



Epec 2040 Colour Display

Technical Document



DOCUMENT VERSION HISTORY

Date	Notes
27.10.2009	Added new hardware revisions (D02, D03), Sections 2. <i>Colour Display General Description</i> and 3.3. <i>Closed Loops Wiring</i> updated.
02.12.2008	Section 10. <i>Additional Documents</i> updated.
01.10.2008	Document and layout updated.
03.09.2007	First released version.

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1 GENERAL

1.1 Purpose of This Document

This technical document is meant to be used in system development. This document contains necessary data concerning the module in question, which system designer needs in system development work.

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1.2 About Manufacturer

Epec Oy helps its customers to manufacture efficient, safe and environmental friendly mobile working machines and special vehicles which help their customers to maximise their productivity.

Epec is a solution provider specialized in embedded control systems, vehicle computers and information logistics systems for mobile machines. We believe that we know control systems for challenging conditions and we are able to offer a total solution from control units to project services and designing.

1.3 Epec CAN Module Family

Epec CAN Module Family is designed to operate in extreme environments, where vibration, wide temperature changes and moisture are normal conditions. The requirements for the system's reliability and safety have been the key words in module family development. A small and protective module casing keeps inside high performance microcontroller with lots of control capabilities.

1.4 Basic skills required

The user of this document must have professional skills on machine controlling, CAN communication, PLCopen programming according to IEC61131-1 and should have skills to use CoDeSys 2.1/2.3 /ANSI C programming environment.

Please refer CoDeSys 2.1/2.3/ C programming manual for further information on programming environment and required installations.

Please refer CAN and CANopen documentation from CAN in Automation (CiA) for further information on communication issues.

1.5 Safety guidelines

The user of this documentation should follow general machine safety guidelines, directives and regulation appropriate to his/her country or market area.

This product does not comply with SIL2 or SIL3 classifications and should not be used in such applications, e.g. lifting people, where SIL 2 or SIL3 are required by directives or other regulations.

A separate safety analysis is always recommended for the machine and its control system. The features of this product should be well documented in machine and control system documents

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so that the machine operator has the right information how to operate the machine correctly and safely.

This product is designed to be used only for machine controlling purposes. The manufacturer does not assume any responsibility for this product being fit for any particular application, unless otherwise expressly stated in writing by the manufacturer.

This product complies with those certifications and standards that are listed below. The manufacturer does not guarantee that this product complies any other certification, standard or test than listed below.

This product is not field serviceable, so it should not be opened at any situation.

An external fuse should be installed for the product or the system power supply.

The system should be designed and constructed according to the Epec general mounting and cabling instruction document.

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1.6 Warranty

The manufacturer does not assume any responsibility for the products being fit for any particular purpose, unless otherwise expressly stated in writing by the manufacturer.

The manufacturer gives the warranty of twelve (12) months to the products and thereto related firmware from commissioning or eighteen (18) months from the date of delivery of the products which ever occurs first

The manufacturer is during the warranty period responsible for defects in the products and thereto related firmware resulting from faults in material, design or workmanship. The manufacturer's only obligation under this warranty is to, at its sole discretion, either to replace the products and/or thereto related firmware or to repair the defective products. The manufacturer shall, at its sole option, repair the products at its manufactory in Seinäjoki, Finland.

The warranty does not cover any costs related to removing or fastening of devices related to the products. Neither does the warranty cover the expenses of sending devices to or from the manufacturer for repairs. The warranty does not cover possible expenses relating to travelling, accommodation, daily benefits, etc. of installers.

The warranty becomes null and void if the buyer and/or a third party alters the products or the firmware in any way or if they are not used in accordance with the Manufacturer's operating instructions.

All claims with respect to defects in the products shall be made to the manufacturer without delay and no later than on the seventh (7th) day after the defect has been or should have been discovered by the buyer. The manufacturer strives to reply to the claim in writing within two (2) weeks from the receipt of the claim. The buyer shall attach to the claim a possible error report or equivalent explanation of the grounds for the claim.

The manufacturer gives no other warranties whatsoever for the products than the warranty set out in this section and thus the warranty given in this section sets forth the warranty given by the manufacturer in its entirety.

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1.7 Limited liability

The manufacturer shall under no circumstances be liable for loss of production, loss of profit, loss of use or any other consequential damages and/or indirect losses, whatever their cause may be. In case claims based on product liability are brought against the Manufacturer for which claims the manufacturer may be liable, the manufacturer's liability is limited to the extent normally covered under normal product liability insurances.

The buyer shall compensate the manufacturer to the extent that the manufacturer might be liable to pay damages as a result of claims based on product liability according to paragraph above.

1.8 Environmental statement

The manufacturer uses ISO14001 environmental certified processes and materials to manufacture products. The manufacturer undertakes to arrange for the recycling and scrapping of the products that are returned to the manufacturer by the buyer and/or the products that are received by the Manufacturer in connection with maintenance services performed as a result of that repairing of the products is deemed by the manufacturer to be inappropriate.

The manufacturer will charge a scrapping fee from the buyer according to the manufacturer's price list in force from time to time. No scrapping fee will, however, be charged for products that are received by the manufacturer during the warranty period.

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2 COLOUR DISPLAY GENERAL DESCRIPTION

The 2040 Colour Display is used as a graphical user interface of a machine's control system. The display is based on TFT technology and provides the latest communication options for the machine operator. The 2040 Display is a solid part of a control system and it allows mounting also outside the cabin. Typically the unit is installed in the dashboard, or on top of a display pedestal, allowing user to adjust the angle and position freely.

Features

- 5.7" QVGA (1/4 VGA) Colour TFT-LCD display
- 32-bit RISC processor
- 64 MB Flash
- 32 MB or 64 MB RAM
- 512 kB NVRAM
- 2 x CAN interface (ISO High Speed)
- 2 x USB 1.1 host interface
- Serial interface:
 - 1 x RS232, or
 - 1 x RS485 / RS422
- 10/100 Ethernet
- Linux 2.6 Operating System
- Operating voltage 11 – 30 VDC
- Overheating and short-circuit protection for outputs
- 5 x soft key buttons for user interface
- Real-Time Clock
- IP66
- Weight 1,0 kg

Applications

- Forest Machines
- Road Maintenance
- Construction Machines
- Crushing Stations
- Industrial Machines
- Agricultural applications
- Automation applications
- Mining Machines

There are different hardware revisions of this product that have different ordering codes. The versions differ regarding the serial interface and memory according to the following table.

Hardware revision	RAM Memory	Serial interface
D00	32 MB	RS232
D01	32 MB	RS485/RS422
D02	64 MB	RS232
D03	64 MB	RS485/RS422



The display's hardware revision can be checked via Application Loader software. For more information refer to the Application Loader manual.

2.1 Monitoring Functions

Following issues can be monitored by the application

- Temperature
- Power supply under voltage

Operating system deadlock is monitored by the hardware watchdog that reboots the module automatically after 180 s deadlock.

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2.2 Programming Environment

This product can be programmed with either ANSI C or CoDeSys 2.3 Visualization depending on the module's firmware. The firmware version can be checked via Application Loader software. For more information refer to the Application Loader manual.

CoDeSys 2.3 Visualization displays can be identified by the CoDeSys license label attached by Epec. In addition C and CoDeSys programmable versions both have their own product codes.

For further information refer to programming manuals.

2.3 Remote Connectivity

Display units that have a firmware revision 3.0 or newer, and are programmed with ANSI C have a possibility for GPRS and Modbus Connectivity. Also, a safe Ethernet connection using OpenVPN is possible for these kinds of displays (a server with an OpenVPN software is required).



The display's firmware version can be checked via Application Loader software. For more information refer to the Application Loader manual.

GPRS Connectivity

For enabling the GPRS connectivity in display, the display requires:

- one free RS232 connector
- Remote connectivity license (Epec ordering code MN0276)
- Cinterion/Siemens MC35iT GPRS modem (Epec ordering code KY0016; cables, antenna and power adapter are included)

To enable the connection, you also need

- A SIM card for the modem from your service provider (for more information, refer to the MC35iT Terminal Hardware Interface Description)
- Server with an OpenVPN software

For more information on GPRS connectivity, refer to the Epec Remote Connectivity Manual (MAN000391).

Modbus Connectivity

For enabling the Modbus Slave connectivity in display, the display must have:

- Modbus/TCP Slave license (Epec ordering code MN0277)
- Ethernet connection to a Modbus master

For more information on Modbus connectivity, refer to the Epec Modbus Manual (MAN000286).

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3 GENERAL PURPOSE I/O

The Colour Display Module has some inputs and outputs or, in other words, I/O pins of different types. The purpose of GPIO pins is to provide connection for switches, indicator lamps and other similar devices.

3.1 Digital Input / Digital Output

3.1.1 Pins X2.4 and X2.6

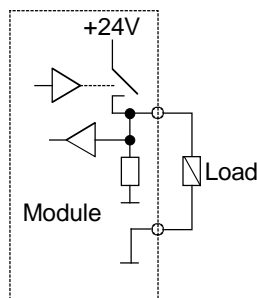
Pins X2.4 and X2.6 are current sourcing outputs. In other words, pin connects the supply voltage to the load. The application program can also simultaneously monitor the actual state of the pin. This feature makes it possible to detect short circuits to the ground. Open loads can not be detected because the internal load resistor is connected to the ground.

In very carefully selected applications a pin of this type can also be used as an input by using the output state monitoring feature. In those cases the output functionality of the pin must of course be kept in off state. It must be taken care in system design that the output unintentionally switching to on state causes no harm to the system.

Electrical Characteristics

Symbol	Parameter	Conditions	Min	Max	Units
R_O	Output Resistance	Output On	0,4 (typ.)		Ω
I_O	Output Current	Output On		1,5	A
R_I	Input Resistance	Output Off	8 (typ.)		$k\Omega$
V_{IH}	Input High Voltage	Output Off	4,8	V_{IN}	V
V_{IL}	Input Low Voltage	Output Off	-0,5	4,2	V
I_{SCL}	Short Circuit Current Limit		4 (typ.)		A

Connection Principle



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3.2 Digital Input

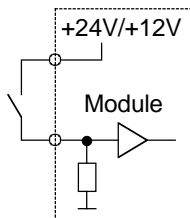
3.2.1 Pins X2.1 ... X2.3

Pins X2.1...X2.3 are ground referenced inputs (**DI**). These pins have 10 kΩ resistor connected to GND.

Electrical Characteristics

Symbol	Parameter	Conditions	Min	Max	Units
R _I	Input Resistance		10 (typ.)		kΩ
V _{IH}	Input High Voltage		4,8	30	V
V _{IL}	Input Low Voltage		-0,5	4,2	V
C _I	Input Capacitance		10 (typ.)		nF

Connection Principle



3.3 Closed Loops Wiring

It is strongly recommended to use closed loops for connecting all sensors, actuators etc. devices to I/O modules. Closed loops wiring can be achieved by connecting the GND wire from the sensor, actuator etc. device into the GND pin of module connector. If it is not possible to use closed loops, use DI pins instead.

3.4 AMPSEAL Connectors

Epec uses gold plated, locked and sealed AMPSEAL heavy duty connectors for all Epec CAN Module Family products to ensure the endurance of extreme conditions.

- 8-pin AMPSEAL for power and system CAN connections
- 23-pin AMPSEAL for I/O, USBs, Ethernet and RS232
- All connectors are mechanically keyed to mate only with identical colours

AMPSEAL connector	Epec ordering code
AMP 23-pin grey plug (female)	KX0007
AMP 23-pin black plug (female)	KX0008
AMP 23-pin blue plug (female)	KX0009
AMP 8-pin black plug (female)	KX0187

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3.5 AMPSEAL Cable Dimensions

Size		Insulation diameter range	Strip length $\pm 0,4$
mm²	AWG		
0,5	20	1,7	5,1
0,8	18	to	5,1
1,4	16	2,7	5,1
Typical hand crimping tool e.g.:			AMP Procrimper 58529-1, Epec ordering code TT0018

- All applied cables should be properly shielded, bundled and grounded
- See the General Mounting and Cabling Instructions for Epec Modules for more detailed information about the cabling

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4 POWER SUPPLY

- Nominal supply voltage 12...24 VDC
- Operating range 11...30 VDC

4.1 Overvoltage

- Max. 70 VDC (Stresses above this value may cause permanent damage to the module.)
- Module has a shutdown circuit which protects the module and loads against over-voltage. The shutdown circuit cuts off the power feed for the logic and loads in case of over-voltage. The shutdown circuit is activated when voltage reaches circa 32 V. Power feed is restored when supply voltage drops to 30 V.

4.2 Power Consumption

- Approx. 7 W (+24 VDC, no external load)
- Over-current protected

4.3 Power Supply Pins

Designation	Connector / pin number	Potential
Supply voltage	X1.5	+VDC (+11...30 VDC)
Ground (for supply voltage)	X1.1	GND
Supply voltage for isolated CAN2	X1.4	+VDC isolated (+10...30 VDC)
Ground for isolated CAN2	X1.3	GND isolated
Ground	X2.5	GND

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5 DISPLAY

TFT element inside the 2040 display is a high-definition wide temperature range industrial-type element. As being an LCD type of an element, it is partially depended on the outside temperature of the unit. An LCD display is typically dimmer and works slower below zero Celsius until the display warms up with the help of a display backlight. The LCD element has the following characters:

Designation	Description
Type	Colour TFT LCD
Size	5,7 inch
Backlight	CCFL (typical lifetime 50 000 h @ 25 °C)
Resolution	320 x 240
Brightness (adjustable)	350 cd/m ² (typical)
Contrast ratio	350 (typical)

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6 BUS CONNECTIONS

6.1 CAN Bus Connection Pins

The CAN communication pins and the power supply are connected in the module's AMP8 connector as follows:

Designation	Connector / pin number
CAN1 interface, system interface	X1.2 (CAN H)
	X1.6 (CAN L)
CAN2 interface (isolated)	X1.7 (CAN H)
	X1.8 (CAN L)

6.2 CAN Interface

- Physical interface is according to ISO 11898 and CAN 2.0B protocol
- Higher layer protocol is user programmable (CAN1 and CAN2) communication
- With CoDeSys Visualization CAN1 and CAN2 are CANopen compatible
- Independent controllers for CAN1 and CAN2
- Galvanic isolation for CAN2

6.3 Universal Serial Bus (USB 1.1 host)

USB ports provide a flexible way to attach peripheral devices. However, it should be noted that the core of the Colour Display is based on embedded processor architecture. Therefore, it is strongly recommended to consult Epec to assess the compatibility with the product when selecting a new USB device.

USB Bus Connection Pins

Designation	Connector / pin number
USB1 interface	X2.18 (USB1_D-)
	X2.19 (USB1_D+)
USB2 interface	X2.20 (USB2_D-)
	X2.21 (USB2_D+)
5V for USB device	X2.12 (USB1)
	X2.14 (USB2)
GND	X2.11 (USB1)
	X2.13 (USB2)

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6.4 Serial Interface

There are two different hardware versions of this product that have different ordering codes. The versions differ regarding the serial interface: the other version has an RS232 interface as the other version has an RS485/422 interface.

6.4.1 RS232 Connection Pins

Designation	Connector / pin number
RS232 interface	X2.7 (RX) X2.8 (TX) X2.22 (RTS) X2.23 (CTS)
GND	X2.15

6.4.2 RS485/422 Connection Pins

Designation	Connector / pin number
RS485 interface	X2.7 (B) X2.8 (A)
RS422 interface	X2.7 (RX_B) X2.8 (RX_A) X2.22 (TX_B) X2.23 (TX_A)
GND	X2.15

6.5 ETHERNET Interface

Designation	Connector / pin number
Ethernet interface	X2.9 (RX+) X2.10 (TX+) X2.16 (RX-) X2.17 (TX-)

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7 ENVIRONMENTAL CHARACTERS

Epec CAN module family is designed for extreme environments and the product family is certified with normal automotive (e17) EMC standards and has shock and vibration endurance up to 50 G.

- Operating temperature range -20°C ... +60°C
- Storage temperature range -30°C ... +70°C

7.1 Protection

- IP66 (classification according to IEC 60529)
- Module is equipped with Oil Rating 7 (according to test method AATCC 118-1997ASTM) hydrophobic and oleophobic Gore HPM Membrane Vent
- Protection for plugs depends on cable processing
- All cables, connectors and tools must be of correct type and sufficiently high quality. Also the environmental suitability of equipment should be checked (protection for moisture, mechanical stability, power durability, coupling resistance, among other things)

7.2 EMC Tests

Epec 4G modules are certified according to following tests:

ISO/DIS 14982 (1998) Agricultural and forestry machines-electromagnetic compatibility-test methods and acceptance criteria							
Electrostatic discharge (ESD) immunity test	<ul style="list-style-type: none"> • Test method EN61000-4-2 (1995) • Performance criterion B <table border="1"> <thead> <tr> <th>Discharge mode</th> <th>Test level (kVp)</th> </tr> </thead> <tbody> <tr> <td>Contact</td> <td>± 2, ± 4, ± 6</td> </tr> <tr> <td>Air</td> <td>± 2, ± 4, ± 8</td> </tr> </tbody> </table>	Discharge mode	Test level (kVp)	Contact	± 2, ± 4, ± 6	Air	± 2, ± 4, ± 8
Discharge mode	Test level (kVp)						
Contact	± 2, ± 4, ± 6						
Air	± 2, ± 4, ± 8						
Transient and surges in vehicular environment immunity test Note: The Mini module (2038) and the Mini display (2029) need the Hub module (2021) in order to reach the full transient immunity.	<ul style="list-style-type: none"> • Test method ISO 7637-2 (1990), pulse 5 • Performance criterion B <table border="1"> <thead> <tr> <th>Pulse</th> <th>Pulse parameters</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>Us=+70V, tr=10ms, td=600ms</td> </tr> </tbody> </table>	Pulse	Pulse parameters	5	Us=+70V, tr=10ms, td=600ms		
Pulse	Pulse parameters						
5	Us=+70V, tr=10ms, td=600ms						
Commission directive 72/245/EEC, as last amended by commission directive 2006/28/EC Requirements to be met by vehicles and electrical/electronic sub-assemblies fitted to a vehicle							

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<p>Radiated disturbance emission test</p>	<ul style="list-style-type: none"> Test method 2005/83/EC, ANNEXES VII and VIII <table border="1" data-bbox="874 315 1433 555"> <thead> <tr> <th>Frequency (MHz)</th> <th>Limit value (dBμV/m)</th> </tr> </thead> <tbody> <tr> <td>30 – 1000</td> <td>62/52/63 (Broadband QP)</td> </tr> <tr> <td>30 – 1000</td> <td>52/42/53 (Narrowband AVE)</td> </tr> </tbody> </table>	Frequency (MHz)	Limit value (dB μ V/m)	30 – 1000	62/52/63 (Broadband QP)	30 – 1000	52/42/53 (Narrowband AVE)																						
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<p>Conducted disturbances emission test</p>	<ul style="list-style-type: none"> Test method 2005/83/EC, ANNEX X <table border="1" data-bbox="874 667 1433 763"> <thead> <tr> <th>Port</th> <th>Limit level (V)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">24V DC input</td> <td>+150</td> </tr> <tr> <td>-450</td> </tr> </tbody> </table>	Port	Limit level (V)	24V DC input	+150	-450																							
Port	Limit level (V)																												
24V DC input	+150																												
	-450																												
<p>Immunity to transient disturbances conducted along supply lines test</p> <p>Note: The Mini module (2038) and the Mini display (2029) need the Hub module (2021) in order to have the full transient immunity.</p>	<ul style="list-style-type: none"> Test method 2005/83/EC, ANNEX X Performance criterion: <table border="1" data-bbox="991 904 1334 1133"> <thead> <tr> <th>Pulse</th> <th>Criterion</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>C</td> </tr> <tr> <td>2a</td> <td>B</td> </tr> <tr> <td>2b</td> <td>C</td> </tr> <tr> <td>3a</td> <td>A</td> </tr> <tr> <td>3b</td> <td>A</td> </tr> <tr> <td>4</td> <td>C</td> </tr> </tbody> </table> <table border="1" data-bbox="874 1167 1433 1424"> <thead> <tr> <th>Pulse</th> <th>Pulse parameters</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>3/2000μs, -600V, 1000 pulses</td> </tr> <tr> <td>2a</td> <td>1/50μs, +100V, 1000 pulses</td> </tr> <tr> <td>2b</td> <td>20V, 220ms, 2 pulses</td> </tr> <tr> <td>3a</td> <td>5/100ns, -200V, 60minutes</td> </tr> <tr> <td>3b</td> <td>5/100ns, +150V, 60minutes</td> </tr> <tr> <td>4</td> <td>100ms -20,5(8,0)V, 20s - 16,5(12,0)V, 2 pulses</td> </tr> </tbody> </table>	Pulse	Criterion	1	C	2a	B	2b	C	3a	A	3b	A	4	C	Pulse	Pulse parameters	1	3/2000 μ s, -600V, 1000 pulses	2a	1/50 μ s, +100V, 1000 pulses	2b	20V, 220ms, 2 pulses	3a	5/100ns, -200V, 60minutes	3b	5/100ns, +150V, 60minutes	4	100ms -20,5(8,0)V, 20s - 16,5(12,0)V, 2 pulses
Pulse	Criterion																												
1	C																												
2a	B																												
2b	C																												
3a	A																												
3b	A																												
4	C																												
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2a	1/50 μ s, +100V, 1000 pulses																												
2b	20V, 220ms, 2 pulses																												
3a	5/100ns, -200V, 60minutes																												
3b	5/100ns, +150V, 60minutes																												
4	100ms -20,5(8,0)V, 20s - 16,5(12,0)V, 2 pulses																												

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<p>Radiated radio-frequency electromagnetic field immunity test</p>	<ul style="list-style-type: none"> • Test method 2005/83/EC, ANNEX IX • Performance criterion: No degradation of 'Immunity-related functions' <table border="1" data-bbox="858 349 1433 678"> <thead> <tr> <th>Specification</th> <th>Frequency Range (MHz)</th> <th>Test level</th> </tr> </thead> <tbody> <tr> <td>Modulation AM80% 1kHz Sweep step 1%, time/step 3s</td> <td>20-800</td> <td>30V/m</td> </tr> <tr> <td>PM 577/4600µs</td> <td>800-2000</td> <td>30V/m</td> </tr> </tbody> </table>	Specification	Frequency Range (MHz)	Test level	Modulation AM80% 1kHz Sweep step 1%, time/step 3s	20-800	30V/m	PM 577/4600µs	800-2000	30V/m
Specification	Frequency Range (MHz)	Test level								
Modulation AM80% 1kHz Sweep step 1%, time/step 3s	20-800	30V/m								
PM 577/4600µs	800-2000	30V/m								
<p>EN 61000-6-3 (2001) Electromagnetic compatibility-generic emission standard part6-3: residential, commercial and light industry</p>										
<p>Radiated disturbance emission test</p> <p>Note: The Color display (2040) needs extra facilities in order to have the limit B covered.</p>	<ul style="list-style-type: none"> • Test method EN 55022 (1994) <table border="1" data-bbox="896 952 1410 1238"> <thead> <tr> <th>Limit</th> <th>Frequency (MHz)</th> <th>Limit value (dBµV/m)</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>30 – 1000</td> <td>40/47 (QP)</td> </tr> <tr> <td>B</td> <td>30 – 1000</td> <td>30/37 (QP)</td> </tr> </tbody> </table>	Limit	Frequency (MHz)	Limit value (dBµV/m)	A	30 – 1000	40/47 (QP)	B	30 – 1000	30/37 (QP)
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B	30 – 1000	30/37 (QP)								
<p>Conducted disturbance at main ports emission test</p>	<ul style="list-style-type: none"> • Test method EN 55022 (1994) <table border="1" data-bbox="935 1366 1370 1653"> <thead> <tr> <th>Frequency (MHz)</th> <th>Limit value (dBµV)</th> </tr> </thead> <tbody> <tr> <td>0,15 - 30</td> <td>66/56/60 (QP)</td> </tr> <tr> <td>0,15 – 30</td> <td>56/46/50 (AVE)</td> </tr> </tbody> </table>	Frequency (MHz)	Limit value (dBµV)	0,15 - 30	66/56/60 (QP)	0,15 – 30	56/46/50 (AVE)			
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<p>EN 61000-6-2 (2005) Electromagnetic compatibility-generic immunity standard part6-2: industrial environment</p>										

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<p>Conducted radio-frequency common mode immunity test</p>	<ul style="list-style-type: none"> • Test method EN 61000-4-6 (1996) • Performance criterion A <table border="1" data-bbox="858 320 1433 562"> <thead> <tr> <th>Specification</th> <th>Port</th> <th>Test level</th> </tr> </thead> <tbody> <tr> <td>Frequency range 0.150-80MHz Modulation AM80% 1kHz Sweep step 1%, time/step 3s</td> <td>DC input port</td> <td>10Vemf</td> </tr> <tr> <td></td> <td>Signal ports</td> <td>10Vemf</td> </tr> </tbody> </table>	Specification	Port	Test level	Frequency range 0.150-80MHz Modulation AM80% 1kHz Sweep step 1%, time/step 3s	DC input port	10Vemf		Signal ports	10Vemf
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	Signal ports	10Vemf								
<p>Radiated radio-frequency electromagnetic field immunity test</p>	<ul style="list-style-type: none"> • Test method EN 61000-4-3 • Performance criterion A <table border="1" data-bbox="858 723 1433 1003"> <thead> <tr> <th>Specification</th> <th>Range (MHz)</th> <th>Test level</th> </tr> </thead> <tbody> <tr> <td>Frequency range 80-2700MHz Modulation AM80% 1kHz Sweep step 1%, time/step 3s</td> <td>80-1000</td> <td>20V/m</td> </tr> <tr> <td></td> <td>1000-2700</td> <td>3V/m</td> </tr> </tbody> </table>	Specification	Range (MHz)	Test level	Frequency range 80-2700MHz Modulation AM80% 1kHz Sweep step 1%, time/step 3s	80-1000	20V/m		1000-2700	3V/m
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	1000-2700	3V/m								
<p>Electrical fast transient (EFT/B) immunity test</p>	<ul style="list-style-type: none"> • Test method EN 61000-4-4 (1995) • Performance criterion B <table border="1" data-bbox="858 1173 1433 1379"> <thead> <tr> <th>Test pulse</th> <th>Port</th> <th>Test level</th> </tr> </thead> <tbody> <tr> <td>5(Tr)/50(Th) ns, repetition frequency 5kHz, duration 1 minute</td> <td>DC input port</td> <td>± 2,0kVp</td> </tr> <tr> <td></td> <td>Signal ports</td> <td>± 2,0kVp</td> </tr> </tbody> </table>	Test pulse	Port	Test level	5(Tr)/50(Th) ns, repetition frequency 5kHz, duration 1 minute	DC input port	± 2,0kVp		Signal ports	± 2,0kVp
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<p>CFR 47 Part 15, Subpart B, Class A and B Code of federal regulations (cfr) title 47 telecommunication, part15 radio frequency devices, subpart b unintentional radiators Class a intended for use in industrial/commercial environments Class b intended for use in residential/small office environments</p>										

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<p>Radiated emissions</p> <p>Note: The Color display (2040) needs extra facilities in order to have the class B covered.</p>	<ul style="list-style-type: none"> Test method ANSI C63.4 and EN55022 <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Class</th> <th>Frequency (MHz)</th> <th>Limit value (dBμV)</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>30 – 1000</td> <td>40/47 (QP)</td> </tr> <tr> <td>B</td> <td>30 – 1000</td> <td>30/37 (QP)</td> </tr> </tbody> </table>	Class	Frequency (MHz)	Limit value (dB μ V)	A	30 – 1000	40/47 (QP)	B	30 – 1000	30/37 (QP)
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<p>CLASSIFICATION OF PERFORMANCE CRITERION</p> <p>A: All functions of a device/system perform as designed during and after exposure to disturbance.</p> <p>B: All functions of a device/system perform as designed during and after exposure to disturbance. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain class A.</p> <p>C: One or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.</p> <p>D: One or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and a device/system is reset by simple "operator/use" action.</p> <p>E: One or more functions of a device/system do not perform as designed during exposure and cannot be returned to operation without repairing the device/system.</p>										

7.3 Environmental Tests

The following environmental tests have been performed to Epec 2040 Colour Display:

Temperature			
Test	Temperature	Duration/ Exposure time	Remarks
Cold IEC 60068-2-1, Test Ab	-25 °C	16 h	-
Dry heat IEC 60068-2-2, Test Bb	55 °C	16 h	-
Damp heat cycling IEC 60068-2-30, Test Db	+25 °C/+40 °C		<ul style="list-style-type: none"> rel. humidity >90% six test cycles
Change of temperature IEC 60068-2-14, Test Na	-30 °C/+60 °C	3 h	<ul style="list-style-type: none"> change time between extreme temperatures 1-2 min 5 test cycles
Change of temperature IEC 60068-2-14, Test Nb	-25 °C/+30 °C	3 h	<ul style="list-style-type: none"> change of temperature 5 °C/min 2 test cycles

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Mechanical resistance			
Test	Duration and direction	Remark	
Shock/Bump test IEC 60068-2-27, and - 29, Tests Ea and Eb	<ul style="list-style-type: none"> • pulse duration 11 ms • 500 impulses in every six directions 	<ul style="list-style-type: none"> • half sine pulse shape • peak acceleration 50 m/s² 	
Vibration, random IEC 60068-2-64, Test Fh	<ul style="list-style-type: none"> • test duration 30 min in every three test direction 	<ul style="list-style-type: none"> • ASD-level 0,5 m²/s³, 10 ... 200 Hz • total spectral acceleration 0,97 grms 	
Free fall, IEC 60068-2-32, Test Ed	<ul style="list-style-type: none"> • one fall / direction on each surface and corner 	<ul style="list-style-type: none"> • fall height 100 cm 	
Corrosion			
Test	Temperature	Duration	Concentration
Salt spray test ISO 9227	+35 °C	24 h	50 g/l, NaCl

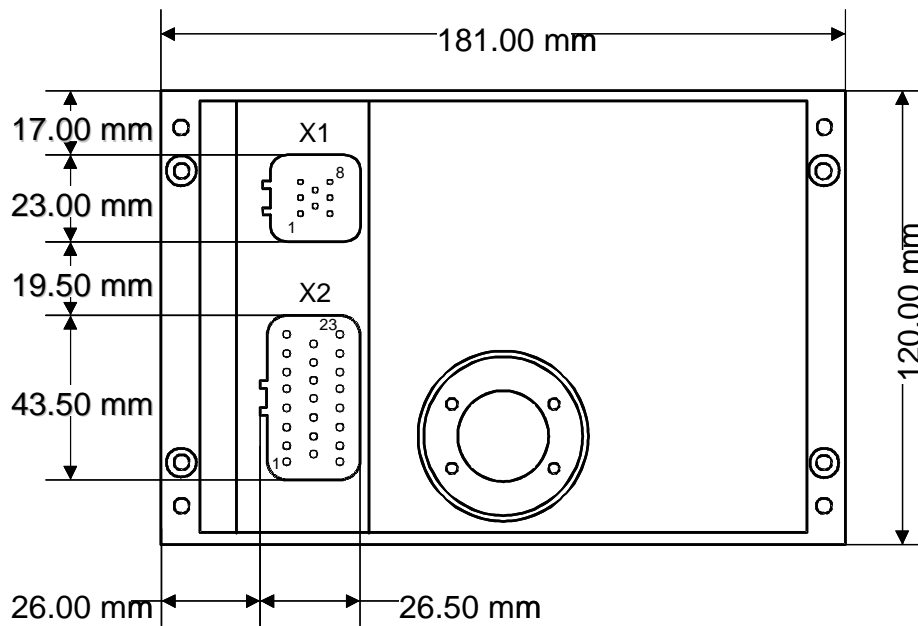
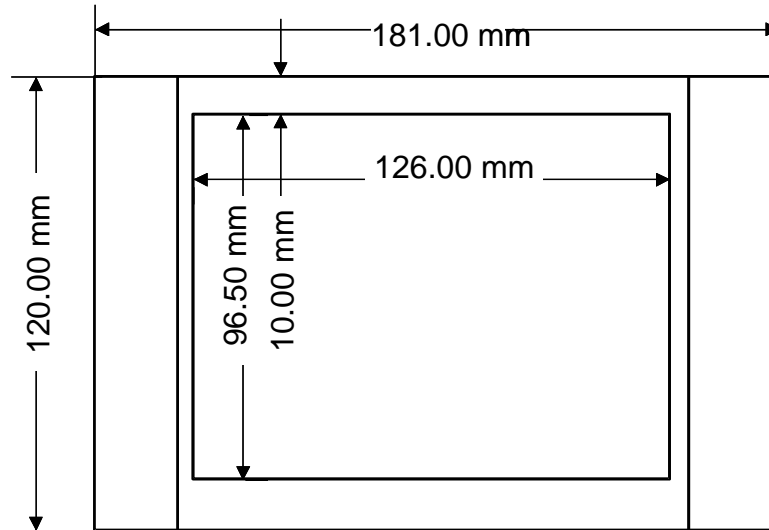
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8 HOUSING

- Closed light cast aluminium housing
- Powder-painted, hexavalent chromium free passivation for aluminium
- Ball-pivot or panel mounting
- Available accessories are for example connector cover and mounting pedestal

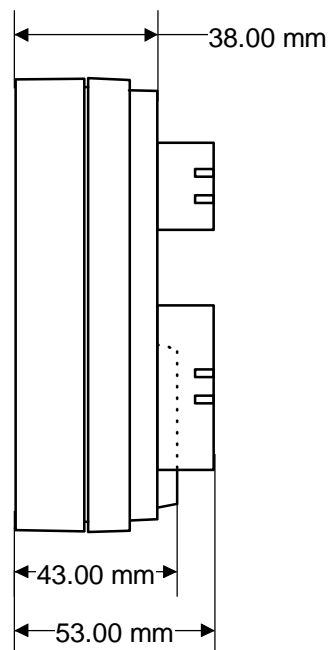
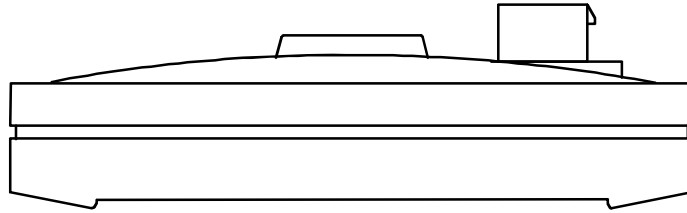
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9 UNIT DIMENSIONS



Scale 1:2

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Scale 1:2

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10 ADDITIONAL DOCUMENTS

For more information on Epec control system products, assembly and programming please refer to the following documents:

Document ID	Document name	Document description
MAN000101	MountingInstructions	General mounting and cabling instructions for Epec modules
MAN000288	CoDeSys 2.3 Visualization	Programming instructions for CoDeSys 2.3 Visualization environment
MAN000281	ANSI C	Programming instructions for ANSI C environment, Visual C++ 6.0
MAN000240	C Programming	Programming instructions for C environment
MAN000245	Application Loader	Instructions for using Application Loader software
MAN000391	Remote Connectivity Manual	Instructions for using GPRS and VPN connectivity with Epec display
MAN000286	Modbus Manual	Instructions for using Modbus slave connectivity with Epec display

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