



PowerPlex[®] Compact Module CM500 Installation and Operating Instructions



User Manual **PowerPlex**[®]

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About this manual

This manual describes start-up of the **PowerPlex**[®] Compact Module (PP-M-CM500) in connection with compatible **PowerPlex**[®] components. We assume that all **PowerPlex**[®] compatible components and devices were installed correctly. The instruction is meant to be used by all professional electricians who want to integrate this control panel into an E-T-A **PowerPlex**[®] system. The **PowerPlex**[®] keypads allow easy and intuitive operation and monitoring of the **PowerPlex**[®] installations.

Besides this document further information on the E-T-A **PowerPlex**[®] can be found on E-T-A's Website.

All manuals contain important instructions for connection and safe operation of the **PowerPlex**[®] devices. Safety instructions have to be observed. All users have to be informed about all safety instructions. The documents have to be accessible for the user.

Qualified personnel



The system must only be installed, connected and configured in connection with this document. Installation and operation of the device/system must only be carried out by qualified personnel. With regard to the safety instructions of this documentation, qualified persons are persons authorised to operate devices, systems and circuits according to the standards and rules of safety engineering.

Safety instructions



Please follow the installation and configuration instructions given in this document carefully. Failure to comply may lead to serious damages of the product or the system. E-T-A is unable to accept responsibility for customer or third-party liability, warranty claims or damage caused by incorrect installation or improper handling in disregard of the Installation and Operating Instructions.

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Symbols

The following conventions and symbols will accompany you throughout the entire manual. They are defined as follows:

	Warning You are in a situation which might cause injury. Before working with one of the devices you have to be aware of the risks of electrical circuitries and you ought to be familiar with standard procedures of accident prevention.
	Caution There is a risk in this situation to do something which might cause damage of the devices or data loss.
	Information Here you receive information which might be particularly useful for the application.

Table 1: Symbols used

1. Introduction

You chose **PowerPlex**[®], a comprehensive, future-oriented on-board system which combines safety, user convenience and reliability. It is a decentralised power distribution and control system, regulating, controlling and monitoring various loads, switches and sensors and connecting them via CAN. All **PowerPlex**[®] modules ensure reliable control and monitoring of the electrical installations on board, either alone or in combination with other **PowerPlex**[®] components. Besides the protection against overcurrent they allow readout of data of the connected level sensors and temperature sensors as well as of shunts.

By means of the **PowerPlex**[®] configuration software, the application-specific logics for power distribution, power control and power monitoring will be defined, stored or adjusted. Communication takes place via the **PowerPlex**[®] CAN, based on SAE J1939.

Thanks to its system properties **PowerPlex**[®] is the perfect solution for smart electrical networks on boats and in vehicles. Typical applications include:

- Buses, special vehicles, mobile homes etc.
- Watercraft, e.g. leisure boats, workboats

Benefits for the OEM

The E-T-A **PowerPlex**[®] system allows switching and controlling of various loads, timer functions, real load status indication, overcurrent protection and wire break detection. Each function can be configured separately to meet the requirements of the loads.

Based on the CAN communication the **PowerPlex**[®] system allows to make individual wiring between load and control unit a thing of the past. The transmission of switch commands and status information is based on the peer-to-peer CAN bus communication. A direct cable connection between the actuator, e.g. a light switch, and the load, e.g. a lamp, is no longer required. The obvious advantages for the OEM include the reduced wiring and production costs as well as a convenient system setup by means of a Windows based configuration software. All control functions of the system are freely configurable with regard to complexity and size of the system. Change or system extension at a later date are also extremely easy.

PowerPlex[®] **Scope of operation** – **PowerPlex**[®] takes over the following tasks:

- **Distributes the DC 12 V or DC 24 V power supply** to all spots of the boat where loads are installed, such as lighting and heating control, bilge and water pumps, windscreen wiper motors etc.
- **Collects all status information** of all sensors and actuators everywhere in the vehicle, such temperature and tank level measuring points, ON/OFF status signals of the actuators.
- **Switches devices and equipment ON and OFF**, according to selectable, pre-set scenarios, at the touch of a button.
- **Monitors devices and equipment** regarding their out-of-range conditions, indicates possible failures and responds by reversing the pertinent control unit, as e.g. switching on a pump, if the water tank level falls below a certain limit.
- **Protects devices and equipment** against hazardous overcurrent and short circuit by isolating the faulty load from the system and failure indication to the system.
- **Offers back-up protection and switching** in the improbable case of a **PowerPlex**[®] system or component failures.

PowerPlex® communication is based on the CAN bus principle by means of “nodes”, which communicate with each other via a serial 2-wire connection. Hence the key components of a **PowerPlex®** system are these nodes distributed over the vehicle or boat. The overall **PowerPlex®** term for these interconnected nodes is “module”.

Various hardware components are required for installation and start-up of a **PowerPlex®** system:

Please check the delivered components upon receipt about completeness. You require the following hardware components for installation and start-up of a **PowerPlex®** system:

- one or more **PowerPlex®** modules (e.g. DC Power Module, DC Mini Module) that meet application-specific requirements
- USB-CAN converters (cable and driver) for transferring the configuration
- USB cables for the USB service interface for transferring application-specific user interfaces onto **PowerPlex®** Touch Panels.

In addition, you require a CAN bus cable for connecting the **PowerPlex®** components to the bus. Many manufacturers offer standard cables for this purpose. For more information on the required cable properties please see chapter 7 of the manual.

PowerPlex® reliably and precisely connects, regulates, controls and monitors electrical loads, switches and sensors via CAN. It controls status indications, operating conditions and execution of commands. Perfectly matched software and hardware components offer a comprehensive total solution with maximum potential of individualisation.

Each module protects the loads and cable harnesses against overcurrent. In addition the modules collect data of level sensors and temperature sensors as well as of shunts. Usually a **PowerPlex®** system consists of several modules of different kinds. The selection depends on the size of the electrical system to be monitored and controlled as well as of the current ratings of the loads.

Use our **PowerPlex®** Configuration Software to “programme” various control configurations. As requested, you can store them on the computer and load them into various **PowerPlex®** control systems. As soon as a **PowerPlex®** configuration has been completed, it will be transferred to the **PowerPlex®** modules (“nodes”) via the CAN bus interface. Via this CAN bus interface you also connect the **PowerPlex®** software for testing, analysing and debugging purposes of the **PowerPlex®** installation.

Fig. 3 shows the entire **PowerPlex®** product range to enable you to design your own **PowerPlex®** system solution:

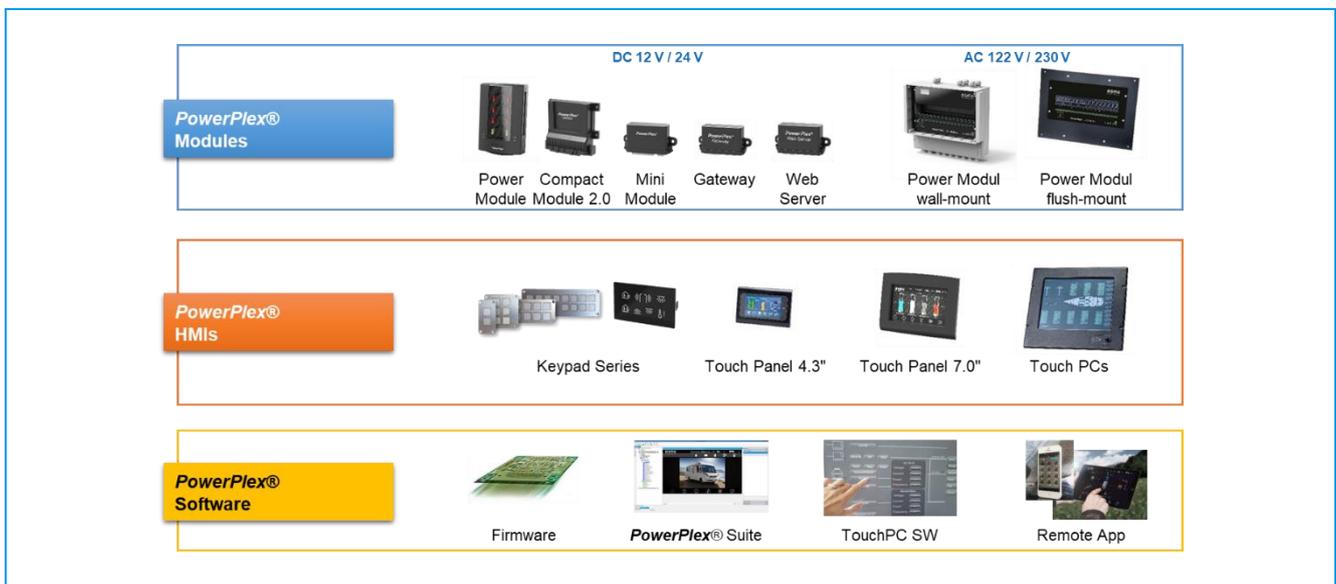


Fig. 3: Overview of PowerPlex® components

More components required for setting up a **PowerPlex**[®] system are shown in .

Accessories	Description
	<p>PowerPlex[®] Suite Configuration software for defining addresses, characteristics and functions of the PowerPlex[®] modules, assignment of the inputs and outputs to the modules and execution of system tests and analyses.</p>
	<p>CAN-USB converter plus driver CAN-USB adapter for connecting the CAN bus hardware to the USB interface of the computer with the PowerPlex[®] configuration software and/or to the USB interface of a touch panel which could be connected to the PowerPlex[®].</p>
	<p>Terminating resistors Two 120 Ω resistors terminate the CAN bus network, one on each end of the CAN bus.</p>
	<p>CAN bus cable A trunk CAN bus cable in pairs with two conductors (CAN-H and CAN-L) and the shield (SHLD) connect two PowerPlex[®] modules with each other.</p>
	<p>Power supply 12 V DC or 24 V DC battery voltage supply</p>
	<p>Line protection Protection of the L (+) connection from a PowerPlex[®] module to the battery or to the CAN bus. <i>Recommendation:</i> Thermal-magnetic E-T-A 8345 circuit breaker type.</p>

Table 2: Additional accessories

3. PowerPlex® system: General

3.1. PowerPlex® Modules

PowerPlex® modules are the key components of a **PowerPlex®** network. According to the CAN bus terminology they are the “nodes” of the network and form the points of switching, transmission and control.

PowerPlex® for DC system include high-end power semi-conductors with integral protective elements for switching and protection of electrical loads. The modules are free of mechanical components and thus insusceptible to wear and shock and vibration resistant.

E-T-A offers various **PowerPlex®** modules for DC 12 V and DC 24 V systems. gives an example of the difference between two modules.

DC Modules		Compact Module CM500	Power Module PM500
			
Voltage ratings		DC 12 V/24 V	DC 12 V/24 V
max. total current		60 A per module	102 A per module
Inputs	digital	8, configurable	8
	analog		4
Outputs		4 (max. 3 A, dimmable) 10 (max. 10 A, dimmable)	4 (max. 1 A, dimmable) 6 (max. 8 A, FLPC) 2 (max. 25 A, FLPC)
Degree of protection		IP22	IP22
Part number		PP-M-CM500-000-0-Z-00	PP-M-PM500-000-0-0-00

Table 3: Different PowerPlex® Modules

3.2. PowerPlex® CAN Bus

A **PowerPlex®** network can embrace up to 30 different **PowerPlex®** modules. The smallest **PowerPlex®** system would consist of two modules communicating via the CAN bus cable (see Fig. 4).

The loads controlled by the modules - in this case a light and bilge pump - are normally installed at some place in the vehicle which may not be necessarily close to the input signal. The decentralised control structure of **PowerPlex®** allows monitoring and switching of the devices anywhere on the vehicle or boat from any chosen installation site.

A level sensor monitors the bilge and supplies the analog information on module 1. From there the information is transferred to module 2 via the CAN bus. As soon as the measured analog input value (i.e. the “pumping level”) has exceeded a pre-set limit value , module 2 will send a switch command to the load (i.e. the “bilge pump”) so as to switch on the pump and to reduce the water level of the bilge back to an acceptable level. The status information of the bilge pump will be sent back to module 1 to switch on the display “bilge pump running”.

In addition, module 2 monitors the position of a light switch – ON or OFF – at one of the digital inputs and sends the switching signal to module 1, which switches the light ON or OFF depending on the switching status.

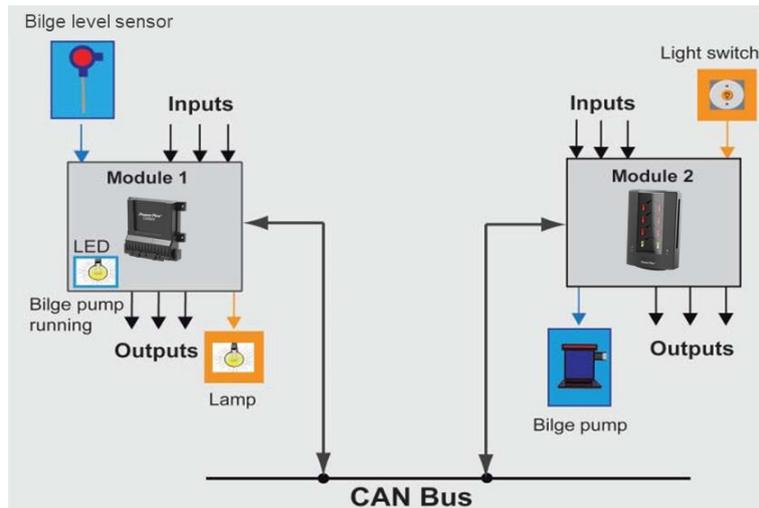


Fig. 4: Two PowerPlex® modules connected via CAN bus cable

An example demonstrates the principle of using the sensor and switching signal information at the module inputs as well as the sending, switching or the display of commands to the outputs of the same or a different module.

A typical **PowerPlex**® control system will of course connect a much higher number of modules and their inputs and outputs which will be distributed over the entire vehicle. Fig. 5 shows the electrical connection of several **PowerPlex**® modules in a serial CAN bus topology. Each module must be connected to the DC voltage supply and the CAN bus.

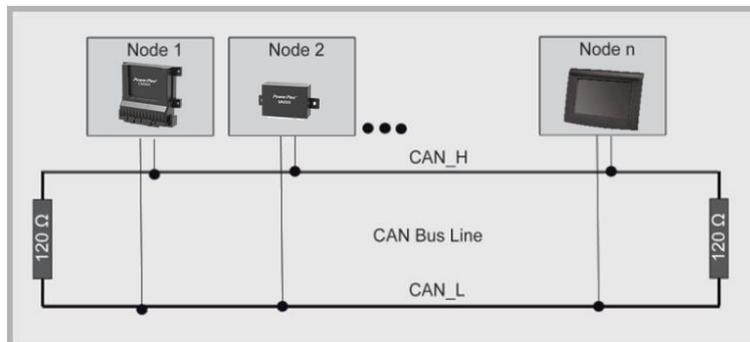


Fig. 5: Various PowerPlex® modules connected via serial CAN bus topology



Note

The first and last Modules of the CAN bus topology must be connected with a 120 Ω terminating resistor between the CAN high and CAN low signals. This helps avoiding interferences on the bus.

3.3. Put down the serial number

Each **PowerPlex**[®] component has a unique serial number. Before mounting the **PowerPlex**[®] modules, we recommend to prepare a list. This list should include: **PowerPlex**[®] component (module type), pertinent serial number and installation area.

You find the serial number of the **PowerPlex**[®] Compact Module on the label attached to the housing. The serial number consists of 7 letters and numbers. It is used as an identification for new, not yet projected modules which have the CAN bus address "0" for a start. The serial numbers are required for system set-up. By means of the **PowerPlex**[®] configuration software the pertinent CAN bus addresses will be assigned.



Note

Please note the 7-digit serial number of each **PowerPlex**[®] component. It is required for the subsequent system configuration with the **PowerPlex**[®] configuration software.

Later, when you start configuring the modules and when you define their roles in the CAN network, the assignment between serial number, CAN bus address and installation area must be made.

The use of CAN bus address labels helps keeping an overview for module identification, above all in the event of comprehensive projects.

3.4. The CAN bus address

Any **PowerPlex**[®] component within a **PowerPlex**[®] network has its own, unique CAN bus address in a range of 1 to 30 for a clear identification. Assignment of the CAN bus addresses is during the system set-up by means of the **PowerPlex**[®] Configuration Software (cf. **PowerPlex**[®] Manual Volume 3: System set-up and configuration).

We recommend to mark the modules in the **PowerPlex**[®] system with the corresponding CAN bus addresses so as to be able to keep track.

4. General: **PowerPlex**[®] Compact Module CM500

Growing demands regarding safety and convenience lead to the installation of more and more electrical loads in vehicles and boats. The **PowerPlex**[®] Compact Module (Fig. 6) is a multifunctional module that perfectly complements the **PowerPlex**[®] product range. Like all the other **PowerPlex**[®] components it meets the special requirements of marine and recreational vehicles applications.

It offers eight multifunctional inputs, which can be used for measuring current, voltage, temperature and/or liquid levels, as well as 14 load outputs.



Fig. 6: **PowerPlex**[®] Compact Module CM500

4.1. Technical data

The technical information of the **PowerPlex®** Compact Module are summarised in Table 4.

Technical Data								
Rated voltage	DC 12 V/24 V							
Operating voltage	9 ... 32 V DC							
Current consumption	typically 63 mA at 12 V typically 44 mA at 24 V							
Max. total current	60 A per module							
Degree of protection	IP22 when mounted vertically with terminals pointing downwards							
Operating temperature range	-30 ... +70°C (-22 ... 158 °F) with derating above +50 °C (+122 °F)							
Storage temperature range	-30 ... +85°C (-22 ... 185 °F)							
mass	approx. 410 g							
Interfaces:								
CAN I*	PowerPlex® CAN, 250 kbit/s, galvanically isolated							
CAN II*	CAN II galvanically isolated, protocol upon request							
*) The CAN-terminals at each end of a CAN bus require a termination by a 120 Ω resistor.								
LIN	LIN bus interface (CI-BUS) upon request							
Inputs:								
8 multifunctional inputs, configurable as	I1	I2	I3	I4	I5	I6	I7	I8
digital input:								
0 ... 8 kΩ; ON; > 10 kΩ OFF; plus or minus switching	•	•	•	•	•	•	•	•
analog inputs:								
a) voltage monitoring: 0 ... 32 V, R _{in} : 60 kΩ; resolution: 10 Bit	•	•	•	•	•	•	•	•
b) battery monitoring: ± 60 mV; battery current measurement with external shunt (I3 & I4)			+	-				
c) resistance measurement: 0 ... 750 Ω; for tank levels and temperature	•	•	•	•	•	•	•	•
d) frequency measurement: 0 ... 10 kHz (I1 & I2)	•	•						
Outputs								
10 outputs with 10 A max. continuous current								
load output	Power MOSFET, high side switching (HSS)							
max. current rating	10 A, adjustable in 1 A steps							
typical voltage drop U _{ON} at rated current (25 °C):	60 mV							
tripping range at overload	1.01 ... 1.30 x I _N							
motor function:	Switching of 2 H-bridges possible (X2: O1 & O2, X2: O6 & O7)							
high current function	20 A outputs via parallel connection of two load outputs (X2: O1 ... O10)							
dimming function:	all outputs are high-frequency dimmable, frequency adjustable							
4 outputs with 3 A max. continuous current								
load output	Power MOSFET, high side switching (HSS)							
max. current rating	3 A, adjustable in 1 A steps							
typical voltage drop U _{ON} at rated current (25 °C):	75 mV							
tripping range at overload	1.01 ... 1.30 x I _N							
dimmer function:	all outputs are high-frequency dimmable, frequency adjustable							
Approvals								
approval authority: KBA Standard: ECE regulation No 10 (E1) Rated voltage: DC 12/24 V								
Part number	PP-M-CM500-000-0-Z-00							

Table 4: Selection of technical data

*) For further information please see the relevant data sheet.

4.2. Scope of delivery

Standard scope of delivery of the **PowerPlex**[®] Compact Module is without accessories.

For completion we recommend the following accessories:

- USB/CAN Converter: XPP-USBC0
XPP-USBC1 (opto-decoupled)
- Connection package: XPP-CP-130
(contains a 2-, 10- and 22-pole connector, 10 x crimp contacts 14-16 AWG and 22 x crimp contacts 16 AWG)
- Temperature sensor XPP-TS500R-HB
(-30 ... +100 °C (-22 ... +212 °F))
XPP-TS500R-PH
(-30 ... +100 °C (-22 ... +212 °F))

4.3. Inputs, outputs and interfaces

Fig. 7 shows an overview of the terminals and interfaces of the **PowerPlex**[®] Compact Module.

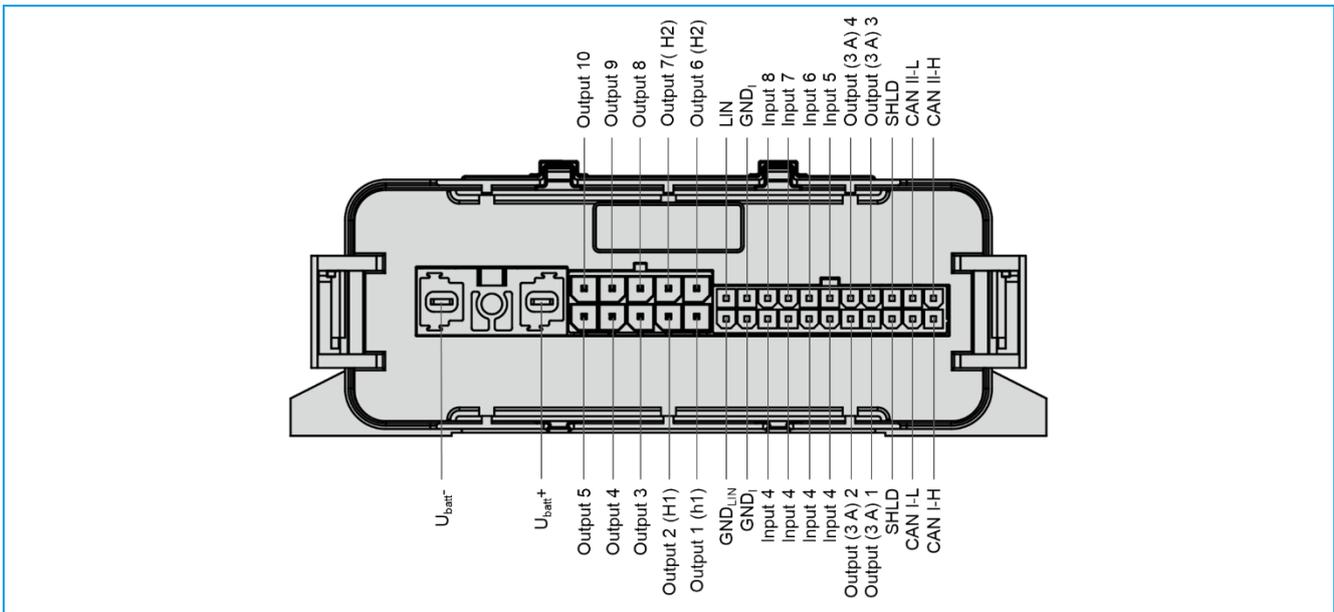
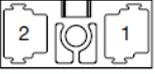
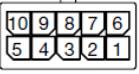
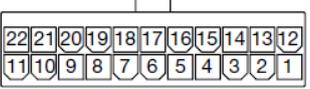


Fig. 7: Pin assignment of the PowerPlex[®] Compact Module

Explanation:

- Inputs (X3: I1 - I8) are multifunctional inputs which can be configured as a digital or analogue input.
- GND_{i} are ground terminals **only** for the multifunctional inputs (X3: I1 - I8). The outputs must be connected to external ground GND_{o} .
- Outputs are dimmable outputs
 - with max. 10 A continuous current, (X2: O1 - O10)
 - with max. 3 A continuous current, (X3: O1 - O4)
- Outputs (X2: O1 & O2; O6 & O7) can be used for switching H-bridges (motor function).
- $U_{\text{batt+}}$ and $U_{\text{batt-}}$ are for the connection of the power supply
- CAN-H, CAN-L, SHLD are the interfaces to the CAN buses (CAN I: **PowerPlex**[®] CAN; CAN II: other CAN bus)

Input/ output/ interface	what is connected	connection	cable connection	protection & status indication/comments
X1: 2-pole connection				
voltage supply	DC 12 V/24 V (DC 9 V ... 32 V)	$U_{\text{Batt}+}$ $U_{\text{Batt}-}$	BUZ 10.16IT/02/*	battery connection
X2: 10-pole connection				
power output 10 A	loads with max. 10 A	O1 - O8	crimp connector, 16 AWG	short-circuit and over-current protection: Current limitation and electronic safety shutdown; motor function: two H-bridges (O1&O2, O6&O7); high current function: 20 A outputs via parallel connection of two load outputs; dimming function with adjustable frequency
X3: 22-pole connection				
PowerPlex® CAN	CAN bus cable	6-pole Molex connector	crimp connector, 16 AWG	based on SAE J1939, galvanically isolated
CAN II	CAN bus cable			
input: digital	switch, momentary switch, ...	I1 - I8	crimp connector, 16 AWG	control inputs, switching to ground
input: analogue	battery, charger, sensor, ...	I1 - I8	crimp connector, 16 AWG	voltage measurement
	external shunt	I3(+) & I4(-)	crimp connector, 16 AWG	battery current measurement ± 60 mV, note: when monitoring the battery, it must be ensured that PLUS/MINUS are correctly connected.
	tank sensor	I1 - I8	crimp connector, 16 AWG	monitoring of tank levels
	temperature sensor:	I1 - I8	crimp connector, 16 AWG	temperature monitoring
ground for multifunctional inputs	GND_I	GND_I	crimp connector, 16 AWG	caution: ground of load outputs GND_O must be connected externally!
power output 3 A	loads with max. 3 A	O1 - O4	crimp connector, 16 AWG	short-circuit and over-current protection: Current limitation and electronic safety shutdown; dimming function with adjustable frequency
LIN interface	LIN	LIN	crimp connector, 16 AWG	interface (CI-Bus)

Tabel 5: Inputs, outputs and interfaces of the PowerPlex® Compact Module



Caution

To avoid inadvertent short circuits, please ensure that the module is disconnected from the power supply before you establish connections.

The ground connections GND_I on the module are only for the multifunctional inputs (X3: I1 - I8). The ground connection GND_O for an output (X2: O1 - O10; X3: O1 - O4) must be installed externally.

Please observe correct polarity for connection and wiring of the device.

5. Mounting

The **PowerPlex**[®] Compact Module has been designed for stationary installation. This **PowerPlex**[®] module is used for loads up to 10 A. We recommend to install the modules in close proximity to the loads to be controlled.

5.1. Installation check list

When planning and installing the **PowerPlex**[®] system please observe the limited number of system components. Our recommendation is some 30 **PowerPlex**[®] modules per system. Maximum values depend on the configuration scope so that more modules per system could be possible. Mounting covers the following installation steps listed in Table 6:

Step	Action
1	Application-specific system planning
2	Determine the installation site and prepare all necessary devices and tools
3	Put down the serial number
4	Run the cables
5	Prepare the necessary cut-outs for cables and device in the mounting plate
6	Connect the device for start-up
7	Mount and connect all remaining PowerPlex [®] components if not done before
8	Start the system by switching on
9	Check the system behaviour by a complete system test

Table 6: Installation check list

5.2. Recommended installation site

All **PowerPlex**[®] components can be installed in any location. The **PowerPlex**[®] HMI devices should be installed in an area which offers maximum benefit for the user. The **PowerPlex**[®] modules on the other hand should be installed close to the connected loads to reduce wiring efforts.

	Important <ul style="list-style-type: none">• Leave enough space for heat dissipation.• Please make sure to install the PowerPlex[®] modules in enclosed rooms.• Please observe the mounting version so as to reach the required degree of protection.
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General requirements of installation site

When choosing the mounting site, various factors that might influence the performance of the device have to be considered. Table 7 gives you an overview of the major factors.

	Ventilation <p>Please ensure sufficient ventilation by leaving enough space at all sides of the device and ensure that the vent holes are not blocked. Leave enough space between the devices.</p>
	Installation area <p>Ensure a tight installation on the mounting area. Please consider the vehicle-specific properties and do not mount components in places where might affect the safety features of the vehicle. In addition, make sure that the mounting surface is flat and even and not too rough so as to ensure the requested protection degree.</p>
	Cable bushing <p>Ensure installation at a site where the cables can be laid and connected properly.</p>
	Electrical noise pulses <p>The installation site should provide sufficient distance to any devices that might emit noise pulses.</p>

Table 7: General requirement of the installation site

5.3. General notes on wiring

The selection of the correct cable types is important for the reliable power distribution, control and monitoring by means of a **PowerPlex®** system. Please ensure to use cables of superior quality with the suitable cross sections to avoid voltage drops. Please also see the separate chapter 7 concerning the integration of the device into the CAN bus network.

The cables should be laid very carefully to achieve the maximum performance of the **PowerPlex®** installation. Table 8 gives general hints which must be observed regarding wiring of a **PowerPlex®** system and the connected loads.

Item	Note
1	The cables should not be kinked or bent sharply. Please provide sufficient bending radii.
2	Cables must be protected against damages and heat. Avoid the proximity to moveable or hot parts and to machines.
3	Cables should be secured by means of brackets or cable clips. Excessive cable lengths should be disposed of appropriately.
4	Depending on the site of the cables, waterproof bushings might be useful.
5	Ensure a suitable strain relief.
6	Check cables about intact insulation, above all after cable laying.

Table 8: General notes on wiring

If AC and DC current is used for installation, an adequate insulation must be ensured.



Note
Please do not forget the 120 Ω terminating resistor when the **PowerPlex®** Compact Module is connected as first and/or last participant on the CAN bus.

5.4. Required installation dimensions - mounting cut-out

The **PowerPlex®** Compact Module are meant for front panel mounting. The modules are screwed onto the mounting plate from the front, e.g. in the side trim panel. The required dimensions are shown in Fig. 8.

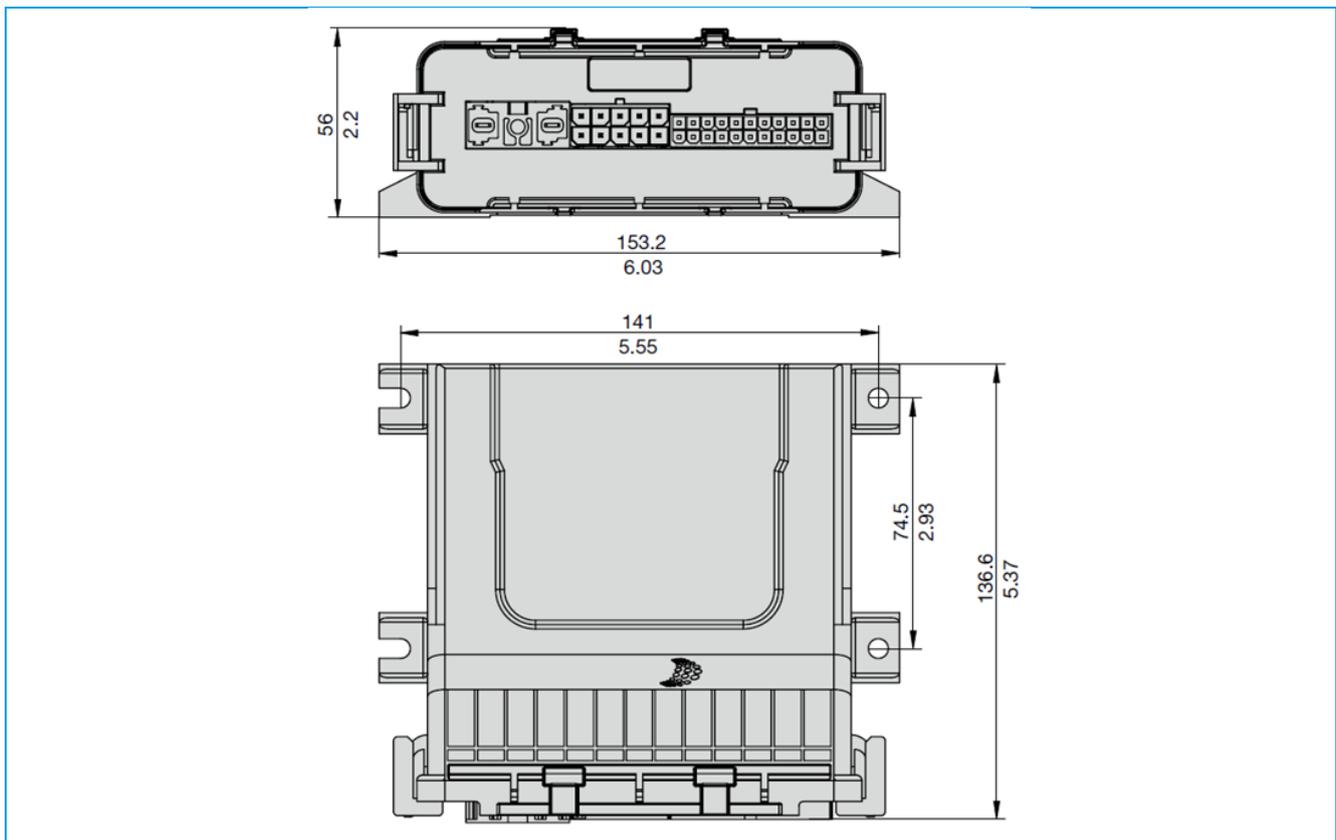


Fig. 8: Dimensions of the PowerPlex® Compact Module

All cables are connected to the module from below. This has to be considered in the planning stage and ensures ease of mounting, preventing a possible kinking of the cables.

5.5. Dimensions and space requirements

According to EMC conditions there must always be sufficient space between the different electrical devices. Space requirement of a device depends on its dimensions shown in Fig. 9.

Delivery of a standard **PowerPlex®** Compact Module does not include any mating plugs. They can be ordered separately as accessories XPP-CP-130:



Information

The protection degree IP22 is achieved when the **PowerPlex®** Compact Module is installed vertically with the terminals pointing downwards.

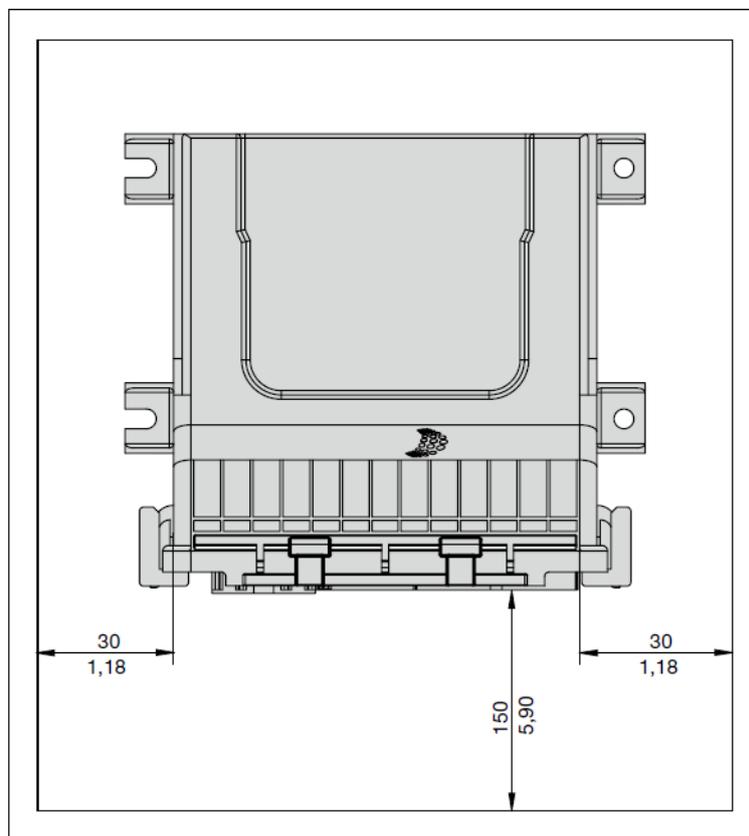


Fig. 9: Installation dimensions of the PowerPlex® Compact Module

5.6. Mounting of the device

Before you start installation, please make sure that

- the installation site was selected under consideration of the product-specific requirements
- the cable connections were identified correctly and cable laying was thoroughly planned
- the power supply was disconnected and protected against inadvertent reset

Step	Action
1	Mark the intended installation site following the installation dimensions
2	Drill the mounting holes into the wall with an adequate tool.
5	Depending on the accessibility of the cable connections we recommend to connect all cables (current, CAN etc.) before mounting the device. Important: A cable connection must only be established if the main switch is OFF. Check the cables with regard to correct polarity and ensure that the max. permissible operating voltage is not exceeded. Please do not forget the terminating resistor if the device is the first or last participant on the CAN bus.

Table 9: Mounting of the device

Pin assignment

The pins of the **PowerPlex**® Compact Module are on the bottom side. The pin assignment is shown in Table 10. Please note that the mating connectors are not included in the delivery scope as standard.

2-pole connection (X1)	interface	assignment	pin
	voltage supply (DC 12V/24V; DC 9 ... 32V)	U _{Batt} +	1.1
		U _{Batt} -	1.2

Table 10: Pin assignment on the 2-pole connector (X1)

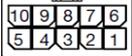
10-pole connection (X2)	interface	assignment	pin
	10 A outputs, dimmable (motor function [H1/H2]: O1 & O2, O6 & O7; high current function: 20 A via parallel connection; GND _O must be connected externally.)	O1 (H1)	2.1
		O2 (H1)	2.2
		O3	2.3
		O4	2.4
		O5	2.5
		O6 (H2)	2.6
		O7 (H2)	2.7
		O8	2.8
		O9	2.9
		O10	2.10

Table 11: Pin assignment on the 10-pole connector (X2)

22-pole connection (X3)	interface	assignment	pin
	CAN I: PowerPlex ® CAN, galvanically isolated	CAN-H	3.1
		CAN-L	3.2
		SHLD	3.3
	CAN II: galvanically isolated	CAN-H	3.12
		CAN-L	3.13
		SHLD	3.14
	10 A outputs, dimmable (note: parallel connection possible; GND _O must be connected externally.)	O1	3.4
		O2	3.5
		O3	3.15
		O4	3.16
	multifunctional inputs (note: when monitoring the battery, it must be ensured that PLUS/MINUS are correctly connected.)	I1	3.6
		I2	3.7
		I3	3.8
		I4	3.9
		I5	3.17
		I6	3.18
		I7	3.19
		I8	3.20
GND for multifunctional inputs (note: only use GND _I for multifunctional inputs (X3: I1 – I8), not for GND _O of the load outputs (X2: O1 – O10; X3: O1 – O4)	GND _I	3.10	
	GND _I	3.21	
LIN bus interface	LIN	3.22	
	GND _{LIN}	3.11	

Table 12: Pin assignment on the 22-pole connector (X3)

6. Connection to power supply

After interconnecting all **PowerPlex**[®] components of your system via a CAN bus cable, the installation only has to be connected to electrical power supply. **PowerPlex**[®] is suitable for both DC 12 V and DC 24 V.



Caution

- Please make sure that all electrical installations were carried out in accordance with EN ISO 10133.
- Please make sure that the power supply is disconnected and protected against inadvertent re-connection during the works on the system.
- Please avoid large differences between the lengths of the (+) and (-) cables.

Connecting the device

The 2-pole connector (X1) are used for connecting the **PowerPlex**[®] Compact Module to the power supply (DC 12 V/DC 24 V). A mating connector ensures easy connection.



Caution

The device has to be directly connected with the power supply via a suitable overcurrent protection. It must not be linked up within the system via some other **PowerPlex**[®] component to ensure impeccable start-up of the entire system.

Protection and cable cross sections

Suitable elements for overcurrent protection must be used to protect the **PowerPlex**[®] components. The current ratings of the circuit breaker should correspond to the max. expected total current of all outputs of the **PowerPlex**[®] component to be protected.

In the event of 60 A this corresponds to a cable cross section of 16 mm² connected to the U_{Batt+} (1.1) of the 2-pole connector. Since Ground (GND₀) of the loads on outputs (X2: O1 - O10 and X3: O1 - O4) is led externally, a cable cross-section of 4 mm² is sufficient for the U_{Batt-} (1.2) of the 2-pole connector.

7. Integration of the device in the CAN bus network

To set up the CAN bus network all **PowerPlex**[®] components are connected with each other (→ Fig. 10).

A CAN bus must be terminated with a 120 Ω resistor at the beginning and end. Bus terminating resistors are not installed in the Compact Module. If the device is operated as the first or last participant on the CAN bus, a 120 Ω terminating resistor has to be placed between the pins 3.1 and 3.2 of the 22-pole connector (→ Table 13).

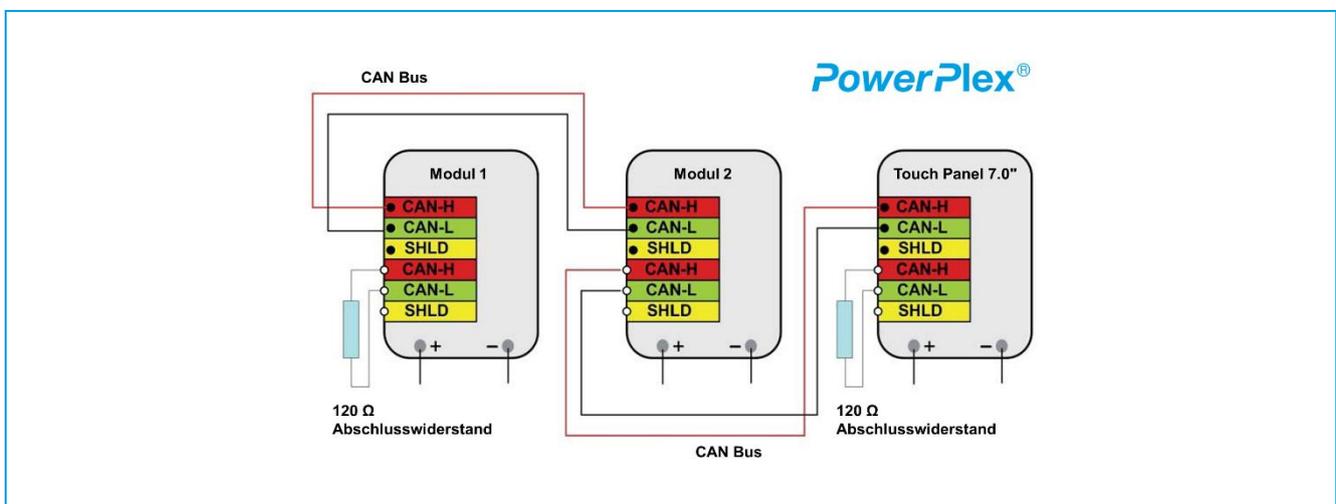


Fig. 10: Connection of the **PowerPlex**[®] components in the CAN bus system

A CAN bus cable typically is a twisted pair cable with two wires, CAN-H and CAN-L, and shield SHLD. Table 13 lists the most important properties which the CAN bus cable to be used should have. They correspond to a typical CAN bus cable.

Mechanical properties*	
Diameter - inner conductor	0.97 mm
Nominal cross section	0.5 mm ²
Conductor material	copper, blank
Structure of conductor	multi-stranded copper conductor
Number of cores	2
Total shield	Tinned copper braiding
Core colours	CAN-H white CAN-L: brown
Outer diameter of cable	7.0 mm
Colour of overjacket	purple
Mass	69 kg/km
Min. bending radius	laid out: 90 mm static: 48 mm
Operating temperature	-40 °C ... +70 °C (-40 ... +158 °F)
Electrical properties*	
Surge impedance	120 Ω
Conductor resistance	37 Ω/km max.
Insulation resistance	1 GΩ/km
Test voltage	1.5 kV
Other properties*	
Resistance against ambient effects	UV resistant, weatherproof, oil-resistant, coolant-resistant, microbe-resistant
Mechanical strength	abrasion-proof, notch-resistant, low adhesion
Chemical resistance	acid- and alkali-proof
Thermal resistance	thermal load: 1.09 MJ/m

Table 13: Major properties of the CAN bus cable to be used

*) Fa. Helukabel: CAN.BUS 1X2X0.50, www.helukabel.de



Caution

Please make sure that beginning and end of the CAN bus network are closed off with a 120-Ω resistor, i.e. both the first and the last **PowerPlex**[®] component must have a 120-Ω terminating resistor. This is of major importance for the correct and reliable function of the **PowerPlex**[®] installation.



Note

The terminating resistors are not included in the scope of delivery They can be ordered separately as accessories.

8. PowerPlex® Configuration Software

The **PowerPlex®** Configuration Software is a part of **PowerPlex®**. The software is listed in the data sheet under “accessories”.

When order your **PowerPlex®** components, please verify if the configuration software is required or not. Possibly you already have the software from an earlier **PowerPlex®** project. You can also download the configuration software form our E-T-A website.



Note

The **PowerPlex®** Configuration Software is not automatically part of the delivery of **PowerPlex®** components. It is available for download on our E-T-A website.

8.1. Computer Requirements

The **PowerPlex®** analysis and configuration software runs on any computer or laptop running with a Windows® operating system. Please check your computer regarding the following requirements (Table 14).

Technical data	
Operating system	Windows®, Windows® XP
processor	Pentium III or higher
RAM	minimum:256 MBytes recommendation: 512 MBytes
hard disk storage unit	minimum:500 MBytes
screen resolution	minimum:500 MBytes
input device	mouse or similar
Interfaces	USB 2.0

Table 14: Requirements of the configuration PC

Step	Action
1	Check if the hard disk of the computer provides sufficient disk space
2	De-install previous versions before installing a new version of the PowerPlex® Configuration Software on your Windows®-based computer (→ chapter 8.2, Software installation)



Note

You require admin access rights for installing the **PowerPlex®** Configuration Software.

8.2. Software installation

The **PowerPlex®** Configuration Software can directly be downloaded from E-T-A's Website. A username and a password are required which will be assigned upon request. On demand the configuration software can also be made available on a USB flash drive. No further entries are required during the installation process. The **PowerPlex®** Suite can also be started from a USB flash drive.

9. CAN/USB converter and driver

For transmission of a complete or modified **PowerPlex**[®] configuration to a **PowerPlex**[®] Compact Module and other **PowerPlex**[®] hardware, you must connect your configuration PC with the **PowerPlex**[®] network (CAN bus). The following USB/CAN adapters are supported by the **PowerPlex**[®] software: CAN/USB-light adapter von Sontheim, PEAK USB, PEAK PC.



Fig. 11: CAN/USB converter (example: Peak)



Note

The driver of the selected CAN/USB adapter must also be installed on the configuration PC.

10. Important information and safety instructions

The following table lists various information and safety instructions for start-up and use of the module.

	Warning: Installation and operation of the module This device must be installed and operated in compliance with the given instructions. Failure to observe the instructions can cause personal injury, damages of the boat or vehicle or reduced operational performance.
	Warning: Switch off main switch Before starting installation, the main switch of the boat or vehicle has to be switched off. A cable connection must only be established if the main switch is OFF.
	Warning: Possible ignition hazard The device must NOT be used in inflammable surroundings.
	Warning: high voltage The cover must NEVER be opened. Access to the inner components is not allowed unless indicated otherwise in this manual.
	Caution Grounding The device must be grounded before switching on.
	Caution Water ingress Disclaimer of warranty in the event of water ingress. Waterproofness of the module depends on the correct installation. E-T-A does not accept any liability in this case.

Table 15: Important information

EMC installation directives

The **PowerPlex**[®] hardware and accessories comply with the EMC directives. Thus electromagnetic interferences between the devices are avoided which would otherwise affect the system performance. A professional installation is mandatory. To ensure the best EMC conditions, the widest possible distance between the different electrical devices should be applied.

Technical Accuracy

All technical data in this manual were correct in all conscience at the time of printing. E-T-A cannot be held liable for any (inadvertent) errors. Due to continuous product improvements at E-T-A there could be discrepancies between the actual product and the manual. Product changes or amendments of the technical specifications will be carried out without prior notification. The latest versions of the **PowerPlex**[®] manuals are available on our website (www.e-t-a.de).



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