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# ES4500.2 Component Rack

User's Guide

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The ES4500.2 Component Rack is used to hold boards used for error and load simulation (ES4510 thru ES4571). As it is designed as a 19" assembly rack, the ES4500.2 Component Rack can be used both inside a rack and as a stand-alone device in its own housing. This increases flexibility as it can be used with various signal box systems.

The ES4500.2 Component Rack is equipped with a so-called ECU backplane. Apart from control and supply signals for the individual slide-in cards, it receives all signals from the connected controller. A maximum of 183 ECU signals can be acquired.

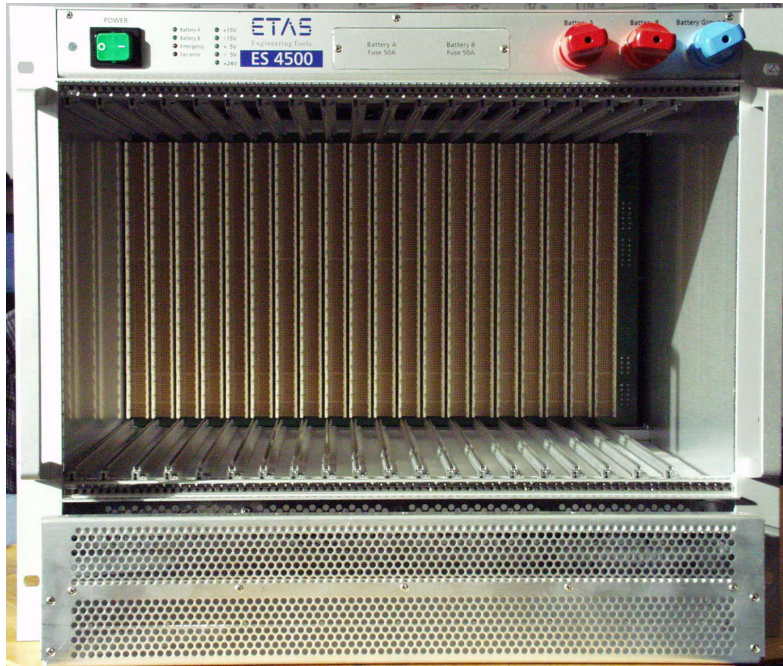
For testing controllers with a number of signals > 183, it is possible to cascade up to eight ES4500.2 Component Racks.

The controller signals are fed using an ECU Interface Board (ES4510, ES4511, ES4513) and supplied to the backplane via standard connectors. It is possible to pass the controller signals first through a standard breakout box (e.g. ES4602).

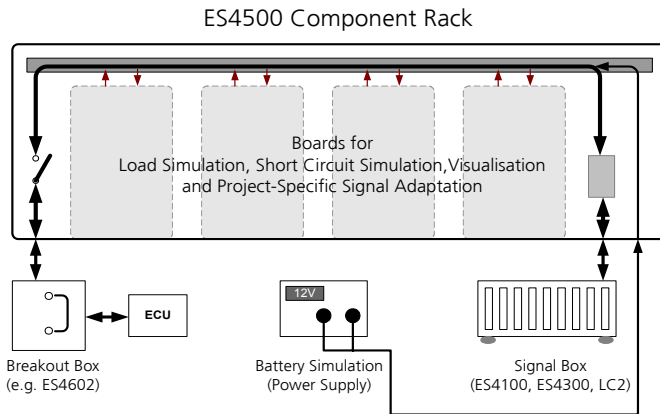
The signal box signals are input using an ES4520 Signalbox Interface Board. Project-specific signal adaptations are implemented on this coupling board.

Short circuit and load simulations are enabled via plug-in boards including the visualization of signals and the adaptation of specific signals by, for example, high-voltage end stages.

The plug-in boards are controlled via CAN. The CAN bus is applied on the coupling board at the signal box side. If multiple ES4500.2 Component Racks are cascaded, the CAN bus is looped through to the next ES4500.2 Component Rack via the coupling board on the controller side.



**Fig. 1-1** Front view of the ES4500.2 Component Rack



**Fig. 1-2** The ES4500.2 Component Rack and its Integration into the LAB-CAR Concept

## 2 Technical Description

The ES4500.2 consists mainly of the following three parts: the 19" assembly rack, the ECU backplane, and the internal power supply unit.

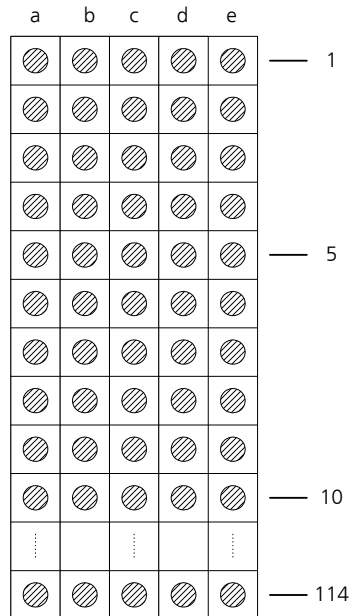
### 2.1 ECU Backplane

#### 2.1.1 Signal Arrangement on the ECU Backplane

As mentioned before in the introduction, the ECU backplane – in the following, simply referred to as backplane – holds the controller signals, the control signals for the battery simulation and the individual test boards, as well as the supply voltages for the boards and the individual battery nodes.

In total, the backplane holds 340 different signals. The backplane width is designed to accommodate 21 slots although only 20 slots are available. The 21<sup>st</sup> slot is used as input for the supply voltages and the ports of the front panel controls.

The backplane is divided into several areas. Each area includes one signal group with a particular signal specification.



**Fig. 2-1** Pin Arrangement of a Slot

Pin No. of Slot	Signal Channel	Signal Group	Current Load (Slot) / Signal Group
a1 - e6	1 - 10	Board power supply	1 A - 10 A
a7 - e11	11 - 35	General control of component rack	0.5 A
a12 - d13	36 - 44	Battery node control	0.5 A
e13 - e14	45 - 50	Power supply unit control for battery simulation (Battery simulation)	0.5 A
a15 - e18	51 - 66	Measuring lines	1 A
a19 - e26	67 - 106	Controller signals (shielded)	1 A
a27 - e61	107 - 281	Controller signals (low current)	1 A
a62 - e85	282 - 321	Controller signals (high current)	3 A
a86 - e102	322 - 338	Controller signals (power) and internal short circuit channels	5 A
a103 - e114	339, 340	Battery voltage $\pm$	20 A

**Tab. 2-1** Division of a Slot at the Backplane into Signal Groups

For more information on the slot pin allocations, refer to the appendix.

**Note**

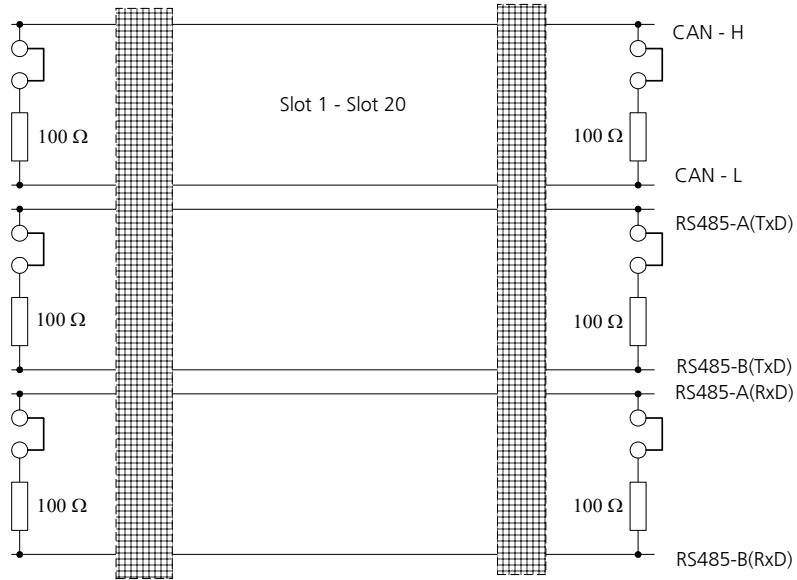
*The division of slots into signal groups is mandatory for the developer. Deviating from this division when designing new cards may cause malfunction or may even destroy the ES4500.2 Component Rack.*



## 2.1.2 Special Signals at the Backplane

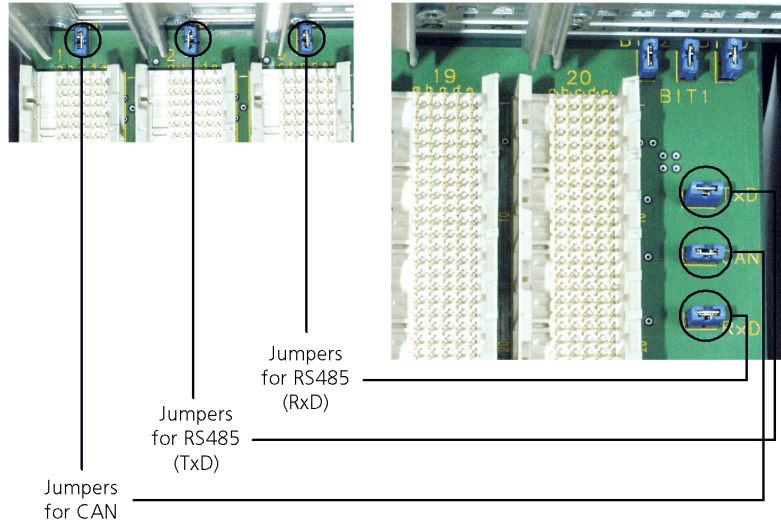
### Control Signals

In the "General control of component rack" area (see Tab. 2-1), 6 signal channels are reserved for the field bus lines CAN and RS485. These signals are used to control several ES4500.2 components. The terminal resistors (passive termination) are located on both sides of each line. Their resistance is  $100\ \Omega$ . As the resistors are connected via jumpers, they can be removed to allow expanding the bus system (see Fig. 2-2).



**Fig. 2-2** High-impedance Signal Connections at the Backplane

The jumpers to open the terminal resistors are accessible to the user on the front of the backplane (see Fig. 2-3). The jumpers can be removed easily using small flatnose pliers.

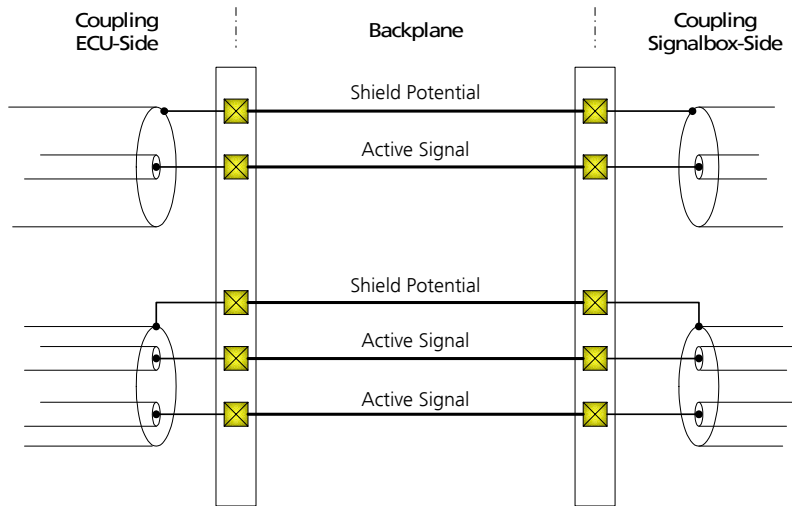


**Fig. 2-3** Jumper Positions for the Terminal Resistors

## Shielded Signals

The backplane includes an area that is reserved for shielded signals. This area is divided into dual and triple signal groups.

A dual signal group consists of one active signal and its corresponding shield potential. A triple group consists of two active signals with one common shield potential.



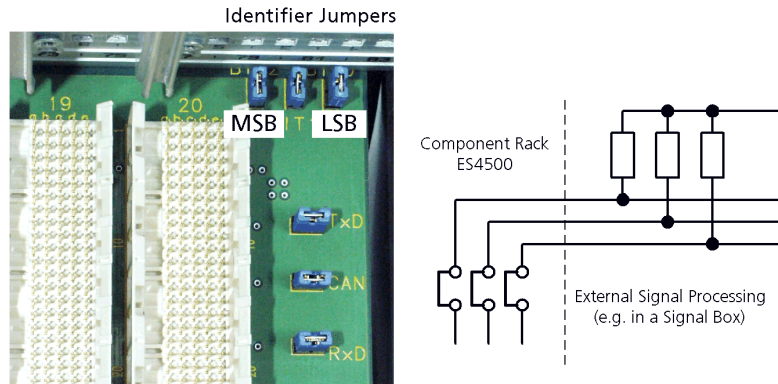
**Fig. 2-4** Shielded Signal Connections at the Backplane

As can be seen from Fig. 2-4, the shield potential is treated as a single channel, i.e. the active signals are not shielded at the backplane. However, since the active signals are connected together with their shield potential, the amount of circuitry on the related coupling boards is reduced.

## Identification of the ES4500.2 Component Rack

As mentioned before in the introduction, it is possible to cascade up to eight Component Racks. For this purpose, each ES4500.2 Component Rack has an identifier of 3 bits.

The signal channels 16 (MSB) to 18 (LSB) are reserved for the identifier. The identifier bits are implemented using jumpers. The identifier bits have to be processed externally via a pull-up resistor, i.e., they can be jumpered on the backplane only against GND (signal channel 1 "card power supply GND") (see Fig. 2-5).



**Fig. 2-5** Identifier of the ES4500.2 Component Rack

The jumpers can be pulled or plugged in easily using flatnose pliers.

### Slot ID

The slot ID is hard-wired for each slot and available at the backplane. There is no slot 0, the numbering starts at slot 1. The slot ID is coded with 5 bits. The signal channel 11 (slot pin a7) forms the MSB, while signal channel 15 (slot pin e7) forms the LSB.

Slot Number	Slot ID Bit0 (LSB)	Slot ID Bit1	Slot ID Bit2	Slot ID Bit3	Slot ID Bit4 (MSB)
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0

**Tab. 2-2** Allocation of Slot ID Bits to Corresponding Slots

Slot Number	Slot ID Bit0 (LSB)	Slot ID Bit1	Slot ID Bit2	Slot ID Bit3	Slot ID Bit4 (MSB)
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1

**Tab. 2-2** Allocation of Slot ID Bits to Corresponding Slots (cont.)

Similar to the ID bits of the Component Rack, the slot ID bits have to be processed via pull-up resistors. Only the '0' potentials are hard-wired on the backplane against GND (signal channel 1 "board power supply GND"). The '1' signals are open, i.e., they have a floating potential.

#### *Battery Node Control Channels*

Nine signal channels – channels 36 to 44 – are reserved on the backplane to control the switched battery nodes. The battery nodes are switched on the coupling board to the controller. Please refer to the corresponding product documentation (ES4510, ES4511, ES4513).

## Power Supply Control

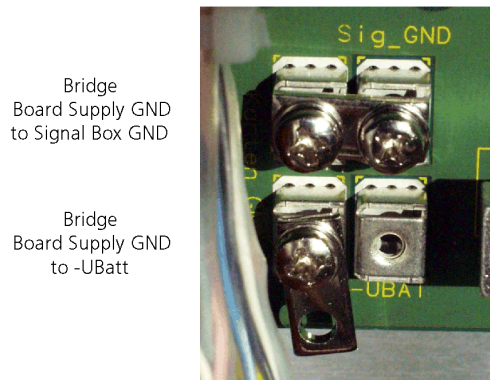
As mentioned before in the introduction, the LABCAR system includes a car battery simulation. The car battery is simulated using a power supply unit, normally manufactured by E/A or Takasago. The ES4500.2 Component Rack provides two battery voltages +UBatt\_A and +UBatt\_B, which refer to a common ground -UBatt.

To control the power supply unit, signal channels – channels 45 to 50 – are reserved on the backplane for voltage switching and for set and actual values.

### 2.1.3 Ground Circuitry on the Backplane

The backplane holds three separate grounds. These three potentials are distributed to the signal channels 1 (board supply GND, plane S1), 51 (signal box GND, plane S2), and 340 (-UBatt, plane S3).

The three signals can be combined via M3 power bridges (see Fig. 2-6), depending on the specific application.

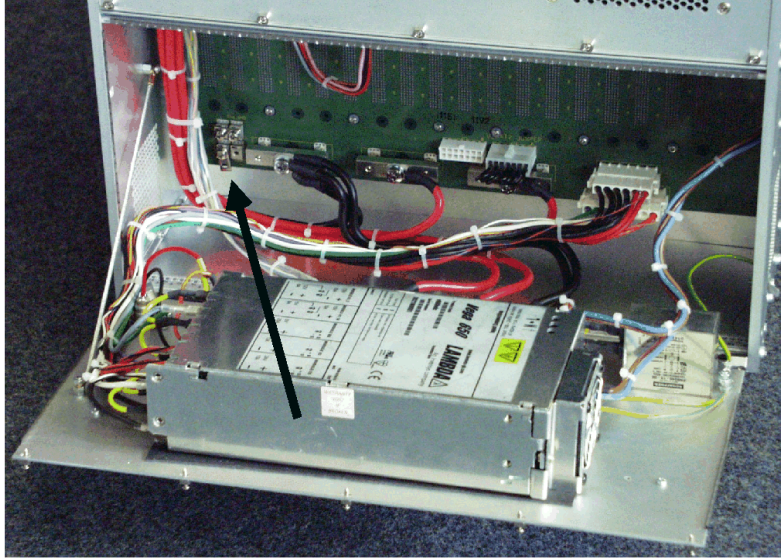


**Fig. 2-6** Connecting the Grounds on the Backplane

#### **Note**

*To separate the potentials the Component Rack is delivered without the "board supply GND to -UBatt" bridge mounted.*

To mount the bridges, remove the air filter holder of the ES4500.2 Component Rack.



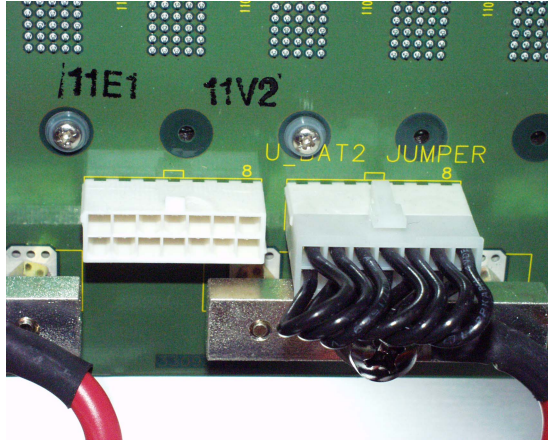
**Fig. 2-7** Position of the Bridges

#### 2.1.4 Setting the Second Battery Voltage

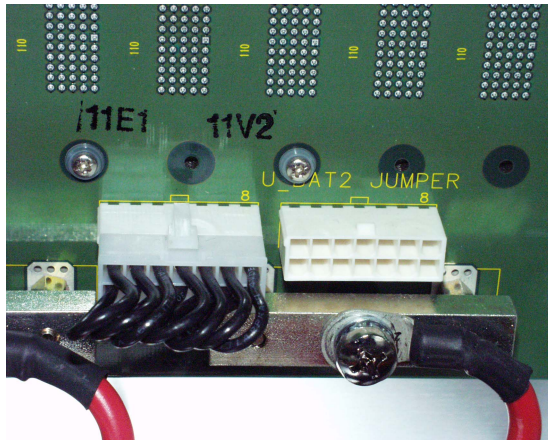
The ES4500.2 supports a second battery voltage which is already preset on delivery. This means that channels 313 to 319 (see "Battery Voltages Channels (+U\_Batt\_B)" on page 57) are connected electrically with one another.

If the second battery voltage is not required or not necessary, channels 313 to 319 can also be used as individual channels.

The battery voltage is set via a jumper on the back of the backplane. The rear panel of the ES4500.2 has to be open for this purpose. The UBatt\_B jumper is then freely accessible.



**Fig. 2-8** Jumper Setting for using a Second Battery Voltage



**Fig. 2-9** Jumper Setting for using Individual Channels



## 2.1.5 Access to ECU Backplane Signals

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There are several options to supply signals to the backplane of the ES4500.2 Component Rack. One of the features for this purpose is that all backplane signals are externally available via the corresponding coupling boards to the ECU or signal box. For a description of the signal traffic via these coupling boards, please refer to the documentation of these boards.

Additionally, the backplane provides dedicated connectors for input and output of signals in certain signal ranges. This input method for certain signals is described below.

### *Supply Voltage Input Connectors*

---

To provide the supply voltages for the plug-in boards, the ES4500.2 Component Rack has its own power supply unit. The supply voltages are fed to the corresponding signal channels via the connectors ST1 and ST2.

The two connectors are different to avoid mistakes. They are 6- or 8-pin Mate-N-Lock type connectors manufactured by AMP.

The pin allocation of the connectors is described in Section "Connectors – Specifications" on page 29.

### *Battery Control Channel Input Connectors*

---

The backplane provides the connectors ST3 and ST4 to allow connecting the battery nodes through a separate control.

By default, these connectors are open since during normal use of the Component Rack, the battery nodes are controlled from a signal box, i.e. these signal channels are connected via the corresponding coupling board.

The two connectors are different to avoid mistakes. They are 10- or 8-pin Mini-Fit type connectors manufactured by Molex.

The pin allocation of the connectors is described in Section "Connectors – Specifications" on page 29.

### *Power Supply Control Connectors*

---

A voltage-controlled power supply unit for simulating the car battery requires signals to set the desired current and voltage values, and to switch on/off the power supply. These signals, along with the actual value signals of the power supply unit, are input to the backplane.

The backplane provides the connector ST5 to allow controlling the power supply unit also externally. This connector is used to connect the power supply control signals with the corresponding front panel connectors (Lemo 19-pin socket) on the front and rear of the ES4500.2 Component Rack.

These connectors are further used to feed the voltages  $\pm U_{\text{Batt}}$  as sense lines to the front panel connectors.

The connector ST5 is a 12-pin Mini-Fit connector manufactured by Molex.

The pin allocation of the connectors is described in Section "Connectors – Specifications" on page 29.

### *Battery Voltage Input*

---

The car battery voltages +UBatt\_A and +UBatt\_B and the battery ground -UBatt are fed to the backplane via three M4 power bolts. The power bolts are labeled ST6(A) and ST6(B).

The connection to the power supply unit is provided by M8 screw connectors that are located on the front and rear of the Component Rack.

### *Controls Connection*

---

The controls of the ES4500.2 Component Rack are LEDs on the front panel. They are used to indicate the supply voltages, battery voltage, and the two alarm conditions "Battery emergency cut-off" and "Fan Alarm". Except for the fan alarm, all signals are provided at the backplane.

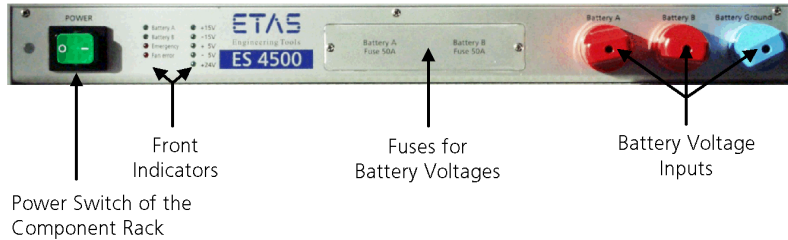
These signals are available at ST7 on the backplane. The signals are fed to the front using ribbon cables.

ST7 is a 14-pin Mini-Fit connector manufactured by Molex.

## 2.2 Controls of the ES4500.2 Component Rack

### 2.2.1 Front Panel Controls

Fig. 2-10 shows the front panel controls of the ES4500.2 Component Rack.



**Fig. 2-10** Front Panel Controls of the ES4500.2 Component Rack

The following controls are located on the front panel from left to right in the top view:

- Power switch  
Switches the internal power supply unit of the Component Rack on/off. When ON, the control lamp will light.
- Front indicators  
LED indicators for supply and battery voltages and for alarm indication.
- Fuses  
50 A car fuses for protecting the power supply unit.
- Battery voltage input  
Battery voltage input to the backplane.
  - Red sockets: +UBatt\_A and +UBatt\_B
  - Blue socket: -UBatt

## LED Indicators

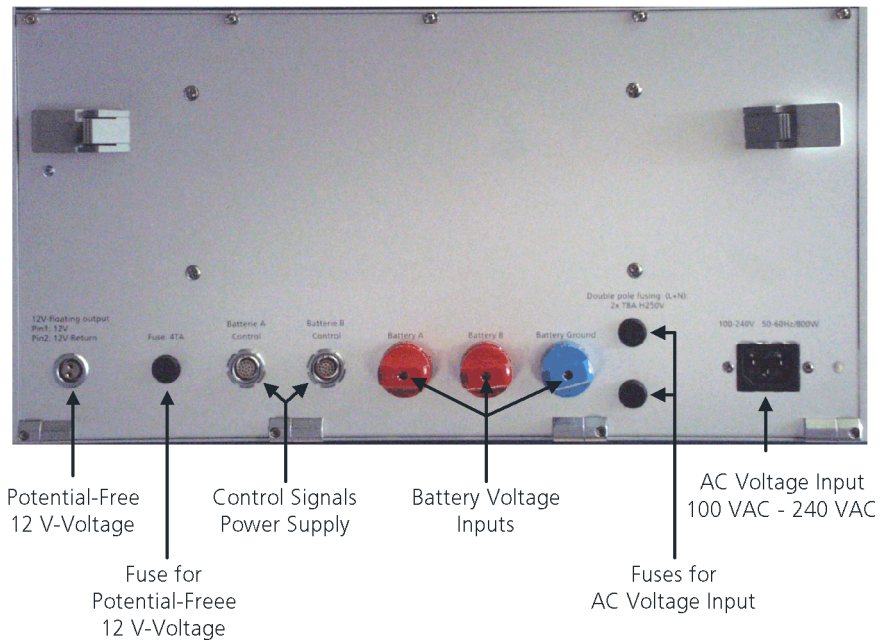
The green LEDs for the supply voltages ( $\pm 5$  V,  $\pm 15$  V, +24 V) light if the voltages are properly applied to the backplane. The battery voltage LEDs light for a battery voltage above approx. 3 V.

The red alarm LEDs light in case of an error condition. The "Emergency" LED is driven from a board (e.g. load module) via signal channel 44. The signal is low-active and indicates if the battery voltage needs to be cut off due to, e.g., an overheat condition in one of the load modules.

The "Fan error" LED lights if at least one fan is defective.

### 2.2.2 Rear Controls

Fig. 2-11 shows the rear panel of the ES4500.2 Component Rack.

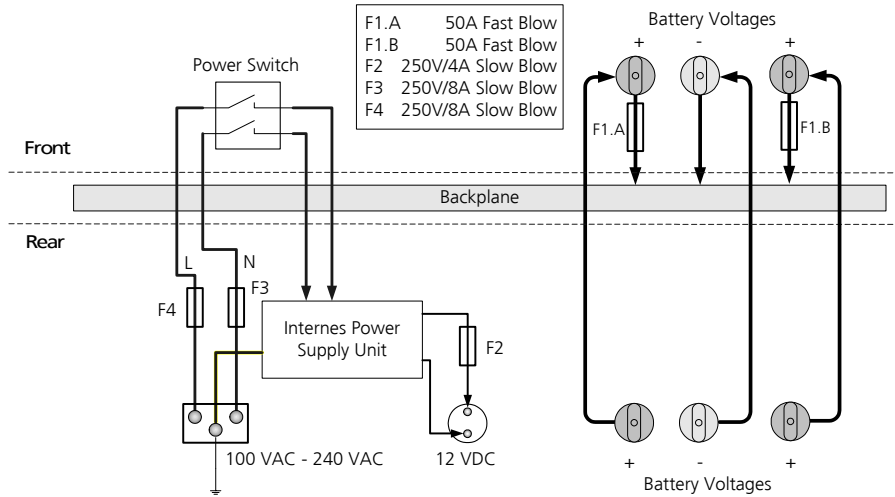


**Fig. 2-11** Controls on the Rear of the ES4500.2 Component Rack

The following controls are located on the rear panel from left to right:

- Potential-free 12 V voltage  
The voltage is supplied by the internal power supply unit of the ES4500.2. The reference potential is independent from the case ground; it is therefore potential-free. This voltage may, e.g., be used to power external ventilation fans in the ES4030 rack system.
- Fuse for the potential-free 12 V voltage  
The 12 V voltage output is protected by a 4 A fuse (slow). **Caution: This output is not intended for customer access!**
- Control signals  
Signal inputs for controlling the power supply unit.
- Battery voltage input  
Battery voltage input to the backplane.
  - Red sockets: +UBatt\_A and +UBatt\_B
  - Blue socket: -UBatt
- Fuses for AC voltage input  
Both the neutral conductor and the phase conductor have its own 8 A fuse (slow).
- AC voltage input  
Supply voltage input to the ES4500.2. The voltage range is 90 VAC to 240 VAC

## 2.2.3 Safety Features in the ES4500.2



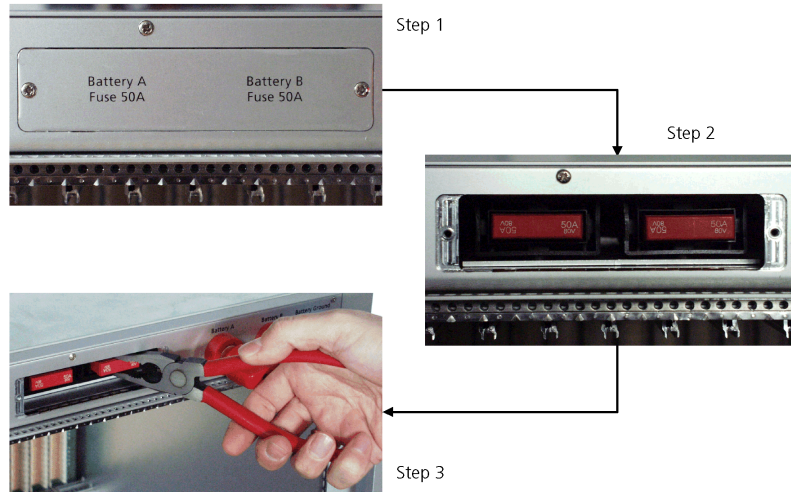
**Fig. 2-12** Safety Circuitry in the ES4500.2 Component Rack

### **Note**

*Be sure to use replacement fuses only of the specified ratings (see Fig. 2-12). The use of other ratings may impair the functionality of the component rack and its slide-in cards and/or damage the unit.*

### Replacing the Battery Voltage Fuses (F1.A and F1.B))

Replace the battery voltage fuses (see Fig. 2-12 on page 22, "Fuse F1.A or F1.B") following the steps shown in Fig. 2-13. The fuse can be replaced easily using flatnose pliers.



**Fig. 2-13** Replacing the Battery Voltage Fuse

### Replacing the Backplane Fuses (F2 -F4)

To replace the fuses F2, F3, and F4 (see Fig. 2-12 on page 22), use an appropriate screwdriver to open the fuse holder. Replace the fuse and screw in the fuse holder until the catch clicks home.

#### **Note**

*Be sure to disconnect the power supply plug before replacing the fuse!*

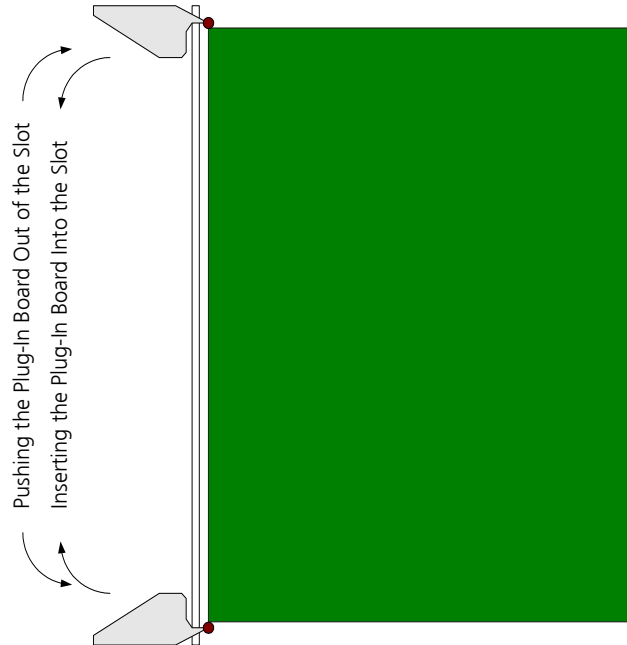
## 2.3

### Mechanical Design of the ES4500.2 – 19" Assembly Rack

As mentioned before in the introduction, the ES4500.2 Component Rack is designed as a 19" assembly rack. This allows installing the Component Rack either stand-alone using the ES4015 housing or as a complete system using the ES4031 rack.

Inserting the plug-in boards into the ES4500.2 Component Rack requires slight force to connect the board with the 540-pin backplane slot connector. Each plug-in board has two handles at the front panel used to push in or pull out the card from the slot.

To insert a plug-in board into an ES4500.2 slot, slightly push it into the slot connector of the backplane. Then push down the two handles simultaneously to fully push the board into the slot (see Fig. 2-14). Finally fix the board with the fastening screws to ensure a reliable connection.

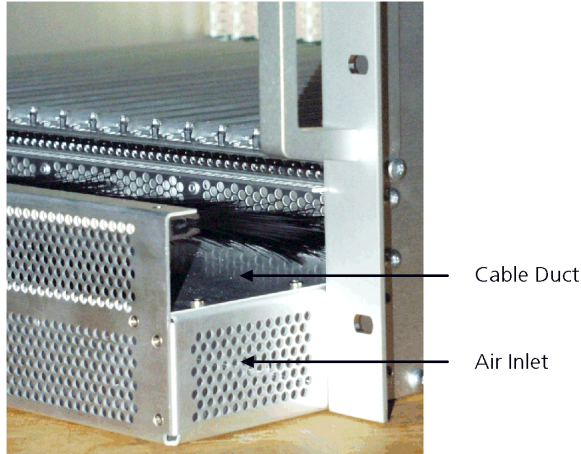


**Fig. 2-14** Operating the Push/Pull Mechanism of an ES4500.2 Board

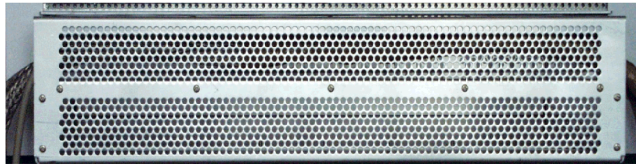
To pull the board out of the slot, push the two handles of the board apart at the same time. Then pull the board out of the backplane slot connector and remove it from the ES4500.2 Component Rack.



The Component Rack has a cable duct to ensure a proper cable arrangement between the boards and the signal box or the breakout box/control unit.



Front Part With Cable in the Cable Duct



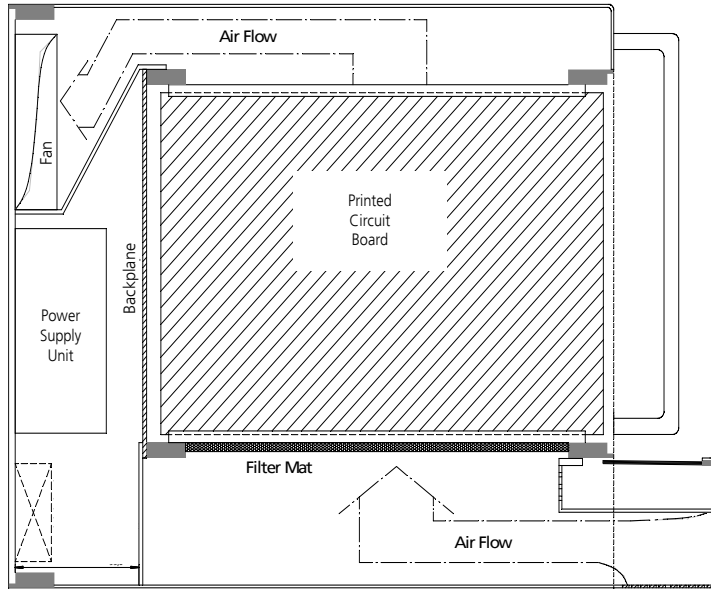
**Fig. 2-15** Cable Duct of the ES4500.2 Component Rack

The cable duct is located above the air inlet. It is covered by a plastic brush, and the cables leave the duct at the sides (see Fig. 2-15).

The ES4500.2 Component Rack has been designed according to EMI principles. As the ES4500.2 Component Rack is usually equipped based on customer specifications, the CE certification (EMI test) is done only when requested by the customer.

## 2.4 Ventilation of the ES4500.2 Component Rack

### *Air Flow Through the ES4500.2*



**Fig. 2-16** Air flow in the ES4500.2 Component Rack

The flow of the cooling air inside the ES4500.2 Component Rack is depicted in Fig. 2-16.

The air current is produced by three controlled DC fans each capable of producing a volume flow of 170 m<sup>3</sup>/h. This allows eliminating heat energy of 1 kW. The fan sensors are located above the backplane.

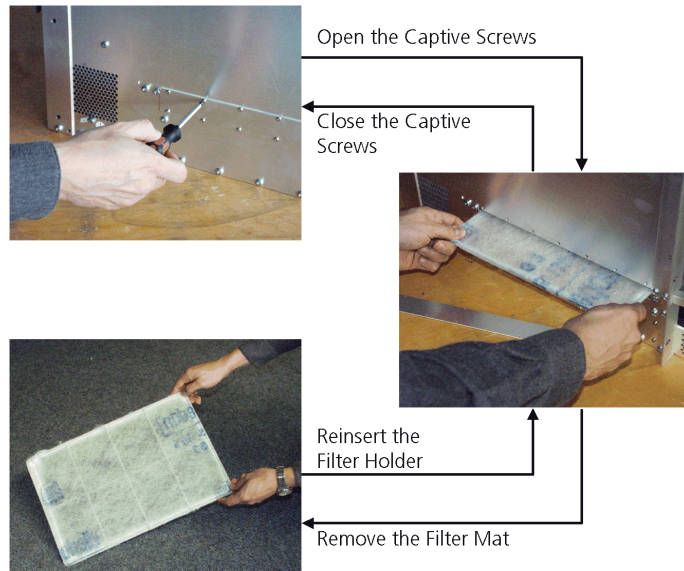
The air flow is conducted by guide plates in the vicinity of the fans through the Component Rack.

The air inlet into the Component Rack is located below the cable duct. The air passes through a filter mat before it reaches the plug-in board area in the Component Rack.

## Removing the Air Filter Mat

After prolonged use in the laboratory, the filter mat of the air filter will have become so contaminated that it loses its ability to clean the air from dust and dirt particles. As a result, dust and dirt particles may enter the interior of the component rack and deposit on the plug-in boards. If this happens, the functionality of the plug-in boards cannot be fully guaranteed.

It is therefore recommended to clean or replace the filter mat periodically. See Fig. 2-17 for details.



**Fig. 2-17** Removing the Filter Mat

To remove the filter mat, open the captive screws of the filter holder. The filter holder can now be pulled out of the ES 4500 Component Rack.

### **Note**

*It may be somewhat difficult to remove the filter due to the EMV springs at the filter holder. You should therefore take sufficient care, avoiding excessive force, to prevent the EMV springs from being distorted.*

After removing the filter holder, take out the mounting grid to remove the mat.

The mat can normally be cleaned using a vacuum cleaner.

After cleaning or replacing the filter mat, reinsert it into the filter holder. Reinsert the filter holder into the component rack.

## 2.5 Internal Power Supply Unit of the ES4500.2 Component Rack

The ES4500.2 Component Rack has its own power supply unit to power the slide-in cards and fans (VEGA 650 W).

The power supply unit features a wide-range input of 100 VAC to 240 VAC. The DC output voltages available are:

- 5 V / 25 A
- 12 V / 12 A
- 24 V / 7 A
- 12 V, 5 V both 6 A
- $\pm 15$  V / 6 A

### **Note**

*The power supply unit is equipped with a power-fail circuit. If one of the outputs is shorted, it is disabled. The output is restored only after a short regenerating phase and resetting the unit.*

### 3 Appendix

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#### 3.1 Connectors – Specifications

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##### 3.1.1 Slot Connectors

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The slot connectors at the backplane are MILIPAC-1 series connectors manufactured by FCI. These connectors have 5 pin rows with pin numbers between 30 and 240.

The specified current load per pin is 1 A.

The insulation voltage of the connection is 1 kV.

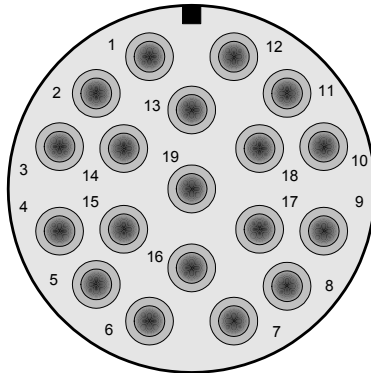
The pin resistance is 20 mΩ.

##### 3.1.2 Connectors "Battery A Control" and "Battery B Control"

---

The sockets for the control signals of the battery simulation are 19-pin ECG.2B.319.CLL type connectors manufactured by Lemo.

The pin allocation of the sockets is as follows:



**Fig. 3-1** Sockets "Battery A Control" and "Battery B Control"

Pin	Signal	Pin	Signal
1	$U_{\text{target}}$	11	n.c.
2	$\text{GND}(U_{\text{target}})$	12	n.c.
3	$I_{\text{target}}$	13	n.c.
4	$\text{GND}(I_{\text{target}})$	14	n.c.
5	$U_{\text{actual}}$	15	n.c.

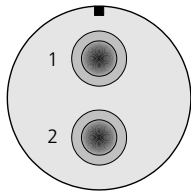
Pin	Signal	Pin	Signal
6	GND( $U_{\text{actual}}$ )	16	n.c.
7	$I_{\text{actual}}$	17	Sense( $U_{\text{Batt+}}$ )
8	GND( $I_{\text{actual}}$ )	18	Sense( $U_{\text{Batt-}}$ )
9	Remote ON/OFF	19	GND(Shield)
10	GND (Remote)		

A cable for controlling a power supply unit is included in the accessories.

### 3.1.3 "12 V Floating Output" Connector

The socket for the 12 V voltage is a 2-pin EGG.2B.302.CLL type connector manufactured by Lemo.

The pin allocation of the socket is as follows:



**Fig. 3-2** "12 V Floating Output" Socket

Pin	Signal	Pin	Signal
1	12 V (fused)	2	GND

## 3.2 General Specifications of the ES4500.2

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### 3.2.1 Ventilation Fan

---

#### **Controlled Fan (Papst 4312)**

Supply voltage	12 VDC
Power consumption	5.5 W
Performance	170 m <sup>3</sup> /h

**Tab. 3-1** Specifications of the Ventilation Fans

### 3.2.2 Power Supply Unit

---

#### **Switchable power supply unit Lambda OMEGA MML600 with internal ventilation**

Supply voltage	100 VAC to 240 VAC
Max. current	10 A
AC frequency range	50 Hz to 60 Hz
Power consumption	600 W
Fuse	12 A

**Tab. 3-2** Specifications of the Power Supply Unit

### 3.3 Backplane Specification

The backplane is designed to withstand voltages up to 300 V.

The specifications of the individual signal channels can be found in the following table.

#### 3.3.1 Board Power Supply Channels

Channel	Back-plane Connector Pin PTS-P	Max. Current Slot [A]	Max. Current BP [A]	Designation
1	1a	10	40	Board power supply GND
	1b			
	1c			
	1d			
	1e			
	2a			
	2b			
	2c			
	2d			
	2e			
2	3a	5	20	Board power supply +5 V
	3b			
	3c			
	3d			
	3e			
3	4a	5	10	Board power supply +24 V
	4b			
	4c			
	4d			

**Tab. 3-3** Board Power Supply



Channel	Back-plane Connector Pin PTS-P	Max. Current Slot [A]	Max. Current BP [A]	Designation
	4e			
4	5a	2	4	Board power supply +15 V
	5b			
5	5c	2	4	Board power supply -15 V
	5d			
6	5e	1	1.5	Board power supply reserved
7	6a	2	4	Board power supply -5 V
	6b			
8	6c	1	1.5	Board power supply reserved
9	6d	1	1.5	Board power supply reserved
10	6e	1	1.5	Board power supply reserved

**Tab. 3-3** Board Power Supply (cont.)

### 3.3.2 Control (General) Channels

Channel	Back-plane Connector Pin	Max. Current Slot [A]	Max. Current Back-plane [A]	Designation
11	7a	0.5	0.5	Slot coding Bit4 (MSB)
12	7b	0.5	0.5	Slot coding Bit3
13	7c	0.5	0.5	Slot coding Bit2
14	7d	0.5	0.5	Slot coding Bit1
15	7e	0.5	0.5	Slot coding Bit0 (LSB)
16	8a	0.5	0.5	Load box coding Bit2 (MSB)
17	8b	0.5	0.5	Load box coding Bit1
18	8c	0.5	0.5	Load box coding Bit0 (LSB)
19	8d	0.5	0.5	Reset
20	8e	0.5	0.5	RS485 - A (TxD)
21	9a	0.5	0.5	RS485 - B (TxD)
22	9b	0.5	0.5	RS485 - A (RxD)
23	9c	0.5	0.5	RS485 - B (RxD)
24	9d	0.5	0.5	CAN-H
25	9e	0.5	0.5	CAN-L
26	10a	0.5	0.5	CAN-Shield
27	10b	0.5	0.5	Daisy-chain IN
28	10c	0.5	0.5	Daisy-chain OUT
29	10d	0.5	0.5	System emergency cut-off
30	10e	0.5	0.5	RS232 (TxD)
31	11a	0.5	0.5	RS232 (RxD)
32	11b	0.5	0.5	Wiring-harness coding 0

**Tab. 3-4** Control (general)

Channel	Back-plane Connector Pin	Max. Current Slot [A]	Max. Current Back-plane [A]	Designation
33	11c	0.5	0.5	Wiring-harness coding 1
34	11d	0.5	0.5	Reserved
35	11e	0.5	0.5	Reserved

**Tab. 3-4** Control (general) (cont.)

### 3.3.3 Battery Control Channels

Channel	Back-plane Connector Pin	Max. Current Slot [A]	Max. Current Back-plane [A]	Designation
36	12a	0.5	0.5	Reserved
37	12b	0.5	0.5	Main relay control
38	12c	0.5	0.5	Battery node 0
39	12d	0.5	0.5	Battery node 1
40	12e	0.5	0.5	Battery node 2
41	13a	0.5	0.5	Battery node 3
42	13b	0.5	0.5	Battery node 4
43	13c	0.5	0.5	Battery node 5
44	13d	0.5	0.5	Battery emergency cut-off

**Tab. 3-5** Battery Control

### 3.3.4 Power Supply Control Channels

Channel	Back-plane connector pin	Max. Current Slot [A]	Max. Current Back-plane [A]	Designation
45	13e	0.5	0.5	Power supply ON/OFF Battery A
46	14a	0.5	0.5	Monitor power supply current Battery A
47	14b	0.5	0.5	Monitor power supply voltage Battery A
48	14c	0.5	0.5	Prog. voltage (current) Battery A
49	14d	0.5	0.5	Prog. voltage (voltage) Battery A
50	14e	0.5	0.5	GND power supply control Battery A
51	15a	1	1.5	Signal box GND
	15b	1	1.5	
	15c	1	1.5	
	15d	1	1.5	
	15e	1	1.5	
52	16a	0.5	0.5	Power supply ON/OFF Battery B
53	16b	0.5	0.5	Monitor power supply current Battery B
54	16c	0.5	0.5	Monitor power supply voltage Battery B
55	16d	0.5	0.5	Prog. voltage (current) Battery B
56	16e	0.5	0.5	Prog. voltage (voltage) Battery B
57	17a	0.5	0.5	GND power supply control Battery B

**Tab. 3-6** Power Supply Control

### 3.3.5 Measuring Channel Channels

---

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. current backplane [A]	Designation
58	17b	1	1.5	Reserved
59	17c	1	1.5	Reserved
60	17d	1	1.5	Reserved
61	17e	1	1.5	Reserved
62	18a	1	1.5	Reserved
63	18b	1	1.5	Reserved
64	18c	1	1.5	Reserved
65	18d	1	1.5	Reserved
66	18e	1	1.5	Reserved

**Tab. 3-7** Measuring Channels

### 3.3.6 Shielded Signal Channels

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
67	19a	1	1.5
68	19b	1	1.5
69	19c	1	1.5
70	19d	1	1.5
71	19e	1	1.5
72	20a	1	1.5
73	20b	1	1.5
74	20c	1	1.5
75	20d	1	1.5
76	20e	1	1.5
77	21a	1	1.5
78	21b	1	1.5
79	21c	1	1.5
80	21d	1	1.5
81	21e	1	1.5
82	22a	1	1.5
83	22b	1	1.5
84	22c	1	1.5
85	22d	1	1.5
86	22e	1	1.5
87	23a	1	1.5
88	23b	1	1.5
89	23c	1	1.5
90	23d	1	1.5
91	23e	1	1.5
92	24a	1	1.5
93	24b	1	1.5

**Tab. 3-8** Shielded Signals

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
94	24c	1	1.5
95	24d	1	1.5
96	24e	1	1.5
97	25a	1	1.5
98	25b	1	1.5
99	25c	1	1.5
100	25d	1	1.5
101	25e	1	1.5
102	26a	1	1.5
103	26b	1	1.5
104	26c	1	1.5
105	26d	1	1.5
106	26e	1	1.5

**Tab. 3-8** Shielded Signals (cont.)

**Note**

*Please note that the signals on the backplane are **not** shielded! This channel range is used entirely as a project engineering aid to ensure that shielded signals are routed separately from unshielded and high-current signals. There is, however, no electrical difference between these channels and other channels for ECU signals.*

### 3.3.7 Controller Signal (Low Current) Channels

#### **Note**

The reserved channels are measure signal channels of the ES45XX boards. They must **not** be assigned ECU signals. The ECUrefx channels are channels reserved for ECU reference voltages (for more details please refer to the "ES4520.1 Signalbox Interface Board User's Guide").

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
107	27 a	1 (reserved)	1.5
108	27 b	1 (reserved)	1.5
109	27 c	1 (reserved)	1.5
110	27 d	1 (reserved)	1.5
111	27 e	1 (reserved)	1.5
112	28 a	1 (reserved)	1.5
113	28 b	1 (reserved)	1.5
114	28 c	1 (reserved)	1.5
115	28 d	1 (reserved)	1.5
116	28 e	1 (reserved)	1.5
117	29 a	1 (reserved)	1.5
118	29 b	1 (reserved)	1.5
119	29 c	1 (reserved)	1.5
120	29 d	1 (reserved)	1.5
121	29 e	1 (reserved)	1.5
122	30 a	1 (reserved)	1.5
123	30 b	1 (reserved)	1.5
124	30 c	1 (reserved)	1.5
125	30 d	1 (reserved)	1.5
126	30 e	1 (reserved)	1.5
127	31 a	1 (reserved)	1.5
128	31 b	1 (reserved)	1.5

**Tab. 3-9** Controller Signals (Low Current)



Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
129	31 c	1 (reserved)	1.5
130	31 d	1 (reserved)	1.5
131	31 e	1 (reserved)	1.5
132	32 a	1 (reserved)	1.5
133	32 b	1 (reserved)	1.5
134	32 c	1 (reserved)	1.5
135	32 d	1 (+ECUref0)	1.5
136	32 e	1 (-ECUref0)	1.5
137	33 a	1 (+ECUref1)	1.5
138	33 b	1 (-ECUref1)	1.5
139	33 c	1 (+ECUref2)	1.5
140	33 d	1 (-ECUref2)	1.5
141	33 e	1 (+ECUref3)	1.5
142	34 a	1 (-ECUref3)	1.5
143	34 b	1 (+ECUref4)	1.5
144	34 c	1 (-ECUref4)	1.5
145	34 d	1 (+ECUref5)	1.5
146	34 e	1 (-ECUref5)	1.5
147	35 a	1 (+ECUref6)	1.5
148	35 b	1 (-ECUref6)	1.5
149	35 c	1	1.5
150	35 d	1	1.5
151	35 e	1	1.5
152	36 a	1	1.5
153	36 b	1	1.5
154	36 c	1	1.5
155	36 d	1	1.5
156	36 e	1	1.5
157	37 a	1	1.5

**Tab. 3-9** Controller Signals (Low Current) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
158	37 b	1	1.5
159	37 c	1	1.5
160	37 d	1	1.5
161	37 e	1	1.5
162	38 a	1	1.5
163	38 b	1	1.5
164	38 c	1	1.5
165	38 d	1	1.5
166	38 e	1	1.5
167	39 a	1	1.5
168	39 b	1	1.5
169	39 c	1	1.5
170	39 d	1	1.5
171	39 e	1	1.5
172	40 a	1	1.5
173	40 b	1	1.5
174	40 c	1	1.5
175	40 d	1	1.5
176	40 e	1	1.5
177	41 a	1	1.5
178	41 b	1	1.5
179	41 c	1	1.5
180	41 d	1	1.5
181	41 e	1	1.5
182	42 a	1	1.5
183	42 b	1	1.5
184	42 c	1	1.5
185	42 d	1	1.5
186	42 e	1	1.5

**Tab. 3-9** Controller Signals (Low Current) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
187	43 a	1	1.5
188	43 b	1	1.5
189	43 c	1	1.5
190	43 d	1	1.5
191	43 e	1	1.5
192	44 a	1	1.5
193	44 b	1	1.5
194	44 c	1	1.5
195	44 d	1	1.5
196	44 e	1	1.5
197	45 a	1	1.5
198	45 b	1	1.5
199	45 c	1	1.5
200	45 d	1	1.5
201	45 e	1	1.5
202	46 a	1	1.5
203	46 b	1	1.5
204	46 c	1	1.5
205	46 d	1	1.5
206	46 e	1	1.5
207	47 a	1	1.5
208	47 b	1	1.5
209	47 c	1	1.5
210	47 d	1	1.5
211	47 e	1	1.5
212	48 a	1	1.5
213	48 b	1	1.5
214	48 c	1	1.5
215	48 d	1	1.5

**Tab. 3-9** Controller Signals (Low Current) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
216	48 e	1	1.5
217	49 a	1	1.5
218	49 b	1	1.5
219	49 c	1	1.5
220	49 d	1	1.5
221	49 e	1	1.5
222	50 a	1	1.5
223	50 b	1	1.5
224	50 c	1	1.5
225	50 d	1	1.5
226	50 e	1	1.5
227	51 a	1	1.5
228	51 b	1	1.5
229	51 c	1	1.5
230	51 d	1	1.5
231	51 e	1	1.5
232	52 a	1	1.5
233	52 b	1	1.5
234	52 c	1	1.5
235	52 d	1	1.5
236	52 e	1	1.5
237	53 a	1	1.5
238	53 b	1	1.5
239	53 c	1	1.5
240	53 d	1	1.5
241	53 e	1	1.5
242	54 a	1	1.5
243	54 b	1	1.5
244	54 c	1	1.5

**Tab. 3-9** Controller Signals (Low Current) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
245	54 d	1	1.5
246	54 e	1	1.5
247	55 a	1	1.5
248	55 b	1	1.5
249	55 c	1	1.5
250	55 d	1	1.5
251	55 e	1	1.5
252	56 a	1	1.5
253	56 b	1	1.5
254	56 c	1 (reserved)	1.5
255	56 d	1 (reserved)	1.5
256	56 e	1 (reserved)	1.5
257	57 a	1 (reserved)	1.5
258	57 b	1 (reserved)	1.5
259	57 c	1 (reserved)	1.5
260	57 d	1 (reserved)	1.5
261	57 e	1 (reserved)	1.5
262	58 a	1 (reserved)	1.5
263	58 b	1 (reserved)	1.5
264	58 c	1 (reserved)	1.5
265	58 d	1 (reserved)	1.5
266	58 e	1 (reserved)	1.5
267	59 a	1 (reserved)	1.5
268	59 b	1 (reserved)	1.5
269	59 c	1 (reserved)	1.5
270	59 d	1 (reserved)	1.5
271	59 e	1 (reserved)	1.5
272	60 a	1 (reserved)	1.5
273	60 b	1 (reserved)	1.5

**Tab. 3-9** Controller Signals (Low Current) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
274	60 c	1 (reserved)	1.5
275	60 d	1 (reserved)	1.5
276	60 e	1 (reserved)	1.5
277	61 a	1 (reserved)	1.5
278	61 b	1 (reserved)	1.5
279	61 c	1 (reserved)	1.5
280	61 d	1 (reserved)	1.5
281	61 e	1 (reserved)	1.5

**Tab. 3-9** Controller Signals (Low Current) (cont.)

### 3.3.8 Controller Signals (High Current) Channels

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
282	62 a	3	6
	63 a	3	6
	64 a	3	6
283	62 b	3	6
	63 b	3	6
	64 b	3	6
284	62 c	3	6
	63 c	3	6
	64 c	3	6
285	62 d	3	6
	63 d	3	6
	64 d	3	6
286	62 e	3	6
	63 e	3	6
	64 e	3	6
287	65 a	3	6
	66 a	3	6
	67 a	3	6
288	65 b	3	6
	66 b	3	6
	67 b	3	6
289	65 c	3	6
	66 c	3	6
	67 c	3	6
290	65 d	3	6
	66 d	3	6
	67 d	3	6

**Tab. 3-10** Controller Signals (High Current)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
291	65 e	3	6
	66 e	3	6
	67 e	3	6
292	68 a	3	6
	69 a	3	6
	70 a	3	6
293	68 b	3	6
	69 b	3	6
	70 b	3	6
294	68 c	3	6
	69 c	3	6
	70 c	3	6
295	68 d	3	6
	69 d	3	6
	70 d	3	6
296	68 e	3	6
	69 e	3	6
	70 e	3	6
297	71 a	3	6
	72 a	3	6
	73 a	3	6
298	71 b	3	6
	72 b	3	6
	73 b	3	6
299	71 c	3	6
	72 c	3	6
	73 c	3	6
300	71 d	3	6
	72 d	3	6

**Tab. 3-10** Controller Signals (High Current) (cont.)



Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
301	73 d	3	6
	71 e	3	6
	72 e	3	6
302	73 e	3	6
	74 a	3	6
	75 a	3	6
303	76 a	3	6
	74 b	3	6
	75 b	3	6
304	76 b	3	6
	74 c	3	6
	75 c	3	6
305	76 c	3	6
	74 d	3	6
	75 d	3	6
306	76 d	3	6
	74 e	3	6
	75 e	3	6
307	76 e	3	6
	77 a	3	6
	78 a	3	6
308	79 a	3	6
	77 b	3	6
	78 b	3	6
309	79 b	3	6
	77 c	3	6
	78 c	3	6
310	79 c	3	6
	77 d	3	6

**Tab. 3-10** Controller Signals (High Current) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
	78 d	3	6
	79 d	3	6
311	77 e	3	6
	78 e	3	6
	79 e	3	6
312	80 a	3	6
	81 a	3	6
	82 a	3	6
320	83 d	3	6
	84 d	3	6
	85 d	3	6
321	83 e	3	6
	84 e	3	6
	85 e	3	6

**Tab. 3-10** Controller Signals (High Current) (cont.)

### 3.3.9 Controller Signal (Power) Channels

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
322	86 a	5	10
	86 b		
	86 c		
	86 d		
	86 e		
323	87 a	5	10
	87 b		
	87 c		
	87 d		
	87 e		
324	88 a	5	10
	88 b		
	88 c		
	88 d		
	88 e		
325	89 a	5	10
	89 b		
	89 c		
	89 d		
	89 e		
326	90 a	5	10
	90 b		
	90 c		
	90 d		
	90 e		
327	91 a	5	10
	91 b		

**Tab. 3-11** Controller Signals (Power)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
	91 c		
	91 d		
	91 e		
328	92 a	5	10
	92 b		
	92 c		
	92 d		
	92 e		
329	93 a	5	10
	93 b		
	93 c		
	93 d		
	93 e		
330	94 a	5	25
	94 b		
	94 c		
	94 d		
	94 e		
331	95 a	5	25
	95 b		
	95 c		
	95 d		
	95 e		
332	96 a	5	25
	96 b		
	96 c		
	96 d		
	96 e		
333	97 a	5	25

**Tab. 3-11** Controller Signals (Power) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
	97 b		
	97 c		
	97 d		
	97 e		
334	98 a	5	10
	98 b		
	98 c		
	98 d		
	98 e		
335	99 a	5	10
	99 b		
	99 c		
	99 d		
	99 e		
336	100 a	5	10
	100 b		
	100 c		
	100 d		
	100 e		
337	101 a	5	10
	101 b		
	101 c		
	101 d		
	101 e		
338	102 a	5	25
	102 b		
	102 c		
	102 d		
	102 e		

**Tab. 3-11** Controller Signals (Power) (cont.)

### 3.3.10 Battery Voltages Channels (+U\_Batt\_A and Ground)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
339	103 a	20	40
	103 b		
	103 c		
	103 d		
	103 e		
	104 a		
	104 b		
	104 c		
	104 d		
	104 e		
	105 a		
	105 b		
	105 c		
	105 d		
	105 e		
	106 a		
	106 b		
	106 c		
	106 d		
	106 e		
	107 a		
	107 b		
	107 c		
	107 d		
	107 e		
	108 a		
	108 b		

**Tab. 3-12** Battery Voltages (+U\_Batt\_A and Ground)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
	108 c		
	108 d		
	108 e		
340	109 a	20	40
	109 b		
	109 c		
	109 d		
	109 e		
	110 a		
	110 b		
	110 c		
	110 d		
	110 e		
	111 a		
	111 b		
	111 c		
	111 d		
	111 e		
	112 a		
	112 b		
	112 c		
	112 d		
	112 e		
	113 a		
	113 b		
	113 c		
	113 d		
	113 e		
	114 a		

**Tab. 3-12** Battery Voltages (+U\_Batt\_A and Ground) (cont.)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
	114 b		
	114 c		
	114 d		
	114 e		

**Tab. 3-12** Battery Voltages (+U\_Batt\_A and Ground) (cont.)



### 3.3.11 Battery Voltages Channels (+U\_Batt\_B)

Channel	Backplane Connector Pin	Max. Current Slot [A]	Max. Current Backplane [A]
313	80 b	3	6
	81 b	3	6
	82 b	3	6
314	80 c	3	6
	81 c	3	6
	82 c	3	6
315	80 d	3	6
	81 d	3	6
	82 d	3	6
316	80 e	3	6
	81 e	3	6
	82 e	3	6
317	83 a	3	6
	84 a	3	6
	85 a	3	6
318	83 b	3	6
	84 b	3	6
	85 b	3	6
319	83 c	3	6
	84 c	3	6
	85 c	3	6

**Tab. 3-13** Battery Voltages (+U\_Batt\_B)



## 4 **ETAS Contact Addresses**

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### *ETAS Subsidiaries and Technical Support*

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For details of your local sales office as well as your local technical support team and product hotlines, take a look at the ETAS website:

ETAS subsidiaries

WWW: [www.etas.com/en/contact.php](http://www.etas.com/en/contact.php)

ETAS technical support

WWW: [www.etas.com/en/hotlines.php](http://www.etas.com/en/hotlines.php)



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