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ES4451.2

# Gasoline Direct Injection Load

User's Guide

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# 1 Introduction

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This section contains information on the basic features and application of the ES4451.2 Gasoline Direct Injection Load.

## **note**

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*Some of the components on the board are prone to electrostatic discharge and could become damaged or destroyed. Leave the board in its protective packaging until you mount it.*

*Only remove the board from its protective package to configure it and mount it. All this work must be carried out at a workplace that is protected against static discharge.*

## 1.1 Features

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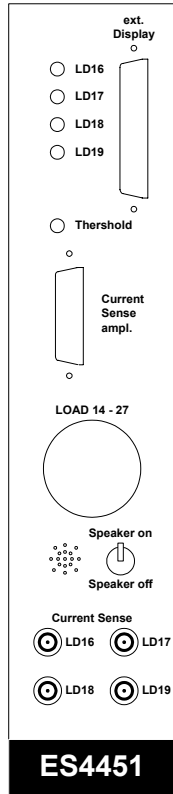
The ES4451.2 Gasoline Direct Injection Load emulates an inductive load (equivalent load circuit). The module is designed to accommodate a maximum of four equivalent load circuits.

The module comprises the following features:

- Equivalent load circuit for four inductive loads
- Current/voltage transducers generate an equivalent voltage curve for each load
- Analog output for voltage proportional to the load current
- Settable threshold for voltage proportional to load current
- Visual and acoustic signals to indicate threshold setting exceeded

The control signals for individual loads are routed to the board via a connector on the front panel.

The figure below shows the front panel of the ES4451.2 Gasoline Direct Injection Load and the position of the controls and displays.



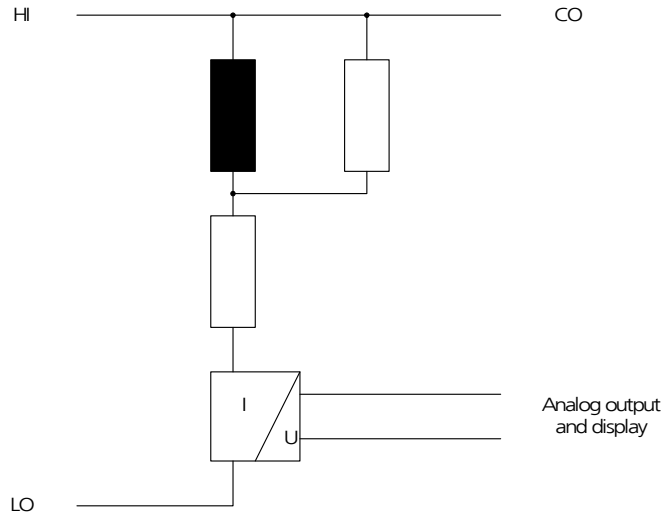
**Fig. 1-1** Front view of the ES4451.2

## 1.2 Applications

The ES4451.2 Gasoline Direct Injection Load is used to emulate the electrical load of injectors in gasoline direct injection (GDI) systems.

### 1.3 Block diagram

The figure below shows a schematic diagram of one ES4451.2 Gasoline Direct Injection Load channel:



**Fig. 1-2** Block diagram of a load channel

The HI and LO terminals are routed to the front panel connectors. CO indicates two terminals on an internal patchboard which you can use to combine loads into load banks. The output signals of the current/voltage transducers are routed to a front panel connector. After comparison with a variable threshold, the signals are displayed and sent to the loudspeaker.





## 2 **Functional Description**

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This section contains a detailed description of the features of the load module.

### 2.1 **Equivalent load circuit**

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The loads are simulated as inductances with parallel and series resistors. The inductances and resistors are equipped according to your requirements. The values for the standard configuration are listed in Section "Equivalent load circuit" on page 17.

With the standard configuration a BOSCH HDEV5 injector can be emulated.

### 2.2 **Current/voltage transducers**

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A current/voltage transducer is integrated in each of the four load channels. The conversion ratio is 0.16 V/A. The output signals of the current/voltage transducers are routed to front panel BNC connectors as analog output signals.

The output signals from the current/voltage transducers amplified by a factor of 12 (1.92 V/A) are routed to the 9-pin Sub-D connector that is also on the front panel.

### 2.3 **Display**

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The output signals of the current/voltage transducers are compared with a variable threshold. If the threshold is exceeded for a channel, the associated LED on the front panel comes on.

An acoustic signal sounds every time the threshold is exceeded. You can turn off the acoustic signal.

### 2.4 **Mechanical design**

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The ES4451.2 Gasoline Direct Injection Load has a front panel height of 6 U (266.7 mm) and a front panel width of 12 HP (60.72 mm).

The ES4451.2 is mounted in a desk-top enclosure and has an incoming feed for the power supply via a connector on an additional front panel.

### 2.5 **Connectors**

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The front panel of the load module has a connector for the load control signals, two Sub-D connectors for the analog output signals, and an external display. In addition the analog output signals of the current/voltage transformers are also routed to four BNC sockets.

### 2.5.1 LOAD 14-27 connector

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The LOAD 14-27 connector is a 17-pin CANNON socket (female) of type ITT Cannon CA20COM and is located on the front panel of the ES4451.2 Gasoline Direct Injection Load. This connector provides the control signals of the inductive loads for the load module.

### 2.5.2 Current sense connector

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The current sense connector is a 9-pin Sub-D connector and is located on the front panel of the ES4451.2 Gasoline Direct Injection Load. The voltages proportional to the load currents (1.92 V/A) are routed externally via these connectors.

Signals at the current sense connector can be routed to a LABCAR via an injector measurement cable.

### 2.5.3 Display connector

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The Display connector is a 15-pin Sub-D connector and is located on the front panel of the ES4451.2 Gasoline Direct Injection Load. An external display can be connected in parallel to the optical display via the Display connector. The signals are routed from the comparator outputs via an isolation amplifier for each load.

### 2.5.4 BNC sockets

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Four BNC sockets on the front panel of the ES4451.2 Gasoline Direct Injection Load represent the voltage curve of the connected loads. The output signal from each current/voltage transducer (0.16 V/A) is routed to a BNC socket. The signal can then be evaluated or reprocessed by devices connected to this connector via a coaxial cable.

### 2.5.5 Power supply

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The supply voltages  $\pm 15$  V and AGND are feed in via a DIN41612 Type F connector.

## 2.6 Patch Board

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The HI terminals of each equivalent load circuit are routed to a patch board. There are two terminals on the patch board for each equivalent load circuit. The single loads can be combined to form load banks by using short-circuit jumpers.

The assignment of load channel to terminal on the patch board is listed in Tab. 3-5 on page 16.

## 2.7 Capacitor block

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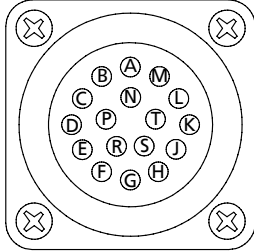
The supply voltages +15 V and -15 V are routed via a capacitor block to stabilize the voltage. The capacitor block consists of the electrolytic capacitors C1 and C2, and fourteen film capacitors.



### 3 Connectors

This section contains information on the pin assignments of the connectors and the patch board.

#### 3.1 LOAD 14-27 connector



**Fig. 3-1** LOAD 14-27 connector

The table below contains the pin assignment of the LOAD 14-27 connector. The names HI and LO refer to the block diagram in Fig. 1-2 on page 7.

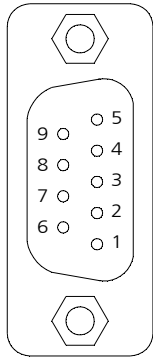
Pin	Signal	Designation
A	LD14	HI channel 1
B	LD15	HI channel 3
C	LD16	LO channel 1
D	LD17	LO channel 3
E	LD18	LO channel 2
F	LD19	LO channel 4
G	LD20	open
H	LD21	open
J	LD22	HI channel 4
K	LD23	HI channel 2
L	LD24	open
M	LD25	open
N	LD26	open
P		open

**Tab. 3-1** Pin assignment of LOAD 14-27 connector

Pin	Signal	Designation
R		open
S		open
T		open

**Tab. 3-1** Pin assignment of LOAD 14-27 connector

### 3.2 Current sense connector



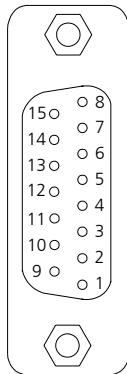
**Fig. 3-2** Current sense connector

Pin	Channel	LOAD terminal
1	1	LD16
2	3	LD17
3	2	LD18
4	4	LD19
5	open	
6	open	
7	open	
8	open	
9	open	

**Tab. 3-2** Pin assignment of current sense connector

### 3.3 Display connector

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**Fig. 3-3** Display connector

Pin	Signal	Designation
1	LD16	Load channel LD16
2	LD17	Load channel LD17
3	LD18	Load channel LD18
4	LD19	Load channel LD19
5	n. c.	
6	n. c.	
7	n. c.	
8	n. c.	
9	n. c.	
10	n. c.	
11	n. c.	
12	n. c.	
13	n. c.	
14	n. c.	
15	n. c.	

**Tab. 3-3** Pin assignment of Display connector

### 3.4 Backplane connector DIN41612 Model F

Pin	Row d	Row b	Row z
2	n. c.	n. c.	n. c.
4	n. c.	n. c.	n. c.
6	n. c.	n. c.	n. c.
8	n. c.	n. c.	n. c.
10	+15 V	n. c.	-15 V
12	AGND	AGND	AGND
14	n. c.	n. c.	n. c.
16	n. c.	n. c.	n. c.
18	n. c.	n. c.	n. c.
20	n. c.	n. c.	n. c.
22	n. c.	n. c.	n. c.
24	n. c.	n. c.	n. c.
26	n. c.	n. c.	n. c.
28	n. c.	n. c.	n. c.
30	n. c.	n. c.	n. c.
32	n. c.	n. c.	n. c.

**Tab. 3-4** Pin assignment of Backplane connector

### 3.5 Patch board

Channel	LOAD terminal	Terminal in patch board
1	LD14	CO6, CO38
2	LD23	CO7, CO36
3	LD15	CO8, CO37
4	LD22	CO9, CO39

**Tab. 3-5** Pin assignment of patchboard



## 4 Technical Data

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This section contains the technical data of the ES4451.2 Gasoline Direct Injection Load in the form of a table.

### *Equivalent load circuit*

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Inductance	1.1 mH
Parallel resistor	68 $\Omega$
Series resistance	1.0 $\Omega$ and 0.68 $\Omega$

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### *Mechanical data*

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Height	284 mm
Width	163 mm
Depth	257 mm

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### *Electrical data*

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Supply voltage	$\pm 15$ V, GND
Supply current	max. 300 mA
Fuse for external power supply	500 mA for each power supply (rewirable fuse)

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#### **note**

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*The supply voltages  $\pm 15$  V are not protected against reverse polarity. With an external power supply, make sure that the power supply has the correct polarity. If the polarity is reversed, active components on the board may become damaged or be destroyed. This will result in incorrect measurements and measurement failures.*

The ES4451.2 Gasoline Direct Injection Load is designed to carry the following continuous currents at a temperature of 30°C:

Continuous current for each channel	17 A
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### *Current/voltage transducer*

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Conversion ratio measuring current/output voltage	1.92 V/A
Nominal current	±25 A
Maximum current	±50 A
Electrical offset voltage at $T_A = 25\text{ °C}$	30 mV (max.)
Magnetic offset voltage at ±50 A	± 40 mV (max.)

## 5 **ETAS Contact Addresses**

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