NEWSLETTER 2024

Hot Topics!

- GENEREX with a booth at „Data Centre World 2024“ in Frankfurt
- 30 Years of GENEREX – New American Headquarters in Mooresville NC

BACS

- BACS for ATEX-Zone 1
- BACS für use in harsh Industrial Environments
- Batterie-Capacity SOC / Battery-Health SOH
- BACS Current Sensors - Generation 5
- NERC PRC-005 Standard for Battery Technicians in den USA
- Halogen-free Cables
- BACS Adhesive Strips for PP-Battery Housings

SMARTBATTERY / SMARTLOGGER

- SMARTBATTERY / SMARTLOGGER Companion App 3.0
- SMARTBATTERY EU Patent EP 18726032.8
- EU Battery Regulation 2024

UPS and Battery Management

- Cybersecurity Firmware 2.18 Update for all GENEREX Products
- INTERTEK Cybersecurity UL 2900-1 Report 2024

Software

- RCCMD - the most successful Shutdown Software in Europe

Service

- Price Stability for CS141 & BACS
- Premium Service for OEM Partner
- GENEREX – 30 Years of History

Click on the bullet points to get there!

GENEREX at the Data Center World 2024 Tradeshow in Frankfurt

Visit us at our booth
Hall 8 - Booth E099

GENEREX SYSTEMS has been operating exclusively as a **B2B** supplier for 30 years. It's served us well so far and will continue to remain our main sales market in the future.

Almost 100 UPS and battery manufacturers sell and install our products under their own brand names, and over 300 UPS and battery service companies worldwide sell and install our products under the GENEREX brand name. End customers are not our business area, and as such we have zero direct commercial contact. We do however have direct contact with end users in when we provide support on behalf of our OEM partners.

DATA CENTRE WORLD

22. – 23. May 2024
Fairground Frankfurt - Hall 8
www.datacentreworld.de

We're of course happy to provide technical support for all our partners, including directly to their end users!

Although end users are not direct customers for us, they are nonetheless the most valuable source of information about our products in practical, or "field", use. None of our B2B partners can provide such valuable user information on BACS or our CS141 UPS network cards as operators and builders of data centers.

BACS Battery Management and CS141 UPS network products are used in almost all data centers in the western world – to date, more than 2 million BACS systems are installed in this sector alone. Banks, airports and the military as well as the energy and transportation sectors follow in second place.

DATA CENTER WORLD 2024 is the world's largest gathering of data center experts and end users. **Many of the world's data centers are currently being built in the greater Frankfurt area - and GENEREX is represented with its products in every one of them**. With this particularly high concentration of GENEREX users in Frankfurt, the DATA CENTER WORLD trade fair occupies a special position for us:
We want to support all interested parties and our partners on-site with our specialist knowledge and expertise!

21 exhibitors at DATA CENTER WORLD are already long-standing GENEREX partners who have extensive experience with our products. When it comes to purchasing or commercial decisions, we will naturally refer all users at this trade fair to our partners.

We look forward to seeing you and talking to you at our booth E099 !

30 years of GENEREX SYSTEMS

New US headquarters in Mooresville, North Carolina

As we prepare to inaugurate our new headquarters in Mooresville, North Carolina, we are not merely relocating; we are ushering in a new era of innovation and growth for GENEREX SYSTEMS Inc. This strategic move comes as a result of the expansion of our software development team in the USA and the increasing demands of our clientele both within North America and beyond the EU borders.

Picture: GENEREX SYSTEMS HQ under construction in Mooresville NC

The significance of this transition extends beyond just physical space; it represents a commitment to providing our team with state-of-the-art facilities conducive to fostering creativity and collaboration. Our new headquarters will boast expansive office spaces designed to accommodate our growing workforce, cutting-edge laboratory and test environments where our products will undergo rigorous testing and refinement, and enhanced storage facilities to meet the evolving needs of our valued customers.

Situated on the picturesque shores of Lake Norman, our new location offers not only a scenic backdrop but also strategic proximity. Just 30 minutes north of Charlotte City, one of the most prominent financial hubs on the US East Coast, Mooresville provides the perfect blend of accessibility and serenity. This relocation aligns with our vision for continued expansion and positions us to better serve our clients while tapping into a rich talent pool in the region.

As we eagerly anticipate the completion of our new headquarters in the summer of 2024, we are mindful of the timing. It coincides with a significant milestone in GENEREX's history—the celebration of our 30th anniversary. This move symbolizes our enduring commitment to innovation, excellence, and the relentless pursuit of customer satisfaction. We look forward to welcoming our team, partners, and clients to our new home, where together, we will shape the future of technology and redefine industry standards.

Our new address will be:

GENEREX SYSTEMS Inc.
109 Magnolia Park Dr
28117 Mooresville, NC
Tel. +1-706-966-1447
E-Mail: D.Baileys@generex.us
www.generex.us

30 years of GENEREX SYSTEMS

GENEREX Systems is proud of three decades of pioneering work and technological innovation. Since its founding in 1994, GENEREX has continued to push the boundaries of technology to provide innovative emergency power and battery management solutions to its customers worldwide. Since its inception, GENEREX has been at the forefront of revolutionizing our industry through innovative software and hardware solutions and gaining global market share with its patented products. From humble beginnings to a renowned leader in the technology sector, GENEREX's journey over the past 30 years has been characterized by an unwavering commitment to excellence, integrity and customer satisfaction. The driving force behind GENEREX's success is technology, shaped by the innovation of technical director and founder Frank Blettenberger. The entire success story of GENEREX and the background are described in an interview conducted by a British trade magazine in London in 2012 with Frank Blettenberger. **Read the full success story at "The BMS Revolutionary" later in this article**.

As GENEREX celebrates this significant 30-year milestone, the company announces an important change in corporate leadership:

The founder Frank Blettenberger hands over the position of technical management of GENEREX SYSTEMS to Daniel Baileys.

As President of GENEREX and all companies and investments belonging to the group, Frank Blettenberger will remain closely linked to the company in the future and will continue to be its highest decision-making authority.

Daniel Baileys will take over his technical tasks immediately. In addition to the entire US operation, Daniel Baileys is also responsible for the software development, hardware research & development and customer support departments in Hamburg, Germany. Baileys has demonstrated exemplary leadership and a deep understanding of the industry over the past 10 years at GENEREX, leading the successful development of GENEREX SYSTEMS USA. His technical expertise and commitment to innovation make him the ideal fit for the position of CTO to lead the company into the next phase of growth and prosperity. Daniel Baileys shared his excitement about this opportunity and the trust placed in him:

Picture: Daniel Baileys CEO & CTO GENEREX SYSTEMS

"It is an honor for me to take on this challenging role of technical leadership at GENEREX. I am committed to continuing GENEREX's tradition of innovation and excellence in the future. GENEREX remains true to its commitment to provide innovative solutions exclusively for the B2B market to be successful together with our partners in this dynamic market."

BACS C modules ATEX now also Zone 1 certified

BACS ATEX certified module of device group II for zones 1/21 and 2/22

Available now!

In the oil and gas industry, various products with **different ATEX certifications** are used depending on the application and environment. While in some areas where explosive atmospheres cannot occur, certification is not required at all, in other areas products for ATEX zones 0, 1 or 2 must be used, which is associated with considerable additional costs.

NEW

GENEREX is the only manufacturer to offer this a BMS for ATEX zones 1/21 and 2/22!

The proven BACS C modules of generation 3 have been built since 2010 and have been sold more than 3.4 million times. This makes BACS the best-selling battery management product for critical power supplies and has proven its robustness and reliability millions of times. Thanks to a special protective housing with up to 3 BACS modules and the use of special cables, BACS is for ATEX group II certified and can be used in zones 1 and 21 or 2 and 22. A flameproof encapsulation according to IEC60079-1 is used as the type of protection. The device is specified for gas group IIC (Typical Gas: Hydrogen) or for conductive dusts such as metal dust or carbon-containing dust. The module can be assigned to temperature class T5 – up to 100°C.

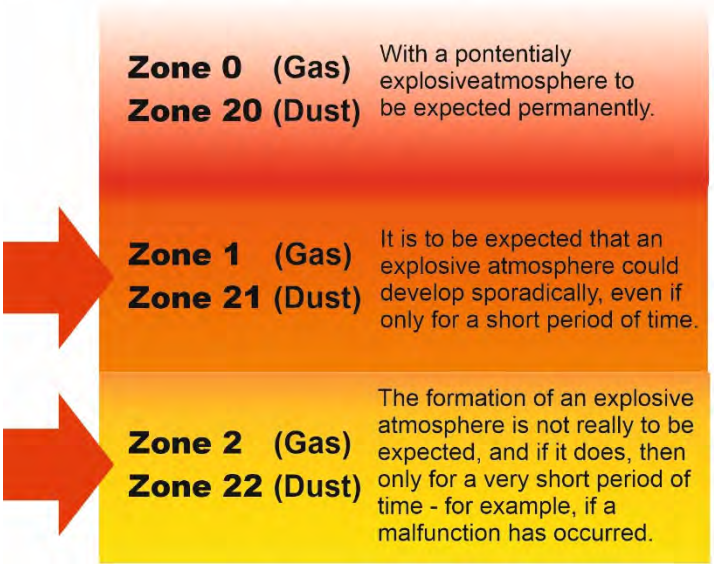


Image: The graphic shows the different ATEX zones. BACS ATEX is designed for protection zones 1/21 for gases and 2/22 for dust environments.

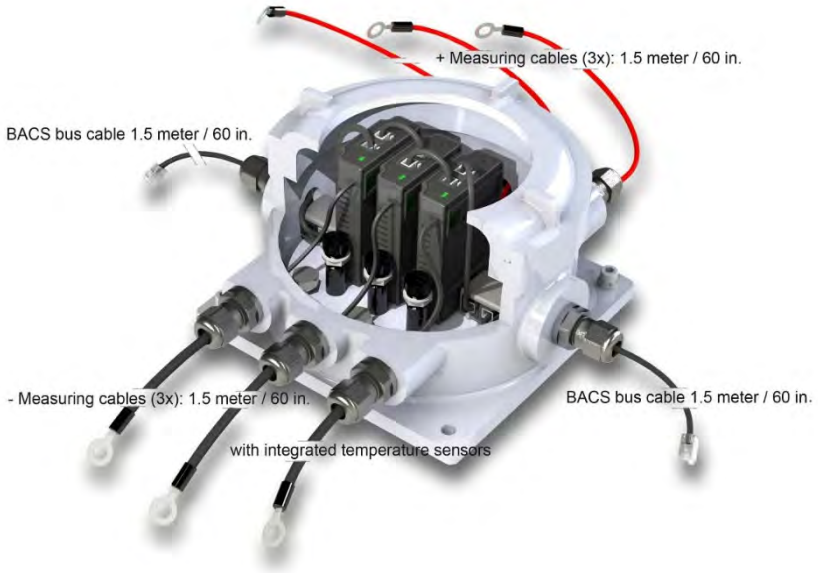


Image:
*C20ex3/C30ex3/C40ex3 - Dimensions/Material: Width 190mm * Height 146mm, weight (with 3 modules) 3400g. Light gray copper-free aluminum, glass viewing window for LED control. Available as a device for ATEX Zone 1 or Zone 2: Use in regions with frequent or occasional contamination with explosive gases and dust and temperatures up to 100°C*

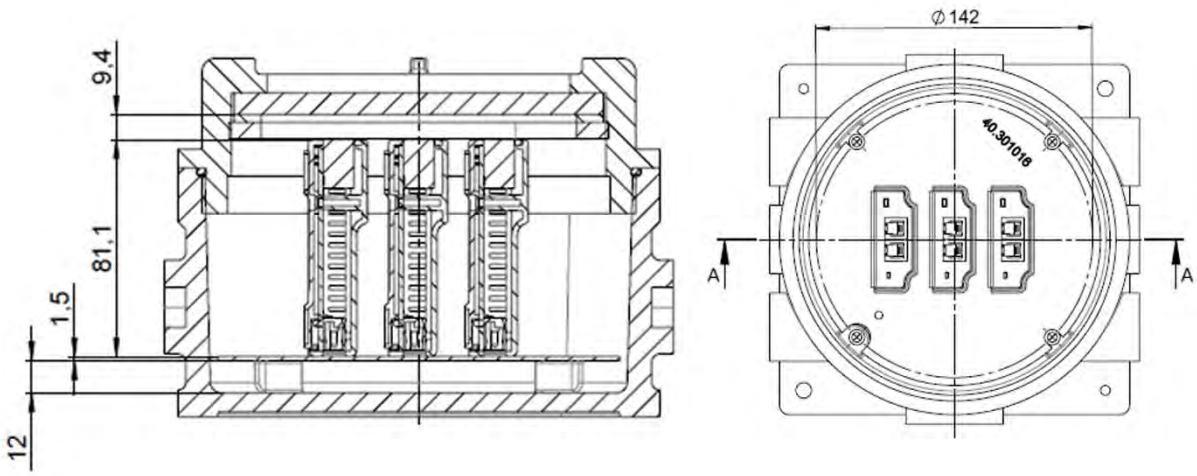
ATEX codes:

Zone 2: II3G Ex dc IIC T5 Gb or II 3D Ex tc IIIC T100°C Db
Zone 1: II2G Ex db IIC T5 Gb or II 2D Ex tb IIIC T100°C DB

The 3 BACS C modules (standard scope of delivery) are delivered mounted on a base board anchored in the housing and are already connected to one another at the factory. All battery measuring cables (each 1.5 m long) are led out in a gas-tight manner. A temperature sensor is installed in the cable lug of the negative cable measuring cable, which is why the negative cable is slightly thicker than the positive cable. There are 6 high-voltage fuses on the base board (which are otherwise installed in the measuring cables), which can now be easily replaced. In the event of repairs, each BACS module can be individually removed from the base board and replaced with a new one.

All 3 modules have their LEDs pointing upwards, so that you can see their operating status directly through the pane in the housing and can easily reach the addressing switch when programming the addresses. The battery measuring cables are available with ring cable lugs M5, M6, M8, M10 or M12. All cables are halogen-free and suitable for use in potentially explosive areas.

The dimensions in the drawings below are in millimeters. The total height is 146mm. The shape is square, so the width is the same on all sides and is 190 mm.



Easy installation and commissioning, even when retrofitting

During the new installation, the pressure housing is opened by the installer and the BACS data line is laid between the individual housing modules. Each Cxxex3 module has two EX - certified cable glands to seal the BACS data line in an ATEX-compliant manner after installation work. Since the BACS measuring cables are already pre-installed, all that remains is to connect the batteries and initialize the modules according to a known scheme using the BACS programmer integrated in the BACS WEBMANAGER.

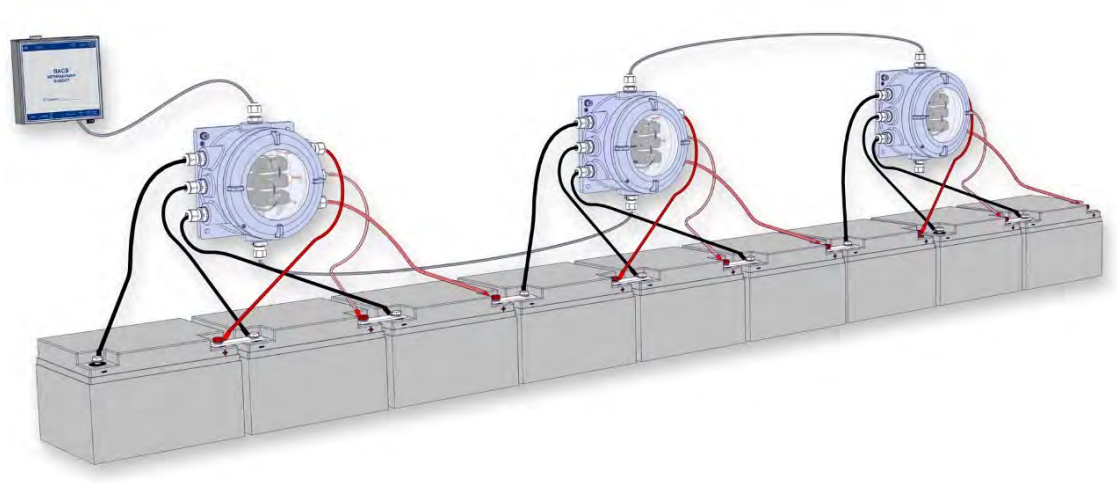


Image: The graphic shows the structure of the ATEX version of BACS - The modules are located in the ATEX - certified housings on a special carrier board - if necessary, the BACS web manager could also be housed in an ATEX-compliant CC cabinet.

Upgrading and converting existing systems

The design of the new housings for the BACS ATEX solution allows existing BACS installations to be easily and intuitively "upgraded" to ATEX without much effort. The ATEX housing and the associated cables can be delivered in an "unequipped" version - after installation, the existing system modules only need to be "plugged" into the individual ATEX housings and sealed and connected accordingly. In this way, your customer has to Don't sacrifice or throw away existing BACS investment to achieve ATEX certification!

BACS has a unique selling point in Zone 1!
No other BMS on the market can boast Zone 1 approval.

“Robust” BACS
Ideal for use in harsh industrial environments

BACS for outdoor installations

The availability of BACS as an ATEX version also solves another application problem - **BACS for outdoor installations or in harsh industrial environments**.

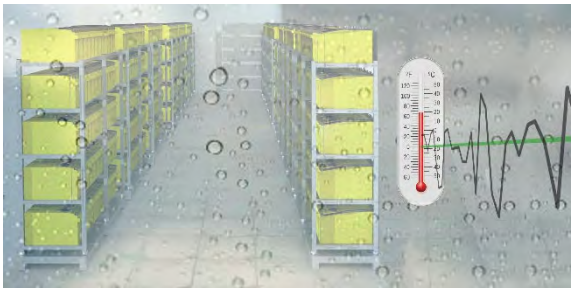
The Zone 2 ATEX housings are not only explosion-proof, the hermetic sealing of all electrical components by the ATEX housing means that BACS can even be used “under water” – or in corrosive environments – which is much more common as an application for batteries an operation under water….

The reason for using an ATEX housing in harsh or aggressive atmospheres is often the constant conditions on site. BACS is used in railway tunnels, ships, submarines, oil and gas industries, military installations and many other applications where it is often impossible to maintain the operating conditions for which electronics are designed. Precisely because lead batteries are almost exclusively used in such environments (due to the lower risk of fire), such locations for BACS are more the rule than the exception.

However, a “standard” BACS system is also significantly safer electrically than any other BMS on the market **as concerns electrical safety, such as protection against contact and prevention of overheating or generation of sparks**. Of course, this is not enough for an ATEX environment, but it is also not enough to operate the product in most unclean environments. Just because BACS is electrically safer than other products on the market and is used in ATEX environments at the user's own risk does not mean that the system can be "attributed" to the expected robustness for industrial and outdoor environments.

In fact, the “robustness” of BACS reaches its limits as soon as the environments also contain corrosive atmospheres – for example an installation in a much more “aggressive” atmospheric environment in which the natural corrosion processes could be accelerated.

We found several use cases where BACS was installed in environments that were otherwise within the BACS specification for temperature and humidity, but where, for example, frequent temperature changes resulted in condensation.



The result of condensation in potentially contaminated rooms (sulphur, salt crystals) creates an aggressive atmosphere and thus corrosion on all exposed parts, including in long-term operation on parts protected by protective varnish. This sometimes led to the complete failure of the modules and cables used.

The BACS modules and cables sent to us for examination showed significant signs of corrosion as shown in the picture. Even without climate control in other harsh industrial environments, such traces of corrosion after only a short period of use in the field were previously unknown to us in Europe and the USA.

Our investigations have shown that the BACS modules (and all connecting cables) were contaminated with a basic electrolyte.

The first question was: **How does electrolyte get into a BACS module if the module is located above the battery filler neck?**

Electrolyte leaks in battery rooms are rare and usually only limited to wet cells. Most such leaks are of no major consequence and usually only occur in new batteries that have never been through a cycle (discharge/charge). This is known to most battery technicians, which is why at least one discharge is carried out during picking so that the electrolyte level can then be checked and possibly corrected. If the electrolyte level is set correctly after the cycle, leaks due to overfilling should no longer occur. If electrolyte leaks again later, this should not cause any damage because wet cells should always be installed at ground level or, in rack installations, there is a collecting tray for electrolyte under each level. This prevents leaking electrolyte from dripping directly onto the batteries underneath.

In the case in the picture above, however, the corrosion could also be found on the BACS modules, which were arranged at the very top of the rack, where no contact could actually take. **Nevertheless, the modules and cables were significantly contaminated and corroded even on the first level.**

Use in higher temperature ranges has little influence on BACS. However, if there is a connection with high humidity and changing temperatures, condensation results. This also has little impact in temperate zones. The protective varnish on the BACS board protects against dust and normal humidity. However, this only applies to the areas covered by the paint. **If the BACS modules are constantly exposed to increased humidity, this causes corrosion on the components that are not protected by the paint (cable sockets, addressing switches, temperature sensors).** This corrosion can be gradual and not noticeable for years, as demonstrated by more than 10-year-old BACS installations in European, American and Asian battery rooms.

However, the speed of the corrosion processes changes significantly if moisture is repeatedly created through condensation in a room with battery acid residue!

Changing temperatures and high humidity lead to condensation. During each condensation process, electrolyte crystals are dissolved in the surrounding area and distributed through the air in the room. These electrolyte salts, dissolved in the humidity, create an aggressive environment and therefore significantly faster corrosion on all exposed metallic parts, much more than in identically contaminated rooms **WITHOUT** such condensation.

Almost all battery rooms with wet cells have been contaminated with electrolytes over the years, which is not a problem in temperate atmospheres. However, if a metallic surface that is contaminated through the air becomes “wet” through accumulated moisture, it will “rust”, and the more moisture and heat that is added, the faster it will do so.

This corrosive mixture of humidity and electrolyte destroyed the addressing switches in the BACS modules we found, and later also destroyed LEDs and other components, and ultimately led to a total failure of the BACS module.

Such cases of corrosion on BACS modules are not found in data centers or other wet cell battery rooms that have normal temperature and humidity levels, **but in tropical regions especially where NiCd wet cells are used due to the expected temperatures.**

Typically, wet cells in tropical environments are delicate to handle because when the cells are refilled with distilled water, a particularly strong foaming effect occurs. Due to this foaming, there is usually significantly more electrolyte in the room than in identical rooms without high humidity. The adjacent picture of an older battery installation shows that humidity makes a difference: Significant acid damage can be seen on the floor of the battery room. Although the room is significantly contaminated with electrolytes, the BACS modules show no signs of corrosion damage even after being used there for over 15 years!

The influence of temperatures on battery rooms is inevitable to a limited extent, but as long as lead batteries or NiCd are used, it is not particularly problematic. This is one of the main reasons for using these battery technologies in such places.

To prevent damage to BACS or other electronics in such battery rooms, the room air should at least be as **dry** as possible. Air conditioning systems regulate this automatically, but even normal, unconditioned ambient air does not cause any problems if condensation is avoided.

But if BACS is used in tropical regions - without air conditioning - and wet cells are also used, in which, due to the high temperatures, they often have to be refilled with electrolyte or water to compensate for evaporation, then the probability is high that such “Foaming” occurs in the surroundings – and then an increased corrosion process will begin.

We therefore recommend that if condensation cannot be prevented (for structural reasons):

1. **Do not use wet cells as batteries:** The use of wet cells, especially nickel cadmium cells, have a high level of robustness at existing elevated temperatures. However, the advantage turns into a disadvantage as soon as the cells are used in environments with additional high humidity. Many customers have recognized this and are now using “pure lead VRLA batteries” or, if there is a lack of space, batteries with lithium titanium oxide instead of wet cells based on lead or NiCd-based batteries. Pure lead batteries achieve almost the same temperature ranges as specified for NiCd batteries, with significantly lower material and service costs. The fact that such VRLA batteries also release almost no electrolyte is another advantage for problematic environments.

2. **The BACS ATEX module:**If it is unavoidable to use wet cell batteries and expose the sensors to corrosive environments, the new BACS ATEX module provides the optimal solution and ensures decades of operation without corrosion and the resulting high operational reliability.

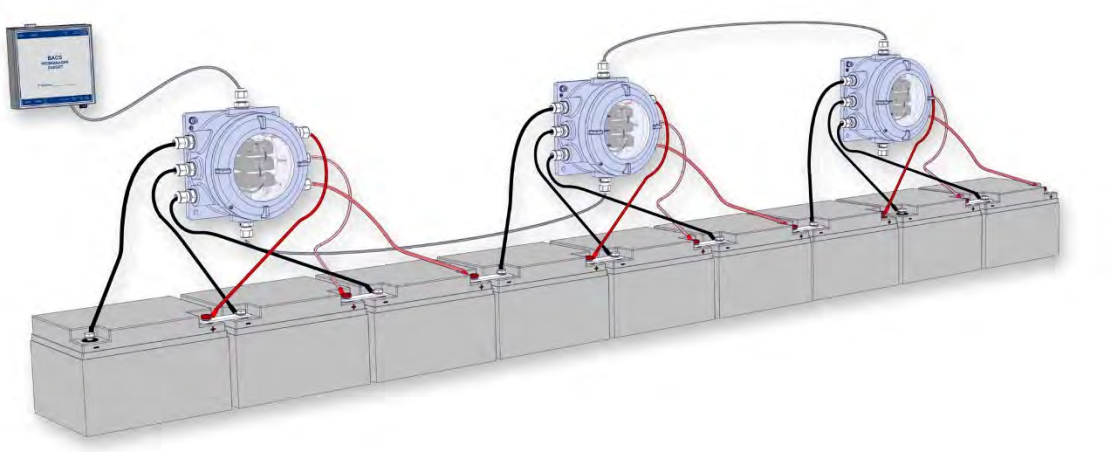
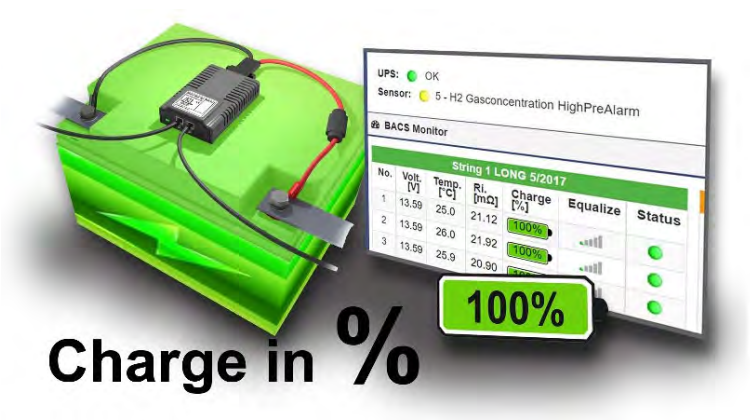


Image: The BACS ATEX version is also suitable for use in corrosive environments, as the BACS modules are sealed airtight in aluminum housings in accordance with the specifications for ATEX zone 1/21 or 2/22.

Battery capacity SOC / battery health SOH

A BACS Specialty, and its relation to the requirements of the European Parliament EU BattG 2024 – "Energy Throughput"



When BACS came onto the market 20 years ago, it quickly attracted great interest from customers with highly critical infrastructures. Within a decade, BACS developed into a key technology for stationary batteries in particularly critical areas and is now advertised by many international corporations as an "unofficial" standard for their systems. BACS has adapted significantly to the requirements of these highly critical customers and is now the undisputed market leader in the EU and number 2 in the USA in this sensitive market segment.

BACS has active battery management with a balancing function, a technology that must be used in lithium battery technology today to keep these cells stable. With the introduction of this technology on lead- and NiCd-based cells, similar positive effects were also observed after a few years. Balancing (or "equalizing") also ensures the stability of lead/acid, NiCd and other types of chemistry whose cells are connected in series to generate high voltages. Just like with lithium-based cells, BACS ensures the "health" of the cells - **SOH (State-of-Health)** and determines the charge level **SOC (State-of-Charge)**.

*For our customers experienced in lithium technology: **SOP (State of Power)** is not measured by BACS. This value is only important for lithium cells because of their special susceptibility to damage in deep discharge and overload situations. Lead and NiCd batteries do not suffer any permanent damage from these situations if they are only used for a short time. In addition, the use of lead and NiCds is typically focused on emergency power situations so that these areas that are dangerous for lithium are never reached anyway.*

The interpretation of the measured values of a battery system is significantly improved by balancing, and it is also a critical qualifier for any measurement having to do with impedance: Balancing keeps all cells/batteries closely within the "healthy" voltage window and thus allows a highly precise impedance measurement. Other BMS systems can also carry out impedance measurements without balancing - BUT: Without balancing, impedance measurements from other BMS systems cannot be compared because different voltages were measured per block/cell!
With BACS, the impedances are always measured at exactly the same voltage - and are therefore comparable for the first time! A battery with different impedance now clearly stands out from the crowd of others and clearly shows the user where the problem lies.

Only with balancing do impedance measurements provide meaningful and comparable results.

The result is that BACS can verifiably improve both the reliability and longevity of almost any battery-based UPS concept, including all types of battery chemistry on the market today!

Our reference list of BACS users now reads like the “Who’s Who” of multiple industries and market segments. BACS is a game changer and the first choice of datacenters and critical civil and military infrastructure in the western world!

Since 2021, BACS has provided a percentage capacity display (SoC - State of Charge) for every lead-based battery, and since 2022 also for NiCd batteries and lithium cells (type LTO), both for trickle charging and for intermittent charging processes.

The battery capacity says a lot about the condition of the cells!

E-car manufacturers have developed interesting solutions when it comes to the discharging behavior of electric cars: If there is a defective cell in the battery strings of an electric vehicle, you have to adapt the discharging behavior and the measuring method accordingly, otherwise the calculation of the total capacity is completely unusable “estimated” result. If several cells are defective, the entire battery string must be “disconnected” to reduce the risk of fire. For this reason, every electric car has more cells than are actually used for operation; some are “reserves” and are not used for driving.

In electric cars, the lithium systems must be oversized to avoid critical situations and to be able to replace the failed cells so that the SOC of the entire system can continue to deliver the minimum range.

This also applies to lithium cells in UPS systems!

String 1 LONG 5/2017

No.	Volt. [V]	Temp. [°C]	Ri. [mΩ]	Charge [%]	Equalize	Status
1	12.52	23.8	21.25	64%		
2	12.41	24.4	21.81	65%		
3	12.46	24.5	20.91	67%		
4	11.77	24.4	21.94	48%		
5	12.46	24.0	20.93	67%		
6	12.44	24.6	21.81	66%		
7	12.42	24.5	21.72	66%		
8	12.56	24.5	22.23	70%		
9	12.43	24.5	22.00	66%		
10	12.48	24.0	21.34	68%		
11	12.46	23.8	21.77	62%		
12	12.55	24.5	21.85	70%		
13	11.08	24.5	21.63	29%		
14	12.47	24.5	22.79	67%		
15	12.51	24.1	21.21	68%		
16	12.56	24.5	21.43	70%		

∑ Voltage **247.51** V

12.38 [V] Target Voltage

-4.1 [A] DC Current -1.01 [KW] Real Power

0 [A] AC Current

Image: When discharged, BACS STATUS shows a battery in yellow with significantly less capacity than the other batteries in the string, with approximately the same impedance values.

The automotive industry uses lithium-based cells with extremely high energy density, which take the charging/discharging methods to a completely different level than is common in most of today's UPS applications. Especially in UPS systems, either the simplest charging technology and conventional lead or NiCd-based batteries are used, or the most complex charging technology and significantly oversized lithium batteries are used - and both technologies struggle with the problem that UPSs almost never discharge – limiting the opportunities to check and calibrate the state-of-charge. In a UPS, all batteries are therefore always considered “full” and “healthy” to be able to simulate a calculation of the autonomy time and thus capacity - which provides extremely inaccurate data if just one cell is not functioning properly, or the batteries start to age. Most UPS users are not even aware of this inaccuracy - a discharge in UPS systems occurs far too rarely to doubt a possibly fake measurement value for SOC or autonomy time.

Since each of these "simulated" SOC values of a UPS can only be checked and corrected with great effort and would have to be repeated regularly for a reliable "state-of-health" derivation and trend

detection, such an effort is only required in a "capacity test" carried out regularly in highly critical datacenters or military facilities.

With the capacity display, BACS provides an automatable and therefore a cost-effective solution for otherwise complex “manual” capacity tests.

In addition, unlike limited battery monitoring, BACS can “delay” the necessary replacement of batteries, for example to achieve a maintenance window.

1. Balancing automatically ensures that a weak cell can remain in the network until it can be replaced during a maintenance window. An impedance trend display shows how long this condition can probably be tolerated. BACS is the only system that tolerates a new battery with different impedances being installed in such an older system. BACS ensures that old and new batteries work together and saves the otherwise usual complete replacement of battery systems.

Image: BACS VIEWER shows the trend of the impedance of the battery No.106 for the period of 1 year as a dashed blue line. The info box shows a difference of 44.2% in “red” and thus signals that this battery has deteriorated significantly during this time. There is a need for action regarding the battery service. The “orange” warning threshold will be reached in 2 months at the latest and probably shortly afterwards the “red” alarm threshold will be reached.

2. If an electronic battery disconnector is used, then BACS - identical to lithium BMS systems - can automatically disconnect the entire string with the affected battery to avoid potential catastrophic consequential damage. (This function complies with US Firecode and requires the optional “GX_R_AUX” and an electronic battery isolator)

The SOH and SOC are the most important metrics for the operator of a battery monitoring system - if these data are missing, the actual meaning and purpose of such a product is missing.

SOH - State of Health – BACS delivers what “norms” promise

To determine the SOH (State of Health), each battery has to be recorded (multiple times) by the service technician when it is discharged using an individual measuring device. To determine the state of health, all battery cells are discharged when new - usually up to a defined limit (e.g. 10.5 volts - the shutdown voltage level of many UPS systems). This discharge results in, for example, 10 minutes in year 1 of commissioning, and thus defines the reference value for SoH at 100%.

These discharges are repeated every year with the same load and the same general conditions, and the results are compared with previous years. The “optimal point for battery replacement” ultimately depends heavily on the battery chemistry used and the usage pattern, but the main problem remains the enormous human and time investment required to determine this data.

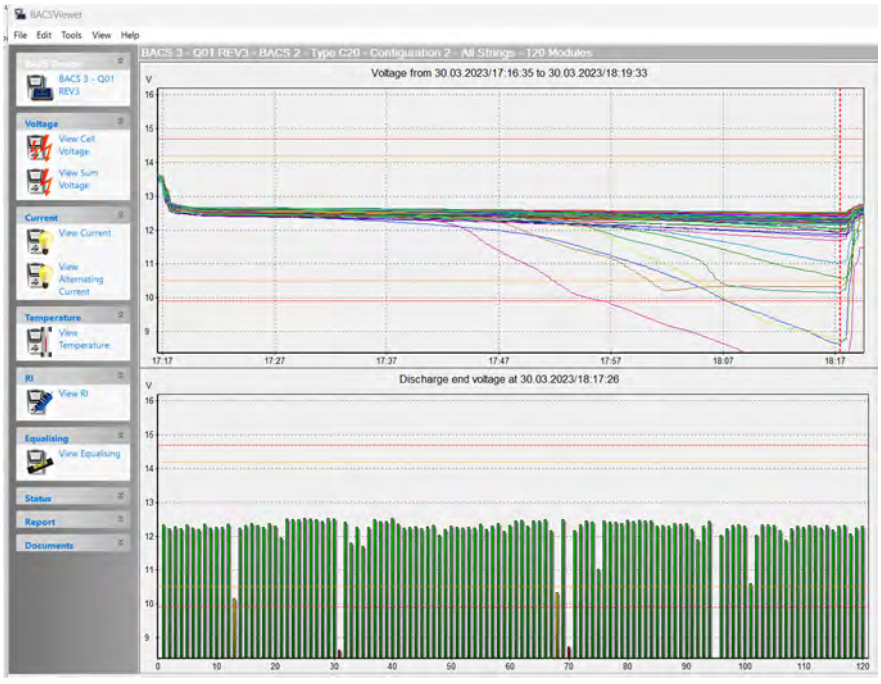
Since BACS measures and monitors each individual battery anyway, this material- and personnel-intensive additional measurement could actually be eliminated. All BACS requires are discharges that either occur “on their own” (due to a power failure) or are triggered “manually” by the battery technician. Analysis tools such as the free BACS VIEWER software allow a quick and direct evaluation of the recorded discharge data and provide the SOC and SOH as a result and a direct comparison with the data from a previous discharge and thus by how much the battery life has decreased in the specified period of time. The next step is to determine whether the cause of the loss of capacity is a single defective battery or whether all batteries have lost capacity due to simple aging?

Discharge 1	
Ø Current	4.68 A
Time:	0.26 h
Capacity:	1.22 Ah
Discharge 2	
Ø Current	4.96 A
Time:	1.05 h
Capacity:	5.21 Ah

Image: BACS VIEWER compares 2 discharges that are roughly similar and detects a significant loss of capacity.
Current discharge 1: Only 1.22 Ah per battery. Discharge 2 a year ago: 5.21 Ah per battery.
A capacity loss of 76% with identical load

The BACS VIEWER provides the answer: When discharging, the batteries that have collapsed prematurely are displayed.

Not all batteries necessarily have to be replaced. In this case, by comparing the impedances of the batteries that have collapsed with the other batteries in the system, it can be quickly determined whether the age limit has been reached - or whether replacing just a few batteries that have aged prematurely is sufficient. The battery replacement procedure can be individually adapted to the respective situation.



Picture: BACS VIEWER shows the “Discharge 1” of all 120 batteries with a constant load over a period of 1 hour. The end of the discharge is represented by the vertical red dashed line. This discharge simply needs to be compared to a similar discharge 1 year ago or earlier to determine the capacity loss and culprit.

BACS as a battery **management** system offers customers freedom in decision-making that cannot be expected from a limited battery **monitoring** system: The active management of the batteries removes the immediate need to act in the case of weak cells/blocks and allows well-founded decisions to be made based on the measured values planned to be implemented.

The aging of the batteries is most clearly visible in the impedance.

A battery, regardless of the type of chemistry, will show an increasing impedance after a long time in "standby". The cause is not only aging or defects in the battery, but usually it is simply the influence of gravity on the differently dense molecules in the more or less liquid electrolyte. This becomes quickly apparent when you see the impedance fall immediately after a discharge, only to see it rise again to the previous value within a few days. **If the impedance value of all batteries behaves the same and does not differ significantly from the measured values of other batteries in this system - then "natural aging" prevails.**

- ✓ As long as all batteries behave "the same", a "normal" aging process can be assumed and the end of their useful life (approx. 80% capacity) is reached at an approx. 30% increase in impedance over the years.

- ✓ If one or more batteries show an increase in impedance of more than 30% over the years, it should be checked whether these batteries are noticeable when discharged, for example if they lose capacity faster than the others. In such a case, the battery must be replaced if it is not to endanger the capacity and thus the SoH of the entire system.

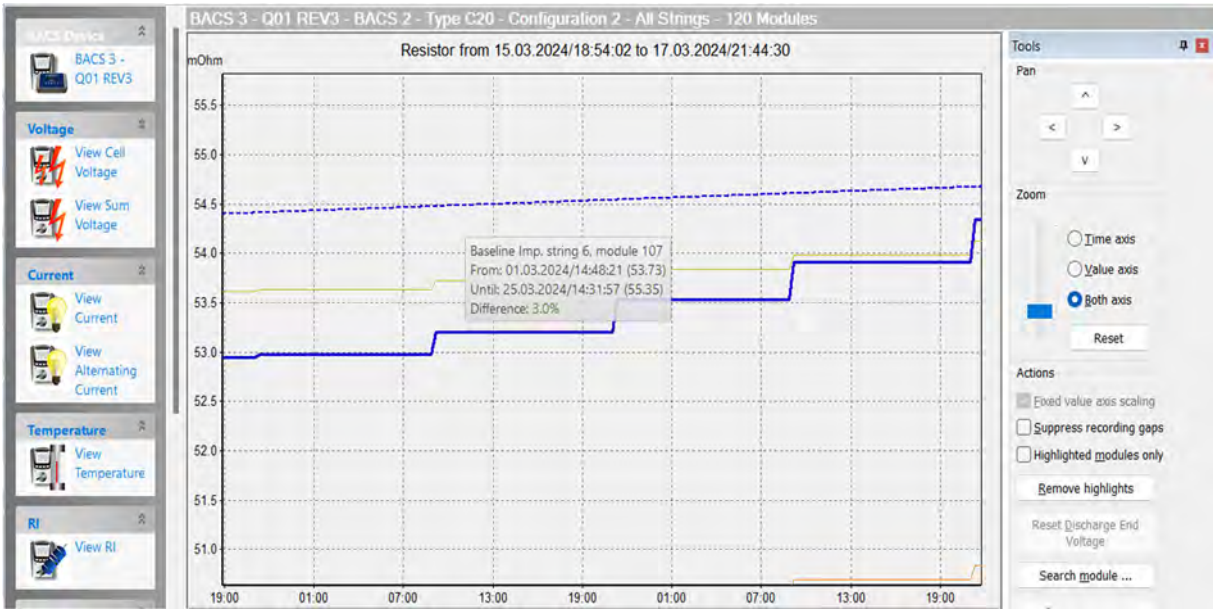


Image: BACS VIEWER shows the trend for the increasing impedance of battery number 107 with the dashed line. In less than 1 month the battery has a 3% higher impedance. This increase is significantly faster than all other batteries in the string - here yellow line - and with the absolute value of over 50mOhm, a clear indication that this battery has reached the end of its life.

In addition to voltage, impedance, capacity and their historical development, there is another parameter that limits the service life of a battery and thus influences the "SoH": the energy throughput.

The Energy Throughput is also described in the new EU Battery Act 2024 as a parameter for determining the SoH.

The “energy throughput” is basically an indication of the accumulated discharges over the entire lifespan of a battery, i.e. *the total amount of energy in Ah that has flowed through the battery*. Behind this lies the desire to determine how many charge/discharges cycles a battery has gone through. Depending on the type of chemistry, the SoH decreases with the number of cycles and thus indicates when a battery needs to be replaced. As already shown above, the BACS VIEWER determines the energy throughput for each discharge. If these values are accumulated, the sum results in the energy throughput of these batteries in the system.

However, this value makes little sense for UPS systems because of the small number of discharges. A UPS battery very rarely comes close to its possible number of cycles, so it hardly makes sense to bother accumulating the values. **For a UPS application, the impedance therefore has much greater information content than the energy throughput or the number of cycles.**

BACS is a “real-time” monitoring and battery management system with the aim of monitoring operational safety and warning when limit values are reached. BACS allows trends to be determined and thus a comprehensive picture of the state of the current batteries compared with older data. In addition, BACS ensures automation of battery systems and is therefore suitable for managing extremely large numbers of batteries with minimal operating personnel. For this task, the energy throughput is not very meaningful.

But this changes when it comes to “battery storage systems” in which cycling operation is the “normal” operation. Since it is hardly possible to compare the measured impedances with constant discharges/loads and loads, the number of discharges - the energy throughput - **is used as a measurement for the "SoH" and determines the battery service life.** A BACS system or other network BMS is “overqualified” for determining the “Energy Throughput”. The SMARTLOGGER -or its “housing integrated” cousin product called a “SMARTBATTERY” -- is a “black box” similar to a flight recorder that records the most important battery data and determines the energy throughput for each battery extremely inexpensively.

Image: SMARTLOGGER permanently installed in a battery of a UPS system. This means that the measured values of voltage, temperature and discharges are recorded for up to 10 years and the energy throughput is determined. If this SMARTLOGGER has reached the number of discharges or energy throughput for this battery type, then this also applies to the other batteries in the same battery string. In addition, the SMARTLOGGER indicates if limit values for these batteries have been violated and damage may have occurred that could lead to a loss of warranty. => Every battery system with more than one battery in the string should have at least one SMARTLOGGER permanently installed, also in order to meet the EU requirements by 2024.

New current sensors - Generation 5

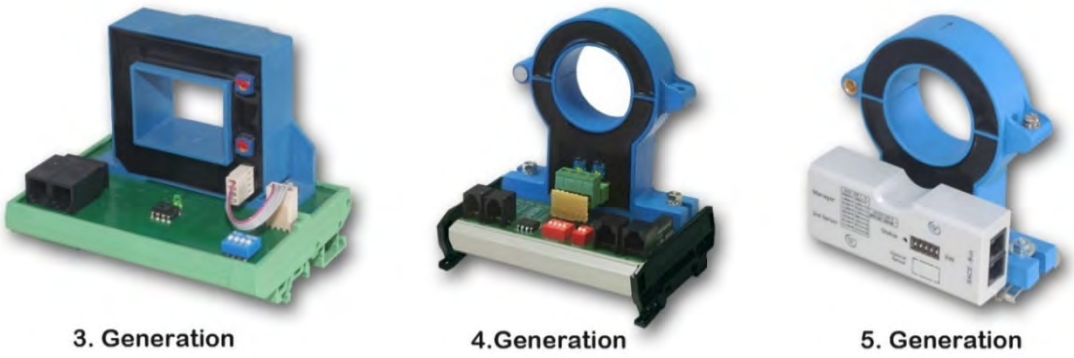
- **AC/alternating current ripple measurement**
- **Higher precision n Up to 8cm diameter of the Hall transducer**
- **DIN rail mounting and flexible mounting**
- **Differential current measurement**

Current sensors play a central role in battery management systems (BMS), contributing significantly to increased operational safety and in the collection of data to calculate the SOH and SOC. They record the current flow of the battery, both direct current (DC) and alternating current (AC). Additionally, these measurements are used for:

1. Error detection: Current sensors can detect anomalies in current flow that indicate battery failures, unbalanced strings, UPS or charger problems, and aging processes.

2. Capacity measurement: Current sensors enable precise measurement of battery capacity by balancing “withdrawals” and “loading”. The measured values are summed up and the full charge status can be determined precisely using battery balancing. This means that the user is shown a significantly more precise autonomy time or battery capacity than the UPS could provide, and thus the security that his UPS can actually achieve the desired autonomy time.

3. Safety shutdown (optional): In critical situations, such as a short circuit or thermal runaway, BACS can detect this based on the current sensor readings and automatically switch off the battery, thus preventing a fire.



Picture from left to right: Generation 3, 4 and 5 current sensors. While the 3rd generation of sensors still had a closed ring through which power cables had to be pulled before crimping, the ring of Generation 4 (middle picture) could already be opened and so that it can be installed later. Like the 4th generation, Generation 5 is available for DIN rail mounting and as a flexible, free-hanging version.

More precise measurements of the 5th generation

The new 5th generation BACS current sensors measure more precisely than all their predecessors. In particular, the resolution in the low range (trickle charge <1A) has been significantly optimized, so that the measurement result of the battery capacity of BACS has been significantly improved.

New assembly variants

In addition, a new assembly variant is being added to the range with the 5th generation. The previous mounting variant for DIN rails is now also available in the 5th generation and bears the model identification **CSHxxxx.** The new "**F" mounting variant is a flexible variant**: The **CHSxxxF** is ideal for "hanging", free assembly in confined spaces. Live cables are often laid in such a way that a DIN rail cannot be mounted. This would mean that the CSHxxxx with a DIN rail would hang freely in the air, which is technically not a problem, but not visually appealing.
It may happen that the cables do not fit through the sensor hole if it sits horizontally or vertically on a DIN rail, or the cables are routed in such a way that there is no space for the DIN housing. This mounting problem can be solved with the CSHxxxxF by hanging the sensor like a current clamp where there is space for it.

Image: Sensor CSHxxx of generation 5 - Like its identical-looking predecessor of the 4th generation, this is mounted on a DIN rail.

*Image: Generation 5 sensor **CSHxxx/F/D**mounted with (optional) DIN rail clips.*

Image: Generation 5 CSHxxxxF/D sensor without DIN rail clips is mounted hanging freely.

Easy retrofitting

A BACS system does not need current sensors to detect a discharge if a UPS connection has been set up via the COM port or via network (SNMP RFC 1628). In these cases, the detection of whether there is a power failure or not is reported by the UPS and not via the current sensor. This makes BACS significantly cheaper than the battery monitoring systems offered by all competitors because they generally require a current sensor for detection.

However, if the customer requires battery capacity (SoC) and/or thermal runaway detection, then the current sensors MUST be retrofitted for each battery string.

This is very easy to implement with all CS sensors with the "H" in the name. All CSH sensors are foldable - this folding technology allows the sensors to be retrofitted at any time without interruption. This represents a significant simplification compared to the Generation 3 CS sensors, where the power cables still had to be pulled completely through the rigid ring. However, the measurement accuracy was

somewhat more precise with this closed version. To counteract this situation, we have developed Generation 5, which now achieves even more precise measurement results than those of the closed sensor of Generation 3.

Larger diameter up to 8cm

The CSHxxxxF is now also available in a version with a larger transducer diameter: All versions of the CSxxxx and CSHxxxx current sensors were previously available with a maximum diameter of 40mm. This ring diameter is sufficient for all common power cables in the EU, although cable diameters that are even thicker than 4cm can sometimes be found in power plants in the USA and Asia. We now offer a special version of the current sensor with an 8cm diameter:

The **CSHxxxxF8** type is available as a 1000A sensor and is available for cables with a diameter of up to 80mm.

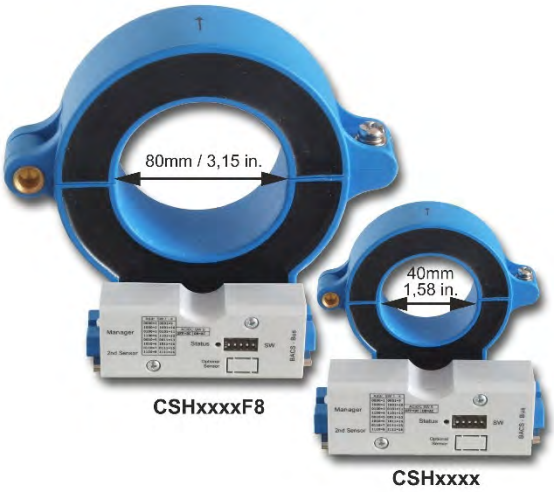


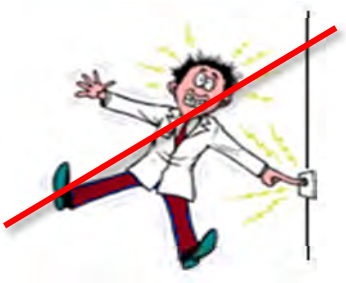
Image: CSH1000F8 with transducer for cables up to 80mm diameter

"Dual Use" - for both BACS as well as for SENSOR MANAGER

All sensors of the 4th and 5th generation can be used either for the SENSORMANAGER or for BACS. For BACS, the RJ10 BACS bus sockets are used on the right side, while the RJ12 sockets are used on the left side for the SENSORMANAGER.

Differential current input

All 5th generation sensors have an additional input through which it is possible to connect the CSHxxxxD differential current sensor in order to detect any leaks between the DC input and DC output.



Differential currents should not occur in DC systems as there is a potential risk of getting an electric shock if touched, as the currents use other paths. This problem should be identified and corrected without exception to avoid injury, personal injury or even fatal accidents.

Generally, live parts in electrical devices are protected by personal protection or residual current circuit breakers, but this does not apply to UPS systems! Due to the system, no residual current switch is used there, so a "leak" can certainly lead to personal injury. The usual "workarounds" using an insulated battery rack etc. ensure safety, but do not rule out leakage current. In order to avoid personal injury and property damage, it is important to recognize these. Furthermore, residual currents are harmful to batteries, endanger the UPS technology and can lead to a fire. For this reason, the use of differential current sensors is required in many tenders in the USA and by the US authority NERC.

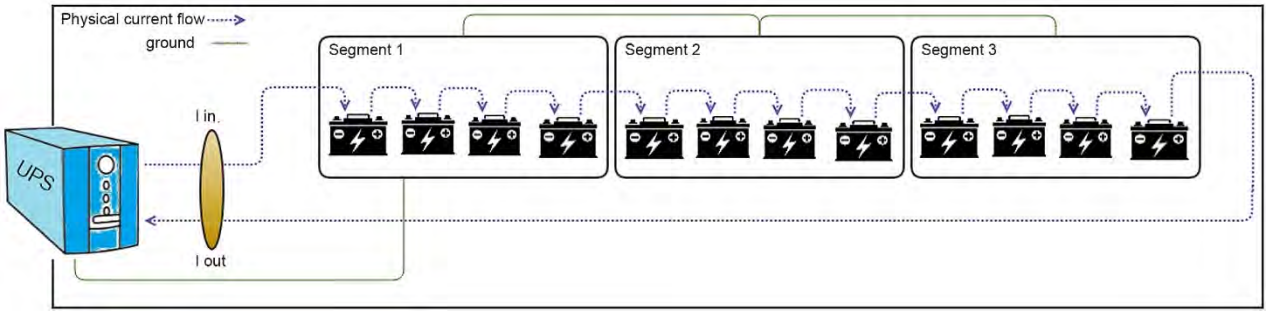
The new current sensor CSHxxxF can be used with the help of the CSHxxxD to detect and measure residual currents.

For this purpose, the CSHxxxF is installed in the positive line of the DC bank and the CSHxxxD in the negative line. A communication cable is laid between the two sensors as in the picture:

As soon as a difference between input (CSHxxxF) and output (CSHxxxD) is detected, the BACS web manager sounds the alarm and warns of the potentially life-threatening situation on site.

In addition, the differential current sensor provides valuable information about the quality of the current flow and indicates that losses are occurring in a monitored segment, which have a negative impact on the performance of the entire system and pose a fire risk.

Image: CSH1000D (left) with connecting cable to CSH1000F (right)



Functional principle of a differential current sensor:
"What goes in must come out again": Both sensors are connected to a daisy chain and then connected to a BACS WEBMANAGER. The WEBMANAGER can use the available measurement data to immediately decide whether there is a ground fault or similar deviations and trigger an alarm according to its configuration.

NERC North American Electrical Reliability Corp.

The NERC PRC-005 Standard for Battery Service Engineers

Clearing up common questions regarding the NERC PRC-005 Standard, and why BACS makes the life of a Battery Technician *easier* while also *reducing* the overhead costs of the end-user*!*

As a nonprofit regulatory corporation based out of Atlanta, Georgia, the North American Electrical Reliability Corporation (NERC) has provided the framework for maintenance standards used in the electrical utility industry and has been a driving force for the **"Automated Battery Management and Maintenance"** fields. NERC is the quintessential Standardization Institute in North America, and most the standards passed on their behalf have found their way into the European Standards by way of parallels like DIN, IEC Norms. In Europe, Battery Management as an independent concept in relation to Battery Monitoring is still relatively new and not as mature as in North America – the assumption can well be made that what happens on one side of the Atlantic will eventually happen on the other.

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RELIABILITY CORPORATION

The Utility-specific standard (PRC-005-6) establishes the varying requirements for maintenance activities and intervals that result in an on-site visit. The specific maintenance activities stipulated are based on whether the battery accords to a Vented Lead Acid (VLA) or Valve Regulated Lead Acid (VRLA) design.

The following are the maintenance activities which a given battery technician would be expected to perform according to this standard:

- Verify DC Supply Voltage and Float Voltage
- Verify Battery terminal connection resistance
- Verify Battery Intercell Connection resistance
- Measure internal Ohmic Values and Cell conditions
- Inspect for unintentional grounds and the physical condition of the battery rack
- Verify Battery Continuity
- Inspect Electrolyte level

That's an honest bit of work! Especially if the technician is expected to perform such measurements and tests "by hand", individually, with each battery within the given system! Endusers and service engineers alike generally seek ways in which the overall effort / cost / time required can be reduced; this search is illuminated by the further NERC stipulation that **no such periodic maintenance activities are required if State of Health (SOH) monitoring and alarm systems are utilized!**

This stipulation on behalf of NERC is dramatic in that it further supports the broader usage case for BMS systems like our own BACS Battery Management System, which already has an established reputation for extending and protecting the value of a client's battery system investment. That such a BMS can in parallel reduce the overall maintenance requirement for such a given system through this NERC stipulation only further hammers home the logical argument.

Although the use of a BMS can reduce the Battery Service maintenance costs dramatically, there nonetheless remain minimum standards for regular maintenance intervals ranging from four, six, and eighteen months, depending on the Battery Type, regardless whether a BMS is in use.

Table 1-4(a)
Component Type – Protection System Station dc Supply Using Vented Lead-Acid (VLA) Batteries Excluding distributed UFLS and distributed UVLS (see Table 3)

Protection System Station dc supply used only for non-BES interrupting devices for RAS, non-distributed UFLS systems, or non-distributed UVLS systems is excluded (see Table 1-4(e)).

Component Attributes	Maximum Maintenance Interval	Maintenance Activities
Protection System Station dc supply using Vented Lead-Acid (VLA) batteries not having monitoring attributes of Table 1-4(f).	4 Calendar Months	**Verify:** • Station dc supply voltage **Inspect:** • Electrolyte level • For unintentional grounds
	18 Calendar Months	**Verify:** • Float voltage of battery charger • Battery continuity • Battery terminal connection resistance • Battery intercell or unit-to-unit connection resistance **Inspect:** • Cell condition of all individual battery cells where cells are visible – or measure battery cell/unit internal ohmic values where the cells are not visible • Physical condition of battery rack
	18 Calendar Months -or- 6 Calendar Years	Verify that the station battery can perform as manufactured by evaluating cell/unit measurements indicative of battery performance (e.g. internal ohmic values or float current) against the station battery baseline. -or- Verify that the station battery can perform as manufactured by conducting a performance or modified performance capacity test of the entire battery bank.

Table 1-4(b) Component Type – Protection System Station dc Supply Using Valve-Regulated Lead-Acid (VRLA) Batteries Excluding distributed UFLS and distributed UVLS (see Table 3) Protection System Station dc supply used only for non-BES interrupting devices for RAS, non-distributed UFLS systems, or non-distributed UVLS systems is excluded (see Table 1-4(e)).		
Component Attributes	**Maximum Maintenance Interval**	**Maintenane Activities**
Protection System Station dc supply with Valve Regulated Lead-Acid (VRLA) batteries not having monitoring attributes of Table 1-4(f).	4 Calendar Months	**Verify:** • Station dc supply voltage **Inspect:** • For unintentional grounds
	6 Calendar Months	**Inspect:** • Condition of all individual units by measuring battery cell/unit internal ohmic values.
	18 Calendar Months	**Verify:** • Float voltage of battery charger • Battery continuity • Battery terminal connection resistance • Battery intercell or unit-to-unit connection resistance **Inspect:** • Physical condition of battery rack

As you can read from the list above, most maintenance items are relatively straightforward. Still, some maintenance items, such as Battery Continuity and Battery terminal/Intercell connection resistance, have come into question. **Therefore, in October 2015, NERC also released a Supplementary Reference and FAQ document (NERC) which helps clear up any confusion the user may have on these items. Let's unpack some of those items:**

Battery Continuity

This maintenance item must be performed every 18 months. The purpose therein is to identify potential breaks in connection along the battery's current path which could potentially result in or cause critical power loss. As such, a given BMS is required to provide a method of measuring the battery continuity of the string. Some methods prescribed in the supplementary reference include: measuring float current on the battery string, discharge testing, and measuring the internal ohmic values of the jars or cells.

Most BMS products in the marketplace today have some variation of ohmic value measurements; generally speaking, the BMS provides for such a measurement on a daily schedule, putting the user in NERC compliance for this maintenance item. The NERC Supplementary Reference states, *"Internal ohmic measurements of the cells and units of lead-acid batteries (valve-regulated lead-acid (VRLA) & vented lead-acid (VLA)) can detect lack of continuity within the cells of a battery string; and when used in conjunction with resistance measurements of the battery's external connections, can prove continuity. Also some methods of taking internal ohmic measurements, by their very nature, can prove the continuity of a battery string without having to use the results of resistance measurements of the external connections. (pg. 80)"*

Generally speaking, we at GENEREX agree only partially with this stipulation, since most BMS provide an ohmic value without respect or relation to the measured voltage – which leads to misinterpretations at best, and the masquerading of failures at worst. When measuring impedance

on an overcharged block without also comparing a “baseline” voltage across multiple blocks, the impedance otherwise appears “normal”; in active comparison to adjacent batteries under an equalized/harmonized base voltage, the individual impedance of the overcharged block shows a clear difference and can thus be considered accurately. **BACS, as a provider of such balancing/harmonization of individual unit voltages, provides this key framework.**

Terminal/Intercell Connection Resistance

Used to ensure that there aren’t any loose connections between the jars or cells, this maintenance item also needs to be performed at least once every 18 months. A loose connection can cause excessive heating during a discharge or voltage drop, disrupting the battery’s continuity.

Some BMS manufacturers measure the intercell as an individual reading or as a part of the battery ohmic value. In any case, it’s been disputed whether or not the user must display a separate intercell value to comply with NERC. According to the NERC Supplementary Reference: *“There are test methods presently that can read post-termination resistances and resistance values between external posts. There are also test methods presently available that take a combination reading of the post-termination connection resistance plus the intercell resistance value plus the post-termination connection resistance value. Either of the two methods, or any other method, that can show if the adequacy of connections at the battery posts is acceptable. (pg. 83)”.*

Bringing the point home: BACS is a ready-made NERC Solution

As such and based upon both the NERC standard itself as well as the additional Supplementary Reference, The BACS Battery Management System is the ideal for any stationary battery system! As the quintessential Management system – as opposed to the more common and far less comprehensive “Monitoring Only” BMS found elsewhere on the marketplace – BACS provides for continuous state of health monitoring and management of your batteries. Most importantly, BACS battery management system boasts the required metrics and reporting functionality to keep the user within NERC compliance.

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NERC Maintenance Item	BACS
Verify DC Supply Voltage	✓
Inspect Electrolyte level (2)	**Only Wet cells**
Inspect for unintentional grounds	✓
Verify Float Voltage	✓
Verify Battery terminal connection resistance	✓
Verify Battery Intercell Connection resistance	✓
Measure internal Ohmic Values	✓
Inspect Cell Condition (1)	✓
Inspect the physical condition of the battery rack (2)	

(1): This is for VLA, but NERC states this is accomplished by measuring Internal Ohmic values
(2): Requires on-site visit

Fundamentally, a BMS system which meets all of the stipulated requirements makes the user's job a lot easier; what's more, by providing the framework for a "passive compliance" to the bulk of NERC standards and preventing the need for frequent, tedious site visits and maintenance appointments, use of a BMS such as BACS also results in an overall dramatic reduction in operating costs!

Once again, BACS rises head and shoulders above any other competing BMS system on the planet. Whether protecting your battery investment, extending your battery asset usage duration, or preventing any number of additional overhead costs such as maintenance and "hands-on" monitoring, BACS is the quintessential definition of a "sound investment"!

References:

- NERC PRC-005-6
- NERC Supplementary Reference and FAQ

Halogen-free cables

Halogen-free cables are standard at BACS – why is this important?

The European Union actively promotes the use of halogen-free cables and wires for safety **and environmental reasons!**

In the last newsletter we talked about halogen-free cables from BACS and focused on the issue of safety.

Link Newsletter 2023: [BACS BC 5 flexible Halogen-free measuring cable | Generex]

The reason for using “simple” cables containing halogen is low production costs. However, in addition to the “fire retardancy” argument, they also neglect important other aspects:

Cables and components containing halogen react in the event of a fire, creating a highly toxic and corrosive atmosphere. In addition, due to the corrosive nature of halogens such as fluorine, bromine or chlorine, technical equipment can fail due to corrosion even months after the fire has been successfully fought, even though they were never directly affected by the fire. To minimize this direct and indirect damage potential in the event of a fire, most professional users explicitly require halogen-free cables for their applications.

BACS is used almost exclusively in industry, the military or by other professional users where “operational safety” is a priority. In addition, it is rather rare that a BMS is actively observed. In practice, only automatically generated alarm messages are given the necessary attention. However, when these alarms are thermal, there is little time to prevent a fire. Therefore, anything that can prevent a fire is IMPORTANT for the user!

A flame-retardant, halogen-free cable provides more time for a reaction to thermal problems. Many end users of battery monitoring systems are now reacting based on negative experiences that showed them that a BMS does not necessarily protect against fire. As a matter of principle, they demand halogen-free cables in their tenders, regardless of the fact that this makes a BMS significantly more expensive.

Picture:
Halogen-free cable for BACS C modules for more safety and improved environmental performance

But it's not just fire protection reasons that speak for halogen-free cables - the environment is also less polluted.

The disposal of cables containing halogen **is up to ten times more expensive than the disposal of halogen-free cables**, as they have to be treated separately in order to protect the environment from toxic substances, because the substances deliberately used as fire retardants in production, such as chlorine, bromine or fluorine, cannot be used for obvious reasons conventional incineration plants and are still disposed of in landfills.

In summary, the price advantage offered by purchasing halogen-containing cables is eliminated as soon as you compare the subsequent recycling costs or even a fire with indirect damage.

In addition: The WEEE Directive (2012/19/EU), the Battery Directive (2006/66/EC) and the Packaging Regulation (94/62/EC), as well as many national laws in other countries outside the EU, require the user to pay disposal costs to be taken into consideration when purchasing**. => Halogen-free cables are slightly more expensive to purchase, but ultimately cheaper during operation, maintenance and disposal than the inexpensive halogen-containing alternatives.**

We care about the environment and whenever possible we want to use more environmentally friendly materials when they are available.

With the standardization at GENEREX on halogen-free measurement and data cables since 2014, we are raising the bar for the physical operational safety of BMS systems. **With BACS, our aim is to deliver both the safest battery management system for the market for stationary applications - BUT also the system with the lowest ecological footprint!**

BACS Velcro fasteners on PP battery cases

Fixing the sticking problems with batteries using polypropylene and flame-retardant plastics

Bonding PP and ABS surfaces: What you need to pay attention to --

Polypropylene (PP) and acrylonitrile butadiene styrene (ABS) are two of the most widely used industrial plastics. They are found in a variety of applications, from the automotive industry to household appliances to many manufacturers' battery products. Although PP and ABS have many similarities, in addition to the cheaper price of PP, there are also some important chemical differences that cause adhesion problems between BACS and the battery housing.

Surface energy differences between PP and ABs

One of the most significant differences is the surface energy. Surface energy is a measure of how well a material is wetted by another material. The higher the surface energy, the better the wetting - and thus the adhesive properties.

PP has a low surface energy while ABS has a high surface energy. Surface energy plays a key role in bonding because it influences the wetting of the substrate by the adhesive. Wetting is the process by which the adhesive spreads across the surface of the substrate. Good wetting is important to ensure a strong and lasting bond. This means that adhesives designed for ABS will not adhere well to PP surfaces, and vice versa.

To achieve a permanent bond between PP and ABS surfaces, it is important to use an adhesive specifically designed for use with the respective materials.

Which adhesive pads are delivered as standard with BACS?

The BACS module housing is made of flame-retardant ABS plastic, the same material as the housings of most batteries on the market. The Velcro tape for positioning the BACS module uses an adhesive that is “safe” and does not pose a risk to the surface to which it is stuck (no solvent, which could potentially remove the plasticizer from plastics and risk damaging the battery case). The adhesive and Velcro combination that BACS uses as standard is the 3M Type 3550 with “DUAL LOCK” and has been used millions of times on all types of battery cases worldwide for more than 15 years.

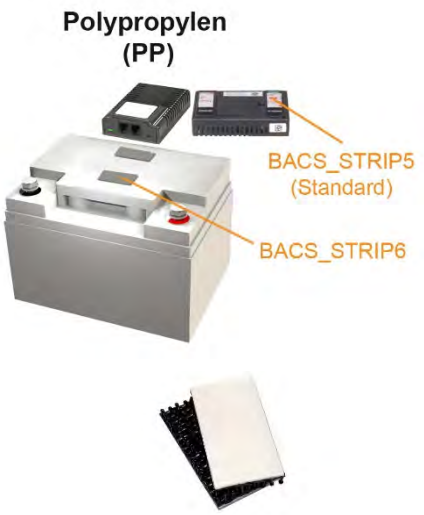
Since most batteries on the market are made of ABS plastic, an ABS adhesive pad is attached to the battery side as standard on every BACS module.

Customers for whom our ABS adhesive pads do not stick to the batteries often unknowingly use batteries whose housings are based on PP, which means that the 3M3550 pads cannot develop the usual adhesive strength on this material. The stiffness of the measuring cables (because they are halogen-free), which is often assumed to be the cause, is not the problem. It is not the stiffness of the halogen-free measuring cable that causes the modules to detach, but rather the plastic used in the battery housings!

The adhesive supplied with the BACS modules is developed for ABS plastics and therefore only sticks to PP polypropylene if it has a “smooth” surface. On smooth surfaces, the ABS adhesive also sticks perfectly to PP, as the adhesion forces of the smooth surface (e.g. Plexiglas as is common in wet rooms) can compensate for the deficit in the adhesive effect. This is not the case with the polypropylene plastics for VRLA batteries. Here the PP surface is “rough”, which means that the adhesive pads of the BACS modules, which initially seemed to stick well, later detach from the batteries as soon as the adhesion forces weaken due to the adhesive drying out due to the rough and therefore air-permeable surface of the battery, and the adhesive strength is then not sufficient.

Replacing it with new stickers specifically for PP - offered as a spare part under the order number "BACS_STRIP6" - solves the problem - permanently.

Picture: Original BACS Velcro strips for ABS - standard adhesive supplied with every BACS module.



Picture: BACS_STRIP6 Self-adhesive Velcro strips for BACS modules V3 on polypropylene battery housings. Velcro type is 3M “DUAL LOCK” is compatible with BACS_STRIP5 on the BACS module housing.

“BACS _STRIP6” for battery housing made of polypropylene (PP)

These alternative Velcro strips for use on PP materials are offered as a spare part (20 pieces per pack). These are already tailored for BACS modules and are compatible with the “Dual Lock”, the ABS side located on the BACS module. Now the battery adhesive side with the BACS_STRIP 6 offers significantly more adhesion of the adhesive on polypropylene surfaces. The original BACS_STRIP 5 remains on the ABS side of the BACS modules and ensures a perfect combination using the “Dual Lock”. The adhesive for BACS_STRIP 6 also comes from the manufacturer 3M and has the article name 3M3540.

SMARTBATTERY / SMARTLOGGER

European patent EP 18726032.8

GENEREX managed to obtain a patent again in 2024. Under the EU patent number 18726032.8 with the title “Method and device for battery management and battery with integrated device for battery management”, GENEREX has the sole right to manufacture, distribute or license products with this function within the EU.

The function described in this patent is used by the "SMARTLOGGER" or the version integrated in the battery, which is then called "SMARTBATTERY". It is currently the only system on the EU market that can store battery data for life without contact using NFC (Near Field Communication) and meets the rules for an “EU Battery Passport”.

The new EU battery law will increase the requirements for the battery industry and battery users from 2024

Many manufacturers have been aware for a long time that a new EU regulation for batteries would come, but in many places, they ignored it or perhaps held onto the hope that it would be overturned after all. Superficially, the new EU law is aimed primarily at electromobility, whose batteries are mostly based on lithium and are therefore viewed with skepticism: the true origin of such drive batteries is sometimes not always clear when imported, and the user is required to provide information about them to provide information required by the EU.
However, the new EU Battery Regulation 2024 has far-reaching consequences for all providers in this industry, not only for environmental reasons but also for safety reasons: Numerous optimizations within battery chemistry now allow high energy densities, although often at the limits of technology.

The following applies to batteries: the higher the energy density per battery, the lower the permissible tolerances for fluctuations in operation!

This may not be as critical for lead-based batteries, where BACS and SMARTLOGGER are mainly used, since the energy density is not as high as with lithium-based batteries. But the requirements of the Battery Ordinance are binding here too: From 2024, providers of battery-supported systems will be obliged to ensure that production, storage and transport conditions are adhered to before a battery is sent to the customer. By 2026, there will also be complete proof up to disposal in order to prevent damaged or defective batteries from being “secretly” put into circulation. **This monitoring - "from the cradle to the grave" -** is required in particular by the EU regulation from 2024 and is to be attached to every battery placed on the market in the EU in a "battery passport" that can be read electronically. **SMARTLOGGER and SMARTBATTERY already offer a solution for these new requirements for the battery industry.**

New requirements for the battery industry

The “SMARTLOGGER” is the heart of a “SMARTBATTERY” and is installed at the factory. The SMARTLOGGER is also available as a licensed and patented technology for battery manufacturers and battery importers with their own battery series with enough space for the electronics. It can be used for all lead, NiCd and lithium-based batteries and meets the new EU regulations.

(Please also read our article “EU Regulation on Batteries” in this newsletter)

The SMARTBATTERY technology is activated in the first hours of production at the factory or from initialization at the customer's site and writes its data into a specially protected and non-erasable memory. This means that the vital functions (voltage, temperature) of a battery are recorded at configurable intervals during the production process, making the entire production and delivery process, as well as storage and transport conditions before and after sale, transparent. This and all subsequent data remain available for the life of the battery.

Since the SMARTBATTERY cannot be reset or manipulated by design, the measurement data is an incorruptible witness to the use and treatment of the battery and is therefore invaluable with regard to warranty disputes!

The use of SMARTBATTERY enables the battery manufacturer to offer increased operational guarantees and reliability, as its own quality is constantly monitored and documented. **Simply because the performance can be verified by the user, a SMARTBATTERY is demonstrably better than any other battery without such technology - and therefore of higher quality and safer !**

The SMARTBATTERY is compatible with almost all current battery chemistries and provides the manufacturer with otherwise missing insight into production, storage and transport. It can be categorically proven that a battery has not suffered any hidden damage during production, transport or storage due to improper handling and this for a period of up to 10 years. Additionally, since each battery contains a unique and tamper-proof serial number, battery providers can collect supply chain information to demonstrate compliance with EU and national safety guidelines for transport, installation and recycling. At the end of its use life, the stored data can be used to prove that the battery was disposed of properly.

=> The “passport” of a battery is the SMARTLOGGER

Optionally, a SMARTBATTERY can also have an installation slot for expansion cards, for example to use an “iBACS” system (“Integrated BACS”) or other BMS from other providers and transfer the recorded measurement data.

If the SMARTBATTERY interface is equipped with “iBACS”, data collection and archiving continue in parallel, but the “iBACS” module also serves data.

GENEREX opens the patented SMARTLOGGER technology to all BMS providers, giving battery manufacturers the opportunity to use more than just GENEREX “iBACS” for their SMARTBATTERY models.

The new EU requirements for the battery industry also result in new opportunities for battery service technicians!

Picture: SMARTBATTERY (in blue) with integrated SMARTLOGGER, high-voltage fuses and interface (an 8-pin connector) to the “iBACS” BACS module for optional insertion into the SMARTBATTERY.

New opportunity for battery service

With the SMARTBATTERY and SMARTLOGGER, GENEREX introduced a flexible and modular battery monitoring solution that allows technicians not only to track the general battery condition, but also to directly check the actual condition of the battery during on-site installation.

The SMARTBATTERY and SMARTLOGGER allow the technician to directly measure the capacity of batteries at the same time without complex measurement setups. Every battery that has been equipped with SMARTBATTERY technology can be read within a few seconds via the “SMARTBATTERY Companion APP” via NFC and is evaluated and graphically prepared in an EXCEL file.

Picture: SMARTLOGGER with FASTON 6.3mm (also available with ring cable lugs in various sizes and lengths) andSMART LOGGERwith “crocodile clips” for battery service technicians to record data during a capacity test of UPS batteries.

The SMARTBATTERY COMPANION APP in the Google Playstore immediately provides all important information about the operating and health status. To do this, the batteries to be monitored must either already be “SMART”, i.e. already have the SMARTLOGGER installed - or be retrofitted with a SMARTLOGGER.

Difference to SMARTBATTERY:

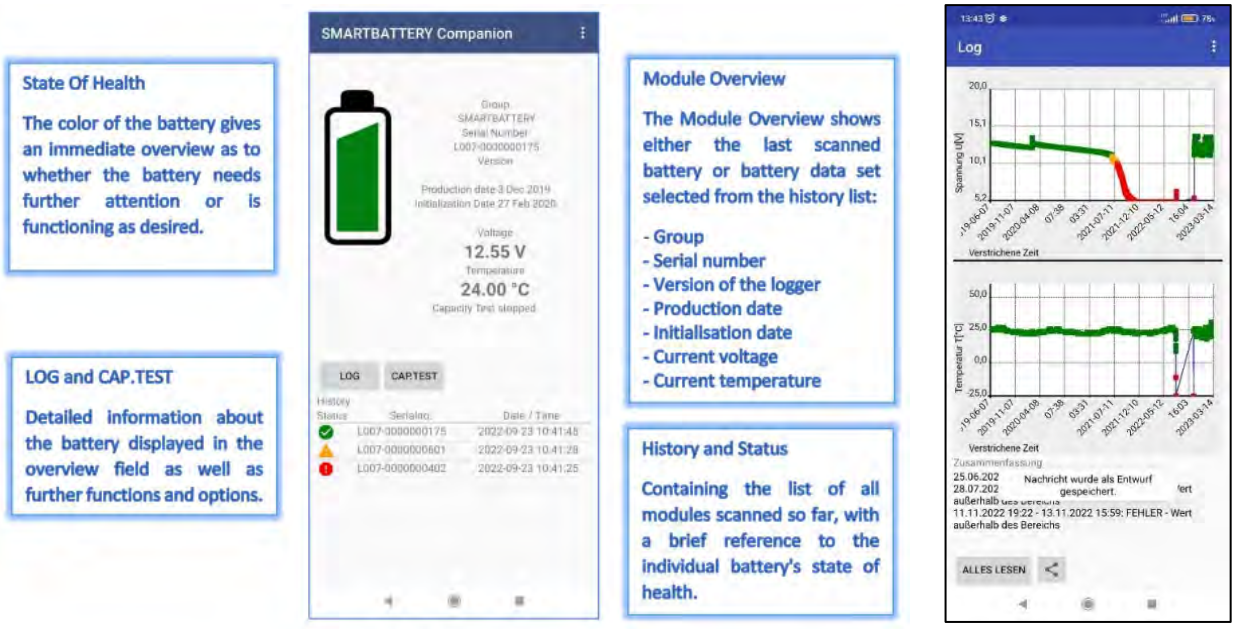
The SMARTLOGGER is functionally identical to the SMARTBATTERY but is intended for retrofitting AND/OR for the battery service technician as a “tool” for battery tests.

- The SMARTLOGGER does not have an interface for an iBACS module, in order to then expand this to a BACS system
  - In contrast to the SMARTBATTERY, the SMARTLOGGER can be “reset” by the technician (not the serial number and ID), so it is not “married” to the battery for life when it is first used, but can be used again on a different battery at any time. This makes the SMARTLOGGER a “tool” and is ideal for a battery capacity test or for temporary monitoring of installations. Note: Resetting a SMARTLOGGER to use it for a new measurement on other batteries is reserved for the battery service technician with a special version of the SMARTBATTERY COMPANION APP and can only be used on non-hardened versions of the SMARTLOGGER. For this type of application, we offer the SMARTLOGGER with "crocodile clips" - as opposed to ring terminals, which are used for permanent installation and cannot be reset. **For this type of application, we offer the SMARTLOGGER with “crocodile clips” – in contrast to ring cable lugs, which are used for permanent mounting and therefore can not accept a RESET.**

In this way, a service technician can measure and document battery systems on site much more accurately with significantly less effort. After all data has been “collected”, the SMARTLOGGER is reset to the delivery state using an APP command and is ready for use by the next customer.

NEW: SMARTBATTERY Companion App 3.0

Evaluation of the SMARTBATTERY and SMARTLOGGER



Since SMART technology is part of the battery, the SMARTLOGGER continuously stores operating data for the respective battery and provides all the necessary data via NFC in order to be able to make a statement about the need for action. The storage capacity is up to 10 years.

The current battery data and recordings are transferred and evaluated directly to any Android phone or NFC reader via the SMARTBATTERY COMPANION APP and an NFC interface.

SMARTBATTERY technology offers significant cost advantages over a traditional BMS with the limitation that the data must be retrieved by the technician using NFC and is not available in the network without using the interface.

Capacity test

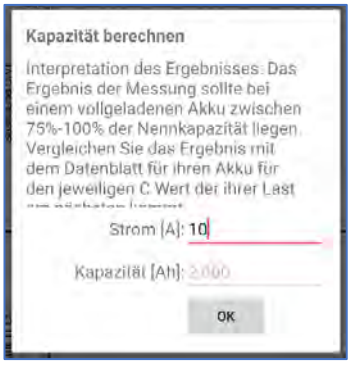
The capacity test can be used to calculate what capacity could be removed from the battery after a discharge.

Function of capacity test:

Simply connect the SMARTLOGGER to the battery and click “START” in the app to test the capacity. It can be configured at which voltage a “discharge” should automatically be recognized (START Voltage) and when the discharge should be considered ended (End Voltage). You can also configure the voltage at which the full charge state is reached again (Full Charge Volt) and the sampling rate at which this is recorded (60, 30, 10, 1 second). The “Lithium BMS Mode” takes into account the special features of lithium-based batteries whose internal BMS temporarily switches off the battery (if the load is too high/low, temperature problems, etc.)

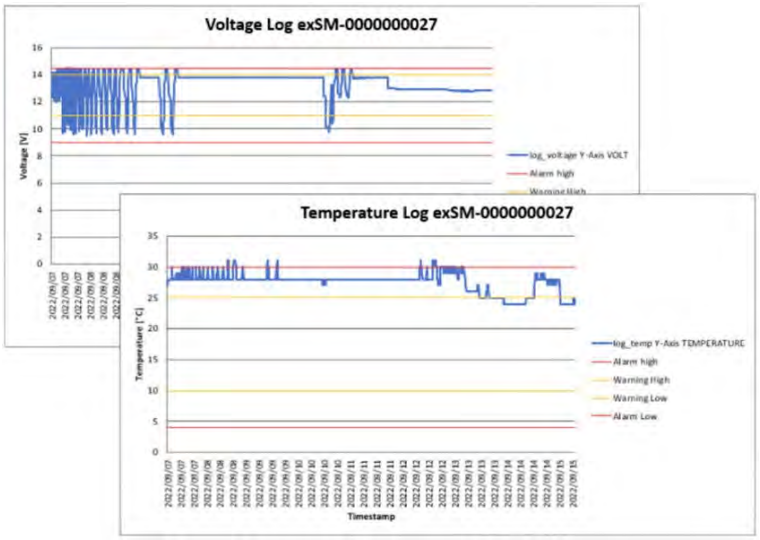
When the set limits are reached, the SMARTLOGGER / SMARTBATTERY will increase the recording frequency and discharge recording begins. After the end of the discharge, the APP calculates the capacity drawn in Ah from the beginning to the end of the discharge.

For further analysis, the battery data can be exported in a file from your mobile phone using standard technologies such as email or messenger services.



Pictures: After the capacity test has been successfully carried out, the results can be displayed and the available capacity can then be determined using the measuring points using the app.

Battery data automatically prepared for your battery report to the customer



The battery data can be downloaded using “SMARTBATTERY EXPORTER” – a freely available Windows program from the GENEREX website (SMARTBATTERY | Generex) in an EXCEL file can be converted

NEW: A new service will be available from mid-2024 that will automate this conversion and send the file back within minutes in converted form, as shown in the example on the right.

The voltage and temperature curve with the set limit values is displayed in this EXCEL graphic and allows deep discharges or other limit value violations to be easily identified over the entire lifespan of the battery.

The Black box &Fitness Tracker Combo: With the SMARTBATTERY you can record the path of a battery from the factory “from the cradle to the grave” and meet the upcoming EU guidelines for the traceability of problematic substances.

What else have we improved with SMARTBATTERY Companion APP 3.0?

1. Name change "SMARTBATTERY Companion": The name of the APP has been changed - in addition, the APP can now also be found under this name in the GOOGLE Playstore under the search terms "iBACS", "SMARTBATTERY" and "SMARTLOGGER" or simply "GENEREX"
2. The welcome screen now shows that this APP complies with the EU directive for a BatteryPassport. Whether this function is "activated" or not depends on the version of the SMARTLOGGER, the version with "crocodile clips" for the battery service technician has not activated the passport.
3. "LOG" function has been improved to be able to process very large data packets >200k/>10 years. The LOGRATE setting can now be changed individually. In addition, the basic LOGFILE is now always retrieved immediately when a battery is read in.

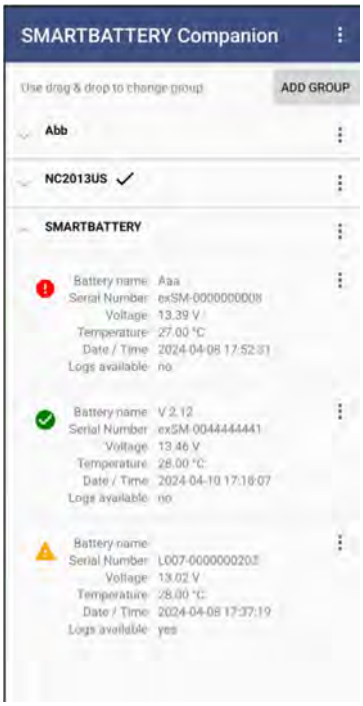
4. From 2025 a new SMARTBATTERY EXPORTER from the GENEREX website converts all data into Microsoft EXCEL compatible data and automatically generates EXCEL graphics that can be used directly in a service report. The SHARE button can now be used to send individual batteries as well as the entire group.

5. BATTERY GROUPS: The "ADD GROUP" function creates a separate battery group for each customer, in which all measurement results can be collected or moved to other groups using drag'n'drop. This makes it possible to manage larger battery systems for different customers on a cell phone using the Android phone - until the data has been exported and processed in battery reports. Sorting has also been improved. STANDARD GROUPS can now be created in which all newly scanned batteries are automatically inserted. The last battery read in is highlighted and deletion can now be carried out individually or in groups.

6. Individual battery threshold values: The user can now define their own threshold values from which the "battery" display should change from green to orange/red.

7. Individual battery names: From HW 2.12, each battery can be given an individual name and the number of discharge cycles is displayed

8. Acoustic read/write confirmation: An acoustic signal is now emitted during the read process to indicate whether it was successful or needs to be repeated. The error message on the display no longer has to be read first, the sound already indicates whether it was successful or not.



SMARTLOGGER / SMARTBATTERY
EU Patented EP18726032.8

The first patent-protected battery passport according to EU BattG 2024

The GENEREX SMARTLOGGER / SMARTBATTERY has received the protection of a Europe-wide patent just in time for the new EU BattG 2024. It carries the **EU patent number EP 18726032.8 and fulfills the functional as well as content and data protection regulations set out in the EU BattG 2024.**

The patented SMARTLOGGER (or, alternatively, the part of the electronics that can be integrated into a battery, which then bears the name SMARTBATTERY) can be retrofitted to all existing 12V batteries in order to meet the EU requirement for measurement data.

Europäisches Patentamt
European Patent Office
Office européen des brevets

The SMARTLOGGER / SMARTBATTERY is the first patented “battery passport” in accordance with the EU BattG 2024, valid in 25 EU countries.

The idea behind the SMARTBATTERY and SMARTLOGGER patents came up shortly after the 2016 Battery Regulation, when it was clear that there would be another revision and that things would become more stringent. It was clear to us that both importers/manufacturers/distributors as well as end customers have an interest in the “life path” each battery has undergone from “birth” to “grave” and whether hidden damage is to be expected. Because batteries of the same design are manufactured in different factories around the world, it is also important to document when and where the first delivery took place and when the last battery recharge took place. Natural self-discharge is not insignificant, especially with lead batteries made from the cheapest type of chemistry (lead calcium). This information is important before delivery to the end customer. Furthermore, for the first time, causes of a battery failure can be subsequently identified, for example in order to be able to reject or grant a warranty claim. The measured values recorded over 10 years in the SMARTLOGGER / SMARTBATTERY quickly reveal whether batteries are defective and need to be disposed of - with appropriate proof of correct disposal and what remaining service life can be expected.

Picture: The SMARTLOGGER opened with connection for external NFC antenna - as a fully-fledged offline BMS via NFC, it provides a comprehensive picture of the use of the battery since the date of production or picking and thus meets both the requirements of the EU BattG 2024 and the GDPR (Data protection). All you need is the SMARTLOGGER Companion app, which is available to download free of charge from the Google Play Store.

The SMARTLOGGER/SMARTBATTERY is the only device on the market with this “battery passport” function that has several unique technical features recognized by the European Patent Office as being worth protecting, based on its unique “dual use“ case: **Battery pass and battery monitoring!**

With the SMARTLOGGER / SMARTBATTERY, the EU requirement for a battery passport is met; at the same time, both also function as efficient and inexpensive battery monitoring.

The battery manufacturer also benefits from the data from the system to optimize and control its products over their entire service life - this provides important data for quality assurance and the user's use of their product in accordance with the guarantee.

The SMARTLOGGER / SMARTBATTERY is a "black box" (similar to a flight recorder in aviation) that archives all battery data from production to disposal in a long-term data storage and at the same time provides the user / battery service with important data for assessing battery health (SOH) and capacity (SOC) delivers. The device therefore complies with the far-reaching EU battery regulations for long-term data storage as well as the GDPR and exceeds the functions required by the EU for a “battery passport”, which every battery sold within the EU should carry from 2024.

The patented long-term data storage and compression as well as the anonymous data transmission via NFC (Near Field Communication), which is also used in online banking, meets the EU battery passport requirements and is now patent protected. As a battery monitoring and data logger system that can be read purely via NFC, the low-power consumption logger works discreetly in the background without interfering with any IT security structure or disrupting the operational safety of the battery or the connected consumers. Similar to a transponder, the SMARTLOGGER only “wakes up” when the NFC device approaches and then delivers the desired data from its long-term storage.

The following measurements and data are available Available with SMARTLOGGER V2:

- Date of production
- Date of commissioning by the end customer and start of the guarantee period.
- Date/time for each measured value for voltage and temperature of 12-volt batteries at intervals of (default). 1 hour, adjustable in intervals of 60s, 30s, 15s, 10s, max. measuring period 10 years.
- Adjustable temperature and voltage limits (warning and alarm)
- Definition of battery groups (e.g. management of own groups and measured values for each individual customer)
- Number of cycles to determine remaining life.
- Unique, non-deletable serial number.
- Definable unique battery names
- Text information for each battery can be freely defined by the user.
- Capacity taken in Ah in the event of a discharge.
- Free SMARTBATTERY COMPANION APP V3 for data export to EXCEL and evaluation in the Google Playstore.
- For all Android 11 or higher based devices with NFC chip
- SMARTBATTERY only: Non-deletable storage areas for proof of disposal and sustainability testing in accordance with EU BattG 2024. With the disposal information entry, logging is stopped, and changes are no longer possible.
- SMARTLOGGER only: Reactivation of a SMARTLOGGER that has been stopped due to disposal by the manufacturer/distributor of the device.

This means that users can meet all current EU requirements for a battery passport with minimal effort.

Announcement: The SMARTLOGGER V4 will be available from 2025!

The SMARTLOGGER V4, a variant with further optimizations, will come onto the market in 2025 and will also enjoy patent protection EP 18726032.8. In addition to all the known features of the SMARTLOGGER V2, this device also comes with the following functions:

- For all battery chemistry types: Suitable for cell voltages 1.2V (LTO), 2V, 12V, 48V, 120V
- Impedance measurement: Long-term impedance measurement (0.05 mOhm to 60 mOhm)
- Improved temperature measurement: More precise temperature measurement thanks to the sensor integrated in the measuring cable.
- BACS compatible housing with 2 LEDs for operation display and connection for external NFC antenna.
- Wide selection of measuring cable lengths and cable lug variants compatible with BACS
- Date/time the battery was disposed of
- Disposal location and name or ID of the waste disposal company
- Additional texts that provide individual information, for example about the location/type and owner

The SMARTLOGGER V4 is currently still in development - we would like to hear your wishes for further improvements and look forward to your feedback to our sales or support via email: support@generex.de **or** support@generex.us

The EU Battery Law 2024

This article describes the difference between the EU draft law from 2021 and today's EU regulation “EU BattG 2024”, which has become law, with regard to the GENEREX products BACS, SMARTBATTERY and SMARTLOGGER.

Pressure is increasing at EU level to combat the waste of resources and the associated environmental pollution. Where you can see this particularly well is the EU's new battery regulation. From a battery manufacturer's perspective, the EU requires annoying documentation work and the industry has been hiring consultants on its own behalf for years, whose only purpose is to influence the EU as a "lobbyist" and to make the legislation "practical" for the industry. This is a common “fate” of such initially ambitious EU legislative proposals - in the end, only a small part is actually implemented. But especially within the booming battery industry, a lot could be done to prevent energy and resource waste; significant savings are possible in both recycling and energy efficiency. After the “voluntary declarations of commitment” in the previous EU drafts of the Battery Act did not take effect, the EU, after years of announcement, has massively increased the pressure with the 2021 draft - only to now take the pressure off again after the moment of shock from the EU battery industry and its lobby reaction. If the suppliers and importers of battery-supported systems such as UPS systems were forced to introduce monitoring and management systems via a battery regulation, the EU importers would mainly be those affected and not the actual causes of the environmental damage from Asia. The lobby at the EU was therefore able to negotiate massive changes to the battery regulation - and thereby gained time for the EU battery industry to begin catching up.

So for our customers in advance: All clear! Most of you are “off the hook”.

But as a manufacturer you should now prepare yourself for where the EU is heading.

The path to the EU Battery Act 2024 (EU BattG 2024)

The updated EU guidelines on batteries were proposed for the first time in 2019 in EU Regulation No. 2019/1020. In the following link (from our 2022 newsletter) you can read that GENEREX already met the EU's requirements with our products in detail.

Link to Newsletter 2022:
Regulation of the European Parliament and of the Council Generex

BACS, SMARTBATTERY & SMARTLOGGER already meet all the requirements of the EU draft from 2021

The geopolitical and economic disaster reports since 2019 have followed one another continuously - corona pandemic, delivery bottlenecks, inflation, the beginning of the global economic crisis, Russia's attack on its neighbors, Cold War 2.0, ... it's been somewhat grim. One can also speak of a "turning point" for our market: the market for our products has become highly "politicized" and now distinguishes between countries and economies as "friend" and "enemy". GENEREX has always focused on the Western world and avoided becoming dependent on non-EU/non-US based suppliers. Today it seems to us that this strategy is being positively recognized by customers from Western countries for the first time. "Made in EU, Made in USA" is still our long-term strategy and has made us number 1 on the market for battery management systems in the industry.

Therefore, we are not particularly sad that the new EU law 2024 has not (yet) made the extremely progressive ideas from 2021 into law.

The time saved for the UPS and battery industry is also a win for us - we can prepare together with our customers for the tightening of EU law that is sure to come and offer the greatest technical basis to meet these requirements - in order to protect their products against the aggressive Enhance competition from Asia!

The new, official regulation can be found in its entirety and in all EU languages here: https://eur-lex.europa.eu/eli/reg/2023/1542/oj

Wind turbines, generators, emergency power systems - wherever batteries are used stationary - can continue as before in compliance with the law, as one of the most important measures proposed jas not ultimately "made the cut": The mandatory introduction of a battery management system for almost all battery groups, which should lead to sustainable management and resource conservation, has been reduced to "batteries in automotive or storage systems".

Important for our EU customers and conclusion : "Stationary UPS systems" have been completely removed from responsibility!

What significance does a BMS still have in the EU BattG?

Both versions of the regulation (the one proposed in 2021 and the regulation that came into force as law in 2024) contain a summarized definition for the term "battery management system", with the focus from 2024 clearly only on the "influence" of a BMS for certain applications (only for batteries in the automotive and storage sectors) and the protection of the public power grid.

A BMS is only required for batteries that are regularly operated on public or private power grids- and therefore almost only affects electric cars that already have a BMS on board.

There are additional regulations at EU level for electric cars: Regulation (EU) 2019/944 on alternative fuels infrastructure Article 13: Smart metering systems, Article 14: Interoperability of smart metering systems, Article 15: Access to data from smart metering systems. Directive (EU) 2012/27/EU on energy efficiency Article 9a: Introduction of smart metering systems, Article 10: Interoperability of smart

metering systems, Article 11: Access to data from smart metering systems, etc. - this list is still long - but the effect is, that the **greatest electricity loads from electric vehicles were initially the responsibility of the operators of the power grids and the problems with the batteries were blamed on the end user.**

As you can see, the obligations of the new EU law with this relaxation are now primarily aimed at the end users of batteries if you compare the 2021 draft with the text of the law for 2024:

OLD: Battery Ordinance 2021

- **Article 2(1)(c):**
  UPS systems were included in the definition of “equipment”.
- **Appendix I:**
  UPS systems were included in the list of devices covered by the battery regulation.

New: Battery Ordinance 2024

- **Article 2(1)(c):**
  UPS systems are no longer included in the definition of “equipment”.
- **Appendix I:**
  UPS systems are no longer included in the list of devices covered by the Battery Regulation.

The EU explains the reason for removing UPS applications from the 2024 Battery Regulation “The European Commission has found that UPS systems are already covered by other legislation, such as: B. Directive 2006/95/EC (Low Voltage Directive) and are therefore sufficiently regulated.

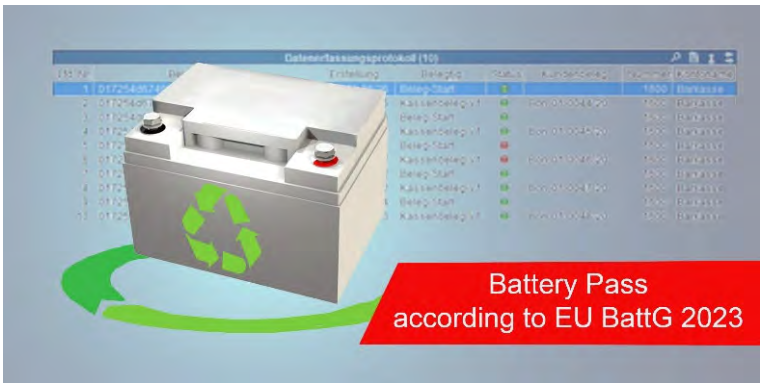
The new wording in the EU Battery Act 2024 can be legally understood to mean that only the end user or operator of batteries is under massive pressure to act. But even if such an interpretation is not accepted, there are plenty of “exemptions” for the manufacturer, defined in Article 12(4) and Article 9(1).

"The competent authority may authorize exceptions to the requirements ... if it considers this to be justified and the proper disposal of batteries and battery waste is otherwise ensured."

"Battery and battery cell manufacturers shall ensure that the batteries and battery cells they place on the market are designed, manufactured and tested in such a way that, under normal operating conditions, they do not pose a risk to the health and safety of people and do not pose an unreasonable burden on the environment."

Nevertheless - even if only the end user currently has a problem with the EU BattG 2024, the matter will still be interesting for manufacturers: **end users’ “problems” can quickly become a lucrative market!**

The obligations for end users and manufacturers in detail:



According to the Battery Regulation, the obligations of the operator/end user are defined in Articles 15 and 17:

The operator must collect data on the consumption, disposal and return of the batteries.

BACS and SMARTLOGGER / SMARTBATTERY can both provide this data, especially the retrofittable SMARTLOGGER makes any battery application EU compliant within seconds!

However, while battery manufacturers do not escape completely unscathed from this obligation, it will be much easier than first feared: The battery manufacturer's obligations are defined in Articles 9, 10 and 11:

The manufacturer must collect data on the chemical composition, performance, durability and safety of batteries and make this data available to the EU and consumers.

The SMARTLOGGER would also be ideally suited to making these technical data of the battery available, in particular the EU's requirement for the introduction of a “battery passport” that contains all technical information, warnings, date of manufacture, anonymous and encrypted transmission of data in accordance with GDPR and ultimately verifiable deletion The SMARTLOGGER / SMARTBATTERY already provides data for disposal and can be read out at any time!

Complete documentation from the “cradle to the grave” – i.e. from battery production to disposal – requires a “black box” like the SMARTLOGGER or SMARTBATTERY.

The "double benefit" of long-term battery monitoring ensures considerably higher customer acceptance than a simple EU battery passport, which actually only serves the EU requirement for data. Since both require a certain minimum level of electronics, the SMARTLOGGER is a more efficient solution than a simple battery passport.

The EU's requirement to monitor and log battery usage in the future is such an attractive market that GENEREX has targeted its products accordingly!

Cybersecurity Firmware 2.18 for CS141, BACS & SITEMANAGER

The world doesn't seem to be calming down and the negative headlines don't stop selling newspapers. The change to cybersecurity was foreseeable, but it was only with the Corona pandemic of 2020-2022 that the topic of home office really took off and with it the security requirements of many companies. Since then, our work and lifestyle have changed massively, and IT departments are faced with numerous new challenges. At the same time, the security situation in the world has continued to worsen and the topic of “cybersecurity” is now at the top of our customers’ priority lists. Cybersecurity and network security has become a top issue for our civilian and military customers.

In addition, the ongoing “economic cold war” between the USA and China is causing Europe to turn away from Chinese products. GENEREX and all others remaining Western IT companies see that network products that do NOT come from China have become the first choice for all operators of western critical infrastructure!

Just how critically users now view the origin of battery management products from China can be seen from the order issued by US Lawmakers on April 15, 2024 that all Chinese-made battery storage systems in the US military must be replaced immediately due to possible cyberattacks. The reason for this is the focus of cyberattacks on the energy sector. The US military has been instructed to replace the systems to be exchanged with those produced in the US or by allied nations. The EU is also trying to defend itself against such attacks, but because of its dependence on Chinese supply chains, it is not naming and shaming the perpetrators, but only imposing stricter requirements on cybersecurity guidelines for the energy sector. Once again, the USA is reacting more clearly ...

Link: U.S. Department of Defense proactively eliminating Chinese battery energy storage systems from use due to foreign threat risks - NotebookCheck.net News

Avoiding Chinese components is a philosophy that GENEREX has followed for years. Of course, this decision to favor Western manufacturing means that our products are at times more expensive than those of our often politically subsidized competitors. However, with the new threat situation, the tide has turned in our favor:

GENEREX is one of the last independent Western manufacturers of network products for critical infrastructures. Our products Made in EU or Made in USA are more in demand than ever and can be found in almost every network in the western world!

The reason for this is our particularly critical approach to cybersecurity for our products, which we improve with every firmware or software update.

We differentiate between security-relevant and normal quality updates:

Security Update

These updates specifically target the security of our devices and contain important updates to meet ever-changing and increasingly stringent cybersecurity requirements.

Normal Update

This “normal” TAG includes service updates to improve ease of use, new functions, customer requests or bug fixes that do not affect the security of the device.

We continue to provide the following email addresses for reporting vulnerability reports. Under security@generex.us for North America and security@generex.de For Europe, we examine incoming reports and immediately deliver corrected versions via our download area on the GENEREX websites.

In the footer of our website you will find a special link entitled “Security” (https://www.generex.de/security). You can use this link to submit questions about cybersecurity or resiliency of our products. The link contains the above email address as well as a GPG key for the necessary encryption of messages between us and the person reporting the vulnerability.

We recently released a new firmware update for all of our networking products since 2016: Security Update Version FW 2.18. This is a major update that does not allow a return to older, more insecure versions of the firmware. We explain the innovations below. We ask our GENEREX partners to strongly recommend that their customers update to the current version.

Excerpt from the security updates firmware 2.12 - 2.18

Security Update

With firmware 2.18, numerous updates and innovations were introduced. Further optimizations have been made, particularly in the area of cybersecurity, since the last cybersecurity update FW 2.12. This allows us to once again claim to be at the forefront of network security in our industry.

Below you will find a list of the most important changes, each with our internal ticket number for reference.

[T5047]
Attempted access from the network is now logged in the EVENT LOG as plain text so that the attacker can be identified.

[T5069]
For some OEM customers, a secure password is now required after the first login.

[T5002]
The password for sFTP access has been tightened to immunize it against “brute force” attacks.

[T5003]
The SSH server has been updated internally and is therefore more secure than the previous version.

[T5135]
sFTP access has been restricted to a limited data area.

[T5122]
The use of insecure protocols now generates a warning in the web server.

[T5121]
The “Serial Trace” support function is switched off by default to prevent attacks via TLS 1.0 or 1.1.

[T4989]
Attacks exploiting a TIMESERVER weakness via WGET script are prevented.

[T4863]
Encryption of the UPSTCP protocol and http is now active by default.

[T4933]
The “Forgotten Password” function has been removed for security reasons and resetting a forgotten password is only possible if the configuration is lost – a complete reset to delivery status.

[T4987]
SNMP traps can be individually configured and tested. This makes commissioning easier for SNMP users; you can safely trigger all types of SNMP traps and test the function with the SNMP evaluation software without having to trigger any real alarms on the UPS.

[T5060]
BACS current sensors can be calibrated by the user on site in order to compensate for any interference.

[T5149]
A firmware downgrade from FW 2.18 to lower versions is no longer permitted for security reasons.

The full list of changes can be viewed at any time under the following link: https://generex.de/support/changelogs/cs141

INTERTEK Cybersecurity UL 2900-1 Report 2024

At GENEREX, data security has been our top priority since 2019. We therefore regularly have our products checked for security gaps by independent institutions. All of our network products are based on this **CS141,** and are at the current security level with firmware 2.18 (March 2024**).** They are therefore validly considered the safest devices on the market!

There are no specific cybersecurity regulations for devices in our industry, such as those for medical technology. Therefore, the UL 2900-1 test uses a basic standard for network products that is collectively referred to as “Software Cybersecurity for Network Connectable Products – General Requirements” and covers many attack scenarios. We chose the US standard UL 2900-1 as the testing standard because we believe this is the most widely used safety standard in the industry and there is currently no better or more practical standard in the EU and in the US this standard is accepted in all data centers.

UL 2900-1 is criticized by safety specialists from the EU from being “too irrelevant” to “too complex”. In our opinion, this impression results from the fact that the effort required to test security is extremely high but does not reflect the reality of an actual attack scenario. But even if one criticizes this standard, in our view it is still a sensible standard that one should adhere to in order to develop secure network products. We also assume that UL will adapt this standard in the future and thus remain current. For us too, the threat situation is constantly changing, and we also have to constantly adapt the security standards and testing procedures, which is why we carry out this security test again at regular intervals and have it certified by UL.

However, since their customers are frontline workers, they are the ones who notice safety-related factors first! We therefore continue to ask all your customers or end users of our products to contact us directly if a security gap is found or if there are any doubts.

Please use the following email addresses to submit security reports security@generex.us for North America and security@generex.de for Europe.

We take care of every incoming security report immediately!

We are pleased to announce that the new UL 2900-1 report on the CS141 with firmware 2.18, issued on March 7, 2024, by the Intertek Nationally Recognized Testing Laboratory (NRTL), is now fully compliant with the UL2900-1 standards!

This achievement underscores our commitment to providing robust cybersecurity solutions. Our customers can rely on the CS141 and all products based on it (BACS, SITEMANAGER and SITEMONITOR) to reliably and effectively protect their critical systems and sensitive data from cyberattacks in 2024.

Figure 1 – Summary of Results

Severity	Number of Issues
High	0
Medium	0
Low	0
Informational	1

The new UL 2900-1 report in firmware 2.18 shows a single point that belongs to the “Informational” category and therefore does not represent a security vulnerability!

The user note that is criticized here is information to the user that the configuration found BEFORE the update contains vulnerabilities that continue to be “unsafe” with the firmware update 2.18. We leave it up to the customer who has decided on their settings to leave them as they are, so we accept this last point of criticism and will no longer rework it and will adopt the configuration we found in an update.

The only change in the next firmware 2.20, which will be released in mid/late 2024: There will be a user note that points out this fact and reminds the user that the user tolerates a known security vulnerability in his configuration. According to the NRTL, this last safety criticism has also been resolved.

What is new is that the UL 2900-1 Cybersecurity Report 2024 with FW 2.18 will now also be available for download on the web so that you can present it to your end customers.

Link: certificate_UL2900-1_2024_en.pdf (generex.de)

We ask for your understanding that we will only allow the detailed NRTL UL2900-1 report on the CS141 to be viewed in the latest 2024 edition if there are legitimate requests. Basically, this is done to protect against future threats, so as not to tell hackers which tools were used in detail to carry out the security checks.

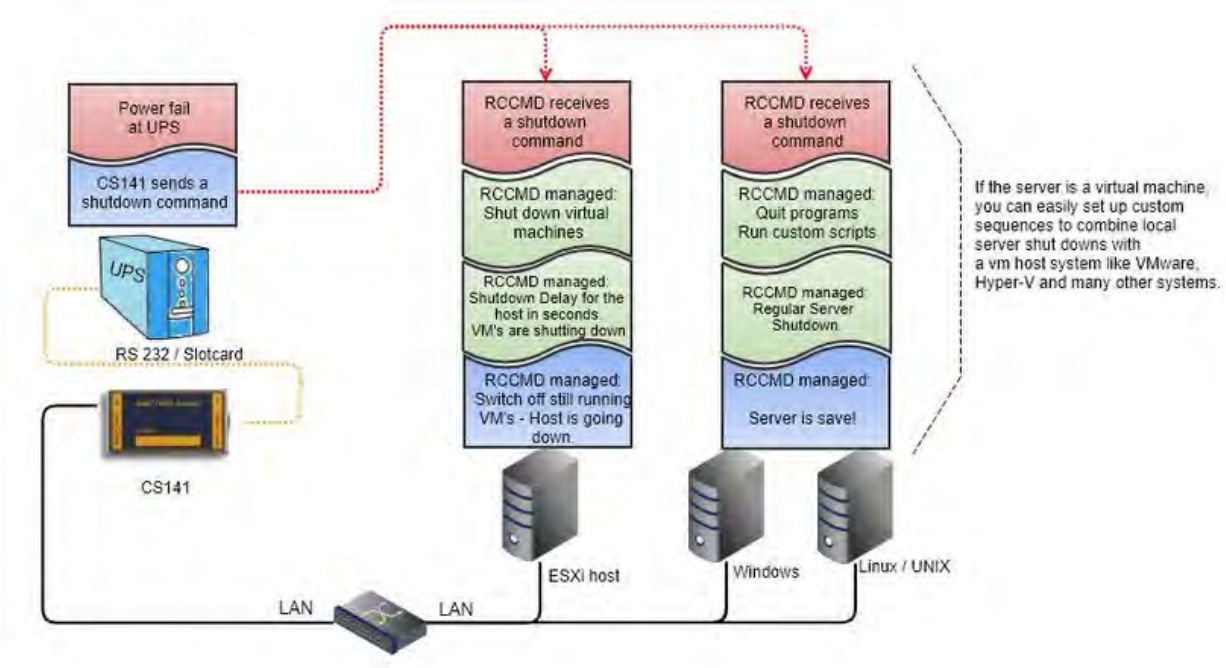
We are proud to be the only provider in this market to be able to offer a device from EU or US production that fully meets the safety standards of UL 2900-1 in 2024!

RCCMD - the most successful shutdown software for UPS systems in Europe

Hardly any other system in the UPS industry manages the balancing act between user-friendliness, flexibility, functionality, security and reliability in heterogeneous server structures with regard to automated shutdown routines like our RCCMD.

What makes RCCMD so uniquely different from “others”?

RCCMD's approach is not, like most other solutions, a central control software that communicates with all participants via complex control commands, but rather a software concept in which each individual client has local shutdown solutions. Each client runs autonomously and without contact with the shutdown sender until the RCCMD sender decides that intervention (shutdown or start of a script) is necessary. This RCCMD concept makes it possible to centrally control an individual shutdown solution for a wide variety of operating systems and even take redundancies into account - with the lowest maintenance effort and minimal resource use for the RCCMD clients.



25 years of RCCMD - the most successful shutdown software in Europe

How time flies: The first version of RCCMD already met with great interest among end users: the UPS systems were very limited in their application in networks and a power failure at the time meant that IT departments had to do a lot of manual work to update their IT to shut down in time. RCCMD made it possible to create complex shutdown routines early on and to automate all previously manual operations. A longer “power outage” with the need to shut down a large network lost its horror and is still carried out “automatically” by RCCMD to this day.

A lot has happened since then, and RCCMD has been continuously developed over the years and is now an integral part of highly critical infrastructure measures and impresses administrators from industry, shipping, aviation, authorities and the military with its flexible, modular and powerful features and inexpensive licensing model.

“RCCMD Licensing and RCCMD Royalty”

Our RCCMD license model is tailored entirely to the wishes of your customers: easy installation of the RCCMD clients in small networks without major licensing and for large installations with frequent server changes, a “RCCMD Corporate License”, with which a key can be used for up to a set number of installations used and can be combined with other licenses as desired.

RCCMD is also integrated into the network cards of many other well-known manufacturers of UPS devices, sensor manufacturers or manufacturers of other systems. These licensees have integrated RCCMD into their own monitoring devices and, in the event of an alarm, send a shutdown into the network that is RCCMD compatible - every RCCMD client that receives this signal will then start its own shutdown procedure, just as if the RCCMD transmitter were from a GENEREX network device been sent out.

This means that inexpensive network products can also be used and can be upgraded without your own shutdown software. Our loyal RCCMD licensees for many years include big names such **as LEGRAND, ABB, HUAWEI, SALICRU, CENTIEL, NSA, UNITE, BECOM, BETRON, QNX, SISWORLD, GE, RITTAL, MITSUBISHI, ONEAC/VERTIV, WINCOR NIXDORF, BENNING** and several others. Worldwide, this acceptance of RCCMD ensures a broad base of users and thus a constantly growing business area - both among the licensees and at GENEREX itself. And our task remains to support all of these licensed users with RCCMD installations, regardless of whether they are from our own devices of the CS141/BACS series or the devices of our licensees. Over the years, this has made RCCMD the most licensed shutdown software on the market worldwide

As a GENEREX OEM customer, you can also purchase a “RCCMD Royalty” and thus receive the “copyright” for the duration of the licensing. This means that GENEREX only supplies the license keys for installation; the pricing model and distribution of the RCCMD software is the sole responsibility of the licensee. This means that each licensee can offer their own prices and packages for RCCMD and their devices and thus offer special shutdown software packages for their UPS range - with always the same license costs - no matter how many licenses are used.

You can't buy RCCMD cheaper than through a royalty license agreement!

Made in the EU

Price stability for the CS141 & BACS
Relocation of component production to Malta

In times of political and economic uncertainty in Germany, it is important for companies producing here to continue to offer their international customers stability and reliability. GENEREX has been a leading provider of high-quality products and services in the electronics industry for 30 years, so far exclusively from German and US production.

But even before the Corona crisis began, we had to adapt to the new “German work ethic” of Generation Z and began moving parts of the software development to the USA. We have also started to relocate parts of the production of electronic products within the EU, but always maintaining at least one German production location for the respective product.

We have had very good experiences with production in other EU countries, and our decision was justified most recently when we were one of the few manufacturers who were hardly affected by interrupted supply chains due to Corona, strikes, etc. during the Corona crisis. **Although everything became more expensive, we retained our ability to deliver almost without restriction.**

However, as is often the case, there’s a mix of bad and good when it comes to German component production – superfluous regulations, the highest taxes and requirements in Europe and unmotivated employees have already caused many of our suppliers to leave the country and produce outside of Germany. At the beginning of 2024, our last electronics assembler based in Germany has also relocated its production to other EU countries - and we are forced to decide: should we now follow this trend - or leave our decades-long suppliers?

We have decided to prioritize the long-term relationship with our CS141 component supplier.

By the end of 2024, we will move production of the CS141, which was previously manufactured in Germany, to Malta.

It is already clear that this step will aid in our efforts to maintain competitive pricing, and perhaps even higher quality, because the automation in the new factory is higher than in the old factory in Germany. Since we are only moving the circuit board production to Malta and all other production steps, especially the software/firmware, continue to be carried out in Hamburg or

Cornelius/Mooresville NC, from a legal point of view we could actually continue to state “Made in Germany” as the country of origin, but we decided to switch to “Made in the EU” - which also gives us more flexibility should we be forced – again- to move production to another location in the EU.

“Made in the USA” remains unaffected! We continue to manufacture at the Madison Wisconsin location and in Cornelius/Mooresville North Carolina, but exclusively for the North American market.

But this decision to diversify production within the EU has an invaluable advantage for our loyal customers:

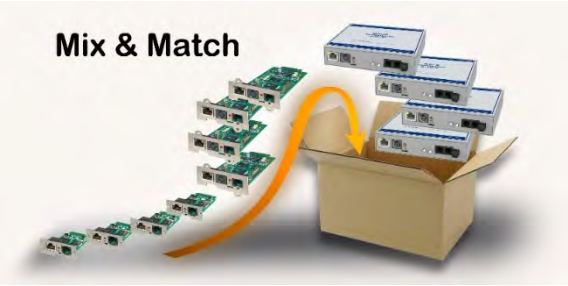
We guarantee stable prices for ALL our products until the end of 2024!

Over the last 2 years we have managed to keep prices stable for our customers - despite inflation, we have not had to pass on any price increases to our customers! We can also guarantee stable prices without price fluctuations in the current year! If the CS141 is purchased in larger quantities, we will even grant a small price reduction!

By the end of 2024 we will be able to look back on stable prices for 3 years in a row and our aim will also be to keep prices stable in 2025.

But our aim is not “just” price stability: We particularly want to help our customers who are competing against Chinese dumping prices to enable price reductions themselves!

Better prices through mix & match and framework agreements



Chinese suppliers are known to dominate the market for UPS devices below 6KVA. The UPS prices are no longer noticeable; people have already gotten used to them due to the lack of alternative providers on the market. However, the network cards advertised by the UPS manufacturer are obviously offered at dumping prices - presumably to promote sales of the UPS. If you take a closer look, the components used in the network cards, which are offered at low prices, are almost identical to those in the CS141 - this fact puts us under pressure to explain! We don't know how to calculate such prices; perhaps the margin on Chinese UPS systems is so enormous that the losses from the dumping prices of the network card can be offset. We have no influence on the European China-friendly policy, so we at least try to help our most competitive customers and offer special prices on the CS141 “BUDGET” for this highly competitive market!

Speak to our sales department and use Mix & Match / framework agreements and buy the CS141 at the best price - permanently stable for a whole year!

In addition: Production in Malta requires slightly longer transport times. For this reason, framework agreements are also recommended to secure the supply chain so that we can keep the appropriate quantities in stock on time.

MIX & MATCH – an easy way to better prices

GENEREX takes the interests of its customers seriously and has therefore put together a package of measures to support them in this difficult market environment:

1. Special prices for the CS141 for framework agreements:

- In order to reduce price pressure, we offer our customers the CS141 at special prices as soon as a framework agreement is concluded.

2. Mix-and-Match improves prices even without a framework agreement

- Customers who buy the CS141 in different versions in larger quantities but do not want to conclude a framework agreement can benefit from our “mix and match” option.
- With “Mix and Match” you can combine different models of the CS141 and receive a discount for the entire quantity - instead of the individual discount for each model.

Framework agreements – long-term security of deliveries and prices for the entire validity period of a price list

Mix & Match offers immediate price optimization for every CS141 order that contains more than just one type, a framework agreement offers longer-term price advantages - from the first order/call until the end of the price list's validity!

GENEREX offers graduated prices for almost all products. As a customer, you benefit from cheaper purchasing prices if you purchase larger quantities. The more you order in one order, the cheaper the prices. However, this also increases your storage costs and tied up financial resources.

A framework agreement is a contractually agreed purchase quantity and thus determines a price scale over the entire term of the price list - and beyond if the prices do not change.

The price scale is determined in advance at the beginning of the framework agreement for the planned quantity. The actual price is therefore fixed as long as the framework contract quantity is purchased, and the framework is within the scope of the current price list.

This is how a framework agreement works:

Let's assume that you estimate a need for 1,500 CS141L SNMP cards for your current projects in the coming year and would like to apply the discount scale of 1,500 pieces - without having to buy and pay for the goods straight away but spread them out over the course of the year.

The framework agreement brings you the following advantages:

- **Planning security:** On the one hand, a framework agreement binds you to accept the goods within the agreed period, but on the other hand, your order is always treated with priority - and always at a discounted price for the total quantity. You always receive your partial deliveries immediately at a volume discounted price!

- **Capital tie-up and storage space optimization:** You can retrieve the reserved goods in up to 4 batches and dates within the term. This means you avoid tying up capital and storage space with them. In our example, this would be calls for 4 * 375 pieces per quarter - if no appointments have been agreed, this is assumed to be 1/4 of the total quantity per quarter.

- **Optimal prices and low default payments:** At the end of the term, the total quantity must be called up in order to meet the selected price scale. If the quantity is NOT purchased, only the price difference to the quantity scale actually achieved will be recalculated. As long as you haven't completely miscalculated, the price difference is very small - much smaller than if you had placed each order with smaller quantities. The closer you are to the target quantity, the greater the savings compared to a normal order without a framework agreement.

Tip: Stay up to date

Experience shows that the scope of your framework agreement should generally be evaluated and, if necessary, adjusted after 6 months or when around 50% of the agreed devices have been purchased by your sales department.

Contact our sales team at GENEREX via sales@generex.de for EMEA and South America and via sales@generex.us for USMCA - North America and let you know the status of the calls and, if necessary, prepare an offer for a follow-up framework agreement.

Our guarantee for your success:

What if the price lists change or the validity of the framework agreement extends beyond the validity period of a price list?

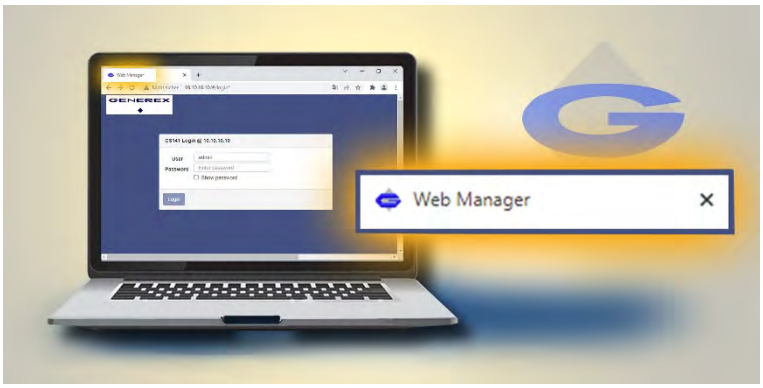
A distinction must be made here between a framework agreement and a price list. The framework agreement represents a guarantee of the ability to deliver and the quantity discount granted - but is not tied to price developments on the market - and the price only applies within the validity of the price list for which it was concluded.

If the prices for our products change between the old and new price lists, but the framework agreement still has a remaining term, then all products that have not yet been purchased at the time of validity of the new price list will be charged at the new price.

Premium service for OEM partners

Favicon and OEM name of the web manager in the web browser tab

Have you noticed it yet? The web interface of your CS141/BACS has received a new, small detail: a “favicon”!
This tiny icon, which you can see in your browser's address bar and in your bookmarks list, is intended to make your OEM version more visible to the user and improve customer loyalty to you.



What is a favicon?

A favicon (a portmanteau of "favorite" and "icon") is a small, square image shown before the name of your CS141/SITEMANAGER/SITEMONITOR/BACS. It appears in different areas of the browser such as within the tab, the address bar, the bookmark list and in the history and usually displays your company logo in a reduced size.

Why is a favicon useful?

1. **Recognizability:** A favicon helps your customers remember your company in a positive way. In a world full of devices with similar designs, a small but unique icon can make all the difference.

2. **User-friendliness**: Favicons make it easier to navigate between the devices on your network. If you use several devices from different manufacturers, you can quickly identify the desired device in the tab thanks to the favicon.

3. **Clarity**: Favicons provide more clarity in your browser bar and bookmark list.

4. **Professionalism**: A favicon with your company logo makes your device look more professional and trustworthy.

The name of the CS141 or BACS can also be adjusted in FAVICON. A few customers have stuck with the GENEREX name "CS141" or "BACS", as shown above with the GENEREX logo and the name "Web Manager" as the title in the web browser window, other customers use their own names.

With firmware 2.18, all of our customers who have not previously provided their own FAVICON or name will now automatically receive a FAVICON customized by us with their logo - while retaining the name. We ask for your attention and, if necessary, feedback.

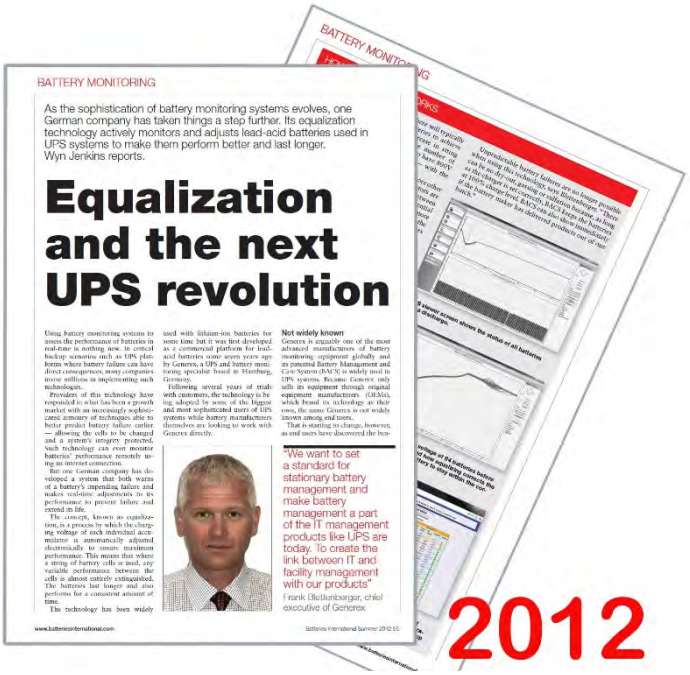
GENEREX SYSTEMS - 30 years of success story

Interview 2012 by Frank Blettenberger - "The BMS Revolutionary" shows the history of the development of GENEREX

From an interview for a British battery magazine in 2012, Frank Blettenberger got his nickname as the "BMS revolutionary" - a few years before this name and his vision actually became reality with BACS.

BACS and the new EU patented “SMARTBATTERY / SMARTLOGGER” are a revolution and the basis of GENEREX’s exponential growth over the last 30 years.

Read the story of GENEREX from humble beginnings as a one-man show to a multimillion-dollar company and industry leader.


BATTERY MONITORING

As the sophistication of battery monitoring systems evolves, one German company has taken things a step further. Its equalization technology actively monitors and adjusts lead-acid batteries used in UPS systems to make them perform better and last longer. Wyn Jenkins reports.

Equalization and the next UPS revolution

"We want to set a standard for stationary battery management and make battery management a part of the IT management products like UPS are today. To create the link between IT and facility management with our products"

2012

Picture: Title page magazine “Batteries International”

Picture: The very first UPSMAN Software for ONLINE UPS systems named “Datawatch” Serialnumber 000000001 from 1994

The revolutionary story begins in 1994 with the founding by Frank and Peter Blettenberger in Hamburg, Germany. As an IT software company, GENEREX brought its first UPS shutdown and monitoring software to the just beginning market of UPS systems in networks, at that time still based on “MS-DOS”, “NOVELL”, “IBM OS/2” and various new OS under the name “UNIX” and the brand-new product “Windows” from a then unknown company “Microsoft”. GENEREX sold the first 1,000 software licenses to the German "ONLINE USV-Systeme" based in Munich, at that time delivered on 5.1/4 floppy discs and magnetic tapes, later 3.5" diskettes. The first GENEREX customer is still a customer 30 years later and under the memorable logo with the eyes, ONLINE is one of the largest UPS dealers in Germany.

The next logical step for the company was to produce its own network cards to transmit UPS data via various network protocols, at that time starting with the "Simple Network Management Protocol" (SNMP). To this day, UPS network cards in Europe are simply called “SNMP cards”, a standard that Frank Blettenberger had established in the UPS industry at the time and which still shapes the market in Europe today. The different classification of UPS systems in Europe and the USA that is still visible today comes from this time - in Europe, UPSs belong to IT using SNMP as a protocol, in the USA, UPSs belong to building management using bus systems such as Modbus, BACnet, etc.

In 1999, the Chinese imports of such network cards proved to be unreliable and GENEREX's strategy of breaking away from Asian partners and only producing themselves was based on this early phase of

network products for UPS devices. GENEREX invested heavily in its own network card, called “CS121,” which first came onto the market in 2001. The CS121 was a milestone in the development of GENEREX and the beginning of a long career of “CS1x1” products, which to this day forms the backbone of the European UPS industry. Frank Blettenberger recognized early on that companies in the critical power supply sector were prepared to pay more for a quality product made in Germany with qualified customer service and support than the usual Chinese products on the market. This evolution to 100% depth of production culminated in GENEREX today launching the 4th generation of its network products under the name “CS141 HW161”, the core product of all other GENEREX products with network connectivity and one of the few with certified network security according to UL 2900 -1 on the market.

But the software products “UPSMAN”, “RCCMD” and “UNMS” have also captured a significant market share in the EU and communicate with almost all UPS products from 1992 to 2024 that are used in Europe.

The shortcoming of most UPS products to this day is their battery - that is the Achilles heel of every UPS.

The logical next step was to develop a battery monitoring system to complement the portfolio of UPS management systems. This is how GENEREX began to enter the world of battery monitoring systems “BMS” in 2003. *However, it soon became clear that battery monitoring alone does not help solve the UPS battery problem*. State of Health (SOH) and State of Charge (SOC) were a hurdle that GENEREX was unable to overcome for a long time, as impedance - the basis for most battery health measurements - although theoretically ideal for such measurements, was at that time in high voltage circuits the most important for UPS are typical, was very inaccurate. So extremely inaccurate that to this day customers refuse to accept impedance as the reference for battery health.

In fact, impedance is still the best method for evaluating the battery, but interference from the UPS end devices themselves and the extremely high resolution of the measured values required have actually made every battery monitoring system on the market unusable to this day. The impedance measurements are displayed, but there was no connection to the actual battery health and customers lost interest in battery monitoring. Battery monitoring had no added value for the user; the batteries were unstable with or without monitoring and were a constant annoyance for the user. So GENEREX first had to find a solution to the inaccurate impedance measurement. After many tests, the collaboration with EFFEKTA, an industrial UPS provider from Germany that is still successfully operating on the market, has shown that adjusting the voltages within a battery string to identical voltage levels solves the problem. Under the name “Equalizing” - which technically corresponds to the balancing that can be found in every lithium battery today - the revolution began in 2004 with the “BACS” - “Battery Analysis & Care System” of the 1st generation with an improved impedance measurement “Equalizing”.

But it quickly became clear: the enthusiastic customers were most interested in the amazing control of the voltage of each individual cell! **All cells in the system were suddenly perfectly balanced and**

there were no longer any deviations from the ideal value. That was exactly the reason for the introduction of balancing - but with the aim of improving impedance measurement.

This balancing technology was first seen in the development of lithium batteries and was early adopted by GENEREX for lead-acid batteries in high voltage ranges for UPS systems. After several years of testing with customers, the technology was also transferred to NiCd, later to lithium ferrophosphate (LiFePo4) - and, more recently, to lithium titanium oxide cells (LTO) and today covers the entire range of battery chemistry types be used in emergency power systems.

The fact that “balancing” - actually introduced as a solution for impedance measurement - had such a positive “side effect” on the service life and reliability of UPS batteries made the world of lead-acid batteries sit up and take notice a few years later - the market success of BACS began with this “revolutionary” technology of balancing.

BACS WEBMANAGER balances
the voltages on the batteries 1 and 3

Thanks to balancing, the batteries became significantly more stable and had a demonstrably higher capacity and in some cases even achieved the “design life” (lifetime specification from the battery manufacturer) in a UPS application - something that no battery in UPS operation had even come close to achieving before the introduction of balancing! **Suddenly there was an explanation and at the same time a solution for batteries that could only achieve a lifespan of 50-60% in UPS operation without balancing!**

In fact, BACS users have made the system a success! The names of the first highly satisfied customers read like a Who's Who of the Industry Elite. Airports and air traffic control in the civil and military sectors were the first customers of BACS, soon followed by the American banks and their data centers, from where word of the new BACS product spread to the rest of the world. Today, almost all of the top 500 companies in the Western world are satisfied users of BACS; hardly any data center built today can do without BACS. **Battery monitoring has had its day, but battery management has become an indispensable part of the world of data centers.**

Other industries also began to be interested in BACS, mainly from the military sector or from particularly critical application areas of batteries such as nuclear power plants, ship technology, tunnel construction, and the oil and gas industry. What these critical applications have in common is that the energy content of the batteries is less important than the stability and safety of the batteries. This is exactly where the new lithium cells emerging from Asia were unable to displace the established batteries. **If safety is more important than battery life - then the reliable lead battery remains the energy source for this market!**

It wasn't just the issue of safety that caused a renaissance, a return to the "old" lead battery technology, the first negative experiences with lithium cells were also seen on the market after a few years. The development of pure lead AGM batteries, which functioned stably even under high temperatures, showed lithium cells their limits, the gap between lead batteries and lithium narrowed: It quickly became clear that lithium cells were only theoretically better for UPS operation were suitable as lead batteries. To date, lithium cells have to be greatly oversized in order to prevent the cells from reaching critical temperature ranges or charge states. Everyone knows the problem of electric cars burning when the battery is empty - and when the battery is overfilled... Such oversizing is not necessary for lead batteries. This caused disillusionment for UPS customers who were initially enthusiastic about lithium. The fact that BACS was able to further narrow the gap between lithium and lead batteries - through more capacity and longer service life and stability of the old lead battery technology - has meant that the market share of this battery technology is no longer shrinking but is actually growing! The new lithium-based cells turned out to be not ideal for the high safety requirements of customers and created a “market niche”

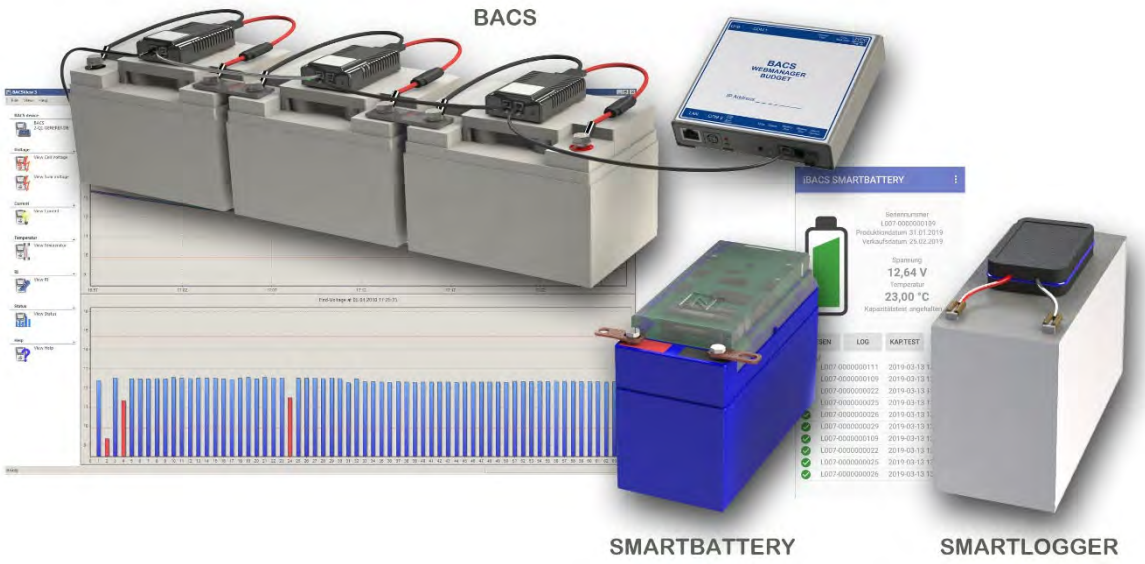
for the supposedly outdated lead or NiCd-based batteries. **To this day, the battery technology, which is considered outdated, is the safest battery solution for UPS systems or emergency power devices on the market - and the cheapest!**

The data center market now forms the largest share of the battery market that BACS serves. Google, Facebook, Microsoft etc. - thanks to “Big Data”!

After many years on the market and with more than 3.4 million BACS systems installed, battery management has also established itself among battery manufacturers - at least where the customer specifies BACS. With the new EU BattG 2024, many other battery applications will certainly require a BMS and GENEREX hopes to continue riding this wave of success together with its customers.

After 30 unsuccessful years of battery **monitoring** the breakthrough for this sector began with BACS in 2012: Battery **management** is now one of the fastest growing markets in the world and BACS with “Balancing/Equalizing” is the “game changer” in this industry.

The success of BACS is undeniable today, but our Frank was already thinking about the next technical solution the market might need. His new idea led to a European patent in 2024 - called "SMARTBATTERY" and "SMARTLOGGER" - in principle the first "battery passport" that meets all the requirements of the EU BattG 2024 - only presented and produced for the first time in 2014 - long before the EU BattG.



The idea for his new patent is based on one **“intelligent battery” – the “SMARTBATTERY” which already has all the data from the “cradle to the grave” built in**”, in the form of a “chip solution”. The new contactless standard “Near Field Communication (NFC) is ideal for this because of its low power consumption and data security. "We want to set a standard for stationary battery management and make it part of the IT management products, like UPSs are today," said Frank Blettenberger back in 2012. Today, in 2024, the new EU battery law describes exactly that, what GENEREX had developed years before and has now been patented just in time for the EU BattG! **If there is a product on the market today that can meet the regulations of the new EU Battery Law 2024, it is GENEREX BACS and the patented SMARTBATTERY/SMARTLOGGER!**

The person - Frank Blettenberger

Successful business people do not always set out to build large companies or be successful in a purely entrepreneurial sense. Rather, they tend to do their work with passion - and be very good at it. Over time, these qualities bring their own rewards - whether intended or not.

Frank Blettenberger is a typical example of this. He is the founder and majority shareholder of GENEREX, the specialists for battery management and networks of critical power supplies based in Hamburg, Germany and Cornelius/Mooresville NC, USA. The company is 100% family-owned, but Frank Blettenberger and his brother Peter play an inconspicuous role. The fact that for many decades he referred to himself only as the company's "technical director" - and not as CEO or CTO - perhaps sums up his attitude to his business and corporate strategy: for him, it's all about the technology. Quote **"If we bring the best products possible to market, the rest will take care of itself," he told Battery International magazine's Wen Jenkins in a 2012 interview.**

GENEREX is today one of the leading manufacturers of UPS connectivity products and battery monitoring systems for emergency power devices but is still a “hidden champion” with little awareness in the market. The reason for this is GENEREX's business model**– exclusively in business-to-business and OEM business for 30 years** never directly with end customers, but always under the brand names of its partners who market its technology. **This ensures a strong bond between partners and deep integration into their own products and will continue to be GENEREX's strategy in the coming years.**

Wyn Jenkins, freelance journalist for various industry trade journals in Great Britain, spoke to Frank Blettenberger, the company's founder and current president, about the development and ambitions of GENEREX and the long journey since 1994 for a specialist article in the magazine "Battery International".