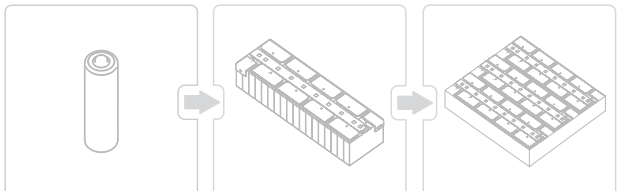
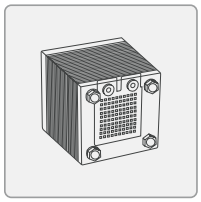
Tektronix® + Elektro-Automatik

Datasheet

EA-FCTS 20920-720

Fuel Cell Test System





TEST SYSTEMS

EA-FCTS 20920-720

Fuel Cell Test System

Features

- Fuel cell test system to discharge and test fuel cells
- High power electronic load within a 42U rack
- System power of 180 kW
- Voltage range of 0 – 920 V
- Current range of 0 – 720 A
- Full energy regeneration in discharge operation
- Very high efficiency of up to 96.5%
- Up to 1 ms command and measurement speed
- Regulation modes CV, CC, CP with fast crossover
- 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 sensors

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, ±10%, 3ph AC
Frequency	50 Hz
Power factor	0.99
DC input/output static	
Load regulation CV	≤0.05% FS (0 - 100% load at constant AC input voltage and temperature)
Line regulation CV	≤0.01% FS (208 V - 480 V AC +10% supply voltage, constant load and constant temperature)
Stability CV	≤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/°C (after 30 minutes of warm-up)
Compensation (remote sense)	≤5% $U_{Nominal}$
Load regulation CC	≤0.1% FS (0 - 100% load at constant AC input voltage and temperature)
Line regulation CC	≤0.01% FS (208 V - 480 V AC +10% at constant load and constant temperature)
Stability CC	≤0.02% FS (during 8 h of operation, after 30 minutes warm-up, at constant AC input voltage load and temperature)
Temperature coefficient CC	≤50ppm/°C (after 30 minutes of warm-up)
Load regulation CP	≤0.3% FS (0 - 100% load at constant AC input voltage and temperature)
Load regulation CR	≤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	
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	≤0.05% FS
Current	≤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 : ±1500 V DC ; Positive DC pole <-> PE : +2000 V DC
DC output to interfaces	1500 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 contacs

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. 650 kg
Weight with water cooling	approx. 700 kg
DC output	
Voltage range	0 - 920 V
Ripple in CV (rms)	≤250 mV (BW 300 kHz)
Ripple in CV (pp)	≤1200 mV (BW 20 MHz)
U_{Min} for I_{Max} (sink)	2.5 V
Current range	0 - 720 A
Power range	0 - 180000 W
Output capacitance	1800 µF
Efficiency sink/source (up to)	96,5% *1
Article numbers	
Air cooled devices	02113017
Water cooled devices	02123007
Air cooled rack	03143004
Water cooled rack	03147002

*1 At 100% power and 100% output voltage

General

The FCTS 20920-720 provides a powerful system for high power fuel cell testing. The system works as an electronic load to discharge and stimulate fuel cells. The system is regenerative and feeds the energy back into the local grid with an efficiency up to 96.5%. The DC power of 180 kW, the DC voltage of 0 - 920 V and the DC current of 0 - 720 A is tailored for the testing of high power fuel cells. The system is equipped with a DC contactor on each pole (one in DC+ and one in DC-) to clearly separate the fuel cell 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, the system has a temperature input to monitor the temperature of the fuel cell under test and to stop the test if the fuel cell 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 fuel cell tester from the fuel cell under test.

Active pre-charge

The FCTS 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 fuel cell under test. The FCTS 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 FCTS 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
- Sense line might fall apart during test

The FCTS 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 FCTS will always set the current to zero before opening any DC contactors. This is even possible when using the fast stop option!

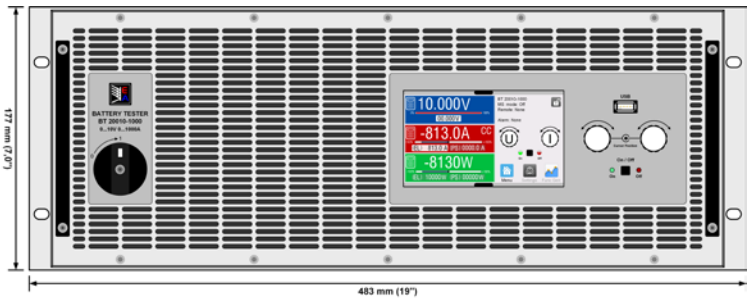
Energy recovery

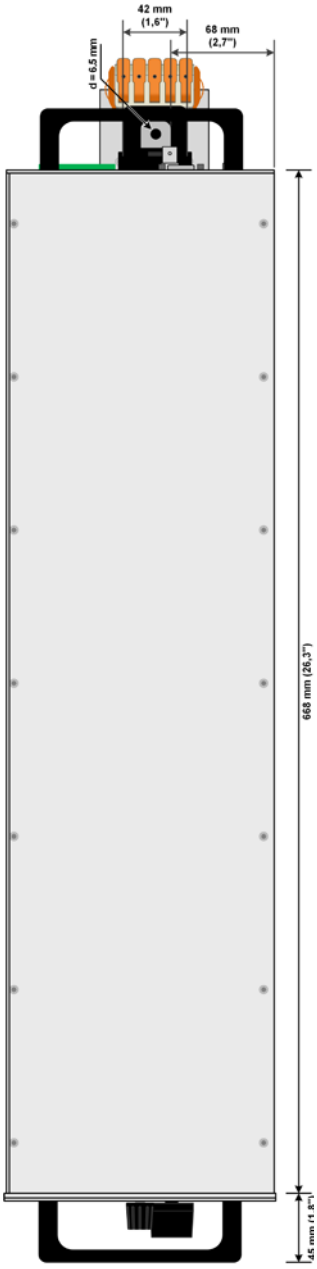
The energy consumed in discharge mode is fed back into the connected grid with an efficiency up to 96.5%. As the energy is not converted to heat as in other loads, the energy costs are reduced. In addition, the devices generate less heat requiring less cost intensive air conditioning.

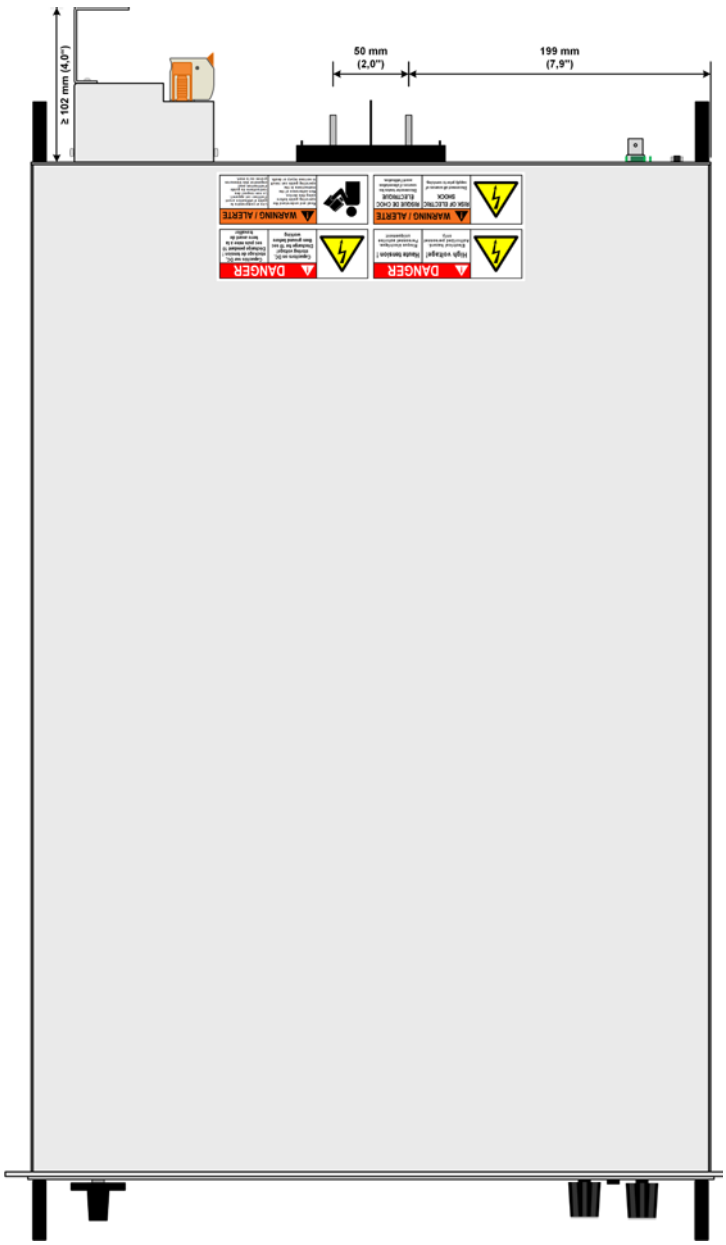
Function generator

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

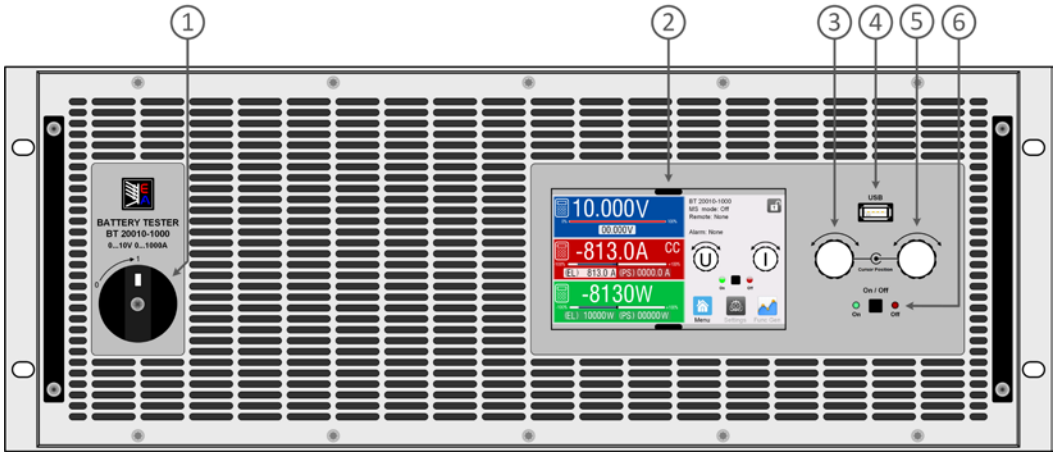






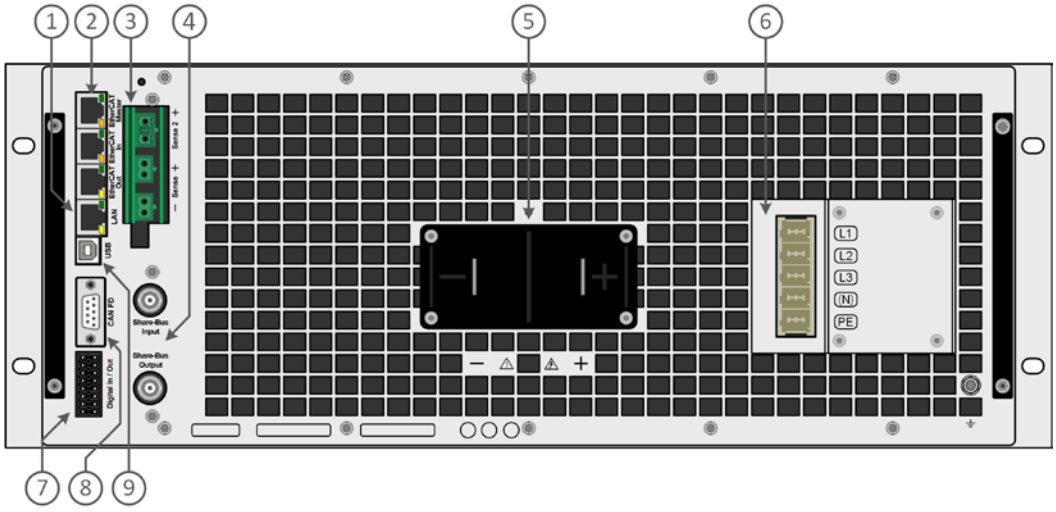
(side view of standard version shown)

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 interfacee
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 fuel cell 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

UNIT 5
EA-BT 20000 4U

UNIT 6
EA-BT 20000 4U

FUSES

FAST STOP
+
CONTROL
KEY SWITCH

Technical drawing fuel cell test system

UNIT 1
EA-BT 20000 4U

UNIT 2
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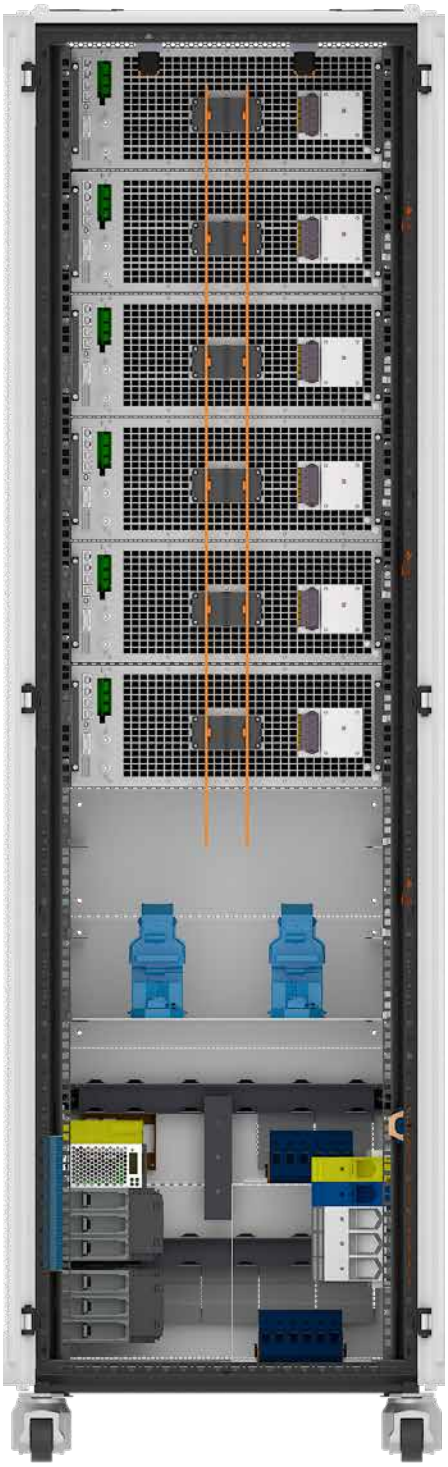
UNIT 5
EA-BT 20000 4U

UNIT 6
EA-BT 20000 4U



DC-
CONTACTOR

CUSTOMER
AC CONNECTION
X1

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