# Epec 6807 Display Unit

## Technical Manual and Cabling Instructions

MAN000791


**Functional versions**
**6807-224**
**6807-222**
**6807-220**

**Document version history**

| Date | Notes |
|---|---|
| 24.01.2024 | Added sections:<br>*Approvals and Safety > Simplified EU Declaration of Conformity* |
| 05.06.2023 | First released version |

**Classification: Public**

# Table of Contents

# 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.

The following symbols may be used on Epec's product labels:

UKCA compatibility
This symbol indicates that the product complies with the requirements set in the UKCA certification.

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

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 symbol indicates that the product is certified with normal automotive (E17) EMC (electromagnetic compatibility) standards.

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


20 PAP
This symbol indicates the material out of which the item is made, to facilitate its recycling process. This symbol identifies that the packaging for this product is corrugated fiberboard (cardboard).

## 1.2 Basic Skills Required

The user of this document should have basic knowledge of machine controlling, CAN communication, PLCopen programming according to IEC61131-3 and should have skills to use CODESYS programming environment.

Refer to CODESYS 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.



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### 1.3 Safety Guidelines

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

A separate safety analysis is always 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.

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 mentioned in this manual. The manufacturer does not guarantee that this product complies with any other certification, standard or test other than mentioned in this manual.

This product is not field serviceable, so it cannot be opened without damaging the unit.

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.

Epec Oy reserves a right to improve its products without a further notice.



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### 1.4 Warranty

Information concerning the warranty of this product can be found from *Epec General Sales and Warranty Terms.*

For more information, contact *sales@epec.fi*



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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.



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## 1.6 Environmental Statement

The manufacturer has a certified ISO 14001: 2015 environmental management system and certified processes to manufacture products. The manufacturer acts in an environmentally responsible manner and always complies with valid environmental legislation and directives.

The manufacturer is committed to comply with all relevant product regulations and directives concerning product safety, and responsible sourcing of raw materials and components.

The manufacturer undertakes to arrange for the recycling and scrapping of products that are returned to the manufacturer by the buyer and/or products that are received by the manufacturer in connection with maintenance services and deemed unusable by the manufacturer.

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. Outside of the European Union, local guidelines for recycling shall be followed.

When recycling the product, note that there is a coin cell lithium battery inside.



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# 2 PRODUCT OVERVIEW

Epec 6807 Display Unit is a high-performance capacitive touch screen display designed for mobile machinery.

Epec 6807 has flexibility in CPU performance, internal memory, and external interfaces. 6807 has durable aluminum housing and the LCD display panel is optically bonded together with the touch panel for a stiff structure and great sunlight readability.

Epec 6807 Display Unit supports both panel and pedestal assembly. The customer can program 6807 with CODESYS Visualization or C/Qt.

6807 Display Unit is fully compatible with Epec SW development tools MultiTool Creator and MultiTool Diagnostics, and Epec IoT products GlobE and GatE.

**Performance**

- Solo, Dual or Quad core CPU variants
- Internal Graphics Processing Unit (GPU)
- Flexible internal memories
- High brightness and wide viewing angle display
- Excellent sunlight readability
- Optically bonded sensitive capacitive touch screen
- Touch with water resistance and glove operation

**Durability**

- Light and leak proof aluminum housing
- IP66/67 protection class

**Assembly**

- Backwards compatible with Epec 6107 display unit
- Mounting can be done with a display pedestal or panel mounting kit

# 3 FUNCTIONAL VERSIONS

This section describes the different product variants, also known as functional versions. The functional version and hardware revision can be found on your product's label.

| Functional Version | 6807-224  | 6807-222  | 6807-220  |
|---|---|---|---|
| **Technical manual ID** | MAN000791 | | |
| **Processor** | Quad core CPU<br>Includes GPU | Dual core CPU<br>Includes GPU | Dual core CPU<br>Includes GPU |
| **Display size & resolution** | 7” 800 x 480 (WVGA) | | |
| **Touch type** | Capacitive PCAP optically bonded | | |
| **CAN** | 2 | | |
| **RS-232** | 1 | | |
| **USB** | 2 | 2 | 2 |
| **Ethernet** | 2 | 2 | 2 |
| **Analog Camera input** | 2 | 2 | - |
| **5 V REF** | 1 | 1 | 1 |
| **DO/DI** | 2 | 2 | 2 |
| **AI/DI/CI** | 2 | 2 | 2 |
| **AI/DI** | 2 | 2 | 2 |
| **KL15** | 1 | 1 | 1 |
| **Buzzer** | x | | |
| **Light sensor** | x | | |
| **Connectors** | 1xAMP23<br>5xM12 | 1xAMP23<br>5xM12 | 1xAMP23<br>3xM12 |
| **Mounting (Both pedestal and panel)** | x | | |
| | | | |
| **Flash** | 4 GByte | | |
| **RAM** | 1 GByte | | |
| **NVRAM** | 512 kByte | 512 kByte | 512 kByte |
| **NVRAM Type** | MRAM | MRAM | MRAM |
| | | | |

| | |
|---|---|
| **IP Class** | IP66 & IP67 |
| **NEMA Class** | TBD |
| **Temperature range** | -30 … +70 ˚C<br>-22 … +158 ˚F |
| **CODESYS version** | 3.5 |
| **Supported CAN higher layer protocols** | CANopen<br>SAE J1939 |
| **CODESYS Licenses in Epec E30 product codes (for W version ordering codes)** | TargetVisu<br>WebVisu<br>CANopen Master<br>Modbus TCP slave<br>OPC-UA server<br>Ethernet IP Scanner IEC |



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# 4 TECHNICAL DATA

**General**

| | |
|---|---|
| **Processor** | 32 bit CPU 792 MHz<br>Solo / dual / quad core Cortex-A9 ARM<br>Includes Internal Graphics Processing Unit (GPU)<br>Processor is hardware specific |
| **Memory** | Flash memory: 4 GByte<br>RAM memory (DDR3): 1024 MByte<br>Non-volatile memory: 0-512 kByte<br><br>Memory sizes are hardware specific, check the device's memory sizes using ApplicationLoader software (for more information, see *Epec Programming and Libraries manual*). |
| **Operating system** | Linux |
| **Programming** | CODESYS 3.5 |
| **Power** | Nominal supply voltage 12/24 VDC systems (8,4 ... 32 VDC)<br>Power consumption typ. 6 W (idle, mid display backlight brightness)<br>Standby power consumption typ. 50 mW |
| **REF voltage outputs** | +5 V |
| **Diagnostics** | Supply voltage<br>Unit temperature<br>Software cycle time<br>REF voltage monitoring |

**Display**

| | |
|---|---|
| **Display size and type** | 7”, TFT color LCD |
| **Touch screen** | Projected capacitive touch panel (PCAP)<br>Optical-bonded 1.8 mm cover glass with anti-glare and anti-fingerprint surface |
| **Resolution** | WVGA 800 x 480 (5:3) |
| **Color depth** | 262k / 16.7 million |
| **Display Panel Brightness** | 850 cd/m$^2$ |
| **Display Panel Contrast** | 1000:1 |
| **Viewing angle** | 170˚ |
| **Brightness control** | Manual backlight control |

**Mechanics:**

| | |
|---|---|
| **Size / Outer dimensions** | 198 mm x 148 mm x 47 mm (width x height x depth)<br>7.8 in x 5.83 in x 1.85 in (width x height x depth) |
| **Weight** | 0.93 kg<br>2.05 lbs. |
| **Protection class** | IP66 & IP67 |
| **Case material** | Aluminum |
| **Operating temperature** | -30... +70 ˚C<br>-22...+158 ˚F |
| **Storage temperature** | -40... +85 ˚C<br>-40... +185 ˚F |

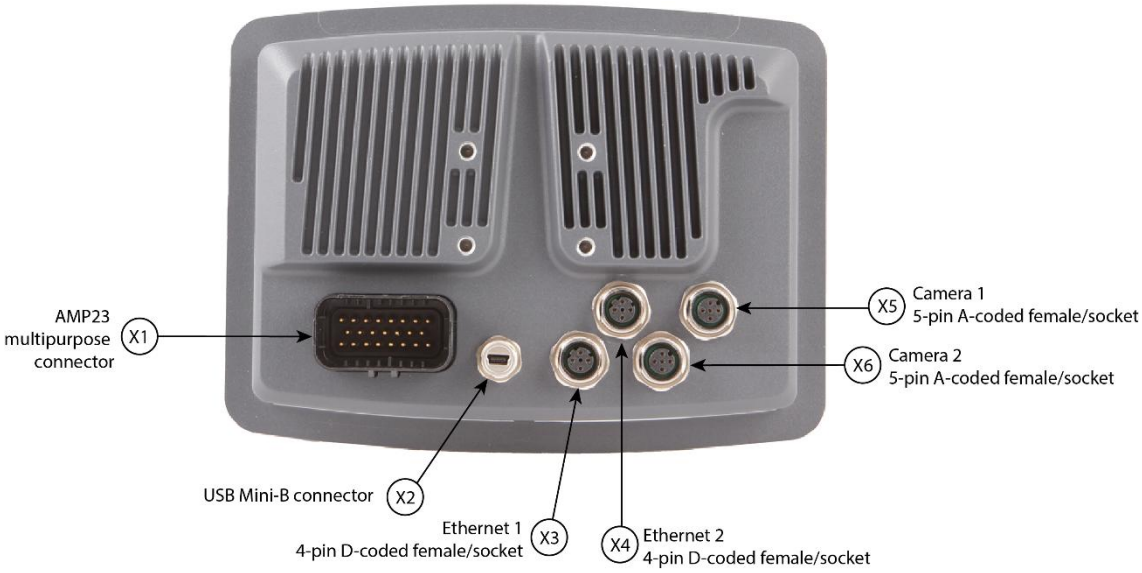
**Connectors and communication:**

<table>
<tr><td>Connectors</td><td>1 x AMP23<br>1 x M12 USB Mini-B<br>2 x M12 D-coded 4-pin socket<br>0/2 x M12 A-coded 5-pin socket</td></tr>
<tr><td>Communications/ Interfaces</td><td>Default interfaces:
<table>
<tr><th>Interface</th><th>Amount</th><th>Connector</th></tr>
<tr><td>CAN</td><td>2</td><td>AMP23</td></tr>
<tr><td>RS-232</td><td>1</td><td>AMP23</td></tr>
<tr><td>USB</td><td>2</td><td>AMP23: full speed (12 Mbps)*<br>M12 USB Mini-B: high speed (480 Mbps)*</td></tr>
<tr><td>Ethernet</td><td>2</td><td>M12 (4 pin)</td></tr>
</table>
* for maintenance purposes only<br><br>Optional interfaces:
<table>
<tr><th>Interface</th><th>Amount</th><th>Connector</th></tr>
<tr><td>Analog camera</td><td>2</td><td>M12 (5 pin)</td></tr>
</table></td></tr>
<tr><td>Other features</td><td>RTC (Real-time Clock) with battery keeps time for approximately (temperature dependent)<ul><li>10 years storage</li><li>20 years 8 h/d in operation</li></ul>ALS<br>Internal buzzer</td></tr>
<tr><td>I/O pins total</td><td colspan="2">6</td></tr>
<tr><td rowspan="2">Outputs</td><td>1x</td><td>+5 V REF</td></tr>
<tr><td>2x</td><td>DO/DI</td></tr>
<tr><td rowspan="3">Inputs</td><td>2x</td><td>AI/DI</td></tr>
<tr><td>2x</td><td>AI/DI/CI/PU</td></tr>
<tr><td>1x</td><td>Wake-up (KL15)</td></tr>
</table>

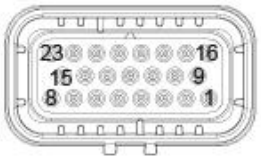
# 5 CONNECTORS AND PIN ASSIGNMENTS

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:



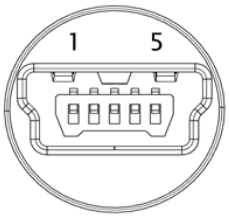

**X1, AMP23 multipurpose connector**

| Picture | Pin | Signal | I/O Type |
|---|---|---|---|
|   | 1 | USB_H1_D+ | |
| | 2 | USB_H1_D- | |
| | 3 | RS-232_TXD | |
| | 4 | RS-232_RXD | |
| | 5 | ANALOG_INPUT_2 | AI/DI TYPE116_4 |
| | 6 | WAKE-UP(KL15) | WAKE-UP(KL15) TYPE196_0 |
| | 7 | CAN1_L | |
| | 8 | CAN1_H | |
| | 9 | USB_PWR | |
| | 10 | DATA_GND | |
| | 11 | ANALOG/DIGITAL_INPUT_1 | AI/DI TYPE219_1 |
| | 12 | ANALOG/DIGITAL_INPUT_2 | AI/DI TYPE219_1 |
| | 13 | CAN2_L | |
| | 14 | CAN2_H | |
| | 15 | CAN/USB_SHIELD (chassis ground) | |
| | 16 | +5 V REF | |

| | | | |
|---|---|---|---|
| | 17 | ANALOG_INPUT_1 | AI/DI TYPE116_4 |
| | 18 | I/O_GND | |
| | 19 | I/O_GND | |
| | 20 | DIGITAL_OUTPUT_1 | DO/DI TYPE220_1 |
| | 21 | DIGITAL_OUTPUT_2 | DO/DI TYPE220_1 |
| | 22 | PWR_GND | |
| | 23 | PWR_IN | |

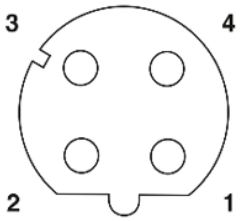
Product connector type: 23-pin AMPSEAL male connector
Mating connector example: AMP 23-pin Plug Assembly black (TE Connectivity 770680-1) + Contact for AMP plug assembly (TE Connectivity 770854-3)

**X2, USB Mini-B connector**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | +5 V |
| | 2 | D- |
| | 3 | D+ |
| | 4 | ID |
| | 5 | GND |
| | Housing | Connected to chassis ground |

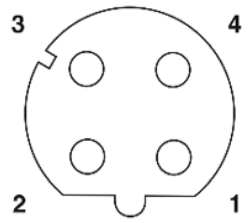
For maintenance purposes only
Product connector type: M12 USB Mini-B receptacle
Mating connector example: any USB Mini-B plug

**X3, Ethernet 1 connector**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | TD+ |
| | 2 | RD+ |
| | 3 | TD- |
| | 4 | RD- |
| | Housing | Connected to chassis ground |

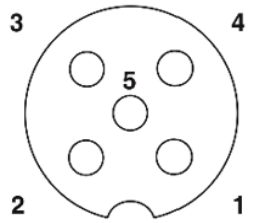
Product connector type: M12 D-coded 4-pin socket (according IEC 61076-2-101)
Mating connector example: M12 D-coded 4-pin plug

**X4, Ethernet 2 connector**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | TD+ |
| | 2 | RD+ |
| | 3 | TD- |
| | 4 | RD- |
| | Housing | Connected to chassis ground |

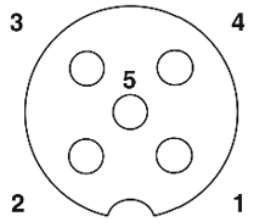
Product connector type: M12 D-coded 4-pin socket (according IEC 61076-2-101)
Mating connector example: M12 D-coded 4-pin plug

**X5, Camera 1 connector**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | COMPOSITE_INPUT+ |
| | 2 | Not connected |
| | 3 | +12V_OUT |
| | 4 | GND |
| | 5 | COMPOSITE_GND |
| | Housing | Connected to chassis ground |

Product connector type: M12 A-coded 5-pin socket (according IEC 61076-2-101)
Mating connector example: M12 A-coded 5-pin plug

**X6, Camera 2 connector**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | COMPOSITE_INPUT+ |
| | 2 | Not connected |
| | 3 | +12V_OUT |
| | 4 | GND |
| | 5 | COMPOSITE_GND |
| | Housing | Connected to chassis ground |

Product connector type: M12 A-coded 5-pin socket (according IEC 61076-2-101)
Mating connector example: M12 A-coded 5-pin plug

# 6 DO/DI TYPE220_1

Possible pin modes:

- Sourcing DO mode (pull-up)
- Sourcing DO mode (pull-down)
- DI mode (pull-up)
- DI mode (pull-down)

## 6.1 DO (digital output) mode

- This pin type is a current sourcing output with a pull-up selection and current sensing capability
  - The pin connects the load to a positive supply voltage
  - The pull-up feature is for open load detection when the pin is used as an output
  - Current measurement is intended for diagnostics purposes
- 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*.

## 6.2 DI (digital input) mode

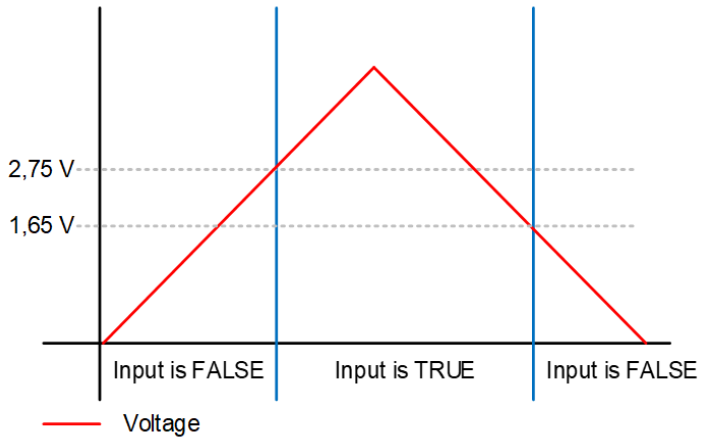
- This pin can be used as a digital input (DI) by using the output state monitoring feature
  - In this case, the output (DO) functionality of the pin type must be kept OFF
- This pin can be used also with NPN-type sensors – sensors with open collector/open drain
- It's highly recommended to use closed loop connections when the output pin is used as an input. By keeping this simple principle in your mind you will avoid many unknown problems later on

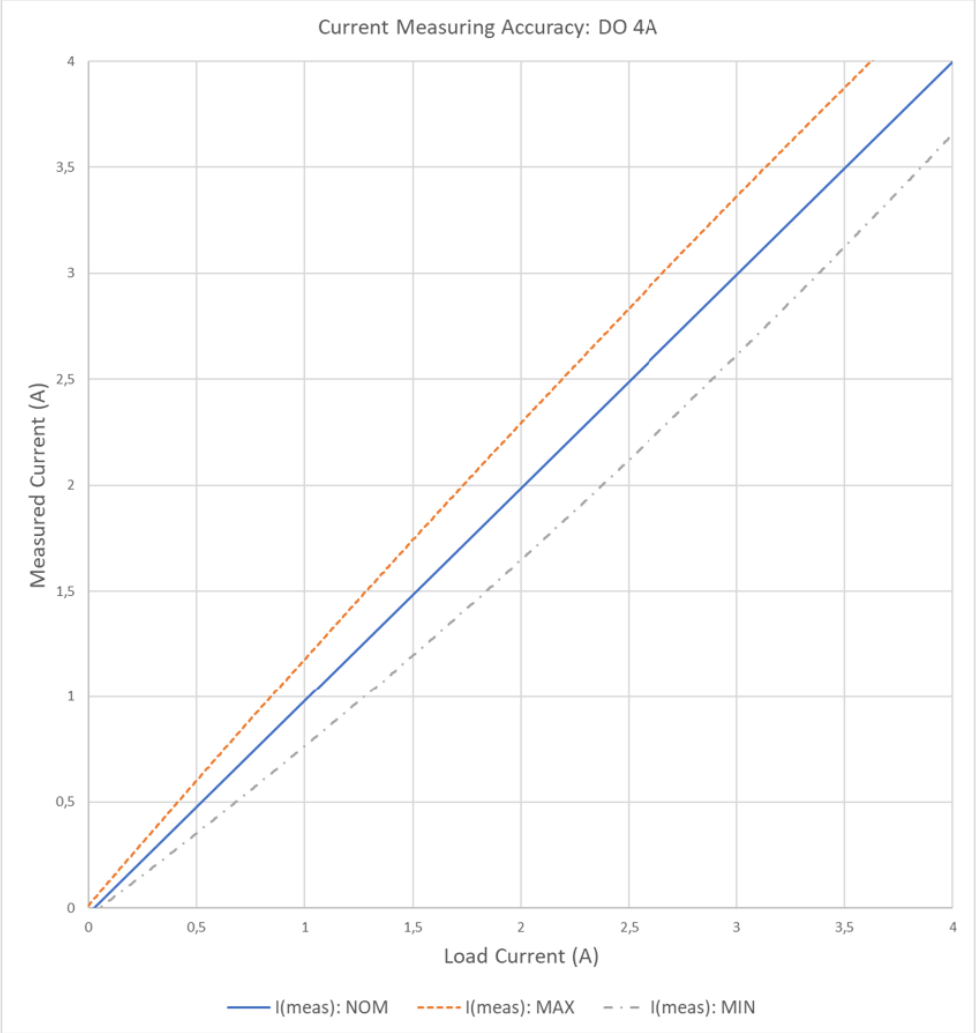
**Electrical characteristics**

| Symbol | Parameter | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| $V_{Level}$ | Output voltage | Output Off, Pull-up selected, Unconnected pin,<br>$U_{in}$ = 24 V<br>$V_{Level}$ = $U_{in}$/1,3 | typ. 18,5 | | V |
| $I_o$ | Nominal Output Current | Output On<br>(Note 3) | 0 | 2 | A |
| $I_{o\text{-}lim\_sw}$ | Internal short circuit protection SW | Output On (Note 2, 9) | typ. 4 | | A |
| $I_{o\text{-}lim\_hw}$ | Internal short circuit protection HW | Output On (Note 2, 6) | typ. 70 | | A |
| $I_{acc}$ | Current measurement accuracy | See picture below | | | |

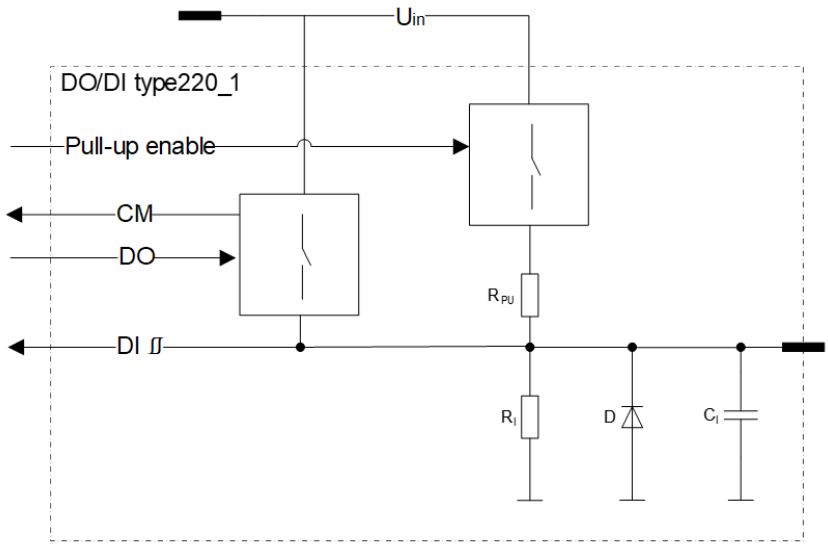
| Digital status input | | | | | |
|---|---|---|---|---|---|
| $R_I$ | Input Resistance | Output Off, Pull-up resistor not selected, $V_I < U_{in\ (referenced\ to\ GND)}$ | typ. 40 | | kΩ |
| | | Output Off, Pull-up resistor selected, (referenced to $U_{in\ /1,3)}$ | typ. 8,0 | | kΩ |
| $V_{IH}$ | High Voltage level | Output Off (Note 3, 8) | 2,75 | 36 | V |
| $V_{IL}$ | Low Voltage level | Output Off (Note 8) | | 1,65 | V |
| $V_{I\text{-}range}$ | Input voltage range | (Note 7) | -0,5 | 36 | V |
| $t_I$ | Digital Status Input Pulse Width | (Note 1, 5) | > tC | | ms |
| $C_I$ | Input pin capacitance | | typ. 1,5 | | 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 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.
**Note 9:** Protection implemented in CODESYS code template






## 6.3 Functional block diagram



# 7 AI/DI TYPE116_4

Possible pin modes:

- +5 V AI voltage mode (pull-down)
- +5 V AI voltage mode (pull-up)
- +20 mA AI current mode
- DI mode

## 7.1 AI (Analog Input) mode

- 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
  - Pull-up voltage measurement

## 7.2 DI (Digital Input) mode

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

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

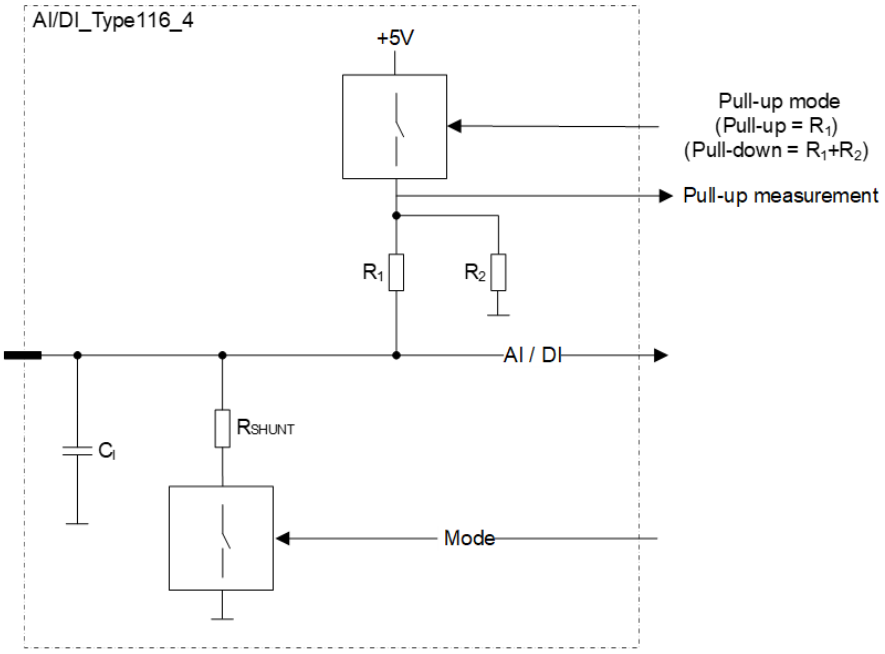
**Electrical characteristics**

| Symbol | Parameter | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| $V_I$ | Input Voltage measuring range | Voltage mode | 0 | 5,0 | V |
| | Scaling factor | Voltage mode | 1/1 | | |
| | | Current mode | 1/1 | | |
| $V_{PU}$ | Pull-up voltage | (Note 1) | typ. 5 | | V |
| $I_I$ | Input Current measuring range | Current mode | 0 | 22,7 | mA |
| $R_I$ | Input Resistance | Voltage mode, pull-up resistor not selected (referenced to GND) | typ. 84 | | kΩ |
| | | Voltage mode, pull-up resistor selected (referenced to + 5 V) | typ. 2200 | | Ω |
| | | Current mode (referenced to GND) | typ. 220 | | Ω |
| BW | Input Low Pass Filter Bandwidth | -3 dB cut-off frequency | typ. 72 | | Hz |

| | | | | | |
|---|---|---|---|---|---|
| $I_E$ | Input Error | Voltage mode | | 0,1 | V |
| | | Current mode | | 0,5 | mA |
| $C_I$ | Input pin capacitance | | typ. 47 | | nF |
| $V_{I\text{-range}}$ | Input Voltage Range | Voltage mode (Note 2) | -0,5 | 36 | V |
| | | Current mode (Note 2) | -0,5 | 36 | V |

**Note 1:** Temperature-dependent.
**Note 2:** Exceeding the max value might cause damage to input.

### 7.3 Functional block diagram



# 8 AI/DI TYPE219_1

Possible pin modes:

- +5 V AI voltage mode
- DI mode

## 8.1 AI (Analog Input) mode

- The pin can be used as high impedance voltage input for signals from 0 to 5 volts
- The pin must be configured to analog input mode when used as an analog input

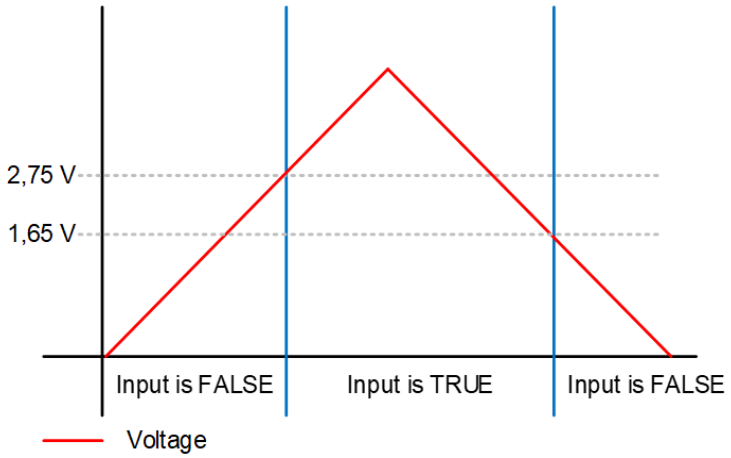
## 8.2 DI (Digital Input) mode

- The type of the pin is a ground referenced input (DI)
- The pin must be configured to digital input mode mode when used as a digital input

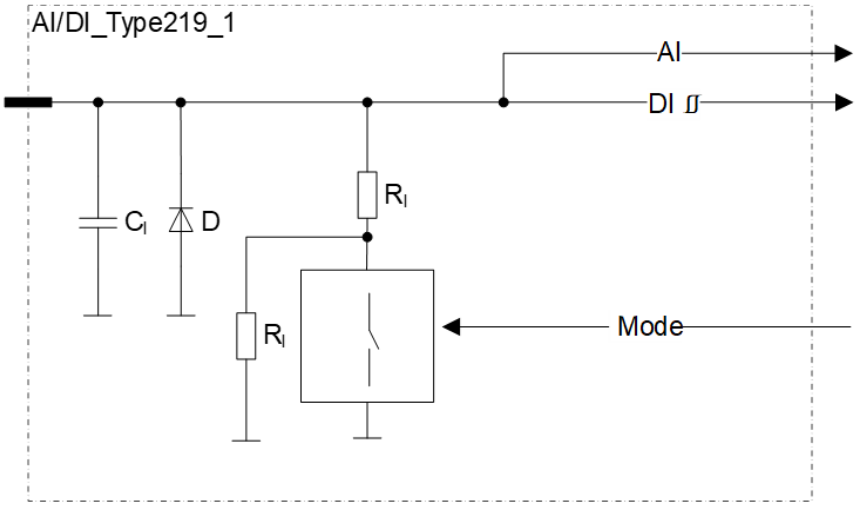
### Electrical characteristics

| Symbol | Parameter | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| $V_I$ | Input Voltage measuring range | | 0 | 5,0 | V |
| $R_I$ | Input Resistance | Analog input mode (Referenced to GND) | typ. 85 | | kΩ |
| | | Digital input mode (Referenced to GND) | typ. 10 | | |
| $I_E$ | Input Error | Analog input mode | | 0,1 | V |
| BW | Input Low Pass Filter Bandwidth | Analog input mode -3 dB cut-off frequency | typ. 72 | | Hz |
| $V_{IH}$ | Input High Voltage level | Digital input mode (Note 1, 3) | 2,75 | 36 | V |
| $V_{IL}$ | Input Low Voltage level | Digital input mode (Note 3) | 0 | 1,65 | V |
| $C_I$ | Input pin capacitance | | typ. 1,5 | | nF |
| $V_{I\text{-}max}$ | Max Input voltage | (Note 2) | -0,5 | 36 | V |

**Note 1:** Exceeding the max value 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.




## 8.3 Functional block diagram



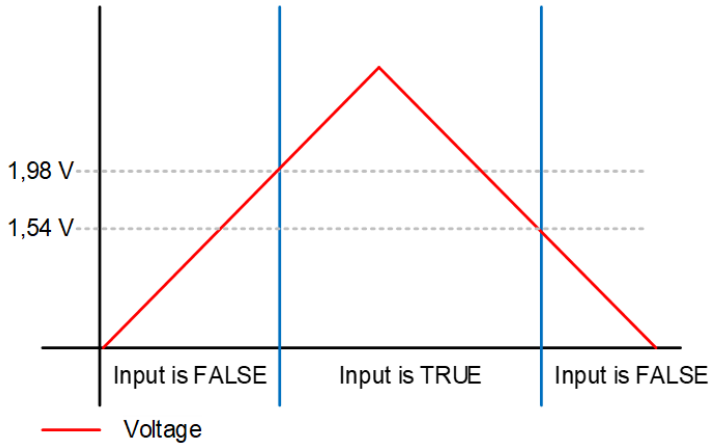
# 9 WAKE-UP (KL15) TYPE196_0

- This type of pin is a ground referenced input
- The pin is used to wake up the unit

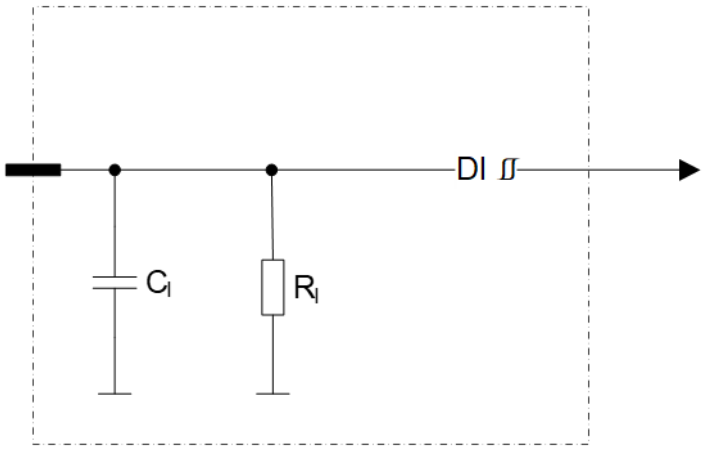
**Electrical characteristics**

| Symbol | Parameter | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| $R_I$ | Input Resistance | Referenced to GND | typ. 10 | | kΩ |
| $V_{IH}$ | Input High Voltage level | (Note 1, 3) | 1,98 | $U_{in}$ | V |
| $V_{IL}$ | Input Low Voltage level | (Note 3) | 0 | 1,54 | V |
| $C_I$ | Input pin capacitance | | typ. 1,5 | | nF |
| $V_{I\text{-}max}$ | Max Input voltage | (Note 2) | -0,5 | 36 | V |

**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.




## 9.1 Functional block diagram



# 10 +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.

## 10.1 Protection features

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

## 10.2 Voltage monitoring

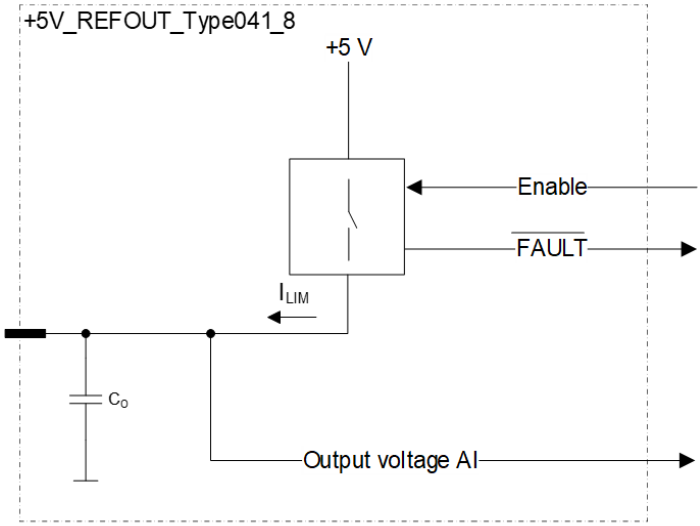
The level of the output voltage can be monitored by application.

### 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 | | 0,5 | Ω |
| $I_o$ | Nominal Output Current | Output On; | 0 | 150 | mA |
| $I_{o\text{-}lim}$ | Internal Current Limitation | Output On (Note 2, 3) | typ. 400 | | mA |
| $I_{o\text{-}sc}$ | Short-circuit Current Limit | Output On; Overcurrent, $R_L = 0$ | typ. 280 | | mA |
| $C_o$ | Output Capacitance | | typ. 4,7 | | 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 | 10 | V |
| | Scaling Factor | (Note 4) | 1/2 | | |

**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.

## 10.3 Functional block diagram



# 11 POWER SUPPLY

- Nominal supply voltage 12/24 VDC
- Operating range 8,4…32 VDC
- Undervoltage reset ≤ 6,6 VDC

## 11.1 Overvoltage Protection

- Max. 36 V continuous (Stresses above this value may cause permanent damage to the unit.)
- The 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 37,4 V. Power feed is restored when supply voltage drops under 37,4 V.

## 11.2 Power Consumption

- Supply voltage ($U_{in}$) maximum continuous current 6 A (with full external load)
- GND current sum max 6 A
- Typical power consumption 6 W (idle, mid display backlight brightness)
- Typical standby power consumption 50 mW

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…32 VDC) |
| Ground (for supply voltage) | X1.22 | GND |
| Data ground (for CAN, RS-232) | X1.10 | GND |
| I/O ground | X1.18<br>X1.19 | GND |
| **Supply outputs** | | |
| Reference supply (for external devices) | X1.16 | +5 VDC / max 150 mA |

Always use an external fuse to protect the unit. The fuse is needed for reverse voltage and overload protection. For more information, see section *Power Supply Cabling*.

**Electrical characteristics**

| Symbol | Parameter | Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| $V_I$ | Nominal Input Voltage | | 8,4 | 32 | V |
| $V_{I\text{-}Load\text{-}dump}$ | Max Input Transient Voltage Level | (Note 1) | | 202 | V |
| $V_{I\text{-}max}$ | Max Continuous Input Voltage Level | (Note 2) | -28 | 36 | V |
| $V_{I\text{-}ovp}$ | Overvoltage Threshold Level | | typ. 37,4 | | V |
| $V_{I\text{-}uvp}$ | Undervoltage Threshold Level | | typ. 6,6 | | V |
| **Supply voltage monitoring** | | | | | |
| $V_{I\text{-}range}$ | Nominal Input Voltage measuring range | | 0 | 65,5 | V |

**Note 1:** Load dump protection according to ISO16750-2: 2012
**Note 2:** Limited functionality when the voltage is higher than the nominal. If the voltage is less than 6,6 V, the unit is in non-operational state.

# 12 INTERFACES

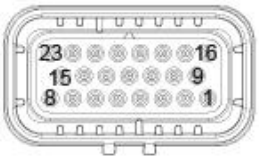
## 12.1 CAN Bus

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

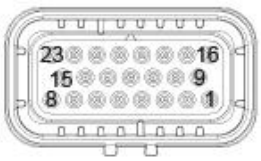
| | |
|---|---|
| **Supported CAN amount:** | 2 |
| **Bit rate:** | All interfaces support bit rates 50, 125, 250, 500, 1000 kbit/s |
| **CAN interface features:** | • Implementations of higher layer protocols are user programmable. Epec provides implementations for CANopen and SAE J1939 as PLCopen libraries.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

### 12.1.1 CAN bus connection pins

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

| Picture (AMP23 male connector, front) | Pin | Signal |
|---|---|---|
|  | 7 | CAN1 L |
| | 8 | CAN1 H |
| | | |
| | 10 | GND (DATA GROUND) |

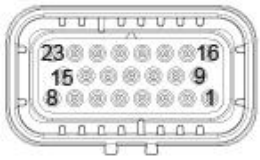
The CAN2 communication pins are located in the product's AMP23 (X1) connector as follows:

| Picture (AMP23 male connector, front) | Pin | Signal |
|---|---|---|
|  | 13 | CAN2 L |
| | 14 | CAN2 H |
| | | |
| | 10 | GND (DATA GROUND) |

### 12.2 RS-232

| | |
|---|---|
| **Supported RS-232 amount:** | 1 |
| **Mode:** | DTE (data terminal equipment)<br>3-wire RS-232 (RTS and CTS excluded) |
| **Cabling:** | See section *RS-232 Cabling* |
| **Related programming libraries:** | • Serial.library (For more information, see *Epec Programming and Libraries manual*) |

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

| Picture (AMP23 male connector, front) | Pin | Signal |
|---|---|---|
|  | 3 | TXD, transmit data |
| | 4 | RXD, receive data |
| | | |
| | | |
| | | |
| | 10 | GND (DATA GROUND) |

### 12.3 USB

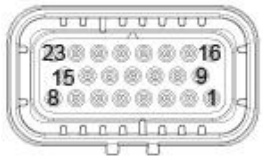
USB ports provide a flexible way to attach peripheral devices. However, it should be noted that the core of the unit is based on embedded processor architecture. Therefore, it is strongly recommended to consult Epec to assess the compatibility with the product when selecting a new USB device.

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

#### 12.3.1 AMP23 USB

| | |
|---|---|
| **Bus speed maximum:** | 12 Mbps (full speed USB) |
| **Features:** | For maintenance purposes only |

**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 |

#### 12.3.2 M12 USB Mini-B

| | |
|---|---|
| **Bus speed maximum:** | 480 Mbps (high speed USB) |
| **Features:** | • Only host mode supported<br>• For maintenance purposes only |

**X2, M12 connector (USB Mini-B):**

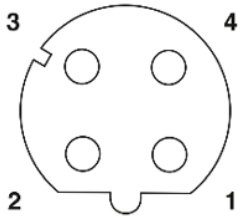
| Picture | Pin | Signal |
|---|---|---|
|  | 1 | +5 V |
| | 2 | D- |
| | 3 | D+ |
| | 4 | ID |
| | 5 | GND |
| | Housing | Connected to chassis ground |

## 12.4 Ethernet

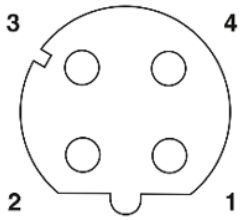
Firewall can be activated for Ethernet, for more information refer to *Epec Programming and Libraries manual*.

| | |
|---|---|
| **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, Ethernet 1, M12 connector (D-coded 4-pin socket):**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | TD+ |
| | 2 | RD+ |
| | 3 | TD- |
| | 4 | RD- |
| | Housing | Connected to chassis ground |

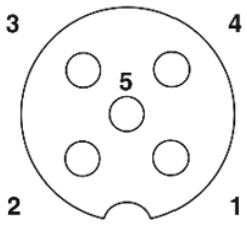
**X4, Ethernet 2, M12 connector (D-coded 4-pin socket):**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | TD+ |
| | 2 | RD+ |
| | 3 | TD- |
| | 4 | RD- |
| | Housing | Connected to chassis ground |

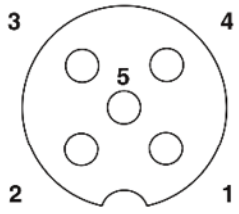
## 12.5 Analog camera

| | |
|---|---|
| **Supported camera amount:** | max 2 |
| **Supported video formats:** | PAL |
| **Camera cable type:** | 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<br>(For more information, see *Epec Programming and Libraries manual*) |

**X5, Camera 1, M12 connector (A-coded 5-pin socket)**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | COMPOSITE_INPUT+ |
| | 2 | not connected |
| | 3 | +12V_OUT |
| | 4 | GND |
| | 5 | COMPOSITE_GND |
| | Housing | Connected to chassis ground |

**X6, Camera 2, M12 connector (A-coded 5-pin socket)**

| Picture | Pin | Signal |
|---|---|---|
|  | 1 | COMPOSITE_INPUT+ |
| | 2 | not connected |
| | 3 | +12V_OUT |
| | 4 | GND |
| | 5 | COMPOSITE_GND |
| | Housing | Connected to chassis ground |

### 12.6 Buzzer

The internal buzzer has a fixed frequency of 4 kHz.

See also *Epec Programming and Libraries Manual > Programming > Programming 6000 series > Using Speaker and Buzzer.*



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# 13 INTERNAL DIAGNOSTICS

## 13.1 Temperature and Voltage Monitoring

### 13.1.1 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.

**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 |

### 13.1.2 Supply Voltage Monitoring

Product supply voltage can be monitored.

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{I\text{-}range}$ | Nominal Supply Voltage measuring range | | 0 | 65,5 | V |
| **Diagnostics** | | | **Low** | **High** | **Unit** |
| | Recommended supply voltage warning level | | 9 | 30 | V |

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

## 13.2 + 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.*

### 13.2.1 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.*

### 13.2.2 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 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.*

# 14 APPROVALS AND SAFETY

## 14.1 EMC Tests

Epec 6807 Display units are tested according to EMC tests that are described in this section.

### 14.1.1 General application

Following tests are done according standards:

- EN IEC 61000-6-2: 2019 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
- EN IEC 61000-6-3: 2021 Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments

| Measurement / test | Reference standard |
|---|---|
| Electrostatic Discharge Immunity (Note 1) | EN 61000-4-2:2009 |
| Radio frequency electromagnetic field (80 MHz to 6 000 MHz) (Note 2) | EN 61000-4-3:2006 + A1:2008 + A2:2010 |
| Fast transient common mode (Note 3) | EN 61000-4-4:2012 |
| Surges to power ports | EN 61000-4-5:2014 |
| Radio frequency common mode | EN 61000-4-6:2014 |
| Power frequency magnetic field | EN 61000-4-8:2010 |
| Radiated Emissions | EN 55032:2015 |
| DC power input port emissions (Note 4) | EN 55032:2015 |
| Wired network ports emissions | EN 55032:2015 |

Additional test levels compared to standard requirement:
**Note 1**: Tested contact discharge ±8 kV, air discharge ±15 kV and HCP/VCP ±8 kV
**Note 2**: Tested 80 MHz – 6 GHz 10 V/m
**Note 3**: Tested DC input port ±2 kV
**Note 4**: Tested with stricter AC mains port limits

### 14.1.2 Automotive application

Following tests are done according to UN Regulation No. 10, supplement 2 to the 06 series of amendments

| Measurement / test | Reference standard |
|---|---|
| Conducted Emission | ISO 7637-2:2004 |
| Radiated Emission | CISPR 25:2002, Corrigendum 2004 |
| Immunity to Electromagnetic Radiation | ISO 11452-2:2004<br>ISO 11452-4:2011 |
| Conducted Transient Immunity | ISO 7637-2:2004 |

### 14.1.3 Earth-moving and building construction machinery application

Following tests are done according to EN ISO 13766-1:2018 Earth-moving and building construction machinery – Electromagnetic compatibility (EMC) of machines with internal electrical power supply – Part 1: General EMC requirements under typical electromagnetic environmental conditions.

| Measurement / test | Reference standard |
|---|---|
| Radiated Emission | CISPR 25:2002, Corrigendum 2004 |
| Conducted transient emissions | ISO 7637-2:2011 |
| Starting Profile | ISO 16750-2:2012 Clause 4.6.3 |
| Load Dump (Test Pulse A) | ISO 16750-2:2012 Clause 4.6.4 |
| Conducted transient immunity (Pulse 1-3) | ISO 7637-2:2011 (Note 1) |
| Electrostatic discharge | ISO 10605:2008 |

Additional test levels compared to standard requirement:
**Note 1**: Tested with level IV

### 14.1.4 Additional tests

Following additional test was made.

| Measurement / test | Reference standard |
|---|---|
| Conducted RF emissions (Voltage method) | CISPR 25:2021 (Note 1) |

**Note 1**: Limits were according to Class III

### 14.2 Environmental Tests

The following environmental tests have been performed to the product.

| **Temperature** | | | |
|---|---|---|---|
| **Test** | **Temperature** | **Duration/ Exposure time** | **Remarks** |
| Cold<br>IEC 60068-2-1:2007, Test Ad | -30 ˚C | 16 h | |
| Cold<br>IEC 60068-2-1:2007, Test Ae | -30 ˚C | 16 h | |
| Dry heat<br>IEC 60068-2-2:2007, Test Bd | +70 ˚C | 16 h | |
| Dry heat<br>IEC 60068-2-2:2007, Test Be | +70 ˚C | 16 h | |
| Damp heat cyclic<br>IEC 60068-2-30:2005, Test Db | +25 ˚C/+55 ˚C | 12+12 h | • rel. humidity >90 %<br>• cycle duration 24 h<br>• six test cycles |
| Change of temperature<br>IEC 60068-2-14:2009, Test Na | -40 ˚C / +85 ˚C | 3 h | • 3 – 4.5 ˚C/min<br>• 5 test cycles |
| Change of temperature<br>IEC 60068-2-14:2009, Test Nb | -30 ˚C/+70 ˚C | 3 h | • 3 – 4 ˚C/min<br>• 2 test cycles |
| High storage temp.<br>ISO 16750-4:2010 | 85 ˚C | 48 h | |
| Low storage temp.<br>ISO 16750-4:2010 | -40 ˚C | 24 h | |

| **Mechanical resistance** | | |
|---|---|---|
| **Test** | **Duration and direction** | **Remark** |
| Shock test<br>IEC 60068-2-27:2009, Test Ea | • Pulse duration 6 ms<br>• 500 impulses in six directions | • half sine pulse shape<br>• peak acceleration 500 $m/s^2$ |
| Broad-band random vibration<br>IEC 60068-2-64:2008+ A1:2019, test Fh | • test duration 60 min in every three test direction | • ASD-level 5 $m^2/s^3$, 10 … 200 Hz<br>• ASD-level 1,0 $m^2/s^3$, 200 … 500 Hz<br>• total spectral acceleration 3,54 grms |
| Rough handling shocks, free fall<br>IEC 60068-2-31:2008, Test Ec | • One drop on each side and corner | • Height 100 cm |
| **Corrosion** | | |
| **Test** | | **Duration** |
| Salt mist test | | 168 h |

| **Tightness** | | |
|---|---|---|
| **Test** | **Duration and procedure** | **Remark** |
| Dust tightness IP6X<br>IEC 60529:1989+ A1:1999 + A2:2013 | | No deposit of dust observable inside the enclosure |
| Water tightness IPX6<br>IEC 60529 | | |
| Water tightness IPX7<br>IEC 60529 | • Immersion duration 30 minutes<br>• Immersion depth 1000 mm<br>• Water temperature +22 ˚C | No ingress of water noticed inside |

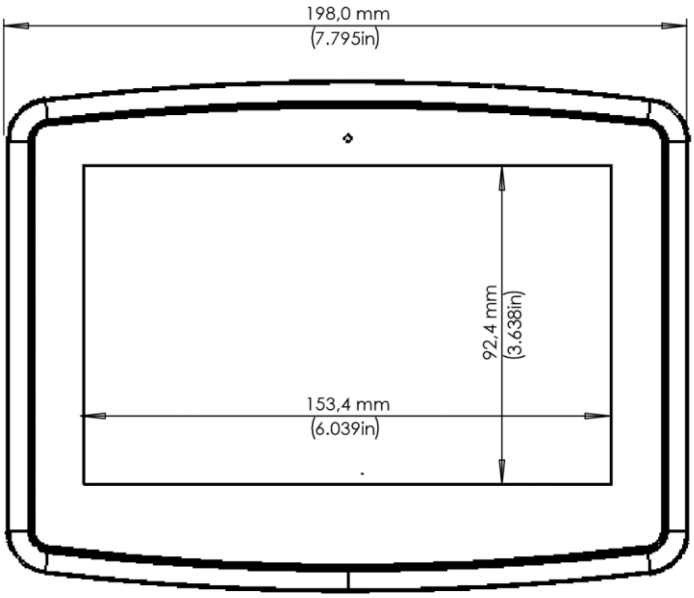
### 14.3 Simplified EU Declaration of Conformity

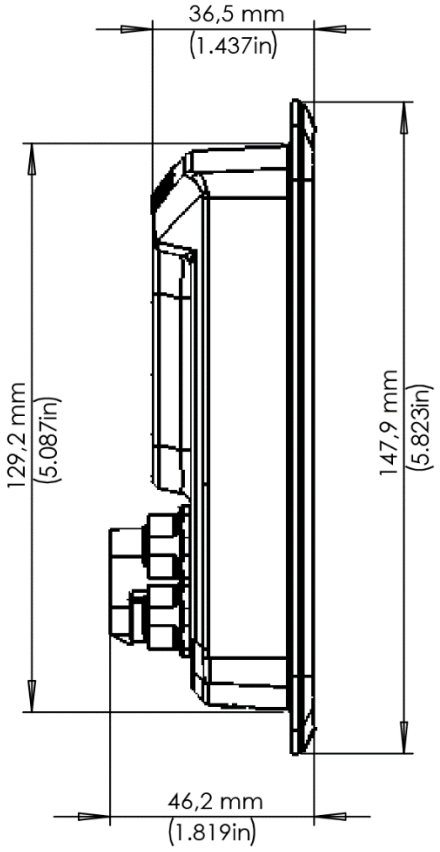
Epec Oy hereby declares that this device is in compliance with Directive 2014/53/EU.

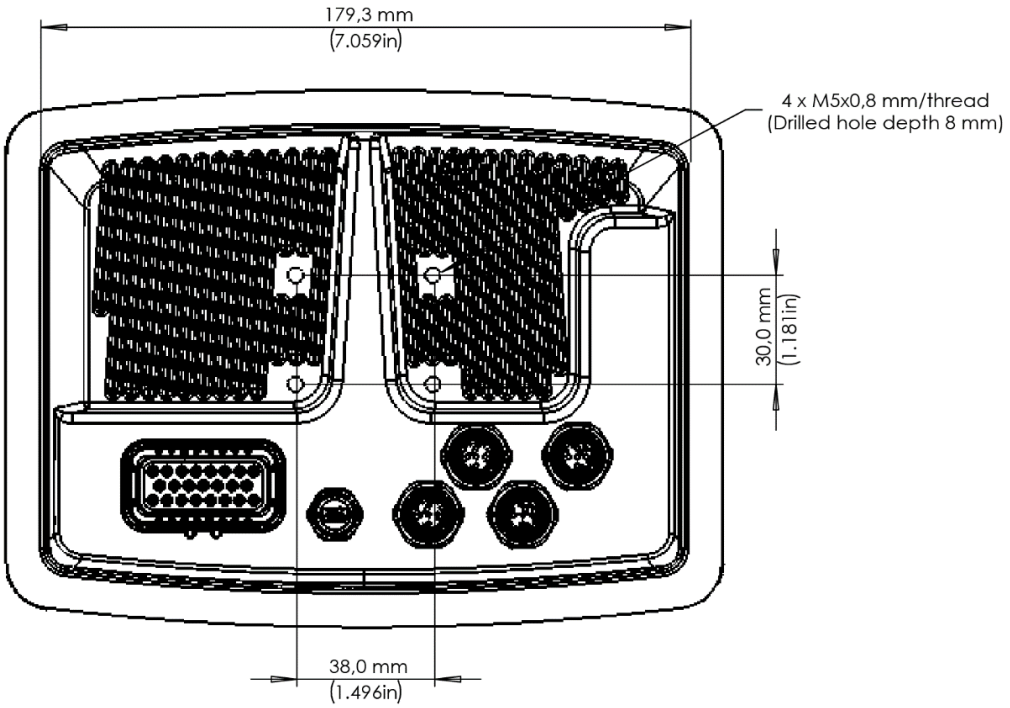
The full text of the EU declaration of conformity is available at the following internet address: *https://extranet.epec.fi/Public/Technical_Documents/6807/EPEC_6807_Declaration_of_Conformity.pdf*

# 15 MECHANICS AND CABLING

## 15.1 Unit Dimensions





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## 15.2 Mounting and Cleaning

It is required that the product housing has a galvanic connection to machine frame.

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

A direct water jet towards the products 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 product.

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

In moist conditions, the product 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 when properly tightened to torque 0.4 Nm. NOTE: Sealing caps need to be tightened when installing the product. To ease installation, sealing caps are not fastened to required torque when delivered from Epec).

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

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

### 15.2.1 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*.

### 15.2.2 Panel mounting

6807 display unit can be panel mounted. Epec offers a panel mounting kit that includes all the needed parts for panel mounting. If an Epec panel mounting kit is not used, make sure that the parts used for mounting are the correct type in order to ensure the needed tightness.

**6807 display unit's panel mounting:**

The panel mounting kit includes a panel mounting plate, four M5x10 screws and an EPDM rubber gasket.

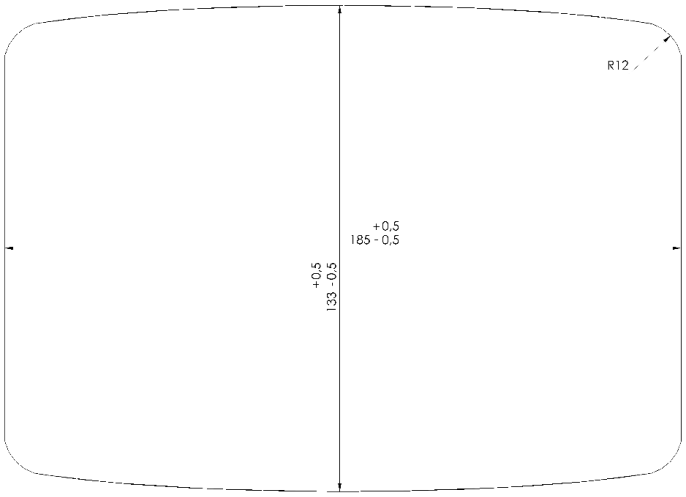
The display is mounted on the panel using four M5 screws and a tightening torque of 5 Nm.

An EPDM rubber gasket is added on the backside of the display to ensure tightness against the dashboard. With a proper assembly, the panel mounting achieves IPX6 and IPX7 rating.

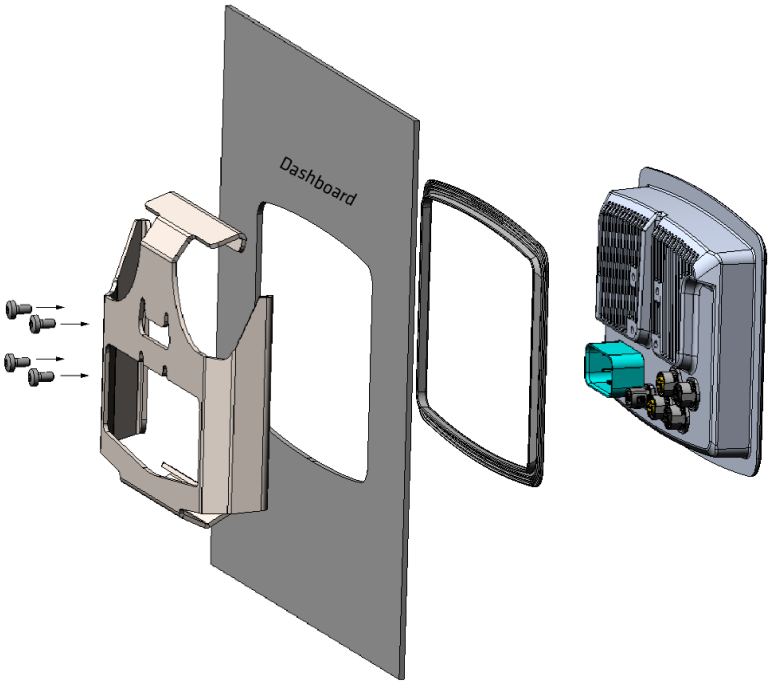
The dimensions for the attachment hole are described in the picture below.

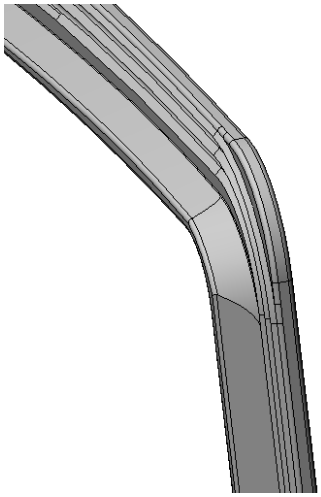
See the panel assembly kit's ordering code in section *Accessories and Ordering Codes*. For more information, refer to panel assembly kit's data sheet (MAN000799).

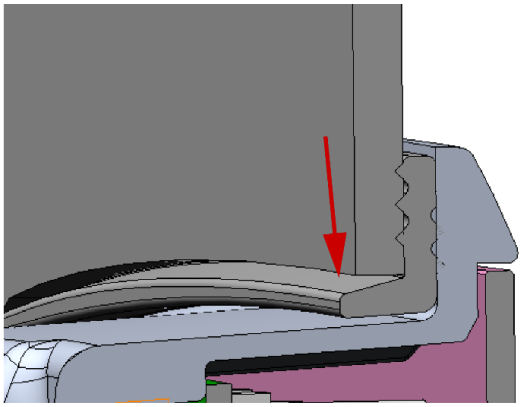
**Measurements for the dashboard's attachment hole:**



Assembly instruction (all the parts are included in the Panel mounting kit):





When assembling the panel mounting kit, make sure that the lip of the gasket is correctly positioned between the display and the dashboard. Also ensure that the gasket is placed evenly around the display to avoid any wrinkles.

### 15.3 Plugging and unplugging the cables/connectors

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 connector sealing caps
- 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 and cables are fixed near the connectors to prevent excessive mechanical vibration

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

## 15.4 Cabling

### 15.4.1 System Topologies

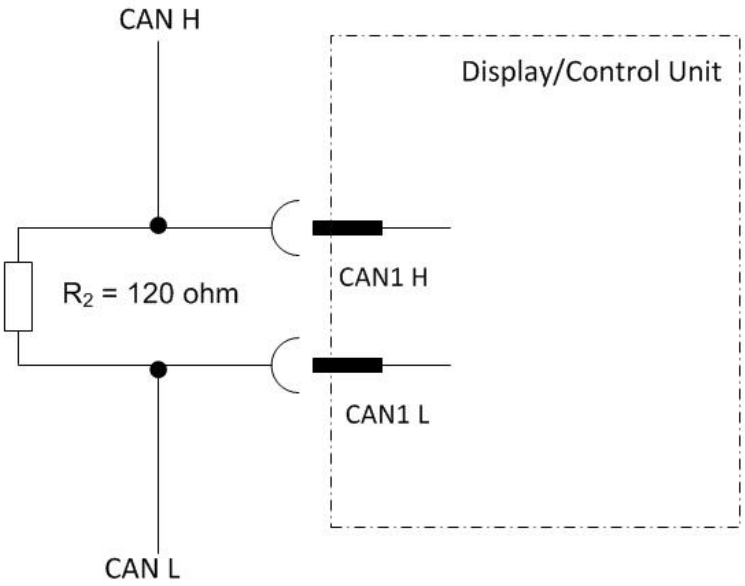
Generally, cabling should be properly designed and documented to help the initial assembly and maintenance.
It is highly recommended to mark each cable on both ends to avoid confusion and errors.

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.

#### 15.4.1.1 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).




**Example1.** The figure shows a connection example of an external termination resistor in CAN1

### 15.4.2 CAN Bus Cabling

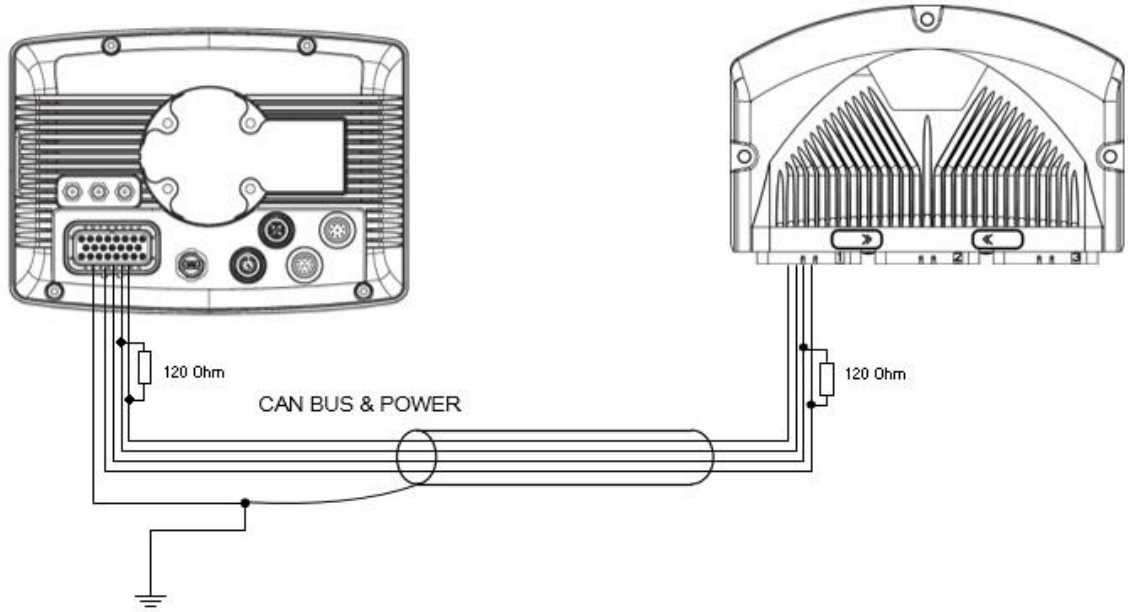
The CAN bus cable is the neural backbone of the whole system and should be designed and constructed with extra care.

#### 15.4.2.1 Cable

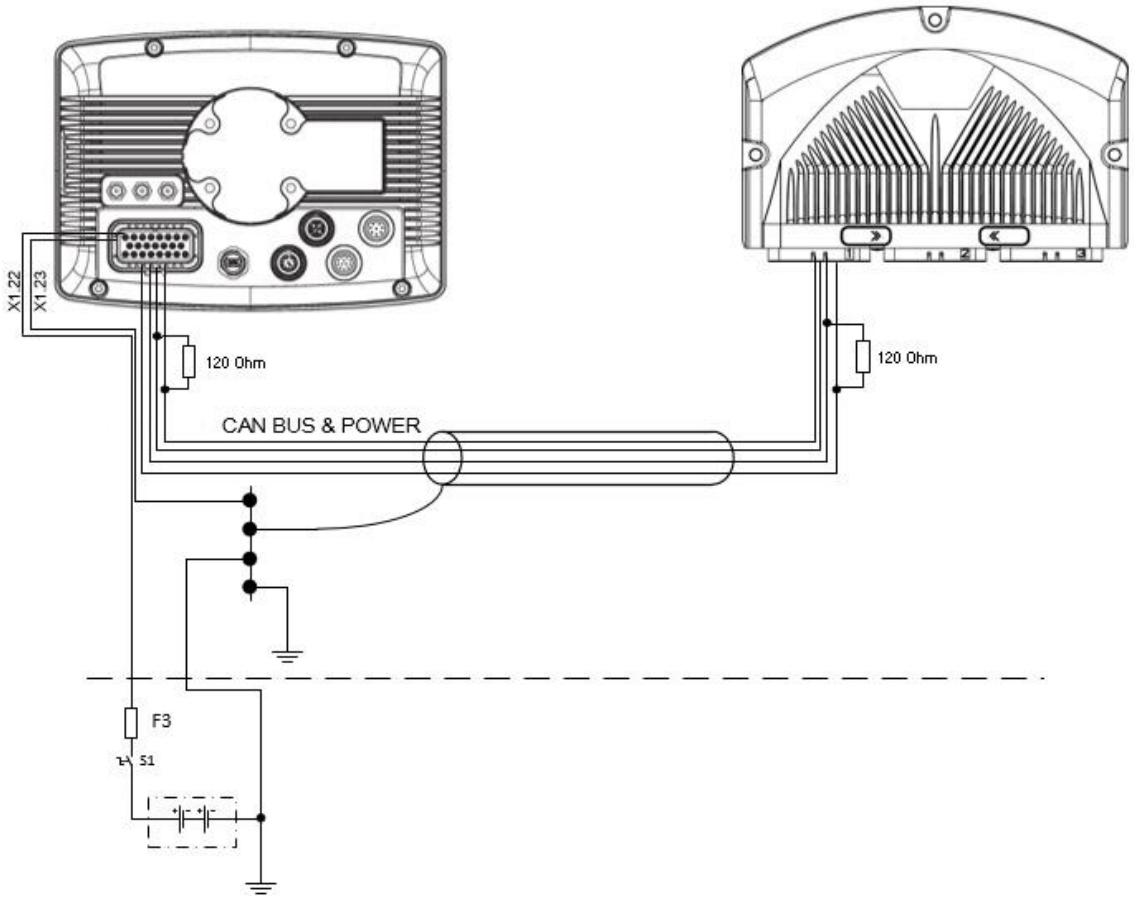
- It is recommended to use high quality and twisted (approx. 1 round / 1 inch) CAN bus cable.
- Normal UTP (Unshielded Twisted Pairs) cable is well suited for distances under approximately 10 meters.
- In longer distances, and especially if there is possibility for electromagnetic interference, it is 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

#### 15.4.2.2 Cable shield

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



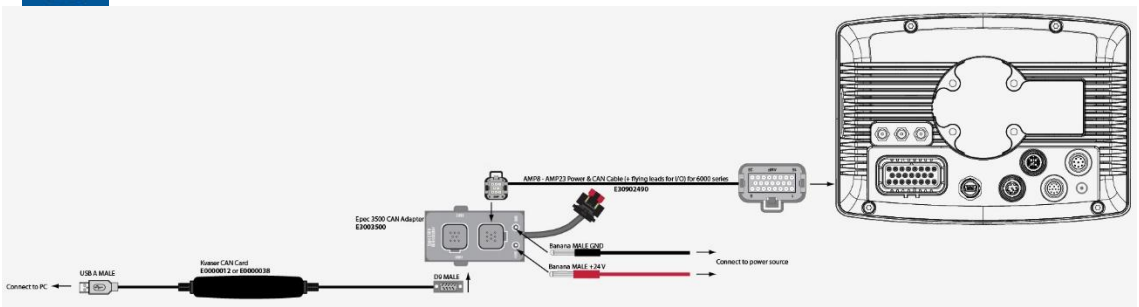
Connection example when there is not a GND pin available in the control unit:




### 15.4.2.3 CAN cabling for system developers

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

An external termination resistor (120 Ω) has to be connected at both ends between CAN H and CAN L.



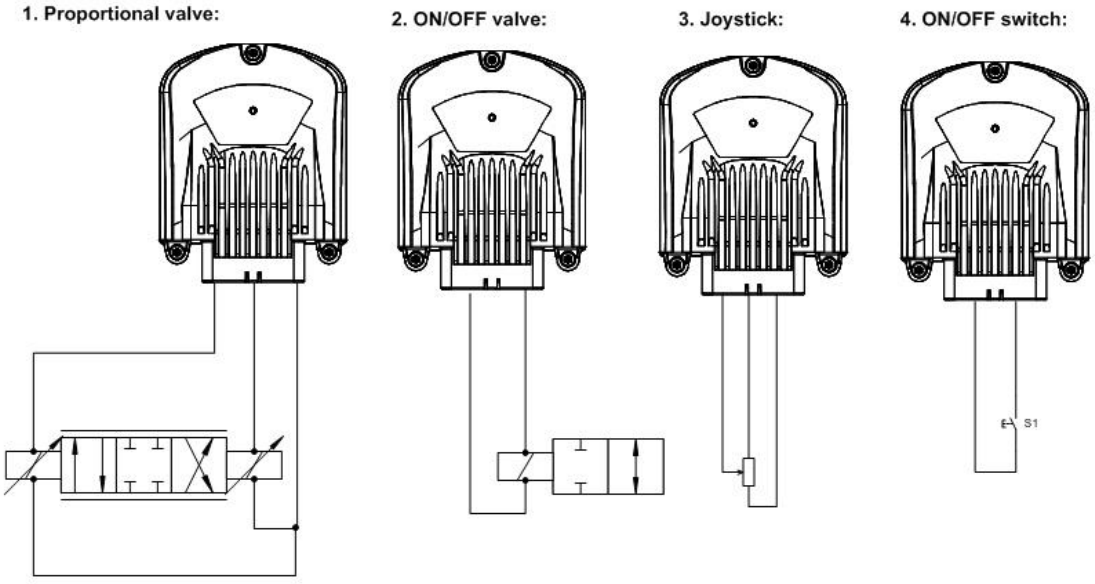
### 15.4.3 I/O Cabling

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

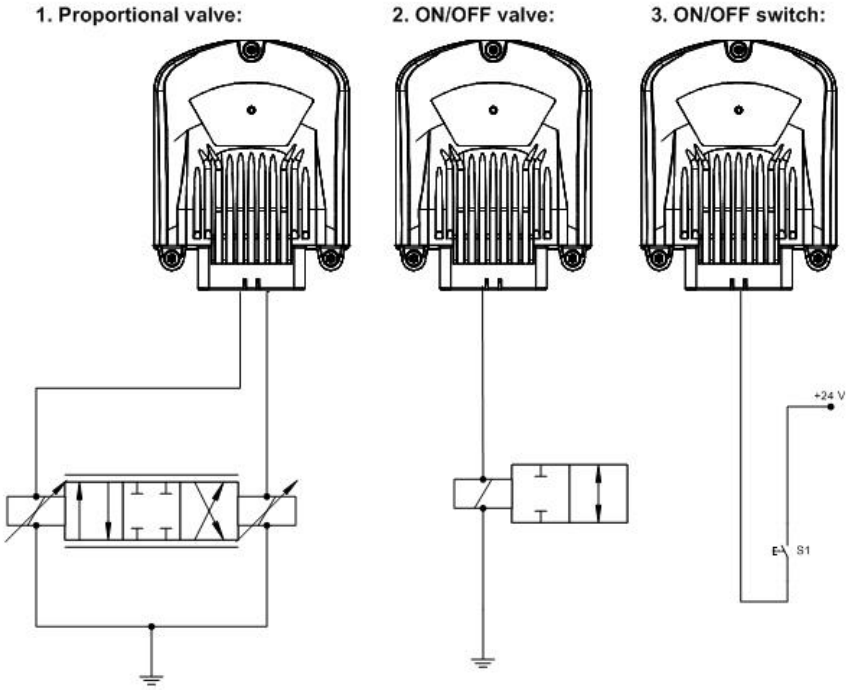
To ensure correct measurement, reserve separate GND pin(s) for AI pin(s) and don't use it/them for any other purposes. See cabling example below.

- 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 and Ordering Codes*) for dimensions.
  - Take extra care for protecting the cables against physical wear and damage.
- 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.

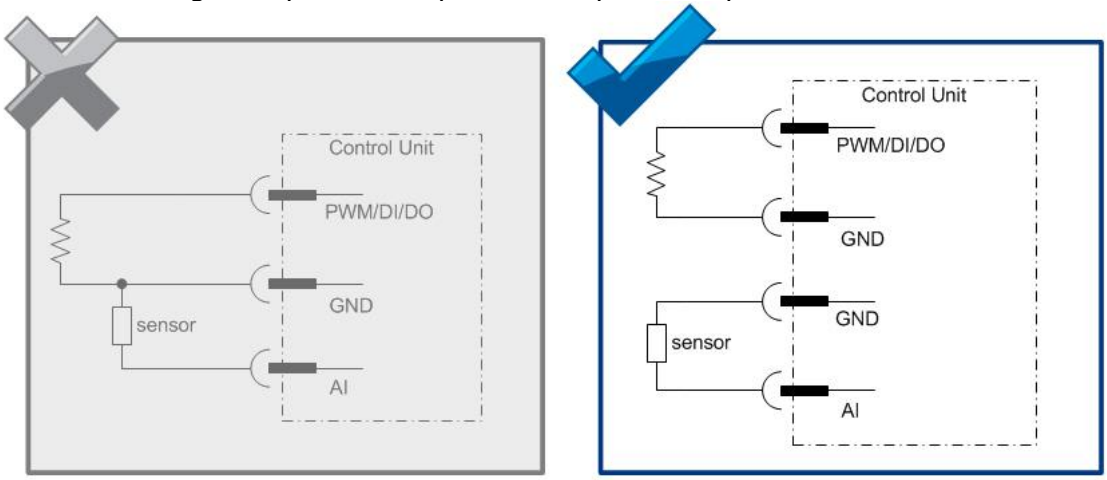
The following figure describes four different ways to connect closed circuit loop through the control unit:



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




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




- 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. Product connector X1 has several GND pins which should be used.

Refer to section *Power supply* for accurate pin allocation of connectors.

### 15.4.4 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.

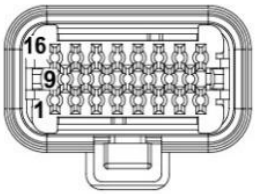
The cable must be installed as far away as possible from other cables with high power.

- This Ethernet connection is based on 10BASE-T/100BASE-TX connection where two twisted pairs are used.

### 15.4.5 RS-232 Cabling

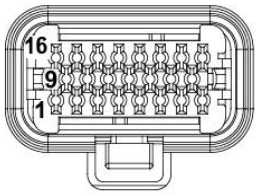
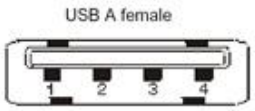
- Minimum requirement for creating the RS-232 data link is a 3-wire connection.
- The maximum length of the cable is 3 m

**RS-232 cabling connection:**

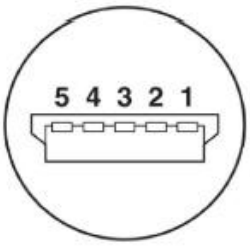
| AMP23 female connector (front) | AMP23 pin |
|---|---|
|  | 3 (TXD, transmit data) |
| | 4 (RXD, receive data) |
| | |
| | |
| | 10 (GND) |

### 15.4.6 USB Cabling

**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) (max 500 mA) | 1 (+ 5 V) | |
| | 10 (GND) | 4 (GND) | |
| | 15 (USB_SHIELD) | Connector chassis | |

**M12 USB Mini-B**

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

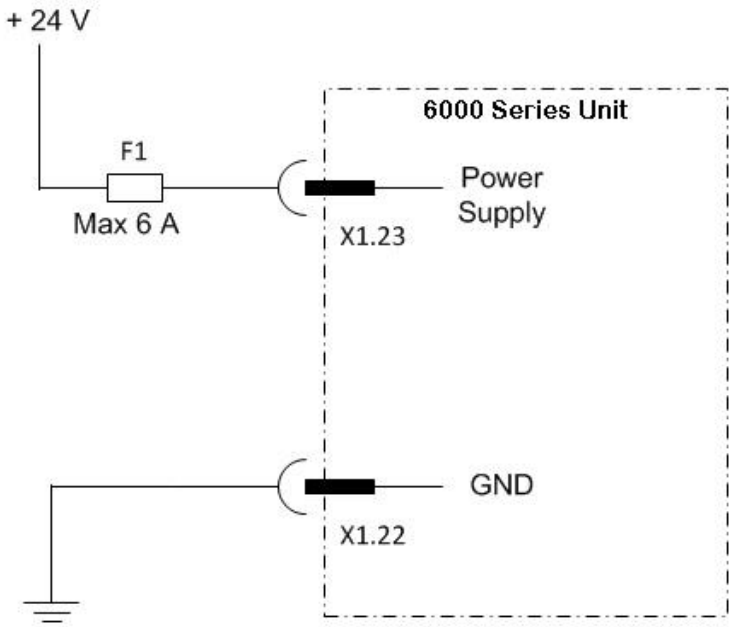
### 15.4.7 Power Supply Cabling

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.

- See section *Power Supply* for accurate pin allocation of the connectors
- Single point grounding should be used for power supply for all the control units
- The type and parameters of the power supply fuse should be selected depending on the machine type and product use case

**Power supply's wiring example:**



## 15.5 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.

## 15.6 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 |
|  | USB cable & Panel Mounting Adapter, 2 m<br>Cable connectors: M12 USB mini-B - USB A male<br>Adapter Connectors: USB A fem - USB A fem | E30902489 | MAN000614 |
|  | USB cable (M12 USB mini-B - USB A male) 2 m | KW0186 | MAN000614 |
|  | Camera (Brigade) | KH0038 | MAN000626 |
|  | Camera cable (M12 FEM - Mini-DIN4 FEM) 30 m (for Brigade) | KW0201 | MAN000626 |
|  | Small Mounting Pedestal | E30802473 | MAN000578 |
| - | 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 |
|   | Kvaser D-Sub Termination Adapter | E0000039 | MAN000696 |
| - | Kvaser CAN Card | E0000038 | - |
|  | Ethernet cable M12 – RJ45 | KW0422 | MAN000801 |
| TBA | Camera adapter cable | KW0421 | |
|  | Panel mounting kit | E30C02507 | MAN000799 |
|  | Panel mounting gasket | MA1136 | - |
|  | Kvaser U100P CAN-USB adapter | E0000045 | - |

### 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 |
| 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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