GENEREX

SMARTBATTERY& iBACS™

Intelligent AGM Battery   in 7AH, 24AH, 50AH, 100AH and 150AH

- ◆ **AGM battery series with integrated state of health monitoring**

- ◆ **Advanced technology designed for critical standby power applications**

- ◆ **CE, CSA, UL and VdS approval** VdS CE UKCA UL

- ◆ **Optional iBACS battery management technology**

- ◆ **Patented Technology**

- ◆ **Coming 2020: 7Ah, 24Ah, 45Ah, 100Ah and150Ah front terminal batteries**

Vital battery data recording every hour for 10 years

- ■ NFC technology provides wireless data transmission and is compatible with any Android smartphone or NFC reader.

- ■ Integrated high voltage fuses when using iBACS / iBACS PRO

Open Source interface

- ■ Flexible battery data usage with 3rd party BMS systems.

- ■ Native interface for the battery management systems iBACS / iBACS PRO

- ■ M5 threaded screws and copper connectors for optimized power transmission and better thermal stability during discharge (optional also as FASTON 6.3mm)
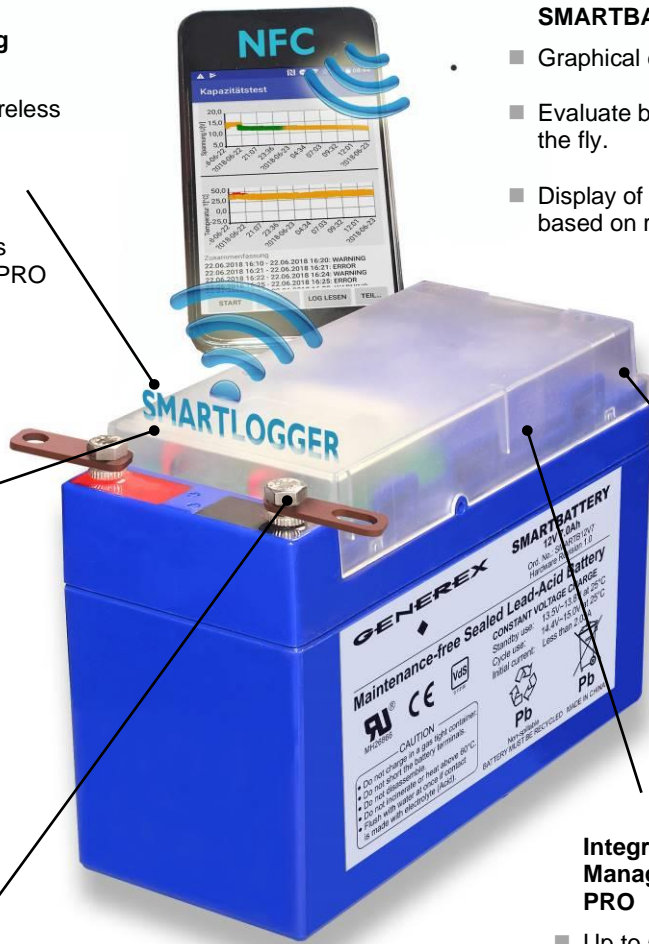
SMARTBATTERY APP

- ■ Graphical display of the measured values

- ■ Evaluate battery State of Health (SOH) on the fly.

- ■ Display of measured battery capacity in AH based on recorded discharge cycles.

Insulated housing

Integrated slot for the optional Battery Management System iBACS / iBACS PRO

- ■ Up to 50% longer life span in all high voltage applications (more than 40 batteries per strand) and warranty that matches design life.

- ■ Up to 20% more capacity for High voltage applications

- ■ Galvanic isolation to maximize immunity against interferences

- ■ Fast data bus for optimal data transmission

Features

The SMARTBATTERY is the world's first IoT battery with an integrated wireless monitoring

Concept

The SMARTBATTERY is the next generation of intelligent AGM battery, integrated with a wireless monitoring interface and an expansion slot for iBACS battery management systems (BMS) or any licensed BMS product.

The integrated life logger board provides the state of health status of the battery from cradle to grave. It utilizes a low-cost NFC technology to provide wireless data transmission to any Android smartphone or tablet.
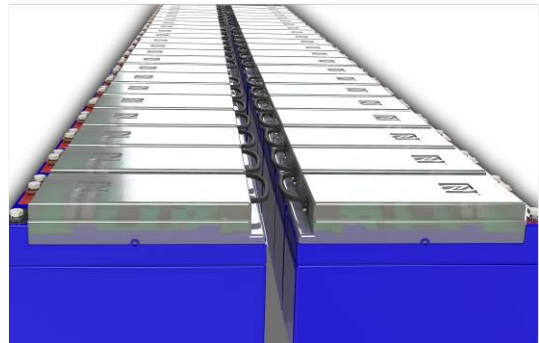
The SMARTBATTERY can be equipped with iBACS battery management system that will provide a full state of health monitoring as well as voltage balancing. The iBACS battery management system provides the user with a lead-acid battery with a real time integrated BMS, increased capacity, longer service life, and a longer warranty period all based on a proven and stable lead-acid chemistry.

The SMARTBATTERY has been developed for use in critical standby power applications which require high reliability and availability. The special design, allows the VRLA-based lead-acid battery to be installed horizontally or vertically. The SMARTBATTERY presents innovative plate technology and a specially developed chemical composition for maximum reliability and longevity even at high current scenarios in combination with a modern housing. This makes it a suitable product for critical applications.

Capacity increasements meet longer service life

The 7AH SMARTBATTERY with a capacity of 7Ah / C20 is technically identical to the PANASONIC type LC-R127R2PG - but contains improvements:

Even after 150 charge / discharge cycles, the battery provides up to 90% of initial capacity.

As a result, depending on the area of application and prevailing environmental conditions, EUROBAT rated the SMARTBATTERY with a reliable design life of 6 to 9 years.

Modern and proven: Robust AGM technology with an unusual flat housing

From the smallest battery...

All batteries tend to fail at the end of their service life, threatening the security concept of most applications using such batteries. The SMARTBATTERY is the first battery on the market to timely record and report problems without complicated measurement equipment. Due to this fact, the SMARTBATTERY is the most reliable battery system available on the market. The smallest SMARTBATTERY is a 7Ah AGM battery with reduced case height, newly designed lead plates and vent caps that provides a place for the electronical components. Thereby the footprint of the battery itself is unchanged and the performance data of the battery is similar to PANASONIC AGM series LC-R127RPG, but provides complete monitoring for each individual battery.

... up to the largest batteries, no matter which chemistry they use...

For larger batteries (24Ah, 50AH, 100Ah, 200Ah), no adjustment of the lead plates and acid density is necessary. This will allow the SMARTLOGGER module to be installed into the original case of any battery manufacturer so that it can be converted into a SMARTBATTERY. The overall production process itself only needs to be adapted to include assembly instructions and related battery documentation.

... the SMARTLOGGER pays off:

Depending on the production volume, the small extra charge over a conventional battery amounts only about 5 EURO - the considerable added value already pays off during the production process as well as during commissioning at the customer: A complete monitoring of the battery state during production, transport logistics as well as in operation will prevent unexpected failures - they can be found just by a simple live check of the battery data during transport or just before final use.

Batteries need advanced safety functions as a core function

The battery is the critical "heart" in many applications: In UPS systems, it is responsible for the availability of critical emergency power.

Basic problems when running low-maintenance UPS systems

Well-known disadvantages…

One disadvantage of modern and particularly low-maintenance UPS devices is that the current battery condition is never completely known. Even when using expensive measuring or management equipment to analyze the current SOH or SOC state, the history of a battery before an initial setup stays unknown. For this reason, many customers choose expensive batteries for their systems or change them more often than sensible and run into the same problem as before: A hidden failure is still not completely visible.

Secondly, a well-known basic problem is that the fact that small sized batteries are indispensable in the UPS area - due to their quantity and inaccessibility, they are difficult to check permanently – Many UPS concepts need to be shut down completely before maintenance work can be done and any downtime always entails significant costs.

Non-working solutions

As a reaction, customers of such systems either rely on particularly high-priced products or replace batteries much more often than it would be technically necessary. Nevertheless, a failure during installation or first use is not completely predictable because the complete history of the batteries is not present.

Safety vs. performance

Many users consider switching from proven technologies to lithium technology, but neglect to consider whether reduced security, more intensive maintenance costs and very high initial costs justify the relatively low increase in performance that ultimately results:

The use of more expensive lithium cells in this design always carries the risk of overheating with fire risk in itself.
This risk cannot be ruled out by using a voltage distribution system and a complete cell monitoring of the lithium cells, which is mandatory for each lithium battery.

With the innovative design of the SMARTBATTERY, it is possible to close the very first time the gap coming with questions about safety performance and pricings

The most reliable method to store emergency power is to use a lead-acid battery! In case of a defect, lead is less reactive and rarely overheats. With lead batteries, the risk of fire is minimized. For this reason, lead-based batteries are used billions of times.

With the introduction of high-efficiency UPS systems with IGBT technology, efficiencies of over 95% can be achieved. Thereby many batteries will be connected in series to provide high-voltages up to 1000V. The entire battery system is only as good as its weakest link. One defective battery can take down the system and also adversely the surrounding batteries with the strings. The UPS system or the users will not be aware of the problems without proper maintenance or the use of a battery management system. In combination with the most stable chemical energy storage technology ever, the lead-based AGM battery is significantly trustier in terms of reliability than more modern battery chemistries. The lower energy density against Lithium is compensated by lower price and significant safety benefits.

The SMARTBATTERY comes in combination with a unique integrated measuring technology, which records the battery data right from the start without the need for additional measuring and control technology. The holistic design of the SMARTBATTERY maximizes protection against outages, allowing timely detection of trends as well as pointing out and maintenance that is required on the battery prior to failure.

Optimized power transmission – design meets customization

Unlike conventional 7Ah batteries, the SMARTBATTERY comes with M5 screw terminals and offers much better power transfer and heat dissipation across the poles than normally used 6.3mm FASTON terminals. The bolted connections are also much more mechanically resilient and the case design allows an insulated installation:

By using the SMARTLOGGER NFC technology in the SMARTBATTERY, measurement data can be collected wirelessly, this avoids direct contact with the battery.

Lifelong record of vital data

The SMARTLOGGER integrated into the SMARTBATTERY ensures the recording function over the entire life of the battery:

The SMARTLOGGER logs voltage and temperature of the battery every hour. This data is kept in a non-volatile memory for up to 10 years. In addition, the memory contains important information such as date of manufacture, date of purchase and serial number.

Warranty issues become verifiable

The first recording of the battery data starts 60 minutes after the production and depending on production process prior to the final quality check. With a total duration of 10 years, the SMARTLOGGER grants a permanent storing of measured data far beyond the point a battery reaches end of design life state.

As a result, a manufacturer will be able to have a simple process to validate warranty services and requirements without complicated testing. At the same time, the measurement data supports ongoing quality controls with valuable measurement data directly after production and saves this for later use in higher-level BMS systems so that seamless monitoring from production to end of life is guaranteed.

Optimized grid design

The amount of lead is crucial when using lead / acid technology - the grade of a battery depends on the quantity of lead. Among other things, this can be noticed by weight comparison to other batteries. Through a specially developed lattice structure, the SMARTBATTERY consists of a very high amount of lead. The battery is unusual heavy.

Further advantages are a lower internal resistance, a higher short-circuit current, a longer design life and an improved current stability. Especially in UPS applications, it is advantageous if the battery can deliver a high current over a short period of time. Under laboratory conditions cyclic 15-minute discharge tests have been carried out. This corresponds to a current drain of 12A over 15 minutes. The nominal capacity for the smart battery under these conditions is 3Ah. Battery replacement is recommended at 80% of the nominal capacity. This corresponds to 2.4Ah in this case. The final discharge voltage has been set to 1.6V / cell. It is possible to drive at least 60 cycles under these conditions until the nominal capacity has been reached. Even after 150 cycles, the battery still reaches more than 90% of the nominal capacity
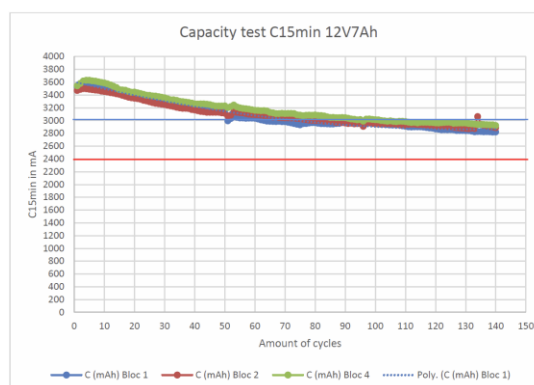
SMARTLOGGER data transfer with NFC communication

The SMARTLOGGER integrated into the SMARTBATTERY is the interface between the battery and the user. Thanks to the build-in NFC technology, the SMARTLOGGER provides wireless communication according to the transponder principle:

On battery side, the same world-wide proven heavy-duty passive NFC is in use as used with millions credit cards for wireless payments. This low power communication is recommended because no radio certifications are required which are mandatory for use WLAN or Bluetooth. Furthermore, the NFC tag does not consume energy in sleep mode - ideal for long-term monitoring of batteries without increasing the self-discharge.

Furthermore, the transponder method is more reliable when the installation site comes with electromagnetic interferences. Transponder technology generates less interference and more reliable protected against incoming interferences.

Each SMARTBATTERY can be tested wirelessly thru a smartphone or an NFC reading device.

For this purpose, a SMARTLOGGER APP available in the ANDROID PLAYSTORE, customizable by according licensees:

With this APP users can adjust measuring intervals and obtain an instant evaluation of the quality of the battery based on its unique historical battery data. The use of NFC technology allows the user to query battery data from any NFC-enabled Android smartphone or NFC reader from a distance of up to 3 cm - Optionally, an antenna extension is available to customize the reading point on the battery.

Compared with other battery monitoring concepts, the GENEREX "offline monitoring" offers significant advantages: Both, costly testing equipment as well as specially trained technical staffs are not required. Once the battery data is read, a technician can respond on-site and take appropriate action.

The SMARTBATTERY APP displays pre-processed battery data graphically to display discharge curves quickly showing whether the battery is has been damaged or not. By doing so, damaged batteries can be identified and replaced before other batteries are damaged. In addition to the SMARTBATTERY APP, the semi-transparent housing of the battery provides an LED for visual feedback. It indicates a problem when the SMARTBATTERY APP communicates with the battery:

 In case of a battery damage due to exceeded limit values, the LED lights up red.

Thus, a user can already detect when the NFC transponder is connected whether the battery is "healthy" or whether the historical data must be evaluated

The GENEREX SMARTLOGGER APP – intuitive monitoring of each battery

The successful connection between smartphone or NFC READER and SMARTBATTERY and the subsequent transmission with NFC is displayed by a visual and audible signal in the APP. The GENEREX SMARTLOGGER APP immediately provides the user with an assessment of the quality of the battery based on the recorded data and the limits set in the manufacturer of the battery.

The SMARTLOGGER APP will display three conditions:

"**GOOD** ": The battery is OK, within tolerance and not action required.

"**WARNING** ": If the threshold values are exceeded, a time stamp and the complete period are displayed. The user can then decide whether the battery remains or needs to be replaced.

"**BAD** ": If the limit values are exceeded, the battery will be moved from "WARNING" to "BAD" state. The battery will also be dropped from "GOOD" to "BAD", if there are extreme deviations; these are indicated with date and duration. In both cases, the battery should not be installed on site – the warranty may be harmed.

With the SMARTBATTERY APP, large battery systems can be read out, logged and processed instantly - much faster than classic manual measuring methods.

This can be done in two ways:

*Reading and analysis via smartphone on site - fast and trustworthy:*

The SMARTLOGGER APP provides multiple tabbed browsing for a clear technical review of several batteries.

Each folder provides graphically processed data of the respective battery like voltage and temperature. In the event specified thresholds are exceeded, the APP changes its color.

Even inexperienced users will be able to get a quick review and perform on-site error analysis.

Fast Reading and deep analyzing

Stored battery data can be downloaded as CSV and are compatible to the GENEREX BACS VIEWER software. Automatic analysis is possible intuitively for many batteries in a row - user immediately recognize whether the battery is OK, warning, or defective. In addition to the transfer to a Windows PC running the powerful BACS VIEWER for deep data analysis. If customers are not familiar with the BACS viewer, the open standard allows data to be used with any compatible application for evaluation.
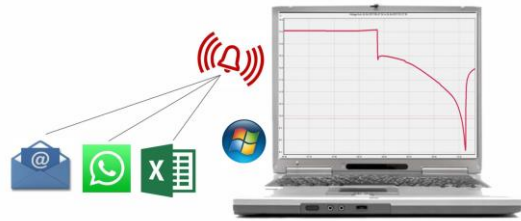
Quality control check using NFC technology

Weak and defective batteries are detectable during final installation. The NFC technology is ideal for battery inspection prior to entering the batteries into inventory as well as for a quick check just before installation or during the maintenance window.

Capacity test and long-term comparison

The SMARTBATTERY APP can set a quicker recording measurement interval for a capacity test. SMARTAPP activates the high-speed mode and SMARTLOGGER will record the measured values every 3-5 seconds and stop automatically when it reaches the capacity limit of 10.50 volts, or by a command from the APP. By inputting the value of the load in mA into the SMARTBATTERY APP after the discharge, the APP can accurately determine the battery capacity. The evaluation of the capacity test remains in the long-term storage, so that one can graphically display the capacity loss over the years.

"Offline" Battery Monitoring through historical data

The technology behind the SMARTBATTERY is designed to provide historical information of the battery.

This allows the user to track back all historical data about a battery as well as recent information such as the operation state since the last discharge:

For this reason, a discharge and recharge cycle are evaluated and the user receives an accurate profile of the entire process. Based on this data, the user is able to decide whether the battery can stay in the system or not.

Historical battery data can be used like an "offline" battery monitoring – they can be used to verify the current battery performance state and allow deep analyzing to predict an upcoming hidden damage.

Unlike lithium-ion batteries, lead-acid batteries can be monitored "offline" - From a relative point of view, slightly damaged lead-acid batteries can stay in their battery string for a for a while without harming neighbored batteries. Therefore, a normal maintenance window can often be used for the replacement operation - expensive emergency services where technicians replace damaged batteries is not necessary.

Power saving mode

A disadvantage of lead acid batteries is self-discharge. If this is not monitored, batteries are forgotten during storage, which can lead to damage. A deeply discharged battery cannot be distinguished from a healthy battery when it is stored - the SMARTLOGGER not only solves this problem, the power saving mode of the SMARTLOGGER board ensures that despite additional electronics, the self-discharge does not increase - the SMARTLOGGER "wakes" only once every hour for 1 Second and writes the measurements into memory.

Sustainability

Lead is also a leader in terms of sustainability, as a lead-acid battery can be recycled up to 95%, a lithium battery cannot be recycled to this day.

Interface to battery management systems

Beneath the NFC interface, the SMARTLOGGER provides secondary plug-in connection in order to establish a link to higher-level battery management systems such as iBACS/iBACS PRO or licensed third party BMS systems that can handle the SMARTBATTERY technology. These interfaces grant save operating conditions up to 1000V

Optional iBACS / iBACS PRO - Battery Management System

The SMARTBATTERY is the first modular battery system that is expandable to grow up to a complete battery management system.

With the optional use of GENEREX products iBACS/iBACS PRO, GENEREX's worldwide successful battery management system "BACS" is available in 4th generation. The system acts on each respective battery to get the maximum capacity and life. The "Equalizing" process delivers up to 20% more battery capacity and extends the life of the SMARTBATTERY closer to the design life. This corresponds to an up to 50% longer service life than without the use of iBACS!

As an alternative to BACS, battery monitoring systems from other manufacturers can also be connected (seeking a licensee).

With iBACS/iBACS PRO the battery readings can also be read via the "BACS" bus in addition to the NFC wireless interface. The control unit of the battery management system communicates with the respective module via the SMARTLOGGER. (Licensees get access to all data and design data for in-house production).
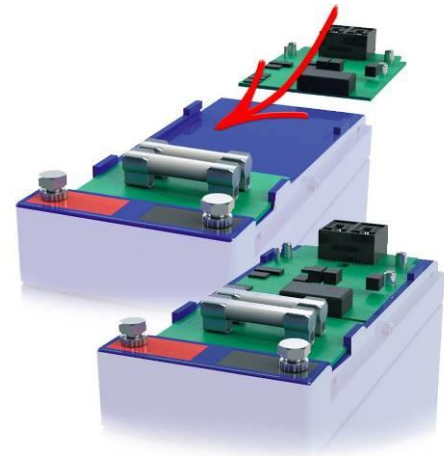
The SMARTBATTERY with iBACS
Integrated network compatible "Battery Analysis & Care System"

The SMARTBATTERY with its possibilities is a big step for the user, but the requirements are growing in many data centers - customers will require a real time monitoring and management of the batteries. This is something that **"offline" battery monitoring** of temperature and voltage via SMARTBATTERY APP cannot provide. Therefore, we offer users of SMARTBATTERY the possibility to expand their battery system into our successful **"online" Battery Management** BACS (or any other licensees BMS) at the lowest possible costs.

The iBACS / iBACS PRO module is inserted into the slot provided on the SMARTBATTERY and the two fuses are inserted into the SMARTLOGGER. The SMARTLOGGER thus becomes the interface between the SMARTBATTERY and iBACS

All data collected and stored locally in the SMARTLOGGER via the battery are automatically forwarded to iBACS and the complete history of that battery will be available to the user. The voltage of the batteries in the system will now be managed via iBACS/iBACS PRO (Equalizing / Balancing). This will provide more capacity and reliability available
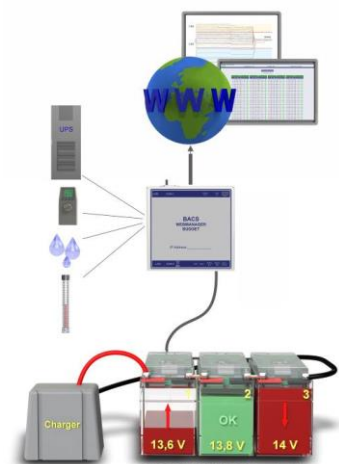
BACS WEBMANAGER regulates the voltage at the batteries 1 and 3

because the BACS system will prevent the batteries from being over and under charged.

As a direct effect of the upgrade, the lifetime is extended by up to 50% compared to a battery system without Equalizing / Balancing. This achieves the maximum availability of the batteries of the entire system!

iBACS

The simplest and least expensive version is the new "iBACS" = "integrated BACS" (from 2019). This is a BACS module which can be inserted into the SMARTBATTERY. Unlike iBACS PRO, iBACS has no RI measurement. Instead of the RI measurement, defective batteries in the iBACS are determined by the intensity of the equalizing current. These values indicate similar information as RI (Impedance) measuring to evaluate the state of health of the batteries (SOH). The more equalizing / balancing that is required in order to keep the battery in the optimal voltage range, the more the battery is defective or simply too old. A "healthy" battery needs only minimal equalizing to stay in the ideal voltage range, only with increasing damage does the battery start to "drift" and this is indicated by the display in the iBACS. Without RI measurements, iBACS is both – the most reliable and low-priced battery management systems available.
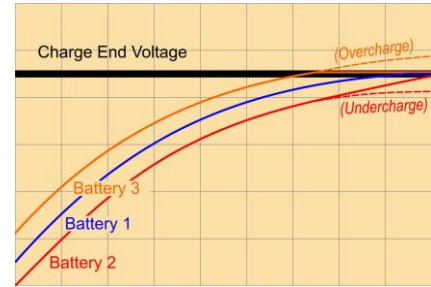
Charge curve of accumulators with BACS Equalization invented by GENEREX. The limitation prevents battery 3 from "gassing". Battery 2 continues to receive energy until it has reached the end-of-charge voltage. Battery 1 behaves ideally and is not regulated.

iBACS PRO
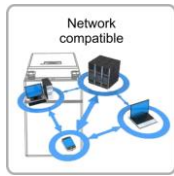
From 2020, the world's most powerful battery management system is the new "iBACS PRO" - the 4th generation of BACS comes as a plug-in version for the SMARTBATTERY. In addition to the determination of temperature and charging voltage, iBACS PRO provides additional features - in addition to a new high-precision internal resistance measurement technology iBACS comes with measurement of disturbances in charging current (AC ripple) as well as a battery capacity measurement!

The SOH (state of health) of each battery is now determined not only by the intensity of the equalization and the internal resistance measurement but also by its capacity, determined via the cyclically measuring of available Amp hours.

If a battery provides a normal capacity of capacity 7 Ah as labeled, it can be declared as "new". If the battery has been in use for a long time and has gone thru many discharges or even a hidden cell damage occurred over time, the measurement will be lower (e.g. 6 Ah) - the aging of the battery can be tracked by the capacity measurement.

This capacity measurement makes the SMARTBATTERY interesting for UPS manufacturers!

The battery capacity and autonomy data provided by the UPSs are rough guidelines. The current state of the battery is still not available- the repeatedly critical point of UPS users. It causes the batteries are replaced too early in order to avoid failures – or too late. With our technology it is now possible to measure and monitor the capacity of the battery. Only the weakest batteries must then be replaced to obtain the desired autonomy times:

Continuous monitoring allows UPS manufacturers to gain a unique insight into the state of each individual battery, providing more reliable runtime information as well as improved security while optimizing their equipment.

Battery Management System
BACS®

xBACS/iBACS Technology

The BACS system is able to accurately determine the status of individual batteries. If a problem is identified, it will be corrected by the "Equalization" process (known in Europe as "EQUALIZATION" known as "BALANCING" in the rest of the world) before the failure can affect the entire battery system. The charging voltage of each battery is individually corrected and adapted to the average voltage of the charging unit. The batteries are kept in the optimum operating voltage range.

With this technology is it possible to detect and avoid failures of standby battery systems in all industrial areas due to defective batteries! If necessary, the constant safe performance of each individual battery in a system is essential to guarantee that the battery system can carry the load in the event of a power failure. For this reason, in the past, the batteries have often been oversized or replaced earlier than necessary. If an early change of the batteries, for cost reasons, was out of the question there was a risk that the UPS would fail completely when requested.

The BACS VIEWER software shows the voltage drop of several batteries during a discharge, unnoticed by the UPS. These batteries would crash the complete system at a later stage. BACS regulate the voltage of each individual battery and during the charging process, thus ensuring the availability of the system.

Known typical problems with VRLA batteries (also known as AGM) are dry out, sulfation of plates, grid corrosion, and excessive gas evolution, which are caused by differential cell performance. If no countermeasures are taken, the failure of the battery and subsequently the loss of the entire battery string is the result.

If a battery in the system is defective and a change is unavoidable, all other batteries must be replaced in systems without BACS. With the use of BACS this is not necessary! BACS will allow both old and new batteries to operate in the string without any interaction:

The aging processes will cause differences between new and old batteries. BACS will compensate these differences and allow to use old batteries with the new batteries in the same string - Battery damages that were previously unavoidable in high voltage applications are prevented by BACS.

By doing so, a BACS system ensures unmatched operational safety and longevity of the battery system.

In addition to the measuring data of the batteries, BACS can additionally manage the ambient measured values (temperature, humidity, acid level, hydrogen concentration, etc.) and other systems (UPS, inverters, transfer switches, generators, potential-free contacts, air conditioners, etc.) and provide automated alarms.

SMARTBATTERY

SMARTLOGGER

High-voltage fuses

iBACS/iBACS PRO PCB
as slotcard

+ and +Polarity with M5
thread and copper bus

BACS WEBMANAGER
external
(slotcard version is available)

iBACS / iBACS PRO

Features

Voltage measurement and regulation (balancing)

iBACS / iBACS PRO measure the voltages of each battery / cell extremely fast and regulates the voltages to 0.01 volt exactly to the target voltage give by the battery charger. This procedure, called "equalizing" or "balancing", is at the heart of every GENEREX Battery Management product.
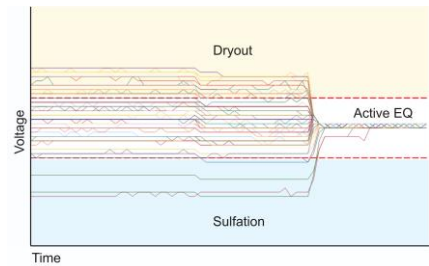
"State of Health "(SOH)

iBACS / iBACS PRO determine the "health" of the battery based on the current required for the equalization (balancing) charge. The more power has to be expended to bring the battery / cell to the target voltage and hold it there, provides insight of the health of the battery. Equalizing / Balancing shows a bar graph indicating performance. This indicator displays the health of the measured battery / cell. iBACS PRO also provides an indication of the internal battery resistance, which also determines the condition of the battery over time.

Temperature measurement
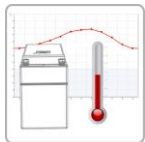
iBACS / iBACS PRO measure the temperature of each battery and alarm to temperatures outside of the optimal specifications. Like any battery, the SMARTBATTERY is dependent on environmental conditions and the temperature indicates whether they are outside the ideal range.

"State of Charge" (SOC) and capacity measurement
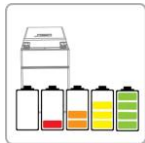
iBACS PRO is the first system that can measure the capacity of each battery / cell. This capacity measurement is also a further indicator of the health of the battery, but also gives the user direc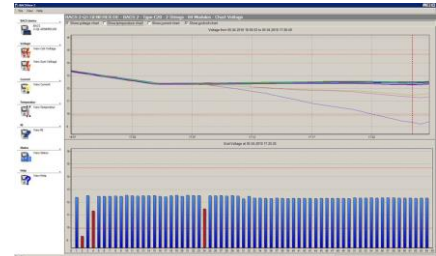t information on how long the battery can deliver energy in the case of a discharge. IEEE states that when a battery reaches < 80% capacity it should be replaced. This new feature is of particular interest to integrators or UPS manufacturers who have always missed this metric to ensure critical applications are supported.

Extremely fast data transfer through Token Ring bus

The data transfer speed of iBACS / iBACS PRO is one of the fastest on the market. Compared to the previous generation of BACS or the performance of competitors, iBACS / iBACS PRO and BACS has the fastest data bus, with measurement intervals of < 0.25 seconds for each battery.

High immunity to interference due to galvanic isolation
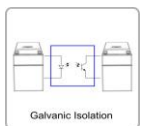
Due to aging of the components, UPS devices can generate electrical noise. This can damage batteries as well as disrupt the measurements of battery monitoring systems. By galvanically isolating each BACS module both to the high voltage side and between the modules (BACS uses Token Ring as bus topology), interference is not a issue. This makes BACS significantly more resistant to

interference than our than other battery monitoring systems.

AC ripple measurement

iBACS is able to measure and display the amount of AC content on the DC bus. The user can see at this value whether the rectifier/charging system is aging or if it requires maintenance. Damage to batteries, due to high ripple content, can be prevented which significantly contributes to increasing the life and reliability of the batteries and the UPS itself.

The SMARTBATTERY

The safest battery system on the market

High voltage fuse protection

A special safety feature is the use of high-voltage fuses for the test and supply lines between the battery, the SMARTLOGGER and the iBACS / iBACS PRO. All BACS generations have built-in fuses that prevent high current conditions across the module in the event of a faulty battery and overheating. By using high-voltage fuses in the SMARTBATTERY in combination with iBACS / iBACS PRO and BACS, the battery system is the safest system on the market. The fuses are supplied with the iBACS / iBACS PRO and are inserted by the user into the holders on the SMARTLOGGER during assembly.

These high-voltage fuses set new safety standards, in contrast to lithium batteries or battery monitoring systems without such technology.

GENEREX's new innovative SMARTBATTERY with iBACS and iBACS PRO offers the safest battery system on the market and provides an integrated solution for critical applications!

SMARTBATTERY batteries are no longer a "Black Box", but a measurable energy storage device with extremely high reliability and long life in critical safety systems.

No battery of other chemistry is more stable than a regulated lead-acid battery!

With minor investments into batteries coming with the GENEREX smart battery technology, lead acid batteries produced by any manufacturer can now offer up to 20% more capacity / performance and up to 50% longer service life
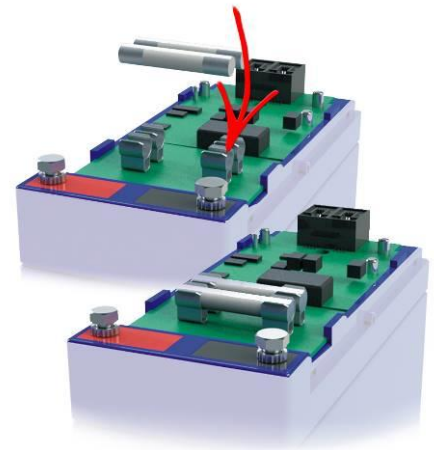
SMARTBATTERY optional parts

M5 /Faston Adapter

Unlike standard 7Ah batteries, the SMARTBATTERY features M5 screw terminals instead of the otherwise used 6.3mm FASTON pole terminals. To replace a conventional 7Ah battery with the SMARTBATTERY, an M5 / Faston adapter is available.

Pole connector

To ensure a secure, low-resistance connection between the battery blocks, a special pole connector for the smart battery has been developed. Due to the one-sided slot, the distance between the batteries can be varied from 0 - 4.5 mm.

The external antenna

If the top of the smart battery is not accessible, the installation of an external antenna will help to read out the battery data. The antenna is equipped with an adhesive film and can be attached to any position. The antenna is available with a cable length of 20 cm and 40 cm

BACS Versions
„Battery Analysis & Care System - 4th Generation"

SMARTBATTERY APP
- Graphical display battery sata
- Instant battery health diagnosis SOH (State of Health)
- Fast memory storage for capacity tests
- Diagnosis of historical battery data up to 10 years
- Data adaptable by BACS WEBMANAGER

data transfer through **Android Smartphones with NFC chip** or **with NFC READER tools**

SMARTBATTERY Series
12 Volt VRLA
capacity 7 Ah

As of 2019:
24 Ah, 45 Ah,
100Ah top terminal
and
150 Ah front terminal

iBACS
integrated BACS
for the SMARTBATTERY
Price optimized version of iBACS PRO

- **Network-compatible**
- **Status of every battery through**
  - Temperatur °C and °F
  - Charging Voltage in V and mV
- **Voltage balancing between each cell/jar Equalizing/Balancing**
- **Warranty extension for the SMARTBATTERY**
  - 3 years full warranty

iBACS PRO
integrated BACS
for the SMARTBATTERY

- **Network-compatible**
- **Status of every Battery through**
  - Impedance / Resistance in Ω and mΩ
  - Temperatur °C and °F
  - Charging Voltage in V and mV
  - Ripple in %/AC
  - Capacity in Ah
- **Voltage balancing between each cell/jar Equalizing/Balancing**
- **Warranty extension for the SMARTBATTERY**
  - 5 years full warranty

xBACS
external version
for all types of lead acid based batteries
likeAGM-, GEL-, Wett-cells, NiCd,
NIMH and Li-Ion batteries

- **Network and standalone**
- **Status of every battery through**
  - Temperatur °C and °F
  - Charging Voltage in V and mV
- **Voltage balancing between each cell/jar Equalizing/Balancing**
- **For Lithium Ion batteries with active Balancing**

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  - Ripple in %/AC
  - Capacity in Ah
- **Voltage balancing between each cell/jar Equalizing/Balancing**
- **For Lithium Ion batteries with active Balancing**

BACS WEBMANAGER
Central controller of the BACS System
- Reading and analysis of battery and all other data thru network
- Free programmable reactions at alarms
- integrated UPS & SNMP & MODBUS Manager
  (all UPS makers)
- Optional: Monitoring of environmental sensors
  (Temperature, humidity, Acid level, hydrogengas concentration,
  DC and AC voltage, potentialfree contacts, etc.
  plus almost any kind of 3rd party sensors)
- Programmable alarm signals
  (E-Mail, SMS textmessage, acoustical and optical)
- Access of all data through various interfaces
  (SNMP, MODBUS, Optional: PROFIBUS, LONBUS, BACnet, etc.)
- Compatibel to Monitoring Software UMNS (up to 5000 devices)
  in the network and remote monitoring with EmailTrap

BACS VIEWER - WINDOWS Software
- Analysis software for batteries
- Graphical display of all BACS and SMARTBATTERY data
- Creating of reports and trend for batteries
- Analyses

Specification SMARTBATTERY 7Ah

Nominal Voltage	12V
Nominal Capacity(20HR)	6.75Ah

Dimensions	Length	151±2mm (5.95 inches)
	Width	65±1mm (2.56 inches)
	Container Height	105±1mm (4.13 inches)
	Total Height (with Terminal)	105±1mm (4.13 inches)

Approx Weight	2.55 kg (5.62lbs)
Terminal	M5
Container Material	ABS

Rated Capacity	6.75 Ah	(20hr ,1.75V/cell,25°)
	6.25 Ah	(10hr,1.75V/cell,25°)
	5.50 Ah	(5hr,1.75V/cell,25°)
	5.20 Ah	(3hr,1.75V/cell,25°)
	3.90 Ah	(1hr,1.60V/cell,25°)

Max. Discharge Current	108A (5s)
Internal Resistance (fully Charged)	Approx 18mΩ

Operating Temp.Range	Discharge : -15～50°C (5～122°F)
	Charge : 0～40°C (32～104°F)
	Storage : -15～40°C (5～104°F)

Nominal Operating Temp. Range	25±3°C (77±5°F)
Cycle Use	Initial Charging Current less than 2.16A.Voltage 14.4V~15.0V at 25°C (77° F) Temp. Coefficient -30mV/°C
Standby Use	No limit on Initial Charging Current Voltage 13.5V~13.8V at 25°C (770 F) Temp. Coefficient -20mV/°C

Capacity affected by Temperature	40°C (104° F)	103%
	25°C (77° F)	100%
	0°C (32° F)	86%

Self-Discharge	SMARTBATTERIES may be stored for up to 4 months at 25° C (77°F) and then a freshening charge is required. For higher temperatures the time interval will be shorter.

Constant Current Discharge (Amperes) at 25°C (77°F)

F.V/Time	5min	10min	15min	20min	30min	45min	1h	2h	3h	4h	5h	6h	8h	10h	20h
1.85V/cell	16.6	12.7	10.2	8.86	6.52	4.78	3.41	2.21	1.63	1.37	1.04	1.00	0.796	0.601	0.316
1.80V/cell	19.8	14.0	11.3	9.52	7.00	5.07	3.52	2.32	1.68	1.41	1.08	1.03	0.814	0.615	0.331
1.75V/cell	22.1	15.3	12.1	10.01	7.30	5.25	3.63	2.40	1.73	1.44	1.10	1.05	0.828	0.625	0.338
1.70V/cell	24.1	16.4	12.9	10.52	7.57	5.41	3.76	2.45	1.77	1.47	1.12	1.06	0.840	0.635	0.343
1.65V/cell	26.2	17.3	13.5	11.0	7.80	5.52	3.83	2.49	1.80	1.49	1.14	1.08	0.850	0.642	0.346
1.60V/cell	27.6	18.0	13.9	11.2	7.93	5.62	3.90	2.53	1.83	1.51	1.16	1.09	0.858	0.649	0.349

Constant Power Discharge (Watt/cell) at 25°C (77°F)

F.V/Time	5min	10min	15min	20min	30min	45min	1h	2h	3h	4h	5h	6h	8h	10h	20h
1.85V/cell	31.5	24.2	19.7	17.3	12.8	9.42	7.56	4.40	3.33	2.74	2.32	2.02	1.61	1.333	0.721
1.80V/cell	37.2	26.7	21.8	18.4	13.7	9.95	8.02	4.61	3.43	2.81	2.37	2.06	1.64	1.355	0.728
1.75V/cell	41.1	28.9	23.1	19.3	14.2	10.3	8.22	4.74	3.51	2.87	2.42	2.10	1.66	1.372	0.740
1.70V/cell	44.5	30.7	24.4	20.2	14.7	10.6	8.45	4.84	3.58	2.92	2.45	2.12	1.68	1.386	0.746
1.65V/cell	47.8	32.1	25.4	21.0	15.0	10.7	8.54	4.89	3.63	2.96	2.48	2.15	1.70	1.398	0.751
1.60V/cell	49.8	33.0	25.9	21.2	15.2	10.8	8.63	4.95	3.67	2.98	2.51	2.16	1.71	1.406	0.755

SMARTBATTERY Dimensions

T15-1 Terminal(M5)
Unit: mm

ø7.9

M5

(8) (7.5)

105±1
95.5±1

(4)

65±1 49

(9.1)

(64.5)

(4.5) 67

151±1

Discharge Characteristics

12V Battery (V)

Temperature:25°C(77°F)

13.0
12.0
11.0
10.0
9.0
8.0

Terminal Voltage(V)

0.093C 0.05C
0.207C
0.4C
1C 0.628C
3C 2C

1 2 4 6 8 10 20 40 60 2 4 6 8 10 20

Min H
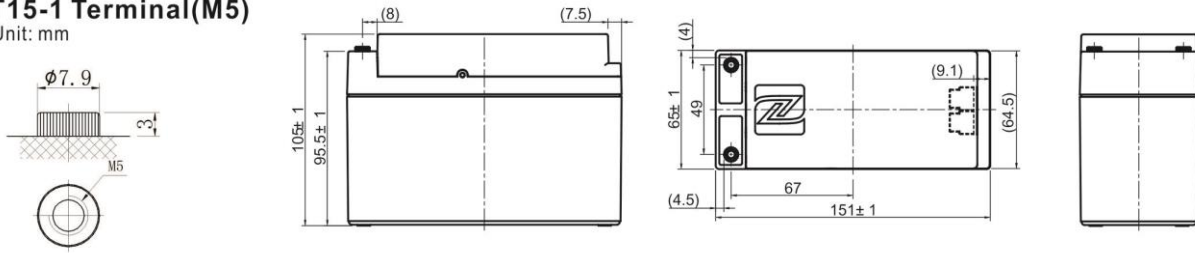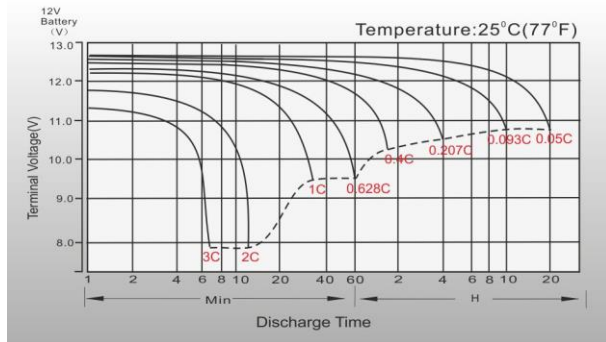
Discharge Time

Float Charging Characteristics

Charge Volume % Charging Current (XCA) Charging Voltage (V)

0.10CA-2.25V/cell   temperature25°C

Charged Volume
Charge Voltage (Constant 2.25v/cell)
After 50% Discharge
After 100% Discharge
Charging Current

0 4 8 12 16 20 24 28 32 36 40

Charging Time(hours)
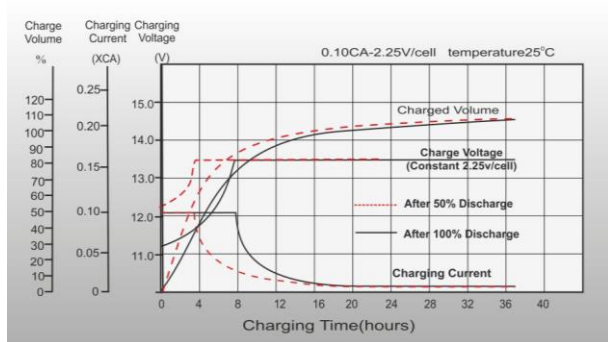
Temperature Effects in Relation Float Life

16
12
10
8
6
4
1
0.5

Float Life(year)

Charging voltage : 2.25V/cell

20/68   30/86   40/104   50/122 °C/°F

Battery temperature
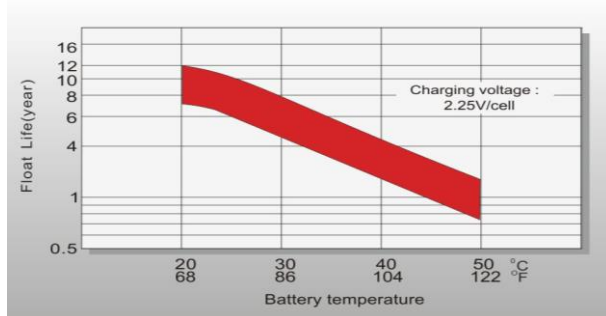
Effect of Temperature on Long Term to Battery Capacity

120
100
80
60
40
20
0

Capacity (%)

0.05CA
0.1CA
0.2CA
1.0CA
2.0CA   3.0CA

-20 -10 0 10 20 30 40 50

Temperature(°C)
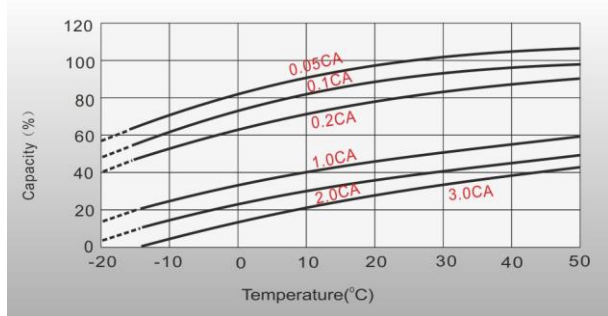
Cycle Life in Relation to Depth of Discharge

Testing condition
Discharging:current 0.17CA (FV 1.7V/cell);
Charging:current 0.25C max, voltage 2.45V/cell;
Charging volume:125% of discharged capacity.

120
100
80
60
40
20
0

Capacity(%)

100% DOD   50% DOD   30% DOD

Ambient Termperature: 25°C (77°F)

0 200 400 600 800 1000 1200

Number of Cycles

Self Discharge Characteristics

100
80
60
40
20
0

Remaining Capacity(%)

10°C
25°C
40°C 30°C

A
B
C

2 4 6 8 10 12

Storage Time(Months)

A No supplementary charge required
(Carry out supplementary charge before use if 100% capacity is required.)

B Supplementary charge required before use.Optional charging way as below:
1.Charged for above 3 days at limted current 0.25CA and constant volatge 2.25V/cell.
2.Charged for above 20hours at limted current 0.25CA and constant volatge 2.45V/cell.
3.Charged for 8~10hours at limted current 0.05CA .

C Supplementary charge may often fail to recover the capacity.
The battery should never be left standing till this is reached.