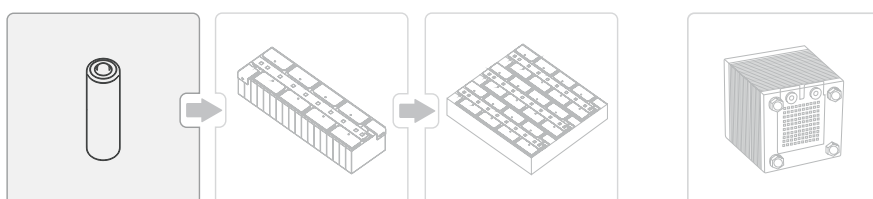




Datasheet

EA-BCTS 20010-600-18

Battery Cell Test System



EA-BCTS 20010-600-18

Battery Cell Test System



Features

- Battery cell tester, a multi channel battery cyclers for charge and discharge
- 18 individual channels within a 42U rack
- Voltage range of 0 - 10 V per channel
- Current range of 0 - 600 A per channel
- 6 kW of power per channel
- Full energy regeneration in discharge operation
- Very high efficiency of up to 90.5%
- Up to 1 ms command and measurement speed
- Regulation modes CV, CC, CP with fast crossover
- Integrated battery test mode
- DC contactors integrated for each channel
- Active pre-charge
- Integrated Reverse Polarity Detection
- Zero Current Turn-off to protect DC contactors
- Dynamic Sense Regulation
- Temperature monitoring for each channel
- 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
- Electrochemical impedance spectroscopy for each channel (coming Q1 2025)

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 <-> PE : ± 600 V DC ; Positive DC pole <-> PE : +600 V DC ; Channel DC <-> Channel DC : ± 1200 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 1200 mm
Weight	approx. 650 kg
Weight with water cooling	approx. 700 kg
DC output per channel	
Voltage range	0 - 10 V
Ripple in CV (rms)	≤25 mV (BW 300 kHz)
Ripple in CV (pp)	≤320 mV (BW 20 MHz)
U_{Min} for I_{Max} (sink)	0.5 V
Current range	0 - 600 A
Power range	0 - 6000 W
Output capacitance	8460 µF
Efficiency sink/source (up to)	90.5% *1
Article numbers	
Air cooled devices	02133002
Water cooled devices	02143002
Air cooled rack	03143005
Water cooled rack	03147001

*1 At 100% power and 100% output voltage

General

The BCTS 20010-600-18 provides 18 individual channels for high current cell testing. Each channel works as a cell 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 of up to 90.5%. The DC voltage of 0 - 10 V and the current of 0 - 600 A of each channel is tailored for the testing of high capacity battery cells. Each channel is equipped with a DC contactor to clearly separate the battery cell from the channel 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 cell under test and to stop the test if the cell becomes too hot.

The channels are installed with a high density into a 42U rack that has a width of only 600 mm and a depth of 1200 mm. The Rack has one AC input and is equipped with a 2-channel fast stop chain 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 chain will be activated automatically. Also, the DC contactors are integrated into the fast stop chain and disconnects the cell tester from the cells under test.

Active pre-charge

The BCTS 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 under test. The BCTS 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 BCTS and does not change when a new test object is connected. As this part of the installation is always fix, 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
- Operator might mix up different sense channels
- Sense line might fall apart during test

The BCTS 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!

Dynamic Sense Regulation

The BCTS measures the internal and external sense completely independent. This offers the advantage to do a dynamic sense regulation by using the full voltage range of 10 V to ensure best current rise times during dynamic tests.

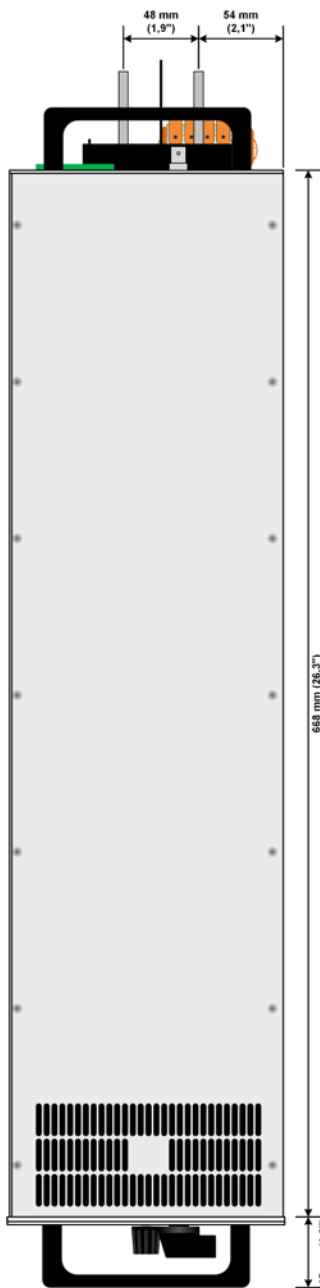
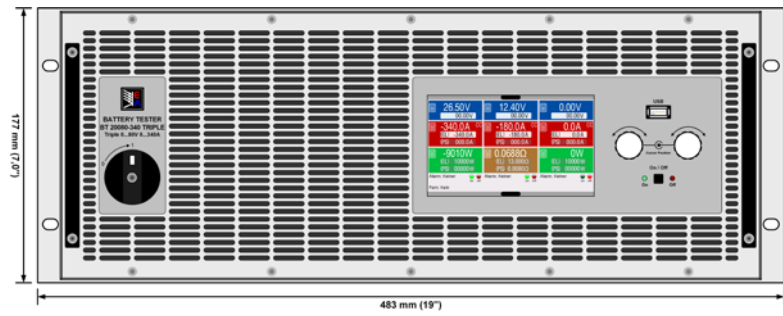
Energy recovery

The energy consumed in discharge mode is fed back into the connected grid with an efficiency of up to 90.5%. 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.

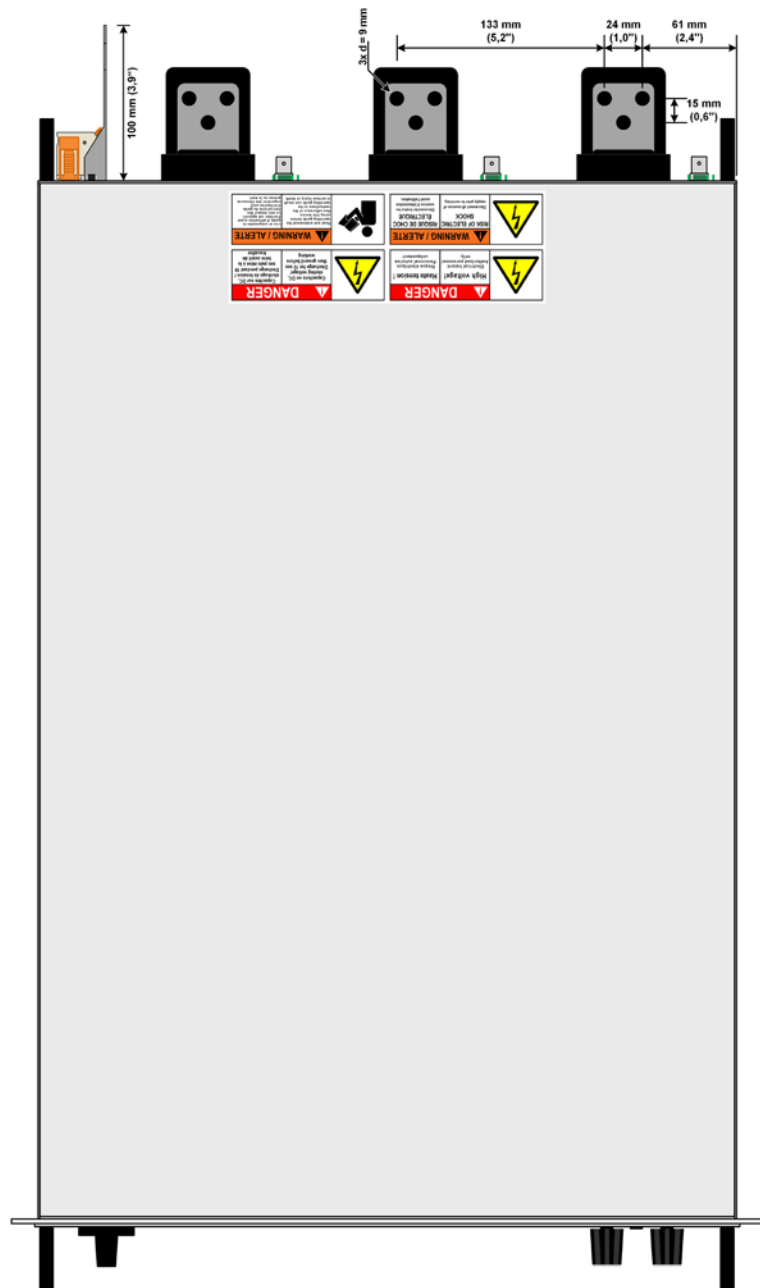
Function generator

Each channel 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.

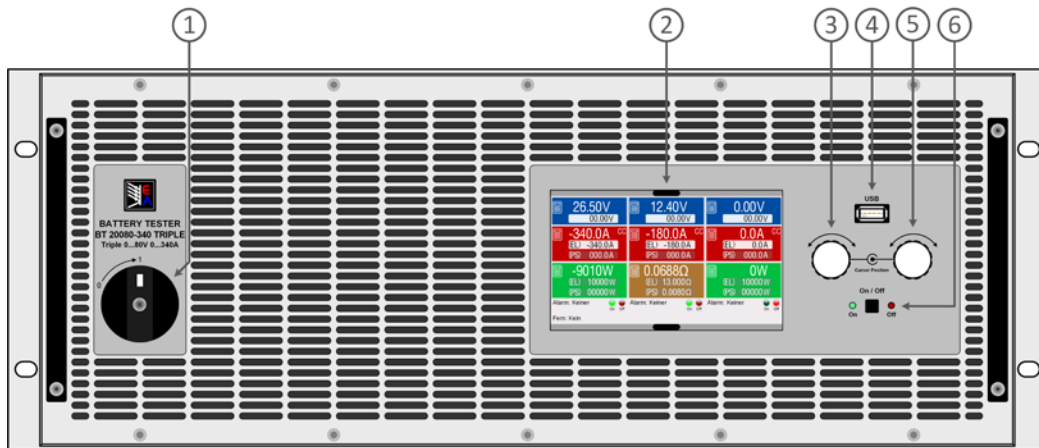
Technical drawings EA-BT 20000 Triple 4U



(side view of standard version shown)

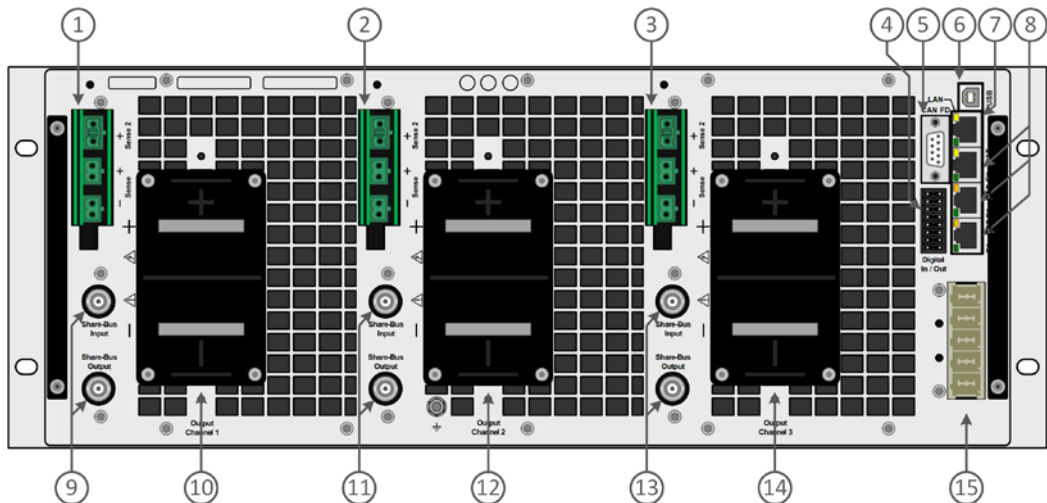


Front panel description EA-BT 20000 Triple 4U



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 Triple 4U



1. Remote sense connectors Channel 1
2. Remote sense connectors Channel 2
3. Remote sense connectors Channel 3
4. Digital In/Out (16 pole connector)
5. CAN FD interface
6. USB interface
7. Ethernet interface
8. EtherCAT ports
9. Share Bus connectors Channel 1
10. DC output connector (copper blades) Channel 1
11. Share Bus connectors Channel 2
12. DC output connector (copper blades) Channel 2
13. Share Bus connectors Channels 3
14. DC output connector (copper blades) Channel 3
15. AC input connector

Technical drawing Cell Test Rack

UNIT 1
EA-BT 20000
TRIPLE 4U

UNIT 2
EA-BT 20000
TRIPLE 4U
UNIT 3
EA-BT 20000
TRIPLE 4U

UNIT 4
EA-BT 20000
TRIPLE 4U
UNIT 5
EA-BT 20000
TRIPLE 4U

UNIT 6
EA-BT 20000
TRIPLE 4U

FUSES F1-F3

FUSES F4-F6
FUSES F15-F16



FAST STOP
+
CONTROL
KEY SWITCH



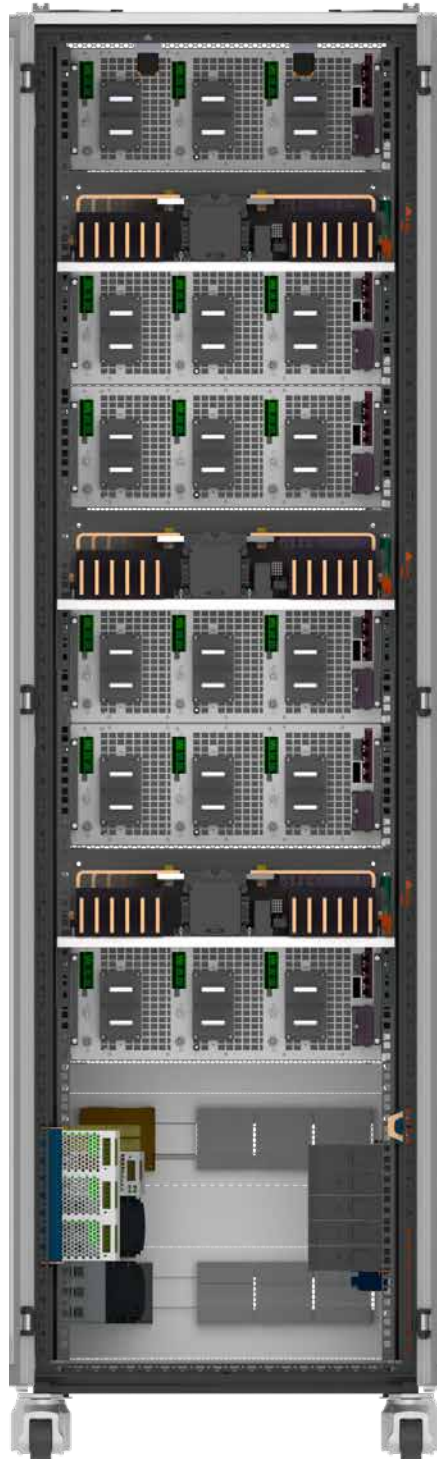
Technical drawing Cell Test Rack

UNIT 1
EA-BT 20000
TRIPLE 4U

UNIT 2
EA-BT 20000
TRIPLE 4U
UNIT 3
EA-BT 20000
TRIPLE 4U

UNIT 4
EA-BT 20000
TRIPLE 4U
UNIT 5
EA-BT 20000
TRIPLE 4U

UNIT 6
EA-BT 20000
TRIPLE 4U

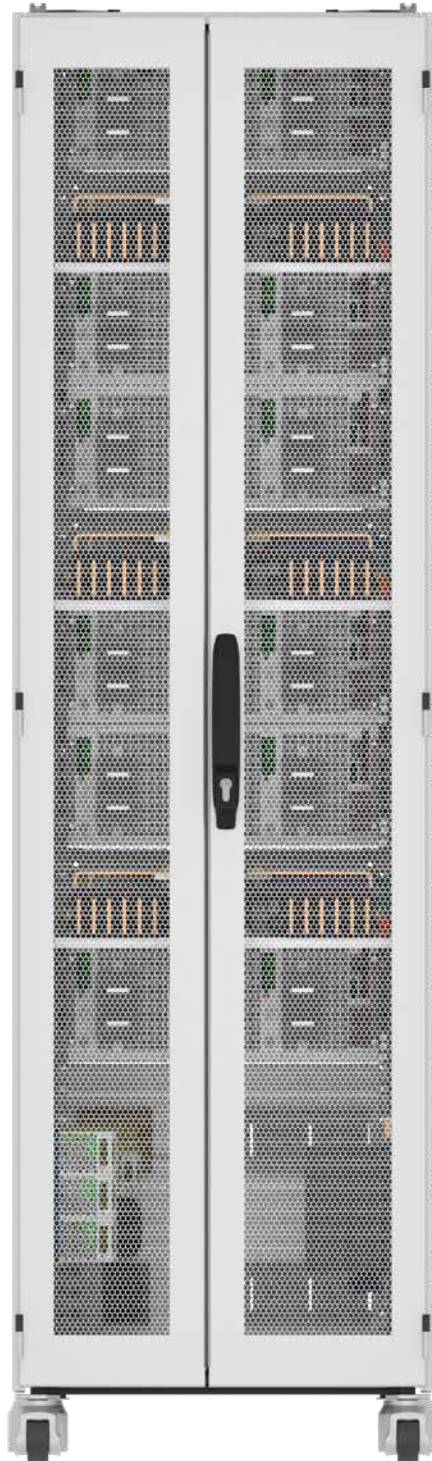


DC-
CONTACTORS

DC-
CONTACTORS

DC-
CONTACTORS

CUSTOMER
AC CONNECTION
X1





EA Elektro-Automatik GmbH & Co. KG

Helmholtzstr. 31-37
41747 Viersen
Germany

Phone +49 2162 3785 - 0
ea1974@elektroautomatik.com

www.elektroautomatik.com