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ES1392.2 High Current Switch Board

User's Guide



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1 Introduction

This section contains information about the basic features and applications of the ES1392.2 High Current Switch Board. A block diagram is also included here to show the schematic layout of the board.

Note

Some components of the ES1392.2 High Current Switch Board may be damaged or destroyed by electrostatic discharges. Please keep the board in its storage package until it is installed.
The ES1392.2 High Current Switch Board should only be taken from its package, configured and installed at a working place that is protected against static discharge.

Note

The components, connectors and conductors of the ES1392.2 High Current Switch Board may carry dangerous voltages. These voltages may even exist when the ES1392.2 is not installed in the ES4100, ES4105 or ES4300 or the ES4100, ES4105 or ES4300 is powered off.
Make sure that the ES1392.2 is protected against contact during operation. Disconnect all connections to the ES1392.2 before removing the board.

1.1 Applications

The ES1392.2 High Current Switch Board is used to switch five high current battery nodes to +UBatt.

The ES1391.1 Power Supply Controller Board is used to control the ES1392.2 High Current Switch Board with TTL signals. An ES1391.1 Power Supply Controller Board can control up to two ES1392.2 High Current Switch Boards and at the same time up to two battery voltage power supplies.

When two ES1392.2 High Current Switch Boards and two power supplies (for example 12 V and 42 V) are used, for each voltage five battery nodes can be switched.

An example of this kind of scenario is shown in Fig. 1-1.

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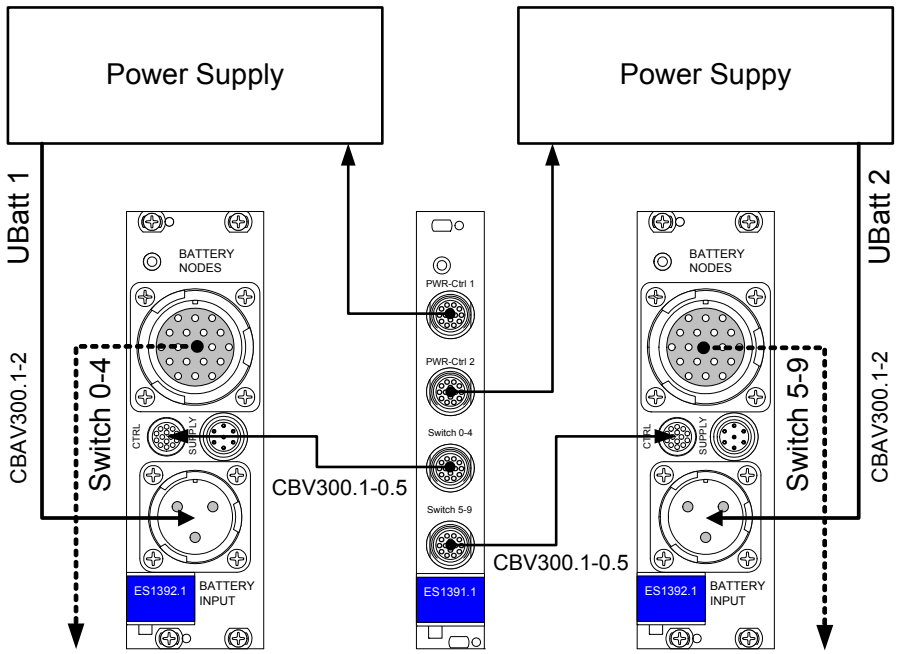


Fig. 1-1 Use of Two ES1392.2 High Current Switch Boards to Switch Two Battery Voltages

The ES1392.2 High Current Switch Board does not have a VMEbus interface - it is controlled by TTL signals which have to be connected to a front-facing connector. In the LABCAR environment, these TTL signals are generated by the ES1391.1 Power Supply Controller Board which communicates with the backplane of the ES4100, ES4105 or ES4300 Signal Box via a VMEbus interface.

1.2 Features

The ES1392.2 High Current Switch Board has the following features:

- Five high current switches to +UBatt for currents of up to 20 A
- Maximum overall current of 40 A
- Input voltage range of 0 - 60 V
- Control connector on the front panel ("CTRL") (digital TTL signals)
- Power supply input on the front panel
- Overcurrent protection
- Overcurrent status is routed to the "CTRL" status output on the front panel
- Versioning information (version/type of board) available via front-facing "CTRL" connector (1-Wire®)
- Supply voltages are routed to the front panel ("SUPPLY") (+5 V (2 A), +12 V (1,5 A), -12 V (1,5 A))

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The following figure shows the front panel of the ES1392.2 High Current Switch Board.

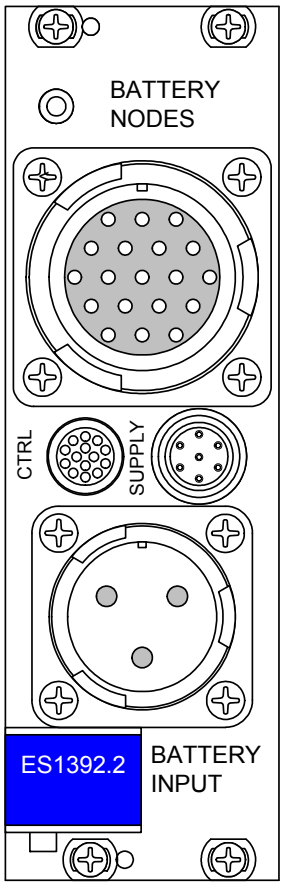


Fig. 1-2 Front Panel of the ES1392.2 High Current Switch Board

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1.3 Block Diagram

Fig. 1-3 shows the block diagram of the ES1392.2 High Current Switch Board. The battery voltages are supplied via "BATTERY INPUT". The battery nodes connected via "BATTERY NODES" can be switched to these battery voltages via the switches.

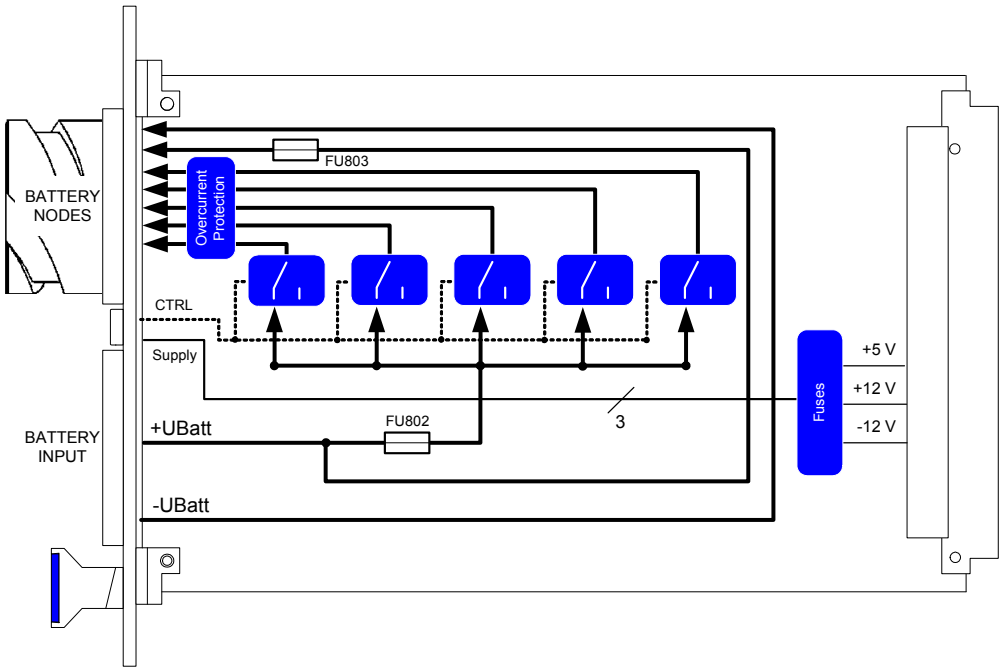


Fig. 1-3 Block Diagram of the ES1392.2 High Current Switch Board

1.4 Notes on Changes in Comparison to the ES1392.1

The ES1392.2 High Current Switch Board is the result of the continued development of the ES1392.1 High Current Switch Board. This development has resulted in changes which could affect your projects.

	ES1392.1	ES1392.2
Input voltage range	6 V - 60 V	0 V - 60 V
Battery node 0 can be switched to -UBatt	Yes	No
Pull-up/pull-down functionality for MRC simulation	No	Yes

Tab. 1-1 The Main Differences between the Versions

The ES1392.2 now has a pull-up/pull-down functionality for the main relay, and battery node 0 can no longer be switched to -UBatt. The control signal which has thus become available is now used for the automatic switching of the pull-up/pull-down functionality on the ES1392.2.

This procedure makes it possible to operate the ES1392.2 without making any changes to the ES1391.1 or its wiring. Do, however, take the following two points into consideration:

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Disabling Pull-Up/Pull-Down Functionality

As both the ES1391.1 and ES1392.2 have connections to the pull-up/pull-down functionality, this functionality must be disabled **on the ES1391.1**.

- Remove the jumpers JP0 and JP1 from the ES1391.1 for this purpose.

Disabling the Switching of BN0 to -UBatt

If you want to operate a LABCAR model on a LABCAR with an ES1392.1 and on another LABCAR with an ES1392.2, switching to -UBatt must be disabled **on the ES1392.1**.

- Configure the jumpers JP1 and JP2 on the ES1392.1 as follows:

JP1	JP2	Control Signal	Configuration
1	0	Any	+UBatt

1.5 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. 1-4 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 page 25).

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2 Hardware

This chapter contains the hardware descriptions of the ES1392.2 High Current Switch Board. It consists of the following sections:

- "Functional Description" on page 11
- "Controlling the Switches" on page 11
- "Overcurrent Protection with the Status Output" on page 11
- "EEPROM" on page 12
- "Battery Voltage at the "CTRL" Connector" on page 12
- "MRC Signal" on page 12
- "Parallel Switching of Several Battery Nodes" on page 13
- "Battery Voltage at the "BATTERY NODES" Connector" on page 13
- "Protective Measures" on page 14

2.1 Functional Description

The ES1392.2 High Current Switch Board has five channels which can all apply a current of up to 20 A. The total current over all channels is, however, limited to 40 A.

2.2 Controlling the Switches

The switches are controlled using the "control signal switch *n*" control signals (see Section 3.3 on page 19).

Control Signal	Switch
L/open	Open
H	Closed

Tab. 2-1 Control Signal and Switch Position

2.3 Overcurrent Protection with the Status Output

If an overcurrent is detected on one of the battery nodes, the relevant switch is opened. After a delay, the switch is automatically closed again to check whether the error has been recovered. If the overcurrent can still be detected, the switch is opened again immediately. This is repeated until there is no longer an overcurrent.

The user is made aware of one of the switches being switched off because of an overcurrent by the "signal switch error" status signal at the "CTRL" connector (see 3.3 on page 19).

Overcurrent	Status Signal
Normal operation	L
Error	H

Tab. 2-2 Status Signal for Overcurrent Errors

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For more details on protective measures, please refer to Section "Protective Measures" on page 14.

2.4 EEPROM

The type of board (ES1392.2) and the version is stored in an EEPROM and can be read out via a 1-Wire® interface on the "CTRL" connector by the ES1391.1 Power Supply Controller Board.

2.5 Battery Voltage at the "CTRL" Connector

-UBatt and +UBatt are available at the "CTRL" connector. Both voltages are protected (see Section 2.9.3 on page 15).

2.6 MRC Signal

The MRC signal is transmitted by the ES1392.2 High Current Switch Board to the ES1391.1 Power Supply Controller Board which is responsible for evaluating the MRC signal.

The MRC signal can be assigned a pull-up to +UBatt or a pull-down to -UBatt both on the ES1391.1 Power Supply Controller Board and on the ES1392.2 High Current Switch Board.

Note

If the ES1391.1 Power Supply Controller Board and the ES1392.2 High Current Switch Board are used together, the ES1392.2 High Current Switch Board takes on the pull-up/pull-down functionality for the MRC signal. In this case, remove jumpers JP0 and JP1 from the ES1391.1. The connected ECU could otherwise malfunction.

The pull-up/pull-down function on the ES1392.2 is realized with current sources. The current sources are designed to provide different currents for the simulation of the pull-up and pull-down resistors depending on the battery voltage +UBatt.

Note

The RTIO configuration of the ES1391.1 Power Supply Controller Board determines whether the pull-up or pull-down function is active.

The "DigOutCtrl_5" signal is set according to the following table in the RTIO during configuration of the ES1391.1:

Setting	Meaning
0	Pull-up
1	Pull-down

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The following figure illustrates the principle of the pull-up/pull-down functionality for the MRC signal on the ES1392.2.

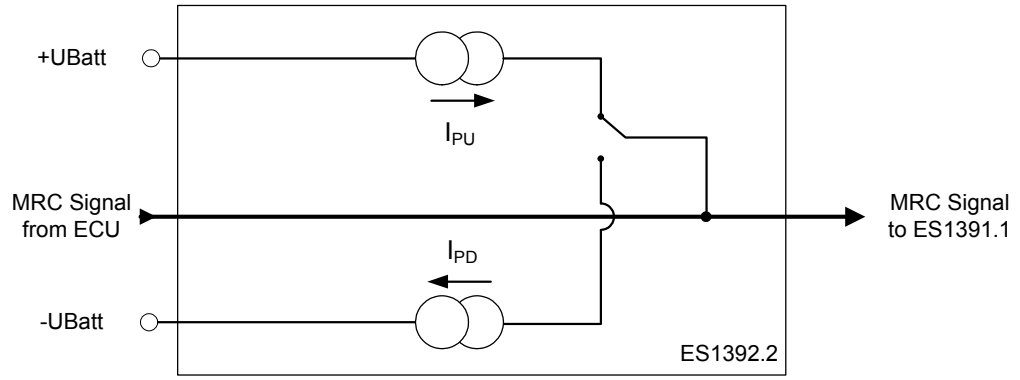


Fig. 2-1 Pull-Up/Pull-Down of the MRC Signal on the ES1392.2

2.7 Parallel Switching of Several Battery Nodes

To increase the maximum current of the battery nodes, the battery nodes BN0 to BN4 can be switched in parallel.

2.8 Battery Voltage at the "BATTERY NODES" Connector

-UBatt and +UBatt are available at the "BATTERY NODES" connector. Both voltages are protected.

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2.9 Protective Measures

The battery voltage +UBatt supplied at "BATTERY INPUT" is protected by fuses. There is a 20 A fuse in front of the output ("BATTERY NODES" connector), and the total current of +UBatt (in front of the switches) is protected by a 40 A fuse.

The battery node switches themselves are protected electronically against overcurrent. The battery voltages, supply voltages and the MRC signal at the front-facing connectors are protected by fuses.

The position of the fuses on the board is shown in Fig. 2-2 - their specifications can be found in the following sections.

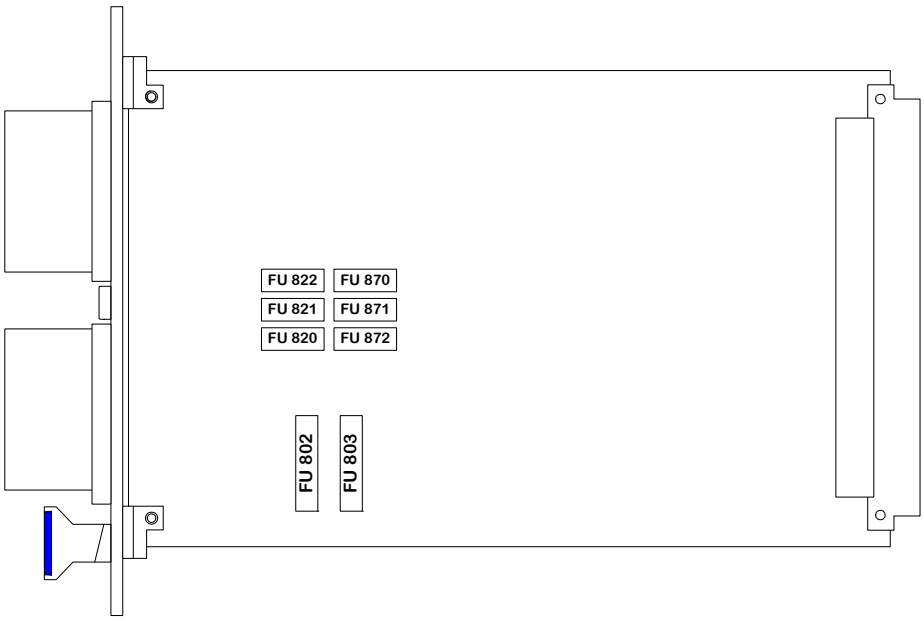


Fig. 2-2 Position of the Fuses (Component Side)

2.9.1 +UBatt at "BATTERY INPUT"

The battery voltage +UBatt fed in at the front-facing "BATTERY INPUT" connector is protected as follows:

Fuse	Specification	Type	Manufacturer/Order No.
FU802	40 A 32 V	Blade Fuse	Pudenz / 162.6185.540

Fuse Protection of Battery Voltage +UBatt at "BATTERY INPUT"

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2.9.2 +UBatt at "BATTERY NODES"

The battery voltage +UBatt output at the front-facing "BATTERY NODES" connector is protected as follows:

Fuse	Specification	Type	Manufacturer/Order No.
FU803	20 A 80 V	Blade Fuse	Pudenz / 166.7000.520

Tab. 2-3 Fuse Protection of Battery Voltage +UBatt at "BATTERY NODES"

2.9.3 +UBatt and -UBatt at "CTRL"

The battery voltages output at the front-facing "CTRL" connector are protected as follows:

Fuse	Specification	Type	Manufacturer / Order No.
FU820 (+UBatt)	1 A, slow-blowing	NANO2 SMD	Littelfuse 154.001T
FU821 (-UBatt)	1 A, slow-blowing	NANO2 SMD	Littelfuse 154.001T

Tab. 2-4 Fuse Protection of +UBatt and -UBatt at "CTRL"

2.9.4 MRC Signal between "BATTERY NODES" and "CTRL"

The MRC signal fed-through between the front-facing connectors "BATTERY NODES" and "CTRL" is protected as follows:

Fuse	Specification	Type	Manufacturer/Order No.
FU822	1 A, slow-blowing	NANO2 SMD	Littelfuse 154.001T

Tab. 2-5 Fuse Protection of the MRC Signal

2.9.5 Supply Voltages at "SUPPLY"

The supply voltages routed from the backplane to the front-facing "SUPPLY" connector are protected as follows:

Fuse	Specification	Type	Manufacturer/Order No.
FU871	2 A	NANO2 SMD	Littelfuse 154.002T

Tab. 2-6 Fuse Protection of the +5 V Supply Voltage

Fuse	Specification	Type	Manufacturer/Order No.
FU872	1.5 A	NANO2 SMD	Littelfuse 154.01.5T

Tab. 2-7 Fuse Protection of the +12 V Supply Voltage

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Fuse	Specification	Type	Manufacturer/Order No.
FU870	1.5 A	NANO2 SMD	Littelfuse 154.01.5T

Tab. 2-8 Fuse Protection of the -12 V Supply Voltage

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3 Pin Assignment

This chapter explains the pin assignment of the connectors of the ES1392.2 High Current Switch Board.

These are:

- ""BATTERY NODES" Connector" on page 17
- ""BATTERY INPUT" Connector" on page 18
- ""CTRL" Connector" on page 19
- ""SUPPLY" Connector" on page 20

3.1 "BATTERY NODES" Connector

Type: ITT Cannon CA02COM-E20A-48SB

Fig. 3-1 shows the pin assignment of the jack (view from the front).

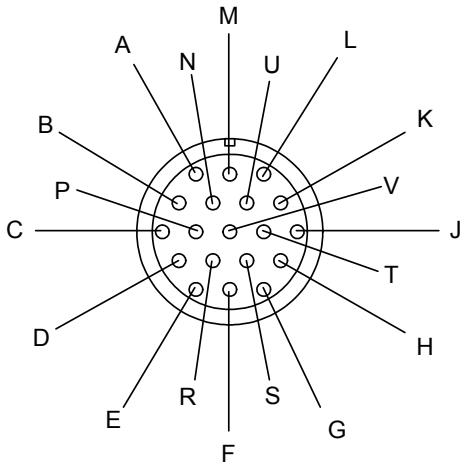


Fig. 3-1 "BATTERY NODES" Connector

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Pin	Signal
A	-UBatt
B	-UBatt
C	MRC signal in
D	+UBatt
E	+UBatt
F	CH4 out
G	CH4 out
H	CH3 out
J	CH2 out
K	CH1 out
L	CH0 out
M	CH0 out
N	-UBatt
P	Not assigned
R	+UBatt
S	CH3 out
T	CH2 out
U	CH1 out
V	n.c.

Tab. 3-1 "BATTERY NODES" Pin Assignment

The counterpart connector is an" ITT Cannon CA06COM-E20A-48PB".

3.2 "BATTERY INPUT" Connector

Type: ITT Cannon CA02COM-E16-10PB

Fig. 3-2 shows the pin assignment of the connector (view from the front).

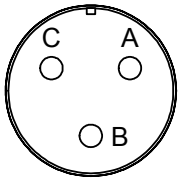


Fig. 3-2 "BATTERY INPUT" Connector

Pin	Signal
A	+UBatt
B	-UBatt
C	+UBatt

Tab. 3-2 "BATTERY INPUT" Pin Assignment

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The counterpart connector is an "ITT Cannon CA06COM-E16-10SB".

3.3 "CTRL" Connector

Type: Lemo EPG.1B.314.LLN

Fig. 3-3 shows the pin assignment of the connector (view from the front).

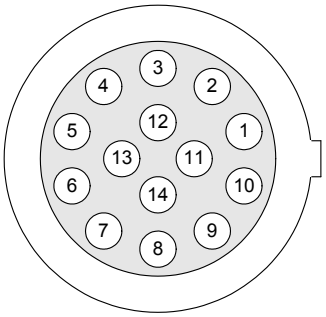


Fig. 3-3 "CTRL" Connector

Pin	Signal
1	Control signal switch 0 in
2	Control signal switch 1 in
3	Control signal switch 2 in
4	Control signal switch 3 in
5	Control signal switch 4 in
6	Not assigned
7	Signal switch error out
8	+UBatt out
9	-UBatt out
10	Input control signal for MRC pull-up/pull-down
11	MRC signal out
12	Switch 0-4 ground
13	ES1392.2 EEPROM signal
14	ES1392.2 EEPROM ground

Tab. 3-3 "CTRL" Pin Assignment

The counterpart connector is a "Lemo FGG.1B.314.CLAD76".

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3.4 "SUPPLY" Connector

Type: LEMO EGG.1B.307.CLL

Fig. 3-4 shows the pin assignment of the connector (view from the front).

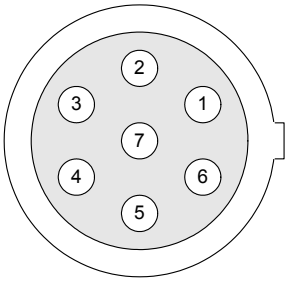


Fig. 3-4 "SUPPLY" Connector

Pin	Signal
1	-12 V
2	Ground
3	Not assigned
4	+5 V
5	Ground
6	+12 V
7	Not assigned

Tab. 3-4 "SUPPLY" Pin Assignment

The counterpart connector is a "Lemo FGG.1B.307.CLAD76".

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4 Accessories

To connect the ES1392.2 High Current Switch Board to the Power Supply and to the Controller Board two cables are required, which are described below.

4.1 Cables

4.1.1 Cable CBAV300.1-2

The cable CBAV300.1-2 connects the ES1392.2 to the power supply (battery voltages).

Product Data	
Short description	CBAV300.1-2
Long description	Cable ITT CA06COM - Ring Tongue (3fc - 2xM8)
Product part number	F 00K 103 223

Specification	
Length	2 m
Type	2 wires, 6 mm^2

Connectors	
To ES1392.2	ITT Cannon CA06COM-E16-10SB
To power supply	2 ring tongue (RT1+RT2): DIN 46237, insulated, M8

Function	**ES1392.2 ITT Connector**	**Ring Tongue Connector**
+UBatt	A, C	brown
-UBatt	B	blue

4.1.2 Cable CBV300.1-0.5

The cable CBV300.1-0.5 connects the ES1392.2 to the ES1391.1.

Product Data	
Short description	CBV300.1-0.5
Long description	Cable Lemo 1B FGG - Lemo 1B FGG (14mc - 14mc, 0.5m)
Product part number	F 00K 103 217

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Specification	
Length	0.5 m
Type	14 wires

Connectors	
To ES1392.2	Lemo FGG.1B.314.CLAD76 (plug, solder version)
To ES1391.1	Lemo FGG.1B.314.CLAD76 (plug, solder version)

Function	ES1391.1 LEMO FGG Connector	ES1392.2 LEMO FGG Connector
Control signal switch 0	1	1
Control signal switch 1	2	2
Control signal switch 2	3	3
Control signal switch 3	4	4
Control signal switch 4	5	5
Not assigned	6	6
Signal switch error	7	7
+UBatt	8	8
-UBatt	9	9
Configuration switch 0	10	10
MRC signal	11	11
Switch 0-4 ground	12	12
ES1392.2 EEPROM signal	13	13
ES1392.2 EEPROM ground	14	14
PE	Front panel	Front panel

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5 Technical Data

This chapter contains the technical data on the ES1392.2 High Current Switch Board.

Battery Inputs

Input voltage range	0 - 60 V
Input current	Max. 40 A

High Current Switches

Overcurrent protection	Yes
Settling time	< 50 µs
Configuration switch 0 - switch 4	Switch to +UBatt
Current rating switch 0 - switch 4	20 A
Overall current	Max. 40 A
Resistance of switches to +UBatt (at 10 A)	~ 50 mΩ
Battery voltage	0 V .. +60 V
MRC pull-up/pull-down resistor simulation	130 mA@0...20 V, 70 mA@20...40 V, 50 mA@40...60 V
MRC pull-up/pull-down supply voltage (±UBatt)	0 V ... +60 V

High Current Switch Interface

Configuration	1 interface
Digital output channels	1
Digital output level	TTL
Maximum digital output current	10 mA
Digital input channels	5
Digital input level	TTL
Digital galvanic isolation	No
Interface for versioning data	1
Type of versioning interface	1-Wire®
Galvanic isolation of the versioning interface	Yes
Overvoltage protection for versioning interface	No

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Power Supply Interface

Configuration	1 interface
Output voltages	5 V, ±12 V
Maximum currents	2 A at 5 V 1.5 A at +12 V 1.5 A at -12 V
Protection	Fuses

Environmental Conditions

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

Power Supply

Power consumption	+5 V DC ± 5 %, 300 mA max. ±12 V DC -5% .. ±15 V +5%, 50 mA max.

Dimensions

Height	3 U
Width	8 HP (occupies 2 VME slots)

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