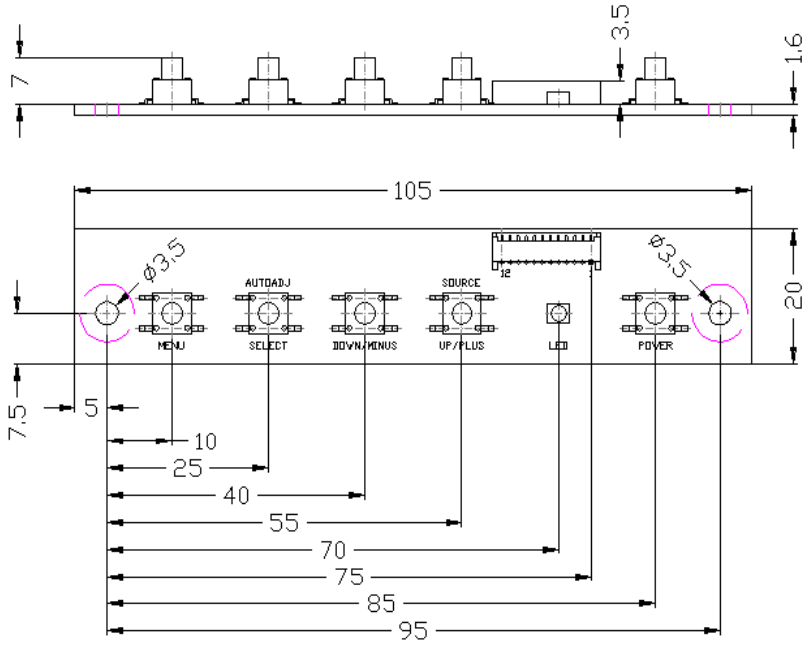
9. OSD (On Screen Display)

The eMotionST1:3 can operate with an external OSD board (optional item).
Generally the OSD offers the user various possibilities of customizing the appearance of the TFT display. By using the OSD board, brightness, contrast, input selection, OSD appearance and much more can be adjusted easily.

The eMotionST1:3 supports a 5 button OSD. Other customized OSDs (4button/6button) may be realized upon request.

9.1. Mechanical dimensions OSD board (CU70008, incl. input cable)

OSD connector CN112: Molex 53015-1210



9.2. Operation & buttons

Item	Description
Menu	Enter OSD main menu Leave sub menu Leave OSD main menu
Select	Navigate down in menu
Down / Minus	Navigate left in main menu Decrease value
Up / Plus	Navigate up in main menu Increase value
Power	Turn power on/off
2 color LED	RED / GREEN

9.3. Hotkeys

The OSD offers hot key functions. To access these functions the user must not open the OSD via ‹Menu›. The hotkey functions offer a direct access to the equivalent function.

Button	Direct access
Up / Plus	Source select, switch to next input source
Down / Minus	Brightness
Select	Auto adjust

9.4. OSD Status LED

Condition	Description
Amber flashing	Stand by (searching input)
Green flashing	Searching display mode (source)
GreenON	OK (displaying signal)
Red ON	Power off

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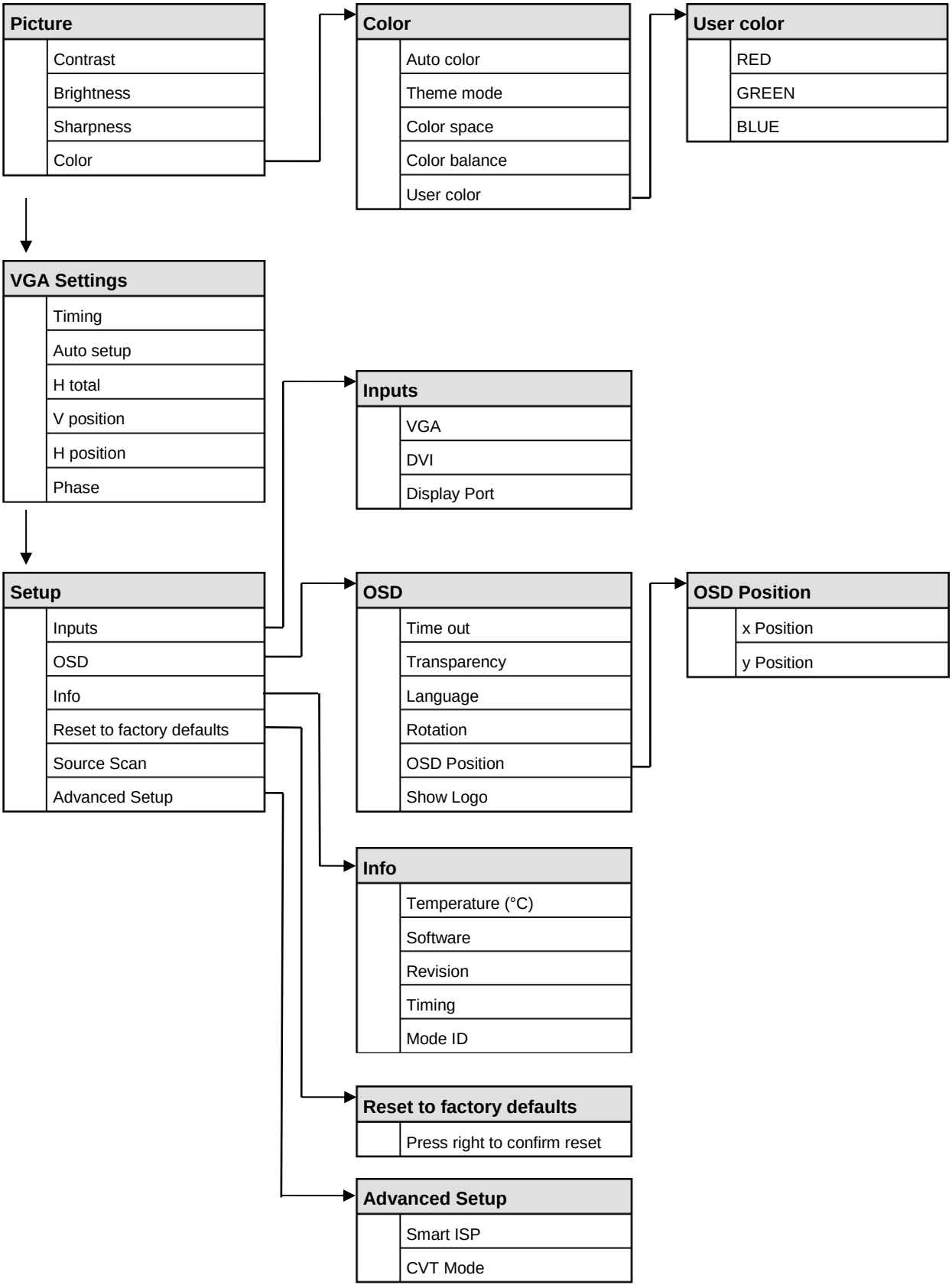
9.5. OSD Structure



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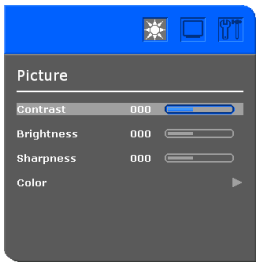
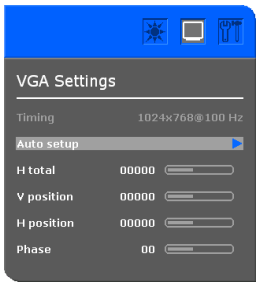
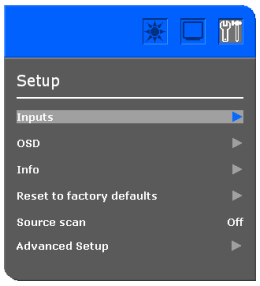
9.5.1 Picture Menu

	Picture	Contrast
		Brightness
		Sharpness
		Color

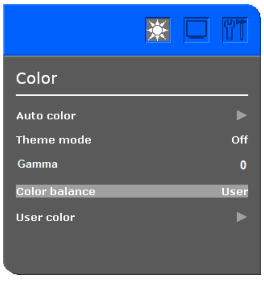
9.5.2 VGA Settings Menu

	VGA Settings	Timing
		Auto setup
		H total
		V position
		H position
		Phase

9.5.3 Setup Menu

	Setup	Inputs
		OSD
		Info
		Reset to factory defaults
		Source scan
		Advanced Setup

9.5.4 Color Menu

	Color	Auto color
		Theme mode
		Gamma
		Color balance
		User color

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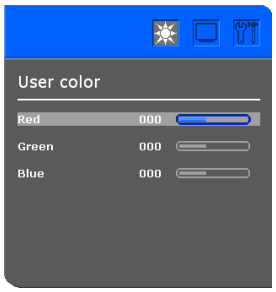
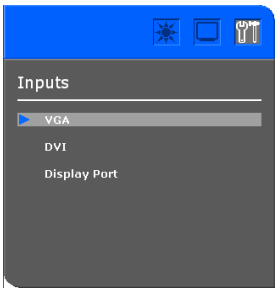
9.5.5 User Color Menu

	User color	RED
		GREEN
		BLUE

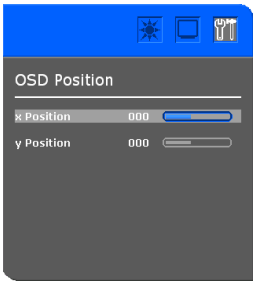
9.5.6 Inputs Menu

	Inputs	VGA
		DVI
		DisplayPort

9.5.7 OSD Menu

	OSD	Time out
		Transparency
		Language
		Rotation
		OSD Position
		Show logo

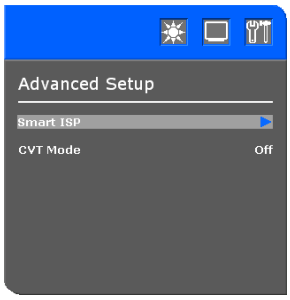
9.5.8 OSD Position Menu

	OSD Position	x Position
		y Position

9.5.9 Info Menu

	Info	Temperature (°C)
		Software
		Revision
		Timing
		Mode ID

9.5.10 Advanced Setup Menu

	Advanced Setup	Smart ISP
		CVT Mode

10. Serial Control RS232

The eMotionST3:1 can be controlled by a serial command set using the RS232. For using the RS232 a level converter from LVTTL to RS232 level must be used. Detailed information about the RS232 protocol are provided on request!

11. DDC/CI Interface

The eMotionST1:3 can be controlled by DDC/CI. Detailed information are provided on request!

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