



E-T-A[®]

current

Newsletter of E-T-A Circuit Breakers

Spring 2003



Cover Story

Good Looks and
Impressive Functionality

**Optimum Protection-
Minimum Size**

Electronic Circuit Breaker
ESS 20

Transportation Products

New power distribution unit
speeds production of giant
mining trucks

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From all of us at E-T-A North America, I would like to welcome you to the new edition of "E-T-A Current," a newsletter that we trust you will find original and creative with information of interest and value.



We are excited about this new forum that gives us the opportunity to share with you the innovative and effective solutions we can provide for your circuit protection and control applications.

A new look for 2004

The unique needs of our customers and our commitment to quality, reliability, brand reputation and lower cost of ownership are the cornerstones of E-T-A's business philosophy.

In this issue, Reindl Powerboats share their thoughts with respect to E-T-A quality and reliability when using our 483 series circuit breaker to protect both man and machine.

The Liebherr Mining story challenged E-T-A's ability to design and develop a power distribution system for this manufacturer of the world's largest double-axle mining truck. The Alcatel article features E-T-A's unique X8340-S02 which provides flexible means of managing power

distribution requirements of a user system and integration with transmission networks. When committing to E-T-A's quality, reliability and brand reputation, these world class manufacturers eliminate potential warranty costs which leads to overall lower cost of ownership.

These are just a few of the interesting articles you will find in this inaugural issue of the new "E-T-A Current." Subsequent issues will continue to bring you interesting product and application stories from around the world.

We at E-T-A are proud of our brand reputation and leadership position in the world of circuit protection and control, and commit to you that we will never be complacent and will work hard to "earn" your business.

Your opinion and ideas are important to us. Please let me know personally what you think of our newsletter or alternatively, fax back the enclosed card.

Tony Bright
President, North American Operations

Optimum protection – minimum size

Switch-mode power supplies are compact and have a very high efficiency. These benefits have helped them to gradually replace traditional transformer power supplies in a wide range of applications. However, the characteristics of switch-mode power supplies can at the same time lead to a particular problem – in the event of a fault current in only one output circuit the whole power supply will shut down. Thus an apparent integral safety feature can become a serious drawback in certain circumstances.

In a typical application with a switch-mode power supply feeding up to ten loads, all loads will be without supply voltage even if there is a fault in only one load output: a potentially disastrous situation in production plants.

Traditional protection solutions quickly reach their limits in this situation. The use of circuit breakers with fast operating characteristics would make selective output disconnection possible without adversely affecting the switch-mode power supply. However the inevitable current peaks would cause nuisance trips,

and capacitive loads such as sensors and interfaces could not be reset.

On the other hand, neither delayed operation nor high performance circuit breakers will respond in any way to overcurrents in individual output circuits, as switch-mode power supplies cannot provide the necessary trip current, even for the shortest duration. The power supply will therefore switch off completely, bringing all connected loads, i.e. the entire system, to a standstill. Fortunately there is now a solution available. E-T-A has introduced the ESS 20 Electronic Circuit Breaker to protect manufacturing systems against such stoppages by exclusively disconnecting the faulty output. All other load circuits continue working as normal.

The newly developed product is designed to limit the prospective load current to a maximum of 1.8 times the rated current and disconnects the output only in the event of an overload or short circuit. For optimum adjustment to the particular application, the



Electronic Circuit Breaker ESS 20.

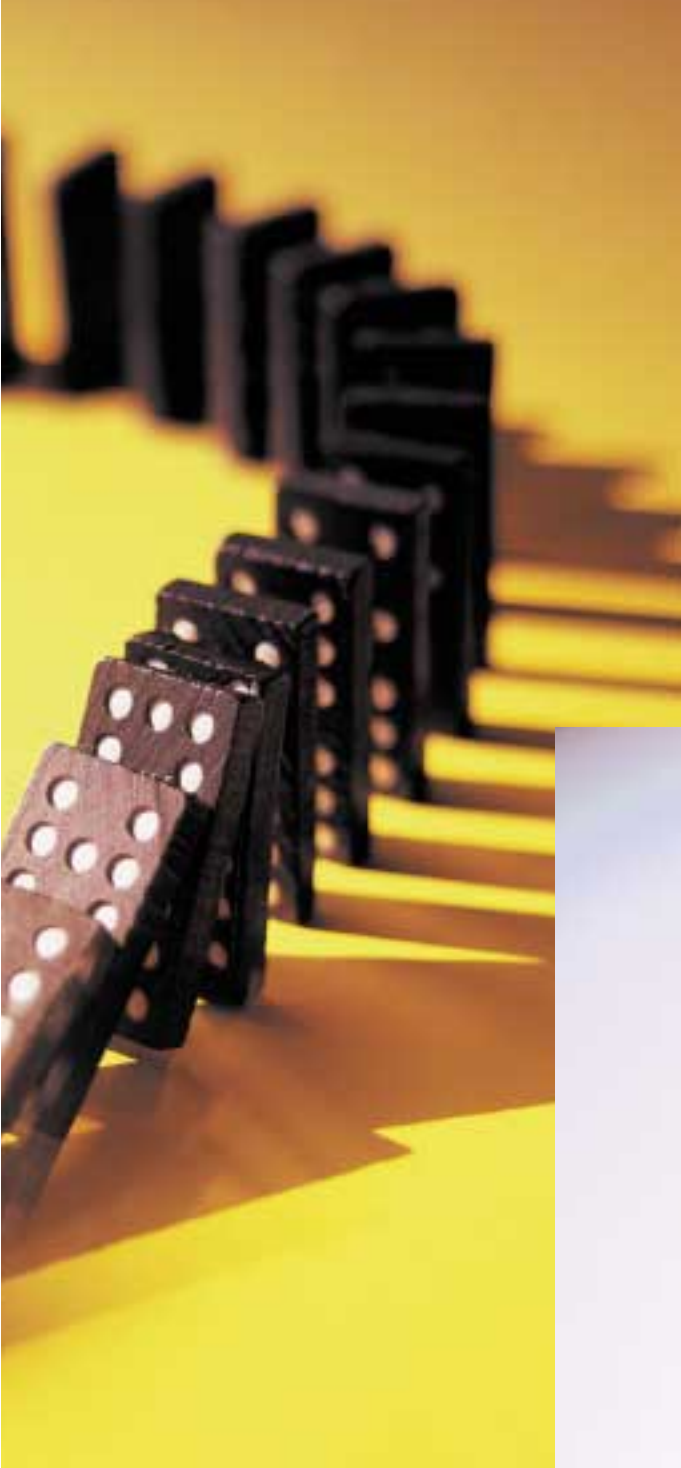
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The Electronic Circuit Breaker ESS 20 Provides Selective Disconnection of 24 V DC Loads.

”

current rating of the ESS 20 can be selected as 3A or 6A. An LED and integral auxiliary contacts provide status and failure indication.

Utilising Electronic Circuit Breakers type ESS 20, it is possible to design highly efficient, cost-effective manufacturing equipment and complex industrial lines. Under worst-case failure conditions, the fault current will always be limited to a minimum value, the rest of the system will remain in operation, and power can be quickly restored once the faulty output circuit has been corrected. This guarantees maximum efficiency and productivity of the entire process.



The ESS 20 is a new addition to E-T-A's product family of electronic circuit breakers. It has a width of only 12.5mm and is designed to be plugged directly into an E-T-A power distribution socket, Module 17plus. Its function is based on a unique combination of active electronic current limitation and well-proven circuit breaker technology with physical isolation.



At a glance – the Electronic Circuit Breaker ESS 20 offers the following features:

- selective load protection with physical isolation
- active current limitation under overload conditions and to enable capacitive loads to function reliably
- single unit for two ratings: 3A and 6A
- ON/OFF switch
- clear signalisation
- width only 12.5 mm
- plug-in mounting utilising E-T-A power distribution system Module 17plus.

Good looks and impressive functionality

Good design is not just a question of taste. Nor should it be restricted just to luxury goods. It is an increasingly important criterion when it comes to devising a product strategy. Attractive styling reflects other intrinsic values such as quality, long product life and technical innovation. Well thought-out design and professional technology signify potential capabilities and ultra-reliable performance.

The recently launched E-T-A Series 8345, an attractive circuit breaker with a modular design, is a prime example of this approach. The CBE, operating on the hydraulic-magnetic principle, consists of a base unit with either plug-in or screw terminals for front panel mounting. A variety of other features may be added according to a customer's needs.

The trend-setting concept has been acknowledged by the jury of the internationally renowned design competition "iF design awards" (International Forum Hannover). New product developments from more than 30 countries were submitted. The judges selected the type 8345 circuit breaker and emphasised the successful combination of modern technology and eye-catching design.

The technical benefits of the product are convincing. Typical applications are in telecommunications equipment, plant control systems, the rail industry and other applications where it is paramount



that circuit breakers do not trip immediately when devices with capacitive or inductive loads are switched on. The current peaks caused by such loads do not present any difficulty for the 8345.

On the other hand the E-T-A 8345 disconnects reliably and extremely fast in the event of a short circuit. In addition, it is temperature-compensated, ensuring safe and reliable operation for applications where the ambient temperature may fluctuate. It is easily resettable after tripping. Unlike fuses the circuit breaker does not have to be replaced, but can simply be reset once the fault occurs, eliminating the need for a replacement fuse. Thus down-time and inventory costs are also reduced.

The type 8345 is available with current ratings from 0.1A up to 125A in a package which measures just 63.5mm x 19mm, and with a rear of panel depth of 19mm. The 125A maximum rating, which is 25A higher than the industry norm, allows designers to increase power output without consuming valuable rack space, a feature that addresses the trend towards more power output to accommodate increased call-switching volumes in telecommunications equipment.

The product is fully approved to UL489, UL1077 and EN 60934 standards and is available in single, two, three and four-pole configurations. It can be specified with different mounting methods and toggle colors, and location notches facilitate optional water splash covers or mechanical toggle guards. The circuit breakers can be installed together in cabinets or racks with optional provision of individual signal status outputs and common rail connection.

With the type 8345, E-T-A has launched a highly innovative product. Combining robust and well-proven technology with an attractive appearance, it offers unique benefits.



At a glance –

Type 8345 Circuit Breaker

- wide range of characteristic curves for current ratings from 0.1A to 125A
- suitable for world-wide usage with UL and EN approvals
- maximum current rating 125A, narrow profile (19 mm)
- plug-in design with hot-swap function (6 mm round connectors)
- snap-on type auxiliary contact module available



E-T-A circuit breakers provide *the safe solution* for Alcatel SEL

Located in Stuttgart, Alcatel SEL is one of Alcatel's most important subsidiaries in Germany. With a turnover of 2.4 billion in 2001 and some 11,000 people on the payroll, the company specialises in network systems and services.



Alcatel is the global market leader for 'cross connect' networks. These provide a very flexible means of managing the power distribution requirements of a user's system and of integrating this with the transmission network.

E-T-A circuit breakers have been selected to protect the DC voltage converters used in the sub-assemblies of Alcatel cross-connect systems. Both the removable rack style and built-in converters have designed-in redundancy for safety reasons. The circuit breakers specified are type 8340-F which offer a range of operating characteristics for different situations.

The installation and exchange of circuit breakers is greatly facilitated by the use of circuit breakers with plug-in terminals,

together with E-T-A X8340-S02 power distribution systems. Their modular design and integral busbar connections contribute to ease of installation, reducing wiring time and costs significantly. Plug-in circuit breakers are readily exchanged during system upgrades or maintenance and can be hot-swapped. In other words: it is not necessary to power down the system, so downtime is practically eliminated.

New power distribution unit speeds production of giant mining trucks

Liebherr Mining Equipment Co. (Newport News, VA) builds big trucks. Its T 282 mining truck is the world's largest two-axle electric drive haul truck. Liebherr's T 282 has a capacity of 360+ tons, stands 24.25 ft tall, is 47.5 ft long and 28.6 ft wide. Advanced design gives it an unloaded weight of 448,000 lbs, which means it has a payload to EVW ratio of 1.8:1.

In addition to its incredible size, Liebherr also included several amenities found in recreational vehicles into the environmentally designed cab. By providing heavy duty thermal insulation, computerized instrumentation, heating/air-conditioning, air ride seats and a tilt and telescoping steering wheel, the comfort level of the operator was addressed.

One of the T 282's major selling points is economy of operation, but Liebherr also wanted economy in the manufacturing process. The original design required the truck use twenty 482 Series high performance thermal circuit breakers mounted in a dashboard unit. The circuit breakers protect all electrical systems including computer instrumentation, exterior and interior lighting systems, relays, power supplies, and cabin components.

Installation wiring took Liebherr nearly three weeks to complete. In addition, the unit was bulky and aesthetically unappealing. Due to increased demand for production, the company required a reduction in assembly time. Liebherr contacted E-T-A Circuit Breakers, who called in its System Solutions experts to create a power distribution unit (PDU) that



reduced installation time and increased capabilities while decreasing space consumption.

The T 282 is continually operating, leaving downtime only for change of drivers, refueling and preventative maintenance. Working 24 hours a day, the truck demands circuit protection that can withstand high vibration and extreme temperature variance.

The Solutions team recommended E-T-A's 482 high performance circuit breaker. Used in some of the most critical applications, such as fighter jets and military tanks, the 482 is rated for 10g vibration from 10 to 2000Hz, and operates under thermal circuit breaker technology, allowing for high arching temperatures. In addition, the 482 is comparatively small and dense offering the highest current rating and performance in the least amount of space.

Having those challenges solved, Liebherr required decreased assembly time. The recent trend toward outsourcing power distribution units has resulted in saving time and money for OEMs, and this was no exception: E-T-A was able to cut the assembly time of the PDU from three weeks to one day. The PDU is equipped with a multi-socketed connector, and the wiring from the truck terminates in a mating connector, for quick and easy installation.

The unit was installed behind the driver's seat. The space allowed for an additional eight circuit breakers for a total of twenty eight per PDU. Additional circuit breakers allow the T 282 to offer cabin accessories such as a CD player. In addition, the extra space allows for auxiliary contacts: when a breaker trips, a signal light appears on the dashboard indicating which circuit breaker tripped.

Reindl Powerboats

Reindl Powerboats, Cincinnati, OH, is the Ferrari of the boat industry. The company's 20 employees meticulously hand-build 12 custom racing and pleasure boats a year. And like Ferrari, Reindl builds winners, having already won three World Championships in two classes.

The best known of Reindl's boats is the V-24 One Design Offshore Raceboat. The V-24 is the only boat used in the American Power Boat Association's One Design Offshore Racing Series, a program intended to create a more competitive balance in offshore racing and prevent teams from outspending their competition in search of the checkered flag. The 24-foot mono-hull, stock 320 HP Volvo Penta engine and design of every boat are identical, so winning depends entirely on the skill of the racers.

Developed in Stockholm, Sweden by Ocke Mannerfelt, the design of the enclosed canopy V-24 "bat boat" emphasizes safety, reliability and ease of use.

The circuit breaker Reindl selected for the V24 was the 483 High Performance Thermal Circuit Breaker from E-T-A Circuit Breakers. Reindl chose the 483 because of its high tolerance to shock and vibration and its salt water resistance. Chris Reindl, president of Reindl Powerboats, said, "Quality of workmanship and dependability were what we were looking for most. Simply put, we build race boats [and] if you do not finish, you cannot win. We only put the best materials in our race boats and pleasure boats."



The E-T-A 483 circuit breaker actually exceeds military specification 3320 for shock and vibration. It is the world's only MS 3320 circuit breaker offering ratings up to 35 amps in the same small package. Consequently, this circuit breaker is also used by the world's leading aircraft manufacturers, including Boeing and Lockheed Martin.

The 483 is a miniature single-pole aircraft-style thermal breaker available in ratings up to 35A. It resists 75 g shock and has an operating temperature range of -55 to +125 °C. The breaker is temperature compensated by a second thermal sensor oriented in the opposite direction.



An advanced two-chamber design contributes to fail-safe operation, by isolating the sensing and switching portions of the breaker. When the switch opens, any arcing between the contacts or hot gasses that could affect the sensing mechanism are contained in a separate chamber.

E-T-A Circuit Breaker type 483.

The 483 circuit breaker includes threadneck mounting; tease-free, trip-free, snap action mechanism; push/pull manual actuation (M-type TO CBE to EN 60934); and an indicator that clearly shows the tripped/off position. It operates on 115V AC or 28V DC.

Reindl designers relied on E-T-A applications engineers for help in breaker selection. Chris Reindl said, "They knew exactly what we were looking for. We had been working on solving our salt water problems with a permanent solution and they were there with the answer."

Chris Reindl was equally impressed with E-T-A's after sales support. "Any time we needed anything at all, we would just make a phone call and the part was shipped over the next night."

Ensuring the Safety of Medical Equipment

The safety of medical equipment is a statutory requirement. Patients and doctors can rest assured that any electrical equipment they come into contact with, or use during the working day, will comply with specific U. S. standards. Strict legislation for the protection of patients demands this compliance.

One such standard is UL60601-1 'Electro-medical equipment – General stipulations for safety'. A particular requirement of this standard requires circuit breakers incorporated within equipment and instrumentation to operate a minimum of ten times under simulated overload conditions. On completion of the test sequence the circuit breaker must be undamaged and fit for its purpose. This test clearly proves the protective function of the circuit breaker and verifies the suitability of its performance characteristics.

The standard does not demand this test for fuses as their proper function can obviously only be proved by their destruction. Furthermore fuses in this application can have a major drawback over time. Short term overloads will typically not cause a fuse to blow, but over a period of a number of month or years, will result in a change in its characteristics. Finally the fuse may blow even at rated current. In other words, fuses 'age'.



When it comes to medical equipment, the life of the patient may depend upon the correct operation of electrical equipment. E-T-A circuit breakers play a vital role in providing reliable protection against faults at the same time as minimizing the risk of unnecessary equipment downtime. Every E-T-A circuit breaker is calibrated to its current rating and is functionally tested before delivery. This ensures sustained and reliable protection during the whole lifetime of any medical equipment using E-T-A circuit protection.

Also, the use of E-T-A circuit breaker protection helps to reduce costs. In the event of an overload, once the fault has been corrected, the circuit breaker can easily be reset. The equipment is then immediately ready for use again. In addition, many models are available with auxiliary contacts to provide an immediate signal of an unexpected equipment stoppage – a valuable safety advantage, especially for hard pressed nursing staff.



These features illustrate the significant contribution that E-T-A circuit breakers make to the safety of medical equipment, and the greater efficiencies which result from reduced maintenance and downtime.

E-T-A circuit breakers type 3120 and 3130 are particularly suited for use in electro-medical applications. All multipole variants satisfy the requirements of UL60601-1. In a single component, they combine the functions of an ON/OFF switch, with rocker actuation, and all-pole overcurrent protection. Illumination of the rocker is optional. The double pole version of the type 3130 is also available with a power inlet module (see photo), while type 3120 can be supplied with additional undervoltage release or auxiliary contact modules.

How do I know when a circuit breaker is better suited for an application than a fuse?

Foremost, circuit breakers can be quickly reset, enabling the circuit to be restored with minimum downtime. There is no assurance that a replacement fuse will be of the proper rating. If a fuse is replaced by a higher rated fuse, overheating and catastrophic equipment failure may occur.

Circuit breaker performance is relatively stable over time, but as fuses age, their trip characteristics change.

Circuit breakers offer designers more options than do fuses. An auxiliary contact may be added that can communicate an alarm condition to an LED indicator or process software. Circuit breakers can be combined with a switch, saving space and adding overload protection. Remote trip is another option available with circuit breakers but not with fuses.

If one or more of the above characteristics are necessary or would improve your design, circuit breakers should be considered.

How can I avoid nuisance tripping caused by in-rush or transient currents?

Most engineers are concerned about nuisance tripping, as they should be, but they often specify a circuit breaker rated much higher than needed. Part of the reason is confusion between fuses and circuit breakers. Engineers are accustomed to oversizing fuses as a way to prevent nuisance tripping. However, there is no need to oversize a circuit breaker.

Unlike a fuse rating, a circuit breaker rating tells you the maximum current that the circuit breaker will consistently



maintain in ambient room temperature. Thus, a 10A circuit breaker will maintain a 10A current without nuisance tripping. In fact, a typical 4A circuit breaker with a slow trip profile will tolerate a temporary 10A current surge without nuisance tripping.

Often times, nuisance tripping is caused by in-rush currents associated with certain electrical components -- primarily motors, transformers, solenoids, and big capacitors. In such cases, the designer needs to specify a circuit breaker that has a delay. Thermal circuit breakers have a natural delay, and magnetic circuit breakers can have added hydraulic delays. Match the delay to the duration of the expected in-rush currents.

To avoid nuisance tripping, always specify circuit protection using the normal current (nominal current) and use trip delays to match the application.

How do I know what degree of protection is needed for my design?

Terms such as drip-proof, ignition protection, water splash protection, and dustproof are in common usage but may be misleading unless standard definitions are applied.

When specifying, use the established standards as a measure, such as EN 60529 / IEC 529, which defines Degree of protection of Electrical Equipment. Using these standards, decide which protection is correct for the application. For example, ignition protection makes sense if the breaker is installed in the engine compartment of a boat, but is not needed if installed in the boat panel. A combination switch-breaker installed in medical equipment might need a water splash protection rating, but it probably does not need a rating for continuous immersion in water. Truly watertight and dust-tight circuit breakers are available, but they are expensive and usually unnecessary.

Upcoming E-T-A Trade Shows

National Design
Engineering Show
Feb. 23-26, Chicago, IL



EDS 2004
May 4-6, Las Vegas, NV



Supercomm 2004
June 20-24, Chicago, IL



ISA
Oct. 5-7, Houston, TX



IBEX
Oct. 25-27, Miami, FL



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