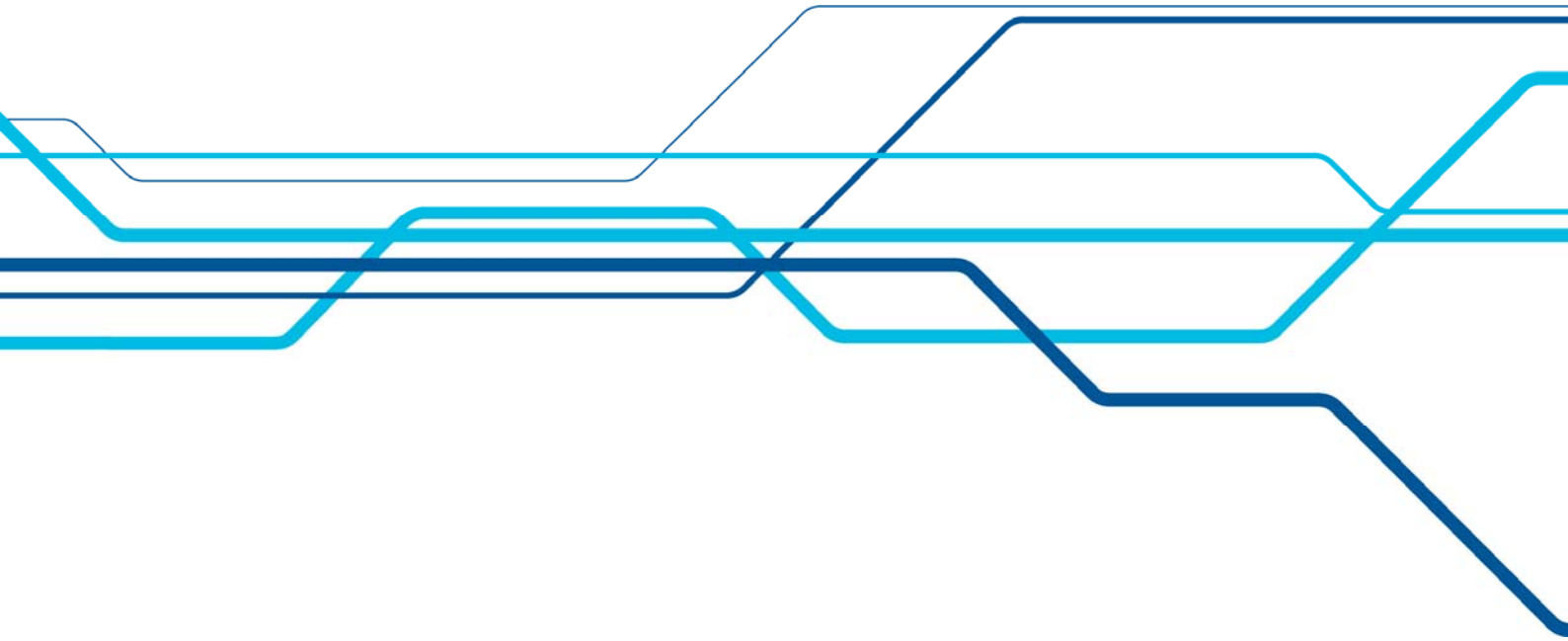
General Mounting & Cabling Instructions

for Epec CAN Module Family



DOCUMENT VERSION HISTORY

Date	Notes
01.02.2010	Layout updated
14.12.2007	4rd released version; RS-485/422 Bus, RS-232, Universal Serial Bus (USB 1.1) and Ethernet 10/100 subtitles added to chapter 2, minor corrections
04.11.2004	Explanations concerning joystick connection and branch wiring added to chapter 2.3. Pedestal mounting dimensions updated to chapter 3.3.2. Few modifications concerning general definitions.
09.12.2002	3rd released version; minor corrections.
29.11.2002	2nd released version; some explanations added into System Topology, CAN bus, I/O cabling, Power Supply and Connectors paragraphs, Emergency Stop paragraph added, some pictures added into Connectors and I/O Module Mounting paragraphs.
12.11.2002	1st released version; document inserted into formal template, some language corrections, some pictures added
06.11.2002	Preliminary version released for selected customers' evaluation

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1 GENERAL

1.1 Purpose of This Document

This technical document is meant to be used in system development. This document contains necessary data concerning the cabling and mounting of Epec modules.

1.2 About Manufacturer

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

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

1.3 Epec CAN Module Family

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

1.4 Basic skills required

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

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

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

1.5 Safety guidelines

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

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.

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

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

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

1.6 Warranty

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

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

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

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

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

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

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

1.7 Limited liability

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

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

1.8 Environmental statement

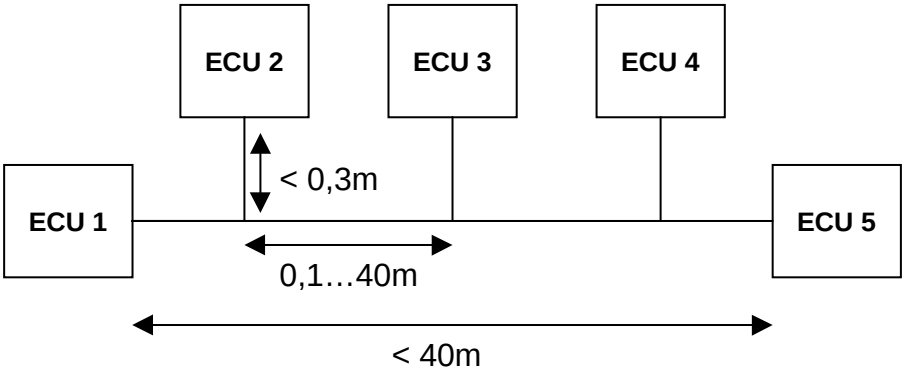
The manufacturer uses ISO14001 environmental certified processes and materials to manufacture products. The manufacturer undertakes to arrange for the recycling and scrapping of the products that are returned to the manufacturer by the buyer and/or the products that are received by the Manufacturer in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

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

2 SYSTEM TOPOLOGY

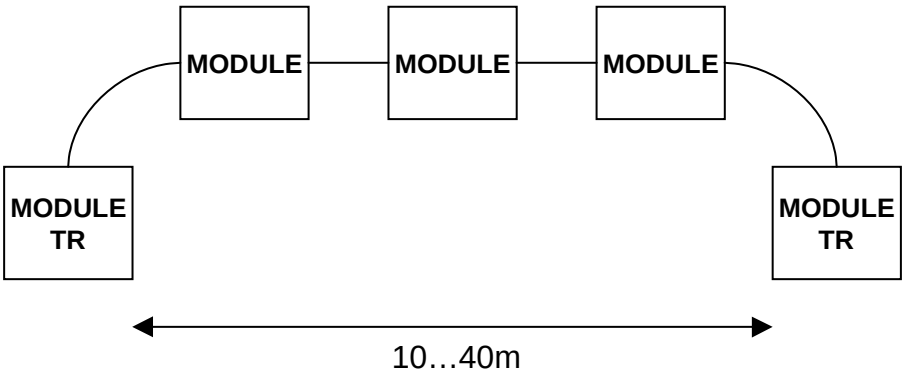
Epec Oy specializes in control systems for various types of mobile and other machinery. Epec Oy designs and manufactures in-house the electronics and programmable basic components (i.e. modules) required for these control systems. A small and protective module case safely houses a powerful microcontroller and peripheral electronics. Modules are connected with each other, using standardised CAN bus. The idea of the Epec embedded system is that all the modules 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.

In many cases modules are installed in extreme environments, where vibration, wide temperature changes and moisture are normal conditions. Requirements for the reliability of the system and safety have been the key words in Epec's product development.



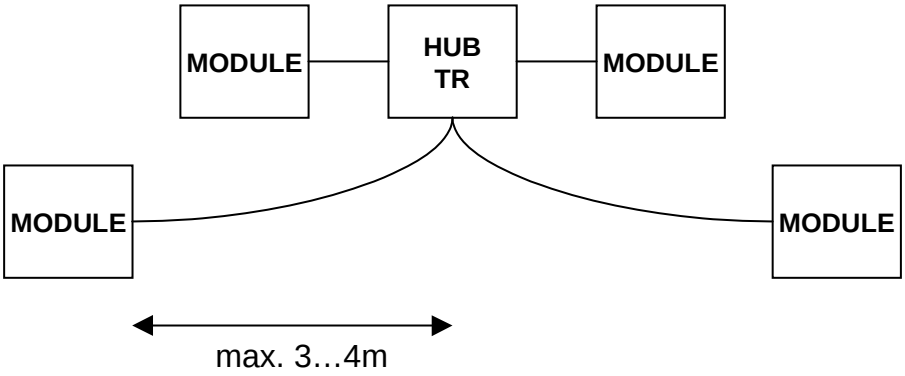
Example 1. Control system topology in theory with maximum bus speed (1000 kbit/s); Electronic Control Units (ECU) in traditional bus arrangement.

Generally the bus cable is terminated at both ends with termination resistors (ISO 11898:1993). In each Epec CAN module, there is an internal terminating resistor (120 Ω) which can be switched on/off by software. The location of the termination resistor can vary depending on the system topology. Here are some examples with approximate safe distances when using High-Speed CAN.

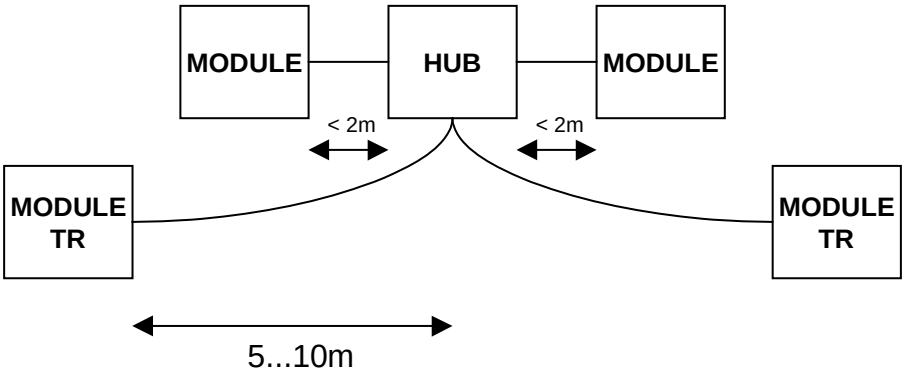


Example 2. The usage of the termination resistor (TR) in conventional bus. The maximum recommended bus length is directly dependent on the bus speed. In theory, the maximum length with the maximum speed can be up to 40 meters. If the bus speed is lower, the length can be extended.

In many cases modules manufactured by Epec, are used in safety-critical heavy machines. Over the years, control systems have been constructed using both traditional bus and modern star topologies. The development has lead to utilising a hub module in star form topology, which increases safety and robustness of the system. Also, in star topology, there has to be at least one termination resistor, which with short cable distances can be switched on in the hub module. Below is couple of examples of the star topology. Both examples are presenting distances in maximum speed.



Example 3. A practical star topology control system. Here, when the lengths of the star cables are relatively short, approximately 1…4 meters, the termination resistor (TR) is switched on only in the hub module. In this case, the bus is terminated conveniently only in one place.



Example 4. Another practical star topology system. When there are several different lengths of cables, the termination resistors (TR) should be switched on in modules with the longest cables (more than 5 meters). Since the other two modules shown are connected with short cables, e.g. 0,5…3 meters, there is no need to switch on the termination resistors. In this case, the bus is terminated in the longest end.

In those cases, where there is only one long bus cable, e.g. over 10 meters, and other cables are fairly short, termination resistors should be switched on in the hub module and in the module at the end of the longest cable.

Generally the topology is more critical with higher bus speeds than with lower speeds.

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

3 CABLING

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 interference with external objects, particularly when moving parts of the machine. It is also good to minimize the amount of the connection points of cable harness to maximise reliability. Also, all valid safety instructions should be observed when coupling.

3.1 CAN bus

CAN bus cable is the neural backbone of the whole system and should be designed and constructed with extra care. In all Epec CAN Module Family modules, the bus connection can be found in black AMP 8 pin connector. 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. However, 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. Please check e.g. SAB Bröckskes offering for shielded cables if needed.

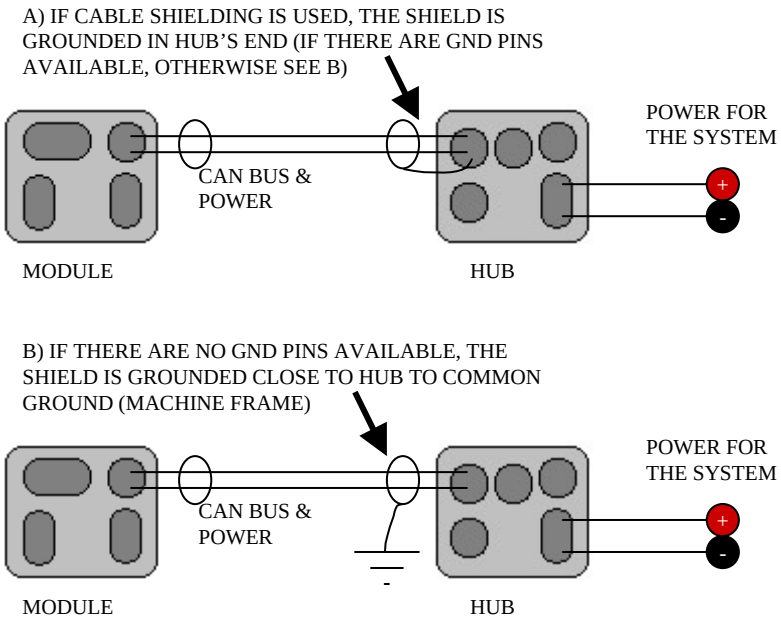


FIG 1. The shield grounding must be done only in one end of the cable; usually the grounding is done in the end of the hub module.

One example of unshielded twisted cable is SAB Bröckskes' S 200. Epec has had a special twisted and colour coded cable manufactured. This cable has following cable dimensions: 2x2,0 + 2x1,0 + 2x0,75 (2+2 for coupled power and 2 for CAN bus). Coupled power supply in the cable increases safety and capacity of the machine. The S 200 cable is not shielded but it has worked well e.g. in forest harvesters for years. Whichever cable is used, the whole CAN-bus should be the same type, and thus the cable type or measurements should not be changed in one system.

To avoid electromagnetic interference (EMI), the bus cable should be located 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.

3.2 RS485/422 Bus

RS485 connection can be found in some of the HW-versions of Epec CAN module family modules and displays. RS422 connection can be found in the display of Epec CAN module family. RS485/422 bus gives aptitude for data transfer in long and fast connections in environment with interferences. This chapter handles cabling RS485 Half-Duplex (Multi-Drop) and RS422 Full-Duplex (Point To Point) and their communication.

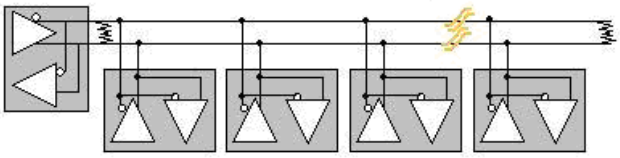


FIG 2. Coupling guideline for Half-Duplex (Multi-Drop) RS-485 -connection.

Here the communication is happened by half-duplex, because only one device in the bus at the same time can be sending information. As termination for the bus, usually 120Ω resistors placed in the both ends of the bus are used. The signal ground is advised to connect, so that the Common Mode voltage stays in suspense between -7V - +12V to assure safe connection. Between signal ground and the base of the device it is recommended to place 100Ω 1/2W resistors to avert large ground currents.

Example:

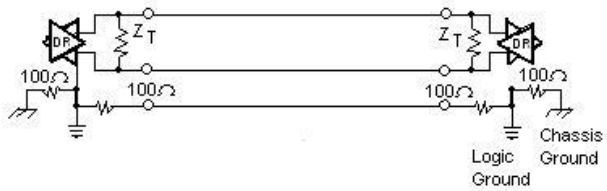


FIG 3. An example of RS-485 Half-Duplex (Point To Point) connection.

The following is an example of connecting the display of the Epec CAN module family to the half-duplex (Point To Point) RS485 bus.

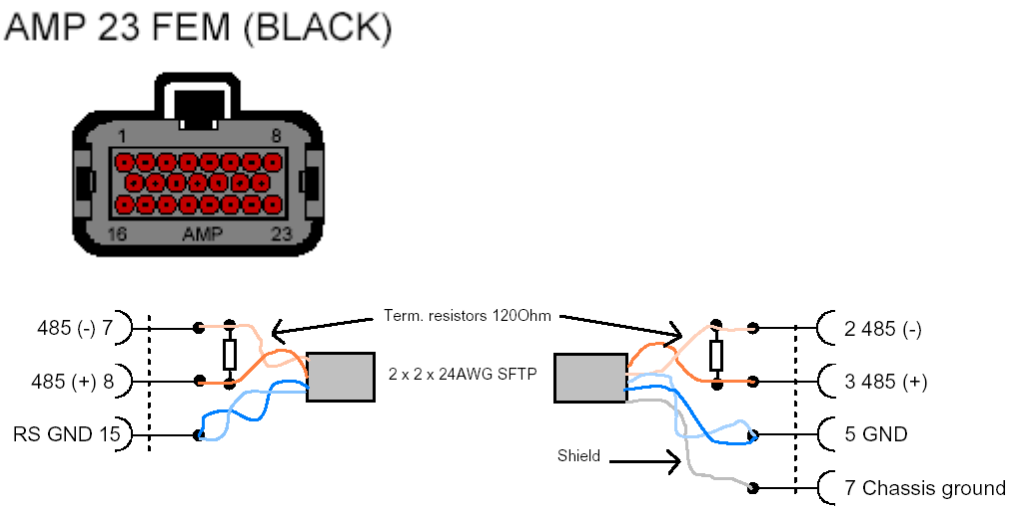


FIG 4. The example of connecting the 2040 display of the Epec CAN module family to the half-duplex (point to point) RS485 bus.

AMP 23Pin		Color
7 (485_(-))	2 (485_(-))	Orange/white
8 (485_(+))	3 (485_(+))	Orange
15 (GND)	5 (GND)	Blue and Blue/white
	7 (Chassis ground)	Shield

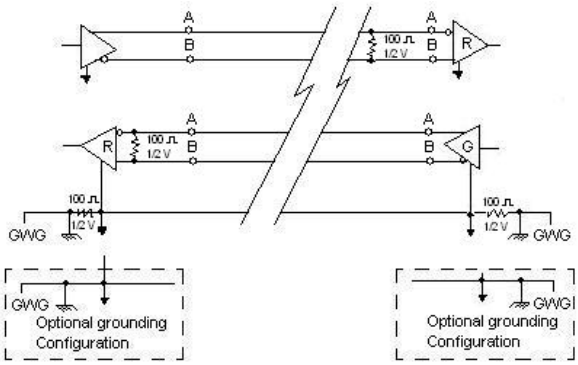


FIG 5. RS422 Full-Duplex (Point To Point) 4-wire connection guideline.

In RS422 Full-Duplex (Point To Point) four wire connection the sending and the reception are accomplished with two individual differential signal pair. The termination of the signal pairs takes place in the receiving end of the connection. It is recommended that the signal ground is connected in order that the Common Mode voltage stays at voltage range of -7 - +7V to ensure safe connection.

The length of the cable:
The standard RS485/422 determinates the maximum length of the cable at 100kbs data transfer is 1200 meters. The length of the cable in proportion to the data transfer rate follows the form of 10^8/m.

Example at 500m data transfer rate: 10^8/ 500m = 200 kbps

The cable:
When choosing the cable, the demands of the installation environment must be considered. At long connections and large data transfer rates it is recommended to use 24AWG twisted-pair cable with characteristic impedance is 120Ω. In environments with interferences it is recommended to use shielded cable. In many cases CAT-5 cable with characteristic impedance of 100Ω is adaptive for using.

3.3 RS232

RS232 connection can be found in some modules and displays HW-versions of Epec's CAN module families. This section gives hints and issues to be considered for coupling the RS232 connection. Minimum requirement for creating the RS232 data link is 3-wire connection. When only flow control is required, the 5-wire connection is adequate. 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 following picture is an example of a connection that has been designed only between Epec CAN Module Family display and PC with 3-wire connection.

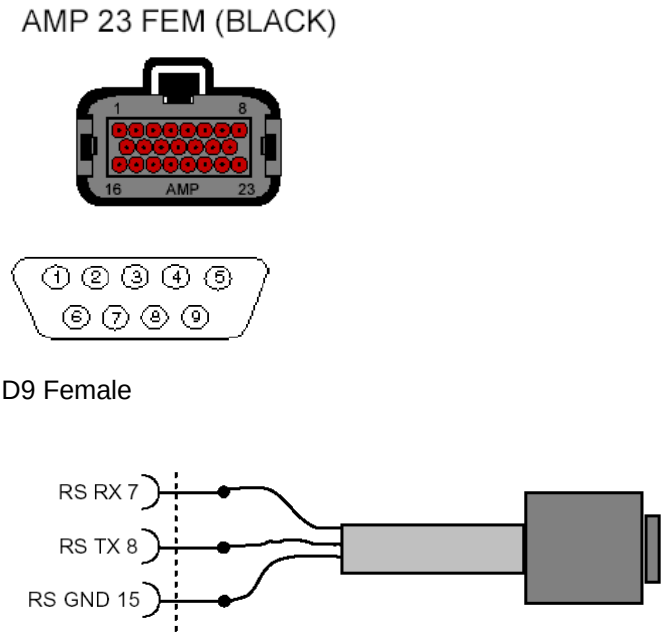


FIG 6. The example of connecting the 2040-display of the Epec CAN module family to the PC with 3-wire connection.

AMP 23 Pin	D9 female Pin
7 (rx)	2 (tx)
8 (tx)	3 (rx)
15 (GND)	7 (GND)

The requirements of the installing environment must be considered when choosing a proper cable. Recommended cable type for demanding environment is Outdoor STP Cat5 2Pairs or one with better qualities. It is recommended that the shield in the cable is connected to the body of the D9 connector, from where it is joined to the body of the device that is being connected. This disables the influences of possible interferences in the transfer connection. Connecting the

shield of the cable to the ground pin in the other end of the cable is case-specific but as a rule it is left unconnected to disable the ground current.
In demanding environments a special attention must be paid connecting the cable to the module or display. The dust- and the splash proofing of the connector must be retained in the connection. The length of the cable is determined according to the total capacitance and the baud rate. The standard determines the maximum length of the cable as 15m but in practise, the length can be crossed when the baud rate declines (Baud rate < 19200).

Cable UTP CAT-5 17pF/0.3m
Maximum cable capacitance 2500pF

➔ Maximum cable length (m) = 2500pF/17pF/0.3m ≈ 44m

3.4 Universal Serial Bus (USB 1.1)

The USB is most used serial bus interface for connecting general devices to the display, such as mouse devices, printers, mass-storage device etc. In the 2040 display of Epec CAN Module Family the USB connections can be found in black AMP 23 pin connector. So that the devices with standard connection can be joined to the USB connections, a medial cable is needed. The following is a description of connecting the medial cable.

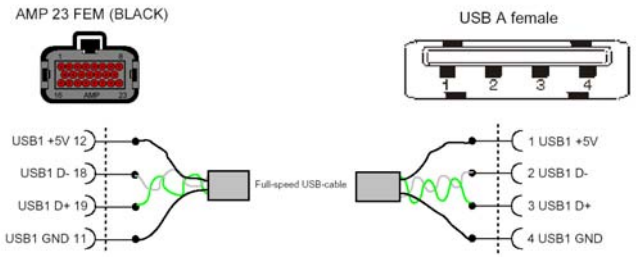


FIG 7. Description of connecting the medial cable.

AMP 23 Pin	USB Type A Pin
11 (GND)	4 (GND)
12 (+5V)	1 (+5V)
18 (D-)	2 (D-)
19 (D+)	3 (D+)

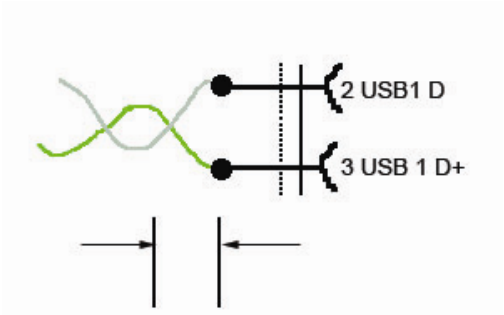


FIG 8. When connecting the signal wires of the signal pair, the untwisted part of the joins of the signal pair should be as short as possible.

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

3.5 Ethernet 10/100

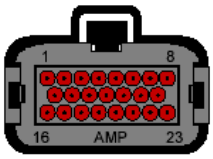
In the Epec CAN Module Family display the Ethernet connections can be found in black AMP 23 pin connector. This Ethernet connection is based on 10BASE-T / 100BASE-TX connection where two twisted pairs are used. This AMP 23 connector is not a standard connecting format and to get the best operation reliability the following issues should be considered in circuitry and installation; type of the used cable, connecting the cable and the installation method.

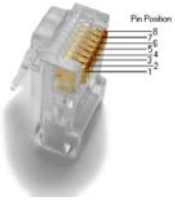
Type of the used cable:
If the installation environment demands for a cable that takes the heat and low temperature, the minimum demand for the cable is under 20m with connection Outdoor UTP Cat5E 4Pairs (Water Blocking / UV Resistant). For longer connections it is recommended to use cable Outdoor UTP 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)

Connecting the cable:
In this section concerns connecting unshielded cable to AMP 23 connector and what should be considered. As a connecting example there is UTP Cat5E cable. The example is meant for a connection, where the 2040-display of Epec's CAN Module Family is intended to connect to a network switch in the Local Area Network (LAN).

AMP 23 FEM (BLACK)





MALE

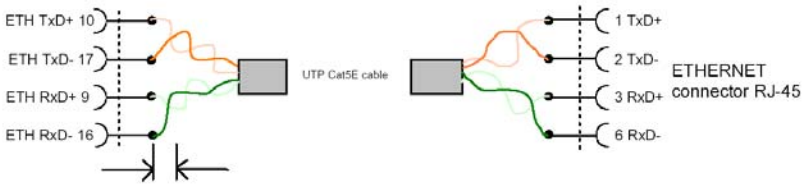


FIG 9. The untwisted part of the twisted pair wires that comes to the AMP23 connector must be as short as possible.

AMP 23 Pin	RJ45 Male Pin	Pair	Color
9 (rxd+)	3 (rxd+)	3	White/green
10 (txd+)	1 (txd+)	2	White/orange
16 (rxd-)	6 (rxd-)	3	Green
17 (txd-)	2 (txd-)	2	Orange
	4	1	Blue
	5	1	White/blue
	7	4	White/brown
	8	4	Brown

Installing the cable:
In order that the electromagnetic interference (EMI) would not affect on 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 from the other cables with high power as possible. The maximum length of a working connection is 100 meters.

3.6 Power supply

The nominal operating voltage for Epec modules is 24 VDC. The full operating range is 11,5 - 30 VDC.

Control systems are designed using the single-point ground principle. This means that the power of the system should be supplied from only one place. If the system is built using a hub module, it is used also to supply power to every module in the system. The power connection to hub module and thus, the power of the whole system is located in the grey AMP23 connector. The power for other modules is supplied through black AMP8 connectors. Please see the technical document of the module for accurate pin allocation of the connectors.

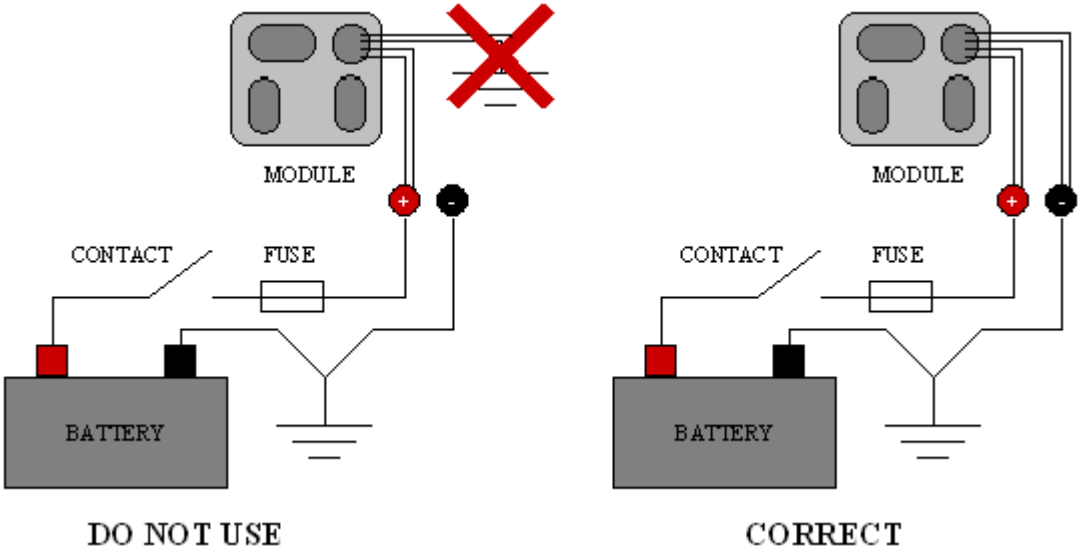


FIG 10. Wiring example of power supply. Single point grounding should be used for power supply for all modules.

Epec recommends using doubled power cabling, though in the picture above both power cables are doubled. By using double cables one gets more area for power cables and therefore more current handling capabilities.

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

Generally the required area of the power cable (Cu) can be determined in following way:

Area = Max Current (A) x Nominal Resistance (Ωm) x Cable Length (m) / Max Voltage Drop (V)

Epec recommends the maximum voltage drop measured against ground potential to be at maximum 2 volts. For extra safety 1 volt should be used as a limit.

Example:
Let's assume that the machine has a 15 meters boom cable made of copper. There will be estimated 5 amps current, so the recommended cable area would be:

5A x 0,0172*10^{-6}Ωm x 15m / 2V = **0,7mm^2**

Especially in those cases, where the formula above gives greater cable dimensions that can be fitted in AMPSEAL contacts, it is recommended to use doubled power cabling.

If power cables are inside the same cable with CAN bus cables, the maintenance of the system is generally easier.

3.6.1 Emergency Stop

This is one example of the emergency stop connection where the display module and HUB still operates and possibly helps to diagnose the problem of the machine that caused the need to press the emergency stop.

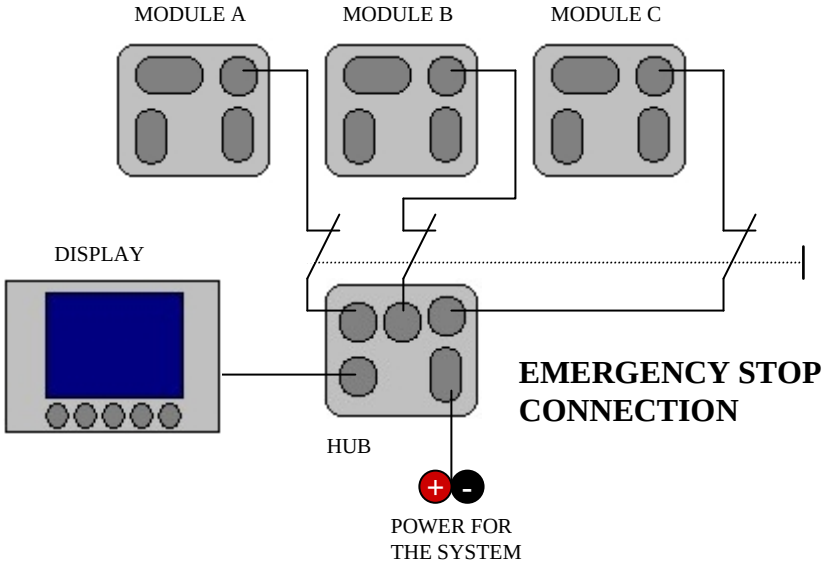


FIG 11. Emergency stop example with wires and connectors.

In this case it is very important to leave all outputs (AMP23) of the HUB module unconnected. This is a requirement for the reliability of the emergency stop connection.

It is also possible to monitor the state of the emergency stop. This can be achieved by installing a signal wire from the emergency stop button into digital input of the hub module.

3.7 I/O cabling

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). Please see the AMPSEAL table (further on) for dimensions. Of course extra care must be taken for protecting these 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. So, in some machine environments using shielded cables for these encoders etc. especially for longer distances to increase safety should be considered. Using shielded cable is recommended also in joystick connections.

There is some extra protection (e.g. filtering capacitors) built in the module for all mA-type inputs to make them easy to deal with.

FIG 12. Wiring example of equipment connected to I/O. Single point grounding should be used.

In all I/O modules there are some auxiliary supplies for external devices, some of which are internally regulated. Voltage and current limits for these can be found in technical documents of the modules. 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 module they are connected to. This way, it is possible to avoid potential harmful differences, so the MOSFET driven output power switching operates properly.

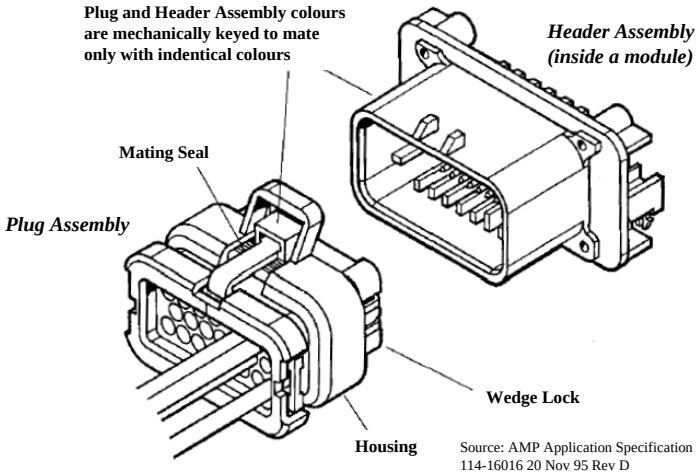
When designing the sensor and encoder connections, one should observe single-point grounding. Each module connector has several GND pins which should be used.

Please see the technical documents of the module for accurate pin allocation of connectors.

3.8 Connectors

All Epec CAN Module Family modules use heavy duty gold plated, locked and sealed AMPSEAL connectors:

– 8-pin for power and CAN-connections



– 23-pin for I/O connections

Gold plated AMPSEAL connectors pack a current of 17 amperes per contact and tolerate temperatures up to 125°C.

All module connectors are mechanically keyed to mate only with identical colours (blue, grey and black).

It should be observed, that the module connectors are pressed down to the bottom and that they are locked. Because connectors are tight and sealed, also cleanness should be observed when inserting a connector to avoid moisture or dirt particles inside the connector. If some of the

module connectors remain unused, they should be covered with empty connectors (i.e. without contacts) of the same colour. This helps to keep the module connectors dry and protected.

All cables, connectors and tools must be 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). A sufficient margin (slack) must be left in the cables to prevent the torsion of the connectors. Wires should be bound to module cover base knob with cable ties.

AMPSEAL cable recommendations (please see AMP Application Specification 114-16016 for more detailed information on connectors):

Size		**Insulation diameter range**	**Strip length ±0,4**	**Wire crimp height**	**Wire crimp width (nom)**	**Insulation crimp height max.**	**Insulation crimp width ±0,1**
mm^2	**AWG**						
0.5	20	1.7	5.1	1.17 ± 0.08	2.03	3.2	3.1
0.8	18	to	5.1	1.27 ± 0.05	2.03	3.2	3.1
1.4	16	2.7	5.1	1.40 ± 0.05	2.03	3.2	3.1

Typical hand crimping tools AMP Procrimper 58440-1 (408-9592)
AMP Procrimper 58529-1 (408-9999)

4 MOUNTING

Epec modules are durable and well enclosed, thus suitable for rugged environments. However, modules contain very sensitive electronic components not designed to endure excessive moisture or mechanical injuries. This should be considered when planning the location and mounting position of the module.

Each module has sealed lightweight cast-aluminium housing with protective powder painting on. Protection classes are between IP65 and IP67, depending of the module.

4.1 Mounting Location

If the module is mounted where it will receive harder impacts than the module cover can endure, the module must be covered with a separate mechanical cover.

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

TIP:
The washing of the machine should be noticed when planning the module mounting location. A direct water jet towards modules 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 modules.

4.2 I/O Module

The module (and the possible module cover) is mounted with two M6 screws supplied by Epec into a conductive metal base, which must have a galvanic connection to machine frame. The powder painting may be removed under the screw head before mounting, to ensure a galvanic connection of the module frame. It is also possible to use a spring washer under the screw head.

I/O- and hub modules have the same dimensions. There are two fastening holes at both sides of the module. The distance between fastening holes is 136 mm.

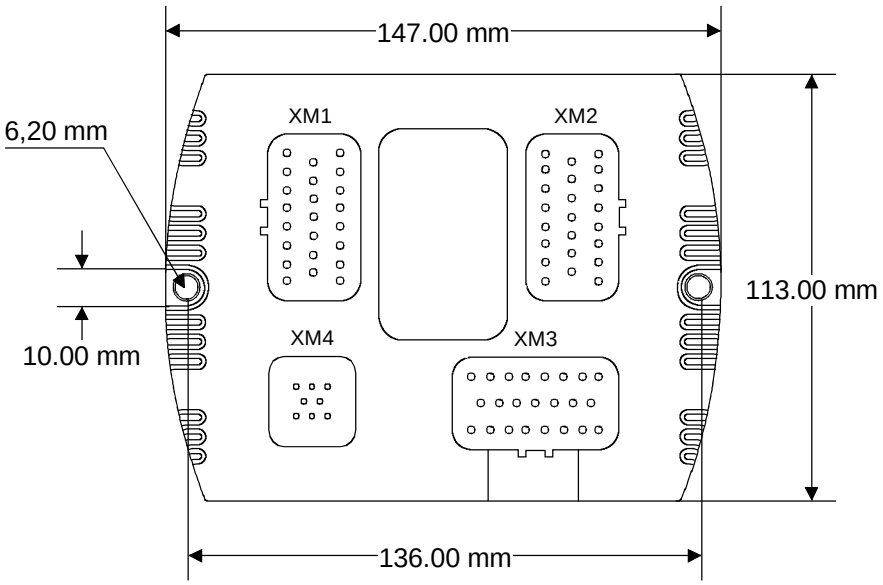
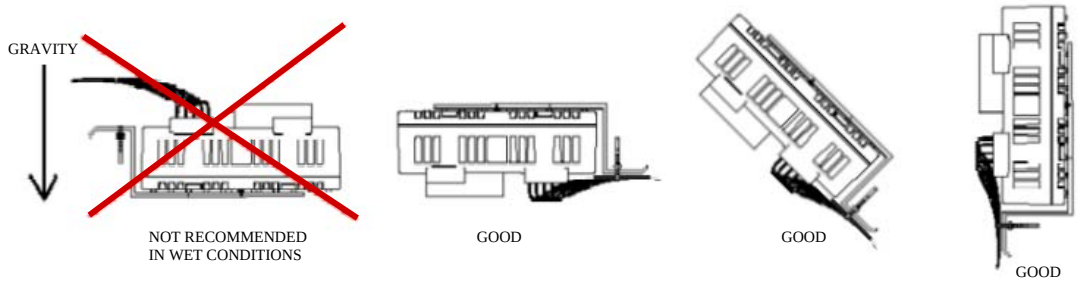


FIG 13. Module dimensions and mounting measurements.

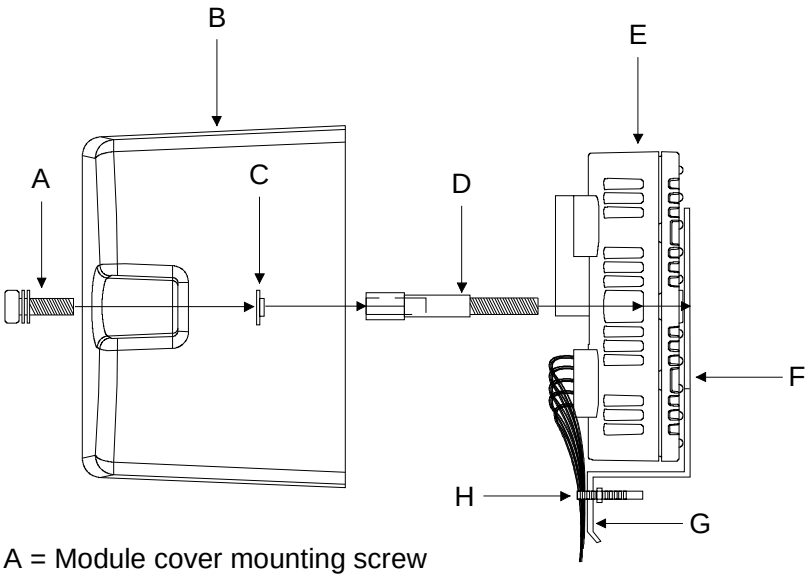
It is recommended that all module cables are routed such way that water or other liquids will not run along the cables into module connectors. In the next picture, there are examples for mounting positions. Generally, all cables should be routed in the direction of gravity.



The best possible mounting position in each machine depends on environment and the possible usage of the module cover.

If some of the module connectors remain unused, they should be covered with empty connectors (i.e. without contacts) of the same colour. This helps to keep the module connector dry and protected.

If a separate Epec module shock protection cover is mounted, it is recommended to use fastening bolts delivered by Epec.



A = Module cover mounting screw
B = Module cover
C = Stopper washer
D = Module mounting screw
E = Module
F = Module cover base
G = Module cover base knob
H = Wires are binded to the base knob with cable ties

The module cover is mounted on top of the module with screws (module mounting screws have threads for module cover screws).

If module is mounted upside down with a module cover in wet conditions, it is recommended to drill a small hole on the cover to allow water flow away on the bottom of the cover. In the picture below, the red arrow points an example location of a leaking hole.

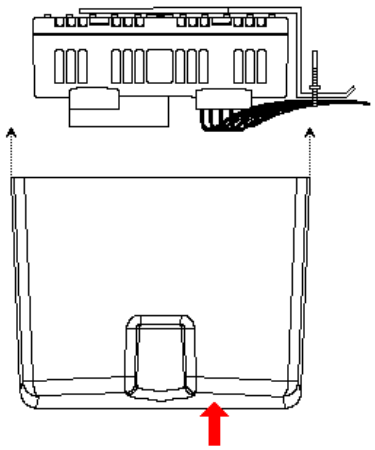


FIG 14. Module cover in upside down mounting.

4.3 Display Module

The display module should be mounted to a location where it is protected from impacts and splashes. Usually the display module is mounted in a machine cabin. However, if display module 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 module can be mounted to the frame with a mounting pedestal or it can be mounted on a panel.

4.3.1 Panel Mounting

When the display module is panel mounted, it must be attached to machine frame. The display is mounted on the panel using four M5 screws. In the panel should be 161 x 114 rectangular space for the display. The overall dimensions can be seen in picture below.

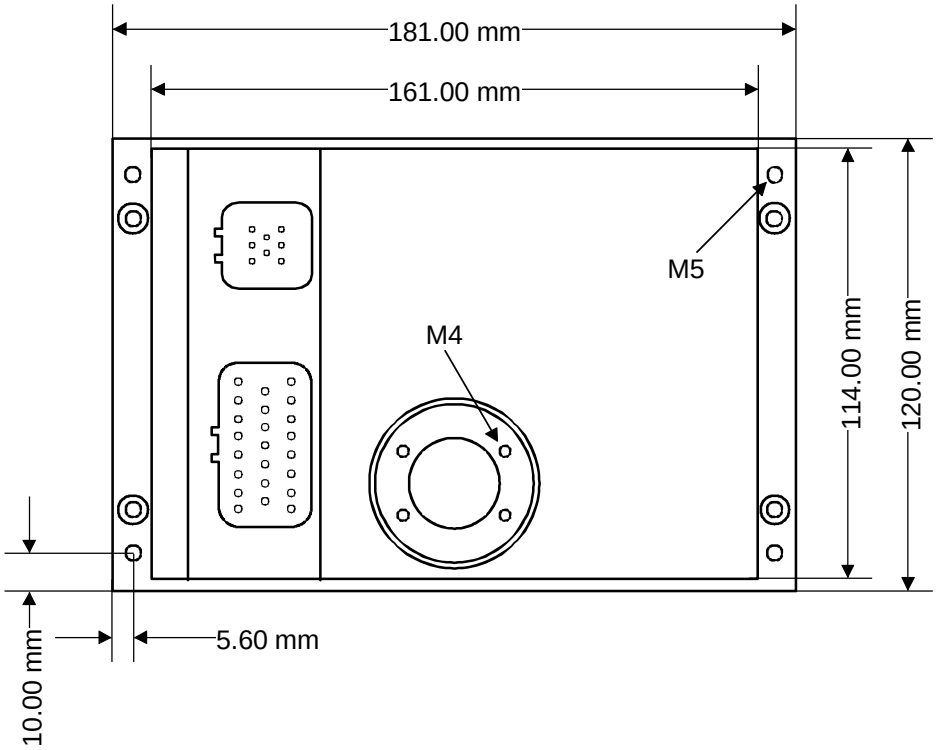


FIG 15. Display dimensions and mounting measurements. There are four M5 screw holes in corners for panel mounting.

4.3.2 Pedestal Mounting

Pedestal is mounted on the back of the display by using four M4 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 one 3/8” screw.

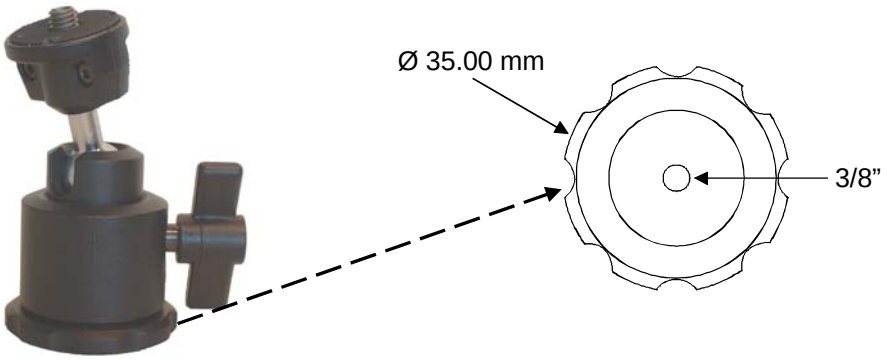


FIG 16. Dimensions of the pedestal base

The mounting pedestal has one big 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.

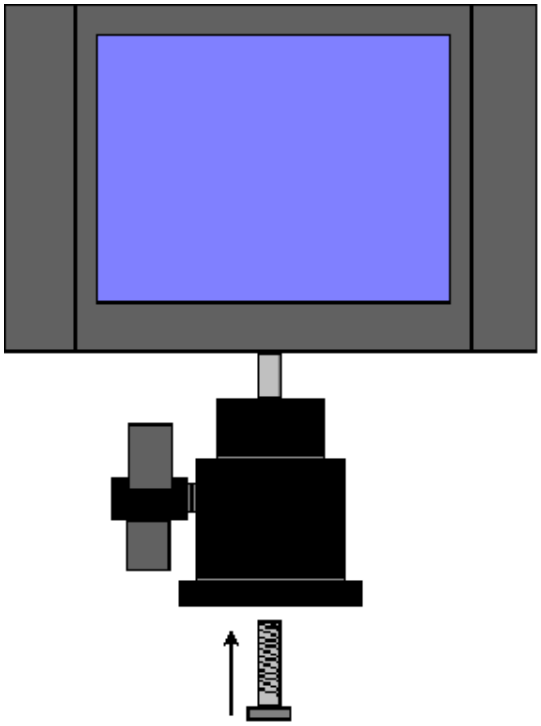


FIG 17. Display module with mounting pedestal. The pedestal is mounted from the bottom using one 3/8” screw.

5 WELDING

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

When the machine control system is implemented properly by using closed loops and single point grounding principle, there is no risk of disturbing the system even if one needs to weld the machine.

As the systems built vary greatly depending on machine type and general topology, it is not possible to give a complete example list of this issue. Prior to welding however it is required to ***disconnect the power supply*** for control system as shown in the following example pictures.

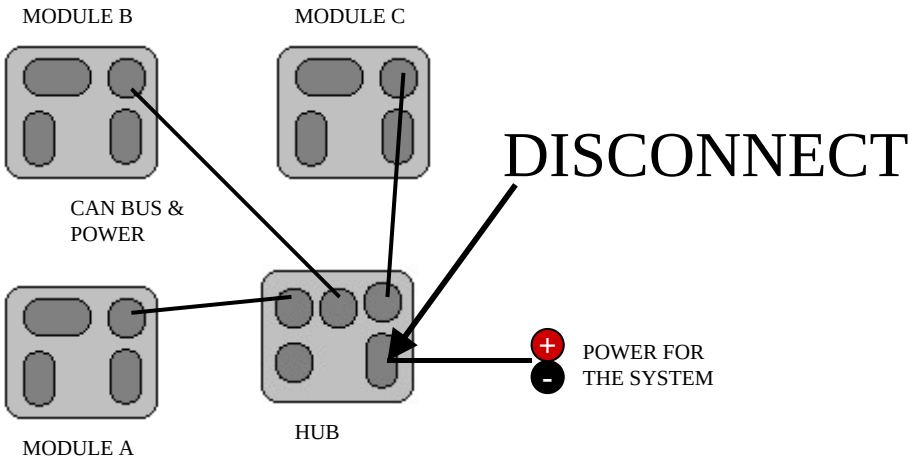


FIG 18. System with a hub module.

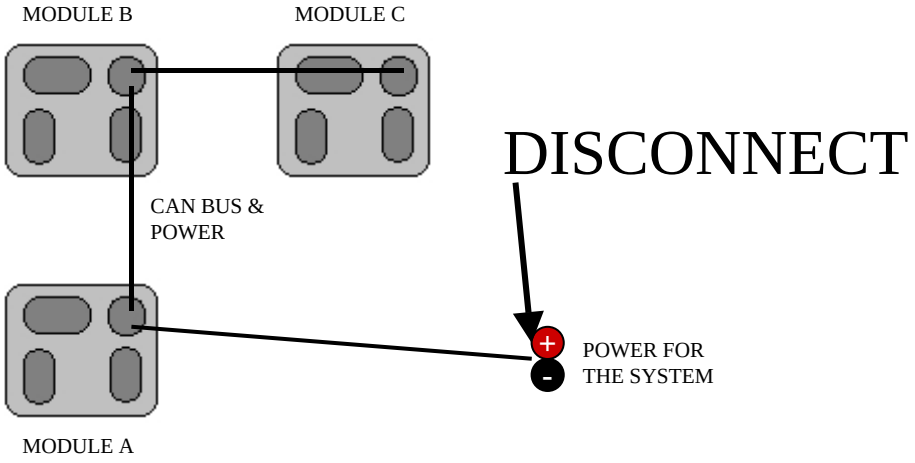


FIG 19. System without a hub module.

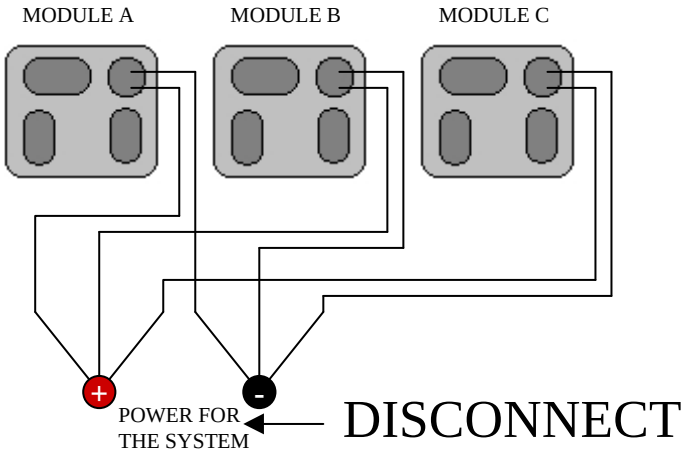


FIG 20. Another example of system without a hub module.

This kind of topology is generally not recommended in larger systems, because it requires a separate topology for CAN bus and may cause cabling complications.

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.

6 AVAILABLE HARDWARE

Epec Oy offers following items related to mounting and cabling:

Epec Code	Product
E10801109	Shock Cover for I/O Modules and Hub Modules
E10701038	Fastening Bolt for the Shock Cover (2pcs / cover)
E10801110	Wire Bracket for I/O Modules and Hub Modules
E308352MBH	Pedestal for Display Module
E10801246	Connector Cover for Display Module
KX0007	AMP 23-pin Grey Connector (does not include contacts, see below)
KX0008	AMP 23-pin Black Connector (does not include contacts, see below)
KX0009	AMP 23-pin Blue Connector (does not include contacts, see below)
KX0187	AMP 8-pin Black Connector (does not include contacts, see below)
KX0010	AMP Goldplated Contacts (1pcs / pin)
E40910700	S 200 Unshielded Twisted Pairs Cable for CAN-bus

7 REFERENCES

CiA 303-1 DR V 1.5: CANopen additional specification - part 1: Cabling and Connector Pin Assignment - Adobe Acrobat document (PDF) is available for CiA members in www.can-cia.org
AMPSEAL Connectors - **Application Specification 114-16016** 20 NOV 95 Rev D - www.tycoelectronics.com

Hub Module Technical Document, Epec Oy

I/O Module Technical Document, Epec Oy

Display Module Technical Document, Epec Oy

Please contact Epec Oy for further information.