



- **BACS is a monitoring, balancing & alarm system for batteries**
- **BACS allows the user to prevent unnoticed or unexpected battery failures**
- **BACS extends battery life and helps to preserve the reliability of UPS systems**



GENEREX's 3<sup>rd</sup> generation BACS® (**B**attery **A**nalysis & **C**are **S**ystem) is the most advanced product of its kind on the market today. An ethernet integrated battery monitoring and management system, BACS® uses web management technology to monitor the temperature, internal resistance, and voltage of every single battery in a given system.

Through our patented balancing process—called **Equalization**<sup>1</sup> in Europe and **Balancing** elsewhere—BACS® calibrates the charging voltage of all batteries with the charger's target value, keeping all batteries within optimal voltage operating range.

1—Note: The term GENEREX uses in Europe (equalizing) should not be confused with the process of overcharging from wet-cells. As pertains to BACS, the term 'Equalizing' (like the term 'Balancing') refers to the process of harmonizing the voltages of cells with the charger's target voltage.

The constant monitoring and harmonization of the individual charging voltages of batteries helps to guarantee the availability of the battery at all times, making the Achilles' heel of any UPS system—or any other battery powered device—a thing of the past!

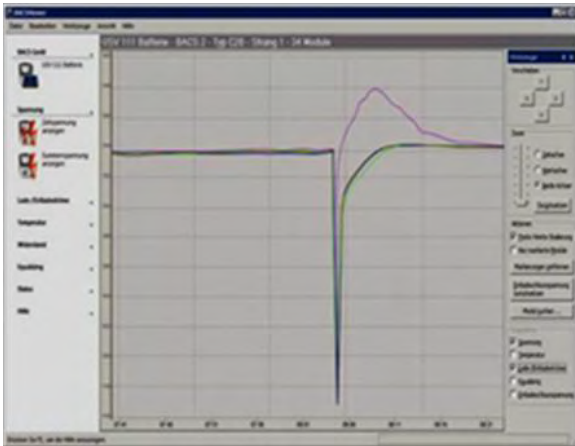
What's more, BACS® has the capacity to manage environmental measurements (temperature, humidity, acid fill level, hydrogen gas concentration, etc.) and appliances (UPS, inverters, transfer switches, generators, dry contacts, air conditioning systems, etc.).

BACS® is the ideal system for lead-acid batteries (open/wet cell, maintenance free, gel, AGM, etc.), as well as NiCad, NIMH and most types of Li-Ion batteries.

# BACS features at a glance

## ● REGULATE CHARGING

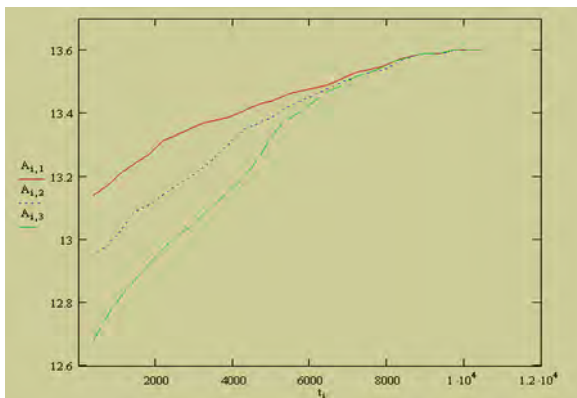
BACS® is designed to monitor and optimize lead-acid and other battery types in a given battery system.



Free BACS® viewer software shows the Equalization (Balancing) of a battery (the bold violet line in the graphic) within a string of 32 batteries during a discharge/recharging process. BACS® Equalization (Balancing) prevents the overcharging of the violet battery, while the batteries around it continue to charge.

## ● INDIVIDUAL VOLTAGE REGULATION

By means of a patented process called **Equalization** (or **Balancing**), BACS® regulates the voltage supply from the charger or UPS for every battery. This process serves to calibrate the batteries and results optimal capacity and improved lifespan.



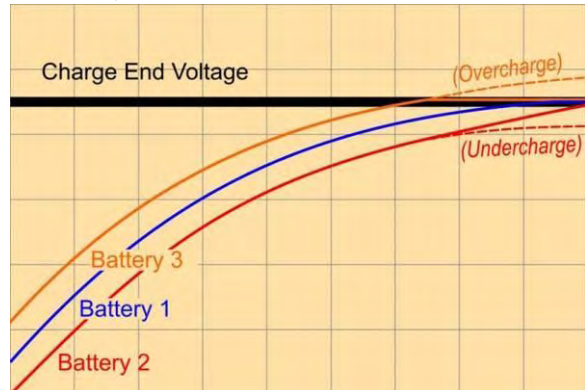
Oscilloscope graph of battery voltages during the Equalizing (Balancing) process: The voltages of the 3 batteries behave differently given the regulating influence of the BACS® modules. The ideal harmonic charging curve will be achieved for every battery in the string.

## ● AVOID OVERCHARGING

The Equalization (Balancing) process prevents the unintended overcharging of batteries. (By preventing overcharging, BACS® helps to limit gassing, dry-out, and thermal runaway.)

## ● AVOID UNDERCHARGING

The Equalization (Balancing) process also prevents unintended undercharging. (By preventing undercharging, BACS® helps to limit sulfation and loss of capacity.)



The charging of accumulators according to BACS® patented equalization process. The charging of Battery 3 is capped to prevent overcharging and gassing. Supply of charging energy to Battery 2 is continued and boosted until the target charging voltage is obtained. Battery 1 performs ideally and is not regulated.

## ● DETECT IMMINENT BATTERY ISSUES

Typical battery problems like sulfation, corrosion, gassing, dry-out, thermal runaway are detectable given proper monitoring. (Changes in impedance and temperature— which are monitored by BACS®—tend to indicate the onset of such issues.)

## ● AVOID SULFATION

Sulfation is often a problem for UPS batteries given that they are consistently held at a float charge level or subject to a charging principle that leaves them uncharged for long periods of time. Without proper regulation, there is no guaranteeing that all batteries have been fully charged when the UPS charge switches from boost to float charging. Often enough, when this takes place, some batteries are overcharged, while others remain incompletely charged. The Equalization (Balancing) process retards sulfation by maintaining ALL batteries at a balanced voltage level and keep them at the ideal SOC— and, thus, in the ideal SOH (State of Health).

## ● DETECT STRATIFICATION

By catching increases in impedance and drifting voltages, BACS® allows the user to detect battery stratification. From time to time, in order to reverse stratification, a battery's acid-gel-water mix requires rectification. It is by rectifying the mix that the ill-effects of stratification are managed. By verifying lower impedance and improved Equalizing (Balancing) performance, BACS® confirms for the user the benefits of the rectifying process.

## ● PROTECT BATTERIES

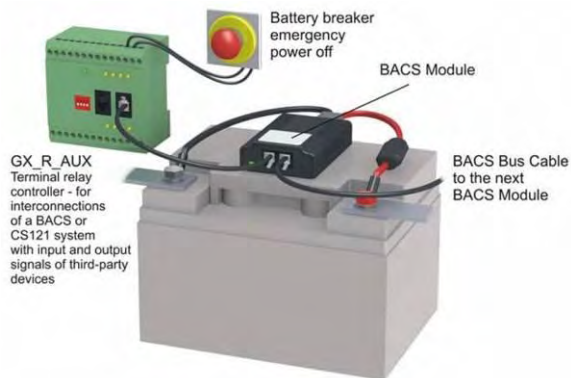
By balancing the voltages of a system's batteries, BACS® prevents damage caused to batteries by neighbors in the system. Thus, a new battery can be swapped into a string of older ones without risk of overcharge, making full swaps unnecessary.

## ● ADVANCE WARNING SYSTEM

Because it monitors key battery parameters and set thresholds, BACS® is able to provide advance warning—via audio, video, and network messages—of system events that require attention.

## ● PREVENT THERMAL RUNAWAYS

By means of an embedded dry contact output, the BACS® system is capable of tripping the battery breaker in the event of thermal runaway. Automatic stringwise battery disconnection is possible, given the presence of a GX\_R\_AUX relay, which trips the battery breaker when user defined parameters are met.



The GX\_R\_AUX module provides 4 relay contacts and 4 digital inputs. It controls up to 4 breakers. The digital inputs read the battery breaker status and display it in the BACS® web interface. Other alarm devices (for example, audio alarms) may be connected to the outputs or digital inputs of the GX\_R\_AUX.

## ● INCREASE BATTERY CAPACITY

BACS® guarantees, through Equalization (Balancing), a full charge level and the optimal functioning of the battery system.

## ● BATTERY REPLACEMENT NEEDED

By monitoring impedance trends, BACS® allows the user to detect weak or damaged batteries in early stages of deterioration. Timely replacement of bad batteries is vital to improving the lifespan of the battery system as a whole.

## ● EXTENSION OF SERVICE LIFE BY > 30%

The service life of a string of batteries depends on the weakest cell of the weakest battery in the string. Typically, in a UPS, the service life of such a string is 50-60% of what is called for by manufacturing designs. By virtue of the Equalizing (Balancing) process, each of the batteries within the string is maintained at optimal voltage levels, eliminating the ill-effects of improper charging. **The constant care provided for by the Equalizing (Balancing) process has been shown to increase service life of batteries by more than 30%!** And, given the virtues of the Equalizing (Balancing) process, we aspire to improve on this. (Test results from 2004 have demonstrated that an increase of 50% in not unrealistic. Two BACS® regulated systems in our labs have been running on the same batteries for 10 years—two years longer than the time frame stipulated by manufacturing specs. These systems are still running.) BACS® proves it is possible to meet—and even greatly exceed—service lives called for by manufacturers.

## ● ALERT SYSTEM

BACS® monitors UPS system data and environmental parameters (temperature, humidity, hydrogen gas concentration, acid fill level, DC current, dry contacts, etc.). Alerts can be set up, and this information can be accessed via multiple communication systems.

The screenshot shows the BACS web interface displaying a table of battery status data for 140 batteries. The table has columns for Battery ID, Voltage, Temperature, Impedance, and Status. The status column uses color-coded LEDs to indicate the health of each battery. The interface also shows a 'BACS Module Status' section with a table of module data.

Here, a BACS® web server displays the battery status of 140 batteries. Actual impedance, temperature, and voltage of every cell is displayed and stored. Status LEDs show a change of color if any battery drifts beyond thresholds.

## ● MAINTENANCE

BACS® improves the service quality by providing remote monitoring through Internet, VPN, or any network that allows for the downloading of real time data and battery history. It is now possible to test batteries without going to the trouble of disconnecting them from the system. Maintenance and testing take place under real operating conditions and require no downtime!



### ● UPS/SNMP & MODBUS MANAGER

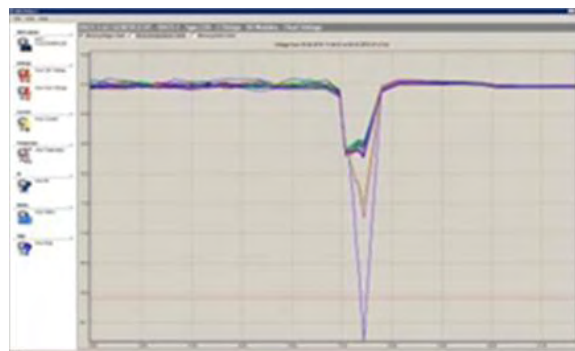
BACS® includes a full qualified UPS/SNMP and MODBUS manager, one that is compatible with any UPS presently on the market! Among BMS systems on the market, this function is unique.

### ● MODBUS/PROFIBUS/LONBUS/SNMP

BACS® allows MODBUS clients to read the system data through IP and RS232 (and optionally RS485), as well as through SNMP. Conversion to PROFIBUS and LONBUS is possible through optional converters.

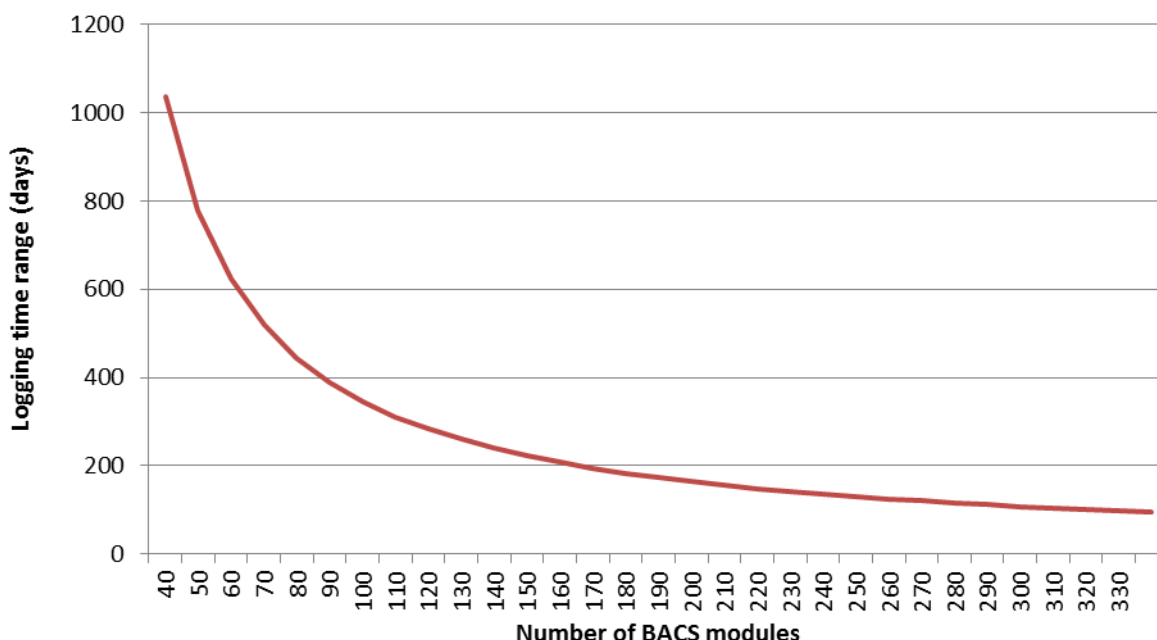
### ● FREE VIEWER ANALYSIS SOFTWARE

Provides graphical BACS® data analysis and reports!



Discharge process displayed through BACS® Viewer software shows the voltage drop of several batteries during a discharge, unnoticed by the UPS. In a later stage, these accumulators would cause the complete system to collapse! BACS® corrects this problem and attempts to fully recharge this specific battery.

### Flash ROM capacity for battery history depending on no. of BACS® modules in the system



No. Of BACS Modules	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330
Log range in flash ROM (in days)	3112	1556	1037	778	622	519	445	389	346	311	283	259	239	222	207	195	183	173	164	156	148	141	135	130	124	120	115	111	107	104	100	97	94

In this graphic, we see the data capacity of the BACS® WEB-MANAGER flash rom during float charging operation. By default, battery data is autosaved every 20 minutes. After a discharge—or any other significant event—the autosave interval is greatly reduced. This increases the amount of data saved on the flash rom, but provides very precise data for analysis. (The user may access this data through the BACS® VIEWER.) The number of BACS® modules and the number of discharges determine the available capacity. The table above shows the number of days of battery history that can be stored on the flash rom during normal system operation (i.e. assuming no significant event has occurred). This data may be transferred to other storage systems on the network. Older files are overwritten once capacity is reached, and only the latest battery data is retained on the flash rom. We recommend downloading and saving battery history on a regular basis. (This also can be done via the BACS® VIEWER.)

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# BACS Description

**The reliability of a battery based power supply can only be guaranteed if every battery in it is able to perform at an optimal level 100% of the time!**

BACS® battery modules are capable of taking precise measurements of a battery's internal resistance, temperature, and voltage. These measurements are essential to making precise analyses of the batteries in any given system. BACS® transfers this data through a bus system to the BACS® WEB-MANAGER. The WEB-MANAGER handles events involving the UPS, inverters, environmental sensors, transfer switches, generators, dry contacts, and other devices.

The BACS® WEB-MANAGER acts as the battery system's central control unit. It gathers, evaluates, and (on its internal flash memory) stores all pertinent system information. The user is provided access to three web server pages. One displays the actual status of batteries; a second shows actual UPS data; the third shows environmental data and alarm contacts status. The web browser interface of the system is designed for easy configuration. It provides the user with access to all system values and events. A flexible programming interface known as the EVENT MANAGER coordinates a system response to significant events (alarms, notifications, etc.).

The BACS® WEB-MANAGER reads individual battery voltages and compares them to the battery system's target voltage. The latter value (the target voltage) is sent to each BACS® module, which steers voltage levels of the batteries under its control if they happen to deviate from the target. This is the process we call equalization (or balancing). By virtue of it, the voltages of all batteries in a given system can be calibrated to within 0.01 volts of that system's target voltage.

BACS® effectively mitigates the possibility of overcharging batteries. In this way, it helps to prevent gassing and drying. It also mitigates the possibility of undercharging. Thus, it helps to prevent sulfation. Through Equalization (Balancing), system batteries are kept at an optimal charging voltage, and, therefore, in an optimal SOH (State of Health).

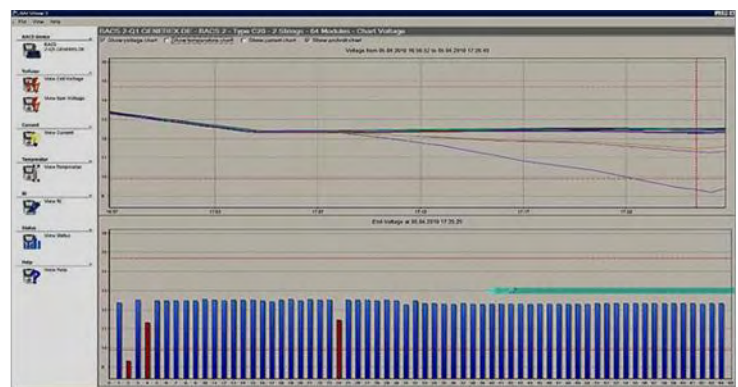
BACS® VIEWER shows the individual battery voltage of all accumulators at the end of a discharge. The red dotted line shows the voltages when power has returned. The lower bar graph indicates those accumulators that have collapsed early and have been discharged to a very low level. These batteries are a risk to the entire system.

By managing a battery system's charging voltages, BACS® vastly improves its durability and reliability.

BACS® has the ability to send out "advance warning" alarms via email, email-to-SMS, network message, SNMP, RCCMD, MODBUS, and, optionally, PROFIBUS, LONBUS, and GSM. (Alarm parameters can be configured by the user to match battery type.) For instance, discovering rising internal resistance in a battery—an indicator of corrosion or sulfation—BACS® triggers an alarm. (Sulfation, when caught in time, can be reversed by means of a series of charging and discharging cycles.) Given early warning of the issues that such a rise indicates, the user is able to investigate and take action far in advance of the consequences that can result from them. And the effects of corrective actions taken are immediately observable. In addition to internal resistance, BACS® monitors voltage, temperature, the Equalizing (Balancing) process, the system's charging/discharging cycles, and, optionally, current. When preset thresholds pertaining to any of these categories are crossed, an alarm is communicated.

In addition to sending network alarms, BACS® also warns users via acoustical and visual signals (a buzzer on the BACS® MANAGER and alarm LEDs on the module and BACS® MANAGER).

The BACS® WEB-MANAGER is equipped with flash memory or SD memory cards. Depending on the size of the battery system, it can log anywhere from 6 months' to 3 years' worth of system data. Using the BACS® VIEWER software, data can be downloaded and archived, freeing up storage capacity for further data logging. The alarms of any device connected to the BACS® WEB-MANAGER (for example, a UPS) are logged in various files on the device and at remote interfaces. The BACS® WEB-MANAGER is equipped with a real-time clock, which is automatically synchronized with a network time server (SNTP). The WEB-MANAGER applies precise data and time stamps to all log files.



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# Batteries in UPS applications

In a typical UPS battery installation, one tends to find large numbers of batteries connected in series, this, in order to produce a high string voltage. Modern UPS systems, augmented with IGBT rectifiers, work very efficiently, but require a high string voltage compared to older systems. This increased need means an increase in the number of batteries one might find in any given string. (With larger strings, it's not unusual to see voltages of 800V or higher.) At the same time, in data centers, space is an increasingly precious commodity. Managers will often choose space saving Valve Regulate Lead Acid (VRLA) batteries over their Flooded Lead Acid (FLA) counterparts. Where VRLA batteries are smaller, they run hotter—and therefore tend to gas and dry out—often resulting in a shortened lifespan.

## EARLY REPLACEMENT, REDUNDANCY...

More batteries in a string... this means higher voltage, but it also means more cables, more connectors, greater impedance, and significant voltage drop. The net effect of this is to create charging issues. (2V fluctuations from battery to battery in such a string are not unusual.) And these issues worsen over time. Over time, discrepancies of no more than a few tenths of a volt grow incrementally. It becomes increasingly difficult to maintain a float voltage of 13.6V on any given battery.

All batteries are not created equal. This is a truism. So, it stands to reason that, given a long string, providing individual batteries and cells with precisely the float voltage required to prevent charging issues is an inherently problematic task. Thus, for years, it has been commonly accepted in the UPS industry that such issues and the ill-effects they bring about (sulfation, drying out, shorter and shorter battery life, etc.) were unavoidable. Lacking a technical solution, rather than focusing on the problem, UPS makers have simply recommended replacing batteries earlier than their expected lifetime. Users wanting to avoid the risk of UPS failure have simply had to accept replacing batteries at 50-60% of the lifetimes specified by manufacturing designs.

Naturally, UPS users have never been satisfied with this solution. Changing batteries more often does not completely mitigate the risk of UPS failure. New batteries have been known to fail without warning. And no high voltage UPS can tolerate missing batteries. Entire systems may collapse given a single point of failure.

So, UPS makers have offered another solution: redundancy. Redundant UPS systems feature two or more strings of batteries. This reduces the risk of UPS failure, but has several disadvantages: increased cost, increased space requirements, increased service costs. And it is still no guarantee. The user has no idea what is going on in any given battery string at any given time. The reduction in risk accomplished by adding more strings is only theoretical.

To counteract the risk of unnoticed battery failures and loss of backup, UPS users began installing automatic transfer switches to redundant UPS systems and using emergency generators as a backup in case of power failure. This is both an extremely costly solution and one that involves a further risk. Emergency generators on standby require at least a ten-second startup time—time enough to lose data in the event of battery failure. The generator's starter battery is still another risk factor. **The battery remains the Achilles' heel of any backup system known to man!**

## BATTERY MANAGEMENT SYSTEMS

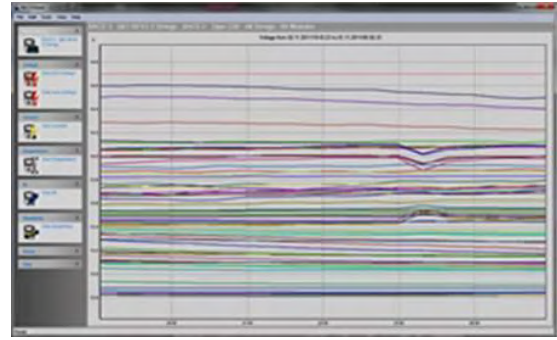
In light of this fact, the Battery Management System (BMS) has become fashionable.

It is out position a complete Battery Management System should not only detect imminent battery failure, it should 1) tell the user why batteries are failing, and 2) provide a reliable Advance Warning System, and 3) initiate actions to counteract battery issues. In a word, a good BMS should not only monitor but regulate.

**By virtue of its patented Equalization (Balancing) process, BACS® is the only BMS on the market that does both: monitor and regulate!**

The graphic below shows the battery history in a UPS that might be found in any data center today. It is five years old; the float voltages of the batteries in the string it contains vary within a window of +/- 1.8V. (That's a large window!) During the period of time described in this readout, this UPS system was not managed by BACS®.

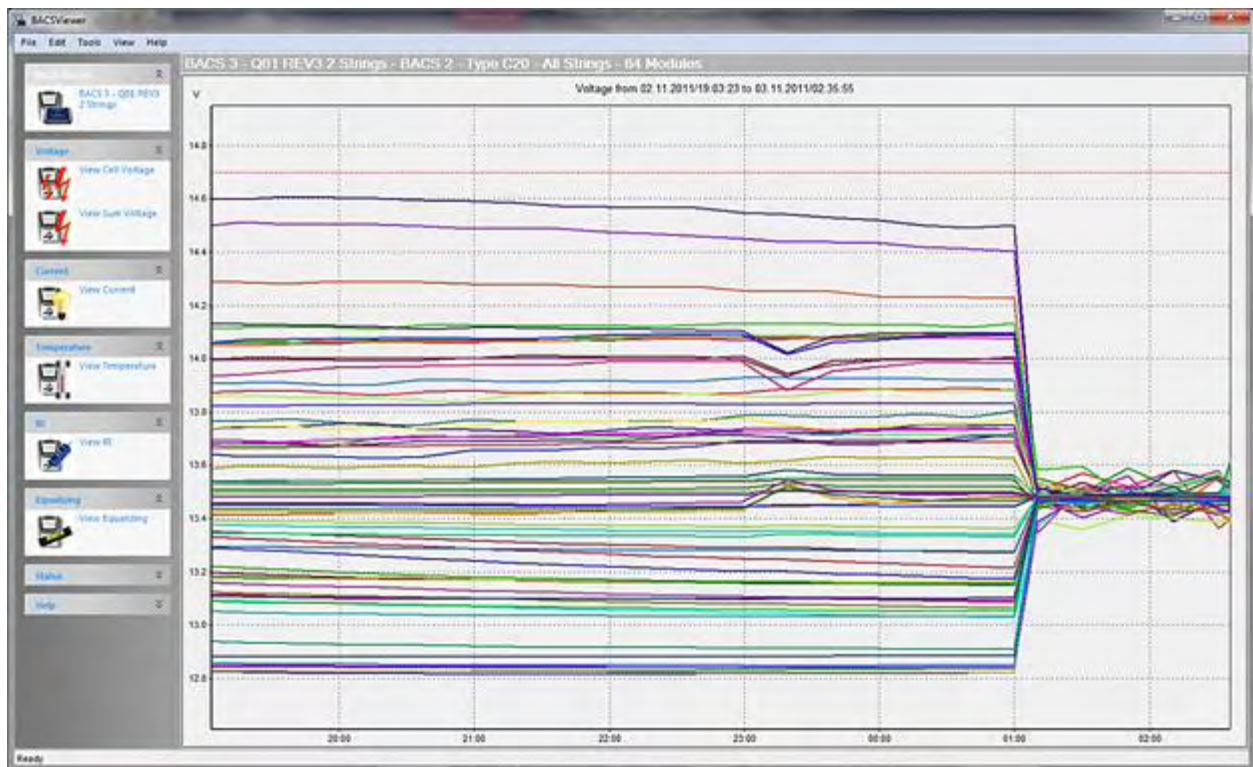
Typically, given the peculiarities of its batteries—without correction—the voltages in such a system will tend to be different. The longer such differences remain uncorrected, the more the voltage patterns start drifting. There comes a point at which these patterns begin to show a significant difference (1 volt or more). That is what we see in the screenshot right.



On the lower picture, we see quite a different screenshot...

#### BACS® VIEWER SCREENSHOT

As seen by BACS®, after 5 years of operation, a UPS with 64 12V batteries presents voltage patterns that vary widely (a window of  $\pm 1.8V$ ).



#### BACS® VIEWER SCREENSHOT

As seen by BACS®, **the same 5 year old system** as shown in the previous graphic, this time, after the application of the patented Equalization (Balancing) process. Within a few hours, this process brings the variance in float voltage to within 1/100th of a volt of the level recommended by the manufacturer.

Applying the patented Equalization (Balancing) process used by BACS® to this same system, note that we are able to eliminate virtually all of the variance in float voltage. The Equalization (Balancing) process brings the float voltage of **all** batteries in the string to within  $\pm 1/100^{\text{th}}$  of a Volt, this despite such factors as connections, location within the string, and so on and so forth. BACS® **keeps** each of the batteries at full charge and at the float voltage recommended by the manufacturer.

A general description about the principle of equalization and an explanation of the reasons it extends battery life drastically and extends cycle life by at least a factor of 3 is scientifically explained in the INTELEC Paper 32.1 "[Life Extension through charge Equalization of Lead-Acid Batteries](#)" by Philip T. Krein, Member of IEEE.

The BACS® patent has been established based on scientific principles and investigations conducted by GENEREX from 2002-2004.

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# BACS® System Components

## BACS VIEWER Software Remote Monitoring



## BACS® C MODULE & CABLE

A diagram of a BACS® module installation:

A calibrated measuring cable with two high-voltage fuses connected to the positive and the negative Battery poles uses a 4-string wire for measuring the individual battery data.

The BACS® module measures through an integrated sensor the surface temperature of the accumulator, the voltage and the impedance.

The BACS® module is available in five different types: 16 volt, 12 volt, 6 volt, 2 volt and for NiCad, NiMH and Lithium Ion batteries with a wide range of 1.2 V- 3Volt.

At Equalization (Balancing) mode, the thermal energy is transferred through the cooling fins to the environment, until the process has finished.

The status is shown at an LED on the front panel.

Simple installation or retrofitting through Velcro tapes and bus cables.

## BACS® WEB-MANAGER

Two external, one external with integrated busconverter and two UPS slot version

Management of up to 600 (with CS121 series products up to 330) BACS® C modules in up to 10 parallel strings.

Includes a full-qualified UPS-SNMP & MODBUS manager at COM 1 for the monitoring of a UPS/inverter/rectifier or other devices with a serial interface.

COM2 for optional environmental sensors (e.g. temperature, humidity, current, acid fill level, etc.).

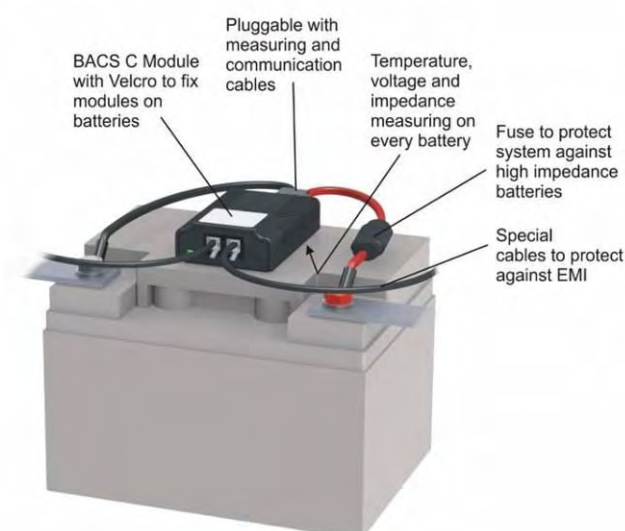
One programmable alarm relay output, one alarm-LED, one alarm buzzer, mute button.

Integrated web server for status display configuration of all alarm thresholds (battery impedance, voltage, temperature, UPS alarms, environmental alarms, etc. network messaging system (email, SMS, SNMP, RCCMD, MODBUS and (optional) PROFIBUS, LONBUS, BACnet.

Data logger for all measuring data, (optional) current sensors for charge- and discharge current measuring.

Compatible to UNMS monitoring software and LED matrix remote display.

Integrated DIN rail mounting on all external manager types.



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# BACS® modules - Technical data and dimensions



<b>BACS® modules REV 3</b>	
Construction	Measuring modules with equalisation BACS patent no.: DE 102004013351.4
current consumption from battery	normal operation: 15 - 20mA (C20, C23, C30) 35 - 40mA (C40, C41) „Sleep Mode“: < 1mA
Measuring precision	Internal resistance : < 10 % at C40, < 5% at C20/30 Voltage : < 0,5 % Temperature: < 15 %
Interfaces	2x RJ10 for BACS battery bus Internal RS232 bus interface 1x button for the addressing Temperature sensor -35 bis + 85 °C Optical display LED (alarms red/green, mode red/green)
Housing dimensions, weight	ABS housing (UL certified, flame retardant, cooling fins) 55 x 80 x 24 mm = 2,17 x 3,15 x 0,94 in. (B x H x T), 45g
Operating condition Int. protection rating	Temperature 0 - 60°C, max. humidity 90%, not condensing IP 42 coated against dust and condensate
High voltages security tested	Protection against high ohmic batteries fault voltages up to 150 Volt /per module (fuse opens). At higher voltages the fuse opens, but BACS module is damaged. All REV 3.1 modules are designed for fault voltages up to 600 Volt
MTBF (calculated)	87.600 hours (10 years)



<b>Module BACS® C20</b>	
Order No. BACSC20	
REV 3 module for 12Volt 7-600Ah lead batteries (UL certified)	
Voltage range	9.7V – 17V
RI range	0.5-60mOhm
Equalisation power	0.15 A



<b>Module BACS® C23</b>	
Order No. BACSC23	
REV 3 module for 16Volt 7-600Ah lead batteries (UL certified)	
Voltage range	9.7V – 21V
RI range	0.5-60mOhm
Equalisation power	0.12 A



<b>Module BACS® C30</b>	
Order No. BACSC30	
REV 3 module for 6Volt 7-900Ah lead batteries (UL certified)	
Measuring value	4.8V – 8.0V
RI range	0.5-60mOhm
Equalisation power	0.3 A



<b>Module BACS® C40</b>	
Order No. BACSC40	
REV 3 module for 2Volt 7-5000Ah lead, NiCd, NiMH batteries (UL certified)	
Measuring value	1.25V – 3.2V
RI range	0.02-6mOhm
Equalisation power	0.9 A (at 2.27V)



<b>Module BACS® C41</b>	
Order No. BACSC41	
REV 3 module for 4Volt 7-900Ah lead, NiCd, NiMH, Li-Ion batteries	
Measuring value	2.4V – 5.0V
RI range	0.5-30mOhm
Equalisation power	0.3 A

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# BACS® WEB-MANAGER – Technical data

## BACS® WEBMANAGER BUDGET SC (slot version)

Order No. BACSKIT\_BSC4

ARM Cortex A8 800MHz CPU, 128 MB RAM/ 512 MB storage for battery history in days (refer to the example table above).

At 12V default power supply approx. 150mA The BACS CONVERTER is part of that product. For technical details and max. count of modules and sensors are listed in the CONVERTER datasheet .

3x RS-232 interfaces, (COM1= UPS/power device,

COM2 =Multipurpose, COM3=BACS battery bus)

1x RJ12 for battery bus converter

1x RJ45, 10/100Mbit Ethernet

2x LED (Manager status, UPS/device alarm)

Slot card "SC format" for UPS devices with compatible slots

UL- Certification

60 x 29 x 120mm = 2,36 x 0,79 x 5,12 in. (L x W x H) – Slot card „SC format“

90g

Temperature 0 - 70°C, max. humidity 20 - 95%, not condensing

849192 hours; 96,9 years



Processor and memory

Power consumption

Interfaces

Display

Housing

Dimensions

Weight

Operating condition

MTBF (calculated)

## BACS® WEBMANAGER BUDGET L

Order No. BACSKIT\_LB4

ARM Cortex A8 800MHz CPU, 128 MB DDR3 RAM/ 512 MB storage for battery history in days (refer to the example table above).

At 12V default power supply approx. 150mA The BACS CONVERTER is part of that product. For technical details and max. count of modules and sensors are listed in the CONVERTER datasheet .

3x RS-232 interfaces, (COM1= UPS/power device,

COM2 =Multipurpose, COM3=BACS battery bus)

1x RJ12 for battery bus converter

1x RJ45, 10/100Mbit Ethernet

2x LED (Manager status, UPS/device alarm)

Aluminium, RAL 7035 (light gray) CE, UL/NEMKO certification

69 x 126 x 35mm = 2,72 x 4,96 x 1,38 in. (L x W x H)

210 g

Temperature 0 - 70°C, max. humidity 20 - 95%, not condensing

849192 hours; 96,9 years



Processor and memory

Power consumption

Interfaces

Display

Housing

Dimensions

Weight

Operating condition

MTBF (calculated)

## BACS® WEBMANAGER BUDGET SCM RS485 (slot version)

Order No. BACSKIT\_SCMB4

ARM Cortex A8 800MHz CPU, 128 MB DDR3 RAM/ 512 MB storage for battery history in days (refer to the example table above).

At 12V default power supply approx. 150mA The BACS CONVERTER is part of that product. For technical details and max. count of modules and sensors are listed in the CONVERTER datasheet .

2x RS-232 interfaces, (COM1= UPS/power device, COM3=BACS battery

bus), 1 \* RS485 = COM2

1x RJ12 for battery bus converter

1x RJ45, 10/100Mbit Ethernet

2x LED (Manager status, UPS/device alarm)

Slot card "SC format" for UPS devices with compatible slots

UL- Certification

60 x 29 x 120mm = 2,36 x 0,79 x 5,12 in. (L x W x H) – Slot card „SC format“

66g

Temperature 0 - 70°C, max. humidity 20 - 95%, not condensing

871680 hours; 99,5 years



Processor and memory

Power consumption

Interfaces

Display

Housing

Dimensions

Weight

Operating condition

MTBF (calculated)

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# BACS® WEB-MANAGER – Technical data



Processor and memory

Power consumption

Interfaces

Display

Housing

Dimensions

Weight

Operating condition

MTBF (calculated)

## BACS® WEBMANAGER BUDGET LM RS485

Order No. BACSKIT\_LMB4

ARM Cortex A8 800MHz CPU, 128 MB DDR3 RAM/ 512 MB storage for battery history in days (refer to the example table above).

At 12V default power supply approx. 150mA The BACS CONVERTER is part of that product. For technical details and max. count of modules and sensors are listed in the CONVERTER datasheet .

2x RS-232 interfaces, (COM1= UPS/power device, COM3=BACS battery bus), 1x RS485

1x RJ12 for battery bus converter

1x RJ45, 10/100Mbit Ethernet

2x LED (Manager status, UPS/device alarm)

Aluminium, RAL 7035 (light gray) CE, UL/NEMKO certification

69 x 126 x 35mm = 2,72 x 4,96 x 1,38 in. (L x W x H)

210 g

Temperature 0 - 70°C, max. humidity 20 - 95%, not condensing

844138 hours; 96,4 years



Processor and memory

Number of Sensors & Power consumption

Interfaces

Display/Signal

Housing

Dimensions

Weight

Operating condition

MTBF (calculated)

## BACS® WEBMANAGER BUDGET 12VOLT

Order No. BACSKIT\_B4

ARM Cortex A8 800MHz processor, 512MB storage for battery history in days ( see Example table in the datasheet above)

Stabilized external power supply 12V 2000mA supplies 1830mA for up to 330 BACS C modules and other BACS bus sensors (See datasheet of other BACS sensors for power consumption)

3x RS-232 interfaces, (COM1= UPS/power device, COM2 =Multipurpose, service port for Windows BACS READER and PROGRAMMER software)

USB

2x battery bus converter outputs internal

1x RJ45, 10/100Mbit Ethernet

1x potential-free contact (2 pole screw terminal for max. 1,0 mm<sup>2</sup>, rated load 24 VDC /1A)

3x LED (Manager status, UPS/device alarm, BACS alarm)

1x Buzzer with mute button

Aluminium, RAL 7035 (light gray) UL/NEMKO certification in preparation

130 x 125 x 30mm = 5,12 x 4,92 x 1,18 in. (W x L x H)

180g

Temperature 0 - 60°C, max. humidity 20 - 95%, not condensing

849192 hours; 96,9 years



Description



## BACS® WEBMANAGER BUDGET 18V - 72V

Order No. BACSKB4\_72

Identical to BACSKIT\_B4, but designed for power supply directly from the 24Volt or 48Volt batterie group. The external pluggable power supply is replaced against a TRACOPOWER TCL 024-112DC DIN rail power supply (DIN rail not included).

Technical data of the TRACOPOWER TCL 024-112DC:

Input : 18V – 72V DC Output : 12V 2000mA DC stabilized.

1830mA are available for up to 330 BACS modules and other BACS bus sensors (see datasheet of other BACS sensors for power consumption).

NOTE: Input safeguarding fuse (recommended circuit breaker 6-16A / characteristic C) is not included.



Description



## BACS® WEBMANAGER BUDGET 120V - 370V

Order No. BACSKB4\_370

Identical to BACSKIT\_B4, but designed for power supply directly from the 24Volt or 120Volt to 370 Volt batterie group. The external pluggable power supply is replaced against a MEANWELL SNT MW-MDR20-12 DIN rail power supply (DIN rail not included).

Technical data of the MEANWELL SNT MW-MDR20-12:

Input : 120V – 370V DC (or 85V-264V AC)

Output : 12V 2000mA DC stabilized.

1500mA are available for up to 330 BACS modules and other BACS bus sensors (see datasheet of other BACS sensors for powerconsumption).

NOTE: Input safeguarding (input fuse) is not included.

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## BACS® WEBMANAGER – Installation Examples



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# SITEMANAGER – Technical data



## SITEMANAGER 6

Order No. SITEMAN\_6

- 8 digital inputs (opened / closed configurable)
- 8 analog inputs (0 - 10V, 4 - 20mA, 0 - 20mA configurable via jumpers)
- 8 relay outputs (changer, max. 230V/ 4A AC/DC)
- 2 x RJ10 for BACS battery bus
- 10/ 100Mbit LAN
- Timer for scheduled output control, start-up settings for every output (on/off)
- RS-232 interface for other devices
- Remote configuration via webbrowser
- Supported protocols:
- Email, Telnet, HTTP, SNMP, SNTP, RFC868, MODBUS Over IP, UPSTCP, DHCP, DNS, FTP, TELNET
- Battery braced real-time clock with time server
- synchronization
- LED alarm display, LED operating status display
- Non-volatile memory for alarms

### Options

- UNMS II Network Management Software
- BACnet, PROFIBUS, LONBUS
- Smoke/fire alarms, motion detectors, door contacts etc., connection of any other alarm contact indicator, which output signal is between 0 - 10V, 4 - 20mA or rather 0 - 20mA (configurable via jumpers)
- Actuators like flash light, alarm buzzer etc.

## BACS® accessories



Construction

### BACS® BUS CONVERTER 5

Conversion and galvanic separation of the BACS battery bus to the BACS WEBMANAGER BUDGET plus real time clock (RTC) timer for the BACS WEBMANAGER, if no timeserver is at hand into the network environment

Power supply

Stabilized external 12V/2000mA for up to 330 BACS and other BACS bus devices (see datasheet for power consumption of other BACS bus devices)

2x RJ10 for BACS battery bus

Interfaces

1xRJ12 for COM3 BACS WEBMANGER BUDGET  
1xMiniDin8/RS232 interface for serial connection to workstation. For CONVERTER 3 an adapter is required (see below)  
1x2,1mm DC connector socket for power supply via external wall wart power supply  
1x potential-free contact (2 pole screw terminal for max. 1,0 mm², rated load 24 VDC /1A)

Display

Optical display (LED) additionally, alarm buzzer with acknowledge button  
Optional: Adapter from mini-8 to RS232 for the BACS CONVERTER 3, with junction cable mini-8 1.5m

Housing

Polystyrene housing in grey

Dimension, weight  
Operating condition

91,5 x 67 x 25 (W x H x D), 120g,  
Temperature 0 - 60°C, max. humidity 90%,  
not condensing



Construction

### BACS® SPLITTING BOX

Passive splitter for BACS communication cables. For the optimization of the cable lengths and for the creation of an optical pleasant wiring. In addition to the extension of the 2 BACS bus inputs at the BACS CONVERTER. We recommend to use the BACS SPLITTING BOX, if you want to connect more than 50 BACS modules into the BACS bus.

Power supply

Not required, passive element for the star wiring of BACS bus cables  
5x RJ10 for BACS bus cable

Interfaces

1x RJ10 for the connection to BACS CONVERTER or rather BACS bus at BACS WEBMANAGER

Housing

Polystyrene housing in grey

Dimension, weight  
Operating condition

91,5 x 67 x 25 (B x H x T), 90g,  
Temperature 0 - 60°C, max. humidity 90%, not condensated

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## BACS® accessories - Technical data



<b>BACS® DC current sensor 50/200/400/1000/2000 Ampere</b>	
Ord. No: BACS_CSH50, BACS_CSH200, BACS_CSH400, BACS_CSH1000, BACS_CSH2000	
Construction	DC current sensor for measuring battery string discharge and charging process +/-50A, +/-200A, +/-400A, +/-1000A, +/-2000A DC Current transducer diameter hole : 21mm [0,82in] (BACS_CSH50) /40 mm [1.57in]
Power supply	No external power supply, device is powered by the BACS bus
Power consumption	60mA
Interfaces	2x RJ10 for BACS bus cable, pluggable system
Housing	DIN rail
Dimension (LxWxH), weight	110 x 82 x 125 mm = 4,33 x 3,22 x 4,92 in. (LxWxH), 420g
Operating condition	Temperature 0 - 60°C, max. humidity 90%, not condensated



<b>BACS® bus interface GX_R_AUX</b>	
Order No. GX_R_AUX	
BACS bus module with free programmable 4 digital inputs and 4 relay outputs.	
A typical application is the control of a battery breaker in case of "thermal runaway" alarm in the battery system. (According to US Norm International Fire Code IFC 608.3 the batteries of a UPS have to be isolated in case of a thermal runaway. ) In case of a high battery temperature and increasing voltages during float charge, the GX_R_AUX may open the battery breaker to stop a further increase of the temperatures in the batteries. Individual programming of the relays through web interface.	
Power supply	No external power supply, device is powered by the BACS bus approx. 170mA
Power consumption	approx. 170mA
Interfaces	4 potential-free relays, 4 digital inputs
Relay output	50VAC – 2A, 30VDC – 1A
Dimension, weight	75 x 75 x 45mm = 2,95 x 2,95 x 1,77 in. (LxWxH), 170g
Housing	Polyamid, pluggable system DIN rail
Operating condition	Temperature 0 - 60°C, max. humidity 90%, not condensated



<b>BACS® external temperature sensor</b>	
Order No. BACS_TS1L23, BACS_TS1L90	
Construction	External temperature sensor for BACS REV 2 and REV 3 for retrofitting. This sensor comes with a 23cm (9.06in) / 88cm (34,65in) cable and allows user to place the temperature sensor at the optimal place on the battery. If this sensor is attached, the internal temperature sensor of the BACS module REV 3 will be automatically switched of. Sensor only, has to be attached to the BACS C module by a qualified BACS service engineer. UL certified material, voltage proofed up to 1000V.
Measuring range/precision	-10°C - +90°C, +/- 1 °Celsius
Dimension, weight	Length 25 cm / 90cm from BACS housing sensor dimension: 2cm x 1.5cm x 1cm) ( 0.87 x 0.58 x 0.37 Inch ")



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# BACS cables - Technical data



## BACS® measuring cables

Order No. BC4B-xxxxx

Measuring cables made of UL certified material for BACS sensors type C40 REV. 3. Resistive checked fuses for system protection and precision measurements

Specification:

cable cross section: .....2x1,50mm<sup>2</sup>  
 nominal voltage U<sub>0</sub>/U: .....300V/500V  
 fuses: .....1000V/10A und 1000V/1A  
 temperature range : .....-25°C – 70°C



Order No. BC4B-xxxxxH

Measuring cables made of halogen free, extremely fire resistant and oil resistant material, for BACS sensors type C40 REV. 3. Resistive checked fuses for system protection and precision measurements.

Specification:

cable cross section: .....2x1,50mm<sup>2</sup>  
 nominal voltage U<sub>0</sub>/U: .....300V/500V  
 fuses: .....1000V/10A und 1000V/1A  
 temperature range: .....-15°C – 70°C  
 cable coating:.....halogen free in accordance with  
 VDE0281 part 14



Order No. BC5-xxxxx,

Measuring cables made of UL certified material for BACS sensors type C20 REV. 3, C23 REV. 3, C30 REV. 3 and C41 Rev. 3. Resistive checked fuses for system protection and precision measurements

Specification:

cable cross section: .....2x0,75mm<sup>2</sup>  
 nominal voltage U<sub>0</sub>/U: .....300V/300V  
 fuses: .....1000V/2A und 1000V/500mA  
 temperature range. ....-25°C – 70°C



Order No. BC5-xxxxxH

Measuring cables made of halogen free, extremely fire resistant and oil resistant material, for BACS sensors type C20 REV. 3, C23 REV. 3, C30 REV. 3 and C41 Rev. 3. Resistive checked fuses for system protection and precision measurements.

Specification:

cable cross section: .....2x0,75mm<sup>2</sup>  
 nominal voltage U<sub>0</sub>/U: .....300V/300V  
 fuses: .....1000V/2A und 1000V/500mA  
 temperature range: .....-15°C – 70°C  
 cable coating:.....halogen free in accordance with  
 VDE0281 part 14

All measuring cables are available in various length and different connection terminals. See latest BACS pricelist for details.



## BACS® bus cables

Order No. B4BCRJx

High quality halogen free twisted pair RJ10 BACS communication bus cable. Various lengths available. See latest BACS price list for details.

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# BACS® CONTROL CABINETS: Technical data and dimensions

Control cabinet for BACS® systems. Plug-play, with AC input plug (Euro) ready to install. With optical and audible display on the outside door, protection class IP 56. Only an AC power supply and Ethernet cable has to be provided by the customer. Easy connection of inputs and outputs through a strip terminal. There is a wide range power supply installed for every BACS® WEB-MANAGER with an input from 110V-240V AC, max. power consumption is 20Watt depending on the number of BACS® components in the bus. Output of the power supply is 12Volt 1600mA, which results in 1140mA available for up to 330 BACS® modules or other components in the BACS® bus (For BACS® bus components power consumptions, see data sheets of the BACS® devices).



## BACS® CONTROL CABINET Type 1

Order No. BACS\_CC1

### 1 \* BACS WEBMANAGER BUDGET,

1 \* 12V Power supply (100 – 240V, 50/60Hz),

1 \* CAT 6 Ethernet socket,

1 \* Alarm contact (potential-free) , max. 230VC, 30VDC, 8A  
in front door integrated:

1 \* POWER LED, 1 \* BACS ALARM LED

6 \* spare bus communication cable

Dimension: 400 x 500 x 210 mm = 15,75 x 19,69 x 8,27 in. (WxHxD)



## BACS® CONTROL CABINET Type 2

Order No. BACS\_CC2

### 2 \* BACS WEBMANAGER BUDGET,

2 \* 12V Power supply (100 – 240V, 50/60Hz),

2 \* CAT 6 Ethernet socket,

2 \* Alarm contact (potential-free) , max. 230VC, 30VDC, 8A  
in front door integrated:

2 \* POWER LED, 2 \* BACS ALARM LED

8 \* spare bus communication cable

Dimension: 500 x 500 x 210 mm = 19,69 x 19,69 x 8,27 in. (WxHxD)



## BACS® CONTROL CABINET Type 3

Order No. BACS\_CC3

### 3 \* BACS WEBMANAGER BUDGET,

3 \* 12V Power supply (100 – 240V, 50/60Hz),

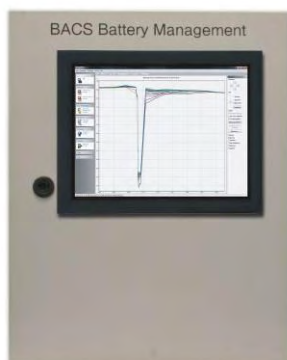
3 \* CAT 6 Ethernet socket,

3 \* Alarm contact (potential-free) , max. 230VC, 30VDC, 8A  
in front door integrated:

3 \* POWER LED, 3 \* BACS ALARM LED

10 \* spare bus communication cable

Dimension: 500 x 500 x 210 mm = 19,69 x 19,69 x 8,27 inch (WxHxD)



## BACS® CONTROL CABINET Type 4

Order No. BACS\_CC4

### 4 \* BACS WEBMANAGER BUDGET,

4 \* 12V Power supply (100 – 240V, 50/60Hz),

4 \* CAT 6 Ethernet socket,

4 \* Alarm contact (potential-free) , max. 230VC, 30VDC, 8A  
in front door integrated:

4 \* POWER LED, 4 \* BACS ALARM LED

12 \* spare bus communication cable

Dimension: 600 x 760 x 210 mm = 23,62 x 29,92 x 8,27 in. (WxHxD)

**NEW**

## BACS Control Cabinets with integrated Touch Panel

Identical Control Cabinets, but with built-in touch panel PC and Windows operating system!

Order No. BACS\_CC1\_TP

Order No. BACS\_CC2\_TP

Order No. BACS\_CC3\_TP

Order No. BACS\_CC4\_TP

Order No. BACS\_CC5\_TP

Order No. BACS\_CC6\_TP

## BACS® CONTROL CABINET Type 5

Order No. BACS\_CC5

### 5 \* BACS WEBMANAGER BUDGET,

5 \* 12V Power supply (100 – 240V, 50/60Hz),

5 \* CAT 6 Ethernet socket,

5 \* Alarm contact (potential-free) , max. 230VC, 30VDC, 8A  
in front door integrated:

5 \* POWER LED, 5 \* BACS ALARM LED .

14 \* spare bus communication cable

Dimension: 760 x 760 x 210 mm = 29,92 x 29,92 x 8,27 in. (WxHxD)

## BACS® CONTROL CABINET Type 6

Order No. BACS\_CC6

### 6 \* BACS WEBMANAGER BUDGET,

6 \* 12V Power supply (100 – 240V, 50/60Hz),

6 \* CAT 6 Ethernet socket,

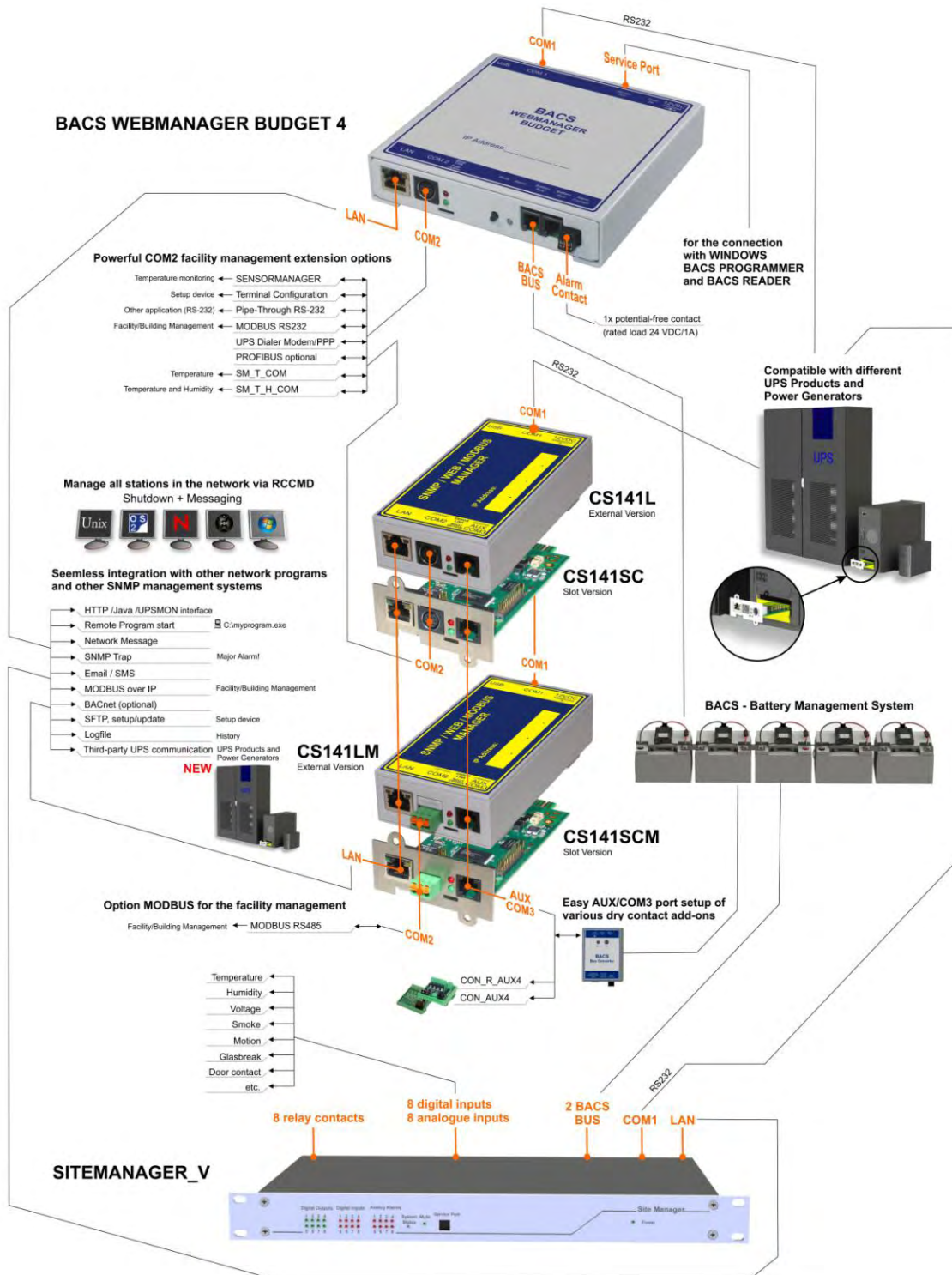
6 \* Alarm contact (potential-free) , max. 230VC, 30VDC, 8A  
in front door integrated:

6 \* POWER LED, 6 \* BACS ALARM LED .

16 \* spare bus communication cable  
Dimension: 760 x 760 x 210 mm = 29,92 x 29,92 x 8,27 in. (WxHxD)

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# Functional Overview: BACS WEBMANAGER



## NEW: The intelligent *third-party UPS communication assistant*

As a default, a BACS WEBMANAGER offers communication using RS232 or slots for almost any UPS systems on the market - even communication with transfer switches and generators is feasible.

In some cases, this direct connection is not possible due to missing or blocked interfaces on the UPS - e.g. if manufacturers prevent this and use their own developments.

From now, this is not an obstacle for the BACS WEBMANAGER:

The intelligent *third-party UPS communication assistant* integrates these third-party SNMP cards via TCP / IP using SNMP in accordance with the RFC1628 standard (or private MIBS e.g. APC) and thus uses existing infrastructures to query data from a UPS. The BACS WEBMANAGER now ensures compatible communication methods to formerly incompatible UPS solutions.

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## ***Common features of all BACS Webmanager based on the BACS WEBMANAGER product family***

- **High-tech made in Germany and made in the USA**

The most powerful and flexible UPS management card worldwide! The BACS WEBMANAGER is delivered with an ARM Cortex A8 CPU, 10/100Mbit Auto-sensing Ethernet, 3 serial RS-232 Interfaces (not BUDGET version), 1 USB Port, AUX port for connecting an external interface Card with 4 dry-contact, external alarms output/input or a BACS System. Available also as MODBUS RS485 interface at COM2.

- **Grafical interfaces**

The web build-in web server is designed for intuitive monitoring and configuration via the network. Handle extensive functions of the BACS WEBMANAGER and perform even the most powerful statistical analysis of the data clearly. Statistical values of all connected devices are displayed graphically - UPS, temperature, humidity, etc. Additionally, the BACS WEBMANAGER provides options to communicate with UNMS 2 - or any type of SNMP management software. Thanks to the GENEREX API, the BACS WEBMANAGER offers additional interfaces for customers who wish to program the settings on the device using self-defined scripts.

- **Universal suitable for nearly type of UPS**

Supports more than 1400 UPS types from 120 UPS manufacturers. The incorporation of RS-232 protocol and support of dry contacts makes the monitoring of any device possible. The BACS WEBMANAGER is used for the monitoring of UPS, Transferswitches, Rectifiers, Inverters, Generators and Fuel Cells – plus Batteries.

- **Scheduler**

Use the intuitive task scheduler to plan recurring tasks such as UPS and battery testing, AUX output switching, or other tasks. The BACS WEBMANAGER will take over regular maintenance tasks. Reduce time needed for reading of alarm and data logs!

- **Data logging**

Measurement values and alarms are logged to the non-volatile storage of the BACS WEBMANAGER. The time synchronization function through NTP insures that all log entries are precise.

- **Email/SMS**

Integrated email client via SMTP can be configured to relay either all or specific messages. The email client can also make the use of public email servers and local email servers to distribute information. Compatible with SMTP email systems such as MS Exchange/Outlook, Lotus, and many others. Support for GSM Modem through COM2 for transmitting SMS Textmessage.

- **Email Trap for UNMS Remote Monitoring**

Every BACS WEBMANAGER can send its data packages via “*Email Trap*” to the UNMS II Software with TELESERVICE module. This allows a remote monitoring via email, without compromising the customers network security systems. All measuring values and graphics are visible on the UNMS at any time.

- **Multiserver Shutdown**

Unlimited shutdown manager for RCCMD clients – for more than 40 different operating systems. This allows the BACS WEBMANAGER adapter to inform and shutdown any type of computer in a network which can then be used to centralize the administration of large networks while greatly reducing both the amount of administrative work and amount of network traffic. Different options are available for conducting shutdowns and system start ups: Cold boot (computers are directly cut-off from or connected to the power supply). Warm boot (using RCCMD operating systems are prompted to shutdown or restart). Wake On LAN (using data packages other computers in a local network are prompted to start-up).

- **Network Services**

UPSMAN compatible server for the alarm management. Supports SNMP V2/V3, IPv4/IPv6, HTTP/HTTPS, DNS, DHCP, SMTP, NTP, SFTP, UPSTCP (UNMS), MODBUS over IP, MODBUS/PROFIBUS over RS232/485, BACnet over IP (optional) and RCCMD (Multiserver/Multi-OS shutdown/ messaging tool).

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- **Network Security**

The BACS WEBMANAGER provides manifold security features to ensure a maximum of network security. The BACS WEBMANAGER uses industrial standards to provide HTTPs and SSL encrypted communication with user created certificates - the BACS WEBMANAGER can be configured to deny outdated or invalid certificates. As a standard, it uses SNMP v3 communication, also less secured systems are supported. Advanced password security and hard-coded user management provides configuration menus according to user level. To prevent unauthorized access inside full-automated scenarios, the webserver can be disabled after configuration – the encapsulated operating system does not support a ROOT access so that no change is possible. An intelligent build-in watchdog will reboot the BACS WEBMANAGER in case of unexpected incidents causing a hang-up. As a special feature, the BACS WEBMANAGER provides tools to assist administrators during network security audits of a network segment. *Upcoming:* Digitally signed firmware updates prevent installing hacked software.

- **SNMP**

The BACS WEBMANAGER supports the RFC1628 MIB (Standard UPS MIB) and MIB extensions for use with the SITEMANAGER 4,5,6, BACS and SENSORMANAGER. This enables the BACS WEBMANAGER adapter to make all of its gathered information from other devices available via SNMP. All SNMP based network-management systems are supported.

- **BACS Battery Management System (option)**

The BACS WEBMANAGER is now capable to connect a BACS system at the COM3/AUX port. This upgrades your BACS WEBMANAGER to a BACS WEBMANAGER – this is the ultimate version of the BACS WEBMANAGER range and adds a battery management functionality to your system. A possible failure of your UPS batteries is now under your control and you gain a massive battery life increase compared to systems without BACS.

- **MODBUS**

All of the BACS WEBMANAGER adapters are equipped with MODBUS-over-IP, which enables the BACS WEBMANAGER to incorporate PLC devices (SPS) like those from Schneider Group or any other MODBUS based management system. The BACS WEBMANAGER devices with a COM2 port possess MODBUS over RS232 additionally. The BACS WEBMANAGER devices LM or SCM provide MODBUS over RS485.

- **Sensormanager (option)**

The optional sensor manager offers 8 analog inputs for almost all analogue sensors on the market. In addition, the sensor manager provides 4 digital inputs for alarm sensors (e.g., for smoke, fire, water, etc.) and 4 digital outputs (e.g., for visual and visual alarms).

- **Analog IO**

It is possible to connect an Interfaceboard (CON\_AUX4/CON\_R\_AUX4) to the COM3/AUX-port to control 4 analog Inputs or Outputs with the BACS WEBMANAGER.

- **PROFIBUS/LONBUS/BACNET (option)**

More Fieldbuskonverters are available as option.

- **Fully automated**

Within very large installations, scripting offers a very interesting way to simplify normalized operations via automated processes. For example, the scripts could import basic configurations, read out log data, save backups, download and import firmware, etc. The BACS WEBMANAGER is capable of scripting. Use these and other powerful features to integrate the BACS WEBMANAGER into your own customized solution