ES4455.1 Load Board

User's Guide

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1 Introduction

This User's Guide describes the ES4455.1 Load Board. It consists of the following chapters:

- "Introduction" on page 5

  This chapter – here you will find general information on the ES4455.1 Load Board.

- "Hardware" on page 11

  This chapter describes the individual function units of the ES4455.1 Load Board in more detail.

- Pin Assignment and Display Elements

  This chapter contains a description of the pins and LEDs on the front panel of the ES4455.1 Load Board.

- "Accessories" on page 21

  This chapter describes the dummy loads available to date which are assembled as piggybacks on the board of the ES4455.1 Load Board.

- "Technical Data" on page 23

  This chapter contains the technical data of the ES4455.1 Load Board.

CAUTION!

Some components of the ES4455.1 Load Board may be damaged or even destroyed by static discharge. Leave the board in its transport package until you want to install it.
The ES4455.1 Load Board should only be taken from its package, configured and installed at a working place that is protected against static discharge.

WARNING!

The components, connectors and conductors of the ES4455.1 Load Board may carry dangerous voltages. These voltages may even exist if the ES4455.1 is not installed in the ES4408.1 Load Chassis or the ES4408.1 Load Chassis is powered off.
Make sure the ES4455.1 is protected against contact during operation. Disconnect all connectors to the ES4455.1 before removing the board.

1.1 Applications

The ES4455.1 Load Board is a carrier board for accommodating two modules (each with two channels) for simulating high-current loads (to 90 V and to 20 A), such as injection loads.

In the ES4408.1 Load Chassis there are three 14 HP slots for accommodating ES4455.1 Load Boards or pre-assembled variants (see "“Pre-Assembled Solutions” with Integrated Load Modules" on page 8).

When fully assembled, the injection loads of a 12-cylinder engine can be simulated.

1.2 Features

The ES4455.1 Load Board has the following features:

- 3 U plug-in board (14 HP, 3400 mm x 100 mm)
- Four channels for load simulations to 20 A
- Four galvanically isolated analog or digital channels for current measuring
- Four galvanically isolated analog channels for voltage measuring
- To date, modules for the Bosch Common Rail System (two modules each with two loads) and Bosch GDI (two modules each with two loads) are available

Fig. 1-1 shows the block diagram of the ES4455.1 Load Board.

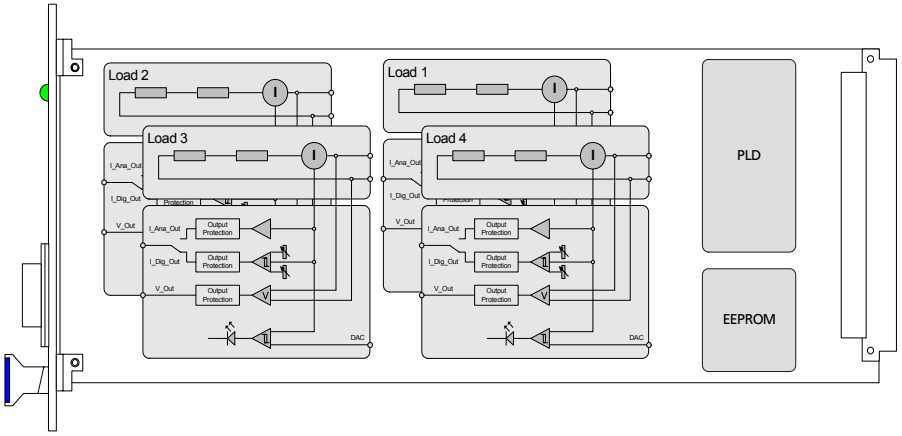


Fig. 1-1 Block Diagram of the ES4455.1 Load Board

The following figure shows the front panel of the ES4455.1 Load Board.

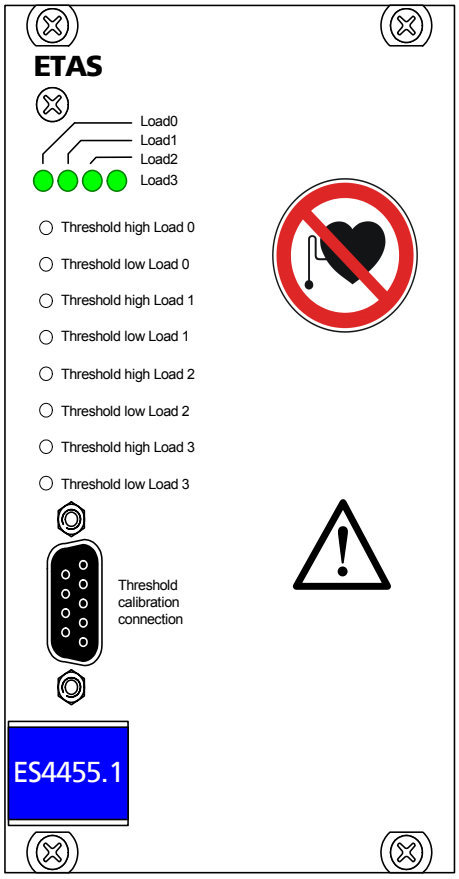


Fig. 1-2 Front Panel of the ES4455.1 Load Board

The elements of the front panel are:

- The „Load*n*" LEDs indicating load current
- The LEDs which light up when the currents exceed a threshold set in the (LABCAR-RTC) software
- The potentiometers for setting the lower and upper thresholds for digitizing the output signal
- The "Threshold Calibration" connector at which the thresholds set using the potentiometers are output

1.3 Load Modules

The following load modules are currently available for the ES4455.1 Load Board:

- PB4451CR Piggyback for 2 RB CRS Injectors

  Simulation for injectors of the Bosch Common Rail System

- PB4451GDI Piggyback for 2 RB GDI Injectors

  Simulation for injectors of the Bosch HDEV GDI system

For more information on the modules, refer to the chapter "Accessories" on page 21.

"Pre-Assembled Solutions" with Integrated Load Modules

The ES4455.1 Load Board can also be supplied as an assembled version with these modules under the following names:

- ES4450.2 Load Board for 4 RB CRS Injectors

  The ES4450.2 enables the simulation of four injectors of the Bosch Common Rail System (CRS). It consists of the ES4455.1 Load Board and two piggybacks of the type "PB4451CR Piggyback for 2 RB CRS Injectors".

- ES4451.3 Load Board for 4 RB GDI Injectors

  The ES4451.3 enables the simulation of four injectors of the Bosch gasoline direct injection system. It consists of the ES4455.1 Load Board and two piggybacks of the type "PB4451GDI Piggyback for 2 RB GDI Injectors".

Order Data

Order Name	Short Name	Order Number
PB4451CR Piggyback for 2 RB CRS Injectors	PB4451CR	F-00K-106-323
PB4451GDI Piggyback for 2 RB GDI Injectors	PB4451GDI	F-00K-106-324
ES4450.2 Load Board for 4 RB CRS Injectors	ES4450.2	F-00K-106-167
ES4451.3 Load Board for 4 RB GDI Injectors	ES4451.3	F-00K-106-171

Tab. 1-1 Order Data for Load Modules and Pre-Assembled Solutions

1.4 Taking the Product Back and Recycling

The European Union has passed a directive called Waste Electrical and Electronic Equipment, or WEEE for short, to ensure that systems are setup throughout the EU for the collection, treating and recycling of electronic waste.

This ensures that the devices are recycled in a resource-saving way representing no danger to health or the environment.

Fig. 1-3 WEEE Symbol

The WEEE symbol on the product or its packaging shows that the product must not be disposed of as residual garbage.

The user is obliged to collect the old devices separately and return them to the WEEE take-back system for recycling.

The WEEE directive concerns all ETAS devices but not external cables or batteries.

For more information on the ETAS GmbH Recycling Program, contact the ETAS sales and service locations (see "ETAS Contact Addresses" on page 25).

2 Hardware

This chapter describes the individual function units of the ES4455.1 Load Board in more detail.

These are:

- "Numbering the Loads on an ES4455.1 Load Board" on page 11
  - "Load Signals to the Backplane" on page 12
- "Current Transducers" on page 13
  - "Configuring the Current Transducers" on page 13
  - "Calibration" on page 15
  - "Overcurrent Protection of the Measure Outputs" on page 15
- "Digital Current Signals" on page 15
  - "Configuring Current Measuring" on page 16
  - "LED Display" on page 16
  - "Acoustic Signals" on page 16
- "Settings in LABCAR-RTC" on page 17

2.1 Numbering the Loads on an ES4455.1 Load Board

The following figure shows the power supply to the load modules via the standoffs, the corresponding current transducers and the jumper strip for configuring an analog/digital current signal (JP200).

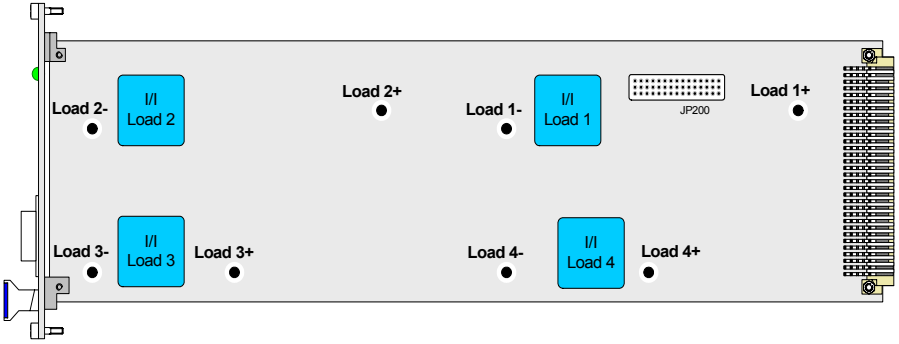


Fig. 2-1 Names of the Load Connectors and Numbering of the Loads (Component Side without Assembled Loads)

2.1.1 Load Signals to the Backplane

Slots 1 - 3 of the ES4408.1 Load Chassis are intended for the integration of the injection loads (for more details, refer to the ES4408.1 Load Chassis) User's Guide. The supply of the signals from the backplane connectors of the ES4408.1 Load Chassis is as follows:

	18	20	22	24	26	28	30	32
z	Load 1+	Load 1-	Load 2+	Load 2-	Load 3+	Load 3-	Load 4+	Load 4-
b	Load 1+	Load 1-	Load 2+	Load 2-	Load 3+	Load 3-	Load 4+	Load 4-
d	Load 1+	Load 1-	Load 2+	Load 2-	Load 3+	Load 3-	Load 4+	Load 4-

Tab. 2-1 Current Signals of the Backplane Connectors Slot 1...Slot 3

2.1.2 Connecting Loads and Measuring the Signals

The loads are connected via connectors on the rear of the ES4408.1 Load Chassis - next to them are the connectors for the measure signals.

Board in Slot	Connect Load to	Measure Signals at
1	Load 8-2	Meas 8-2
2	Load 8-1	Meas 8-1
3	Load 7	Meas 7

Tab. 2-2 Assignment of Slots to Connectors

For details of the individual pin assignment, refer to the ES4408.1 Load Chassis User's Guide.

2.2 Current Transducers

The load current is measured in galvanic isolation by the current transducers. Internally, the entire current range is mapped to a voltage range of 0..10 V.

2.2.1 Configuring the Current Transducers

The range of currents to be measured is configured using solder straps (on the solder side of the ES4455.1 Load Board) at the current transducers (see Fig. 2-1 on page 11).

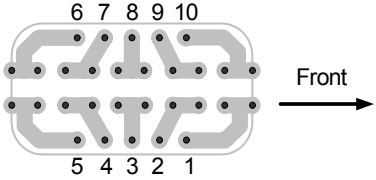


Fig. 2-2 Current Transducer Pins seen from the Solder Side (Front Panel, Right)

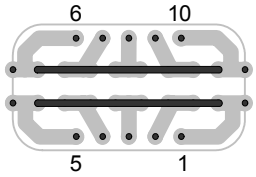
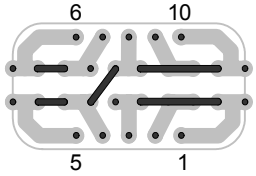
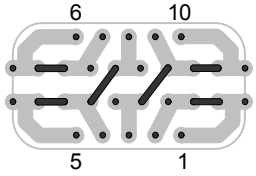
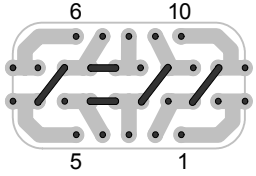
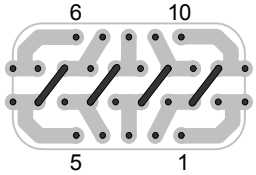
Note

Use only the two inner rows for the solder straps as the voltage converter is soldered to the outer ones.

Note

Please note that changing the current ranges makes recalibration necessary (see "Calibration" on page 15)!

The solder straps necessary for the relevant primary current ranges are listed in the following table.

Nominal Current	Max. Current	Solder Straps
25 A	36 A	
12 A	18 A	
8 A	12 A	
6 A	9 A	
5 A	7 A	

Tab. 2-3 Configuring the Current Ranges using Solder Straps

2.2.2 Calibration

ETAS provides a calibration service for correcting any current converter and threshold offsets for the front panel LEDs.

The order data is as follows:

Order Name	Short Name	Order Number
Calibration Service for ES4455	K_ES4455	F-00K-106-386
Calibration Service for ES4450	K_ES4450	F-00K-106-174
Calibration Service for ES4451	K_ES4451	F-00K-106-385

2.2.3 Overcurrent Protection of the Measure Outputs

The outputs (I_{analog}, $I_{digital}$ and U_{analog}) of theES4455.1 Load Board are protected against shorts to +UBatt and against ±60 V.

2.3 Digital Current Signals

The current signal over a load can also be output digitally – the upper and lower thresholds are set via the potentiometers "Threshold high Load_*n*" and "Threshold low Load_*n*".

Once the upper threshold has been reached, the digital signal assumes the value "High" and retains this until the lower threshold is crossed.

The settable ranges are:

- 0...2.5 V for the lower threshold in accordance with 0 A...I_{max}
- 0...2.5 V for the upper threshold in accordance with 0 A...I_{max}

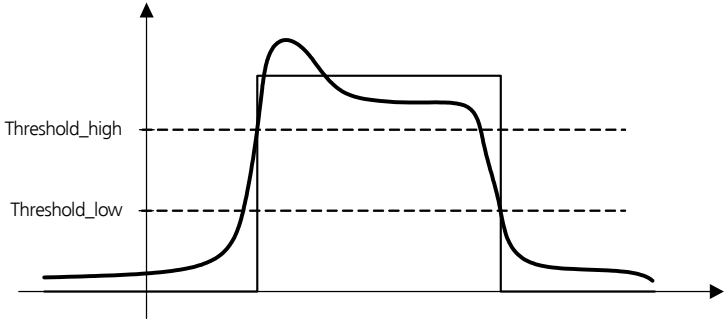


Fig. 2-3 Digitizing an Injection Signal

The thresholds set are verified at the front-facing connector (see " "Threshold Calibration Connection" Connector" on page 19).

2.3.1 Configuring Current Measuring

Current measuring (for all loads installed on the carrier board) is configured using the "JP200" jumper strip.

Fig. 2-1 on page 11 shows the position of the jumper strip on the board – this is only accessible when the rear load is removed.

The possible settings are shown in Fig. 2-4 on page 16.

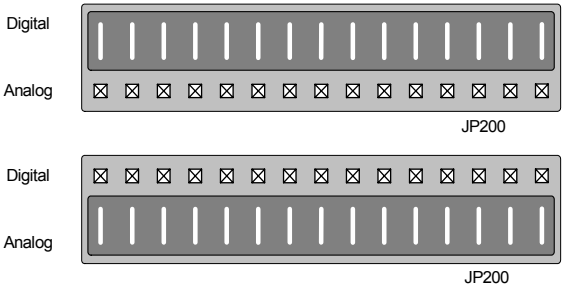


Fig. 2-4 Current Measuring Configurations: Digital (Top) and Analog (Bottom)

The configuration can also be queried in LABCAR-RTC. Select the ES4455-Load-Carrier Device there, and then the "Data" tab. When an experiment is running, the "JumperSetting" signal contains the configuration: 0 = digital, 1 = analog.

2.3.2 LED Display

The LED display on the front panel (see "LEDs for Status Display" on page 20) shows when a specific current value has been reached – if the current over a load is over this value, the relevant LED lights up.

The thresholds are set in the software; this is described in the section "To set thresholds for LEDs" on page 17.

2.3.3 Acoustic Signals

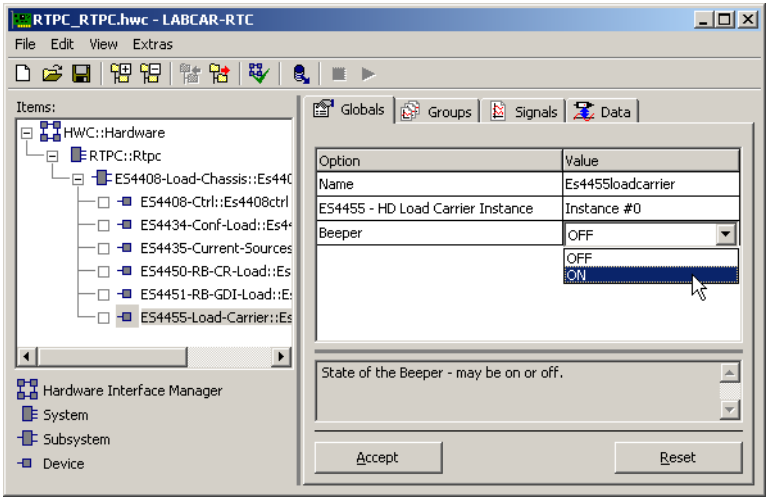
An acoustic signal can be emitted when the above-mentioned thresholds have been attained. The section "To set the beeper" on page 17 describes how to enable/disable this function.

2.4 Settings in LABCAR-RTC

The software settings for the ES4455.1 Load Board are described below.

To set the beeper

- To enable/disable the acoustic signal to indicate when a threshold has been exceeded (see "To set thresholds for LEDs" on page 17), select the option "Beeper" "ON" or "OFF".



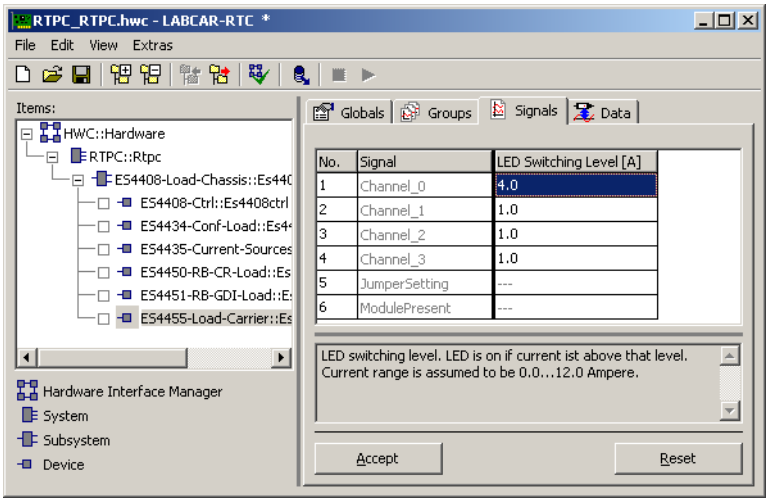
- Click **Accept**.

  The settings are accepted.

To set thresholds for LEDs

- To configure the thresholds for the optical (via LEDs) and acoustic signals, select the "Signals" tab.

- Enter a value (for the relevant channel) for “LED Switching Level [A]”.



- Click **Accept**.

  The settings are accepted.

For more detailed information on LABCAR-RTC, refer to the LABCAR-RTC V4.1 - User’s Guide

3 Pin Assignment and Display Elements

This chapter contains a description of the pins and LEDs on the front panel of the ES4455.1 Load Board.

3.1 "Threshold Calibration Connection" Connector

The thresholds for digitizing the current signal, which can be set on the front panel using potentiometers, can be tapped at the "Threshold Calibration Connection" connector.

Type: 9-pin DSUB (female)

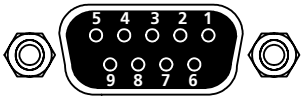


Fig. 3-1 "Threshold Calibration Connection" Connector

The pin assignment is as follows:

Pin	Signal	Pin	Signal
1	Threshold high Load 0	6	Threshold low Load 1
2	Threshold high Load 1	7	Threshold low Load 2
3	Threshold high Load 2	8	Threshold low Load 3
4	Threshold high Load 3	9	AGND
5	Threshold low Load 0	Housing	Protective earth

Tab. 3-1 "Threshold Calibration Connection" Pin Assignment

3.2 LEDs for Status Display

There are four LEDs on the front panel of the ES4455.1 Load Board which light up when the thresholds set in the software are exceeded.

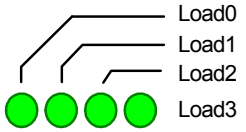


Fig. 3-2 LEDs on the Front Panel

The LEDs have the following meaning:

LED	Display	Meaning
Load*n*	Showing green	Current over load *n* is greater than the threshold value set (see "LED Display" on page 16)

Tab. 3-2 Meaning of the LEDs

4 Accessories

This chapter describes the dummy loads available to date which are assembled as piggybacks on the board of the ES4455.1 Load Board.

These are:

- PB4451CR Piggyback for 2 RB CRS Injectors

  This piggyback enables the simulation of two injectors of the Bosch Common Rail System (CRS).

- PB4451GDI Piggyback for 2 RB GDI Injectors

  This piggyback enables the simulation of two injectors of the Bosch gasoline direct injection system.

For order data, please refer to Tab. 1-1 on page 8.

4.1 PB4451CR Piggyback for 2 RB CRS Injectors

The following figure shows a schematic of the PB4451CR Piggyback for 2 RB CRS Injectors and the simplified diagram of a channel.

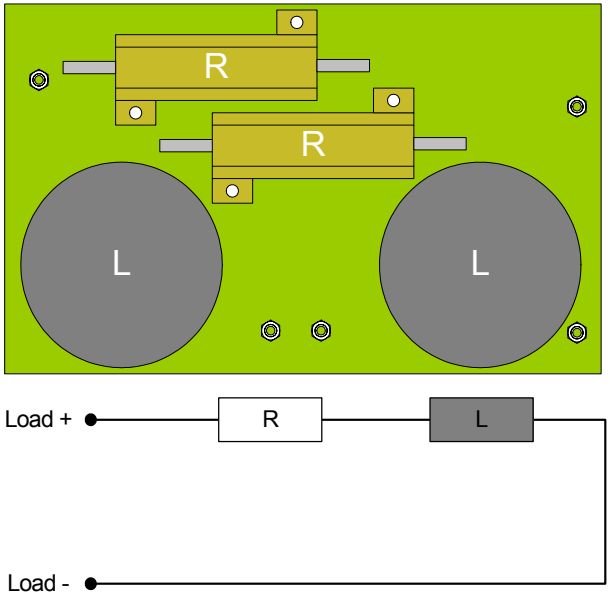


Fig. 4-1 Schematic of the PB4451CR Piggyback for 2 RB CRS Injectors and Simplified Diagram of a Channel

The resistor and the inductor are specified as follows:

R1	0.22 Ω/50 W
L	180 µH

4.2 PB4451GDI Piggyback for 2 RB GDI Injectors

The following figure shows a schematic of the PB4451GDI Piggyback for 2 RB GDI Injectors and the simplified diagram of a channel.

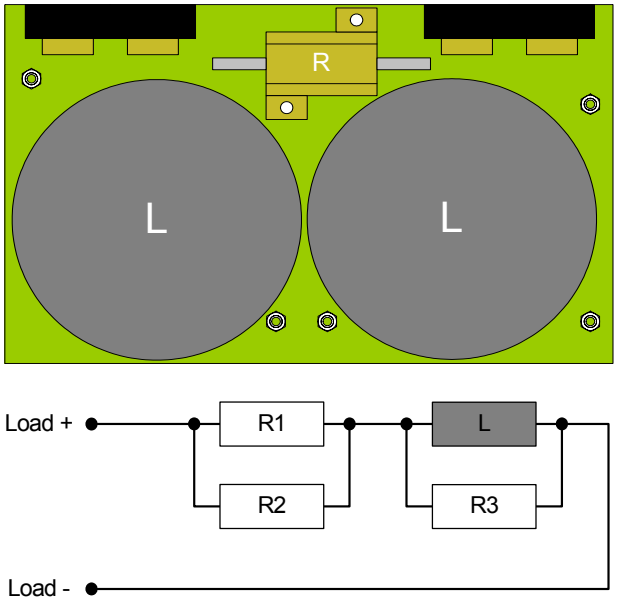


Fig. 4-2 Schematic of the PB4451GDI Piggyback for 2 RB GDI Injectors and Simplified Diagram of a Channel

The resistors and the inductor are specified as follows:

R1	3.3 Ω/60 W
R2	3.3 Ω/60 W
R3	68 Ω/25 W
L	1.1 mH

5 Technical Data

This chapter contains the technical data of the ES4455.1 Load Board.

Load Channels

Number	4
Max. load current	20 A
Max. load voltage	90 V

Measurement Channels

Accuracy of current measuring - level	±3%
Accuracy of current measuring - timing	±2%
Electrical strength of the outputs	±60 V

Environmental Conditions

Operating temperature	5 °C to 35 °C (41 °F to 95 °F)
Relative humidity	0 to 95% (non-condensing)

Power Supply

Current consumption	+ 3.3 V: 100 mA + 5 V: 20 mA +12 V: 30 mA -12 V: 30 mA +24 V: 200 mA

Dimensions

Height	3 U
Width	14 HP
Depth	340 mm

6 ETAS Contact Addresses

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70469 Stuttgart	Fax:	+49 711 89661-106
Germany	WWW:	www.etas.com

ETAS Subsidiaries and Technical Support

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
ETAS technical support	WWW:	www.etas.com/en/hotlines.php

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