# ES1391.1
# Power Supply Controller Board
User's Guide

## Copyright



R1.0.2 EN - 01.2007 TTN F 00K 102 732

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# 1 Introduction

This section contains information about the basic features and applications of the ES1391.1 Power Supply Controller Board. A block diagram is also included here to show the schematic layout of the board.

**note**

*Some components of the ES1391.1 may be damaged or destroyed by electrostatic discharges. Please keep the board in its storage package until it is installed.*
*The ES1391.1 Power Supply Controller 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 ES1391.1 Power Supply Controller Board may carry dangerous voltages.*
*These voltages may even exist when the ES1391.1 is not installed in the ES4100, ES4105 or ES4300 or the ES4100, ES4105 or ES4300 is powered off.*
*Make sure that the ES1391.1 is protected against contact during operation.*
*Disconnect all connections to the ES1391.1 before removing the board.*

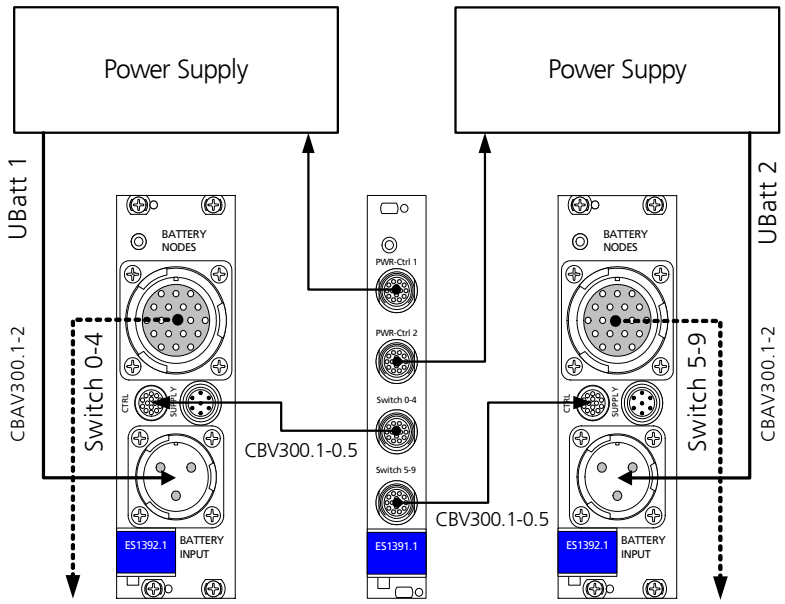


**Fig. 1-1** Use of the ES1391.1 Power Supply Controller Board to Address Two Power Supplies and Two ES1392.1 High Current Switch Boards

The ES1391.1 Power Supply Controller Board has two functions:

- addressing and controlling up to two external power supplies
- addressing up to two ES1392.1 High Current Switch Boards

Thanks to its architecture the ES1391.1 can also be used generally as a D/A and A/D converter board and to acquire and output digital signals.

The ES1391.1 Power Supply Controller Board can be used to simulate two power supplies with e.g. 12 V and 42 V (two-voltage power supply). Up to ten battery nodes can be switched together with the ES1392.1 High Current Switch Board.

The ES1391.1 Power Supply Controller Board has four functional units. Two of these are used to address and control the external power supplies: power supply control units PwrCtrl 0 and PwrCtrl 1 (PwrCtrl: power control). The other two units are used to address the ES1392.1 Boards: switch control units SwCtrl 0 and SwCtrl 1 (SwCtrl: switch control).

The ES1391.1 Power Supply Controller Board has a VMEbus interface which is used to connect it to the VME backplane of the ES4100, ES4105 or ES4300 Signal Box.

## 1.2 Features

The ES1391.1 Power Supply Controller Board has the following features:

- Two 14-pin PwrCtrl connectors for addressing a maximum of two power supplies

  One power supply control unit (PwrCtrl) contains

  – two analog outputs (D/A converters) for setting the target voltage and the target current; output voltage range: 0...10 V, output current: max. 10 mA, D/A converter resolution: 14-bit

  – two analog inputs (A/D converters) for acquiring actual variables (actual voltage and current) of the power supply: input voltage range: 0...10 V, A/D converter resolution: 16-bit

  – three digital inputs for tapping status signals of the power supply, e.g. "overvoltage", "overcurrent" or "overheating"

  – two digital outputs which can be configured for powering on/off the power supply

  – all analog and digital inputs and outputs are galvanically isolated

- Two 14-pin SwCtrl connectors for addressing a maximum of two ES1392.1 High Current Switch Boards

  One switch control unit (SwCtrl) contains

  – five outputs for addressing up to five high-current switches per interface

  – level detection for the main relay signal with pull-up circuit to battery voltage and pull-down circuit to battery ground. The pull-up and pull-down circuit is configured using jumpers

  – an alarm input for monitoring error states such as overcurrent or overheating on the connected ES1392.1 High Current Switch Board

  – programming port for the versioning EEPROM of the connected ES1392.1

- All analog and digital inputs/outputs have an overvoltage and short protection (exception: programming port for the serial EEPROM of the ES1392.1)
- Overvoltage protection ±60 V, short protection against ground
- Simulation of two power supplies with e.g. 12 V and 42 V possible (one ES1392.1 High Current Switch Board is required for each supply voltage)

- Occupies one VME slot

## 1.3 Front Panel

The following figure shows the front panel of the ES1391.1 Power Supply Controller Board

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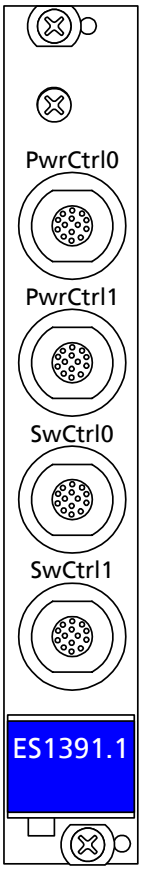


**Fig. 1-2** Front Panel of the ES1391.1 Power Supply Controller Board

## 1.4 Block Diagram

Fig. 1-3 shows the block diagram of the ES1391.1 Power Supply Controller Board.

The individual functions and interfaces of the board are described below.

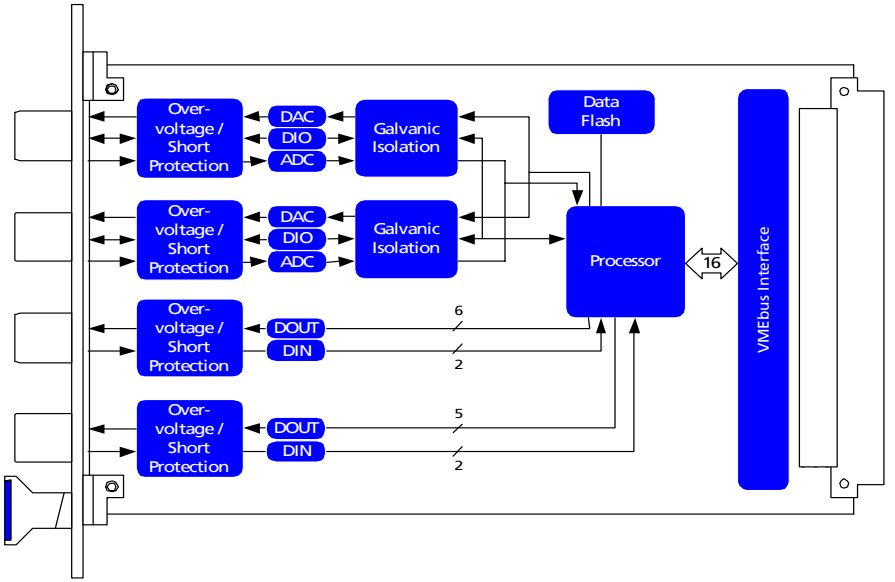


**Fig. 1-3** Block Diagram of the ES1391.1 Power Supply Controller Board

*Overvoltage and Short Protection*

All inputs/outputs of the top two power supply control units have both overvoltage and short protection. All inputs/outputs (digital and analog) are galvanically isolated.

All inputs/outputs of the bottom two switch control units also have both overvoltage and short protection. The only exception is the programming port for the EEPROM of the ES1392.1.

*D/A and A/D Converters*



A D/A converter with 14-bit resolution is used to generate the analog output

### *Motorola MPC555 Processor*

The Motorola MPC555 is the processor used. It is responsible for signal generation, measure variable processing and communication with the VMEbus. It generates the digital and analog output signals and cyclically acquires all digital and analog input signals. For details of the technical data, refer to "Technical Data" on page 39.

### *VMEbus Interface*

The ES1391.1 has a VMEbus slave interface. The base address can be set dynamically by accessing the register or statically using hex switches.

For more information and addressing possibilities, refer to "Addressing the ES1391.1 at the VMEbus" on page 23.

### *Data Flash*

The Data Flash contains versioning information of the ES1391.1 and the calibration data of the analog and digital inputs/outputs.

# 2 Hardware

This chapter contains the descriptions of the hardware of the ES1391.1 Power Supply Controller Board. It consists of the following sections:

- "Power Supply Control Unit" on page 12, description of the inputs/outputs with technical data
  - "Digital Inputs" on page 12
  - "Digital Outputs" on page 13
  - "Analog Inputs" on page 14
  - "Analog Outputs" on page 15
- "Switch Control Unit" on page 17
  - "Functions of the Switch Control Unit" on page 17
  - "Control Output for Battery Nodes 0…4" on page 17
  - "Alarm Input for Error Monitoring" on page 18
  - "+UBatt and -UBatt Contacts" on page 19
  - "Configuration Output for Battery Node 0" on page 19
  - "Main Relay Input (MRC)" on page 20
  - "Programming Port for the EEPROM of the ES1392.1 High Current Switch Board" on page 22
- "Main Relay Function" on page 20: main relay switching and functions
- "Addressing the ES1391.1 at the VMEbus" on page 23
- "Optional Piggybacks" on page 26

## 2.1 Power Supply Control Unit

The power supply control unit has a connector with 14 pins. The unit is used for addressing and controlling an external power supply.

Digital outputs can be configured depending on the power supply used. They can be used, for example, to power on/off the power supply or power on/off the supply voltage of the power supply (e.g. with the ES4080, ES4081 from Takasago). The digital inputs detect overvoltage or overheating of the power supplies. Every analog and digital input/output is galvanically isolated.

### 2.1.1 Digital Inputs

Every digital input has a pull-up/pull-down circuit for power supplies whose status lines have an "open collector" at the output. This circuit is configured using jumpers.

*Block Diagram*

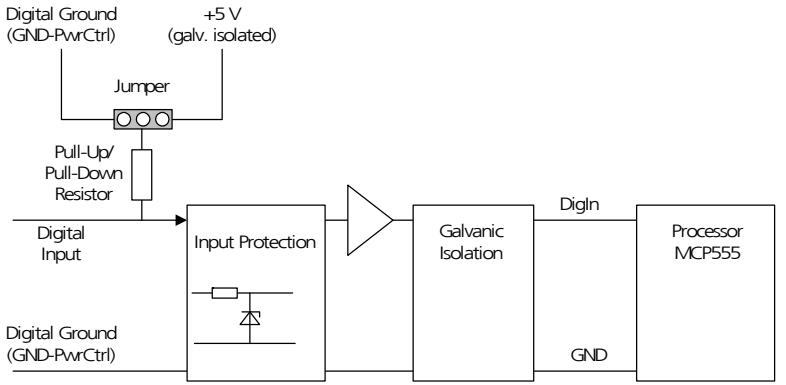


**Fig. 2-1** Block Diagram of the Digital Inputs

For more details on jumper configuration, refer to "Jumper c: Digital Input 0" on page 30.

*Technical Data of the Digital Inputs*

| Input Variable | Data |
|---|---|
| Input voltage | TTL |
| Input current | < 5 mA |
| Overvoltage protection | Yes, to ±60 V |
| Galvanic isolation | Yes |
| Sampling rate | 1 ms |

**Tab. 2-1** Technical Data of the Digital Inputs

### 2.1.2 Digital Outputs

The digital outputs of a power supply control unit can be realized either as simple switching contacts (open collector output) or can be assigned a pull-up to 5 V by setting a jumper (TTL output).

Short-circuit-proof PhotoMOS relays are used as switching contacts. Their turn-on time is approx. 500 µs. Their turn-off time is approx. 80 µs.

The pull-up functionality is realized with constant current sources which provide an output current of 10 mA.

The delay times of the switching contacts are small in comparison to the typical response times of the addressed power supplies. These are over 100 ms when setting voltage states; with high-current circuits the delay time is over 50 ms. This means that the delay time can be ignored with digital outputs.

*Block Diagram*

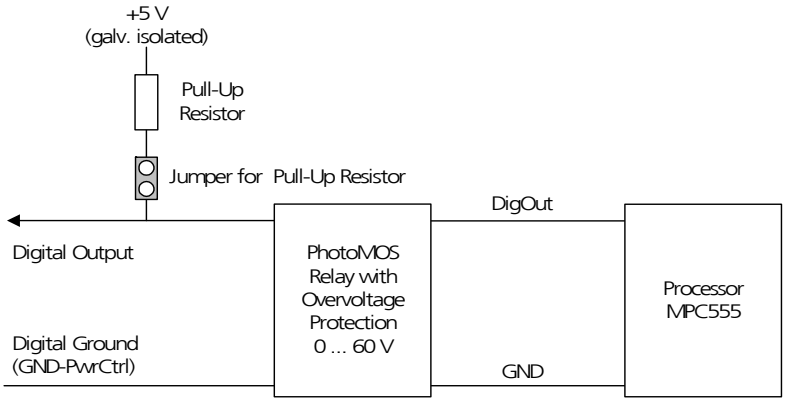


**Fig. 2-2** Block Diagram of the Digital Outputs

For more details on jumper configuration, refer to "Jumper a: Digital Output 0" on page 30 and "Jumper b: Digital Output 1" on page 30.

*Technical Data of the Digital Outputs*

| Output Variable | Data |
|---|---|
| Output voltage | Open collector/TTL |
| Output current | 10 mA |
| Overvoltage protection | Yes, to ±60 V |
| Galvanic isolation | Yes |
| Switching frequency | Max. 500 Hz |

**Tab. 2-2** Technical Data of the Digital Outputs

## 2.1.3 Analog Inputs

Serial A/D converters are used to measure the analog signals of the power supplies. The galvanic isolation takes place in the serial connection between the A/D converter and the MPC555 processor.

*Block Diagram*

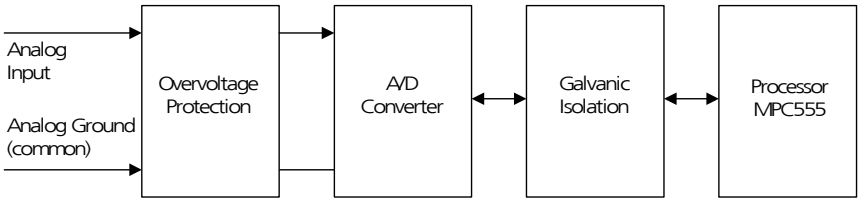


**Fig. 2-3** Block Diagram of the Analog Inputs

*Technical Data of the Analog Inputs*

| Input Variable | Data |
|---|---|
| Input voltage | 0 to 10 V |
| Input impedance | >1 MΩ |
| Accuracy | ±3 mV (10.7-bit) typical |
| Resolution | 16-bit |
| Sampling rate | 1 ms |
| Galvanic isolation | Yes |
| Overvoltage protection | Yes, to ±60 V |

**Tab. 2-3** Technical Data of the Analog Inputs

### 2.1.4 Analog Outputs

Serial D/A converters are used to generate the analog control voltages for the power supply. The galvanic isolation takes place in the serial connection between the D/A converter and the MPC555 processor.

*Block Diagram*

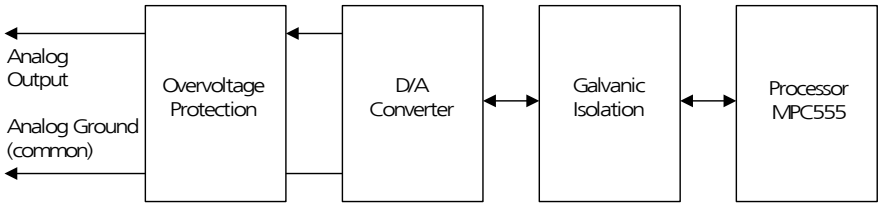


**Fig. 2-4** Block Diagram of the Analog Outputs

*Technical Data of the Analog Outputs*

| Output Variable | Data |
|---|---|
| Output voltage | 0 to 10 V |
| Output current | 10 mA |
| Resolution | 14-bit |
| Accuracy | ±2 mV (11.2-bit) typical |
| Galvanic isolation | Yes |
| Overvoltage protection | Yes, to ±60 V |

**Tab. 2-4** Technical Data of the Analog Outputs

## 2.2 Switch Control Unit

The switch control unit has a connector with 14 pins. It provides control signals for addressing the battery nodes (relays) of the ES1392.1 High Current Switch Board. The pins also have other functions which are explained below.

### 2.2.1 Functions of the Switch Control Unit

- Control output for battery nodes 0…4
- Configuration output for battery node 0
- Alarm input for error monitoring
- Main relay control input (MRC = Main Relay Control)
- Programming port for the EEPROM of the ES1392.1)

### 2.2.2 Control Output for Battery Nodes 0…4

This output switches the relevant relay on the ES1392.1. H level activates the relay, i.e. it is closed, L level deactivates the relay, i.e. it is opened. An open output is brought down to L level on the ES1392.1 by pull-down. This means that if an output is open, the battery node is deactivated.

| Control Signal | Switch |
|---|---|
| L/open | Open |
| H | Closed |

**Tab. 2-5** Control Signal and Switch Position when Addressing the Battery Node

The following table shows the technical data of the control output for battery node x

| Control Output of Battery Node x | Data |
|---|---|
| Output voltage | TTL |
| Output current | 10 mA |
| Galvanic isolation | No |
| Overvoltage protection | Yes, to ±60 V |

**Tab. 2-6** Technical Data of the Control Output for Battery Node x

### 2.2.3 Alarm Input for Error Monitoring

The ES1391.1 Power Supply Controller Board is informed of any errors, e.g. overcurrent or overheating at the battery node, by the ES1392.1 High Current Switch Board via the alarm input.

The user can define the reaction of the ES1391.1 firmware when an error arises via the RTIO configuration software. The ES1391.1 can power off both, one or none of the power supplies addressed by the ES1391.1 as a reaction to an active alarm signal.

If an error is detected at one of the battery nodes on the ES1392.1 High Current Switch Board, the ES1392.1 opens the relevant node. After a delay time of max. 800 ms, the node is automatically opened again to check whether the error has been recovered. The node is opened immediately when an overcurrent reoccurs. This is repeated until no overcurrent occurs. This also has an effect on the power supplies connected to the ES1391.1 Power Supply Controller Board.

**note**

*The cyclical current pulses during an overcurrent can exceed the current limitation of some power supplies. In this case, the battery voltage should be buffered with a large capacitor at the output of the power supply or a low-impedance power resistor should be inserted into the battery voltage line to limit the current.*

| State | Status Signal |
|---|---|
| Normal operation | L |
| Error | H |

**Tab. 2-7** Level at the Alarm Input during Normal Operation and an Error

The following table contains the technical data of the alarm input:

| Alarm Input | Data |
|---|---|
| Input voltage | TTL |
| Input current | <1 mA |
| Galvanic isolation | No |
| Overvoltage protection | Yes, to ±60 V |

**Tab. 2-8** Technical Data of the Alarm Input for Error Monitoring

### 2.2.4 +UBatt and -UBatt Contacts

These contacts carry the supply voltage for the pull-up and pull-down resistors of the main relay input (MRC).

The following table contains the technical data of the +UBatt and –UBatt contacts:

| +UBatt/-UBatt Contact | Data |
|---|---|
| Input voltage | 0 to 60 V |
| Input current | Max. 1 A |
| Galvanic isolation | Yes |
| Overvoltage protection | Yes, to 60 V |

**Tab. 2-9** Technical Data of the +UBatt and –UBatt Contacts

### 2.2.5 Configuration Output for Battery Node 0

Battery node 0 on the ES1392.1 High Current Switch Board can be switched against the battery voltage +UBatt and also (alternatively) against the battery ground –UBatt.

If high is pending at the configuration output, battery node 0 switches to battery ground; if low is pending, the battery node switches to battery voltage.

| Level at the Configuration Output | Response of Battery Node 0 |
|---|---|
| L (Low) | Switches to battery voltage |
| H (High) | Switches to battery ground |

**Tab. 2-10** Response of Battery Node 0 Depending on the Level at the Configuration Output

The following table contains the technical data:

| Control Output of Battery Node x | Data |
|---|---|
| Output voltage | TTL |
| Output current | 10 mA |
| Galvanic isolation | No |
| Overvoltage protection | Yes, to ±60 V |

**Tab. 2-11** Technical Data of the Configuration Output for Battery Node 0

### 2.2.6 Main Relay Input (MRC)

Depending on the signal at the main relay input, the battery nodes can be activated or deactivated. The user defines which battery nodes depend on the main relay and whether the main relay signal is high-active or low-active via the RTIO.

The following table contains the technical data of the main relay input:

| Main Relay Input | Data |
|---|---|
| Input voltage | 0 to 60 V |
| Input current | 0-20 V: 100 mA, 20-40 V: 50 mA, 40-60 V: 33 mA |
| Galvanic isolation | Yes |
| Overvoltage protection | Yes, to ±60 V |

**Tab. 2-12** Technical Data of the Main Relay Input

*Main Relay Function*

The ES1391.1 makes it possible to evaluate an existing signal from the connected ECU directly in the hardware for addressing a main relay (MRC=Main Relay Control) and to include this in the activation/deactivation of the individual battery nodes. The ECU signal is accepted by the ES1392.1 High Current Switch Board and routed from this board to the main relay input of the ES1391.1.

Depending on the state of the main relay signal, individual battery nodes can be activated. The battery nodes dependent on the MRC signal are defined using the RTIO configuration software.

The main relay input of the ES1391.1 Power Supply Controller Board can be assigned a pull-up to battery voltage or a pull-down to battery ground.

A subsequent comparison with the half battery voltage returns logical level information (high or low) which is supplied to the processor. The processor then decides whether the signal is active or inactive based on the polarity set by the user for the main relay signal (low-active or high-active) via the RTIO configuration software. The processor closes or opens those battery nodes which are controlled by the status of the main relay input in accordance with this active/inactive information.

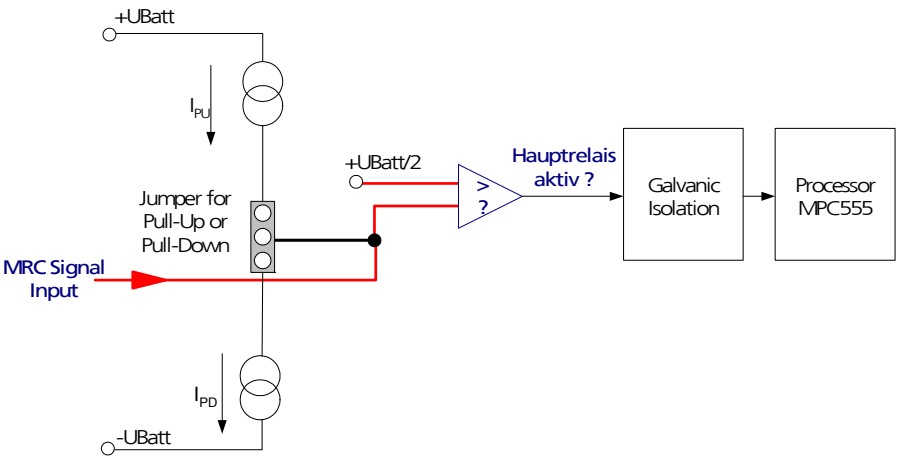


**Fig. 2-5** Logic and Jumper Function with Main Relay Function

Whether the main relay signal is assigned a pull-up or pull-down circuit is selected using jumpers (for more details on the configuration of the jumpers, refer to "JP0: Configuration of the Main Relay Input for Switch Control Unit 0" on page 29 and "JP1: Configuration of the Main Relay Input for Switch Control Unit 1" on page 29). The user specifies the circuit of the main relay input via the jumpers.

The pull-up/pull-down function on the ES1391.1 is realized with current sources. The current sources are designed to return different currents for the simulation of the pull-up and pull-down resistors depending on the pending battery voltage +UBatt.

| Battery Voltage +UBatt | Size |
|---|---|
| 0 to 20 V | 100 mA |
| 20 to 40 V | 50 mA |
| 40 to 60 V | 33 mA |

**Tab. 2-13** Dependency of the Current on the Battery Voltage

### 2.2.7 Programming Port for the EEPROM of the ES1392.1 High Current Switch Board

Via this port, the EEPROM of the ES1392.1 High Current Switch Board is read and programmed by the ES1391.1. The ES1391.1 then transfers the data to the host system. This means that the configuration and versioning information can be read from the EEPROM.

The EEPROM is accessed via a 1-Wire® interface.

| Programming Port | Data |
|---|---|
| Input voltage | TTL |
| Galvanic isolation | No |
| Overvoltage protection | No |

**Tab. 2-14** Technical Data of the Programming Port for the EEPROM

## 2.3 Addressing the ES1391.1 at the VMEbus

The ES1391.1 Power Supply Controller Board can be operated both in VMEbus and in VME64x systems with geographical addressing. With two rotary switches, SW1 and SW2, the board is addressed in the relevant address spaces in the setting "0x00" in "geographical addressing mode" and in all other settings.

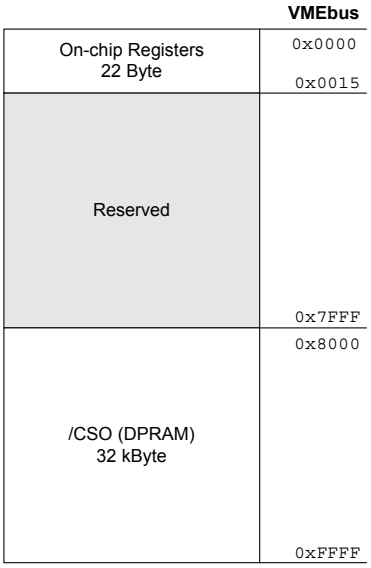


**Fig. 2-6** Address Map

In the "0x00" setting, the ES1391.1 Board overlays 256 bytes into the A24 address space depending on the slot position. Depending on the available memory area, the 64 kB address space is then assigned dynamically by the system controller.

| Slot Position | Address | VME Interface (Control Register) |
|---|---|---|
| 1 | E0E000 - E0E0FF | 256 bytes |
| 2 | E0E100 - E0E1FF | 256 bytes |
| 3 | E0E200 - E0E2FF | 256 bytes |
| 4 | E0E300 - E0E3FF | 256 bytes |
| 5 | E0E400 - E0E4FF | 256 bytes |
| 6 | E0E500 - E0E5FF | 256 bytes |
| 7 | E0E600 - E0E6FF | 256 bytes |
| 8 | E0E700 - E0E7FF | 256 bytes |
| 9 | E0E800 - E0E8FF | 256 bytes |
| 10 | E0E900 - E0E9FF | 256 bytes |
| 11 | E0EA00 - E0EAFF | 256 bytes |
| 12 | E0EB00 - E0EBFF | 256 bytes |
| 13 | E0EC00 - E0ECFF | 256 bytes |
| 14 | E0ED00 - E0EDFF | 256 bytes |
| 15 | E0EF00 - E0EFFF | 256 bytes |
| 16 | E0F000 - E0F0FF | 256 bytes |
| 17 | E0F100 - E0F1FF | 256 bytes |
| 18 | E0F200 - E0F2FF | 256 bytes |
| 19 | E0F300 - E0F3FF | 256 bytes |
| 20 | E0F400 - E0F4FF | 256 bytes |

**Tab. 2-15** Slot Position and Address

The 64 kB address space is assigned statically with every other setting of the hex switches (≠ 0x00).

| Switch Setting | Address Space |
|---|---|
| 0x01 | 010000 - 01FFFF |
| 0x02 | 020000 - 02FFFF |
| 0x03 | 030000 - 03FFFF |
| .. | . |
| .. | . |
| .. | . |
| 0xFF | FF0000 - FFFFFF |

**Tab. 2-16** Address Space Settings

| SW1 | SW2 |
|---|---|
| 0x**n**0 | 0x0**n** |
| Address A23 - A20 | Address A16 - A19 |

**Tab. 2-17** Switch for Address Setting

**Example:**

Required: base address A24 at 0xC20000

Settings: SW1=0xC, SW2=0x2

**note**

*The default setting is: SW1=0x0, SW2=0x0*

## 2.4 Optional Piggybacks

The main relay outputs of some ECUs make increased requirements of the impedance resp. of the pull-up and pull-down currents of the main relays.

The optional piggyback enables the user to increase the pull-up and pull-down currents of the main relay input by connecting other current sources or resistors in parallel and thus to reduce the input impedance in accordance with the specific requirement..

**note**

*Project-specific piggybacks are developed by ETAS as part of the engineering services.*

# 3 Jumper Assignment

The ES1391.1 Power Supply Controller Board has five jumpers, seven connectors, one DIP switch and two Hex switches for configuration and allocation of the board.

This chapter explains which jumpers, connectors and switches are relevant for the user, describes their functions and how they can be set.

*Position of the Jumpers on the Board*

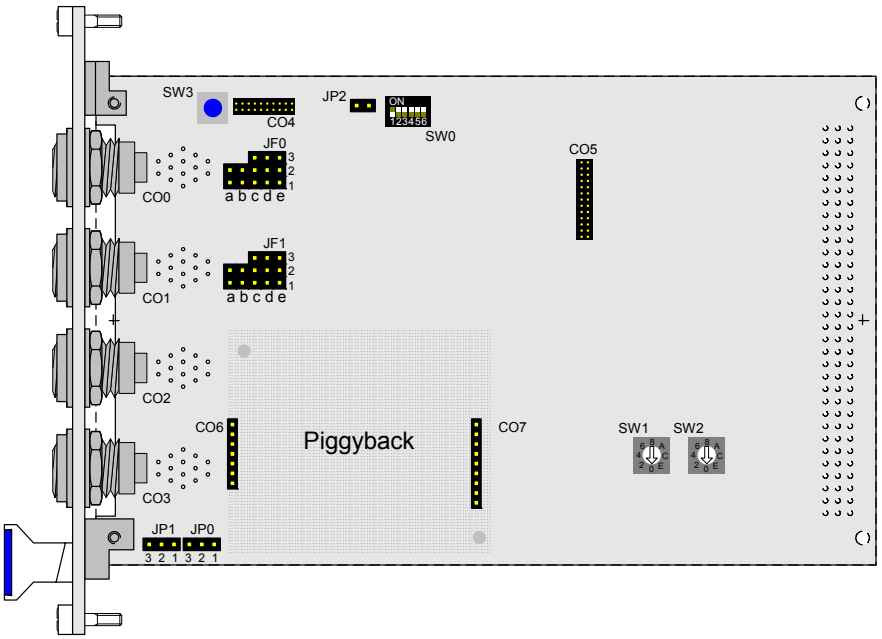


**Fig. 3-1** Jumpers, Connectors and Switches on the ES1391.1

*Connector Function*

| Connector | Function |
|---|---|
| CO0 | Power supply control unit 0 (PwrCtrl 0) |
| CO1 | Power supply control unit 1 (PwrCtrl 1) |
| CO2 | Switch control unit 0 (SwCtrl 0) |
| CO3 | Switch control unit 1 (SwCtrl 1) |
| CO4 | **Not** relevant for users (multiple connector, functions: RS232, debug interface, JTAG interface, boundary scan interface) |
| CO5 | Reserved |
| CO6 | 1st post rail for piggyback |
| CO7 | 2nd post rail for piggyback |

*Function of the Button, the DIP Switch and the Hex Switches*

| Switch | Function |
|---|---|
| SW0 | **Not** relevant for users<br>(boot configuration of the MPC555) |
| SW1 | Setting the addresses on the VMEbus |
| SW2 | Setting the addresses on the VMEbus |
| SW3 | Board's reset switch |

## 3.1 Jumper Description

| Jumper Name | Function |
|---|---|
| JP0 | Configuration of the main relay input for switch control unit 0 |
| JP1 | Configuration of the main relay input for switch control unit 1 |
| JP2 | Configuration debug port, jumper is **not** relevant for users |
| JF0 | Configuration of power supply control unit 0 |
| JF1 | Configuration of power supply control unit 1 |

### 3.1.1 JP0: Configuration of the Main Relay Input for Switch Control Unit 0

| Position | Function |
|---|---|
| 1-2 | Pull-up circuit to +UBatt active |
| 2-3 | Pull-down circuit to -UBatt (ground) active |
| open | Pull-down/pull-up circuit open |

### 3.1.2 JP1: Configuration of the Main Relay Input for Switch Control Unit 1

| Position | Function |
|---|---|
| 1-2 | Pull-up circuit to +UBatt active |
| 2-3 | Pull-down circuit to -UBatt (ground) active |
| open | Pull-down/pull-up circuit open |

### 3.1.3 Jumper fields JF0 and JF1: Configuration of the Power Supply Control Units PwrCtrl 0 and PwrCtrl 1

JF0: Configuration of PwrCtrl 0

JF1: Configuration of PwrCtrl 1

Each jumper field consists of jumpers a to e.

*Jumper a: Digital Output 0*

| Position | Function |
|---|---|
| set | Pull-up active |
| open | Open collector output |

*Jumper b: Digital Output 1*

| Position | Function |
|---|---|
| set | Pull-up active |
| open | Open collector output |

*Jumper c: Digital Input 0*

| Position | Function |
|---|---|
| 1-2 | Pull-down circuit active |
| 2-3 | Pull-up circuit active |
| open | Pull-down/pull-up circuit open/inactive |

*Jumper d: Digital Input 1*

| Position | Function |
|---|---|
| 1-2 | Pull-Down circuit active |
| 2-3 | Pull-up circuit active |
| open | Pull-down/pull-up circuit open/inactive |

*Jumper e: Digital Input 2*

| Position | Function |
|---|---|
| 1-2 | Pull-down circuit active |
| 2-3 | Pull-up circuit active |
| open | Pull-down/pull-up circuit open/inactive |

# 4 Pin Assignment

This chapter explains the pin assignment of the connectors of the power supply control and switch control units of the ES1391.1 Power Supply Controller Board.

These are:

- "Assignment of the Connectors for the Power Supply Control Units PwrCtrl 0 and 1" on page 31
- "Assignment of the Connectors for the Switch Control Units SwCtrl 0 and 1" on page 33

## 4.1 Assignment of the Connectors for the Power Supply Control Units PwrCtrl 0 and 1

Type: Lemo ECG.1B.314.NLV

Assignment of the PwrCtrl connector (view from the plug-in side).

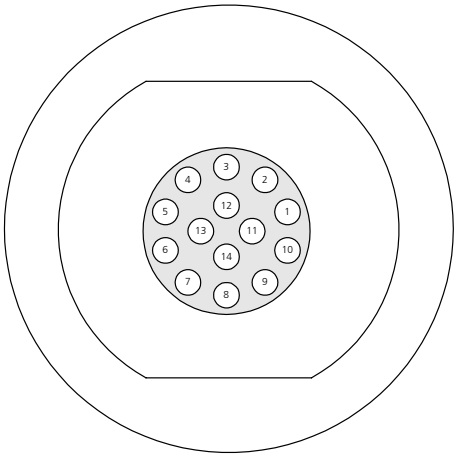


**Fig. 4-1** PwrCtrl Connector Pins

| Pin | Signal |
|---|---|
| 1 | Analog output 0 signal |
| 2 | Analog output 0 GND |
| 3 | Analog output 1 signal |
| 4 | Analog output 1 GND |
| 5 | Analog input 0 signal |
| 6 | Analog input 0 GND |
| 7 | Analog input 1 signal |
| 8 | Analog input 1 GND |
| 9 | Digital output 0 signal |
| 10 | Digital output 1 signal |
| 11 | Digital input 0 signal |
| 12 | Digital input 1 signal |
| 13 | Digital input 2 signal |
| 14 | Digital GND |

**Tab. 4-1** Pin Assignment of the PwrCtrl Connectors

The mating connector is of type Lemo FGG.1B.314.CLAD76

## 4.2 Assignment of the Connectors for the Switch Control Units SwCtrl 0 and 1

Type: Lemo ECG.1B.314.NLV

Assignment of the SwCtrl connector (view from the plug-in side).

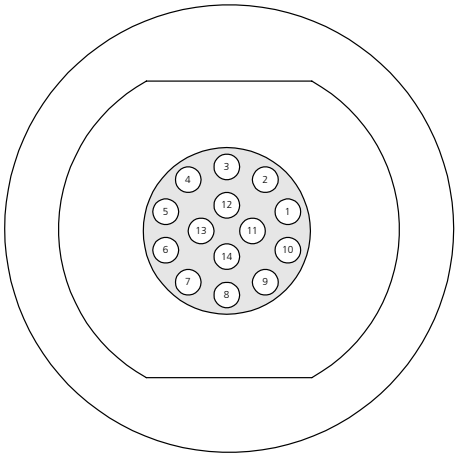


**Fig. 4-2** SwCtrl Connector Pins

| Pin | Signal |
|---|---|
| 1 | Control output switch 0 |
| 2 | Control output switch 1 |
| 3 | Control output switch 2 |
| 4 | Control output switch 3 |
| 5 | Control output switch 4 |
| 6 | Not assigned |
| 7 | Alarm input for error statuses |
| 8 | Battery voltage +UBatt |
| 9 | Battery ground (-UBatt) |
| 10 | Configuration output for node 0 |
| 11 | Main relay input (MRC) |
| 12 | Ground node 0-4/ ground alarm signal |
| 13 | ES1392.1 EEPROM signal |
| 14 | ES1392.1 EEPROM ground |

**Tab. 4-2** SwCtrl Connector Pin Assignment

The mating connector is of type Lemo FGG.1B.314.CLAD76

# 5 Accessories

## 5.1 Cables

Two cables are necessary to connect the ES1391.1 Power Supply Controller Board: these are described below.

### 5.1.1 CBAV310.1-2 Cable between the ES1391.1 and the Power Supply for Battery Voltages ES4080, ES4081

| **Product Data** | |
|---|---|
| Short name | CBAV310.1-2 |
| Long name | Cable Lemo 1B FGG-Hirose DX30 (14mc-28mc, 2m) |
| Product part number | F 00K 103 224 |

| **Specification** | |
|---|---|
| Cable length | 2 m |
| Type | 14-wire |

| **Connector** | |
|---|---|
| To the ES1391.1 | Lemo FGG.1B.314.CLAD76 |
| To the power supply | Hirose HRS DX30-28P |

| **Function** | **ES1391.1 LEMO FGG Connection** | **Power Supply Connection Hirose HRS** |
|---|---|---|
| Target voltage | 1 | 2 |
| Target voltage ground | 2 | 3 |
| Target current | 3 | 8 |
| Target current ground | 4 | 3 |
| Actual voltage | 5 | 18 |

| Function | ES1391.1 LEMO FGG Connection | Power Supply Connection Hirose HRS |
|---|---|---|
| Actual voltage ground | 6 | 3 |
| Actual current | 7 | 19 |
| Actual current ground | 8 | 3 |
| Output on/off | 9 | 23 |
| AC input on/off | 10 | 22 |
| Alarm | 11 | 27 |
| CV status (voltage) | 12 | 12 |
| CC status (current) | 13 | 13 |
| Ground (DGND) | 14 | 28 |
| Protective earth (PE) | Front panel | Front panel |

### 5.1.2 CBV300.1-0.5 Cable: Connection between the ES1391.1 and the ES1392.1

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

| Specification | |
|---|---|
| Cable length | 0.5 m |
| Type | 14-wire |

| Connector | |
|---|---|
| To the ES1391.1 | Lemo FGG.1B.314.CLAD76 (connection, solder version) |
| To the ES1392.1 | Lemo FGG.1B.314.CLAD76 (connection, solder version) |

| Function | ES1391.1 LEMO FGG Connection | ES1392.1 LEMO FGG Connection |
|---|---|---|
| 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 alarm | 7 | 7 |
| +UBatt | 8 | 8 |
| -UBatt | 9 | 9 |
| Configuration of switch 0 | 10 | 10 |
| MRC signal | 11 | 11 |
| Ground – switches 0-4 | 12 | 12 |
| ES1392.1 EEPROM signal | 13 | 13 |
| ES1392.1 EEPROM ground | 14 | 14 |
| Protective earth (PE) | Front panel | Front panel |

# 6 Technical Data

This chapter contains the technical data of the ES1391.1 Power Supply Controller Board.

The technical data on the power supply control units and the switch control units are described in the relevant sections. "Power Supply Control Unit" on page 12, "Switch Control Unit" on page 17.

*Power Supply Control Interface*

| | |
|---|---|
| Configuration | 2 interfaces |
| Analog output channels | 2 per interface |
| Analog output resolution | 14-bit |
| Analog output accuracy | ±2 mV (11.2-bit) typical |
| Analog output voltage | 0 ... 10 V |
| Analog output current | Max. 10 mA |
| Analog input channels | 2 |
| Analog input resolution | 16-bit |
| Analog input accuracy | ±3 mV (11.7-bit) typical |
| Analog input voltage | 0 ... 10 V |
| Analog input impedance | > 1 MOhm |
| Digital output channels | 2 |
| Digital output level | Open collector/TTL (jumper configurable) |
| Digital output current | Max. 10 mA |
| Digital input channels | 3 |
| Digital input level | TTL with jumper configurable pull-up or pull-down circuitry |
| Digital input current | < 5 mA |
| Galvanic isolation | Yes |
| Overvoltage protection | ±60 V |

*Switch Control Interface*

| | |
|---|---|
| Configuration | 2 interfaces |
| Switch control output channels | 5 |
| Switch control output level | TTL |
| Switch control output current | Max. 10 mA |
| Alarm input channels | 1 |
| Alarm input level | TTL |
| Alarm input current | < 1 mA |
| Overvoltage protection | Yes |
| MRC (main relay control) input level | 0...60 V |
| MRC pull-up/pull-down resistor simulation | 130 mA@0...20 V<br>70 mA@20...40 V<br>50 mA@40...60 V |
| MRC pull-up/down supply voltage (±UBatt) | 0...60 V |
| External versioning interface | 1 (1-Wire®) |
| Galvanic isolation | No |
| Overvoltage protection for versioning interface | No |

*Microprocessor*

| | |
|---|---|
| Main processor | Motorola MPC555, 40 MHz, 32-bit |
| Memory | 512 kByte external SRAM<br>512 kByte serial Flash memory<br>32 kByte Dual Ported RAM for the VMEbus |

### *VME Conformity*

| | |
|---|---|
| VME specification | Revision C.1, October 1985 and<br>IEC 821-1987 |
| Type | Slave<br>with geographical addressing in acc. with VME64x |
| Address/data bus | A24:D16 |
| Address modifier | 39 (hex):<br>A24 non-privileged data access |
| Base address | $000000-FF0000 jumper-programmable or by<br>VME64x backplane slot detection automatically |
| Memory map | Standard I/O space, occupying 64 kB |
| Backplane | 160-pin VME64 connector strip |
| Interrupts | Single level, IRQ 1 – 7<br>By software:<br>– IRQ level<br>– interrupt vector source |

### *Power Supply*

| | |
|---|---|
| Current consumption | +5 V DC ±5%, 1850 mA max. |

### *Environmental Conditions*

| | |
|---|---|
| Operating temperature | 0 °C to 70 °C (32 °F to 158 °F) |
| Storage temperature | -55 °C to +85 °C (-67 °F to 185 °F) |
| Relative humidity | 0 to 95% (non-condensing) |

### *Dimensions*

| | |
|---|---|
| Height | 3 U |
| Width | 4 HP (occupies 1 VME slot) |

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