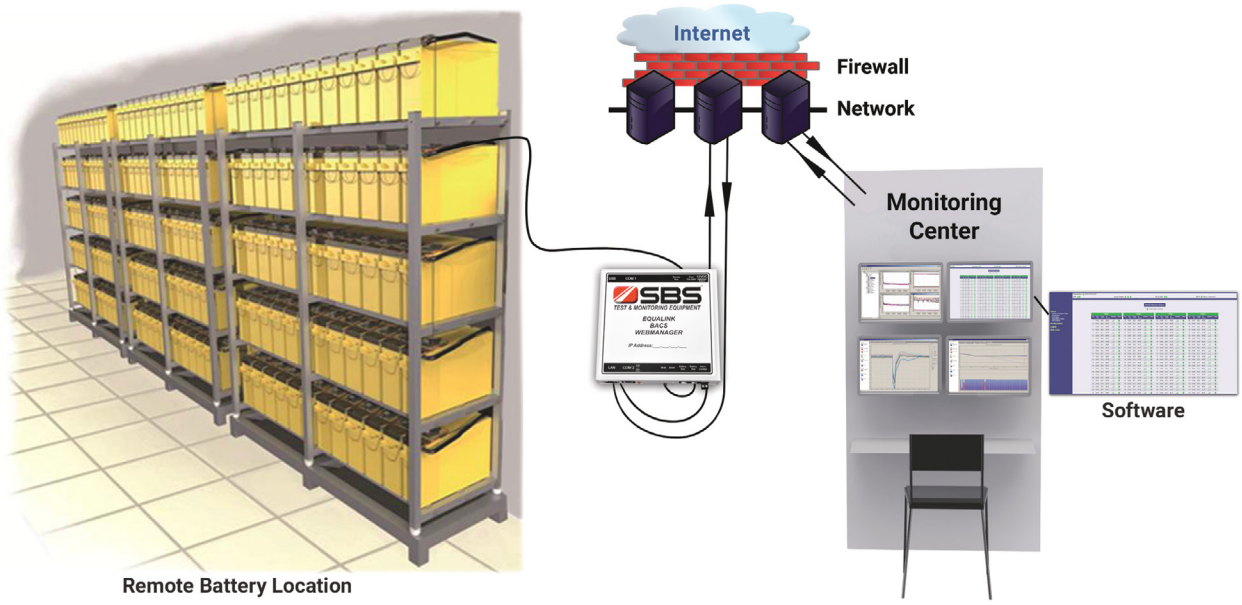
EquaLink Battery Management & Monitoring System

Active Battery Management System with Voltage Balancing



EquaLink is an Ethernet-based battery management system which monitors the voltage, internal resistance and temperature of each battery in a stationary battery system.

Through a patented Balancing process, EquaLink actively regulates the float charging current of each battery ensuring that all batteries charge at the optimal voltage. Continuously monitoring and balancing the individual charging/float voltage of each battery enables the full capacity of the entire battery system to be available at all times.

EquaLink Battery Management System actively manages batteries to increase reliability and extend life, whereas other battery monitoring systems simply monitor batteries as they deteriorate.

EquaLink has the ability to monitor current, ambient/room temperature, humidity, hydrogen gas and electrolyte levels. Through available Form C contacts/relays, EquaLink can also monitor electrical equipment such as UPSs, inverters, transfer switches, generators and air conditioning systems.

EquaLink is designed for lead-acid batteries (flooded/wet, VRLA, gel, AGM, etc.) as well as some Ni-Cd battery applications. EquaLink is easy to install and configure.

NERC PRC-005 compliance is mandatory for utilities and EquaLink helps simplify NERC testing and reporting. EquaLink is also ideal for IEEE data reporting and battery maintenance programs in telecom, UPS, data centers and similar applications.

EQUALINK BATTERY MANAGEMENT

EquaLink Features

INDIVIDUAL VOLTAGE REGULATION (BALANCING)

Without proper regulation, there is no guarantee that each battery is fully charged. Typically some batteries are overcharged, while others remain undercharged. Using a patented Balancing process EquaLink regulates each battery in a system to float charge at the same voltage.

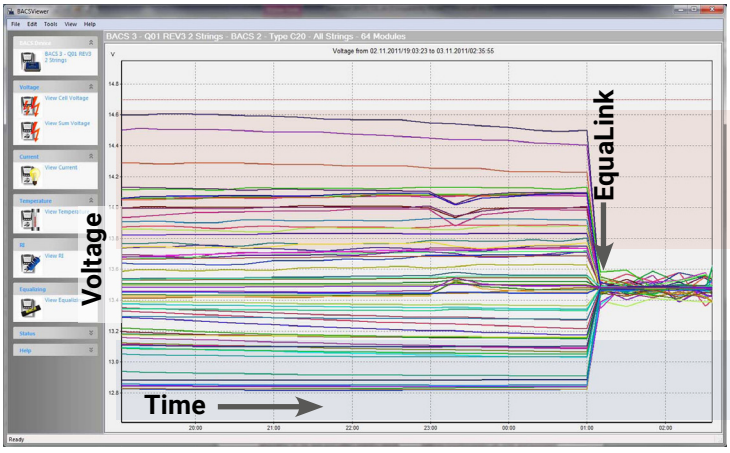
EquaLink balances individual battery voltages by only supplying the float current necessary to optimally charge each individual cell. Voltage spread is eliminated since EquaLink will float charge each battery at the same voltage (±0.01 Volt).

How It Works

EquaLink reads individual battery voltages and compares them to the battery system's overall voltage. Each EquaLink module controls the amount of float current passing through the battery to regulate the voltage to the optimum value. This constant monitoring and Balancing of the individual charging voltages helps guarantee the availability of the battery system at all times.

Due to its proprietary Balancing process, EquaLink surpasses other battery monitoring systems, having the ability to monitor and actively regulate battery voltage to within 0.01 volts of the system's average float charging voltage.

The included EquaLink software (below) shows the Balancing of voltages by EquaLink on a 5-year-old battery system with voltage spread.



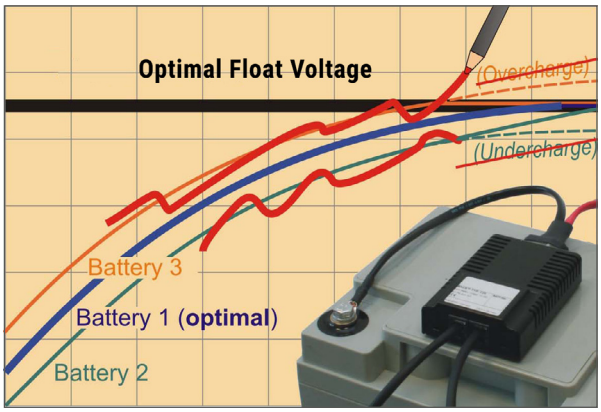
EquaLink's Balancing prevents overcharging and undercharging, ensuring maximum capacity and service life.

Avoid Overcharging

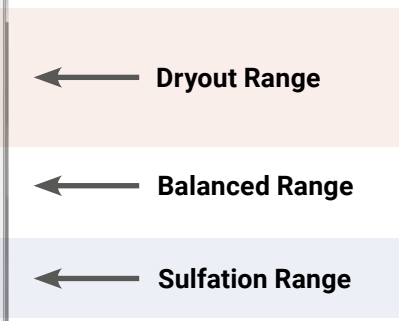
Overcharging leads to premature plate growth and a shorter operational life. The EquaLink Balancing process prevents unintended overcharging of batteries which helps eliminate unnecessary gassing, dry-out, and thermal runaway.

Avoid Undercharging

The Balancing process also prevents undercharging and helps eliminate sulfation. Sulfation leads to a loss of capacity and a shorter operational life. The Balancing process helps eliminate sulfation by maintaining ALL batteries at a balanced voltage level and keeping them at the ideal state of charge (SOC).



- Battery 3's voltage (above) is capped at the charge end voltage by removing current to prevent overcharging and gassing.
- Battery 2 is supplied extra current until the optimal float charging voltage is obtained.
- Battery 1 is held at the correct voltage and is performing ideally.



EXTENSION OF SERVICE LIFE

The service life of a battery system is tied to the weakest battery in the system. Often, the service life of a battery system is 50 – 60% of the manufacturer's design life. In the Balancing process, each of the batteries within the system is maintained at optimal voltage levels, eliminating the ill-effects of improper charging. The constant care provided by the Balancing process has increased battery service life up to 30% longer compared to a system without active battery management.

INCREASED BATTERY CAPACITY

Through Balancing, EquaLink ensures that every battery in the system is fully charged. This assures that, when called upon, the system will function at optimal levels. EquaLink has been proven to increase a battery system's capacity up to 15% compared to a system which is only monitored.

THERMAL RUNAWAY PREVENTION

With automated built-in Thermal Runaway Detection diagnostic capabilities, the EquaLink system can predict a thermal unbalance or event and prevent a true thermal runaway event from becoming catastrophic. Therefore safely isolating a battery string and preventing damage.

Automatic battery disconnection is possible with the optional Auxiliary Form C relay (Part no. BM-AUX), which can trip the battery breaker when user-defined parameters are met.

MAINTENANCE

EquaLink provides remote location monitoring and automatic data collection that can be accessed through secure VPN, and network Ethernet connections.

Cost and Time Savings

EquaLink reduces maintenance costs, especially for remote locations, due to:

- Decreased travel to remote locations
- Decreased time spent on manual data collection
- Decreased time preparing and submitting reports
- Less labor hours spent monitoring, as alarms are set to custom parameters

Battery Swaps/Replacements

By monitoring internal resistance trends, EquaLink allows users to detect weak or damaged batteries in early stages of deterioration. Timely replacement of bad batteries is vital to improving the lifespan of the entire battery system. A new battery can be swapped into a string of older batteries without risk of overcharge or undercharge, making full system replacements unnecessary.

NERC PRC-005 Battery Maintenance Requirements

■ - Meets the minimum requirements of NERC PRC-005*
● or ■ - Meets IEEE Recommendations*

	Vented / Flooded Lead Acid Batteries (VLA)	IEEE450-2010			
		Monthly	Quarterly	Yearly	5 Years
	Visually inspect batteries, rack, charger, room	●	●	■	
✓	Record battery system float voltage and current at battery terminals	●	●	■	
✓	Record charger output voltage and current; correct if needed	●	■	■	
✓	Check electrolyte levels. Fill with distilled water to 'max' line if necessary.	●	■	■	
✓	Record ambient/room temperature	●	●	●	
	Make sure ventilation system is operational	●	●	●	
	Inspect system for unintentional battery grounds	●	■	■	
	Record pilot cell(s) or block(s) voltage and electrolyte temperature	●			
	Record pilot cell(s) specific gravity (temp. corrected to 77° F)	●			
✓	Record voltage of ALL cells/blocks		●		
	Record specific gravity of 10% of the cells (temp. corrected to 77° F)		●		
✓	Record temperature of 10% of the cells		●		
	Record specific gravity of ALL cells (temp. corrected to 77° F)			●	
✓	Record the internal resistance value of ALL cells/blocks		■	■	
✓	Record temperature of ALL cells/blocks			●	
	Record internal resistance value of ALL cell-to-cell and terminal connections			■	
Records	Conduct load test two years after installation and then every five years. When the system's capacity falls below 90% load test annually.				■

✓ EquaLink can assist in NERC and FERC reporting by verifying and recording the relevant information (see checkmarks on left).

*The above testing schedules are based on SBS's interpretations of both IEEE and NERC PRC-005. This information should be used for guidance purposes only and SBS can't be held responsible if the information is incorrect or if other parties interpret the information differently.

ADVANCE WARNING ALARMS

Typical battery problems like sulfation, corrosion, excessive gassing, dry-out and thermal runaway are detectable through EquaLink's monitoring of voltage, internal resistance and temperature. Because of EquaLink's ability to detect these issues early, long term damage and shortened operational life can be avoided.

Standard EquaLink system monitors:

- Voltage
- Internal resistance
- Individual battery temperature
- Intercell connection deviations due to loose connections

With the addition of available options, EquaLink can monitor:

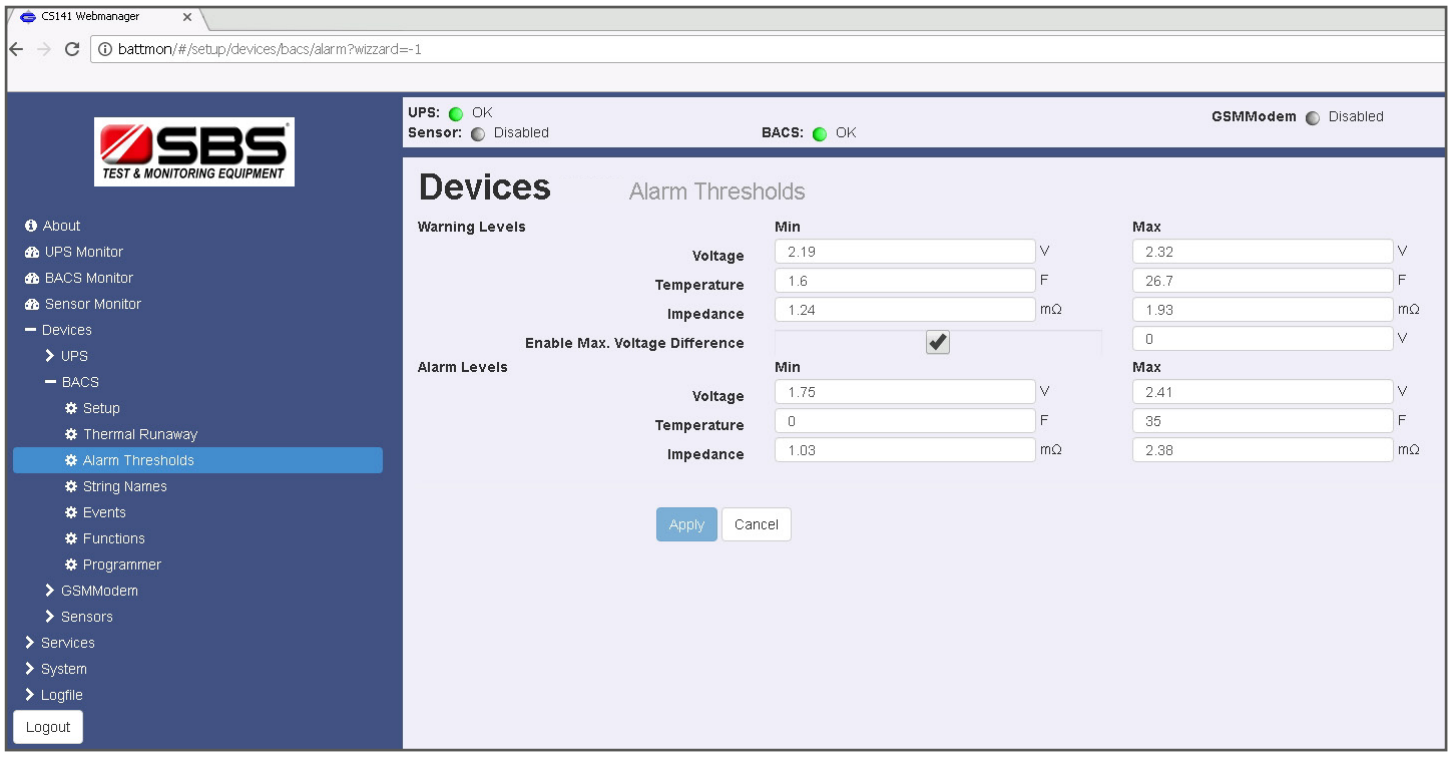
- Current
- Ambient/room temperature
- Humidity
- Presence of hydrogen gas
- Dry contacts
- Electrolyte levels

Warning alarms can be customized and configured to match the user's particular parameters and battery type. Users can receive alarms via several communication systems:

- Email
- Email-to-SMS
- Network message
- SNMP
- RCCMD
- MODBUS - allows MODBUS clients to read the system data through IP and RS232 (and, optionally, RS485)
- DNP3 communication compatible

In addition to sending electronic alarms, EquaLink can warn users via audible and visual signals:

- Buzzer: on EquaLink WebManager
- Alarm LEDs: on individual modules and WebManager



BROWSER INTERFACE & SOFTWARE

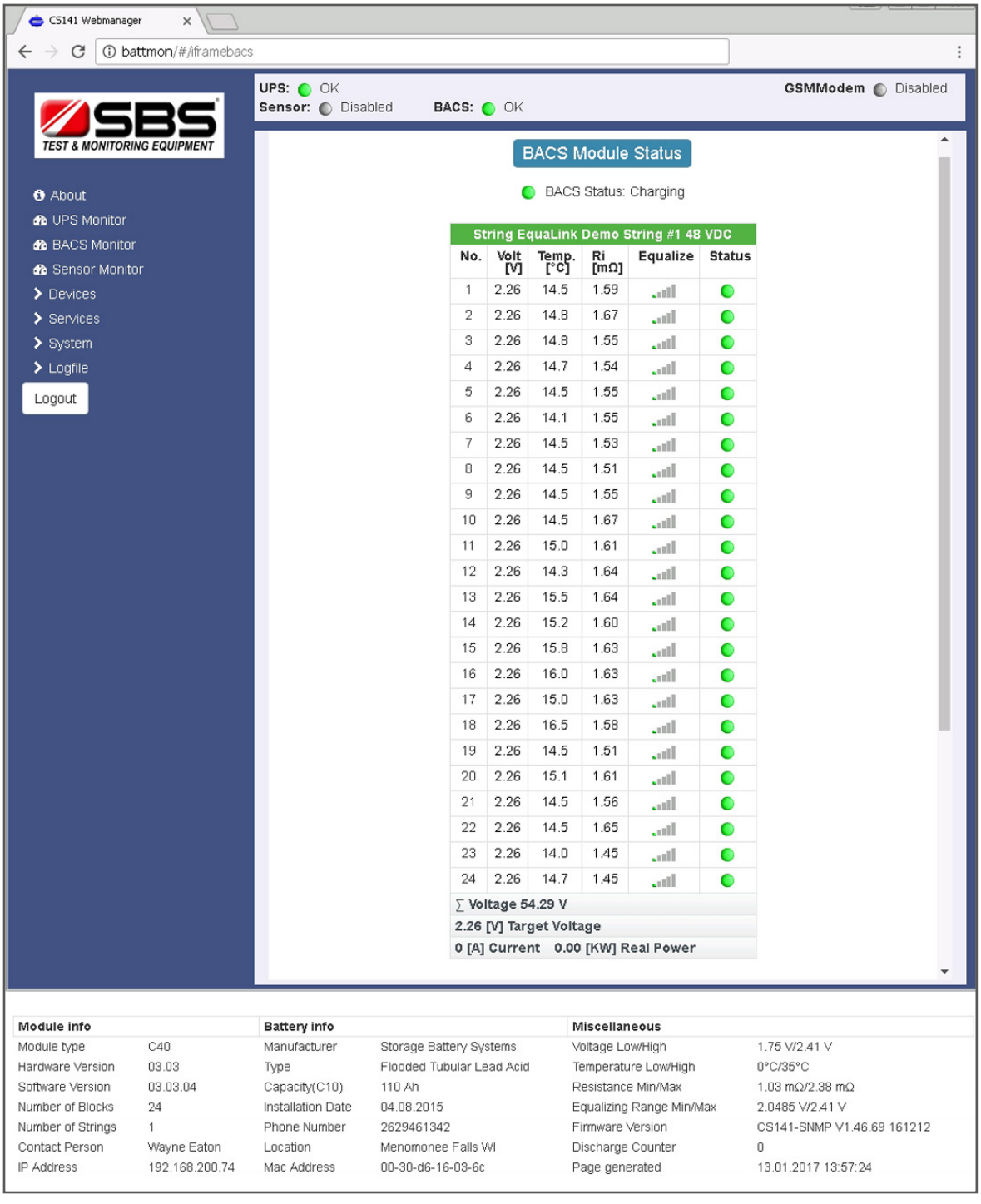
Through a web browser, the interface displays:

- Current status of the batteries
- Environmental data
- Events
- Alarm indications

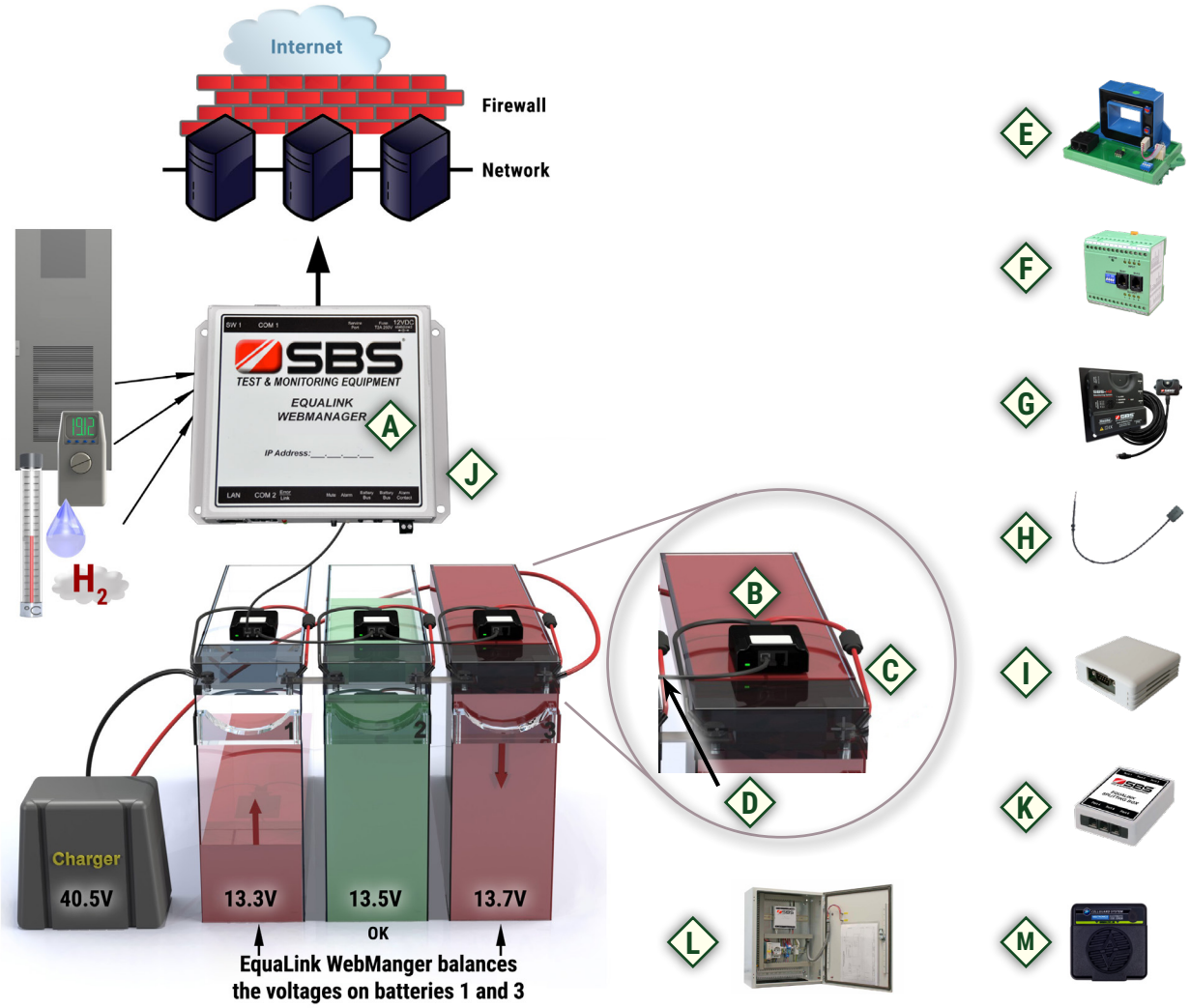
The interface coordinates a system response to significant events (alarms, notifications, etc.).

The alarms of any device connected to the EquaLink WebManager apply date and time stamps to all log files.

Software is also included to allow users to download historical graphical data. Raw data can be downloaded and archived, freeing up storage capacity for further data logging.



EquaLink System Components & Accessories



System Components (Included)		
A	WebManager	Battery system's central control unit, connects to modules
B	Modules	One module per battery for individual battery data collection
C	Voltage Measuring Cables	Attach module to battery
D	Communication Bus Cables	Link modules together and link to WebManager
System Accessories (Optional)		
E	DC Current Sensor	Measures and records overall system DC current
F	Auxiliary Alarm & Control Interface	For monitoring other equipment through WebManager
G	Hydrogen Gas Detector	1% Warning and 2% Alarm relays
H	External Temperature Sensor	External; overrides module's internal temperature sensor
I	Ambient Temperature Sensor	For comparison of room temperature and battery temperature
J	Mounting Kit	Wall mounting plate/DIN rail mounting kit, included with WebManager
K	Splitter Box	Splitter for EquaLink communication cables
L	Control Cabinet	Customizable
M	Electrolyte Level Sensor	For monitoring electrolyte level at each cell

WEBMANAGER

The WebManager acts as the battery system's central control unit. It gathers, evaluates, and (on its internal flash memory) stores all pertinent system information.

Each WebManager can manage up to 330 EquaLink modules in up to 10 parallel battery systems. A wall/ DIN rail mounting kit is included.

Technical Data	
Processor and Memory	ARM Cortex A8 800MHz processor, 512MB RAM
Interfaces	(2) RS232 (1) USB (2) RJ10 Communication bus cable outputs (1) RJ45 10/100 Mbit Ethernet
Display/Signal	(1) Potential-free contact (3) LED (Manager status, device alarm, EquaLink alarm) (1) Buzzer with mute button
Housing	Aluminum, RAL 7035 (light gray)
Dimensions (W x L x H)	5.12" x 4.92" x 1.18" (130 x 125 x 30mm)
Operating Conditions	Temperature: 32 to 140° F (0 to 60° C) max., humidity: 20–95%
MTBF (calculated)	849,192 hours; 96.9 years

Power Options			
Part No.	**Input**	**Output**	**Power Details**
BM-WEBMGR-12/120VAC	100–240Vac/12Vdc 50/60Hz	12Vdc 2000mA	AC Plug
BM-WEBMGR-18-72VDC	18–72Vdc	12Vdc 2000mA	TracoPower TCL 024-112DC Converter DIN Rail Mountable
BM-WEBMGR-120-370VDC	120–370Vdc	12Vdc 2000mA	Mean Well MDR20-12 Converter DIN Rail Mountable

	Description	Function
1	12VDC Input	12VDC (+/- 1%) regulated power required
2	Fuse	T2A 250V
3	Service Port	Port used to program EquaLink Reader and Programmer software (PS/2 Mini-D to 9P serial cable connector included)
4	COM1	Port to connect an external power device, such as a UPS, via serial connector
5	USB Port	Configuration port for on-site system setup via laptop
6	LAN-Socket	RJ45 Ethernet port connects the EquaLink system to owner's network or an onsite laptop for local or remote monitoring and programming
7	COM2	Port used to connect optional devices such as a Modem, non-EquaLink accessories, communication protocols (MODBUS, RS232, Profibus, LONBus), etc.
8	LEDs (Red or Green)	Optical displays for WebManager status Red: Boot process error or system alarm Green: OK
9	MUTE Button	Silences WebManager's internal audible alarm. Alarm LED will change from red to yellow when MUTE button is pressed during an alarm condition.
10	Alarm LED	Summary Alarm LED for WebManager Off: No problem Yellow: Warning or alarm was muted Flashing Red: Alarm
11	Battery Bus Connections	2 x RJ10 ports to connect the WebManager to the battery modules and optional EquaLink accessories
12	Alarm Contact	Dry Form C Output Contact - Summary Alarm - Normally Open Rated load: 24Vdc/1A
	IP Address	Default is 10.10.10.10; User can reset after installation is complete

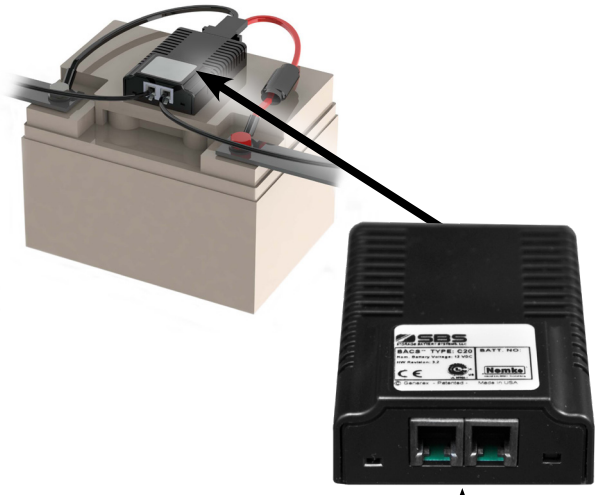
MODULES

EquaLink battery modules are capable of taking precise measurements of individual battery voltage, internal resistance and, through an integrated sensor, surface temperature. These measurements are essential to making precise analyses of the batteries in any given system.

EquaLink transfers this data through the communication bus cable system to the EquaLink WebManager.

There are 4 different types of EquaLink modules: 12 Volt, 2 Volt, 6 Volt and 8 Volt.

The module can be mounted on top of, or on the side of, each battery.



Communication Bus Input

Voltage Lead Input

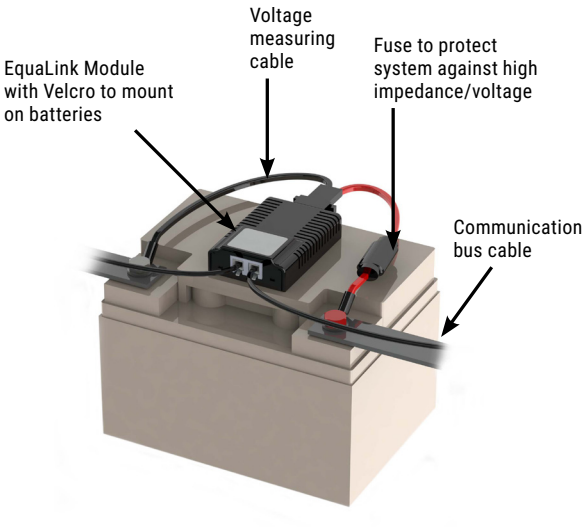
Technical Data	
Measuring Precision	Internal Resistance: <10% C40/41, <5% C20/30 Voltage: <0.5% Temperature: <15%
Interfaces	2x RJ10 for EquaLink communication cable bus system Internal RS232 bus interface 1x button for the addressing
LED Status Indicator	Optical display LED (alarms red/green, mode red/green)
Housing	ABS (UL certified, flame retardant, cooling fins)
Dimensions (W x H x T)	2.17" x 3.15" x 0.94" (55 x 80 x 24mm)
Operating Conditions	Temperature: 32 to 140° F (0 to 60° C) max., humidity: 90%
Protection Rating	IP 42 coated against dust and condensate
MTBF (calculated)	87,600 hours (10 years)
Certification	NEMKO certified (Listed to UL 60950 Standards/CE/IFC608.3 compliant)

Specifications				
Model	**BM-C20**	**BM-C40**	**BM-C30**	**BM-C23**
Voltage	12 V	2 V	6 V	8 V
AH Range	7–600 AH	7–5000 AH	7–600 AH	7–900 AH
Voltage Measuring/ Balancing Range	9.7–17 V	1.25–3.2 V	4.8–8.0 V	9.7–21.0 V
IR Range	0.5–60 mOhm	0.02–60 mOhm	0.5–6 mOhm	0.5–60 mOhm
Balancing Power (Current)	0.15A	0.9A	0.3A	0.12A
Current Consumption	15–20 mA (<1 mA sleep mode)		35–40 mA (<1 mA sleep mode)	

Temperature Sensor

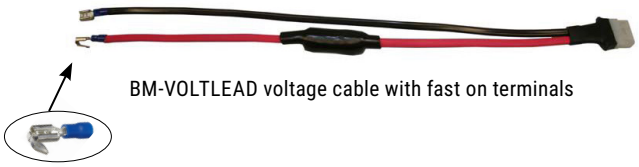
VOLTAGE MEASURING CABLES

The EquaLink voltage measuring cable assembly attaches the module to the battery. It connects to both the positive and negative battery posts and precisely measures individual battery data.



Specifications	
Fuses	2V: 1000V / 10A and 1000V / 1A 6/8/12V: 1000V / 2A and 1000V / 500mA
Temperature Range	-13 to 158° F (-25 to 70° C)

Available Sizes & Applications			
Part No.	**Module Voltage**	**Length**	**Eyelet Size for Post/Bolt**
BM-VOLTLEAD2V-.25M	2V	9.8"	M6, M8, M10, M12
BM-VOLTLEAD-.25M	6/8/12V	9.8"	M6, M8, M10, M12
BM-VOLTLEAD-.4M	6/8/12V	15.75"	M6, M8, M10, M12
Optional halogen-free cables available			
Standard cables come with 1/4" push on tab			
BM-TAB-5MM	2/6/8/12V		M5 / 1/5"
BM-TAB-6MM	2/6/8/12V		M6 / 1/4"
BM-TAB-8MM	2/6/8/12V		M8 / 5/16"
BM-TAB-10MM	2/6/8/12V		M10 / 3/8"
BM-TAB-12MM	2/6/8/12V		M12 / 1/2"



BM-VOLTLEAD voltage cable with fast on terminals

Push on tab

COMMUNICATION BUS CABLES

The EquaLink communication bus cables link the WebManager to the modules and select accessories (current sensor, auxiliary bus interface, splitter box).

Communication bus cable

Specifications	
Cable	Halogen-free twisted pair
Connectors	RJ10

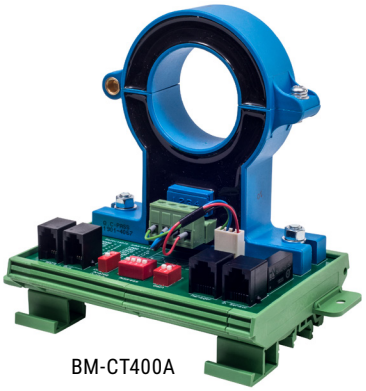
Available Sizes & Applications		
Part No.	**Length**	**Typical SBS Application**
BM-COMMCABLE-.25M	9.75"	STT2V100 – 600; AFT & PLH Series; S, G and UPS Series (VR Rack installation)
BM-COMMCABLE-.4M	15.8"	STT12V50 – 100; STT6V200; STT2V800 – 3000; S, G and UPS Series
BM-COMMCABLE-.7M	27.6"	STT12V150; STT6V250 - 300; 2-step jumper; VR Rack jumper
BM-COMMCABLE-1M	39.4"	2-tier jumper
BM-COMMCABLE-1.5M	59.0"	
BM-COMMCABLE-3M	118" (~10')	
BM-COMMCABLE-5M	197" (~16')	
BM-COMMCABLE-10M	394" (~32')	
BM-COMMCABLE-20M	788" (~65')	

Optional Accessories

DC CURRENT SENSOR

Part No.: BM-CTxxxA (400, 1000, 2000)

The DC current sensor measures and records the system's DC current during the charge and discharge processes. This sensor is available from 400–1500 Amps and connects to the WebManager via the communication bus cable system.



BM-CT400A

Specifications	
Construction	Current transducer opening hole: 1.58" x 1.2" (40mm x 30mm)
Power Supply	No external power supply; device is powered by the EquaLink bus
Power Consumption	70mA
Interfaces	2x RJ10 for EquaLink bus cable, pluggable system
Housing	DIN rail
Dimensions (L x W x H)	4.33" x 3.54" x 2.99" (110 x 90 x 76mm)
Operating Conditions	Temperature: 32 to 140° F (0 to 60° C) max., humidity: 90%

AUXILIARY ALARM & CONTROL INTERFACE

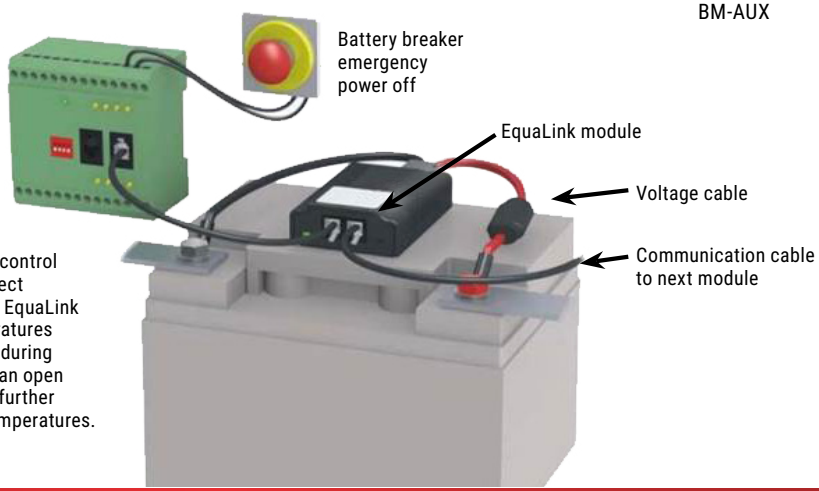
Part No.: BM-AUX

The AUX alarm and control interface allows the user to setup and control 4 relay/Form C outputs and 4 digital inputs.

This auxiliary contact can control up to 4 breakers. The digital inputs read the battery breaker status and display it in the EquaLink web interface. Other alarm devices (example: audio alarms, SBS-H2 hydrogen alarm or electrolyte level monitoring) may be connected to the digital inputs of the BM-AUX. This device connects to the WebManager via the communication bus cable system.

Specifications	
Construction	Bus module with free programmable 4 digital inputs and 4 relay outputs
Power Supply	No external power supply; device is powered by the EquaLink bus
Power Consumption	Approx. 170mA
Interfaces	4 potential-free relays, 4 digital inputs
Relay Output	50 Vac - 2A, 30 Vdc - 1A
Housing	Polymid, pluggable system DIN rail
Dimensions (L x W x H)	2.95" x 2.95" x 1.77" (75 x 75 x 45mm)
Operating Conditions	Temperature: 32 to 140° F (0 to 60° C) max., humidity: 90%

BM-AUX



A typical application is the control of a battery breaker to protect against thermal runaway. If EquaLink senses high battery temperatures and/or increasing voltages during float charge, the BM-AUX can open a battery breaker to stop a further increase in voltages and temperatures.

HYDROGEN GAS DETECTOR
Part No.: SBS-H2

The SBS-H2 has two hydrogen concentration detection points and relays: 1% and 2%. The 1% relay can be connected to an exhaust fan (to initiate airflow) and the 2% relay can be connected to a building/SCADA system (to notify nearby personnel). If the SBS hydrogen gas detector is purchased with the BM-AUX alarm and control interface, the EquaLink can monitor the SBS-H2 status through the EquaLink web interface.

Specifications	
Power Inputs	110/220 Vac and/or 12–48 Vdc input
Power Supply	Dual AC or DC power supply connections
Alarms	Audible and visual

EXTERNAL TEMPERATURE SENSOR
Part No.: BM-REM-TEMP-9 / BM-REM-TEMP-35

In some installations it is not possible for the EquaLink module to be mounted directly onto the battery, therefore the module's internal temperature sensor would not be able to monitor and record the temperature of the battery. An external temperature sensor, available in either 9" or 35" long leads, can be connected to each module and battery to measure the battery's temperature. (If this remote sensor is attached to the module, the module's internal temperature sensor will be disabled.)

Specifications	
Measuring Range/Precision	14 to 194° F (-10 to 90° C, ±1°)
Cable Lengths	9" or 35" (25 or 90cm) from EquaLink module housing
Sensor Dimensions	0.87" x 0.58" x 0.37" (22 x 15 x 9mm)

AMBIENT TEMPERATURE SENSOR
Part No.: BM-AMB-TEMP

The ambient temperature sensor is a separate temperature sensor that connects to COM2 of the WebManager. The addition of this sensor allows for the comparison of the room temperature to the battery temperature.

ELECTROLYTE SENSOR MONITOR
Part No.: BM-ELSENSOR

BM-ELSENSORs can be connected with the EquaLink WebManager or can be used as a standalone electrolyte monitoring system if purchased with a WebManager. The BM-ELSENSOR monitors both the electrolyte level and the cell temperature. The sensor has a green (normal), yellow (warning) and red (critical) LED indicator.

SPLITTER BOX

Part No.: BM-SPLIT

The RJ10 splitter box is a 1 input and 5 output splitter for the EquaLink communication bus cables. The splitter can be used for the optimization of the cable lengths and for cleaner wiring configurations. Required for all systems greater than 50 modules.

Specifications	
Power Supply	Not required
Interfaces	5x RJ10 for EquaLink bus cable 1x RJ10 for the connection to EquaLink converter or EquaLink bus at EquaLink
Dimensions (L x W x H)	3.60" x 2.63" x 0.98" (91.5 x 67 x 25mm)
Operating Conditions	Temperature: 32 to 140° F (0 to 60° C) max., humidity: 90%

CONTROL CABINET

Custom control cabinets are available for EquaLink systems. These cabinets are plug and play — only an AC power supply and an Ethernet cable is necessary to get the system online. All wiring/connections are made through a terminal strip.

These custom control panels come fully assembled and can house multiple WebManagers, optional accessories and have an integrated monitor/display.

Ordering Information

EquaLink Order Code

		A	B		C	D
*Example**	*BM-*	*125-*	*60*	*x*	*2V*	*.01*
Your Code	BM-			x		

		Code	Feature
A	Nominal DC System Voltage	12-	12 Vdc
		24-	24 Vdc
		48-	48 Vdc
		125-	125 Vdc
		250-	250 Vdc
		XXX-	Other XXX Vdc
B	Number of Individual Batteries to Monitor	XXX	Enter number of batteries (blocks or cells)
C	Battery Voltage	2V	2 V Cells
		4V	4 V Blocks
		6V	6 V Blocks
		12V	12 V Blocks
D	Input Power	.01	120 Vac/12 Vdc
		.02	18–72 Vdc
		.03	120–370 Vdc

Example part number BM-125-60x2V.01 represents:
125Vdc system consisting of sixty (60) 2 Volt cells.
WebManager to run on 120 Vac input power.

Available Options

Part Number	Description
BM-ELSENSOR	Electrolyte Level Sensor
BM-CT400A	DC Current Sensor, 400Amp
BM-CT1000A	DC Current Sensor, 1000Amp
BM-CT2000A	DC Current Sensor, 2000Amp
BM-AUX	Terminal Relay Controller, 4 digital inputs & 4 relay outputs
SBS-H2	Hydrogen Gas Detector (BM-AUX also required)
BM-REM-TEMP-9	External Temperature Sensor for Module, 9"L
BM-REM-TEMP-35	External Temperature Sensor for Module, 35"L
BM-SPLIT	1 x 5 RJ10 Splitter Box
BM-AMB-TEMP	Ambient Room Temperature Sensor

SBS
TEST & MONITORING EQUIPMENT

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