Epec 6107 Display Unit

Technical Manual and Cabling Instructions



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DOCUMENT VERSION HISTORY

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TABLE OF CONTENTS

1 PREFACE 5
1.1 Use of Symbols 5
1.2 Basic Skills Required 6
1.3 Safety Guidelines 6
1.4 Warranty 7
1.5 Limited Liability 8
1.6 Environmental Statement 8

2 PRODUCT OVERVIEW 6107 DISPLAY UNIT 9

3 TECHNICAL DATA 11

4 CONNECTORS AND PIN ASSIGNMENTS 14

5 DO/DI 17

6 AI/DI 19

7 DI 22

8 +5 V REF 23

9 POWER SUPPLY 25

10 INTERFACES 27
10.1 CAN Bus 27
10.2 RS-232 28
10.3 USB 29
10.4 Ethernet 30
10.5 Camera 31
10.6 GSM/UMTS (GPRS/3G/HSPA+/Modem) 32
10.7 GPS/GLONASS 33

11 INTERNAL DIAGNOSTICS 35
11.1 Temperature and Voltage Monitoring 35
11.2 + 5 V REF Diagnostics 37

12 APPROVALS AND SAFETY 38
12.1 R&TTE Directive (1999/5/EY) 38
12.1.1 EMC Tests 38
12.1.2 RF Tests 38
12.1.3 Low Voltage Directive (2014/35/EU) 38
12.2 Environmental Tests 39

13 MECHANICS AND CABLING 40
13.1 Unit Dimensions 40
13.2 Mounting and Cleaning 42
13.2.1 Pedestal Mounting 43
13.2.2 Panel Mounting 44
13.3 Plugging and unplugging the cables/connectors 45
13.4 Cabling 47
13.4.1 System Topologies 47
13.4.2 CAN Bus Cabling 50
13.4.3 I/O Cabling 52
13.4.4 Ethernet Cabling 54
13.4.5 RS-232 Cabling 56
13.4.6 USB Cabling 57
13.4.7 Power Supply Cabling 58
13.5 Welding 59

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13.6 System Examples 60
13.7 Accessories and Ordering Codes 62

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1 PREFACE

1.1 Use of Symbols

This manual uses the following symbols to point out important information or safety instructions:



The information icon indicates important information and issues to be noted for the reader.



The caution icon indicates very important information or a warning. If the advices are ignored, it can result in personal injury or damage to software or equipment.



The (electrical) warning icon indicates a hazard which could cause an electrical danger and/or a personal injury.

This product uses the following symbols to point out important information or safety instructions:



Caution, surface may be hot.



CE compatibility
This symbol indicates that the product described in this manual complies with the requirements set in the CE Standard.



Europe-EU Declaration of Conformity
This equipment complies with the essential requirements of the European Union Directive R&TTE 1999/5/EY

This equipment may be operated in:

AT	BE	CY	CZ	DK	EE	FI	FR
DE	GR	HU	IE	IT	LV	LT	LU
MT	NL	PL	PT	SK	SI	ES	SE
GB	IS	LI	NO	CH	BG	RO	TR

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WEEE symbol
This symbol indicates that the product must be sent to separate collection facilities for recovery and recycling when the end-user wishes to discard the product.



E17 Approval
This product is certified with normal automotive (E17) EMC (electromagnetic compatibility) standards.



RCM (Regulatory Compliance Mark)
This product complies with the ACMA (Australian Communications and Media Authority) regulatory arrangements concerning electromagnetic compatibility and radio equipment.

1.2 Basic Skills Required

The user of this document must have basic knowledge of machine controlling, CAN communication, PLCopen programming according to IEC61131-1 and should have skills to use CODESYS 2.3/3.5 programming environment.

Refer to CODESYS 2.3/3.5 manual for further information concerning the programming environment and required installations.

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

1.3 Safety Guidelines

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

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 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.

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External fuses 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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1.4 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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1.5 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.

1.6 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.

WEEE

This product complies with the European Community Directive 2012/19/EU on waste electrical and electronic equipment (WEEE) encouraging and setting specific criteria for the collection, handling and recycling of electric and electronic waste.



This product includes a lithium battery soldered on the PCB's bottom side (placed on the upper right part of the PCB). When recycling the product, make sure that the battery is removed from the PCB and recycled separately.

RoHS

This product complies with the European Community Directive 2011/65/EU (RoHS) restricting hazardous substances such as quicksilver and lead in electrical and electronic equipment.

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2 PRODUCT OVERVIEW 6107 DISPLAY UNIT





Epec 6107 Display Unit is a high-performance and rugged full-color capacitive touch screen display designed for mobile machinery. Epec 6000 product platform is fully compatible to the existing Epec product portfolio. Some of the advances of the Epec 6107 Display Unit are listed below.

Efficiency

- A multifunction display unit / controller
  - 32 bit processor
  - high calculating power
  - includes Internal Graphics Processing Unit (GPU)
- Provides control system solutions for both centralized and distributed intelligence systems
- Can be used as a calculation unit and/or as remote access unit to provide access to internet services such as Epec GlobE service
- Fully compatible with the existing Epec product portfolio

Mechanics & hardware

- Bright and colorful display panel with resistive touch screen and wide viewing angles
- High brightness and contrast offers an excellent readability even in direct sunlight
- Robust, light and leak proof aluminum housing has been widely tested against different chemicals and environmental conditions
- The shape of the casing works to protect the electronics inside against mechanical wear
- Mounting can be done with a display pedestal or as a panel mounting
- Each connector is mechanically keyed to fit only to the correct, corresponding place
- Made in Finland

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Application programming

- Epec products are based on PLCopen and CANopen®, which make them easily scalable to meet requirements for both small and large machines
- Open I/O and communication interface, thus making it possible to connect
    - sensors,
    - actuators,
    - joysticks, and
    - other devices

  from other manufacturers to optimize the whole machine environment, both technically and ergonomically.
- Internal diagnostics which makes it possible to
    - detect e.g. overvoltage and overtemperature alarms and
    - program customized log applications
- For more information about programming, see *Epec Programming and Libraries Manual*, MAN000538 (provided in Epec Extranet)

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3 TECHNICAL DATA

General

Processor	32 bit CPU 792 MHz Includes Internal Graphics Processing Unit (GPU)
Memory	Flash memory: 4 GByte - 16 GByte RAM memory (DDR3): 1024 MByte Non-volatile memory: 512 kByte Memory sizes are hardware specific, check the device's memory sizes using ApplicationLoader software (for more information, refer to *ApplicationLoader Manual*).
Operating system	Linux
Programming	CODESYS 3.5
Power	Nominal supply voltage 12/24 VDC systems (8,4 ... 36 VDC) Power consumption 100 W (+24 VDC, full load), 50 W (+24 VDC, typical)
REF voltage outputs	+5 V
Diagnostics	Supply voltage Unit temperature Software cycle time REF voltage monitoring

Display

Display size and type	7”, TFT color LCD
Touch screen	Resistive GFG (For touch screen calibration, refer to *ApplicationLoader Manual*)
Resolution	WVGA 800 x 480 (5:3)
Number of colors	High color, 65 536 colors: 5 bits red, 6 bits green, 5 bits blue (16 bits)
Backlight	LED (lifetime 70 000 hours at 25 °C)
Display Panel Brightness	800 cd/m^2

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Display Panel Contrast	600:1
Viewing angle	170 ° (super wide)
Brightness control	Automatic/Manual LED backlight control

Mechanics:

Size / Outer dimensions	183 mm x 128 mm x 49,5 mm 7.2 in x 5.04 in x 1.95 in
Weight	1,1 kg 2.4 lbs
Protection class	IP 66
Case material	Aluminum
Operating temperature	-30... +70 °C -22...+158 °F -30... +55 °C with 2G/3G/GPS option -22... +131 °F with 2G/3G/GPS option
Storage temperature	-30... +70 °C -22...+158 °F

Connectors and communication:

Connectors	1 x AMP23 1 x mini-B USB (M12) 2-4 x M12 0-2 x SMA antenna connector
Communications/ Interfaces	Default interfaces:

Interface	Amount	Connector
CAN 2.0 B	2	AMP23
RS-232	1	AMP23
USB	2	AMP23: full speed (12 Mbps)* M12 miniB-USB: high speed (480 Mbps)
Ethernet	0-2	M12 (8 pin)

*only for application download

Optional interfaces:

Interface	Amount	Connector

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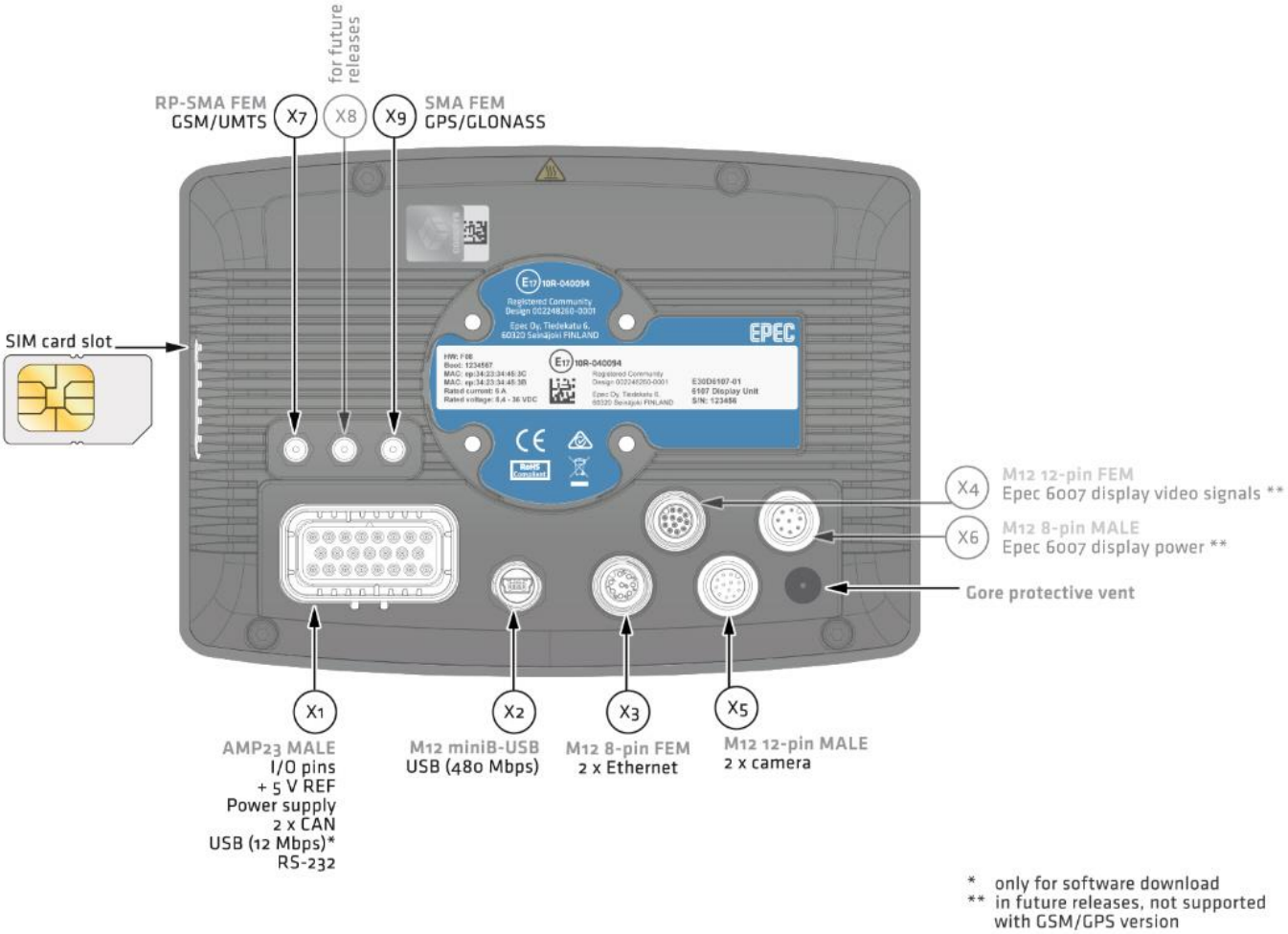
	Camera	2	M12 (12 pin)
	GSM/UMTS/HSPA+/ GPS/GLONASS	1	2 x SMA antenna SIM card slot
Other features	• RTC (Real-time Clock) with battery keeps time for approximately 10-15 years (depending on operating temperature) • Speaker		
I/O pins total	5		
Outputs	2x	DO/DI (sourcing, up to 1 A)	
Inputs	2x	DI (pull-down to GND)	
	1x	AI/DI (0-5 V / 0-22 mA and pull-up selection by application)	

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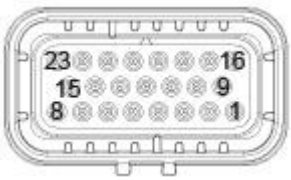
4 CONNECTORS AND PIN ASSIGNMENTS

This manual describes the full hardware version. Some of the features are optional and not implemented in all hardware versions.

The connectors are placed in the unit according to the following figure:



X1, AMP23 male connector (USB, RS-232, CAN1, CAN2, DI, AI/DI, DO/DI, + 5V REF, power supply)

Picture	Pin	Signal	I/O Type
	1	USB_H1_D+	
	2	USB_H1_D-	
	3	RS-232_TXD	
	4	RS-232_RXD	
	5	RS-232 RTS	
	6	RS-232 CTS	

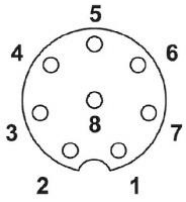
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	7	CAN1_L	
	8	CAN1_H	
	9	USB_H1_PWR	
	10	DATA_GND	
	11	DIGITAL_INPUT_1	DI/PI
	12	DIGITAL_INPUT_2	DI/PI
	13	CAN2_L	
	14	CAN2_H	
	15	CAN/USB_SHIELD	
	16	+5 V REF	
	17	ANALOG_INPUT	AI/DI
	18	AI GND	
	19	I/O_GND	
	20	DIGITAL_OUTPUT_1	PWM/DO/DI
	21	DIGITAL_OUTPUT_2	PWM/DO/DI
	22	PWR_GND	
	23	PWR_IN	

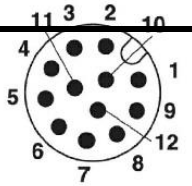
X2, mini-B-USB connector

Picture	Pin	Signal
	1	+5 V (max 500 mA)
	2	D-
	3	D+
	4	ID
	5	GND

X3, M12 connector (8 pin FEM, ethernet)

Picture	Pin	Signal
	1	RD2+
	2	TD2+
	3	TD2-
	4	RD1-
	5	TD1+
	6	RD1+
	7	RD2-
	8	TD1-

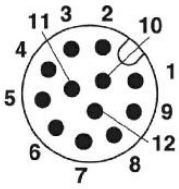
X4, M12 connector (12 pin FEMALE, Display video signals), not supported in 1-3. release

Picture	Pin	Signal
	1	EXTDISP_CLKP

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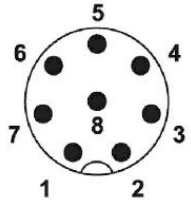
	2	EXTDISP_D0N
	3	EXTDISP_D0P
	4	EXTDISP_D1N
	5	EXTDISP_D1P
	6	GND
	7	EXTDISP_D2N
	8	EXTDISP_D2P
	9	EXTDISP_CLKN
	10	GND
	11	GND
	12	GND

X5, M12 connector (12 pin MALE, 2xcamera)

Picture	Pin	Signal (default configuration for composite video)	Signal (optional hw configuration for s-video)
	1	-	CAMERA1_CHROMA_INPUT
	2	-	CAMERA1_CHROMA_GND/SHIELD
	3	CAMERA1_COMPOSITE_INPUT	CAMERA1_LUMA_INPUT
	4	CAMERA1_COMPOSITE_GND/SHIELD	CAMERA1_LUMA_GND/SHIELD
	5	-	CAMERA2_CHROMA_INPUT
	6	-	CAMERA2_CHROMA_GND/SHIELD
	7	CAMERA2_COMPOSITE_INPUT	CAMERA2_LUMA_INPUT
	8	CAMERA2_COMPOSITE_GND/SHIELD	CAMERA2_LUMA_GND/SHIELD
	9	+12 V (CAMERA1)*	+12V (CAMERA1)*
	10	+12 V (CAMERA2)*	+12V (CAMERA2)*
	11	GND (CAMERA1)	GND (CAMERA1)
	12	GND (CAMERA2)	GND (CAMERA2)

* +12 V for cameras is not allowed when GSM/GPS is in use.

X6, M12 connector (8 pin MALE, Epec display power & communication signals), not supported in 1-3. release

Picture	Pin	Signal
	1	Serial data
	2	Serial clock
	3	GND
	4	INT
	5	GND
	6	SPKR+
	7	SPKR-
	8	+12,2 V

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5 DO/DI



It is recommended to use pins 20 and 21 as pairs (both configured to input mode or both configured to output mode).

Output (DO)

- This kind of pin is a current sourcing output with a pull-up selection
  - In other words, the pin connects the load to a positive supply voltage.
  - This pull-up feature is for open load detection when the pin is used as an output.
- These outputs have a switching element called a smart FET. It has integrated features to protect itself and also the external pin, wiring and actuator.
- When used as an output, the input feature indicates the output FET's state



It is recommended to use the function blocks in *DigitalOutputDiagnostics* library to protect and diagnose outputs when used as digital outputs. For more information, refer to *Epec Programming and Libraries Manual*.

Input (DI)

- This pin can be used as a digital input (DI)
- A pin of this type can also be used as an input by using the output state monitoring feature.
  - In this case, the output functionality of the pin type must be kept in the off state.
- It must be taken care in system design that the output unintentionally switching to on state causes no harm to the system.
- This pin can be used also with NPN-type sensors – sensors with open collector/open drain.
- It's highly recommended to use closed loop connections when the output pin is used as input. By keeping this simple principle in your mind you will avoid many unknown problems later on.

Electrical characteristics

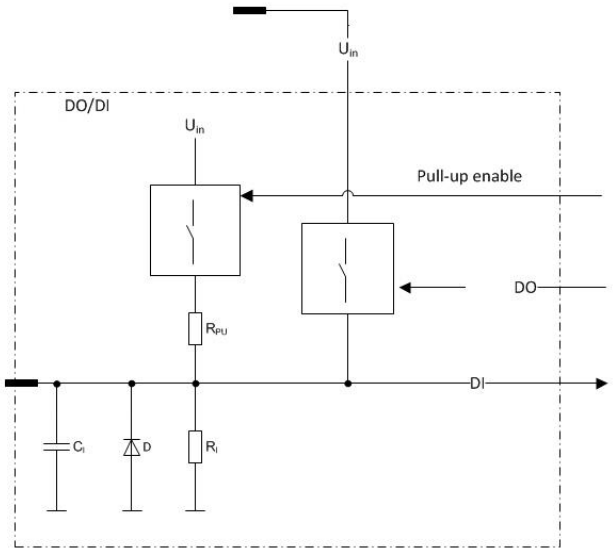
Symbol	Parameter	Conditions	Min	Max	Units
V_{Level}	Output voltage	Output Off, Pull-up selected, Unconnected pin, U_{in} = 24 V V_{Level} = U_{in}/1,3	typ. 18,5		V
I_o	Nominal Output Current	Output On	0	1	A

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		(Note 3, 4)			
$I_{o\text{-}lim}$	Internal current limitation	Output On (Note 2, 6)	typ. 12		A
Digital status input					
R_I	Input Resistance	Output Off, Pull-up resistor not selected, $V_I < U_{in}$ (referenced to GND)	typ. 44		kΩ
		Output Off, Pull-up resistor selected, (referenced to U_{in} /1,3)	typ. 8,1		kΩ
V_{IH}	High Voltage level	Output Off (Note 3, 8)	4,2	U_{in}	V
V_{IL}	Low Voltage level	Output Off (Note 8)		3,2	V
$V_{I\text{-}range}$	Input voltage range	(Note 7)	-0,5	U_{in}	V
t_I	Digital Status Input Pulse Width	(Note 1, 5)	> tC		ms
C_I	Input pin capacitance		typ. 1		nF

Note 1: tC denotes software cycle time.
Note 2: Current limit for short circuit protection to protect cabling and to limit internal power dissipation.
Note 3: Exceeding the max value might cause damage to input.
Note 4: The maximum output current depends on the load and temperature.
Note 5: Pulse width must be greater that the software cycle time. For example with 50/50 pulse ratio, the pulse frequency is 1 / (2*pulse width)
Note 6: When the limit is exceeded, the output voltage circuit starts to limit the current by switching the output voltage. The switching does not affect the application software.
Note 7: Overload conditions
Note 8: Includes hysteresis. The input state is maintained until the second voltage limit is exceeded.

Functional block diagram



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6 AI/DI



This pin has a dedicated AI GND pin (X1.18) that is internally connected to the I/O ground and data ground pins.

- This type of pin is an analog input and a digital input
- The configurable features are controlled by two control signals:
  - One control signal is for selecting:
    - Voltage mode: High impedance input for signal from 0 to 5 V with or without pull-up.
    - Current mode: Low impedance input for signal from 0 to 22 mA.
  - One control signal is for selecting (when in voltage mode):
    - Pull-up mode to +5 V by a resistor
    - Pull-down mode to GND by a resistor



Configure the pin to current mode before applying the current signal.



A switch will disconnect the measurement circuit if an overvoltage event is detected.
Overvoltage protection mode is indicated with a dedicated signal (*DEV_DSC_OVP_STATE_X1_17*). The protection mode is active as long as the overvoltage persists.
The protection circuit can be bypassed (the switch will reconnect the measurement circuit) momentarily with a reset signal (*DEV_DSC_OVP_RESET_X1_17*). The signal is edge activated and the bypass time is fixed.

DI

- This pin can also be used as digital input by using an application library.
- The pin must be configured to voltage mode when used as a digital input

Electrical characteristics

Symbol	Parameter	Conditions	Min	Max	Units
V_I	Input Voltage measuring range	Voltage mode	0	5	V
	Overvoltage Detection Threshold	Protection mode not active (Note 5)	typ. 7,2		V
		Protection mode active (Note 5)	typ. 5,6		V
	Scaling factor	Voltage mode (Note 4)	10/11		
		Current mode (Note 4)	10/11		

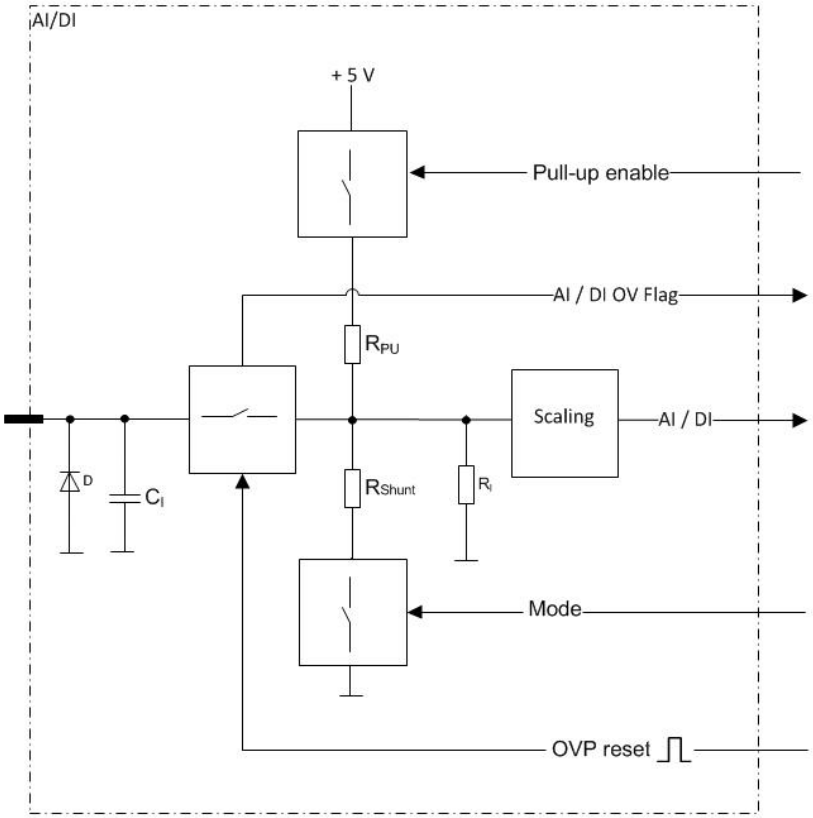
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V_{PU}	Pull-up voltage	(Note 1)	typ. 5		V
I_I	Input Current measuring range	Current mode	0	22	mA
R_I	Input Resistance	Voltage mode, pull-up resistor not selected (referenced to GND)	typ. 70		kΩ
		Voltage mode, pull-up resistor selected (referenced to + 5 V)	typ. 2200		Ω
		Current mode (referenced to GND)	typ. 220		Ω
		Overvoltage protection mode, V_I > Overvoltage detection threshold (referenced to GND)	typ. 9,6		kΩ
BW	Input Low Pass Filter Bandwidth	Voltage mode (Note 3)	typ. 1		kHz
		Current mode (Note 3)	typ. 1		kHz
I_E	Input Error	Voltage mode		0,25	V
		Current mode		1,1	mA
C_I	Input pin capacitance		typ. 4,4		nF
$V_{I\text{-range}}$	Input Voltage Range	Voltage mode (Note 2)	-0,5	43	V
		Current mode (Note 2)	-0,5	43	V

Note 1: Temperature-dependent.
Note 2: Exceeding the max value might cause damage to input.
Note 3: 2nd order low pass filter
Note 4: HW multiplies the measurement by 10/11. The effect is compensated in *6107Int.library* (the measurement is multiplied by 11/10), so the measurement is automatically accurate when using Epec programming libraries. For more information about conversions, refer to *Epec Programming and Libraries* manual.
Note 5: When protection mode is active the measurement circuit is disconnected from the input.

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Functional block diagram



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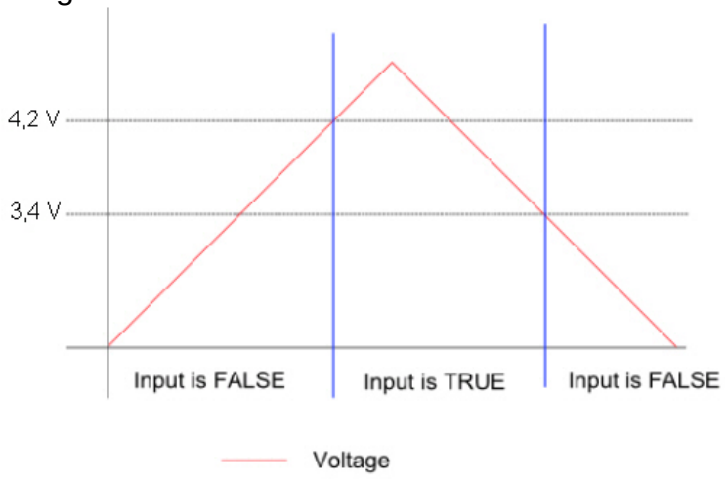
7 DI

- This type of pin is a ground referenced input (DI)
- This type of pin has no configurable features

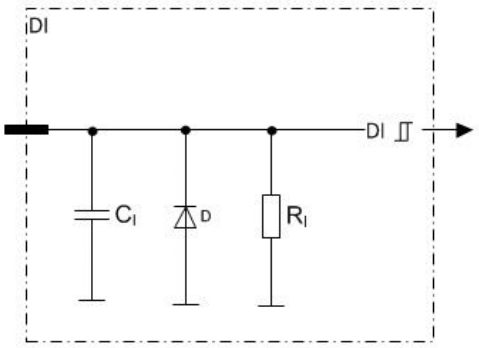
Electrical characteristics

Symbol	*Parameter*	*Conditions*	*Min*	*Max*	*Units*
R_I	Input Resistance	Referenced to GND	typ. 44		kΩ
V_{IH}	Input High Voltage level	(Note 1, 3)	4,2	36	V
V_{IL}	Input Low Voltage level	(Note 3)	0	3,4	V
$V_{I\text{-}max}$	Max Input voltage	(Note 2)	-0,5	43	V
C_I	Input pin capacitance		typ. 1		nF

Note 1: Exceeding the max values might cause damage to input.
Note 2: Overload conditions.
Note 3: Includes hysteresis. The input state is maintained until the second voltage limit is exceeded:



Functional block diagram



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8 +5 V REF

- This is an internally regulated and monitored reference voltage supply for external devices.
- This reference output can be switched on/off by application.

Protection features

- Overcurrent
- External voltage protection
- Errors are indicated with a fault signal

Voltage monitoring

- The level of the output voltage can be monitored by application.

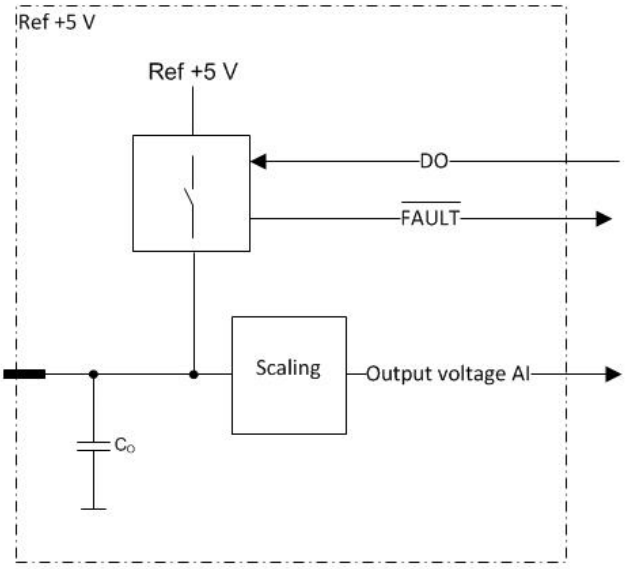
Electrical characteristics

Symbol	*Parameter*	*Conditions*	*Min*	*Max*	*Units*
$V_{o\text{-}level}$	Output voltage	Output On; Unconnected pins	typ. 5		V
R_o	Output Resistance	Output On		2	Ω
I_o	Nominal Output Current	Output On;	0	100	mA
$I_{o\text{-}lim}$	Internal Current Limitation	Output On (Note 2, 3)	typ. 500		mA
$I_{o\text{-}sc}$	Short-circuit Current Limit	Output On; Overcurrent, $R_L = 0$	typ. 350		mA
C_o	Output Capacitance		typ. 47		uF
	Fault-signal overvoltage threshold level	External overvoltage conditions	typ. 5,7		V
$V_{I\text{-}max}$	Max Input voltage	Overload conditions (Note 1)	0	36	V
Voltage monitoring					
V_I	Nominal Voltage measuring range		0	7	V
	Scaling Factor	(Note 4)	typ. 0,5		V/V

Note 1: When output voltage is under overload conditions, for example, short circuit to supply voltages. Exceeding the max value might cause damage to output.
Note 2: Current limit for overcurrent protection to limit internal power dissipation.
Note 3: When the limit is exceeded, the output current is regulated. In regulation, the output is switched into overcurrent mode.
Note 4: The measurement is scaled down before the conversion. The effect is compensated in Epec software libraries. For more information, see *Epec Programming and Libraries* manual.

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Functional block diagram



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9 POWER SUPPLY

- Nominal supply voltage 12/24 VDC
- Operating range 8,4…36 VDC
- Undervoltage reset ≤ 8 VDC

Overvoltage Protection

- Max. 70 V continuous (Stresses above this value may cause permanent damage to the unit.)
- The display unit has a shutdown circuit which protects the unit and loads against overvoltage. The shutdown circuit cuts off the power feed for the logic and loads in case of overvoltage. The shutdown circuit is activated when voltage exceeds circa 36,8 V. Power feed is restored when supply voltage drops under 36,8 V.

Power Consumption

- Supply voltage (U_{in}) maximum continuous current 6 A (with full external load)
- GND current sum max 6 A

In this unit, there is only one power supply pin (X1.23).
The ground pin (X1.22) is the recommended pin for the power supply return line. The following table shows the power supply pin locations.

Power supply pins

Designation	Connector / pin number	Potential
Supply voltage (for logic and power)	X1.23	+12/+24 VDC (+8,4…36 VDC)
Ground (for supply voltage)	X1.22	GND
Data ground (for USB, CAN, RS)	X1.10	GND
AI ground	X1.18	GND (max current is 100 mA)
I/O ground	X1.19	GND
Supply outputs		
Reference supply (for external devices)	X1.16	+5 VDC / max 100 mA



Always use an external fuse to protect the unit. The fuse is needed for reverse voltage and overload protection. For more information,

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see section *Power Supply Cabling*.

Electrical characteristics

Symbol	Parameter	Conditions	Min	Max	Units
V_I	Nominal Input Voltage		8,4	36	V
$V_{I\text{-}Load\text{-}dump}$	Max Input Transient Voltage Level	(Note 1)		123	V
$V_{I\text{-}max}$	Max Continuous Input Voltage Level	(Note 2)	-20	70	V
$V_{I\text{-}ovp}$	Overvoltage Threshold Level		typ. 37		V
$V_{I\text{-}uvp}$	Undervoltage Threshold Level		typ. 8		V
Supply voltage monitoring					
$V_{I\text{-}range}$	Nominal Input Voltage measuring range		0	36	V

Note 1: Load dump protection according to ISO7636-2: 2004 pulse 5, Us=+123 V

Note 2: Limited functionality when the voltage is higher than the nominal. If the voltage is less than 7,7 V, the unit is in non-operational state.

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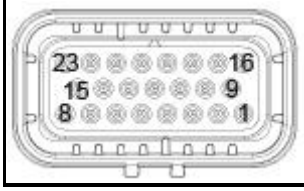
10 INTERFACES

10.1 CAN Bus

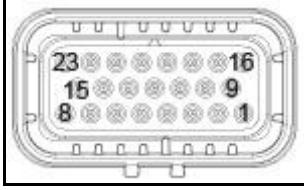
Supported CAN amount:	2
Bit rate:	All interfaces support bit rates 50, 125, 250, 500,1000 kbit/s
CAN interface features:	• Implementations of higher layer protocols are user programmable. Epec provides implementations for CANopen and SAE J1939 as PLCopen libraries. • The physical interface of CAN is according to ISO 11898 and CAN 2.0B protocol • 11-bit and 29-bit message receive and transmit are supported • Transmitting of remote frames is supported in all CAN interfaces
Cabling instructions:	See section *CAN Bus Cabling*

CAN bus connection pins

The CAN1 communication pins are located in the control unit's AMP23 (X1) connector as follows:

Picture	Pin	Signal
	7	CAN1 L
	8	CAN1 H
	10	GND (DATA GROUND)

The CAN2 communication pins are located in the control unit's AMP23 (X1) connector as follows:

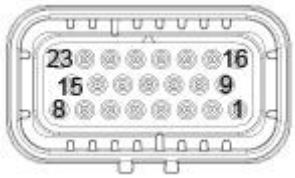
Picture	Pin	Signal
	13	CAN2 L
	14	CAN2 H
	10	GND (DATA GROUND)

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10.2 RS-232

Supported RS-232 amount:	1
Mode:	DTE (data terminal equipment)
Cabling:	See section *RS-232 Cabling*
Related programming libraries:	• Serial.library (For more information, see *Epec Programming and Libraries manual*) • 3S SysCom.library (For more information, see *3S CODESYS manual*)

The serial bus communication pins are located in the control unit's X1 (AMP23) connector as follows:

Picture (AMP23 male connector, front)	Pin	Signal
	3	TXD, transmit data
	4	RXD, receive data
	5	RTS, request to send (output)
	6	CTS, clear to send (input)
	10	GND (DATA GROUND)

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10.3 USB

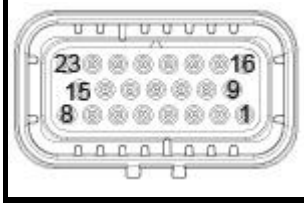
USB ports provide a flexible way to attach peripheral devices. However, it should be noted that the core of the display is based on embedded processor architecture. Therefore, it is strongly recommended to consult Epec to assess the compatibility with the product when selecting a new USB device.

Supported USB amount:	2
Cabling instructions:	See section *USB Cabling*
Ordering USB cable:	See section *Accessories and Ordering Codes*
Related programming libraries:	6000UsbDrive.library (For more information, see *Epec Programming and Libraries manual*)

AMP23 USB

Bus speed maximum:	12 Mbps (full speed USB)
Features:	Only for application updating

X1, AMP23 male connector:

Picture (AMP23 male, front)	Pin	Signal
	1	D+
	2	D-
	9	+5 V (max 500 mA)
	10	GND
	15	USB_SHIELD

M12 miniB-USB

Bus speed maximum:	480 Mbps (high speed USB)
Features:	• Recommended for updating CODESYS application • Recommended for updating firmware • Only host mode supported

X2, M12 connector (miniB-USB):

Picture	Pin	Signal
	1	+5 V (max 500 mA)
	2	D-
	3	D+

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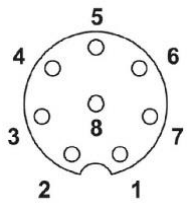
	4	ID
	5	GND

10.4 Ethernet

Firewall can be activated for Ethernet, for more information refer to *Epec Programming and Libraries manual*.

Supported Ethernet amount:	max 2
Bus speed:	Maximum 10/100 Mbps
Cabling instructions:	See section *Ethernet Cabling*
Ordering Ethernet cables:	See section *Accessories and Ordering Codes*

X3, M12 connector (8 pin FEM, ethernet):

Picture	Pin	Signal
	1	RD2+
	2	TD2+
	3	TD2-
	4	RD1-
	5	TD1+
	6	RD1+
	7	RD2-
	8	TD1-

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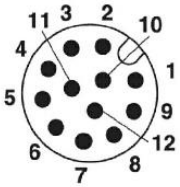
10.5 Camera

This manual describes the full hardware version. Some of the features are optional and not implemented in all hardware versions.

+12 V from X5 connector for cameras is not allowed when GSM/GPS is in use.

Supported camera amount:	max 2
Supported video formats:	PAL (NTSC on request)
Camera cable type:	Twisted pair or coaxial cable
Maximum current:	0,8 A (2 x 400 mA, internal automatic fuse)
Ordering camera cables and cameras:	See section *Accessories and Ordering Codes*
Related programming libraries:	6000Multimedia.library (For more information, see *Epec Programming and Libraries manual*)

X5, M12 connector (12 pin MALE, 2xcamera)

Picture	Pin	Signal (default configuration for composite video)	Signal (optional hw configuration for s-video)
	1	-	CAMERA1_CHROMA_INPUT
	2	-	CAMERA1_CHROMA_GND/SHIELD
	3	CAMERA1_COMPOSITE_INPUT	CAMERA1_LUMA_INPUT
	4	CAMERA1_COMPOSITE_GND/SHIELD	CAMERA1_LUMA_GND/SHIELD
	5	-	CAMERA2_CHROMA_INPUT
	6	-	CAMERA2_CHROMA_GND/SHIELD
	7	CAMERA2_COMPOSITE_INPUT	CAMERA2_LUMA_INPUT
	8	CAMERA2_COMPOSITE_GND/SHIELD	CAMERA2_LUMA_GND/SHIELD
	9	+12 V (CAMERA1)*	+12 V (CAMERA1)*
	10	+12 V (CAMERA2)*	+12 V (CAMERA2)*
	11	GND (CAMERA1)	GND (CAMERA1)
	12	GND (CAMERA2)	GND (CAMERA2)

* +12 V for cameras is not allowed when GSM/GPS is in use.

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10.6 GSM/UMTS (GPRS/3G/HSPA+/Modem)

This manual describes the full hardware version. Some of the features are optional and not implemented in all hardware versions.

Make sure SIM card slot is properly closed to ensure tightness protection.

SIM slot cover is tightened with two Pozidriv M2x4 (DIN 965) screws. Switch off system power when changing the SIM card.

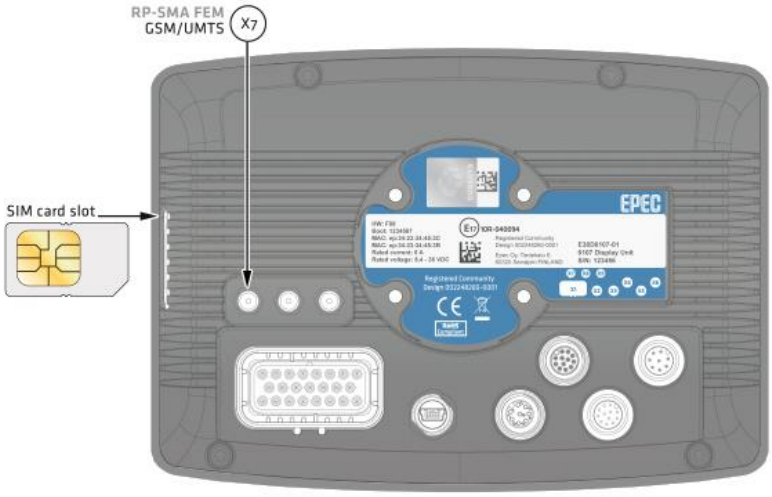
Firewall can be activated for the modem, for more information refer to *Epec Programming and Libraries manual*.

SMA connector in display:	RP-SMA female
SMA connector type for antenna:	RP-SMA male *
SMA tightening torque:	brass: 0,3 - 0,6 Nm steel: 0,8 - 1,1 Nm
Supported frequencies:	Global coverage: • 800/850/900/1900/2100MHz@UMTS • 850/900/1800/1900MHz@GSM
SIM card size:	Mini-SIM (2FF)
SIM requirements:	Switch off the PIN code request
SIM card slot type:	Push-push
Ordering antenna:	See section *Accessories and Ordering Codes* *
Related programming libraries:	Modem.library (For more information, see *Epec Programming and Libraries manual*)

*) Tested with Plantec Planar Combination Antenna K70ZVR (for using other antenna types, additional testing is required)

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Correct SIM card position and antenna connector location:



10.7 GPS/GLONASS

This manual describes the full hardware version. Some of the features are optional and not implemented in all hardware versions.

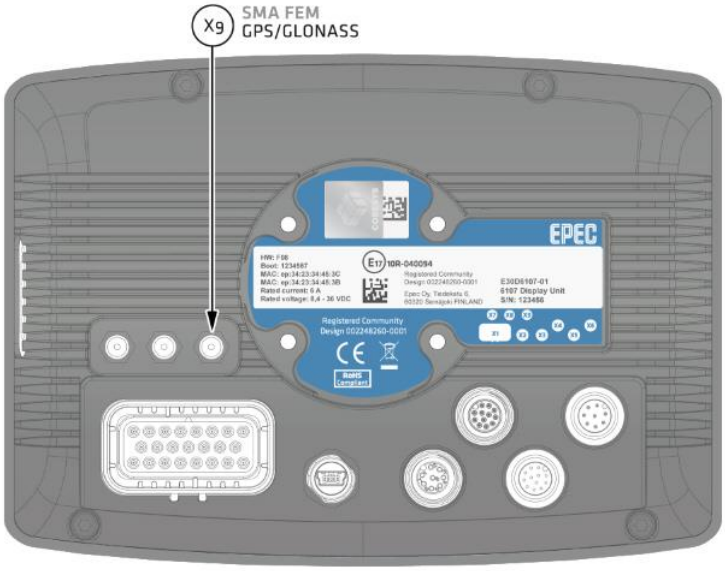
In addition to positioning, GPS can be utilized for example for fetching the UTC time for the unit's real-time clock.

SMA connector in display:	SMA female
SMA connector type for cable:	SMA male *
SMA tightening torque:	brass: 0,3 - 0,6 Nm steel: 0,8 - 1,1 Nm
Antenna:	It is recommended to use active antenna *
Internal power supply for active antenna:	2,85 V
Max current for active antenna:	10 mA
Ordering antenna:	See section *Accessories and Ordering Codes* *
Related programming libraries:	GPS.library (For more information, see *Epec Programming and Libraries manual*)

*) Tested with Plantec Planar Combination Antenna K70ZVR (for using other antenna types, additional testing is required)

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Antenna connector location



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11 INTERNAL DIAGNOSTICS

11.1 Temperature and Voltage Monitoring

Temperature Monitoring

This unit has an internal temperature sensor for monitoring the unit's internal temperature.

The temperature information is useful for self-diagnostic purposes and safety features.

PCB Area Temperature

Symbol	***Parameter***	***Conditions***	***Min***	***Max***	***Unit***
T_{PCB}	Nominal PCB Temperature measuring range		-55	+125	°C
$T_{PCB-err}$	Temperature Measurement Error	-40 .. +100 °C		+/- 6	% (FS)
		-55.. +125 °C		+/- 9	% (FS)
Diagnostics			***Low***	***High***	***Unit***
	Recommended warning levels		-30	+80	°C

Processor Core Temperature

Symbol	***Parameter***	***Conditions***	***Min***	***Max***	***Unit***
T_{Core}	Nominal Core Temperature measuring range		-40	+125	°C
Diagnostics			***Low***	***High***	***Unit***
	Recommended warning levels		-30	+80	°C
	Screen dimming	Non-configurable		+90	°C
	Lowering CPU clock frequency to half	Non-configurable		+95	°C
	Shut-down	Non-configurable		+100	°C

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Supply Voltage Monitoring

Supply voltage of the control unit can be monitored.

Symbol	*Parameter*	*Conditions*	*Min*	*Max*	*Unit*
U_{in}	Nominal Supply Voltage measuring range		0	36	V
Diagnostics			***Low***	***High***	***Unit***
	Recommended supply voltage warning level		9	30	V

For additional electrical characteristics refer to section *Power Supply*.

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11.2 + 5 V REF Diagnostics

The +5 V reference supply has two diagnostics checks:

- analog output voltage monitoring and
- dedicated digital fault-signal

Both can be used to indicate overload and overvoltage situations. The diagnostics are independent from each other.



For fastest and most reliable error detection, it is recommended to use both output voltage monitoring and fault-flag diagnostics to detect errors.

OVERLOAD

The diagnostics can detect overcurrent situation. The fault-signal is activated when excessive current is taken from the output. The output current is regulated when internal current limit is reached. The regulation current is always smaller than the limit. Current regulation causes the output voltage to drop with increasing load. This can be detected, using the output voltage monitoring feature, by setting a minimum (low) value limit for the output voltage.

With large enough loads, the output voltage drops to 0,1 V and the output current is limited to $I_{o\text{-}sc}$ value to protect the output from overheating.
This is indicated by the fault-signal. The fault-signal is deactivated, when the error source is removed by decreasing the load (and reducing the output current below $I_{o\text{-}sc}$ value) or when the output is turned off.



It is recommended to turn off the output when fault-signal becomes active.

OVERVOLTAGE

Overvoltage event caused by an external source can be detected by using a combination of the diagnostic features. The fault-signal is activated when pin voltage goes above the fault-signal overvoltage threshold level. If the output voltage monitoring value is above nominal and/or the fault-signal is active, it can be determined that an external voltage source is connected to the output pin.

The output pin is protected against external voltages, but it is not recommended to connect external voltage sources to this pin.



In case of a limit violation, the output should be disabled as soon as possible. The display unit can handle short term errors, but long term (e.g. several hours) exposures should be avoided with application/system design. Long term exposure to overvoltage or overload can cause permanent damage to the unit.

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12 APPROVALS AND SAFETY

12.1 R&TTE Directive (1999/5/EY)

12.1.1 EMC Tests

Epec 6000 series units are tested according to EMC tests that are described in this section.

The following tables provide a summary of performed EMC tests:

Measurement / test	Reference standard
Conducted Emissions from the Mains Cable	EN 55016-2-1:2009
Radiated Emissions	EN 55016-2-3:2006
Electrostatic Discharge Immunity	EN 61000-4-2:2009
Radiated RF-field Immunity	EN 61000-4-3:2006, A1:2008, A2:2010
Electrical Fast Transient	EN 61000-4-4:2012
Surge Immunity	EN 61000-4-5:2006
Conducted RF-field Immunity	EN 61000-4-6:2009

Measurement / test	Reference standard
Conducted Emissions	ISO 7637-2:2004, Amendment 1:2008
Radiated Emissions	CISRP 25:2002, Corrigendum 2004
Immunity to Electromagnetic Radiation	ISO 11452-2:2004 ISO 11452-4:2005, Corrigendum 1:2009
Conducted Transient Immunity	ISO 7637-2:2004, Amendment 1:2008

12.1.2 RF Tests

Epec 6000 series units are tested according to following RF tests:

Measurement / test	Reference standard
Radiated spurious emissions — MS allocated a channel	EN 301 511 V9.O.2
Radiated Emissions (UE)	EN 301 908-1 V7.1.1
Receiver spurious emissions	EN 300 440-2 V1.4.1

12.1.3 Low Voltage Directive (2014/35/EU)

Epec 6000 series units comply with Low Voltage Directive (2014/35/EU). Standard IEC/EN 60950-1:2006 + A11:2009 + A1:2012 + A12:2011 + A2:2013.

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12.2 Environmental Tests

The following environmental tests have been performed to Epec 6000 series units (without 2G/3G/GPS option):

Temperature			
Test	**Temperature**	**Duration/ Exposure time**	**Remarks**
Cold IEC 60068-2-1 (2007-03),Test Ad	-25 °C	16 h	• 1 °C/min
Dry heat IEC 60068-2-2 (2007-07),Test Bb	70 °C	16 h	• 1 °C/min
Damp heat cycling IEC 60068-2-30 (2005-08),Test Db	+25 °C/+55 °C		• rel. humidity >90 % • cycle duration 24 h • six test cycles
Change of temperature IEC 60068-2-14 (2009-01), Test Na	-30 °C/+60 °C	3 h	• change time between extreme temperatures 1-2 min • 5 test cycles
Change of temperature IEC 60068-2-14 (2009-01), Test Nb	-40 °C/+70 °C	3 h	• change of temperature 10 °C/min • 2 test cycles

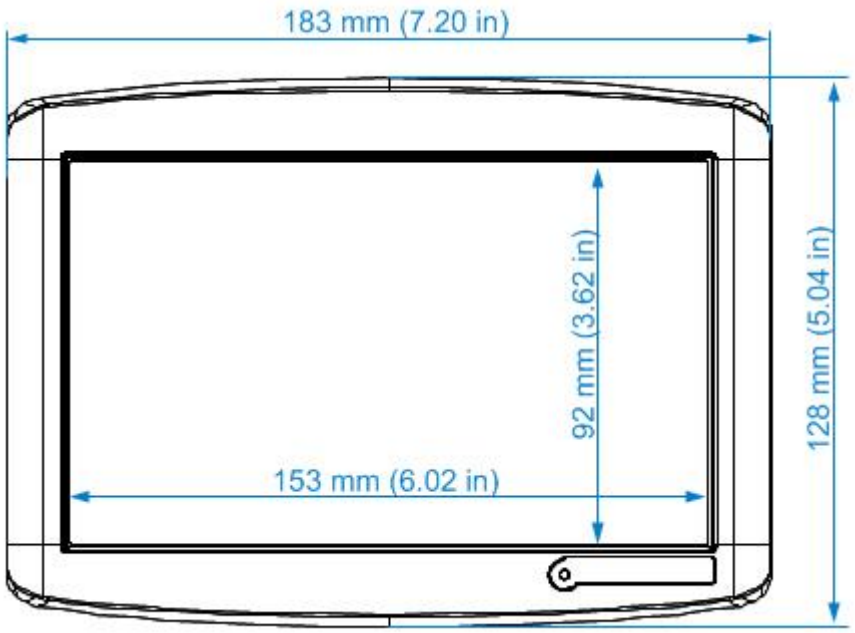
Mechanical resistance		
Test	**Duration and direction**	**Remark**
Shock test IEC 60068-2-27 (2008-02) Test Ea	• pulse duration 6 ms • 500 impulses in six directions	• half sine pulse shape • peak acceleration 500 m/s^2
Vibration, random IEC 60068-2-64 (2008-04),Test Fh	• test duration 60 min in every three test direction	• ASD-level 5 m^2/s^3, 10 … 200 Hz • ASD-level 1,0 m^2/s^3, 200 … 500 Hz • total spectral acceleration 3,54 grms

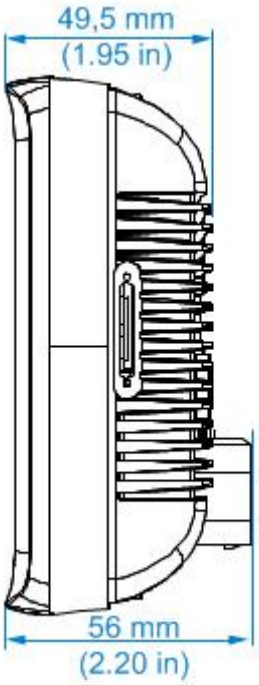
Corrosion			
Test	**Temperature**	**Duration**	**Concentration**
Salt spray test ISO 9227	+35 °C	24 h	5 % NaCl

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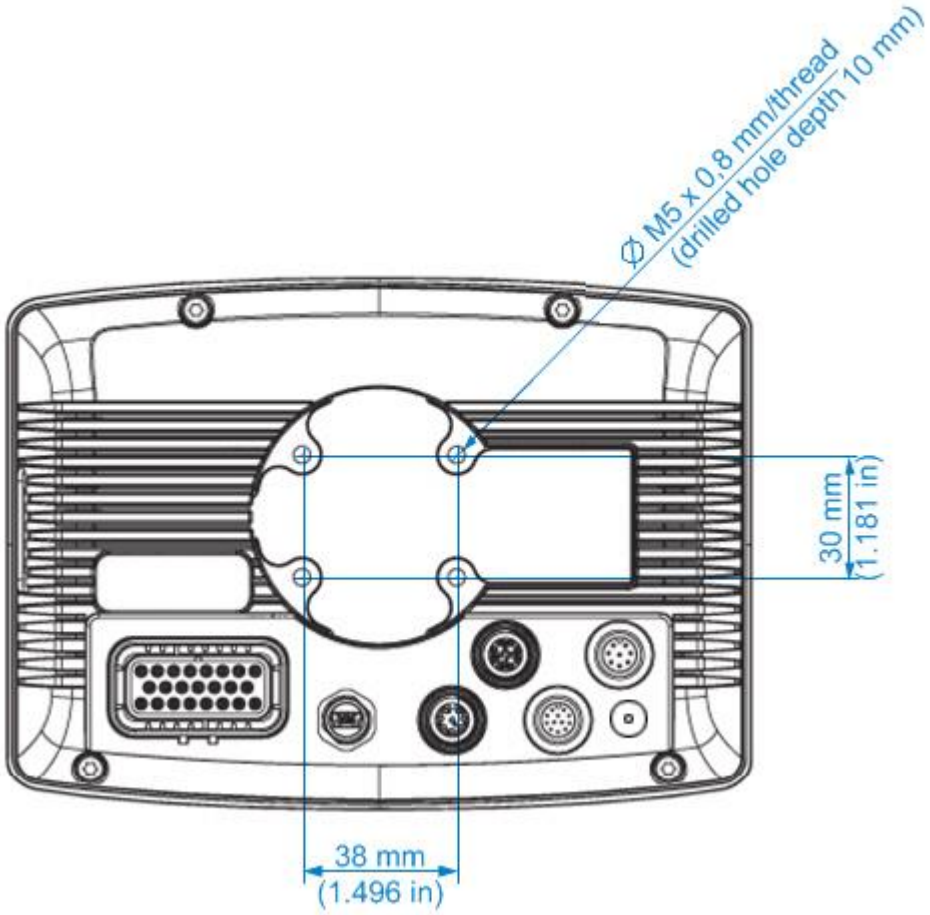
13 MECHANICS AND CABLING

13.1 Unit Dimensions





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13.2 Mounting and Cleaning



It is recommended that the unit housing has a galvanic connection to machine frame.



Control unit mounting location should be planned so that the machine's washing does not damage the unit.

A direct water jet towards the control units should be avoided, especially when using high pressure. Also, the use of any such solvent that causes damage to electronic devices should be avoided when handling the control units.



When cleaning the control unit, do not use highly alkaline / acidic substances, too hot water, or too heavy mechanical abrasion.



In moist conditions, the unit must be mounted and oriented so that the connectors are not filled with water.



Make sure that all the unused connectors are sealed properly using the provided covers (sealing cap protection class is IP67).



The display unit should be mounted to a location where it is protected from impacts and splashes. Usually the display unit is mounted in a machine cabin. However, if display unit must be mounted in such place that it is exposed to impacts or splashes, it should be thoroughly covered with a separate, mechanical cover. Platforms with extreme vibrations should be avoided.

The display unit can be mounted to the frame with a mounting pedestal or it can be mounted on a panel.

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13.2.1 Pedestal Mounting

Pedestal is mounted on the back of the display by using four M5 screws. The pedestal and the display are then mounted into a conductive metal base, which must have a galvanic connection to machine frame. The pedestal is mounted using two M4 screws or by using the mounting rail included. See the mounting pedestal's ordering code in section *Accessories and Ordering Codes*.

The mounting pedestal has adjusting lever on the side that can be operated without tools. By loosening and tightening this lever, the display can be easily adjusted for the best possible viewing angle. For more information, refer to mounting pedestal's data sheet (MAN000578).



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13.2.2 Panel Mounting

When the display unit is panel mounted, it must be attached to machine frame. The display is mounted on the panel using four M6 screws. In the panel should be 161 x 114 rectangular space for the display. The overall dimensions can be seen in picture below See the panel mounting kit's ordering code in section *Accessories and Ordering Codes*.
For more information, refer to panel mounting kit's data sheet (MAN000583).

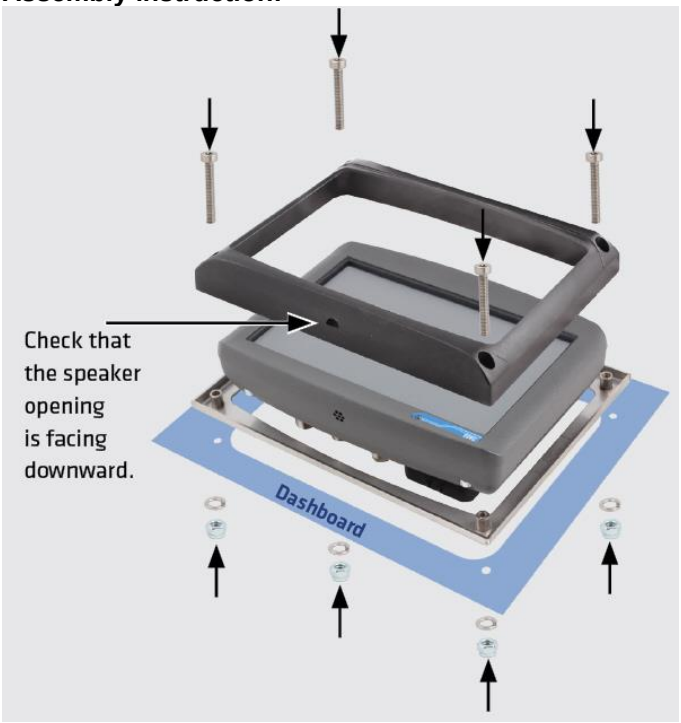
Panel Mounting Kit parts:



Assembled:



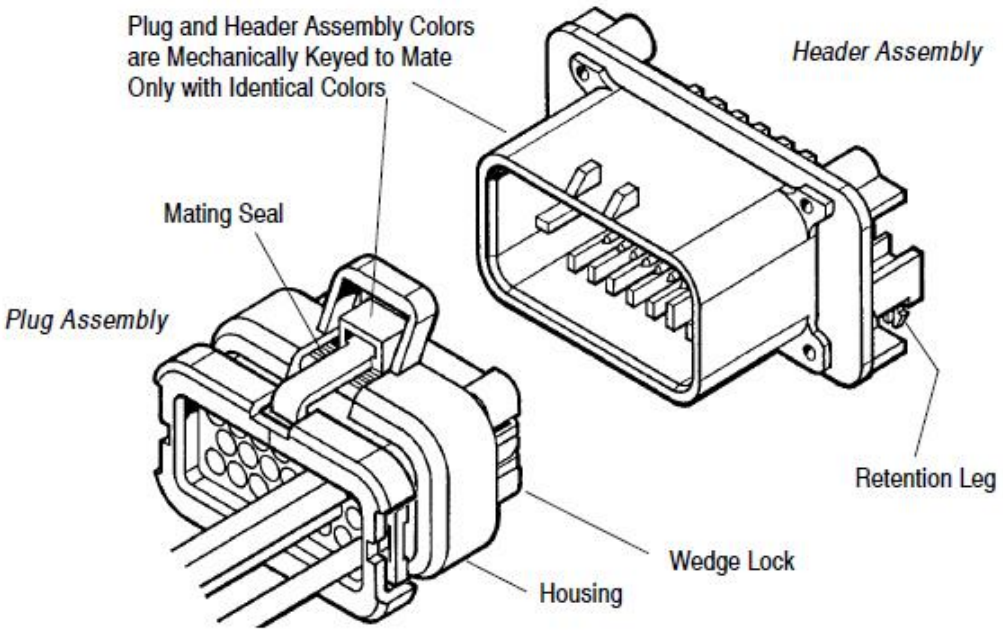
Assembly instruction:



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13.3 Plugging and unplugging the cables/connectors

All Epec control units use heavy duty gold plated, locked and sealed AMPSEAL connectors. The following figure shows an example of an AMPSEAL connector:



- Gold plated AMPSEAL connectors pack a current of 15 amperes per contact and tolerate operating temperature range.
- All module connectors are mechanically keyed to mate only with identical colors (blue, grey and black).

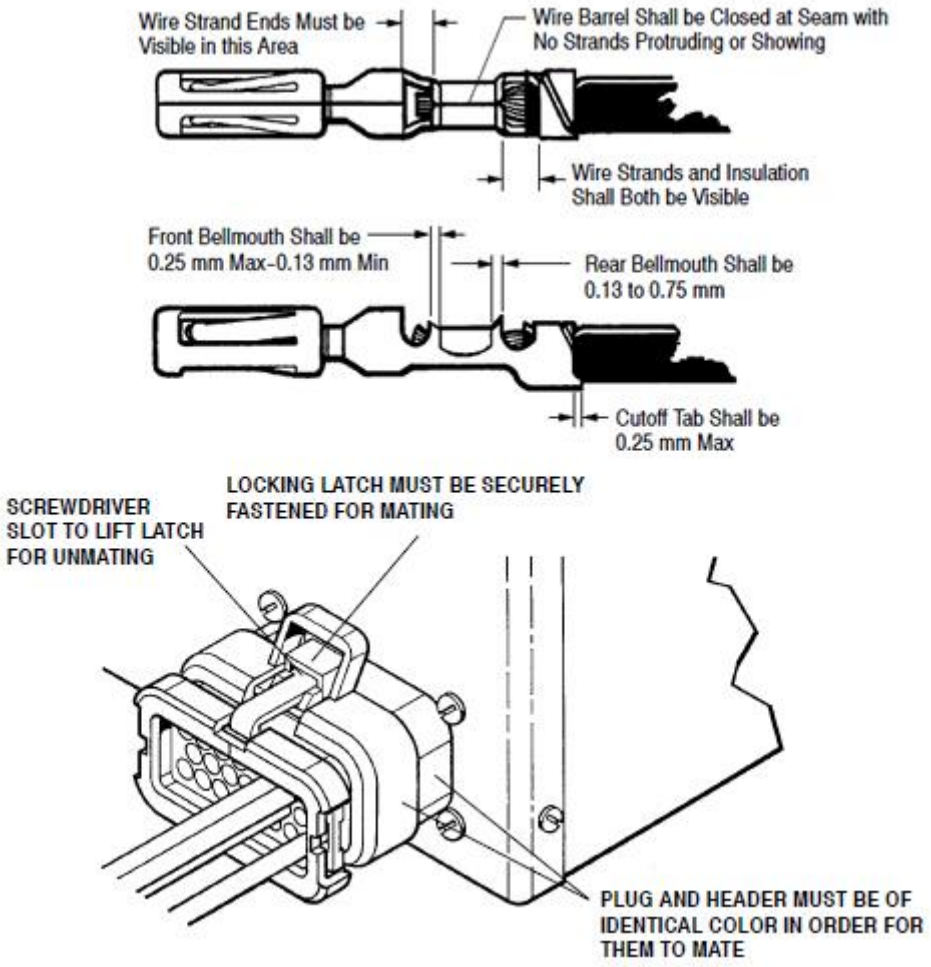
When connecting, make sure that:

- connectors are pressed down to the bottom and that they are locked
- connectors are clean (avoid moisture or dirt inside the connector)
- unused connectors are covered with empty connectors of the same color (this helps to keep the control unit connectors dry and protected)
- all cables, connectors and tools are of correct type, and sufficiently high quality, and suitable for this kind of use (protection for moisture, mechanical stability, power durability, coupling resistance among other things)
- there is a sufficient margin (slack) left in the cables to prevent the torsion of the connectors
- wires are bound to the control unit cover base knob with

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cable ties

The following figure describes some general instructions about the connectors.



Refer to AMP Application Specification 114-16016 for more detailed information on connectors and cable recommendations.

Ordering codes for the AMPSEAL connectors, crimps and tools are listed in Section *Accessories*.

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13.4 Cabling

13.4.1 System Topologies



Generally, cabling should be properly designed and documented to help the initial assembly and maintenance.
It is highly recommended to mark each cable on both ends to avoid confusion and errors.



The cables must be run in a safe route along the machine frame. When routing cables, avoid interfering objects and pay particular attention to moving parts of the machine.
It is also good to minimize the amount of the connection points of the cable harness to maximize reliability.
Also, all valid safety instructions should be observed when coupling.

- The control units are connected with each other using standardized CAN bus.
- The idea of the Epec embedded control system, is that all the control units are installed close to sensors, encoders and other equipment connected to them.
    - This way the amount of the traffic on the CAN bus is minimized and connections can be made using short wires.

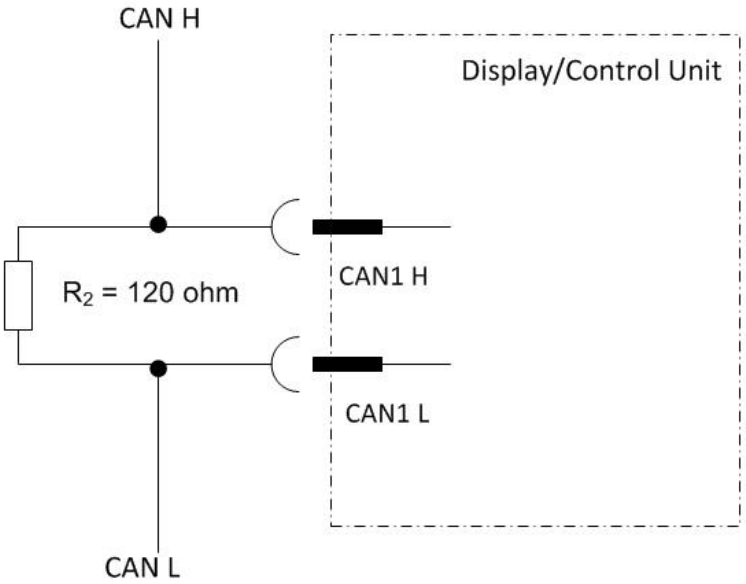
Termination resistors

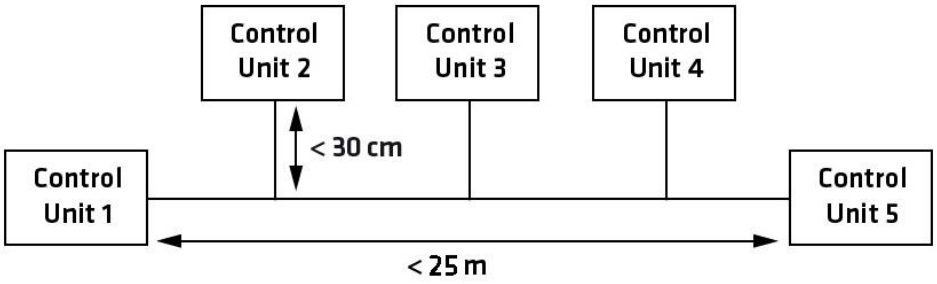
- Generally, the bus cable is terminated at both ends with termination resistors (ISO 11898:1993).
- External termination resistor (120 Ω) has to be connected at both ends between CAN H and CAN L.



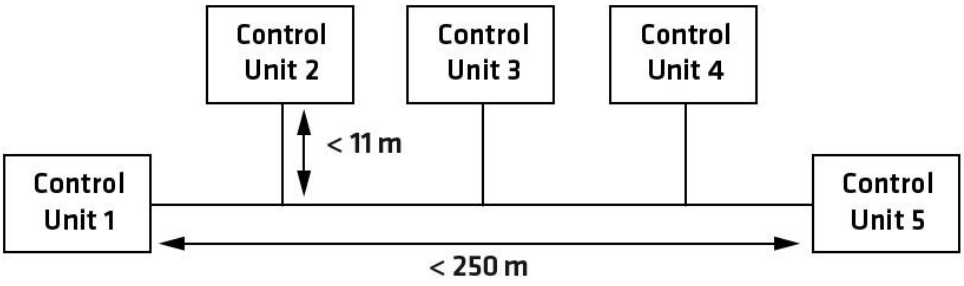
The cable lengths presented here are approximates. Actual cable lengths also depend on the cable quality, the cable type and also on the machine environment (possible interference).

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Example 2. Control system topology in theory with maximum bus speed (1000 kbit/s); Control Units in traditional bus arrangement. For more information about the bus speeds, refer to CiA DS-102 standard.



Example 3. Control system topology in theory with 250 kbit/s bus speed; Control Units in traditional bus arrangement. For more information about the bus speeds, refer to CiA DS-102 standard.

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Example 4. The usage of the termination resistor (TR) in a conventional bus. The maximum recommended bus length is directly dependent on the bus speed.
In theory, the maximum length with the maximum speed can be up to 25 meters. If the bus speed is lower, the length can be extended.
The maximum length of the bus depends on the bus speed. For more information about the bus speeds, see the table below / refer to CiA DS-102 standard.

The following table shows some baud rates in general purpose CAN bus networks as well as the maximum bus length for a given baud rate, that CAN in Automation (CiA) international users and manufacturers group has recommended to be used. For more information, refer to CiA DS-102 standard.

CAN bus baud rates and bus lengths according to CiA DS-102 standard

Baudrate	Bus length
1 Mbits/s	25 m
800 kbits/s	50 m
500 kbits/s	100 m
250 kbits/s	250 m
125 kbits/s	500 m
50 kbits/s	1000 m

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13.4.2 CAN Bus Cabling

The CAN bus cable is the neural backbone of the whole system and should be designed and constructed with extra care.

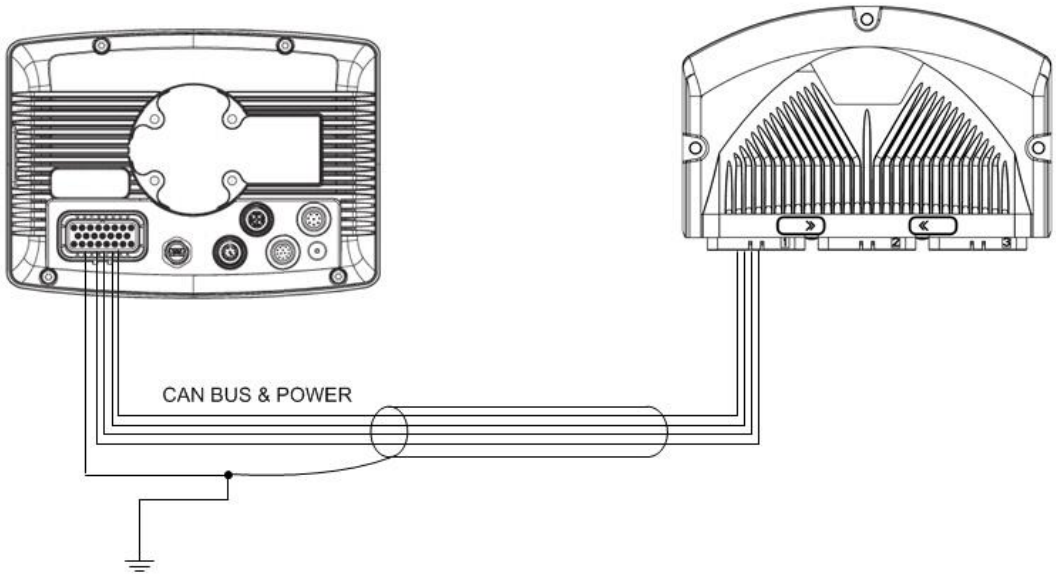
- For information about the CAN bus lengths and baud rates, refer to section *System Topologies*.

Cable

- It is recommended to use high quality and twisted (approx. 1 round/ 1 inch) CAN bus cable.
- Normal UTP (Unshielded Twisted Pairs) cable is well suited for distances under approximately 10 meters.
- In longer distances, and especially if there is possibility for electromagnetic interference, it is highly recommended to use shielded and twisted cable for CAN bus, also for shorter distances.
- To avoid electromagnetic interference (EMI), locate the bus cable as far away from high-current carrying cables as possible. Generally, the amount of the connections and connectors should be minimized to maximize security; also all connections should be done carefully.
- The shield grounding must be done only in one end of the cable

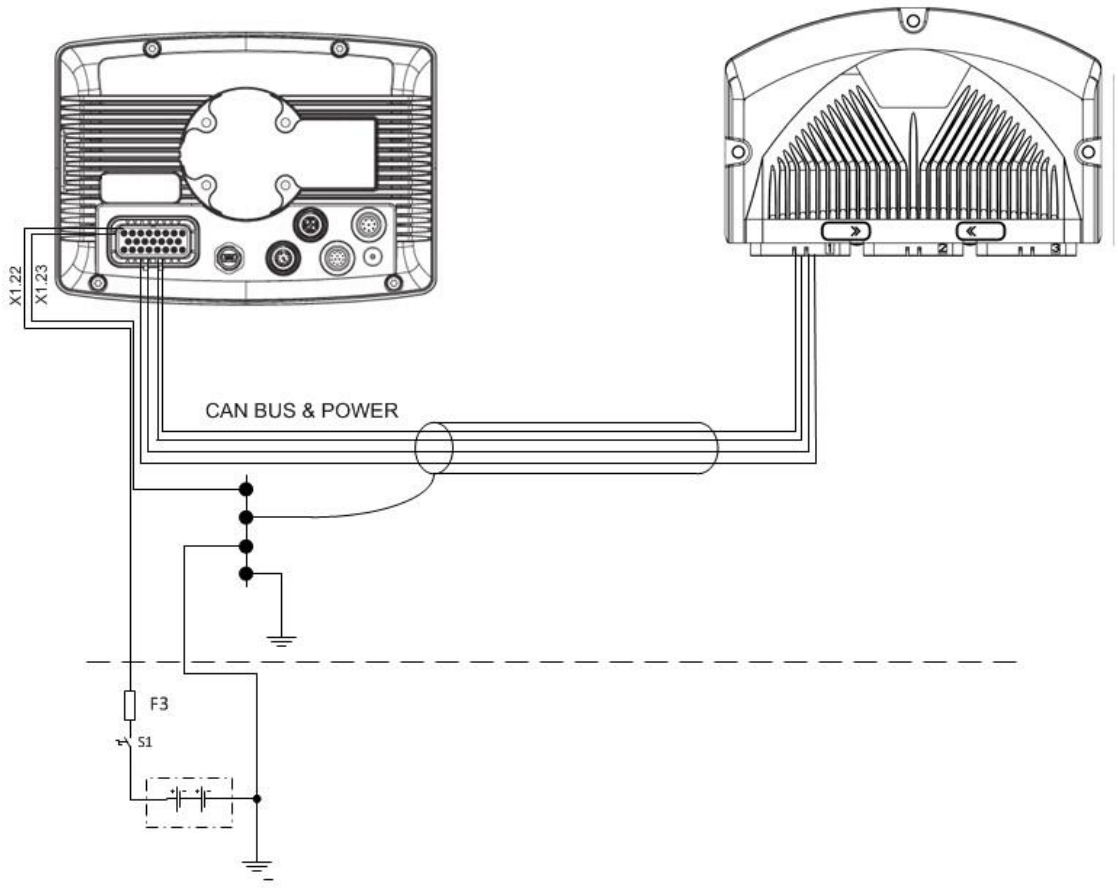
Cable shield

Connection example when there is a GND pin (X1.22) available in the control unit:



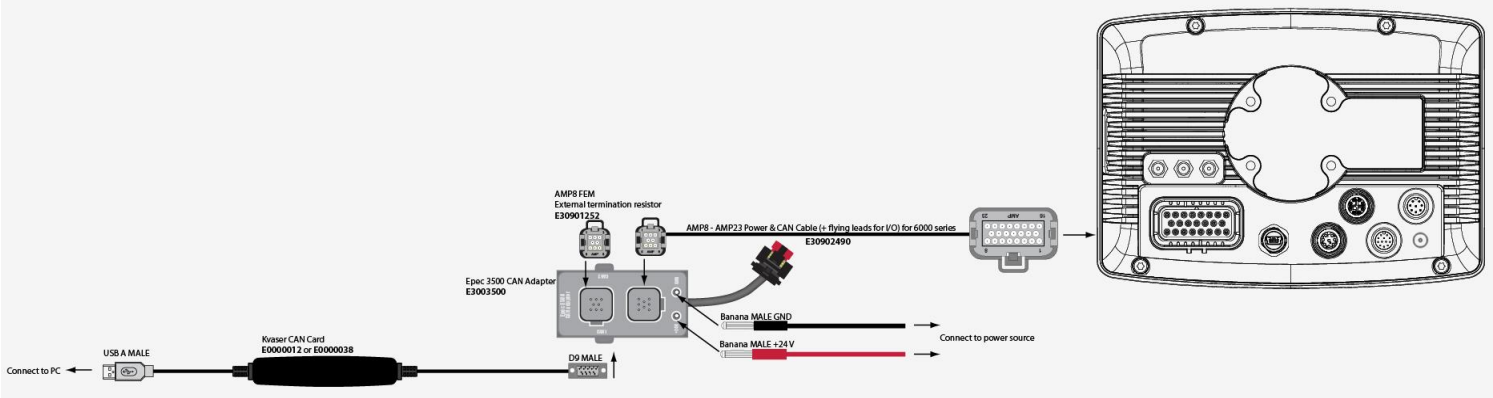
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Connection example when there is not a GND pin available in the control unit:



CAN cabling for system developers

The following figure describes cabling example for CAN communication between Epec control units and PC.
Ordering codes for the needed hardware is included in the figure.



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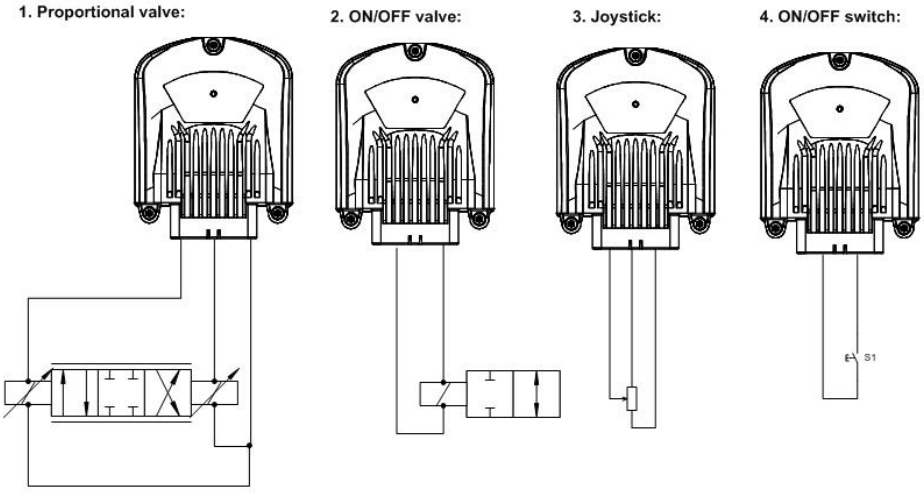
13.4.3 I/O Cabling

Closed circuit loops are always recommended and mandatory when you are using DO or PWM pin as an input.

To ensure correct measurement, reserve separate GND pin(s) for AI pin(s) and don't use it/them for any other purposes. See cabling example below.

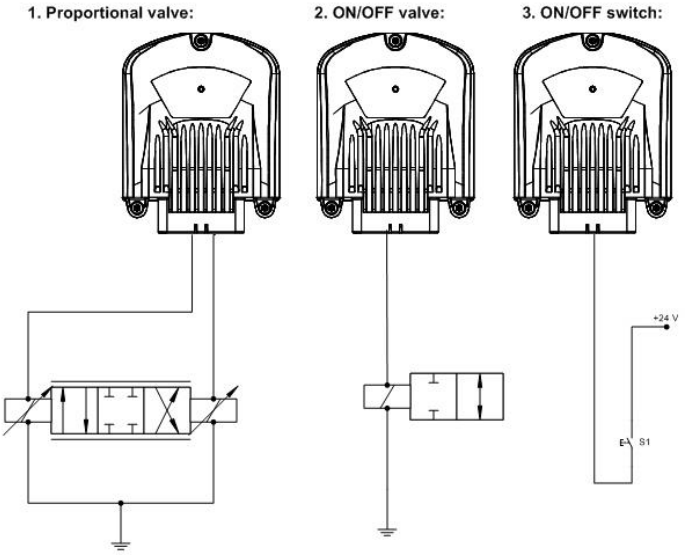
- The cabling for encoders etc. is in many cases supplied together with them.
- In many cases, very simple basic cable may be used, e.g. automobile R2 cable (0,5 or 1,0) by NK Cables.
- Dimensions of the cable should be appropriate for AMP contacts (so that crimping is possible).
    - Refer to AMPSEAL table (in section *Accessories*) for dimensions.
    - Take extra care for protecting the cables against physical wear and damage.
- Normally, only one wire can be connected to one AMPSEAL connector pin. However, if more than one wire has to be connected to one connector pin, it has to be connected by branch wiring.
- Some voltage inputs use relatively low voltages.
    - Consider using shielded cables for these encoders etc. especially for longer distances to increase safety
- Using shielded cable is recommended also in joystick connections.

The following figure describes four different ways to connect closed circuit loop through the control unit:

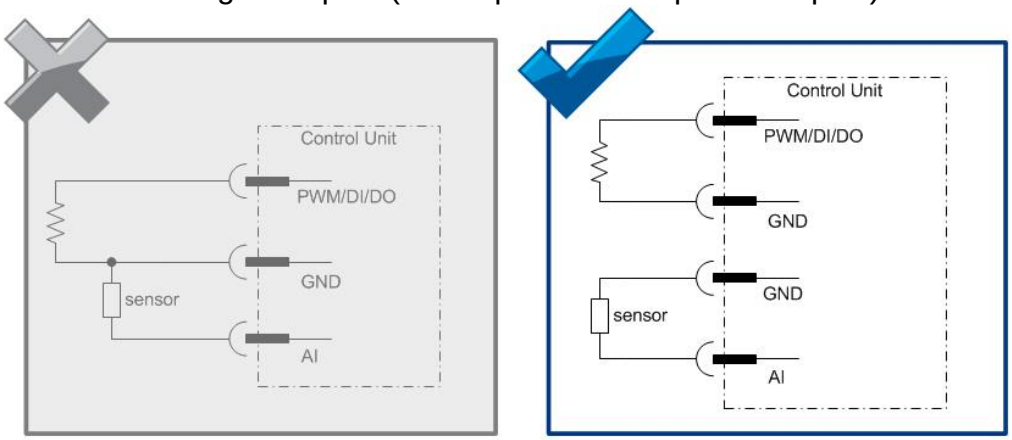


The following figure describes three different ways to connect open circuit loop (from the control unit's point of view):

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AI - GND cabling examples (use separate GND pin for AI pins):



- All sensors and encoders must be wired according to the closed-loop principle, i.e. the power for the sensors and encoders is supplied by the control unit they are connected to. This way, it is possible to avoid potential harmful differences, so the MOSFET driven output power switching operates properly.

When designing the sensor and encoder connections, observe single-point grounding. Each control unit connector has several GND pins which should be used.
Refer to section *Power Supply* for accurate pin allocation of connectors.

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13.4.4 Ethernet Cabling

In order that the electromagnetic interference (EMI) would not effect the data transfer, the installation of the cable should be done as close as possible to the body of the machine.

It is recommended to wire the cable under the shelter of mechanical hits if the installation environment makes it possible.

The cable must be installed as far away as possible from other cables with high power.

The maximum length of a connection is 30 meters.

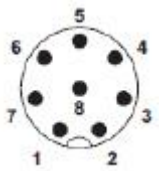
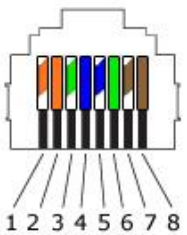
- This Ethernet connection is based on 10BASE-T/100BASE-T connection where two twisted pairs are used.
- M12 connector is not a standard connecting format and to get the best operation reliability the following issues should be considered in circuitry and installation; type of the used cable, connecting the cable and the installation method.

Cable

If the installation environment requires a cable that takes heat and low temperature, the minimum demand for the cable is under 20 m with connection Outdoor UTP Cat5E 4Pairs (Water Blocking / UV Resistant).
For longer connections it is recommended to use cable Outdoor UTP Cat6 4Pairs (Water blocking / UV Resistant), similar to it or better.

- (SFTP = Shielded Foiled Twisted Pair)
- (FTP = Foiled Twisted Pair)
- (STP = Shielded Twisted Pair)
- (UTP= Unshielded Twisted Pair)

Ethernet cable connection with Epec 6107 display unit:

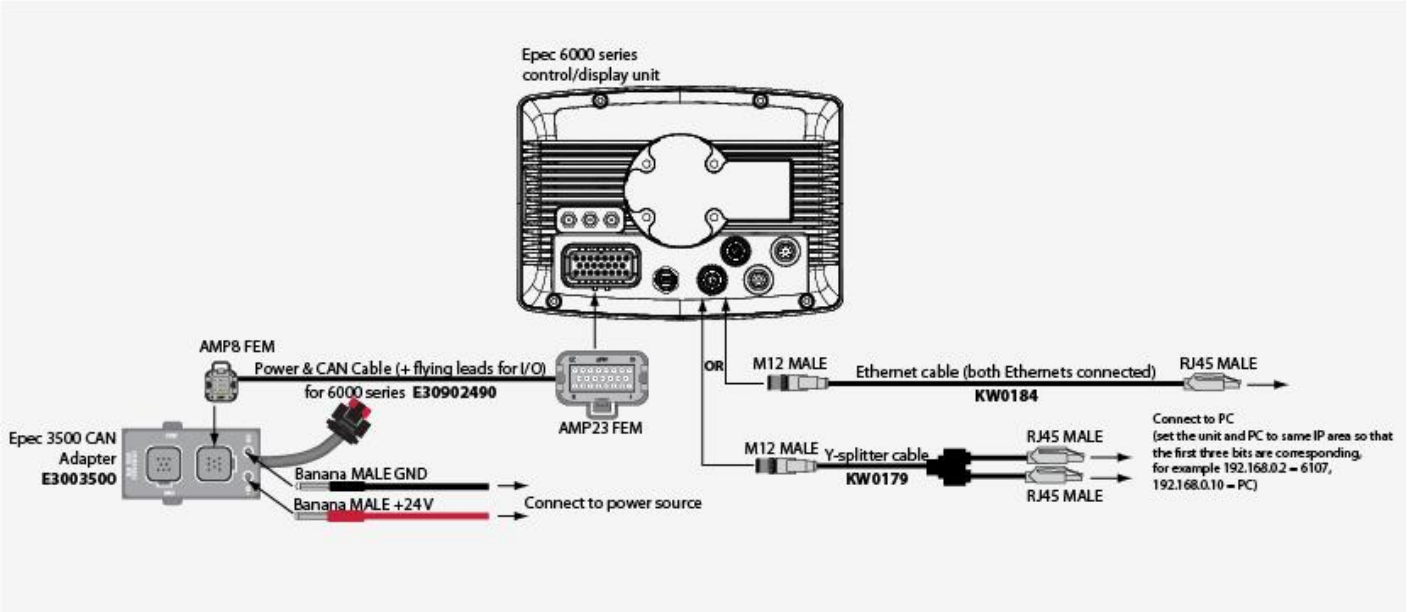
M12 male connector (front)	M12 pin (Ethernet)	M12 pin (Ethernet 2)	RJ45 male pin	T568B Pair	Color (according to T568B standard)	RJ45 male connector (front)
	6 (rxd1+)	1 (rxd2+)	3 (rxd+)	3	White/green	
	5 (txd1+)	2 (txd2+)	1 (txd+)	2	White/orange	
	4 (rxd1-)	7 (rxd2-)	6 (rxd-)	3	Green	
	8 (txd1-)	3 (txd2-)	2 (txd-)	2	Orange	
			4	1	Blue	
			5	1	White/blue	
			7	4	White/brown	
			8	4	Brown	

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Ethernet cabling for system developers

The following figure describes cabling example for Ethernet communication between Epec control units and PC.
Ordering codes for the needed hardware is included in the figure.

To check 6107 display unit's IP addresses, use ApplicationLoader (device software). For more information, see *ApplicationLoader manual* (available in Epec Extranet).

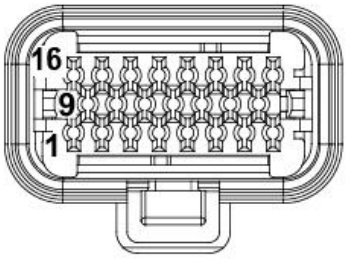


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13.4.5 RS-232 Cabling

- Minimum requirement for creating the RS-232 data link is 3-wire connection. When only hardware flow control is required, the 5-wire connection is needed. The following signals are in use in 5-wire connection:
    - RX = Receive Data
    - TX = Transmit Data
    - RTS = Request To Send (output)
    - CTS = Clear To Send (input)
    - GND = Signal Ground
- The maximum length of the cable is 3 m
- The following picture is an example of a connection that has been designed only between Epec display unit and PC with 3-wire connection.

RS-232 cabling connection with 6107 display unit to device:

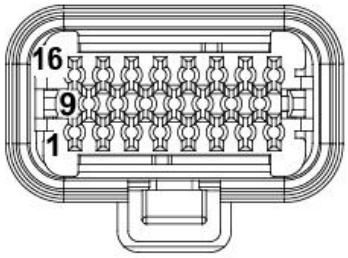
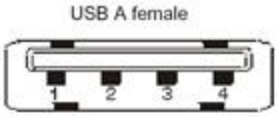
AMP23 female connector (front)	AMP23 pin
	3 (TXD, transmit data)
	4 (RXD, receive data)
	5 (RTS, request to send [output])
	6 (CTS, clear to send [input])
	10 (GND)

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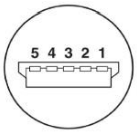
13.4.6 USB Cabling

- It is recommended to use full speed rated USB cable.
- Full speed cable consists of twisted signal pairs, VBUS, GND and an overall shield.
- When using an appropriate cable, the operation reliability of the connected device is assured.
- The maximum length (2 m) of the used cable is determined of transit time delay, attenuation, communication speed and the power consumption of the connected device.
- In practise, it is not recommended to use longer cable than 1 m.
- The previous things should be considered when connecting the device directly to the USB connection.

AMP23 USB cabling connection with 6107 display unit:

AMP23 female (front)	AMP23 pin	USB A female pin	USB A female (front)
	1 (D+)	3 (D+)	
	2 (D-)	2 (D-)	
	9 (+ 5 V)	1 (+ 5 V)	
	10 (GND)	4 (GND)	
	15 (USB_SHIELD)	Connector chassis	

M12 miniB-USB

Picture	Pin	Signal
	1	+5V
	2	D-
	3	D+
	4	ID
	5	GND

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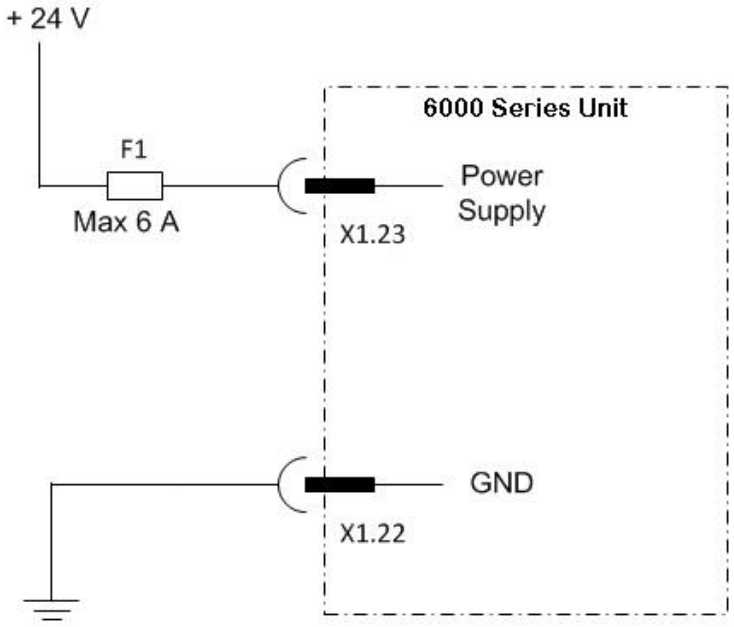
13.4.7 Power Supply Cabling

The maximum continuous current per pin is 6 A.

The power for sensors, encoders and other equipment should be supplied from the very same unit that the equipment is connected to, to ensure the best performance of the system. No external power (or ground) connections are allowed.

- The nominal operating voltage for Epec control units is 12 and 24 VDC. The full operating range is 8,4 - 36 VDC.
- See section *Power Supply* for accurate pin allocation of the connectors when using Epec 6107 display unit.
- Single point grounding should be used for power supply for all the control units.

Power supply's wiring example:



Emergency Stop

In all European Community countries, the emergency stop should be implemented in accordance with standard EN ISO 13850, which complies to the EC Machinery directive 2006/42/EC. In other countries, the emergency stop should be implemented according to local standards and/or to local legislation.

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13.5 Welding



Welding causes some high current flows and voltage peaks in the machine. It should be noted that the electronics of the control system may be damaged, if the welding current can get through the control unit itself.
So, when welding, it should be taken care to prevent high currents from going through the control units or through the CAN bus.

Follow carefully the following instructions.



Disconnect all the connectors from the control units before welding.

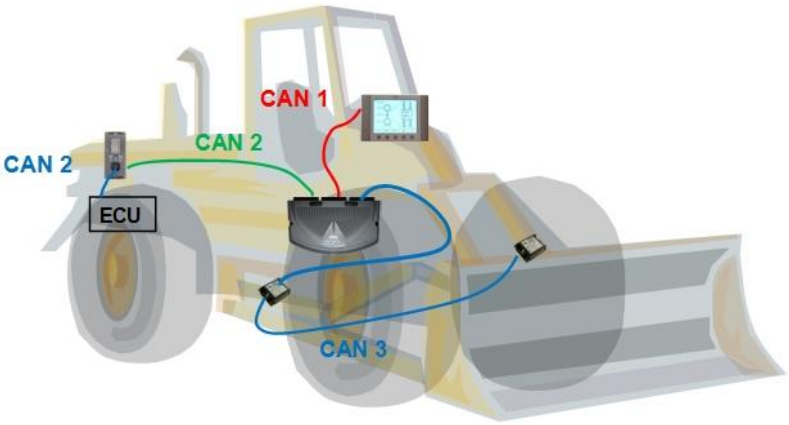


Generally, even if the control system power is disconnected, welding should be done carefully and by following appropriate safety measures. Welding grounding should be connected close to the welding point to avoid long distance high current flow through machine frame.

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13.6 System Examples

Loading machine



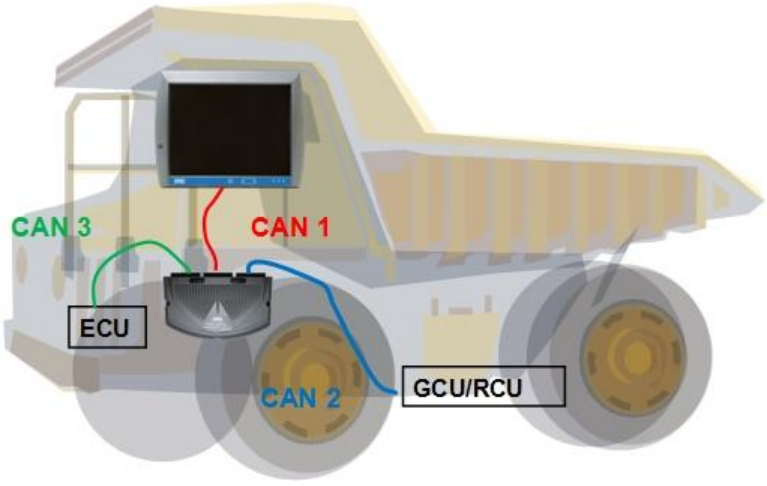
Cabin control unit
- reads the joysticks and switches
- controls the boom and bucket
- controls the gearing
- controls the steering and brakes
- controls the lights

Rear frame control unit
- controls the engine
- controls the hydraulic pumps
- controls the rear lights

Tilt sensors
- measures the frame position
- measures the loader position

Display
- gauge
- diagnostics
- software updating

Dumper

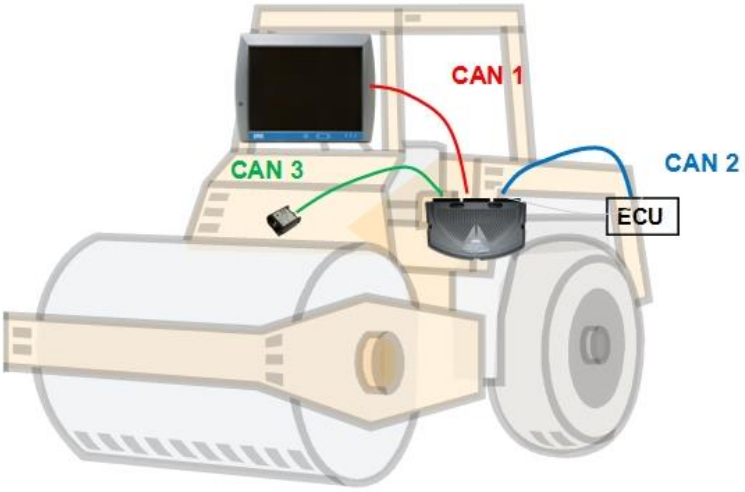


Cabin control unit
- reads the joysticks and switches
- controls the engine
- controls the gearing
- controls the driveshaft brake
- controls the steering and brakes
- controls the dump box

Display
- remote connection
- positioning
- gauge
- diagnostics
- software updating

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Landfill compactor

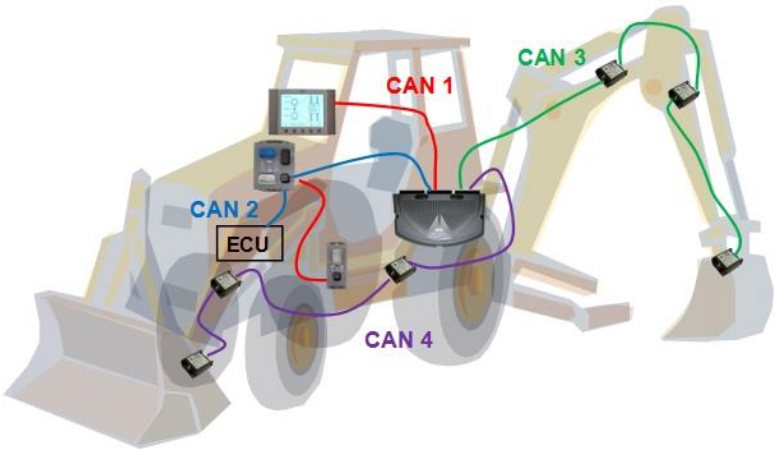


Cabin control unit
- reads the joysticks and switches
- controls the engine
- controls the transmission
- controls the steering
- controls the lights

Tamping sensors
- measures the degree of concentration

Display
- remote connection
- positioning
- gauge
- diagnostics
- software updating

Backhoe



Cabin control unit
- reads the joysticks and switches
- controls the excavator
- controls the roof lights
- booms' position calculation

Engine control unit
- controls the engine
- controls the front loader
- reads the fluid pressures and temperatures

Gearing control unit
- controls the gearing
- controls the suspension

Tilt sensors
- measures the frame position
- measures the excavator and front loader positions

Display
- gauge
- diagnostics
- software updating

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13.7 Accessories and Ordering Codes

Related products

Picture	Product Name	Epec ordering code	Epec data sheet code
	3500 CAN Adapter Box	E3003500	MAN000385
	Epec Measuring Adapter	E3002014	MAN000387
	Ethernet Y-splitter cable 0,8 m	KW0179	MAN000585
	Ethernet cable 3 m	KW0184	MAN000585
	USB cable (M12 USB mini-B - USB A male) 2 m	KW0186	MAN000614
	GSM UMTS / GPS antenna	KY0035	MAN000627
	Camera (Brigade)	KH0038	MAN000626

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	Camera cable (M12 FEM - Mini-DIN4 FEM) 30 m (for Brigade)	KW0201	MAN000626
-	Camera Y-splitter cable (M12 FEM- 2 x M12 MALE) 1 m (for Brigade)	E30902496	MAN000626
	Small Mounting Pedestal	E30802473	MAN000578
	Panel Mounting Kit	E30802471	MAN000583
-	M12 sealing cap for male connector (IP67)	KX0423	-
-	M12 sealing cap for female connector (IP67)	X0058261	-
	Power supply & CAN cable for 6000 series (AMP23 - AMP8 + 17 x flying leads) 2 m	E30902490	MAN000615
-	External termination resistor	E30901252	-
-	Kvaser CAN Card	E0000038	-

AMPSEAL Connectors

Epec uses gold plated, locked and sealed AMPSEAL heavy duty connectors for all Epec CAN Control Unit Family products to ensure endurance under extreme conditions.

- All connectors are mechanically keyed to mate only with identical colors

AMPSEAL product	TE Connectivity ordering code	Epec ordering code
Contact for AMP plug assembly	770854-3	KX0010
Crimping tool	58529-1	TT0018

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AMP 23-pin Plug Assembly, Black	770680-1	KX0008
AMP 23-pin Plug Assembly, Black with 2 m leads	-	E30901311

AMPSEAL cable dimensions

Size		Insulation diameter range	Strip length ±0,4
mm²	AWG		
0,5	20	1,7 to 2,7	5,1
0,8	18		
1,4	16		
1,5	---	2,2 to 2,4	

Typical hand crimping tool e.g.: AMP Procrimper 58529-1 (TE Connectivity), Epec ordering code TT0018

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