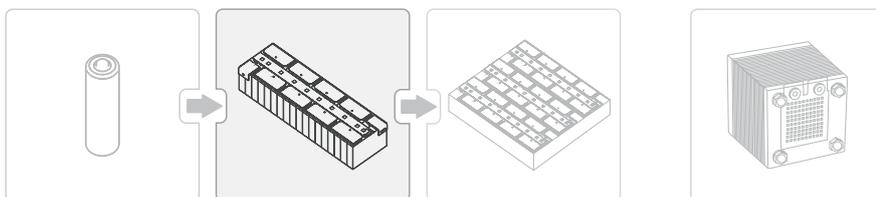




Datasheet

EA-BMTS 20200-840-2

Battery Module Test System



EA-BMTS 20200-840-2

Battery Module Test System



Features

- Battery module tester, a battery cyclers for charge and discharge
- 2 individual high power channels within a 42U rack
- Power of 60 kW per channel
- Voltage range of 0 – 200 V per channel
- Current range of 0 – 840 A per channel
- Full energy regeneration in discharge operation
- Very high efficiency of up to 95.3 %
- Up to 1 ms command and measurement speed
- Regulation modes CV, CC, CP with fast crossover
- Integrated battery test mode
- DC contactors integrated
- Active pre-charge
- Integrated Reverse Polarity Detection
- Zero Current Turn-off to protect DC contactors
- Temperature monitoring
- AC input 3 phase, 400V, 50 Hz
- Rack equipped with a 2-channel fast stop system
- Command languages and drivers: SCPI and ModBus, LabVIEW, IVI

Built-in interfaces

- USB
- Ethernet (1 Gbit/s)
- EtherCAT
- CAN FD
- USB Host on front panel
- Master-Auxiliary bus
- Share-Bus
- Digital input, relay contact and temperature sensor per channel

Software

- EA Power Control

Options

- Water cooling in stainless steel
- Grid monitor
- Insulation monitor

Technical data

General specifications

AC input Rack

Voltage, Phases	400 V, $\pm 10\%$, 3ph AC
Frequency	50 Hz
Power factor	0.99

DC input/output static per channel

Load regulation CV	$\leq 0.05\%$ FS (0 - 100% load, at constant AC input voltage and temperature)
Line regulation CV	$\leq 0.01\%$ FS (208 V - 480 V AC +10% supply voltage, constant load and constant temperature)
Stability CV	$\leq 0.02\%$ FS (during 8 h of operation, after 30 minutes warm-up, at constant output voltage, load and temperature)
Temperature coefficient CV	≤ 30 ppm/ $^{\circ}$ C (after 30 minutes of warm-up)
Compensation (remote sense)	$\leq 5\%$ U_{Nominal}
Load regulation CC	$\leq 0.1\%$ FS (0 - 100% load at constant AC input voltage and temperature)
Line regulation CC	$\leq 0.01\%$ FS (208 V - 480 V AC +10% at constant load and constant temperature)
Stability CC	$\leq 0.02\%$ FS (during 8 h of operation, after 30 minutes warm-up, at constant AC input voltage load and temperature)
Temperature coefficient CC	≤ 50 ppm/ $^{\circ}$ C (after 30 minutes of warm-up)
Load regulation CP	$\leq 0.3\%$ FS (0 - 100% load at constant AC input voltage and temperature)
Load regulation CR	$\leq 0.3\%$ FS + 0.1% FS current (0 - 100% load at constant AC input voltage and temperature)

Protective functions

OVP	Overvoltage protection, adjustable 0 - 110% U_{Nominal}
OCP	Overcurrent protection, adjustable 0 - 110% I_{Nominal}
OPP	Overpower protection, adjustable 0 - 110% P_{Nominal}
OT	Overtemperature protection (DC output shuts down in case of insufficient cooling)

DC input/output dynamic per channel

Rise time 10 - 90% CV	≤ 10 ms
Fall time 90 - 10% CV	≤ 10 ms
Rise time 10 - 90% CC	≤ 2 ms
Fall time 90 - 10% CC	≤ 2 ms

Display & measurement accuracy

Voltage	$\leq 0.05\%$ FS
Current	$\leq 0.1\%$ FS

Insulation

AC input to DC output	3750 Vrms (1 minute, creepage distance > 8 mm)
AC input to case (PE)	2500 Vrms
DC output to case (PE)	Negative DC pole \leftrightarrow PE : ± 1000 V DC ; Positive DC pole \leftrightarrow PE : +1000 V DC
DC output to interfaces	1000 V DC

Communication interfaces

Rear, galvanically isolated	USB, Ethernet (1 Gbit), EtherCAT, CAN FD, all for communication
Communication speed	≥ 1 ms
Front, galvanically isolated	USB host, for data acquisition

Digital In/Out

Built-in, galvanically isolated	16 pole
Inputs	3x independent, user-configurable; 3x independent, for temperature sensor
Outputs	3x independent, as dry contacts

General specifications

Safety and EMC

Safety	EN 61010-1 IEC 61010-1 UL 61010-1 CSA C22.2 No 61010-1 BS EN 61010-1
EMC	EN 55011, class A, group 1 CISPR 11, class A, group 1 FCC 47 CFR part 15B, unintentional radiator, class A EN 61326-1 include tests according to: - EN 61000-4-2 - EN 61000-4-3 - EN 61000-4-4 - EN 61000-4-5 - EN 61000-4-6
Appliance class	I
Ingress Protection	IP20
Environmental conditions	
Operating temperature	0 - 40 °C (32 - 104 °F)
Storage temperature	-20 - 70 °C (-4 - 158 °F)
Humidity	≤80% relative humidity, non-condensing
Altitude	≤2000 m (≤6,600 ft)
Pollution degree	2
Mechanical construction	
Cooling	Forced air flow from front to rear (temperature controlled fans), optional water cooling
Dimensions (W x H x D)	600 mm x 42U x 1000 mm
Weight	approx. 600 kg
Weight with water cooling	approx. 650 kg
DC output per channel	
Voltage range	0 - 200 V
Ripple in CV (rms)	≤40 mV (BW 300 kHz)
Ripple in CV (pp)	≤300 mV (BW 20 MHz)
U_{Min} for I_{Max} (sink)	1.8 V
Current range	0 - 840 A
Power range	0 - 60000 W
Output capacitance	10800 µF
Efficiency sink/source (up to)	95,3% *1
Article numbers	
Air cooled devices	02113014
Water cooled devices	02123004
Air cooled rack	03143003
Water cooled rack	03147003

*1 At 100% power and 100% output voltage

General

The BMTS 20200-840-2 provides 2 individual channels for high capacity battery module testing. Each channel works as a cycler device which can perform the function of charging and discharging. In discharge mode the device is regenerative and feeds the energy back into the local grid with an efficiency up to 95.3%. The DC power of 60 kW, the DC voltage of 0 - 200 V and the DC current of 0 - 840 A of each channel is tailored for the testing of high capacity battery modules. Each channel is equipped with DC contactors (one in DC+ and one in DC-) to clearly separate the battery module from the system and to enable additional, useful functionalities. These include the active pre-charge, the reverse polarity detection and the zero current turn off functionality. In addition, each channel has a temperature input to monitor the temperature of the battery module under test and to stop the test if the battery module becomes too hot.

The system is installed with a high density into a 42U rack that has a width of only 600 mm and a depth of 1000 mm. The Rack has one AC input and is equipped with a 2 channel fast stop system to shut down the rack in emergency situations. The fast stop button is placed on the front of the door and the rear door is secured by door contact switches. Once the rear door opens during operation the fast stop system will be activated automatically. Also, the DC contactors are integrated into the fast stop system and disconnects the module tester from the battery module under test.

Active pre-charge

The BMTS offers an automated active pre-charge to avoid sparks and current peaks during contactor closing. Due to independent internal and external sense measurement, the device will pre-charge its internal capacitor without using any energy from the battery module under test. The BMTS will close the DC contactor once the active pre-charge is finished.

Reverse Polarity Detection

The reverse polarity detection is achieved through a second sense connection. It is a fixed installed part of the BMTS and does not change when a new test object is connected. As this part of the installation is always fixed, it is not affected by a set of possible mistakes the operator might run into like

- Operator might put test object and sense in reverse
- Sense line might fall apart during test

The BMTS offers the capability to detect such faults through the Reverse Polarity Detection!

Zero Current Turn-off

DC contactors would wear down fast if they are opened while current flows. With the "Zero Current Turn-off" function, the BCTS will always set the current to zero before opening any DC contactors. This is even possible when using the fast stop option!

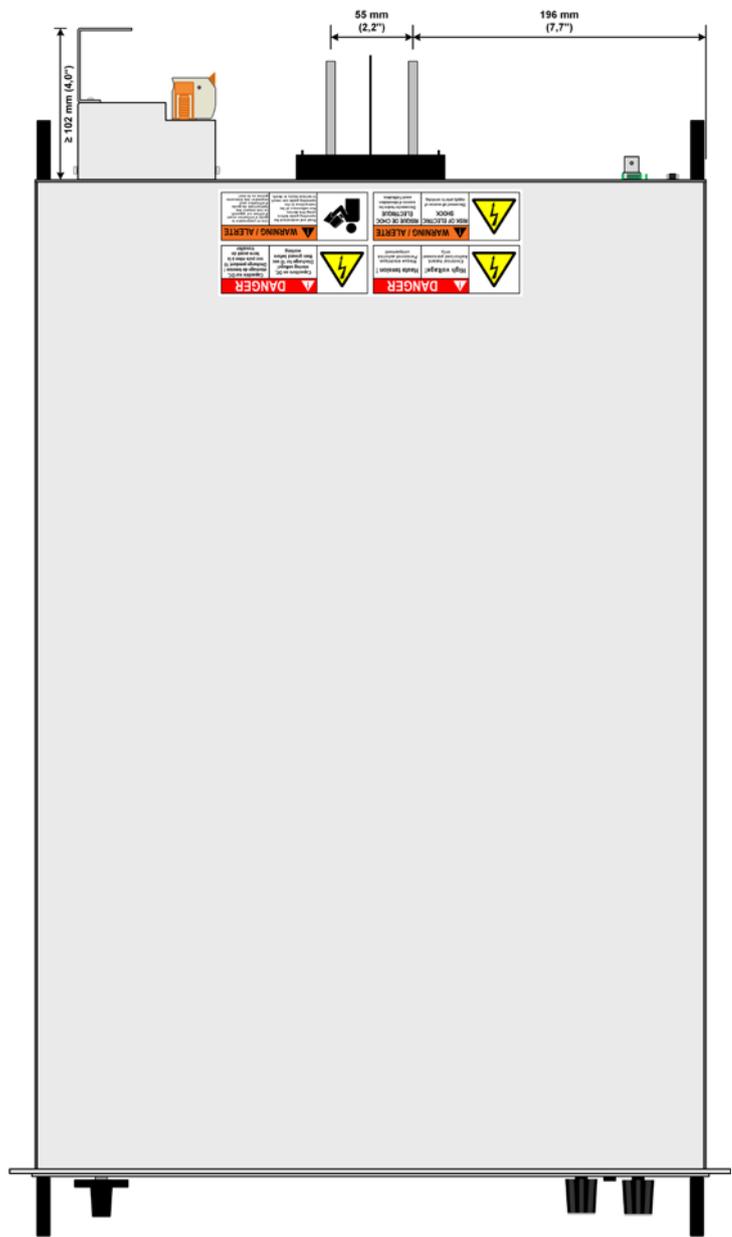
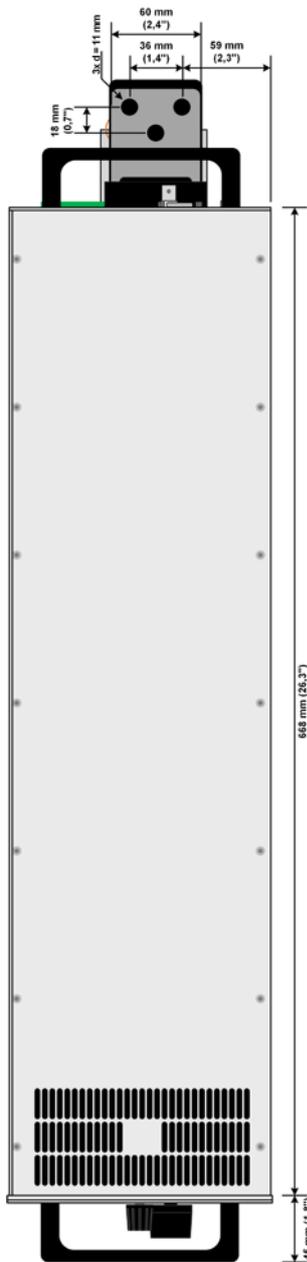
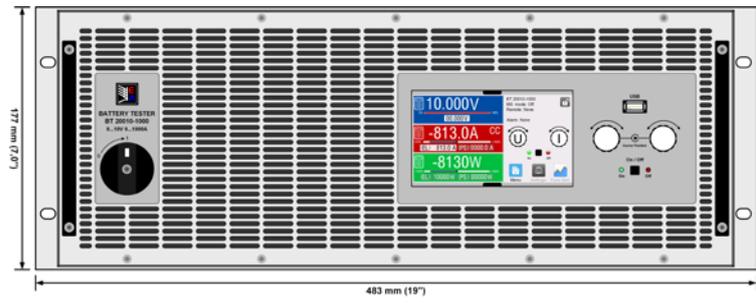
Energy recovery

The energy consumed in discharge mode is fed back into the connected grid with an efficiency up to 95.3%. As the energy is not converted to heat as in other loads, the energy costs are reduced. In addition, the devices generate less heat requiring less cost intensive air conditioning.

Function generator

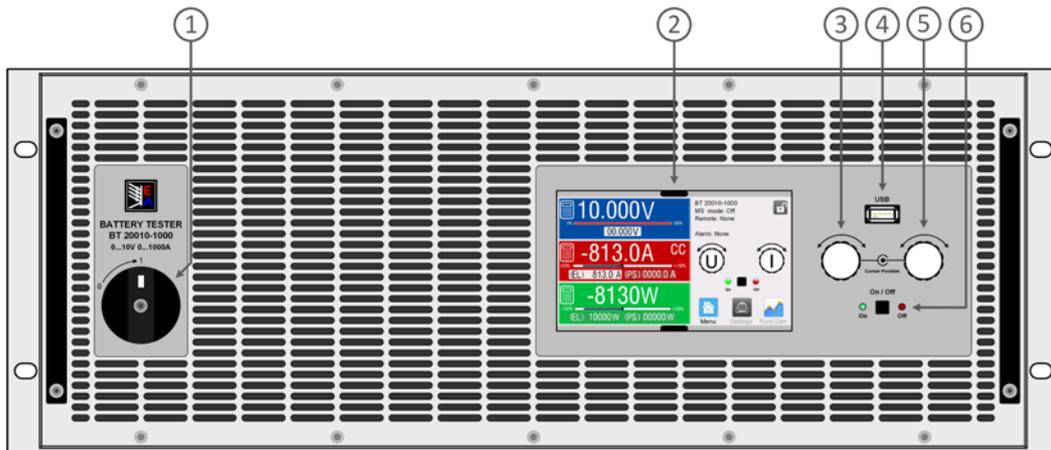
The system is equipped with a function generator. This allows waveforms such as sine, triangle, square or trapezoid to be simply called up and to applied either to the voltage or the current. An arbitrary generator allows voltage and current progression to be freely programmable. Test sequences for repeated tests can be saved and reloaded when needed, which saves time.

Technical drawings EA-BT 20000 Single 4U



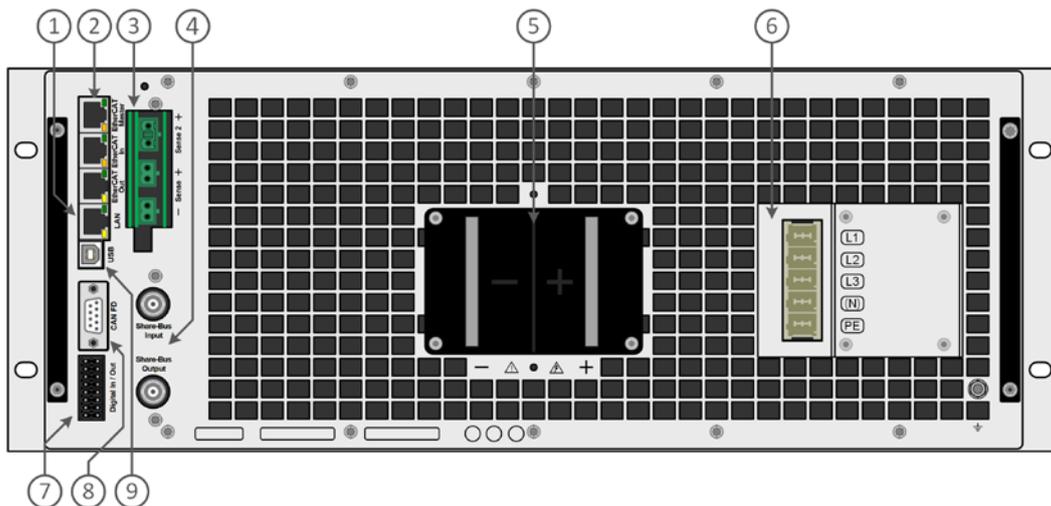
(side view of standard version shown)

Front panel description EA-BT 20000 Single 4U



1. Power switch
2. TFT control interface, interactive operation and display
3. Rotary knob with push-button action, for settings and control
4. USB host, uses USB sticks for data logging and sequencing
5. Rotary knob with push-button action, for settings and control
6. On / Off push-button with LED status display

Rear panel description EA-BT 20000 Single 4U



1. Ethernet interface
2. EtherCAT ports
3. Remote sense connectors
4. Share Bus connectors to set up a system for parallel connection
5. DC output connector (copper blades)
6. AC input connector
7. Digital In/Out (16 pole connector)
8. CAN FD interface
9. USB interface

Technical drawing battery module test system

UNIT 1
EA-BT 20000 4U

UNIT 2
EA-BT 20000 4U

UNIT 3
EA-BT 20000 4U

UNIT 4
EA-BT 20000 4U



FAST STOP
+
CONTROL
KEY SWITCH



Technical drawing battery module test system

UNIT 1
EA-BT 20000 4U

UNIT 2
EA-BT 20000 4U

UNIT 3
EA-BT 20000 4U

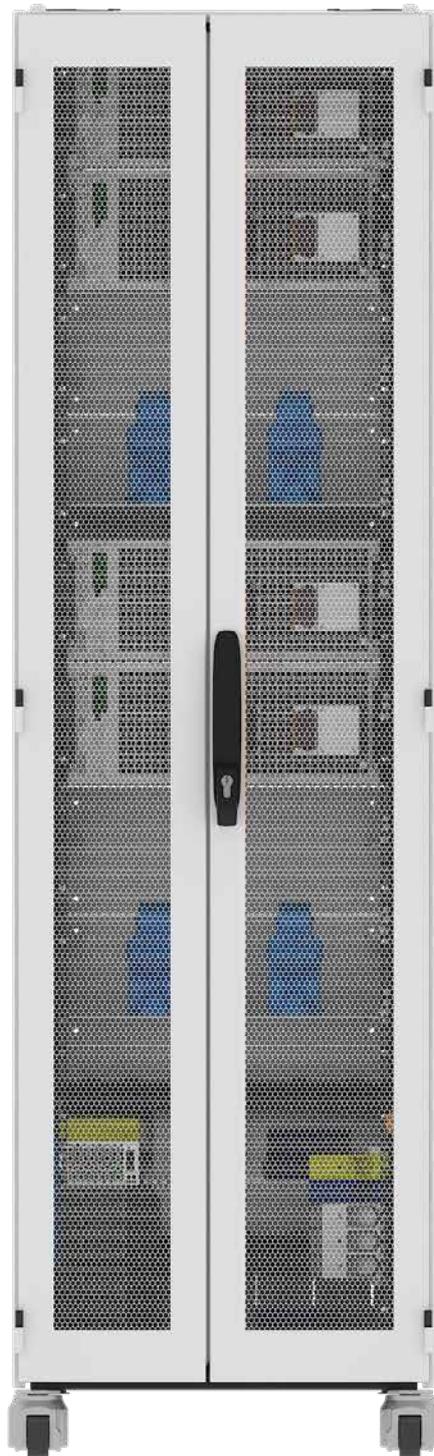
UNIT 4
EA-BT 20000 4U



DC-
CONTACTOR

DC-
CONTACTOR

CUSTOMER
AC CONNECTION
X1





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