Tektronix®

EA-ELR 21000-80

High Speed Regenerative Load

DATASHEET

Features

- Input: 380 V - 480 V, ±10%, 3 ph AC
- Active power factor correction, typical 0.99
- Regenerative with energy recovery into the grid
- Very high efficiency of up to 95.1%
- High performance with up to 30 kW per unit
- Voltage range 0 - 1000 V
- Current range 0 - 80 A
- Flexible power regulated DC input stages (autoranging)
- Overpower feature allowing 125% power (within nominal voltage and current) for 500 ms. Optimized for 800 V systems.
- Regulation modes CV, CC, CP, CR, with fast crossover
- Digital regulation, high resolution with 16 bit ADCs and DACs, selection of voltage control speed
- Galvanically isolated Share-bus for parallel operation
- Master-Auxiliary bus for parallel operation
- Built-in EtherCAT interface with 1 ms communication speed
- Command languages and drivers: SCPI, ModBus, LabVIEW, IVI

Built-in interfaces

- USB
- Ethernet 1 Gbit/s
- EtherCAT
- CAN FD
- Master-Auxiliary bus
- Share-bus
- USB host (front panel)
- Digital In/Out

Software

- EA Power Control

Options

- Water cooling in stainless steel

Energy recovery

The energy consumed in load mode is fed back into the connected grid with efficiencies of up to 95%. Unlike conventional loads that dissipate energy as heat, the regenerative design helps reduce energy costs. Lower heat generation also reduces cooling requirements and associated air conditioning costs. For many applications, a single device may be sufficient, helping reduce investment and installation costs.

Elektro-Automatik

The principle of energy recovery

Figure 1 demonstrates, based on a typical application, how a device under test consumes energy from the mains, converts it to DC and feeds that into an EA device. The high-speed regenerative load EA-ELR 21000-80 4U HS converts this energy back into an AC current and feeds it back into the grid.

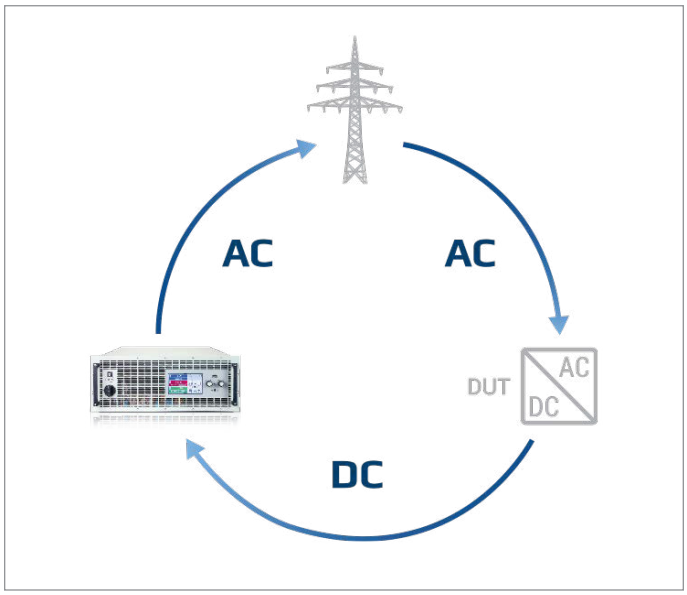


Figure 1

Interfaces

The EA-ELR 21000-80 4U HS includes the most commonly used interfaces and ports, all of which are galvanically isolated from the DC side. Communication speeds of up to 1 ms are supported. The following digital interfaces are available:

- USB
- Ethernet 1Gbit/s
- EtherCAT
- CAN FD
- USB host

In addition, there are 3 digital inputs, 3 relay contacts and 3 temperature sensor inputs.

A Master-Auxiliary bus and Share bus are available for expanding the devices as a high-performance system. With these interfaces, the system works like a single device with symmetrical load sharing.

DC connection

DC connections are made using copper blade terminals located on the rear of the device. For higher power requirements, multiple devices can be connected in parallel. A protective cover is included to help prevent accidental contact.

Master-Auxiliary bus and Share bus

If the integrated Master-Auxiliary bus and Share bus are used, a multi device system behaves as a single device. Both buses are connected between each device. With the Master-Auxiliary bus the system data, such as total power and total current, are collected and shown on the master device. Warnings and alarms of the auxiliary devices are shown clearly in the display. The Share bus provides an equal load distribution to the individual devices.

General Specifications

AC Input

Voltage, Phases	380 - 480 V, ±10%, 3 ph AC
Frequency	45 - 65 Hz
Power Factor	ca. 0.99
Leakage Current	<10 mA
Inrush Current[1]	@400 V: ca. 54 A per phase
Overvoltage Category	II

Protective Functions

OVP	Overvoltage protection, adjustable 0 - 110% $U_{Nominal}$
OCP	Overcurrent protection, adjustable 0 - 110% $I_{Nominal}$
OPP	Overpower protection, adjustable 0 - 110% $P_{Nominal}$ Overpower protection, adjustable 110 - 125% $P_{Nominal}$[4]
OT	Overtemperature protection (DC terminal shuts down in case of insufficient cooling)

DC Input Dynamic

	Stepwith	Basic Configuration[2]	Enhanced Performance Settings[2]	Max. Performance Settings[2]
di/dt performance 1 Device	10% - 60% 4 A - 22 A 3.2 kW - 17.6 kW	di/dt: 0.5 A/µs Current Overshoot: 20%	di/dt: 0.8 A/µs Current Overshoot: 30%	di/dt: N/A Current Overshoot: N/A
	50% - 100% 19 A - 37 A 15.2 kW - 29.6 kW	di/dt: 0.5 A/µs Current Overshoot: 40%	di/dt: 0.8 A/µs Current Overshoot: 55%	di/dt: N/A Current Overshoot: N/A
	10% - 100% 4 A - 37 A 3.2 kW - 29.6 kW	di/dt: 1.1 A/µs Current Overshoot: 30%	di/dt: 1.3 A/µs Current Overshoot: 30%	di/dt: 1.5 A/µs Current Overshoot: 80%
	10% - 120%[3] 4 A - 47 A 3.2 kW - 37.6 kW	di/dt: 1.5 A/µs Current Overshoot: 25%	di/dt: 1.7 A/µs Current Overshoot: 20%	di/dt: 1.9 A/µs Current Overshoot: 45%

	Stepwith	Basic Configuration[2]	Enhanced Performance Settings[2]	Max. Performance Settings[2]
di/dt performance 2 Devices	10% - 60% 7 A - 45 A 5.6 kW - 36 kW	di/dt: 1.1 A/µs Current Overshoot: 30%	di/dt: 1.6 A/µs Current Overshoot: 35%	di/dt: N/A Current Overshoot: N/A
	50% - 100% 37 A - 75 A 29.6 kW - 60 kW	di/dt: 1.3 A/µs Current Overshoot: 45%	di/dt: 1.6 A/µs Current Overshoot: 50%	di/dt: N/A Current Overshoot: N/A
	10% - 100% 7 A - 75 A 5.6 kW - 60 kW	di/dt: 2.3 A/µs Current Overshoot: 35%	di/dt: 2.7 A/µs Current Overshoot: 35%	di/dt: 3.1 A/µs Current Overshoot: 50%
	10% - 120%[3] 7 A - 93 A 5.6 kW - 74.4 kW	di/dt: 3.0 A/µs Current Overshoot: 35%	di/dt: 3.3 A/µs Current Overshoot: 35%	di/dt: 3.7 A/µs Current Overshoot: 45%

	Stepwith	Basic Configuration[2]	Enhanced Performance Settings[2]	Max. Performance Settings[2]
di/dt performance 4 Devices	10% - 60% 15 A - 90 A 12 kW - 72 kW	di/dt: 1.6 A/µs Current Overshoot: 10%	di/dt: 2.0 A/µs Current Overshoot: 15%	di/dt: 2.9 A/µs Current Overshoot: 30%
	50% - 100% 75 A - 150 A 60 kW - 120 kW	di/dt: 1.9 A/µs Current Overshoot: 20%	di/dt: 2.4 A/µs Current Overshoot: 20%	di/dt: 3.1 A/µs Current Overshoot: 30%
	10% - 100% 15 A - 150 A 12 kW - 120 kW	di/dt: 3.3 A/µs Current Overshoot: 15%	di/dt: 3.7 A/µs Current Overshoot: 15%	di/dt: 4.5 A/µs Current Overshoot: 20%
	10% - 120%[4] 15 A - 187 A 12 kW - 150 kW	di/dt: 4.3 A/µs Current Overshoot: 15%	di/dt: 4.6 A/µs Current Overshoot: 10%	di/dt: 5.5 A/µs Current Overshoot: 20%

	Stepwith	Basic Configuration[2]	Enhanced Performance Settings[2]	Max. Performance Settings[2]
di/dt performance 8 Devices	10% - 60% 30 A - 180 A 24 kW - 144 kW	di/dt: 3.4 A/µs Current Overshoot: 10%	di/dt: 4.7 A/µs Current Overshoot: 15%	di/dt: 6.4 A/µs Current Overshoot: 35%
	50% - 100% 150 A - 300 A 120 kW - 240 kW	di/dt: 4.1 A/µs Current Overshoot: 25%	di/dt: 5.6 A/µs Current Overshoot: 20%	di/dt: 6.8 A/µs Current Overshoot: 45%
	10% - 100% 30 A - 300 A 24 kW - 240 kW	di/dt: 7.0 A/µs Current Overshoot: 15%	di/dt: 7.8 A/µs Current Overshoot: 10%	di/dt: 10.0 A/µs Current Overshoot: 25%
	10% - 120%[3] 30 A - 375 A 24 kW - 300 kW	di/dt: 9.4 A/µs Current Overshoot: 20%	di/dt:10.1 A/µs Current Overshoot: 10%	di/dt: 12 A/µs Current Overshoot: 20%

1. Calculated for the peak value of the stated voltage including 10% tolerance, at 23°C ambient and first switch-on (cold start).
2. Measured with following configuration:
   - cable lenght: 3 m
   - cable twisted together
   - cable diameter: 25 mm²
   - number of cables: 1 per pole (2 per device)
   - Voltage: 800 V
3. 120% with overpower feature enabled.
4. For Overpower feature.

Display & Measurement Accuracy

Voltage	≤0.05% FS
Current	≤0.1% FS

Insulation

AC Input to DC Terminal	3750 Vrms (1 minute, creepage distance >8 mm)
AC Input to Case (PE)	2500 V DC
DC Terminal to Case (PE)	See model table
DC Terminal to Interfaces	1500 V DC

Communication Interfaces

Rear, Galvanically Isolated	USB, Ethernet (1 GBit), EtherCAT, CAN FD, all for communication
Communication Speed	≤1 ms[4]
Front, Galvanically Isolated	USB host, for data acquisition

Digital In/Out

Built-in, Galvanically Isolated	16 pole
Inputs	3× independent, user-configurable
Outputs	3× independent, as dry contact
Sensor Inputs	3× independent, for temperature sensor

Device Configuration

Parallel Operation with Share Bus	Up to 64 units of the same series

Safety and EMC

Safety	EN 61010-1 IEC 61010-1 BS EN 61010-1
EMC	EN 55011, class A, group 1 CISPR 11, class A, group 1 EN 61326-1 including 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 - 35 °C (32 - 95 °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)	**Chassis:** 483 mm (19 in) × 177 mm (4U) × 668 mm (26.3 in) **Overall Depth:** min. 802 mm (min. 31.6 in)
Weight	50 kg (110 lb)
Weight with Water Cooling	56 kg (126 lb)

DC Input

Voltage Range	0 - 1000 V
U_{Min} for I_{Max} (sink)	36.5 V
Current Range	0 - 80 A
Power Range	Nominal: 0 - 30000 V With Overpower: 0 - 37500 W
Output Capacitance	80 µF
Efficiency Sink/Source (up to)[1]	95.1 %

AC Input

P_{Max}	33 kW
Phase Current[2]	≤56 A

Insulation

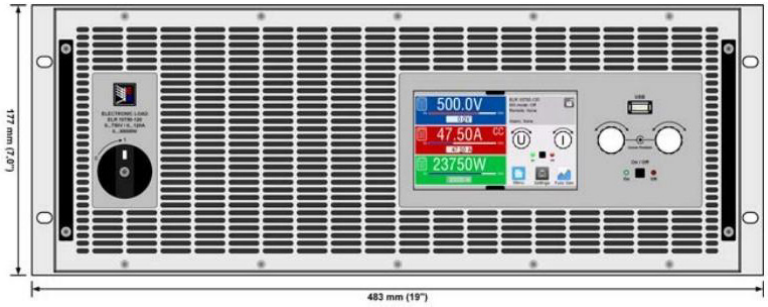
Negative DC pole <-> PE	±1500 V DC
Positive DC pole <-> PE	+2000 V DC

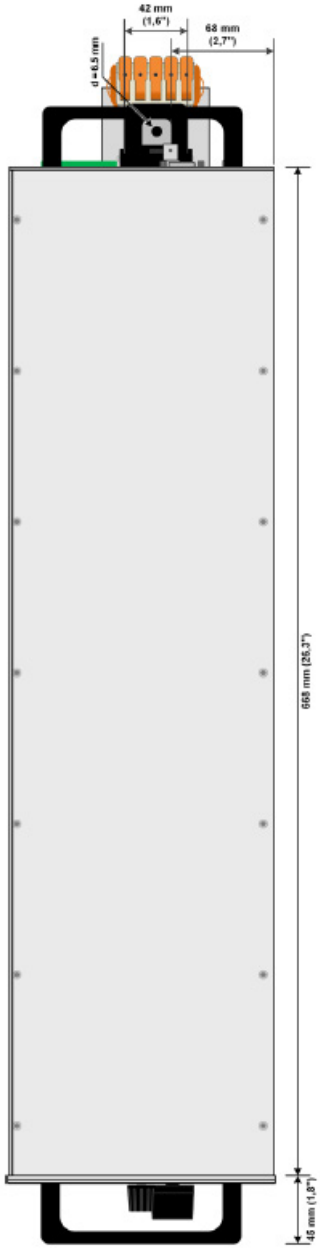
Product Codes

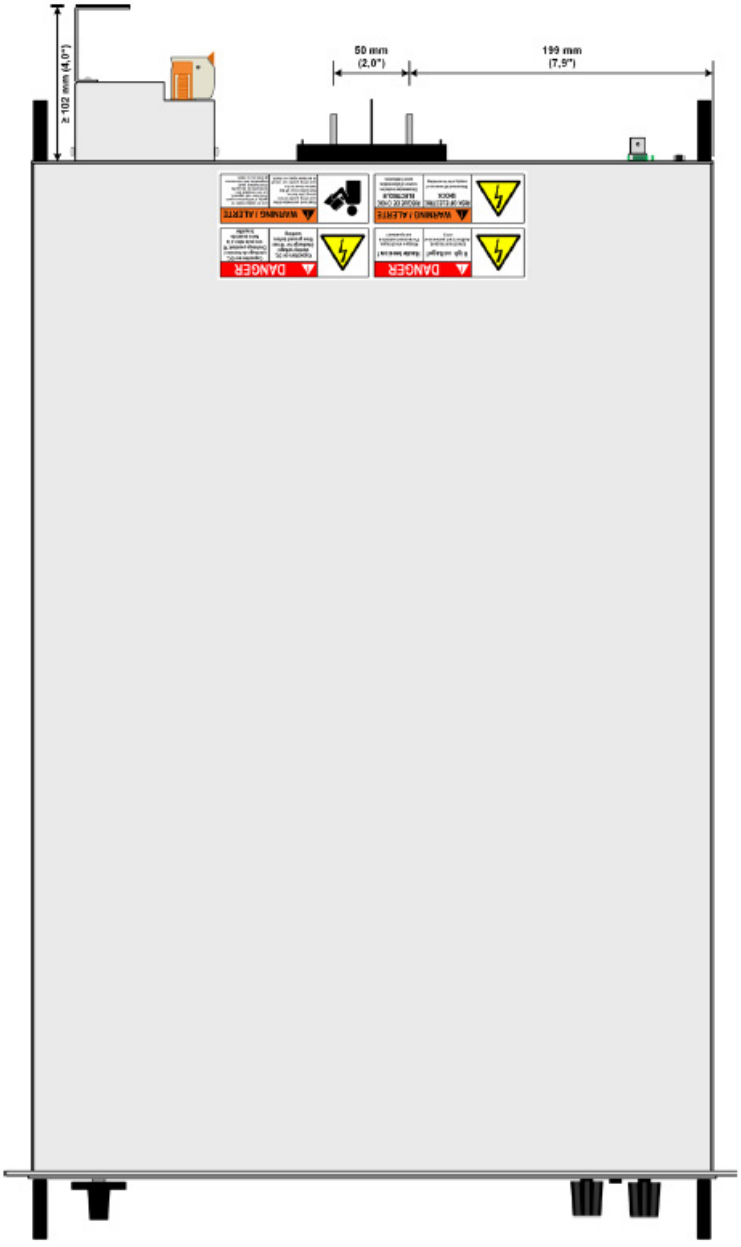
Standard	33530406
Standard + Water Cooling	On request

1. At 100 % power and 80 % output voltage.
2. Calculated for the default AC supply voltage in the stated range, minus 10 % tolerance, at maximum output power and 10 % power loss from AC to DC.

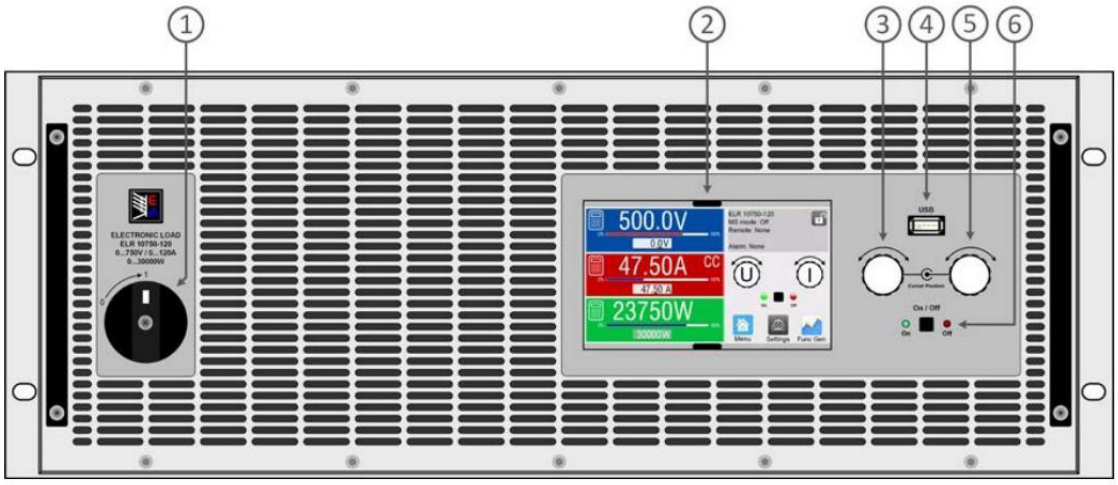
Technical Drawings EA-ELR 21000-80 4U HS





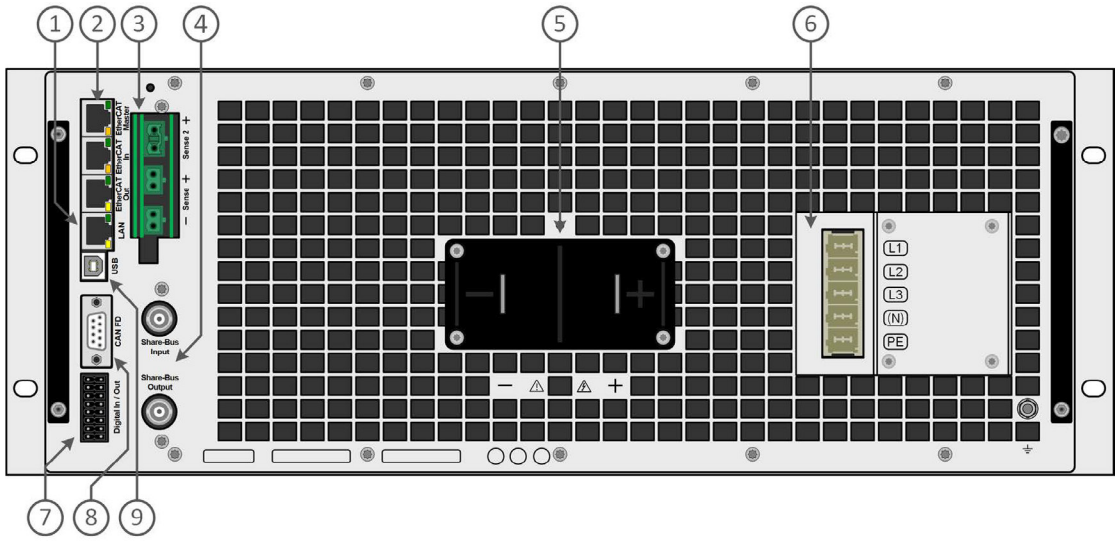


Front Panel Description EA-ELR 21000-80 4U HS



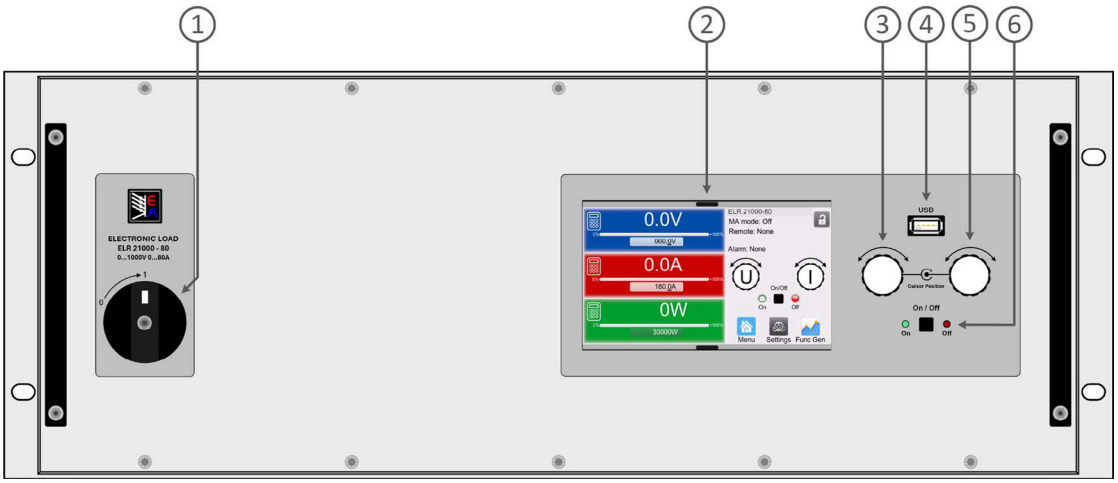
1. Power switch
2. TFT control interface, interactive operation and display
3. Rotary knob with push-button action, for settings and control
4. USB host, uses USB sticks for data logging and sequencing
5. Rotary knob with push-button action, for settings and control
6. On / Off push-button with LED status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

Rear Panel Description EA-ELR 21000-80 4U HS



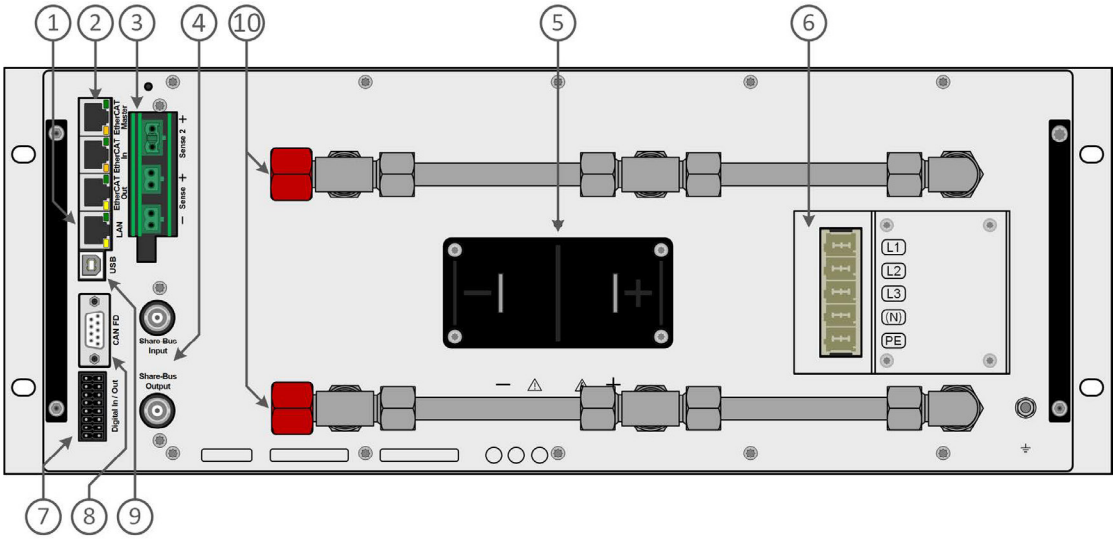
1. Ethernet interface
2. EtherCAT ports
3. Remote sense connectors
4. Share bus connectors to set up a system for parallel connection
5. DC output connector (copper blades)
6. AC input connector
7. Digital In/Out (16 pole connector)
8. CAN FD interface
9. USB interface

Front Panel Description EA-ELR 21000-80 4U HS with Water Cooling option



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-ELR 21000-80 4U HS with Water Cooling option



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
10. Water inlet/outlet

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