

PowerPlex[®] Compact Module User Manual

Instructions for Mounting and Installation



User Manual **PowerPlex**[®]

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About this Manual

The manual for the **PowerPlex**[®] Compact Module is intended for the professional vehicle electrician who wants to install and configure the E-T-A **PowerPlex**[®] Compact system for controlling the vehicle's electrical equipment.

The manual in hand describes the analysis and configuration software which is part of the **PowerPlex**[®] control and multiplexing system. The manual gives you step-by-step instructions on how to set up your **PowerPlex**[®] Compact Module in a **PowerPlex**[®] System once the hardware has been properly installed. We take you through the dialog boxes and menus of the software.

The following manuals provide additional information about E-T-A **PowerPlex**[®].

PowerPlex[®] Manual Volume1
Volume 1: System Description

Here you find a general system overview, a description of the **PowerPlex**[®] system architecture and a detailed explanation about the function of each PowerPlex system component. The Appendix contains background information which you may be interested in in connection with the principles of the **PowerPlex**[®] system. It gives you a short introduction into CAN networking, and provides the technical data sheets of the main components, such as PowerPlex modules and circuit breakers.

PowerPlex[®] Manual Volume2
Volume 2: Hardware Installation
and Maintenance

Volume 2 of the **PowerPlex**[®] Manual Box gives you step-by-step instructions on how to install the system. Here you find out where and how to mount the **PowerPlex**[®] Power Modules and the **PowerPlex**[®] Panel Modules, how to wire them up, and how to connect the appliances and equipment you wish to control. The final chapter summarizes the installation instructions and provides you with a Quick Installation Guide.

PowerPlex[®] Manual Volume3
Volume 3: System Setup and
Configuration

Volume 3 describes the **PowerPlex**[®] Configuration Software and gives you step-by-step instructions on how to set up your **PowerPlex**[®] system once the hardware has been properly installed. We take you through all the dialog boxes and menus of the software and create a configuration example. This example configuration shall be loaded into the **PowerPlex**[®] hardware and tested. A separate chapter is dedicated to special **PowerPlex**[®] functions that allow you to create a highly sophisticated CAN bus based control system for the boat's entire electrical equipment.

All manuals contain important information for the connection and the safe use of **PowerPlex**[®] devices. Safety must be observed. All users must be informed of all precautions. The manuals must be accessible to the user.

Qualified Personnel

The **PowerPlex**[®] Compact Module may only be installed, connected and set up in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Safety Instructions



Please follow the installation and adjustment instructions in this manual carefully. Nonobservance may result in serious damage to the product or your system. E-T-A will not accept liability or warranty claims for issues caused by incorrect installation or handling by the customer or a third party.

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Conventions and Symbols

The following conventions and symbols are used throughout this manual and are defined as follows:

BOLD	Menu names and items, text you must select in the PowerPlex [®] Configuration Software, such as menu items, buttons and commands.
ITALICS	Words and characters you see on the screen when you are working with the <i>PowerPlex</i> [®] configuration software. In some cases, italics are used to emphasize a new term or an important fact.
NUMBERED LISTS	indicate sequential steps for completing a procedure
IMPORTANT	Information that is critical for successful application and understanding of the product is displayed on a light blue background.
→	indicates the progression of menu choices you should select in the graphical user interface (GUI), such as File → Print

Table 1: Conventions used in this manual

	WARNING: You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.
	CAUTION: In this situation, you might do something that could result in equipment damage or loss of data.
	INFORMATION: At this point, you get an information which could be especially useful for the application.

Table 2: Symbols used in this manual

1 Introduction

PowerPlex® is a decentralized electrical power distribution system. All **PowerPlex®** Modules ensure, alone or in combination with other **PowerPlex®** components, reliable control and monitoring of all installed electrical devices and functions. They protect loads and harness against overcurrent. In addition the modules are used to collect sensor data from level and temperature sensors as well as shunt resistors. Outputs for dimming of electrical loads are also available. Particularly in combination with a connected Touch PC or **PowerPlex®** Touch Panel, **PowerPlex®** provides easy and fast access to alarm information and operation hours counts which facilitates service and maintenance jobs.

All modules of a **PowerPlex®** system are communicating via CAN bus using a SAE J1939 based protocol. **PowerPlex®** can be configured directly by the vehicle manufacturer using the **PowerPlex®** Configuration Software on a standard PC. The configuration is transferred to the modules via the CAN bus using a USB-CAN adapter.

Thanks to its system properties **PowerPlex®** is the perfect solution for smart electrical systems in boats and vehicles. Typical applications are

- Buses, special vehicles, camper, caravans, etc...
- Watercraft, e. g. recreational boats and workboats

BENEFITS FOR THE OEM

The E-T-A **PowerPlex®** system provides switching and controlling, timer functions, real load status indication, overcurrent protection and wire break detection. Each function is individually configurable to fit the requirements of the different loads.

Based on CAN network communication, the **PowerPlex®** system makes individual wiring between loads and switching equipment to a thing of the past. As the transmission of switching commands and status information is based on peer-to-peer CAN bus communication, there is no need to have direct cabling between the operating element, say a light switch, and the load to be switched, say a lamp. The obvious advantage to the OEM lies in the reduced cabling and build costs, and in the convenient system setup using Windows based configuration software. As the system's control functions are freely configurable with respect to complexity and system size, modification and expansion at a later stage is extremely easy.

PowerPlex® FUNCTIONAL RANGE – **PowerPlex®** takes charge of the following tasks:

- DISTRIBUTE THE DC 12 V OR DC 24 V SUPPLY to all points of the boat where loads are installed, such as lighting and heater control, bilge pumps, water pumps, windscreen wiper motors, etc.¹
- COLLECT STATUS INFORMATION from all sensors and operating elements around the vehicle, such as temperature and tank level measurement points, ON/OFF status signals of actuators.
- SWITCH APPLIANCES AND EQUIPMENT ON AND OFF, according to selectable, predefined scenarios, at the touch of a button.
- MONITOR APPLIANCES AND EQUIPMENT for out-of-range conditions, indicate such faults and respond to them by switching the associated control device, such as switching ON a pump if the potable water tank level is too low.
- PROTECT APPLIANCES AND EQUIPMENT against dangerous overloads and short circuits by isolating the faulty load from the system and indicating its failure.
- PROVIDE BACKUP PROTECTION AND SWITCHING in the unlikely event of **PowerPlex®** system or component failure

¹ Distributing AC 230 V supply is with PowerPlex® AC modules possible

2 System Components: Overview

With **PowerPlex**[®], E-T-A offers a comprehensive, on-board system which combines safety, comfort and reliability. **PowerPlex**[®] allows individual and flexible concepts for switching the illumination, sirens, special signals and much more. It can automatically switch loads and will immediately inform the driver about undesirable behavior of the devices or the electrical installation. This will ensure that everything works as it is designed to – reassuring when loads are not always visible. E-T-A **PowerPlex**[®] is a decentralized power distribution system with electronic protection – fully geared to the future.

Figure 1 shows a typical **PowerPlex**[®] arrangement comprising a number of distributed **PowerPlex**[®] components – modules and user interfaces – installed in different locations of a vehicle.

PowerPlex[®] communication is based on the CAN bus principle using "nodes" that talk to each other over 2-wire serial connections. Therefore, the key components of the **PowerPlex**[®] system are such nodes distributed over the vehicle. The **PowerPlex**[®] term for these interconnected nodes is "module".

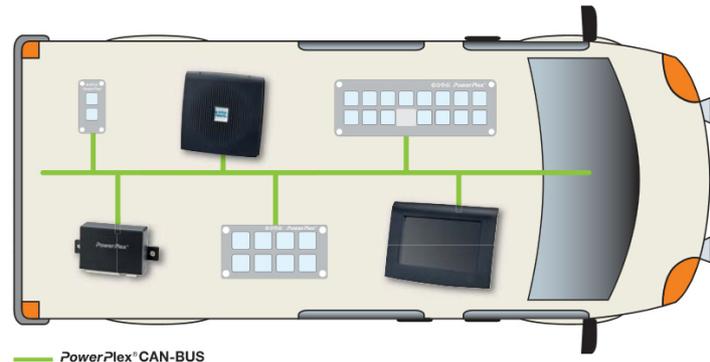


Figure 1: Exemplary PowerPlex[®] system design in an ambulance vehicle

To install and setup a **PowerPlex**[®] system are different hardware components necessary.

- One or more **PowerPlex**[®] modules (e. g. **PowerPlex**[®] Power Module, **PowerPlex**[®] Compact Module) in care and attention of the module-specific requirements
- USB-CAN-Converter (cable and driver software) for transferring the configuration → more in chapter 9,
- USB cable for the USB service interface for transferring application-specific user interfaces to **PowerPlex**[®] Touch Panels

You also need CAN bus cables to connect the **PowerPlex**[®] components to the CAN bus. A number of manufacturers provide standard cables. Further information about required cable properties in chapter 7 of the manual.

PowerPlex[®] connects, regulates, controls and monitors a wide variety of loads, switches and sensors over CAN – precisely and securely. It controls status functions, operating modes and command executions. Ideally matched software and hardware components provide a total solution with an enormous potential for individual customization.

Each **PowerPlex**[®] module protect loads and harness against overcurrent. In addition the modules are used to collect sensor data from level and temperature sensors as well as shunt resistors. Your **PowerPlex**[®] system will most probably comprise a certain number of each module type, depending on the size of the electrical system you wish to monitor and control, and on the current rating of the loads you wish to switch.

Use the **PowerPlex**[®] Configuration Software to "program" different control configurations, save them on the computer and load them into different **PowerPlex**[®] control systems, as required. Once a **PowerPlex**[®] configuration has been completed, it is loaded into the **PowerPlex**[®] modules (also called "nodes") using a CAN bus interface. It is also over this CAN bus interface that you connect the **PowerPlex**[®] Software when you want to test, analyses and debug the **PowerPlex**[®] installation.

In Figure 2 you see our complete **PowerPlex®** product range for designing your **PowerPlex®** system solution.



Figure 2: Design your PowerPlex® system - PowerPlex® components

Other components which are necessary to get a functional system are in Table 3 specified.

ACCESSORIES	DESCRIPTION
	POWERPLEX CONFIGURATION SOFTWARE Windows based configuration software for defining the addresses, characteristics and functions of the PowerPlex® modules, assigning inputs and outputs to them, and carrying out system tests and analysis.
	CAN-USB CONVERTER PLUS DRIVER SOFTWARE CAN-USB adapter to connect the CAN bus hardware to the USB interface of the computer running the PowerPlex configuration software and/or to the USB interface of a touch panel that might be connected to the system.
	TERMINATING RESISTORS Two 120 Ω resistors terminate the CAN bus network, one at each end of the bus structure.
	CAN BUS CABLE A standard twisted-pair CAN bus cable comprising two wires (CAN-H and CAN-L) and the shield (SHLD) connects two PowerPlex modules to each other.
	VOLTAGE SUPPLY 12 V DC or 24 V DC battery voltage supply
	LINE PROTECTION Protection of the L (+) connection from the PowerPlex® module to the battery or the bus. <i>Recommended:</i> E-T-A thermo-magnetic circuit breaker type 8345

Table 3: Accessories to complete the PowerPlex® system

3 PowerPlex® System: General Characteristic

3.1 PowerPlex® Modules

PowerPlex® modules are the key components of the **PowerPlex®** control network. According to CAN bus terminology, they are the "nodes" in the network and form the switching, relaying and control points.

PowerPlex® for DC systems incorporates high-end power semiconductors with integrated protective elements for switching and protecting electrical loads. The DC modules are free of any mechanical components and are thus hardwearing as well as shock- and vibration-proof.

E-T-A offers four **PowerPlex®** modules for DC 12 V and DC 24 V systems. Every module is different. Table 4 shows exemplify the difference of two modules.

DC MODULES		COMPACT MODULE	POWER MODULE
			
Total voltage		DC 12 V / DC 24 V	DC 12 V / DC 24 V
Total current max.		60 A per module	102 A per module
Inputs	digital	10	8
	analog	4	4
Outputs		10 (max. 10 A, two are configurable as H-bridge)	4 (max. 1 A) 6 (max. 8 A, FLPC) 2 (max. 25 A, FLPC)
Protection Class		IP20	IP22
Order number		PP-C-COM24-00E-0-Z-00	PP-M-DC024-000-0-0-00

Table 4: Different PowerPlex® modules

3.2 PowerPlex® CAN Bus

One **PowerPlex®** control network may comprise up to 30 **PowerPlex®** modules of any type. The smallest **PowerPlex®** network would be made up of two such modules interconnected by a CAN bus cable (→ shown in Figure 3).

The loads controlled by the module outputs – here: a lamp and a bilge pump – will typically be installed somewhere in the vehicle, not necessarily close to the input signal. The distributed control architecture of **PowerPlex®** therefore allows you to monitor and switch appliances anywhere on the vehicle from any point you wish.

A level sensor monitors the bilge area and feeds this analog information to Module 1. From there, the information is transmitted to Module 2 over the CAN bus. As soon as the measured bilge level (i.e., the analog input value) exceeds a predefined limit value, Module 2 sends a switching command to the load (i.e. the "Bilge pump") to switch on the pump and empty the bilge to an acceptable level. Information on the bilge pump status can be sent back to Module 1 to light up the visual "Bilge pump running" indicator. Module 2 monitors the position of a light switch – ON or OFF – at one of its digital inputs, sends this switch signal to Module 1 which switches the light ON or OFF depending on the switch position.

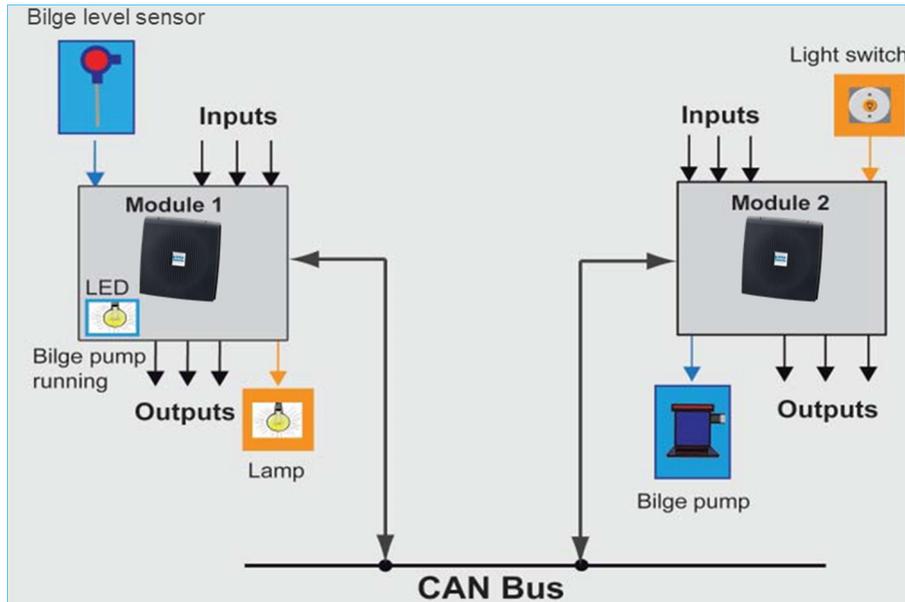


Figure 3: Minimum PowerPlex® System design – two PowerPlex® modules connected via CAN bus cable

The example illustrates the principle of applying sensor and switch signal information to the module inputs and sending switching or indicating commands to the outputs of the same or another module.

A typical **PowerPlex®** control system will of course interconnect a much larger number of modules, and their inputs and outputs, which are distributed over the entire vehicle. Figure 5 illustrates the electrical connection of several PowerPlex modules in a serial CAN bus topology. Each module must be connected to the DC power supply and to the CAN bus.

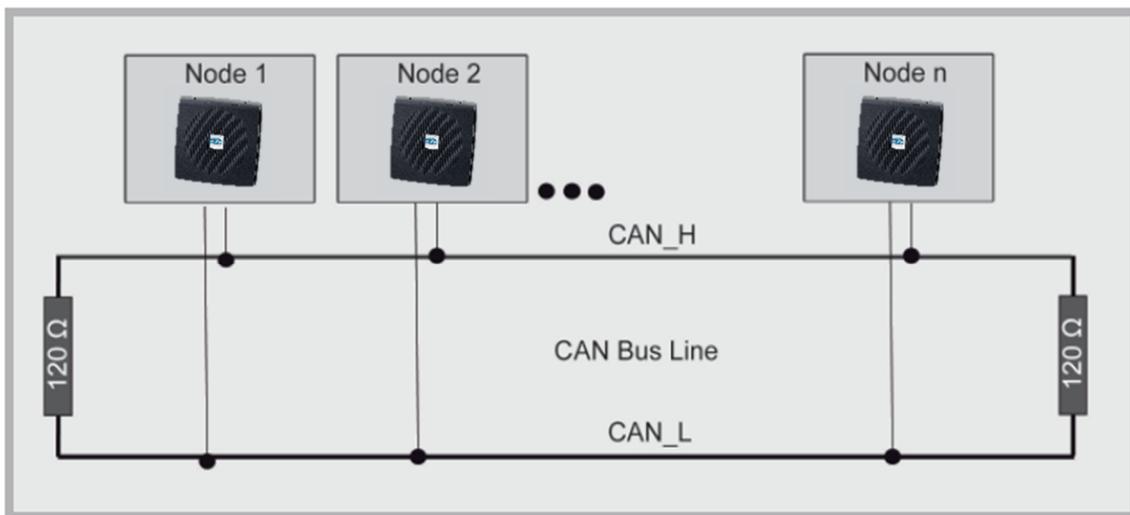


Figure 4: Several PowerPlex® modules connected in a serial CAN bus topology

The first and the last module of the CAN bus topology have to have a 120 Ω terminating resistor connected between the CAN-High and the CAN-Low signals to prevent interferences on the bus.



NOTE:

The first and the last module of the CAN bus topology have to have a 120 Ω terminating resistor connected between the CAN-High and the CAN-Low signals to prevent interferences on the bus.

3.3 Noting the Serial Numbers

Every **PowerPlex**® component has a unique serial number. Before you actually mount the PowerPlex modules, we recommend you make a note of all serial numbers and keep a list of which module with which serial number you mount where.

You find the serial number label of the **PowerPlex**® Compact Module on the housing underneath the cover. To see this label, remove the module's snap-on cover by clicking the covers top handle towards you and then pulling the cover off. The serial number comprises 7 letters and digits.

The serial number serves as an identifier for new, unconfigured modules which initially have the CAN bus address 0. You will come across the module serial number when you set up your **PowerPlex**® system and assign CAN bus addresses using the **PowerPlex**® Configuration Software.

**NOTE:**

Note the 7-digit serial number for each **PowerPlex**® component. These are needed for the subsequent system configuration with the **PowerPlex**® Configurations Software.

Later on, when you are going to configure and define the modules' role in the CAN network, you will have to make the association between serial number, CAN bus address and mounting position on the boat.

We recommend using the CAN bus address labels 1 to 30 provided and fix them to the upper right corner of the module covers to keep track of module identification. For details on the recommended circuit and address labels, please consult the module data sheets.

3.4 The Module CAN Bus Address

Every **PowerPlex**® module connected to the CAN bus must have its own unique CAN bus address in the range from 1 to 30 for unambiguous identification within the network. You assign the address when you set up your **PowerPlex**® system using the **PowerPlex**® Configuration software (see **PowerPlex**® Manual Volume 3: System Setup and Configuration).

We recommend to mark the modules in your **PowerPlex**® system with their corresponding module addresses. This allows you to keep track of module identification.

4 General Information: **PowerPlex**® Compact Module

Today field buses, in particular CAN, are indispensable. Primarily due to increased demands for safety and comfort, more and more electrical equipment is being installed in vehicles.

During the development of the **PowerPlex**® Compact module was especially taken to ensure that it meets the specific requirements in special vehicles and watercraft and optimally complement the **PowerPlex**® system. Especially the **PowerPlex**® Compact Module provides outputs for dimming of electrical loads are also available.

The **PowerPlex**® Compact Module offers eight power outputs with up to 8 A or 10 A – depending on the configuration. You can connect switches, push buttons, lamps and other appliances to a **PowerPlex**® Compact Module.



Figure 5: PowerPlex® Compact Module

4.1 Technical Data

The following table shows which principal features the **PowerPlex**® Compact Module has.

TECHNICAL DATA*	
Voltage rating	DC 12 V / DC 24 V
Operating voltage	9... 32 V DC
Total current max.	60 A per module
Operating temperature range	-30... +50°C (-4... +122 F)
Storage temperature range	-30...+85°C (-22... +185 F)
Protection class	IP20 (coated PCB)
CAN according to	SAE J1939 250 kBit/s
Mass	Approx. 380 g
Inputs	
10 digital inputs	0...50 Ω: ON; > 100 kΩ: OFF
4 analogue inputs	1 for capacitive level monitoring: 0... 4 V with external DC supply (max. 100 mA); R _{in} : 40 kΩ; resolution: 10 bit 1 for temperature monitoring (for KTY13-6) 1 for battery monitoring (via external shunt resistor, measuring range ± 60 mV) 1 for four point level indication
Outputs	
10 outputs with 8 A / 10 A max. continuous current	
load output:	Power MOSFET, high side switching
max. current rating:	8 A / 10 A adjustable from 1 A to 8 A / 10 A in 1 A steps
typical voltage drop U _{ON} at rated current (at 25 °C):	60 mV
overload tripping range:	1.01... 1.30 x I _N
Approvals	Authority: KBA; Voltage ratings: DC 12/24 V
Ordering number	PP-C-COM24-00E-0-Z-00

Table 5: Principal technical data

*) For further information please see the relevant data sheet

4.2 Scope of Delivery

By default contains the delivery of your **PowerPlex®** Compact Module (mounted):

- Housing of the module
- Cover

Additional you could order the following accessories:

- USB/CAN converter
- Stocko connector: 2-, 3-, 4-, 5-pole
- Different adapters
- 120 Ω terminating resistor

For further information please see the relevant data sheet or visit www.e-t-a.de.

4.3 Inputs, Outputs and Interfaces

Figure 6 shows an overview about the connectors and interfaces from the **PowerPlex®** Compact Module without snap-on cover.

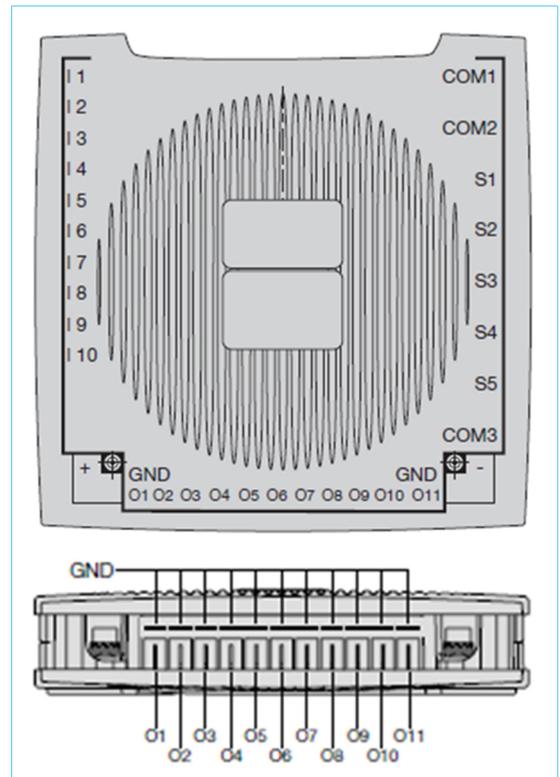


Figure 6: PowerPlex® Compact Module without snap-on cover

INPUT/ OUTPUT/ INTERFACE	WHAT TO CONNECT	TERMINALS	CABLE CONNECTION	PROTECTION & STATUS INDICATION/ COMMENTS
CAN bus	CAN bus cable	COM1 COM2	4-pole stocko connector	SAE J1939 protocol
LIN bus	LIN bus cable	COM3	RS232	
Input: digital	Switch, pushbutton, ...	I1 - I6 I9 & I10	2-pole stocko connector	Control inputs, switching to ground
		I7 & I8	2-pole stocko connector	Control inputs, switching to ground or to positive (configurable)
Input: analog	Level sensor	S1	5-pole stocko connector	Four point level indication
	Load control	S2	4-pole stocko connector	
	Battery monitor	S3	3-pole stocko connector	battery monitoring via external shunt resistor
	Temperature sensor	S4	2-pole stocko connector	temperature monitoring for KTY13-6
	Level sensor, Step-less	S5	5-pole stocko connector	capacitive level monitoring
Output: Power 8 A / 10 A	Loads 8 A / 10 A max.	O1 - O11	blade terminals 6.3 mm	Short-circuit and overload proof: Current-limiting and electronic safety disconnection ensured by semiconductor components used in the modules; female connectors <u>not</u> included in delivery
		GND	blade terminals 6.3 mm	
Voltage supply	DC 12 V or DC 24 V Min DC 9 V, Max. DC 32 V	(+) terminal (-) terminal	hexagon socket M5x10	Serrated lock washer and washer included in delivery; Cable lug up to max. 16 mm² usable (<u>not</u> included in delivery)

Table 6: Inputs, outputs and interfaces of PowerPlex® Compact Module

CAUTION:

To avoid accidental short circuits, make sure that the module is disconnected from the power supply before you make any connections.

5 Mounting

The **PowerPlex**[®] Compact Module is designed for stationary installation. Normally, you choose this **PowerPlex**[®] module for your application if you have to switch loads up to 8 A / 10 A. We recommend installing of the modules in the vicinity of the loads to be controlled.

5.1 Mounting-Checklist

The mounting includes the following installation steps:

STEP	ACTION
1	Application specific system planning
2	Determining an installation location and preparation of all necessary equipment and tools
3	Note of the serial number
4	Cable laying
5	Preparing of the required cutouts for cable and devices in the mounting plate
6	Connection of the module for commissioning
7	Mounting and system connection of all remaining PowerPlex [®] components, if not previously done.
8	System start by switching on.
9	Verification of system behavior through complete system test

Table 7: Mounting checklist

The maximum number of system components is limited. This must be considered during the planning and installation process of the complete **PowerPlex**[®] system. Our recommendation is approximately 30 **PowerPlex**[®] modules per system. The maximum number varies with the scope of the configuration, so that also more modules are possible.

5.2 Recommended Installation Location

Generally is the installation location of all components **PowerPlex**[®] completely flexible. The **PowerPlex**[®] HMI devices² should be installed at the location that provides the maximum benefit for the user. For the **PowerPlex**[®] modules, however, the installation is recommended close to the connected loads in order to reduce the amount of wiring.

	<p>CAUTION:</p> <ul style="list-style-type: none"> • Leave enough space for heat dissipation. • Be sure to install the PowerPlex[®] modules indoors. • Pay attention to the built-in version in order to achieve the required safety class.
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The installation of the touch panel required at least the following tools: drill, jig saw, screwdriver, if necessary a rasp.

² HMI = Human Machine Interface, in this case it means **PowerPlex**[®] Touch Panels, Touch PC, etc.

GENERAL REQUIREMENTS FOR THE LOCATION

When choosing the location you have to consider several factors which can affect the performance of the devices. Table 8 shows the most important factors.

	VENTILATION Make sure that the modules has enough space for proper ventilation on all sides. Leave sufficient distance between modules.
	MOUNTING AREA Ensure a secure attachment of the modules on the mounting surface. Note the vehicle-specific properties and attach no components at locations which affect the safety features of the vehicle. In addition, make sure that the mounting surface is flat and the terminals are directed downward to ensure the required level of protection.
	CABLE ENTRY Ensure the mounting of the modules on a location where the cables can be decent routed and connected.
	WATER INLET The device is designed to be mounted below deck. Therefore, the installation is recommended in a protected location.
	ELECTRICAL INTERFERENCE PULSES The location should be selected at a sufficient distance to devices that can send out interference pulses.

Table 8: Requirements for the installation location

5.3 Precautions on Wiring

For a reliable power distribution, control and monitoring via a **PowerPlex**[®] system is the choice of the correct cable types and lengths extremely important. To avoid voltage drops it should be ensured that the cable quality is good and the cable cross section is correct. Please read chapter 7 regarding the integration of the unit into the CAN bus network.

Wiring should be done carefully to achieve the maximum performance of the **PowerPlex**[®] installation. Table 9 lists the general notices which should be considered for the wiring of a **PowerPlex**[®] system.

ITEM	NOTE
1	Cables should not be excessively bent. Provide a enough diameter of the curve.
2	Cables must be protected from damage and heat. Avoid the near to moving or hot parts and to machines.
3	Cables should be secured by clamps. Excess cable lengths should be handled professionally.
4	Waterproof cable bushings are meaningful, depending on the location.
5	Ensure a suitable strain relief by using the cover from the PowerPlex [®] Compact Module
6	Checking the cables for damage to the isolation, especially after laying the cables.

Table 9: Precautions on wiring

If during installation direct and alternating current (DC / AC) used, adequate isolation must be ensured.

5.5 Required Dimensions

PowerPlex® modules are intended for wall-mounting. The **PowerPlex**® Compact Module is mounted from the front onto the prepared mounting plate. For mounting we recommend M4 cylinder head bolt. The required dimensions are shown in Figure 7.

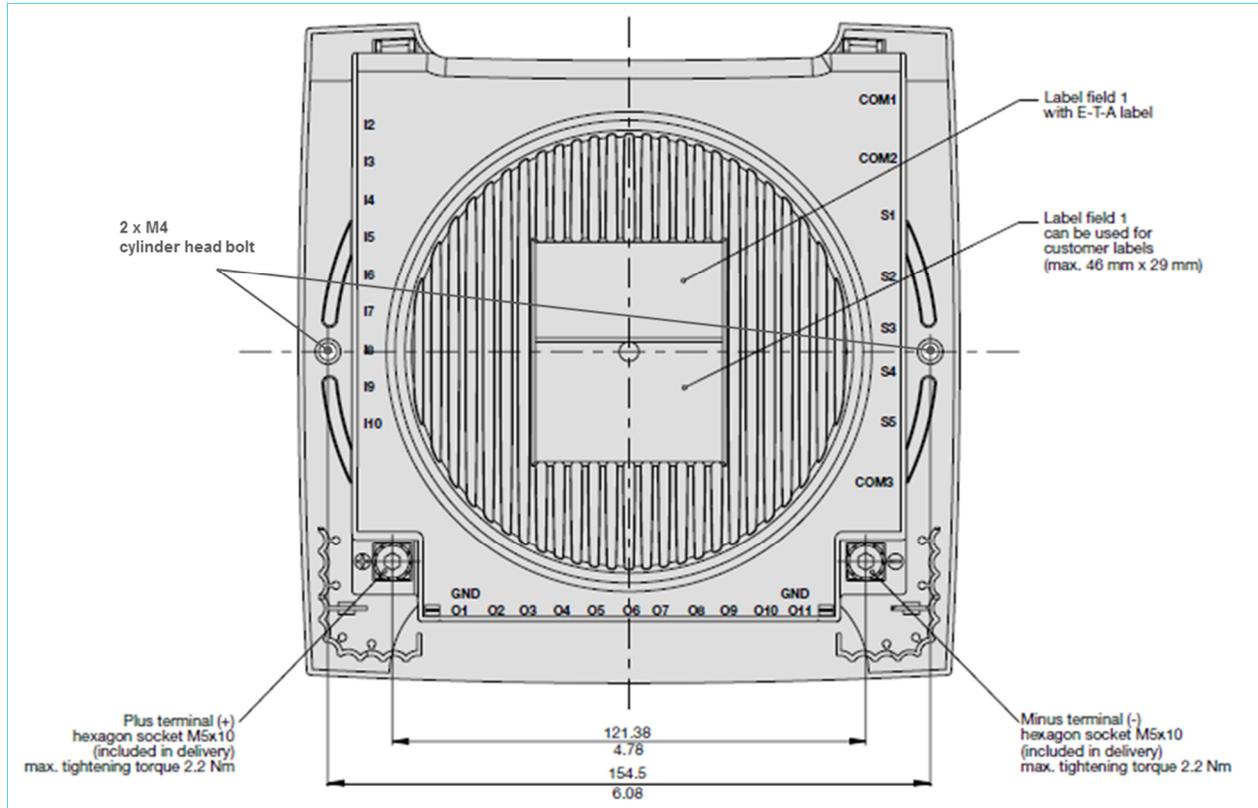


Figure 7: Overview for mounting

The cables are connected from the side and / or from below. This should be considered during the planning and ensures easy installation without a possible bending of the cable.

According to the EMC conditions should always sufficient space between the various electrical devices. The necessary space requirement of the **PowerPlex**® Compact Module is shown in Figure 8.

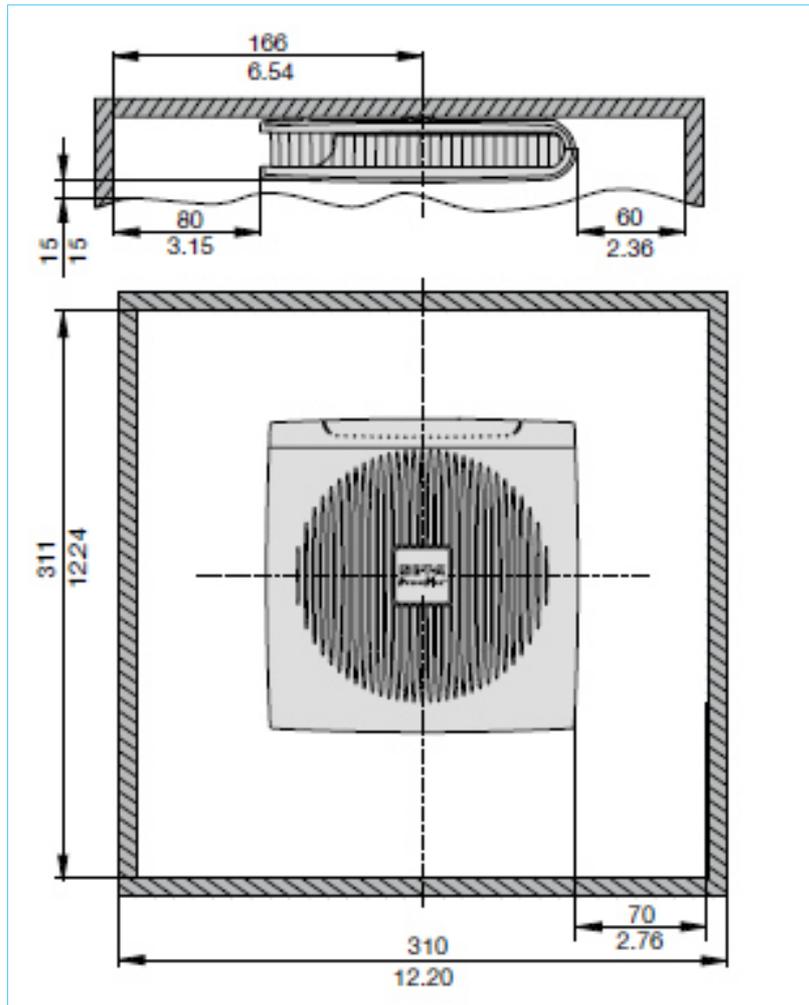


Figure 8: Installation drawings

5.6 Mounting of the Module

The **PowerPlex**[®] Compact Modules requires no separate cutout at the installation location. Before you start the installation, make sure that

- The location was selected in consideration of product-specific requirements
- cable connections were properly identified and wiring is well planned

STEP	ACTION
1	Mark the drillings at the chosen installation location according to the dimension drawing
2	Drilling the mounting holes.
3	Make sure that the module fits into the prepared hole.
4	Depending on the accessibility of the cable connections, we recommend that all cables (power, CAN, etc.) be connected even before the mounting the unit. Important: The cable connection should only be made when the main switch is OFF. Check the power cable for correctness of the poles (→ chapter 4.3, Table 6). Ensure that in operation the max. allowable voltage is not exceeded. Think of the terminating resistors, if the device is the first or last node on the CAN bus.
5	Attach the modules without front cover into the two holes provided with cylinder head screws M4 by tightening the screws.

Table 10: Mounting of the module

	<p>NOTE: Protection class IP22 requires that the Compact Module is mounted vertically and that the PCB is coated.</p>
---	--

6 Connecting to the Power Supply

After you have linked all **PowerPlex**[®] components of your system via a CAN bus cable with one another, you have to provide the power supply of the installation. **PowerPlex**[®] is suitable for either DC 12 V or DC 24 V.

	<p>CAUTION:</p> <ul style="list-style-type: none"> • Ensure that all electrical installations are performed in accordance with EN ISO 10133. • Make sure that during the entire work on the system, the power supply has been disconnected and secured against unintentional restart. • Avoid large differences between the lengths of the (+) and (-) cables.
---	---

CONNECTION OF THE MODULE

The connection of the **PowerPlex**[®] Compact module to the power supply (DC 12 V / DC 24 V) occurs by means of hexagon sockets M5x10 at the positive and negative terminals of the module (→ Table 5 and Figure 7).

	<p>CAUTION:</p> <p>The module must be connected to a suitable overcurrent protector directly to the power supply. To ensure the faultless commissioning of the entire system, it should not be networked via another PowerPlex[®] component in the system.</p>
---	--

CABLE CROSS SECTIONS

Suitable elements for overcurrent protection should be used to protect the **PowerPlex**[®] components.

Therefore, the amperage of the circuit breaker should have the maximum of the expected total current from all outputs of the used **PowerPlex**[®] component.

The required cable cross section of the voltage supply line depends on the maximum rated current that will be transmitted in the **PowerPlex**[®] system.

MAX. TOTAL CURRENT	CABLE CROSS SECTION
54 A	16 mm ²
72 A	25 mm ²
87 A	35 mm ²
105 A	50 mm ²
135 A	70 mm ²
165 A	95 mm ²
190 A	120 mm ²
220 A	190 mm ²

Table 11: Cable cross sections for different current ratings

7 Integration des Gerätes in das CAN-Bus-Netzwerk

To build up the CAN bus network all **PowerPlex®** components needs to be connected to each other (→ Figure 9 Fehler! Verweisquelle konnte nicht gefunden werden.).

A CAN bus must be terminated with a 120 Ω resistor at the beginning and at the end of the bus. Terminating resistors are not included in a Compact Module. If the module is operating as first or last node at the CAN bus, a 120 Ω terminating resistor is to be considered (→ chapter 9, CAN/USB Converter and Driver Software).

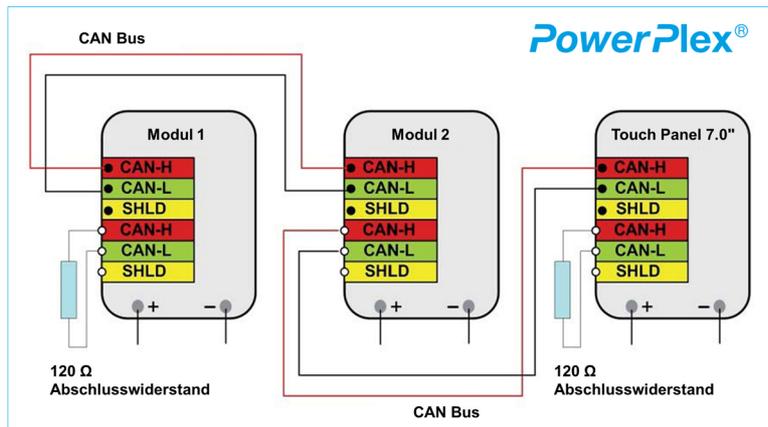


Figure 9: PowerPlex® components in a CAN bus system

A typical CAN bus cable is a twisted-pair cable comprising two wires CAN-H and CAN-L and the shield wire SHLD. Table 12 lists the principal characteristics of the type of CAN bus cable to be used. The following specifications are those of a typical CAN bus cable, type CAN.BUS 1X2X0.50 HOC, as supplied by HELUKABEL (www.helukabel.de).

MECHANICAL PROPERTIES*	
Inner conductor diameter	0.97 mm
Conductor nominal cross-sectional area	0.5 mm ²
Conductor material	copper, bare
Conductor class	Class 2: stranded
Number of cores	2
Total shielding	CU braid, tinned
Core colors	CAN-H: White (wh) CAN-L: Brown (bn)
Cable external diameter	7.0 mm
Outer sheath color	violet
Mass	69 kg/km
Minimum bending radius	laying: 90 mm static: 48 mm
Operation temperature	-40 °C... +70 °C (-40 °F... +158 °F)
ELECTRICAL PROPERTIES*	
Characteristic impedance	120 Ω
Conductor resistance	37 Ω/km max.
Insulation resistance	1 GΩ/km
Test voltage	1.5 kV
OTHER GENERAL PROPERTIES*	
Resistance to ambient influences	UV, weather, oil, coolant and microbe resistant
Mechanical resistance	Abrasion and notch resistant, low adhesion
Chemical resistance	Acid and alkali resistant
Thermal resistance	Caloric load: 1.09 MJ/m

Table 12: Main features of the used CAN bus cable
*) Fa. Helukabel: CAN.BUS 1X2X0.50, www.helukabel.de

	<p>CAUTION:</p> <p>Make sure that the beginning and end of the CAN bus network was completed with a 120 Ω resistor. Both the first and the last PowerPlex® component must have been equipped with a 120-Ω termination resistor. This is for the proper and reliable operation of the installation PowerPlex® crucial.</p>
	<p>NOTE:</p> <p>The terminating resistors are normally not included in delivery. They can be ordered separately as an accessory.</p>

8 PowerPlex® Configuration Software

The **PowerPlex®** Configuration Software is part of **PowerPlex®**. You will find it specified in the data sheets of the **PowerPlex®** hardware modules under the heading "Accessories".

When ordering your **PowerPlex®** components, please make sure to state explicitly whether or not you also need the **PowerPlex®** Configuration Software. You may already have the software from a previous **PowerPlex®** project. You also can download the Configuration Software from our E-T-A website.

	<p>NOTE:</p> <p>The PowerPlex® Configuration Software will not automatically delivered with the ordered PowerPlex® components. You may already have received this software with a previous order or you downloaded it from our E-T-A Website.</p> <p>If you need the software, please make sure to explicitly specify it on your order or download it from our Website.</p>
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8.1 Computer Requirements

The **PowerPlex®** analysis and configuration software runs on any computer or laptop that uses the Windows® operating system. Please check your computer to make sure that it meets the following basic requirements.

TECHNICAL DATA	
Operating system	Windows®, Windows® XP
Processor	Pentium III, or higher
RAM	Minimum: 256 MBytes Recommended: 512 MBytes
Hard disk memory	Minimum: 500 MBytes
Screen resolution	Minimum: 500 MBytes
Input devices	Mouse, or other screen pointing device
Interfaces	USB 2.0

Table 13: Computer requirements for the PowerPlex® Configuration Software

Prior to installing the **PowerPlex®** configuration software check your computer to ensure that it is prepared for the new software.

STEP	ACTION
1	Verify that the computer's hard disk has sufficient free memory space.
2	Uninstall a prior version before installing the new version of the PowerPlex® Configuration Software on your windows-based computer (→ chapter 8.2, Installing the Software)

Table 14: Computer Check

**NOTE:**

You have to have administrator access rights to be able to install the **PowerPlex®** Configuration Software.

8.2 Installing the Software

The **PowerPlex®** Configuration Software can be downloaded directly online via the E-T-A website. For this purpose, the username and password are required to be made on request. Upon request we provide the configuration software also provides a USB stick.

The **PowerPlex®** Configuration Software no longer requires you to run through an installation procedure. The **PowerPlex®** Configuration Software can also be started from a USB stick.

If an even earlier version of the **PowerPlex®** Configuration Software is installed on your computer, make sure to uninstall it before you use the newer version.

STEP	Action	
1	Download the PowerPlex® Configuration Software from the provided Internet address to a new folder on your computer's hard disk.	 PowerPlex X.Y.AB
2	In the folder, double click the software archive and extract all files to the same or a different folder.	
3	To start the PowerPlex® Configuration Software, look in the folder with the extracted program files and double click the POWERPLEX.EXE.	 PowerPlex

Table 15: Installing the PowerPlex® Configuration Software

8.3 Short Introduction: First Steps

The following chapter explains the principal interactive elements of the **PowerPlex®** analysis and configuration software.

**NOTE:**

Please see the Manual **PowerPlex® Manuel Volume3** "System Setup and Configuration" to get detailed information about "How to configure a **PowerPlex®** System".

8.3.1 The Opening Window

The opening windows opens immediately upon program start. It offers all the functions that you need to configure a **PowerPlex®** system. These are, amongst others:

- Insert, define and modify **PowerPlex®** modules,
- Specify and manage module inputs and outputs,
- Assign links between inputs and outputs
- Print out system information,
- Upload the configuration into the **PowerPlex®** modules using the CAN bus interface.

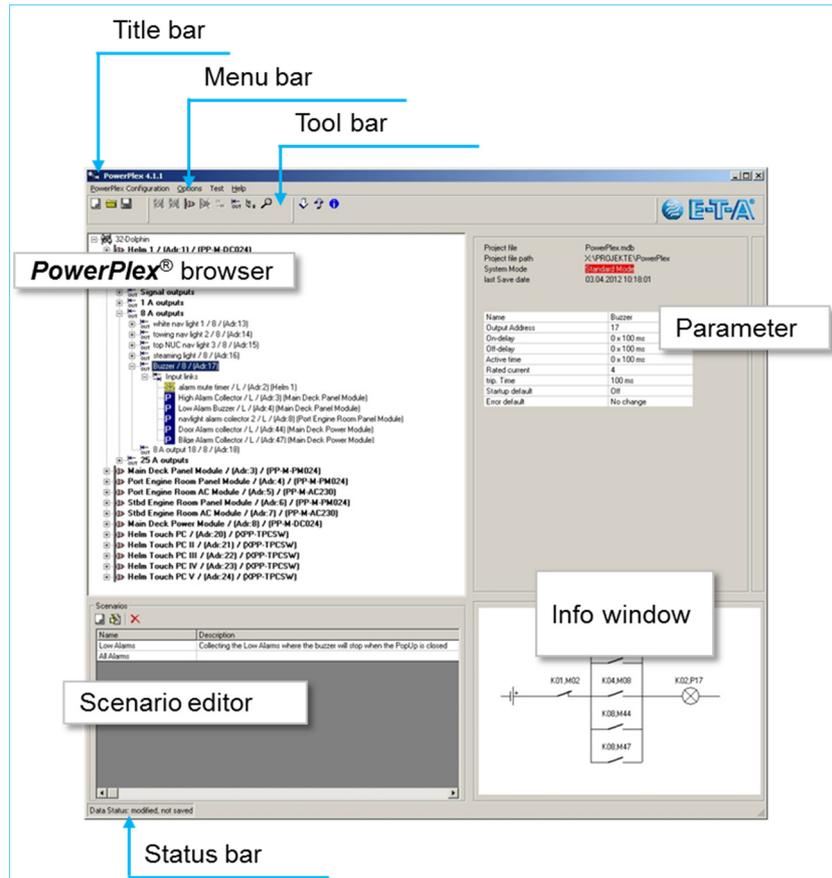


Figure 10: PowerPlex® user interface: The opening window

WINDOWS SECTION	DESCRIPTION
Title bar	Displays program name and version number
Menu bar	Offers interactive PowerPlex® menus for creating, modifying and testing PowerPlex® configurations.
Toolbar	Offers interactive icons for quick access to program functions, such as Create, Save, Edit, Delete...
Browser	Displays the components of the PowerPlex® configuration in tree form. It navigates you through the configuration, i.e. to modules, inputs, outputs, input-output assignments for editing.
Diagnostics window	Displays diagnostics information during testing and debugging
Parameters	Displays important parameters of the selection
Status bar	Shows the status of the PowerPlex® configuration: <ul style="list-style-type: none"> loaded or not loaded new, but not yet saved modified, but not yet saved ...
Scenario editor	Assists you in the creation, modification and deletion of switching scenarios.
Info window	Displays information on program execution and the progress of data transmission. It also informs about errors that may have occurred.

Table 16: Contents of the PowerPlex® opening window

8.3.2 The Menu Bar

The **PowerPlex®** menu bar gives you access to all menus for editing configurations and setting program parameters.



Figure 11: Menu bar

THE **PowerPlex**® CONFIGURATION MENU

The **PowerPlex**® Configuration menu provides you with all the commands you require to handle the configuration:

PowerPlex Configuration	Options		
New	Strg+N	NEW	Creates a new PowerPlex ® configuration.
Load	Strg+O	LOAD	Loads an existing configuration for further modification.
Import	Strg+I	IMPORT	Imports a configuration previously exported and saved in .mux file format.
Save	Strg+S	SAVE	Saves the edited configuration under the specified name. Note that a newly created configuration can only be saved after its first module has been inserted.
Save As...		SAVE AS...	Saves the edited configuration under a new name.
Export	Strg+E	EXPORT	Exports the configuration to a file in .mux format.
Transmit	Umschalt+Strg+F8	TRANSMIT	Transmits the edited configuration to the PowerPlex ® hardware modules.
Print...	Strg+P	PRINT	Takes you to a selection dialog in which you select the documents you wish to print out.
Exit		EXIT	Closes the PowerPlex ® program after having reminded you to save your modifications

Table 17: Configuration Menu

THE OPTIONS MENU

The Options menu in the menu bar offers all the commands necessary to change system and program settings.

Options		
Options Test Help	LANGUAGE	Select the language of the Graphical User Interface (GUI) of the configuration software. The language changes during online mode.
Language	DISPLAY EDITOR	Opens the Display editor which assists you in designing the texts and screens to be displayed on the connected touch screen.
Display editor [Default.dt]	CHANGE MODULE ADDRESSES	Gives you access to the hardware modules in order to change their addresses. *)
Display editor []	UPDATE FIRMWARE	Updates the firmware of the PowerPlex ® modules. *)
Change module addresses	DELETE MODULE CONFIGURATION	Deletes the current configuration from a specific module or from all modules of the PowerPlex system. In a new dialog box, you will be asked to enter the bus address of the module(s) concerned. *)
Update firmware	CHANGE PROJECT FILE	Calls a new project file (.mdb-file) into which the configuration can be saved.
Delete module configuration	CREATE NEW PROJECT	Creates a new project (.mdb-file) and asks you for confirmation whether this new project file shall be the container for the new configuration(s) you are going to program.
Change project file	CAN INTERFACE	Selects the CAN interface driver used for the Configuration PC ↔ PowerPlex ® connection: virtuell, Sontheim CANusb light, PEAK PCI, PEAK USB, HSP-USBCAN,
Create new project		
CAN interface		

Table 18: Options menu

*) This action requires a connection between the Configuration PC and the CAN bus interface of the **PowerPlex**® hardware.

THE TOOLBAR

The most important commands offered by the menus in the menu bar can alternatively be activated by symbols displayed in the toolbar. Thus, the toolbar buttons act as shortcuts to the actions most frequently used.

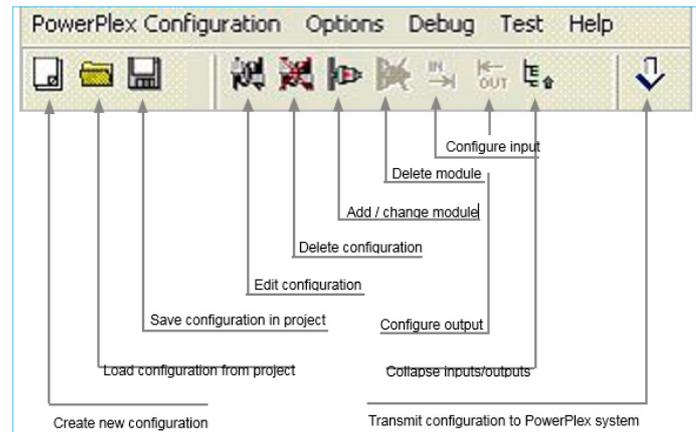


Figure 12: Toolbar

9 CAN/USB Converter and Driver Software

To upload a completed or modified **PowerPlex**® Configuration into a **PowerPlex**® Compact Module and other **PowerPlex**® hardware, you will have to connect your configuration PC to the CAN bus network of the **PowerPlex**® system.

To do so, you need the

- CAN/USB converter cable, connecting the USB port of your computer to the 9-pin D-SUB socket of the hardware. The following adapters are supported by the **PowerPlex**® Software: CAN/USB-light adapter supplied by Sontheim, PEAK USB, PEAK PC
- associated CAN/USB driver software, installed on your computer



Figure 13: CAN/USB converter cable (example: Peak)



NOTE:

The driver software of the selected CAN/USB converter must be installed on the configuration computer.

10 Important Safety Information

In the table below you find several information and safety information for the commissioning and use of the **PowerPlex®** Compact Module.

	<p>WARNING: INSTALLATION AND USE OF THE MODULE</p> <p>This equipment must be installed and operated in accordance with the instructions provided. Disregard may result in personal injury, damage to the boat or vehicle, and reduced product performance.</p>
	<p>WARNING: SWITCHING OFF THE MAIN SWITCH</p> <p>Before starting the installation, the main switch of the boat or vehicle may need to be turned off. The cable connection should be established only when the main switch is OFF.</p>
	<p>WARNING: IGNITION HAZARD</p> <p>The operation of the module is NOT recommended in inflammatory environments.</p>
	<p>WARNING: HIGH VOLTAGE</p> <p>The housing of the module should NEVER be opened. Also, access to the internal components is not allowed, unless it is pointed out in this manual.</p>
	<p>CAUTION: GROUNDING</p> <p>The unit must be grounded before switching on.</p>
	<p>CAUTION: WATER INGRESS</p> <p>Disclaimer: Water Entry</p> <p>The water resistance of this module depends of the correct mounting. E-T-A makes no warranty for damages caused by water ingress.</p>

Table 19: Important information

EMC INSTALLATION GUIDELINES

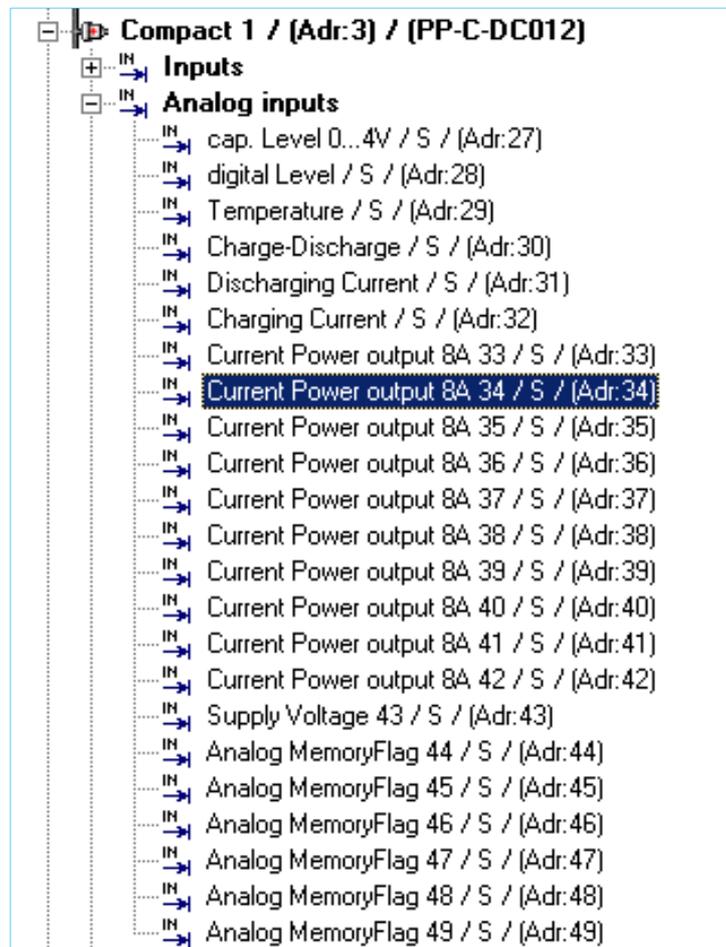
The **PowerPlex®** hardware and accessories conform to EMC Directives. As a result, electromagnetic interference between devices can be avoided which would otherwise degrade system performance. A professional installation is therefore imperative. To ensure the best EMC conditions, the maximum distance between the various electrical devices should always be respected.

TECHNICAL ACCURACY

All technical data in this manual was correct at the time of going to press, to the best of knowledge and belief. For any (unintentional) error E-T-A cannot be held liable. Due to continuous product improvements by E-T-A may temporarily occur differences between the product and handbook. Changes to the product or in the technical specifications shall be made without prior notice. On our website E-T-A (www.e-t-a.de), you can ensure that they have the latest versions of the manuals **PowerPlex®**.

Appendix

Appendix 1: Function of the analog inputs of a PowerPlex® Compact Module





Anwenderhandbuch / User Manual **PowerPlex**[®]
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