

## Cover Story

A type with many good qualities  
Circuit breaker 1620/1626 type 2

## PowerPlex® goes AC

Distributed bus system  
now available for 230 VAC

## Safety afloat

PowerPlex® in RNLI life-boats



### From electric mobility to E-T-A mobility

E-T-A Director  
Carl Horst Poensgen on  
automobile locomotion,  
an industry of the future



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**PowerPlex®** goes AC  
Distributed bus system  
now available for 230 V AC



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A type with many good qualities  
Circuit breaker 1620/1626 type 2



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FAQ – Frequently Asked Questions  
All you ever wanted to know about  
E-T-A products.



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Safety afloat  
**PowerPlex®** in RNLI life-boats

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Circuit breaker 1620/1626 type 2.  
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## Impressum

**Current,** Customer Magazine of  
E-T-A Elektrotechnische Apparate GmbH

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There is hardly any other topic in environmental discussions which is so amply discussed presently as electric mobility. Meanwhile this has even become a topical subject in politics where electric mobility has been identified as a market of the future and where this type of energy is considered as most important for automobile locomotion.



What kind of professional electrical protection solutions will be required by electric cars to ensure reliable function and to provide suitability for everyday use? We have been working on these questions for quite some time and we have assigned adequate resources in Research and Design. This will help to turn electric mobility into E-T-A mobility from the start.

However, if we start looking at all those discussions, considerations and concepts a bit more closely, we will very quickly discover the uncertainty which is still connected with this topic. In fact nobody seems to have reliable knowledge today about eventual future technical developments and which types of electric mobility will finally make the running. Innovation, courage and foresighted thinking are more in demand than ever.

As a globally acting medium-size company, we have been dealing with the subject of electric mobility for quite a while and we have clearly identified the requirements which are relevant for our industrial sector.

One thing is for sure: no matter which concept will make the running in the end – at any rate there will have to be a suitable protection for these currents. Switching high d.c. currents will be of the greatest importance, hence our design work is focussing on this aspect, whether it concerns the vehicles themselves or a reliable network of charging stations.

If you want to learn more about our concepts or if you require more detailed information and advice regarding a project or quotation, please do not hesitate to get in touch.



Carl Horst Poensgen

Executive Committee  
E-T-A Elektrotechnische Apparate GmbH

## Electric Mobility turns into E-T-A Mobility



**At a glance – PowerPlex® AC Module**

- 16 channels single pole with CAN bus control
- max. 30 A per channel
- 75 A total current
- single or double pole
- 120 V AC or 230 V AC

The CAN-controlled Power Distribution System  
PowerPlex is now also available for 230V AC.

# PowerPlex® goes AC

Up to now, **PowerPlex**® had been restricted to 12 and 24V DC electrical systems. However, some of the electrical loads on board are supplied with AC voltage, and as a consequence **PowerPlex**® was extended to cover this range as well.

**PowerPlex**® is a power distribution system that allows monitoring and controlling electrical loads on boats via CAN. The CAN bus enables controlling the electrical system of a boat with one or even more computers.

Thanks to the new AC module it is now also possible to switch and protect AC loads such as the air conditioning system, the dishwasher or the oven and protect them at the same time. The AC module is linked to the rest of the system via CAN. Inputs or sensors of the DC system can now also switch and monitor AC loads.

Of course the special conditions and requirements of a boat were considered during the development and design of the **PowerPlex**® AC module. The AC voltage can be supplied via shore power, generator or inverters. Especially larger yachts or recreational craft do not always travel in the same region of the world. Therefore it must also be possible to connect a 2 phase grid with 120V.

The **PowerPlex**® AC module provides 16 single pole switched and protected channels, which can be combined to be 8 double pole channels if required. The circuit breakers used for protection are plug-in types. They allow optimum configuration of the current ratings and



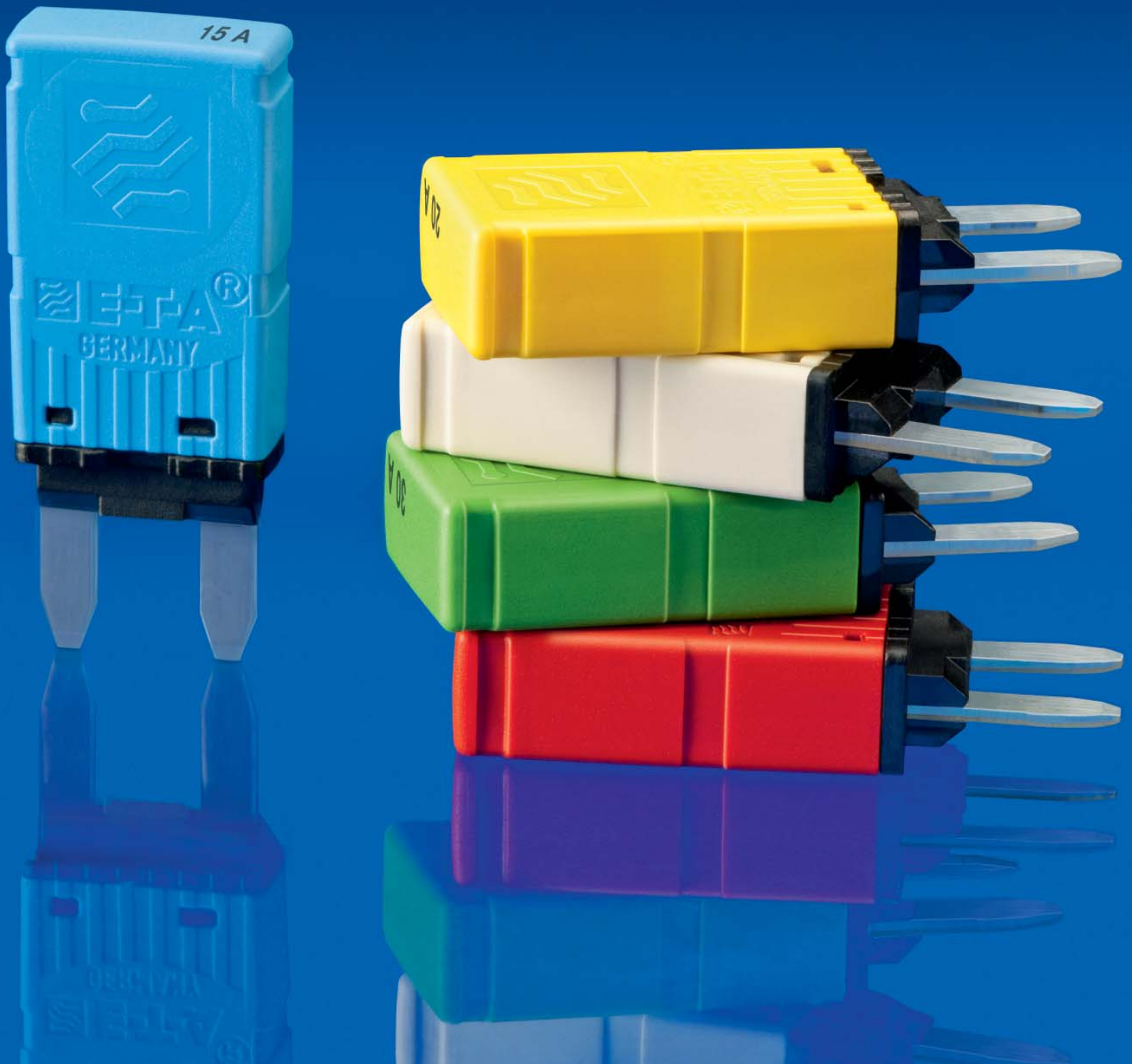
The new PowerPlex AC module allows switching and protection of numerous AC loads at the same time

the use of double pole breakers. The maximum total current is 75 A, with the maximum current per channel being 30 A. In order to be widely independent of the available voltage without draining the batteries of the DC system, the AC module is fitted with its own AC power supply.

Through launching the **PowerPlex**® AC module it has now become possible to control definitely all electrical loads on board of a boat via **PowerPlex**® – without exceptions.

**At a glance – features and benefits of type 1620-2:**

- no replacement fuses required, can be used instead of fuses
- clear colour coding of current rating
- miniaturised design – fits into MINI fuse blocks
- enhanced reliability for a professional environment



*The new circuit breaker raises the bar as it is the only circuit breaker in the market which really and reliably works as a type 2 version.*

Circuit breaker **1620/1626 type 2** for passenger cars and commercial vehicles

# A type with many good qualities

In 2010 E-T-A already launched series 1620 (holding 100 percent rated current continuously in accordance with SAE J533) and series 1626 (faster trip curve, holding 70 percent rated current). They represent an innovative new circuit breaker type suitable for use in passenger cars and commercial vehicles. At that time the product range was limited to two versions:

- **type 1** (12 VDC – automatic reset) and
- **type 3** (manual reset – 12 and 24 VDC).

In March 2011 this programme has been extended by the so-called **type 2** (12 VDC).

A circuit breaker SAE type 2 offers the feature of “modified reset”. This means the contacts of circuit breaker type 1620-2 will remain open after tripping in the event of overload or short circuit as long as power is applied to the terminals. Only upon switching off the ignition or the load in question will the breaker be reset automatically. Technical realisation of the modified reset feature is by means of a heating element through which a minimum limited residual current will flow. It is a highly interesting fact that type 1620-2 requires only one third of the holding current required by other models available in the market.

Ever since our product launch we have experienced brisk interest from OEMs or tier 1 suppliers in the automotive industry and a substantial demand for such a protection concept. Type 1620-2 is available in seven ratings from 5 to 30 A. The current rating is marked on the device

and the moulded housing is coloured correspondingly as specified in DIN/ISO standards. This allows quick and easy replacement of fuses or circuit breakers made by other manufacturers.

Typical loads to be protected by type 1620-2 include

- seat adjustment motors
- windshield wipers
- power outlets in the vehicle (more and more important in view of the growing number of possible applications)
- electric sunroofs
- power outlets for trailers
- all loads which often cause fuses to blow

**Summary:** for all these applications the circuit breaker significantly increases reliability and safety of a passenger car or truck.

**What's so special about circuit breaker 1620 type 2?**

- production on a fully automatic assembly line with multiple test steps, leading to 100 % quality – each E-T-A circuit breaker will only leave the factory after having been tested!
- an innovative heating element which reduces housing and terminal temperature after tripping (unlike competitive devices)
- suitability for high ambient temperatures up to 105 °C

- moulded housing with clear colour coding related to current ratings
- low holding current – increasing life span of the battery and reducing CO<sub>2</sub> emission
- space-saving design – suitable for fuse blocks and central electric boxes for MINI fuses.

**E-T-A is setting the pace for circuit protection!**



*High-quality reliability for cars: E-T-A circuit breaker 1620/1626 type 2*

# Colour Display with Touch Function and integral CAN-interface.



Graham Lewis,  
Business Development  
Manager at E-T-A UK

*E-T-A UK is active in many business fields. One important market for E-T-A UK is the marine industry. Graham Lewis is the Business Development Manager for this market segment. He is supporting boat builders with*

*information about E-T-A's PowerPlex System and concepts for modern computerized electrical systems. Graham is involved in the development of new components for the PowerPlex® System and is one of the main pacemakers for innovation in our product range.*



*In addition to touch function and CAN interface, the PowerPlex system offers tailor-made layouts for boatbuilders.*

**Current:** What are the main criteria for the selection and development of new user interfaces?

**Graham Lewis:** The most important reason for new user interfaces are definitely the requirements and wishes of our lead customers in the different market segments. We have to distinguish between two main branches in the marine industry – workboats and leisure yachts.

**Current:** Where do you see differences or synergies between the two market segments?

**Graham Lewis:** Both sectors are definitely asking for high quality products, especially designed for their application with a maximum of flexibility. Another important factor is the service for our products that should be available in every part of the world. The differences are mainly on the design side. On a workboat clear information needs to be provided and the handling has to be easy – a nice design is

good but not the main focus. Whereas on a leisure boat the main focus is comfort and high quality design combined with a modern style.

**Current:** How can you manage to provide both, modern style and a clear structured design to satisfy both markets?

**Graham Lewis:** This is definitely not easy, but the flexibility of our CAN system PowerPlex® allows us to use standard products for the system's backend and customized user interfaces for the front-end. The PowerPlex® modules are identical for both markets, but the layout of the user interface is different regarding functionality and design.

**Current:** What is the main benefit of using a touch screen like the new 4.3" colour display?

**Graham Lewis:** It provides a maximum of flexibility in the design of the GUI and regarding the functions provided.

We are able to supply tailor made designs for different OEMs and even for different types of boats. The main benefit compared to a key pad is the possibility to display text messages provided via pop ups for alarm or status messages. It is a big improvement in usability when you get instructions instead of a blinking red light.

**Current:** Thank you for your time.

### Royce Rote



Business Development Manager – Transportation

Royce Rote joined E-T-A US in September 2006 and brought with him years

of experience specifically in the area of aerospace, defense and transportation. In

his role at E-T-A, Royce is responsible for all areas within the transportation market including: passenger cars, commercial and agricultural equipment, rail vehicles, buses, military vehicles, commercial and defense based aircraft and custom system solution designs.

Royce works directly with Marko Wilsdorf and the US based regional sales managers to expand E-T-A's reach into the market.

Royce also manages the introduction of new products into the market – most recently the launch of the 1620/1626 and the PR60 & PR80. Royce's knowledge of the market, creativity in presenting products and strong connection to the sales team has brought the transportation division in the US to where it is today.

### Brett Macdonald



Business Development Manager – **PowerPlex**<sup>®</sup>

Brett Macdonald joined the E-T-A US Sales & Business development team in July 2010. Before

joining E-T-A, Brett spent six years

managing the Wes-Garde Components multiplexing efforts, including the E-Plex line.

This experience gave Brett a wealth of knowledge in multiplexing technology and what is currently available and being used in the market. Brett works closely with Fred Zöls and the US regional sales managers in areas where boat building and caravan manufacturing exists to

expand the **PowerPlex**<sup>®</sup> product line into new accounts.

Brett's technical understanding of the product allows him to communicate in the market as an expert. This, along with the quality of the product, is allowing the **PowerPlex** to make inroads into more leisure yachts, workboats and recreational vehicles than ever before.

### Graham Lewis



Sales Engineer for Marine and Telecommunications

We were very pleased to welcome Graham at E-T-A UK earlier this year.

Graham has joined us with a wealth of experience in the electrical and electronic fields.

His work involvement has also extended to specialised network applications in the marine market, including J1939 and NMEA 2000 systems.

Among Graham's diverse roles he will be promoting the benefits of our **PowerPlex**<sup>®</sup> system to marine customers.

We have developed **PowerPlex**<sup>®</sup> to meet the special electrical circuit requirements of

watercraft. It significantly reduces the need for conventional wiring, combining reliability and user convenience with easy-to-install modules. Graham will use his experience to work alongside potential customers for this product.

Graham is qualified for electrical installations to the 17th Edition of the IEE Wiring Regulations (BS7671) and has received training at the Loyds Maritime Academy.



Our FAQ pages are meant to intensify the dialogue between manufacturer and customers. They will deal with topics arising from practice and answer relevant questions as shortly as possible and as detailed as necessary.

Do you have any questions you need answer to?

Send it to us – we are looking forward to hearing from you.

**E-T-A Elektrotechnische Apparate GmbH**

**Keyword: [Current FAQ](#)**

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## Higher d.c. voltages

*Switching high power at direct voltage – what are the challenges? What are the chances?*

Presently high d.c. voltages are being discussed in various places of technology and engineering. This does not only concern photovoltaic systems and electric cars, but also d.c. power grids for power distribution in industrial buildings. A working group in the IEC TC23 is dealing with this topic and a EU research project ENIAC shall be started. E-T-A is part of both projects.

### **What will change on the closed contact at higher d.c. voltages?**

The resistance of a closed contact basically depends only on the contact force, the specific resistance and the hardness of the contact material. The power processed by the contact will then exclusively be determined by the current going over it. Hence it will be of no importance what voltage will be supplied by the supplying energy source.

### **What is physically happening when high d.c. voltages are disconnected?**

If the contact opens, the conditions will change abruptly. There will be a switch arc which is indeed related to the driving voltage. This so-called plasma, a very hot gas consisting of ionised air, metal ions and electrons, will develop a certain momentum and has itself to be considered a voltage source in the circuit. The arc will only go out if the voltage it

is producing is higher than the source voltage in the circuit. So the higher the source voltage, the harder can the arc be quenched.

### **Is it reasonable to disconnect as quickly as possible?**

If we disconnected an inductive circuit within an infinitely short period of time, the energy stored in the circuit would be unloaded through explosions. A switch arc kills off this energy, but the plasma life span has to be limited to a few milliseconds to keep thermal effects at bay. This will be done by additional energy removal by means of quenching sheets, outgassing chamber walls or arc extension through magnetic fields.

### **Wouldn't it be easier to disconnect electronically?**

The advantage of electronic power semi-conductors in a switching process compared to mechanical contacts is their controllability. In addition there will be no arc. The resistance of the open contact clearance can be changed in a defined time from low-resistance to high-resistance. However, semi-conductors withstanding higher voltages in the OFF condition are still very expensive so that economic considerations often override technical possibilities.

### **What are the d.c. voltages in question?**

For photovoltaic applications, voltages up to 800 VDC have become usual today, values up to even 1,500 VDC are being discussed. For electric mobility we are talking about values of 350 to 600 VDC, for commercial vehicles even 900 VDC are being discussed. Fuel cells might become the batteries of the future

and are suitable for all aforementioned voltages. Buildings will be equipped with regenerative systems supplying direct voltage. Therefore some experts also speculate about 380 VDC as a mains supply voltage in buildings.

### **What is the wattage range in question?**

In photovoltaic systems the wattage range is from only a few kW up to several MW in solar power plants. Usual wattage for electric cars today is 40 to 60 kW. For building wiring installation it will most likely be a few kW.

### **What technologies are already available to switch off high d.c. voltages?**

Technologically we can use either purely mechanical solutions as well as electronic solutions. In addition hybrid devices seem to be very promising as they combine the advantages of both approaches.

### **What are the chances for E-T-A?**

Besides opportunities in photovoltaic systems there will be new business opportunities also in the automotive industry for electric cars and on the score of HVDC networks for building installation, for data centres and telecommunications equipment.

# Reduce CO<sub>2</sub> emission – use Smart Power Relay E-1048



Marko Wilsdorf, Business Field Manager and Head of the Transportation Division of E-T-A

Reliable switching of loads is the major task of a relay. Additional reasons for using electronic relays are their enhanced shock and vibration resistance, their insusceptibility to dust and dirt, their noiseless operation as well as their

suitability to include additional functions and benefits (e.g. overcurrent protection, delayed trip behaviour, bus connection...)



A semi-conductor relay helps to save fuel: Smart Power Relay E-1048-8D

In view of all this you may not think of fuel consumption and reduction of CO<sub>2</sub> emissions in the first place when talking about semi-conductor relays or solid state remote power controllers.

However, with Diesel prices skyrocketing, all components of a car are being put to the test whether they could in some way help to save fuel.

In this respect, semi-conductor relays such as type E-1048 can score again, because a standard electro-magnetic relay (EMR) up to a current rating of 50A requires a permanent holding current of typically 130 mA, whereas the electronic relay only requires a control current of typically 5 mA. In a 24 V electrical on-board system of a commercial vehicle this means savings of up to 3 W per relay. This may not sound much, but considering the efficiency of the diesel engine and the generator (see fig. 1) this turns into more than 30 l Diesel fuel and thus more than 80 kg CO<sub>2</sub> emissions which are saved per vehicle and year (see table 1).

Values for 10 relays in vehicle	Fuel savings (diesel) <sup>1</sup>	CO <sub>2</sub> reduction <sup>2</sup>
per hour	0,015 l	40 g
per hour (8 working hours/day)	0,122 l	321 g
per year (250 working days/year)	30,612 l	80,204 g

<sup>1</sup> heating value of diesel: 9.8 kWh/m<sup>3</sup>  
<sup>2</sup> CO<sub>2</sub> emission per litre diesel: 2,620 g

Table 1: fuel and CO<sub>2</sub> savings

Savings can also be achieved with a bistable EMR, but on the one hand a mono-stable relay cannot easily be replaced by a bistable one and on the other hand many automotive systems only accept mono-stable solutions for safety reasons.

Another possibility to save holding power is to reduce the current after a switching operation to the so-called holding current. This leads to a rarely acceptable higher susceptibility to shock and vibration.

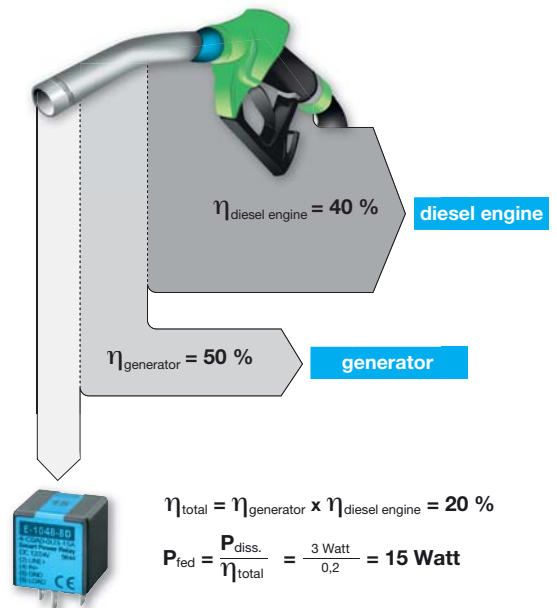


Fig. 1: multiplication of energy demand through poor efficiency

## E-T-A solutions for many products

*E-T-A offers tailor-made solutions for a wide range of industries and products. Here are some interesting examples.*

**Application:** Mobile fuel cells – power supply

**E-T-A Type:** 8345 with remote actuation X8345-R

The SFC Energy AG ([www.sfc.com](http://www.sfc.com)) is the market leader for mobile and remote power supplies based on fuel cell technology, selling more than 20,000 fuel cells per year. They design and sell power supply solutions for on-board electrical systems in special vehicles and public authority vehicles.

The system shown below consists of an EFOY Pro fuel cell, a modern lithium battery and a power inverter, each included in an easily removable module. The 125 A circuit breaker type 8345 is fitted in the battery module for controlled switching the connected loads on and off. SFC's intelligent loading status monitoring system is measuring the load of the fuel cell and the battery. In the event of an overload at the fuel cell or imminent total discharge of the lithium battery, the electrical system will reliably be disconnected from the fuel cell system by the 8345 circuit breaker.

**Application:** Laser marking equipment

**E-T-A Type:** 3140

Alltec GmbH (Foba laser marking + engraving), located in Selmsdorf near Luebeck, is a major manufacturer of precision systems for laser marking and engraving. The laser marker DP30FGS has been newly included into their product range and has been designed particularly for safety-relevant marking applications in the ID and personalisation sector. This high-tech laser marker is used for forgery-proof marking of chip cards and credit cards as

well as passports, ID cards and driving licenses. Overcurrent protection is provided by our three-pole thermal circuit breaker type 3140 which at the same time serves as ON/OFF switch of the laser marker. Its positively trip-free mechanism allows reliable switching and ensures unobstructed operation of the marking equipment.



# Applications

**Application:** Monitoring systems for photovoltaic power plants

**E-T-A Type:** ESX10-T

The company skytron@energy, located in Berlin-Adlershof, is a major manufacturer of complete monitoring systems for photovoltaic power plants in the range of 1000 mW. Their product range includes DC distribution boxes with phase current measurement by means of data loggers and servers as well as high-performance control room software for plant managers. In their data logger skylog skytron uses our electronic circuit protector ESX10-T for the selective protection of the DC 24 V load circuits



(industrial PCs, ethernet switches, master pcbs etc.). Selective protection means: the ESX10-T only disconnects the faulty path in the event of an overload or short circuit in the load circuit without any repercussions on the Dc 24 V supply. skytron@ energy opted for the version ESX10-TB-114 with status output for a fast fault detection and remote control signal ON/OFF.

**Application:** Service trains

**E-T-A Type:** PR60

P.T. INKA (Indonesian Railway Industry), the state-owned manufacturer of Indonesian rolling stock, was founded in 1981 and meanwhile has nearly 1000 people on the payroll. Production facilities are located in Madiun (Central Java), they manufacture passenger trains, freight trains, ambulance trains and also service trains. Their trains are mainly sold into the Indonesian market, but also into neighbouring Asian countries.

P.T. INKA opted to utilize our PR60 for their new series of maintenance locomotives to ensure reliable switching of high loads. They decided to use PR 60 due to its competitive price/performance ratio,



its compact size and its unrivalled technical performance. On grounds of positive experience they already plan to use the PR60 in other products such as their new commuter train series.



# Safety afloat

*Protecting, controlling and monitoring with a distributed bus system.*

## PowerPlex® in RNLI life-boats

*Start of series production of the new class of life-boats for rescue and transportation of castaways will be end of 2011. PowerPlex® will not only protect the electrical system, but also control and monitor electrical loads.*

E-T-A **PowerPlex®** is a comprehensive de-centralised power distribution system designed to protect, control and monitor electrical on-board systems in recreational craft and workboats.

**PowerPlex®** consists of modules positioned as needed around the vessel. Each power module is capable of switching up to 102A continuously and transferring to 12 outputs. In addition there are inputs for switches and sensors. The **PowerPlex®** system functions as a single programmable control system, with modules communicating with each other via a thin wired CAN bus network.

If required, the addition of a touch PC screen and E-T-A touch PC software facilitates the full function of the system from load switching and monitoring to displaying sensor and alarm information. Using the Windows based E-T-A software, the system can be configured to the boat builder / owner's requirements.

**PowerPlex®** offers a wealth of new possibilities, both for the control of on-board electrical systems and to provide added functionality to the user. It can perform additional functions which would otherwise require costly and complex electronic solutions.

The **PowerPlex®** system employs a four level protection concept to ensure utmost safety at sea. Software and hardware monitoring of the load current and internal processor provides effective over-current protection. In the event of a catastrophic failure of any output the circuit breaker can be unplugged and plugged into an



*Distributed bus system PowerPlex fitted into life-boats of the RNLI, UK.*

additional slot directly connected to the supply, thus creating a “get home” scenario.

### Rugged deployment

Eight **PowerPlex®** modules control most of the electrical power distribution on the initial prototype of the latest class of all-weather lifeboat being developed by the Royal National Lifeboat Institution (RNLI). The Fast Carriage Boat 2 (FCB2) will eventually replace the Mersey class of lifeboat. After a 3-year test phase production of the new boat class will start end of 2011. **PowerPlex®** will be connected to the CAN bus via the SIMS (System Integrated Management System) and will be controlled by the shipboard computer. As the **PowerPlex®** is a Multi-Master-System, it is fully functional even without the shipboard computer. Robust keyboards with CAN bus interface will be used for controlling functions such as windshield wipers or illumination.

On completion, the whole fleet of all-weather lifeboats will have a 25-knot capability, with the result that casualties can be reached more quickly and efficiently.



*E-T-A PowerPlex-System*

# Englishman's favourite: »Shepherd's Pie«

One of the quickest and easiest supper dishes is a recipe shepherds pie. As you can see with this easy Shepherds Pie recipe, traditionally the pie is made with ground lamb, but if using ground beef it would be called a Cottage Pie. However, the recipe is the same for both.



Quick and easy preparation: »Shepherd's Pie«, traditionally British

- Heat the oven to 375 °F/190 °C/Gas 5
- Boil the potatoes until soft then drain into a colander. Place the milk and butter in the pan used to boil the potatoes, return to the heat and warm gently until the butter has melted. Add the potatoes and mash. Season to taste and keep to one side.
- Melt the lard or dripping in a large deep pan. Add the onion and carrot and fry for 5 minutes. Add the garlic and cook for another minute.
- Add the ground lamb and one-third of the beef stock to the onion and carrot mixture and cook, stirring constantly until all the meat is browned. Add the remaining stock, parsley and mushrooms, season with salt and pepper. Cover with a lid and cook for 15 minutes.
- Mash the flour into the remaining 1 tbsp butter then add in small pieces to the ground meat sauce, stirring until all the flour has dissolved and the sauce has thickened slightly, approx 5 mins.
- Place the meat sauce into an 8" x 3"/ 20 cm x 7 cm deep ceramic or glass ovenproof dish and cover with the mashed potato. Sprinkle the grated cheese on top of the potato and bake in the heated oven for 30 - 35 mins until the surface is crisp and browned.  
**Serve immediately.**

**Prep time:** 30 minutes

**Cook Time:** 40 minutes

**Total Time:** 1 hour, 10 minutes

### Ingredients

- 2 lb / 900g potatoes, peeled and quartered
- 6 tbsp milk
- 1 stick / 110g butter, cubed + 1 tbsp for the sauce
- Salt and ground black pepper
- 1/2 tbsp lard or dripping
- 1 cup/ 115g chopped onion
- 1 cup / 115g finely diced carrot
- 1 clove garlic, minced
- 2 cups / 450g ground/ minced lamb
- 1 pint / 600 ml beef stock
- 1 cup / 115g chopped white mushrooms
- 2 tbsp finely chopped flat leaf parsley
- 1 tbsp all-purpose flour
- 1 cup/ 115g grated Cheddar Cheese

