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# ES1390.1
# High Current Relay Board
User's Guide

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Document QH139001 R1.0.1 EN TTN F 00K 700 277



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# 1 Introduction

The ES1390.1 plug-in board is used to simulate switchable battery nodes in the LabCar. An external power supply unit simulates the vehicle battery. The ES1390.1 plug-in board distributes the voltage of the power supply unit to five separately switchable nodes. The nodes simulate a part of the board voltages network of the vehicle. The plug-in board provides the following features:

- five separately switchable battery nodes
- current measurement for all five battery nodes
- setting the nominal voltage for an external power supply unit
- measuring the total current and output voltage of the external power supply unit
- separate current limiting for all five battery nodes by electronic cut-out circuits
- monitoring and limiting of both the individual currents and the total current of the battery nodes by control software
- front panel ports for the battery nodes and for power supply of external units
- VMEbus interface for control and data acquisition

The ES1390.1 plug-in board can be used in VMEbus systems where permanent currents up to 4.7 A at voltages up to 36 V need to be switched and monitored.

The ES1390.1 plug-in board can be combined with the following card cages within the ETAS product line:

- ES4100 Chassis (19“, 4 U, 21 Slot, VME64x)
- ES4101 Chassis (19“, 4 U, 15 VMEbus-, 6 Transputer Slot)
- ES4102 Chassis (ES4101 preconfigured for case mounting)
- ES4103 Chassis (ES4101 preconfigured for rack mounting)



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The following figure shows the front panel and the position of the connectors.

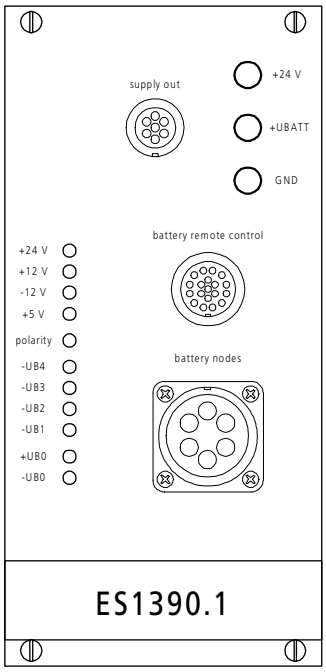



**Fig. 1-1** Front panel

The block diagram below illustrates the working principle of the battery node simulation.



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In the center, you can see the five switches of the battery nodes. On the left is the connection of the external power supply unit, on the right the outputs to the control unit.

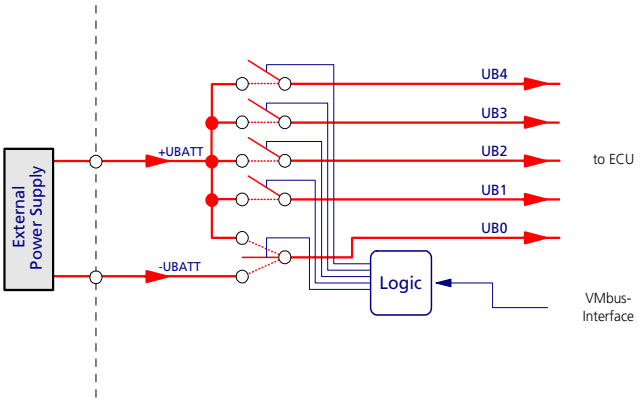



**Fig. 1-2** Block diagram

The central logic of the plug-in board controls the switching functions of the plug-in board. The logic receives its control information from the VMEbus.



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# 2 Hardware

This chapter describes the hardware of the plug-in board. It includes the chapters "Functional Description", "Hardware Configuration", and "Technical Data".

## 2.1 Functional Description

This section provides a detailed overview of the features of the ES1390.1 plug-in board.

### 2.1.1 Battery Node UB0

The battery node UB0 can be connected to the vehicle ground (-UBATT), to the battery voltage (+UBATT), and to high impedance.

### 2.1.2 Battery Nodes UB1 to UB4

The four battery nodes UB1 to UB4 can be switched to the battery voltage (+UBATT) or to high impedance independently from each other.

### 2.1.3 Current Measurement

The plug-in board allows measuring the individual current of each of the five battery nodes.

### 2.1.4 Current Limiting

The current through each battery node is limited by Polyswitch cut-out circuits. These cutout circuits enter a high-impedance state when exceeding their current-time curve.

After several seconds without external voltage, the cutout circuits return to their low-impedance state.

### 2.1.5 Analog Output

For programming an external power supply unit, an analog output with 0 V to 10 V output voltage is available. This output can be used to determine the nominal output voltage of the external power supply unit simulating the board battery.

### 2.1.6 Power Supply for External Units

For the power supply of external units, the front panel of the plug-in board provides the supply voltages +5 V, -12 V, and +12 V of the chassis.



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The +24 V supply voltage can be supplied externally and is also available also for supplying external units then.

## 2.2 Connectors and Displays

The following tables provide an overview of the connectors and LED displays.

| Connector | Function |
|---|---|
| Battery remote control | Programming interface for external power supply unit |
| Supply out | Power supply for external units |
| Battery nodes | Battery node connectors |
| +24 V | Input of external 24 V supply |
| +UBATT | Input of battery voltage from external power supply unit |
| GND | Vehicle ground, external power supply ground, VMEbus ground |

**Tab. 2-1** Front connectors

| LED display | Function |
|---|---|
| +24 V | Green: external +24 V supply active<br>Red: Fuse of external +24 V supply defective |
| +12 V | Green: Internal +12 V supply active<br>Red: Fuse of external +12 V supply defective |
| -12 V | Green: Internal -12 V supply active<br>Red: Fuse of external -12 V supply defective |
| +5 V | Green: Internal +5 V supply active<br>Red: Fuse of external +5 V supply defective |

**Tab. 2-2** Displays



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| LED display | Function |
|---|---|
| Polarity | Green: polarity of external +24 V supply correct<br>Red: polarity of external +24 V supply incorrect; output disabled |
| UB4 | Green: battery node 4 enabled<br>Red: battery node 4 disabled due to overcurrent |
| UB3 | Green: battery node 3 enabled<br>Red: battery node 3 disabled due to overcurrent |
| UB2 | Green: battery node 2 enabled<br>Red: battery node 2 disabled due to overcurrent |
| UB1 | Green: battery node 1 enabled<br>Red: battery node 1 disabled due to overcurrent |
| +UB0 | Green: battery node 0 connected against +UBATT<br>Red: battery node 0 disabled due to overcurrent |
| -UB0 | Green: battery node 0 connected against vehicle ground<br>Red: battery node 0 disabled due to overcurrent |

**Tab. 2-2** Displays (cont.)

## 2.3 Hardware Configuration

This section contains the information required for configuring the jumpers of the ES1390.1 plug-in board. The VMEbus base address can be modified by jumpers.

**Note**

*The ES1390.1 plug-in board includes additional jumpers in addition to the jumpers for address configuration. These jumpers **must** remain in the positions specified in the table.*



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The ES1390.1 plug-in board consists of four printed circuit boards: a carrier board for piggyback modules, two piggyback modules and one circuit board for the high-current signals. The carrier board and the circuit board for the high-current signals are bolted to each other by stud bolts.

The figure shows the position of the jumpers and post plugs for the piggyback modules on the carrier board.

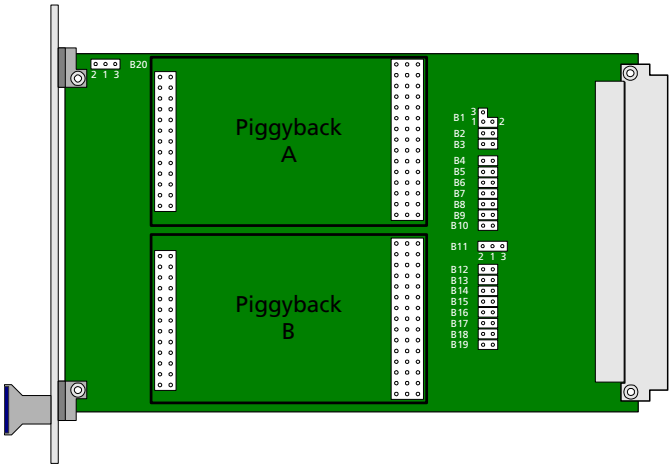



**Fig. 2-1** Jumpers on the carrier board (component side)

### 2.3.1 VMEbus Base Address

The base address of the ES1390.1 plug-in board is selected by the five jumpers B2, B12, B13, B14, and B15.

**Note**

*Make sure that the address range of the ES1390.1 plug-in board does **not** overlap the address ranges of other boards in your system.*

**Note**

*A closed jumper indicates logical "0", an open jumper logical "1".*



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The default base address of the plug-in board is $FE0400.

| Jumper | Address | Default setting |
|---|---|---|
| B2 | A15 | closed |
| B12 | A14 | closed |
| B13 | A13 | closed |
| B14 | A12 | closed |
| B15 | A11 | closed |

**Tab. 2-3** Setting the base address

### 2.3.2 Additional Jumpers

All jumpers listed in the following table *must* remain in the specified positions.

| Jumper | Position |
|---|---|
| B1 | open |
| B3 | open |
| B4 | open |
| B5 | open |
| B6 | open |
| B7 | open |
| B8 | open |
| B9 | open |
| B10 | open |
| B11 | open |
| B16 | open |
| B17 | closed |
| B18 | closed |
| B19 | open |
| B20 | Pin 1-2 closed |

**Tab. 2-4** Jumpers



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## 2.4 Pin Allocation

This section describes the pin allocations of the ES1390.1 plug-in board.

### 2.4.1 Supply Out

This front panel connector provides the supply voltages +5 V, +12 V, -12 V, and +24 V for the power supply of external units.

The voltages +5 V, +12 V, and -12 V are provided by the power supply unit of the chassis. The +24 V supply voltage requires an external input from the front panel.

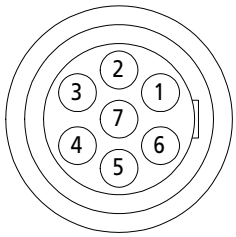



**Fig. 2-2** "Supply Out" connector

| Pin | Function |
|---|---|
| 1 | -12 V |
| 2 | AGND |
| 3 | +24 V |
| 4 | +5 V |
| 5 | AGND |
| 6 | +12 V |
| 7 | n. c. |

**Tab. 2-5** "Supply Out" pin allocation



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### 2.4.2 Battery Remote Control

This connector contains the ports for programming the external power supply unit.

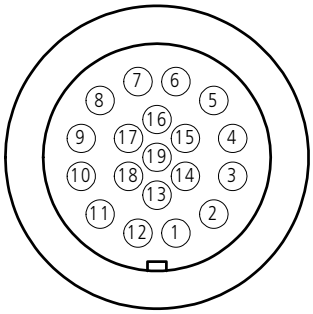



**Fig. 2-3** "Battery Remote Control" connector

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | Analog Output (desired value) | 2 | AGND |
| 3 | n. c. | 4 | n. c. |
| 5 | UBATT (true value) | 6 | AGND |
| 7 | IBATT (true value) | 8 | AGND |
| 9 | n. c. | 10 | n. c. |
| 11 | n. c. | 12 | n. c. |
| 13 | n. c. | 14 | n. c. |
| 15 | AGND | 16 | AGND |
| 17 | n. c. | 18 | n. c. |
| 19 | n. c. | | |

**Tab. 2-6** "Battery Remote Control" pin allocation



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### 2.4.3 Battery Nodes

This connector contains the ports of the battery nodes.

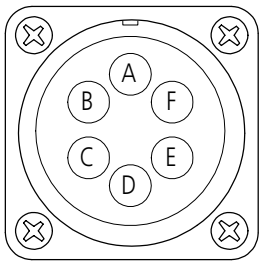



**Fig. 2-4** "Battery Nodes" connector

| Pin | Function |
|---|---|
| A | UB0 |
| B | UB1 |
| C | UB2 |
| D | UB3 |
| E | UB4 |
| F | AGND |

**Tab. 2-7** "Battery Nodes" pin allocation

## 2.5 Technical Data

This section contains the technical data of the ES1390.1 plug-in board in tabular form.



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*Battery Node*

| | |
|---|---|
| Battery voltage: | 3 V to 36 V |
| Number of nodes: | 4, switchable to battery voltage,<br>1, switchable to battery voltage **or** battery ground |
| Switches: | Relays |
| Integrated error detection | Overcurrent |
| Max. current per node: | 4,7 A permanent<br>8 A max. 20 sec<br>40 A max . 1 sec |
| Total max. current: | 16 A permanent<br>20 A max. 20 sec<br>40 A max . 1 sec |

*Analog Interface to Power Supply Unit (D/A Converter)*

| | |
|---|---|
| Number of D/A converters: | 1 |
| Output voltage: | 0 V to 10 V |
| Resolution: | 12 bits |
| Ground reference: | electrical isolation of each channel |
| Calibration: | fully automatic |

*Analog Interface from Power Supply Unit (A/D Converter)*

| | |
|---|---|
| Number of A/D converters: | 2 |
| Input voltage: | 0 V to 10 V |
| Resolution: | 12 bits |
| Ground reference: | electrical isolation of each channel |
| Calibration: | fully automatic |



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| | |
|---|---|
| Output voltages from VMEbus system: | +5 V, +12 V, -12 V |
| Output voltage via front panel supply: | +24 V |
| Output current: | max. 2 A |
| Current limiting: | Fuses |



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