Power Supply System ~ Telecom

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User's Guide

# Smartpack Controllers


## Monitoring and Control Units

Powerpack, Flatpack2 & Minipack
DC Power Supply Systems

350003.013

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# Safety Precautions

- ☑ The equipment described in this manual must only be operated by Eltek Valere personnel or by persons who have attended a suitable Eltek Valere training course
- ☑ The equipment represents an energy hazard and failure to observe this could cause terminal injury and invalidate our warranty
- ☑ There are hazardous voltages inside the power system. As the modules incorporate large charged capacitors, it is dangerous to work inside the system even if the mains supply is disconnected
- ☑ Products into which our components are incorporated have to comply with a number of requirements. Installation is to be in accordance with the recommendations herein
- ☑ Please read the manual carefully before using the equipment

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# Table of Contents

# 1. Introduction

*Smartpack* controllers are powerful and cost-effective modules, developed for monitoring and controlling a wide range of *Eltek Valere's* DC power supply systems, such as *Powerpack, Flatpack2* and *Minipack* DC power systems.

## About this Guide

This booklet provides users of *Smartpack*-based DC power systems with the required information for operating the system using the *Smartpack*'s front panel. The booklet also describes the *Smartpack* controller's building blocks, external connections and technical specifications, as well as available controller options and other CAN bus nodes.

Read also the generic and site specific documentation for your *Smartpack*-based DC power system.

For detailed functionality description, browse and search through *PowerSuite Online Help*.

## System Diagram — Flatpack2 Power System

In the *Flatpack2 PS* system shown in Figure 1, the *Smartpack* controller monitors and controls the whole system, and serves as the local user interface between you and the system. The *Po*werSuite application is used for remote operation and system configuration.

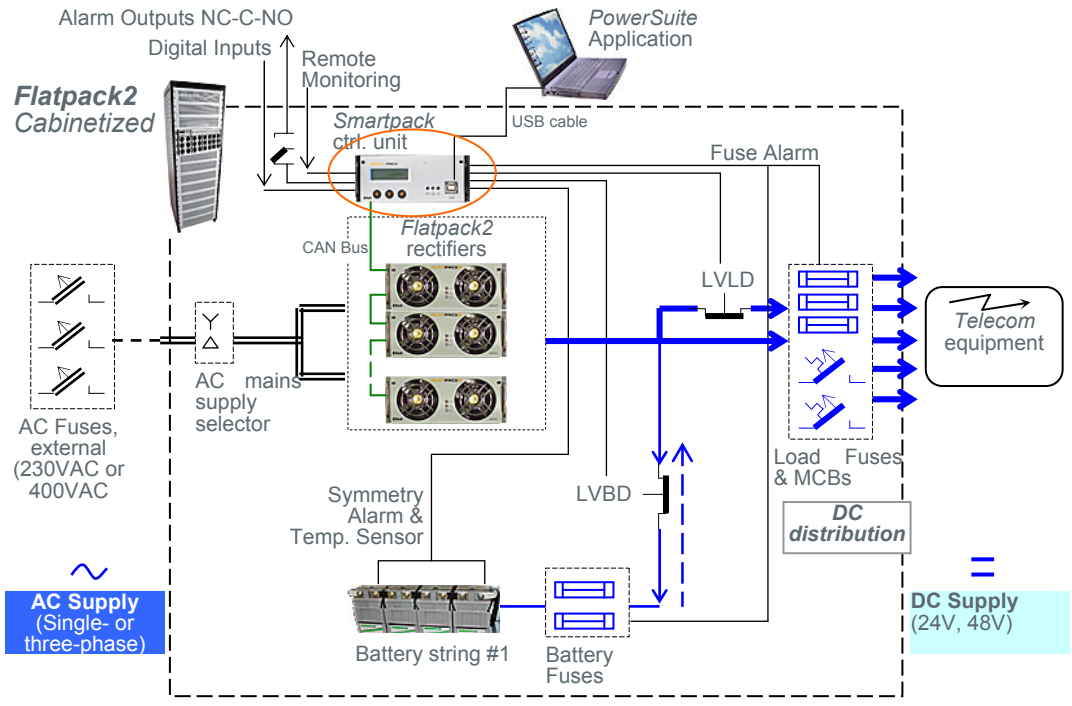



*Figure 1 Example of a typical* Flatpack2 PS *system for DC power supply of telecom equipment. The system is fed from an external AC mains supply, and consists of rectifiers in power shelves, a control unit and DC distribution unit. Battery banks, LVD contactors, etc. are typically also a part of the system.*

# 2. Control Units

The control system — in Eltek Valere DC power systems — consists of control units or hardware devices connected to the system's CAN bus. Several types of control units may be connected, such as:

- *Smartpack* controllers, see page 9
- *Smartnode* control units, see page 24
- Battery Monitors, see page 25
- Load Monitors, see page 26
- I/O Monitors, see page 27
- Mains Monitors
- CAN Power Unit, see page 28
- Other CAN nodes

## CAN bus

The *Smartpack*-based DC power systems utilize the CAN[1] bus — a digital interface architecture that supports a dedicated communication channel between the control units and each of the rectifiers.

### CAN bus Addressing

All rectifiers, *Smartpack* controllers and other control units connected to the *Eltek Valere*'s CAN bus must have a unique address or ID number.

The control system's master controller assigns automatically the rectifiers' addresses (**software assignment**).

The control system's controllers and control units use DIP switches for configuring their unique CAN bus ID number (**hardware assignment**)

#### Software Assignment — Rectifiers

Each rectifier in the *Smartpack*-based DC power system is automatically configured by the *Smartpack* controller with a unique CAN bus ID number (software-assignment).

When the rectifiers are hot-plugged in the power shelves the first time, the *Smartpack* controller dynamically assigns the rectifiers with the next available ID number (software-assignment), and automatically increases the number of communicating rectifiers on the CAN bus. Also, the controller registers the rectifiers' ID numbers, or CAN bus address (01, 02…), together with their serial numbers.

When a previously installed rectifier is hot-plugged in the power shelf again, it retains its previous ID and serial number, unless reassigned during a Reset Rectifier command.

When a new *Smartpack* controller is inserted in an existing system, the controller will recalculate the number of connected rectifiers, reassigning them with the same ID numbers as they already have in memory.

[1] Control Area Network. Serial protocol utilised for communication between *Eltek Valere*'s rectifiers and controllers

## Hardware Assignment — Control Units

The control system consists of one or several CAN bus connected control units. The control units are factory configured with a unique CAN bus ID number, using DIP switches on the side of units (hardware-assignment).

For example, in a distributed DC power system with several *Smartpack* controllers, the master is configured with ID # <1>, the slave with ID # <2> and so on. Refer to the table in this chapter and Figure 3, page 8.

## CAN Bus Address Range — Control Units

You can address a maximum of 14 control units of each type — Smartpack controllers, Smartnode units, Battery Monitors, Load Monitors, etc. — to the control system's CAN bus. See table below:

| Number of nodes | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Smartpack Controllers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | <-- ID # |
| Smartnode Control Units | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | <-- ID # |
| Battery Monitor CAN nodes | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | <-- ID # |
| Load Monitor CAN nodes** | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | <-- ID # |
| | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | <-- ID # |
| I/O Monitor CAN nodes | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | <-- ID # |
| Mains Monitor nodes | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | <-- ID # |

ID numbers in red are not available due to software constraints.
** Only 4 of the 8 mounted DIP switches may be used (max. 14 Load Monitors may be connected).

The table below shows examples of the DIP switch position on Smartpack controllers, Smartnode control units and other CAN bus nodes:

| **Smartpack** Controller | ID # | DIP Switch Position 1 -- 2 -- 3 -- 4 |
|---|---|---|
| (Master) Controller 1 | 1 | OFF--OFF--OFF--OFF |
| (Slave) Controller 2 | 2 | **ON**--OFF--OFF--OFF |
| (Slave) Controller 3 | 3 | OFF-- **ON**--OFF--OFF |
| (Slave) Controller 4 | 4 | **ON**-- **ON**--OFF--OFF |
| (Slave) Controller 5 | 5 | OFF--OFF-- **ON**--OFF |
| (Slave) Controller 6 | 6 | **ON**--OFF-- **ON**--OFF |
| (Slave) Controller 7 | 7 | OFF-- **ON**-- **ON**--OFF |
| (Slave) Controller 8 | 8 | **ON**-- **ON**-- **ON**--OFF |
| (Slave) Controller 9 | 9 | OFF--OFF--OFF-- **ON** |
| (Slave) Controller 10 | 10 | **ON** --OFF--OFF-- **ON** |
| (Slave) Controller 11 | 11 | OFF-- **ON** --OFF-- **ON** |
| (Slave) Controller 12 | 12 | **ON** -- **ON** --OFF-- **ON** |
| (Slave) Controller 13 | 13 | OFF--OFF-- **ON** -- **ON** |
| (Slave) Controller 14 | 14 | **ON** --OFF-- **ON** -- **ON** |

Note that the controller's ID # corresponds to the DIP switch's binary value plus one.

| **Smartnode** Control Unit | ID # | DIP Switch Position 1 -- 2 -- 3 -- 4 |
|---|---|---|
| Smartnode 1 | 17 | OFF--OFF--OFF--OFF |
| Smartnode 2 | 18 | **ON**--OFF--OFF--OFF |
| Smartnode 3 | 19 | OFF-- **ON**--OFF--OFF |
| Smartnode 4 | 20 | **ON**-- **ON**--OFF--OFF |
| Smartnode 5 | 21 | OFF--OFF-- **ON**--OFF |
| Smartnode 6 | 22 | **ON**--OFF-- **ON**--OFF |
| Smartnode 7 | 23 | OFF-- **ON**-- **ON**--OFF |
| Smartnode 8 | 24 | **ON**-- **ON**-- **ON**--OFF |
| Smartnode 9 | 25 | OFF--OFF--OFF-- **ON** |
| Smartnode 10 | 26 | **ON** --OFF--OFF-- **ON** |
| Smartnode 11 | 27 | OFF-- **ON** --OFF-- **ON** |
| Smartnode 12 | 28 | **ON** -- **ON** --OFF-- **ON** |
| Smartnode 13 | 29 | OFF--OFF-- **ON** -- **ON** |
| Smartnode 14 | 30 | **ON** --OFF-- **ON** -- **ON** |

Note that the unit's ID # corresponds to the DIP switch's binary value plus one.

| **Battery Monitor** | ID # | DIP Switch Position 1 -- 2 -- 3 -- 4 |
|---|---|---|
| Node 1 | 33 | OFF--OFF--OFF--OFF |
| Node 2 | 34 | **ON**--OFF--OFF--OFF |
| Node 3 | 35 | OFF-- **ON**--OFF--OFF |
| Node 4 | 36 | **ON**-- **ON**--OFF--OFF |
| Node 5 | 37 | OFF--OFF-- **ON**--OFF |
| Node 6 | 38 | **ON**--OFF-- **ON**--OFF |
| Node 7 | 39 | OFF-- **ON**-- **ON**--OFF |
| Node 8 | 40 | **ON**-- **ON**-- **ON**--OFF |
| Node 9 | 41 | OFF--OFF--OFF-- **ON** |
| Node 10 | 42 | **ON** --OFF--OFF-- **ON** |
| Node 11 | 43 | OFF-- **ON** --OFF-- **ON** |
| Node 12 | 44 | **ON** -- **ON** --OFF-- **ON** |
| Node 13 | 45 | OFF--OFF-- **ON** -- **ON** |
| Node 14 | 46 | **ON** --OFF-- **ON** -- **ON** |

Note that the node's ID # corresponds to the DIP switch's binary value plus one.

| **Load Monitor** | ID # | DIP Switch Position 1 -- 2 -- 3 -- 4 |
|---|---|---|
| Node 1 | 49 | OFF--OFF--OFF--OFF |
| Node 2 | 50 | **ON**--OFF--OFF--OFF |
| Node 3 | 51 | OFF-- **ON**--OFF--OFF |
| Node 4 | 52 | **ON**-- **ON**--OFF--OFF |
| Node 5 | 53 | OFF--OFF-- **ON**--OFF |
| Node 6 | 54 | **ON**--OFF-- **ON**--OFF |
| Node 7 | 55 | OFF-- **ON**-- **ON**--OFF |
| Node 8 | 56 | **ON**-- **ON**-- **ON**--OFF |
| Node 9 | 57 | OFF--OFF--OFF-- **ON** |
| Node 10 | 58 | **ON** --OFF--OFF-- **ON** |
| Node 11 | 59 | OFF-- **ON** --OFF-- **ON** |
| Node 12 | 60 | **ON** -- **ON** --OFF-- **ON** |
| Node 13 | 61 | OFF--OFF-- **ON** -- **ON** |
| Node 14 | 62 | **ON** --OFF-- **ON** -- **ON** |

Note that the node's ID # corresponds to the DIP switch's binary value plus one.

## CAN bus Termination

To ensure a correct bus communication and avoid data reflection, you must always terminate the CAN bus with two 120Ω resistors at both ends of the line *(60Ω bus impedance)*, see Figure 2. The CAN bus is connected using CAT5 twisted-pair cables.

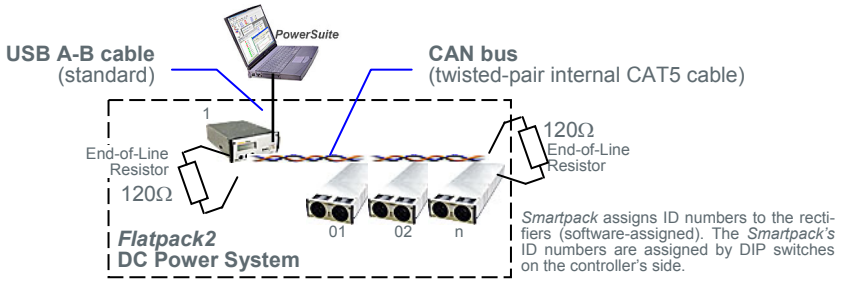



*Figure 2* CAN bus terminated with a 120Ω resistor on both line ends (60Ω bus impedance)

The example in Figure 3 shows a *Flatpack2* DC power system expanded with a slave controller to implement additional digital inputs, relay outputs or similar functionality.

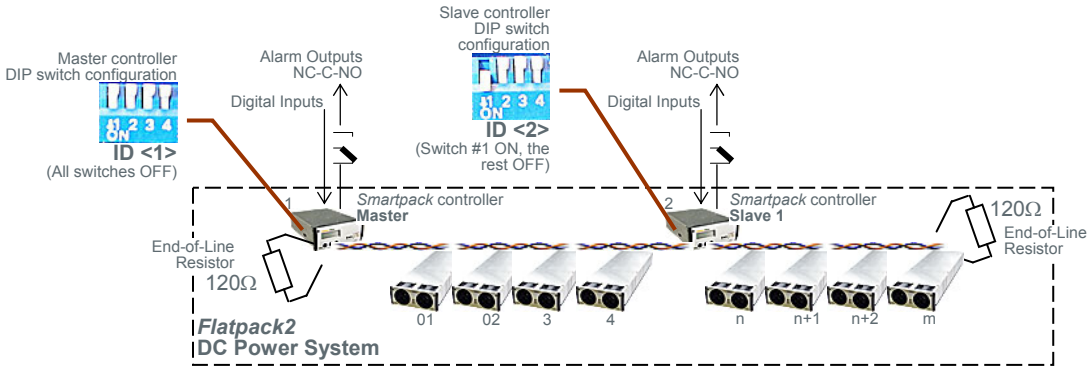



*Figure 3 A* Flatpack2 *DC power system expanded with two controllers*

## Configuration — Control Units

Each control unit must be configured with a CAN bus address (or ID number), to enable multiple units to communicate reliably on the CAN bus (hardware-assignment). The addresses are configured via DIP-switches. Read chapter "CAN Bus Address Range — Control Units" on page 7.

You must then configure and calibrate the unit using the *PowerSuite* software application. Read the *PowerSuite Online Help System* for a description of how to configure and calibrate the CAN Bus Nodes.

# 3. The *Smartpack Controller*

The *Smartpack* controller is a monitoring and control unit used as the vital nerve center of the DC power plant. You operate the system from the elegant front panel, using three front keys and the LCD-display. They represent the main interface between you and the system.

You can also operate the system locally via a PC using Eltek Valere's *PowerSuite* application, or remotely via modem, Ethernet and the Web. The module then utilizes the USB- or RS-232 ports to interface with a local PC, SNMP or Web adapters. See also chapter "Technical Specifications", on page 20.

## Key Features

- ✧ Front panel LCD and buttons for on-site service without PC.
- ✧ USB- or RS-232 interface for PC connection locally or remote monitoring and control via modem, Ethernet, web or SNMP.
- ✧ Main program upgrade via USB port and the FWLoader application
- ✧ 6 user programmable relay outputs for traditional remote control
- ✧ 6 user programmable inputs for monitoring of other equipment on site
- ✧ Battery monitoring and testing without site attendance
- ✧ Temperature compensated charging for increased battery lifetime
- ✧ Battery lifetime indication
- ✧ Password protected operator access levels
- ✧ Alarm/event log with time and date
- ✧ Windows-based PC communication software

## Block Diagram

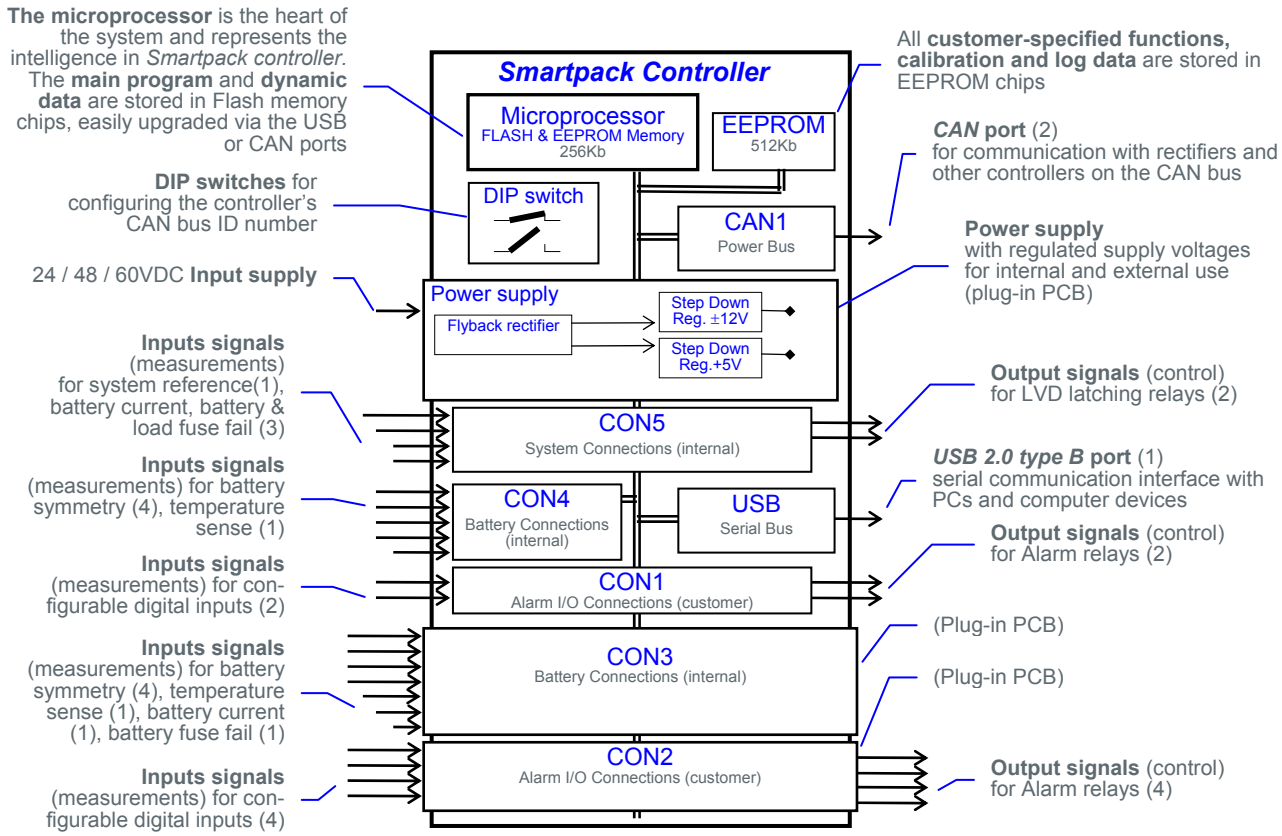
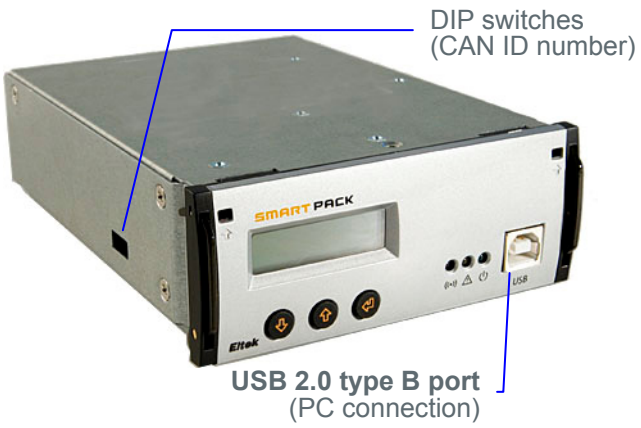



*Figure 4 Block diagram of the* Smartpack *Battery Extended controller showing the module's main functions*

## Typical Applications

The *Smartpack* controller employs CAN bus communication with the rectifiers in the *Smartpack*-based DC power system — and other bus-connected *Smartpack* control units in the system — thus enabling flexible expansion of system functionality and number of measuring points. System components can be set up and upgraded to meet the demand of any tailor-made power solution.

# Location of Connectors & Communication Ports




You can easily connect the *Smartpack* controller to a PC, plugging a standard USB A-B cable to the USB port on the front of the controller and to any available USB port on the computer.

The *Smartpack* controller is configured from factory — via DIP switches on the side — with an ID number for CAN bus communication. Read chapter "CAN Bus Address Range — Control Units" on page 7.

On the controller's rear panel —see Figure 6 — you find two identical RJ45 CAN ports (for incoming and outgoing CAT5 twisted-pair cables) to connect the controller to the CAN bus. See also chapter "CAN bus", on page 6.

*Figure 5 Front access USB port, and DIP switches for ID configuration on the side.*

The *Smartpack* controller's system cable connections are located on the controller's rear panel. These connections are used for monitoring and controlling the system, the batteries, alarm relays and status of external equipment.

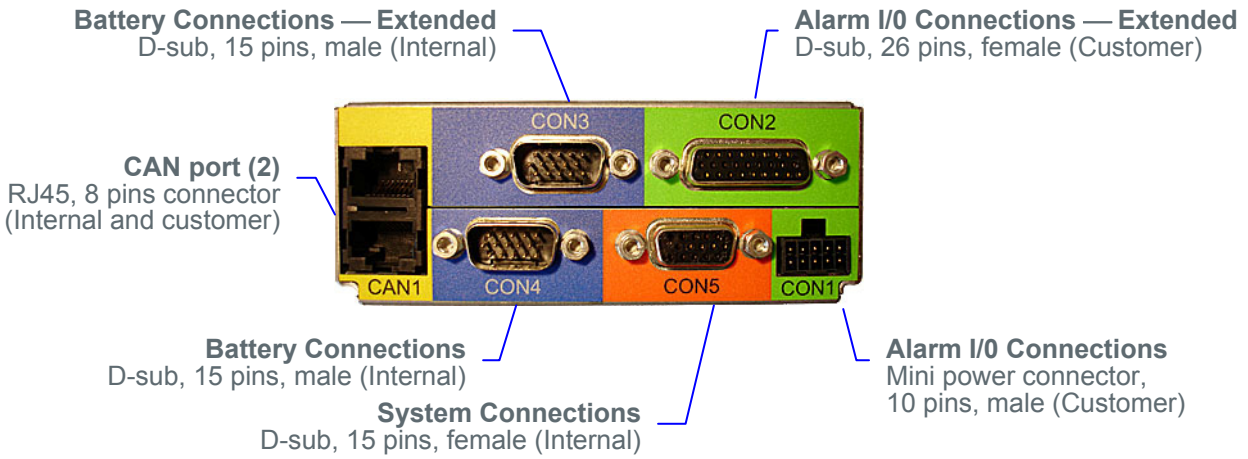



*Figure 6 Rear plug connections on a* Smartpack *Battery Extended controller*

# System & Battery Signals — Internal Connections


In standard *Smartpack*-based DC power systems, the controller's internal signals are cabled either directly to the corresponding monitoring or measuring points, or to internal terminals, as shown in Figure 7. See your system's specific arrangement drawings.

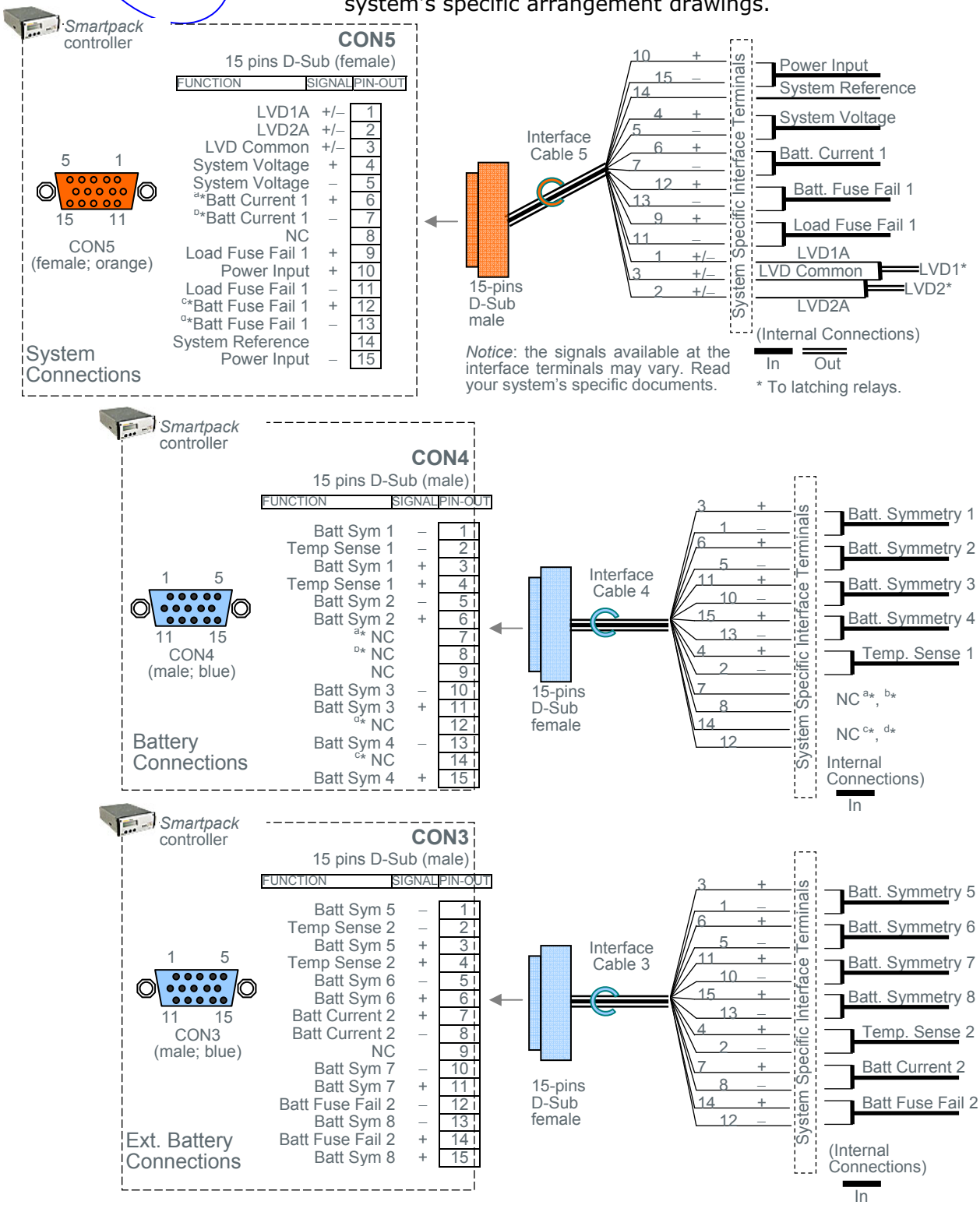



*Figure 7 Overview of internal system and battery connections*

# Alarm Relay & Digital Input Signals — Customer Connections

In standard *Smartpack*-based DC power systems, the controller's customer alarm relay and digital input signals are cabled to dedicated easy accessible terminals, as shown in Figure 8. See also your system's specific arrangement drawings.

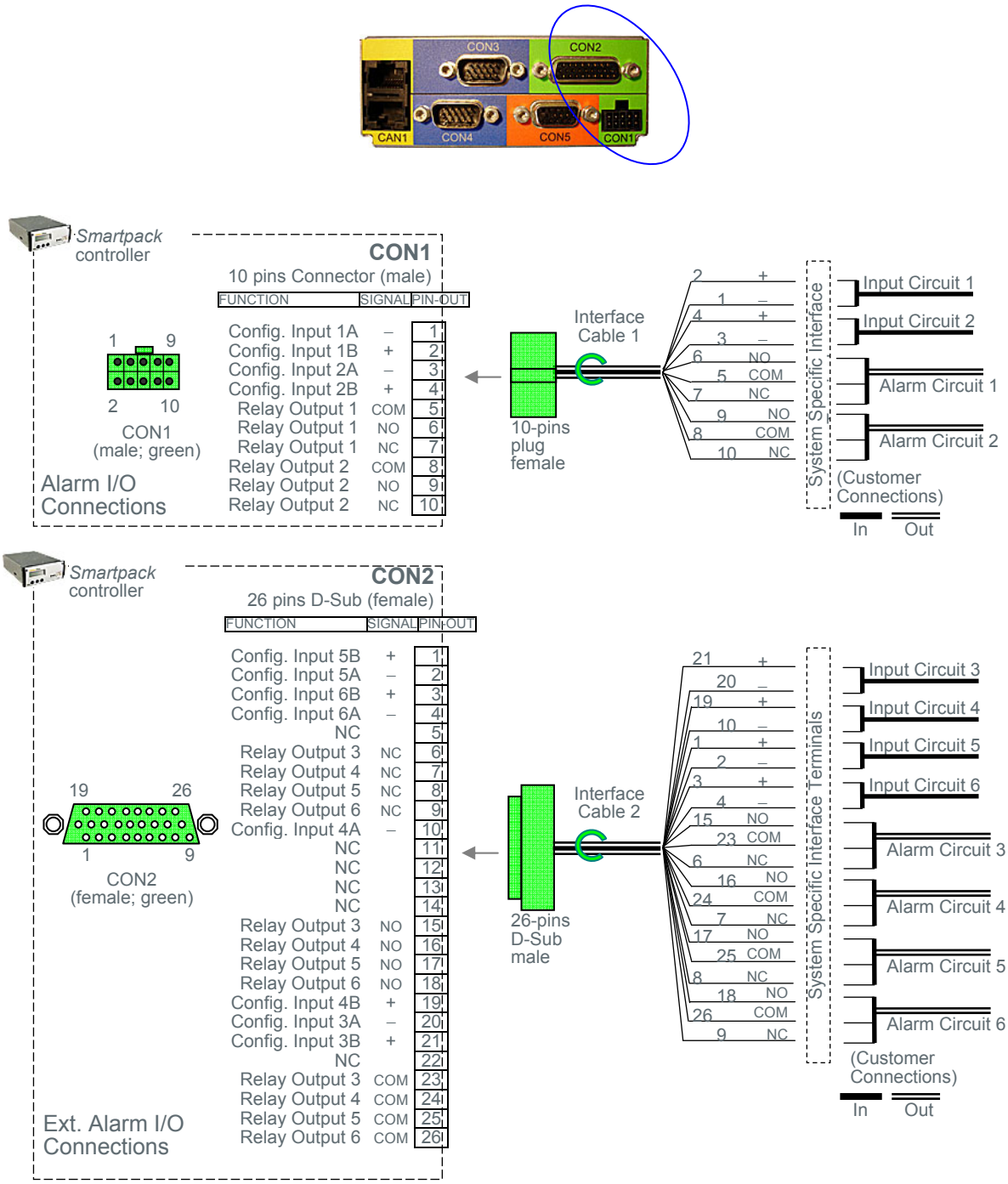
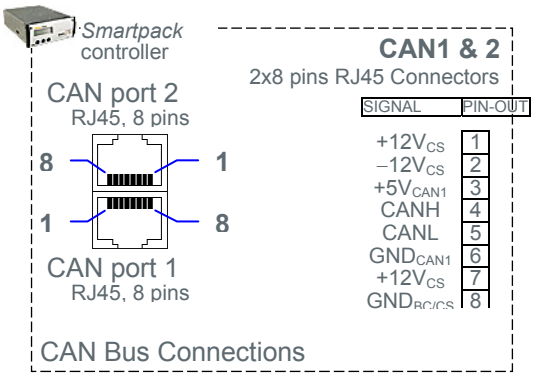



*Figure 8 Overview of customer connections — alarm relay & digital input signals*

# CAN Port Signals — Internal Connections




*Figur 9 CAN port signals*

CAN port 1 and 2 are electrically identical, and are used to enable connection of the CAN bus incoming and outgoing CAT5 cables.

A special RJ45 plug with built-in 120Ω end-of-line resistor can be connected to one of the CAN ports; refer to Figure 2, page 8.

CAN ports' pin 1&2 may supply the slave controller with 12VDC, 16W via the CAN bus.

# Installation of Smartpack Controller

## Safety precautions

Get acquantied with the satety precautions on page 2, before installing or handling the equipment.

## Mounting and Removing the Controller

The *Smartpack* controller incorporates handles that serve both to lock the module into position and to pull it out of its housing.

Device hazard

**CAUTION**: **Do not hand-carry** the controller by its handles. **Cables are plugged** to the controller's rear panel. **Open the handles before inserting** the controller into the power shelf.

Mount **blind panels** in unused module locations.

Electric shock


Mounting the *Smartpack* controller

1. **Open the handles** by inserting a screwdriver into the holes to release the spring mechanism
2. **Insert the module** fully into the power shelf, after plugging the cables to the rear panel
3. **Lock the handles** by pushing the handles up into their housings (locked position), so that the module is securely locked


Removing the Smartpack controller

1. **Open the handles** by inserting a screwdriver into the holes to release the spring mechanism
2. **Remove the module** by using both handles to pull the module loose gently; support from underneath; unplug the cables connected to the rear panel

*Figure 10 Smartpack controller's locking mechanism*

## Removing Blind Panels

Release the panel's upper left and right corners by inserting a small screwdriver into the panel's upper left gap, and carefully press down and out to release the locking tabs. Repeat on the upper right gap. Refer to the *Flatpack2* system's quick start guide for more information.

# Front Panel Operation

This chapter describes the *Smartpack* controller's keys and indicators, and how to operate the *Smartpack*-based DC power system from the controller's front panel.

## Description of Keys, Display and Indicators

The *Smartpack* controller's front panel consists of two functional areas: the *presentation area* (LCD display and LED lamps) and the *control area* (keys). For information about the handles and the USB port, read pages 10 and 14.


*Figure 11 Smartpack controller's front keys and indicators*

### LED indicators

The *Smartpack* controller has the following LED indications:

- "Power" (green) indicates that the power supply is ON or OFF
- Alarm (red) indicates an alarm situation (major alarm)
- Warning (yellow) indicates an abnormal situation (minor alarm)

### LCD Display

The graphic display is an important part of the power supply system's user interface. The display is in *Status Mode* (displays the system's status) or in *Menu Mode* (displays the menu structure).

Depending on the display's mode, the upper line shows the output voltage or menu options, while the lower line displays battery and load current, alarms, or information about which key to press. See also chapter "Modes of Operation", on page 16.

### Front Keys

You can control the whole *Smartpack*-based DC power system via a network of software menus accessed with the controller's front keys.

- Press on the ↵ key to change from *Status Mode* to *Menu Mode*.
- Press the ↓ or ↑ keys to scroll up or down and navigate to find menu options (function or parameter).
- Press then the ↵ key to select the function.

# Modes of Operation

The controller's display is either in *Status Mode* or in *Menu Mode*.

## Status Mode

When the front keys are not in operation, the display is in *Status Mode.* The following information is then scrolled through the display:

- The upper line continuously displays the battery voltage.
- The lower line continuously scrolls the following information:
    - Battery Current
    - Load Current
    - Active alarms
    - Other messages

## Menu Mode

When the front keys are in operation, the controller's display switches to *Menu Mode* and the following information is scrolled through the display:

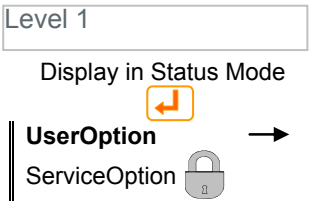
- The upper line shows the name of the active menu or sub-menu
- The lower line indicates which key to press

Notice that if no keys are pressed within 30 seconds, the display will automatically switch from *Menu Mode* and to back to *Status Mode*.

# Operating Menus, Overview

The *Smartpack*-based DC power system's functionality is accessed via a network of software menus and submenus, enabling you to configure and control the whole power system.

The functionality is divided in two different hierarchical menu structures: the *User Options* menus and the *Service Options* menus (password protected, only authorized personnel have access to them).



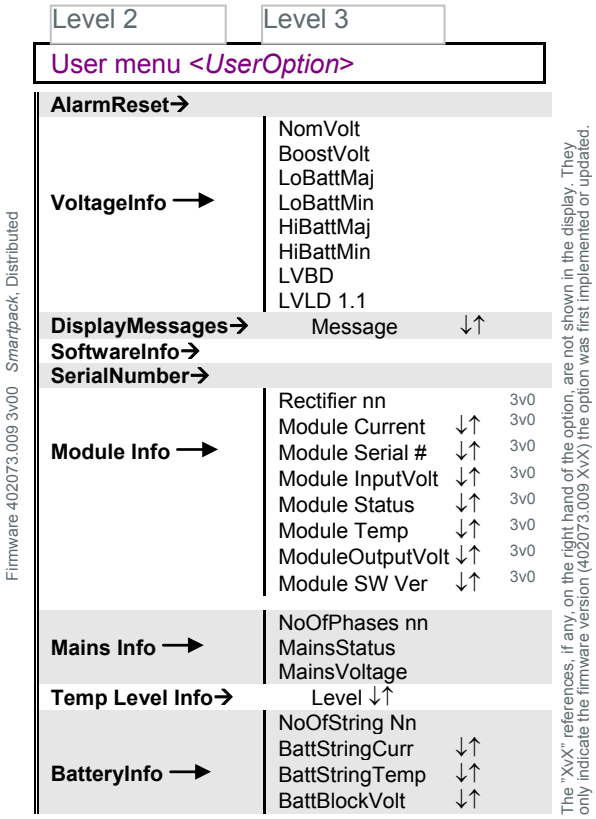

Special, not so frequently used options — such as calibration and adjustments — are accessible in the *Service Options* sub-menus.

## User Options

When you "enter" *Menu Mode,* you access the *User Options*.

How to browse the display menus

- **Entering *Menu Mode***
  Press on the ↵ key to change from *Status Mode* to *Menu Mode*
- **Browsing "down" to a menu option**
  Press the ↓ key, to scroll down within the same menu level, and find menu options (functions or parameters)
- **Selecting a menu option**
  Press on the ↵ key to select the displayed menu option or parameter
- **Browsing "up" to a menu option or level**
  Press the ↑ key to scroll up to the previous menu option, and out to the previous menu level.




For description of the User menu options, read chapter "Functionality Description" page 30. Also, refer to the *PowerSuite Online Help System*.

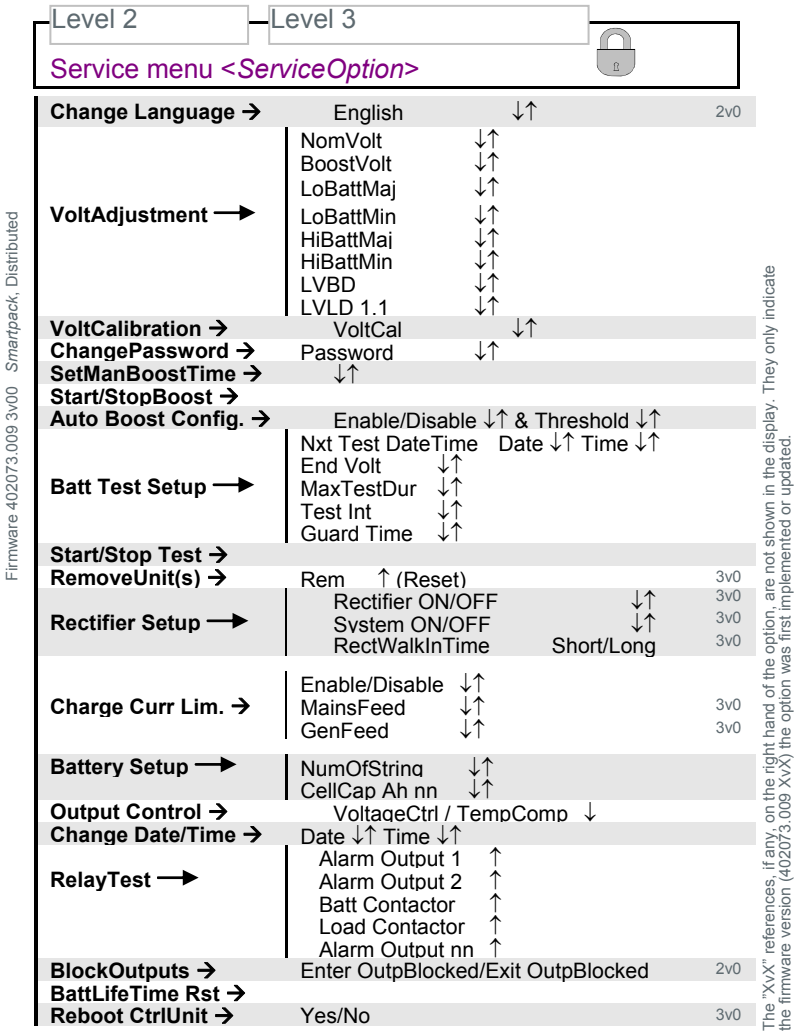
## Service Options

When you enter Menu Mode, you access the User Options. You may then scroll down to the password protected Service Options.

The Service Option's password is factory-programmed to <0003>. We strongly recommend that this password is changed as soon as the system is installed

How to browse the display menus

- **Entering *Menu Mode***
  Press on the ↵ key to change from *Status Mode* to *Menu Mode*
- **Browsing "down" to a menu option**
  Press the ↓ key, to scroll down within the same menu level, and find menu options (functions or parameters)
- **Selecting a menu option**
  Press on the ↵ key to select the displayed menu option or parameter
- **Browsing "up" to a menu option or level**
  Press the ↑ key to scroll up to the previous menu option, and out to the previous menu level.




For description of the Service menu options, refer to the *PowerSuite Online Help System*.

# Firmware Upgrade of the *Smartpack* controller

You can use the *FWLoader* program[2] running on a PC to upgrade the *Smartpack* controller's firmware. To find your controller's firmware version, refer to page 31. The PowerSuite program has to be installed previously on the PC. Do following:

1. **Connect a PC to the *Smartpack***
   using a standard USB cable
2. **Start the *FWLoader* program** on the PC;

   On the *FWLoader* dialog box:
3. **Select "Smartpack"**, in Target Selection
4. **Select "1"**, in Target Address
5. **Select "COMx"**
   in Communication Type. Refer to the *PowerSuite* program to find the communication port the PC uses to communicate with the controller.
6. Click on the "Open Source File" button and, **Select the file "*.mhx"**
   that contains the firmware to upgrade the controller with
7. **Click on the "Write to Target" button**, to load the firmware to the *Smartpack* controller

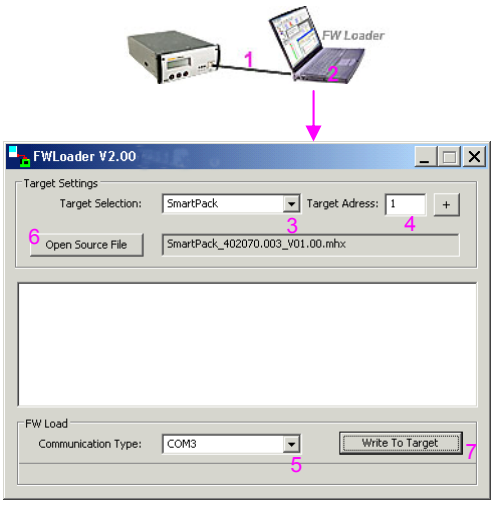



*Figure 12*
*FWLoader dialog box*

While the firmware is loaded to the *Smartpack* controller, the *FWLoader* program displays a progress bar, and the controller's display shows the currently programmed segment.

Once the firmware has loaded, the *Smartpack* controller will automatically restart.

[2] You can get a copy of the FWLoader progam by contacting Eltek Valere's Service Dep.

# Technical Specifications - Controllers

## Remote Monitoring and Control

- ✓ **From a PC running PowerSuite**
  a Windows-based communication program installed on a remote computer, the system can be monitored and controlled via modem or Ethernet network
- ✓ **From an NMS via Ethernet (SNMP)**
  With an SNMP agent connected to the Smartpack, the system can be monitored and controlled from a Network Management System (NMS) through Ethernet on Simple Network Management Protocol (SNMP)
- ✓ **Using alarm relays (voltage free contacts)**
  6 internal failsafe alarm relays provide voltage free contacts that can be connected to equipment used for traditional alarm monitoring

## Local Monitoring and Control

- ✓ **From a PC running PowerSuite**
  a Windows-based communication software, can also communicate with the Smartpack through an USB serial or RS-232 cable
- ✓ **LCD and three keypads for local operations**
  If any alarm (major or minor) is activated, a (red or yellow) LED is lit in the front panel, the alarm text appears in the LCD and the corresponding alarm relay is activated

  In normal operation, the front LCD will display the output voltage, battery current, load current and charge mode. (Not on Basic Slave version)

## Features

**System**
- Output Voltage Measurement
- Total Load Current Measurement
- Load/Battery Disconnect
- Alarm Level Settings (major / minor)
- Alarm Log (up to 1000 events)
- Real Time Clock with Battery Backup
- Site Text/ID
- Test of Relay Outputs
- Voltage Level setup
- Data logging (up to 7000 data points)

**Battery**
- Battery Current Measurement
- Battery Temperature Measurement (optional)
- Battery Testing (acc. to discharge table or set time limit)
- Battery Test Information (10 latest tests)
- Setup of Battery Data
- Battery shunt setup
- Battery quality indication
- Battery Boost Charging
- Battery Cable Voltage Drop Compensation
- Temperature Compensated Charging
- Protection against Temperature Probe Failure

**Rectifier**
- Available information about each rectifier, e.g. serial
- number, version, internal temperature
- Individual Rectifier Current Measurement
- Individual Rectifier Input Voltage
- Efficiency Management

## Available Alarms

All alarms can be set up with monitoring of minor, major, average and peak levels.

**System**
- Mains Failure (individual phases)
- Digital Inputs (programmable names)
- Load Disconnect (voltage or timer)
- Load Fuse
- Load Current

**Battery**
- High Battery voltage
- Low Battery voltage
- High Battery temperature
- Low Battery temperature
- Battery Capacity
- Battery Disconnect
- Battery Fuse
- Symmetry Failure
- Battery quality indication

Battery discharge current

**Rectifier**
- Rectifier Failure
- Critical Rectifier Failure (> 1, programmable)
- Rectifier Capacity w. programmable level
- Rectifier Current Limit
- Rectifier Overvoltage Protection
- Rectifier Current

## Specifications

| | |
|---|---|
| Input Voltage | 24/48/60 VDC<br>nominal system voltages |
| Dimensions (WxHxD) | 109 x 44 (1U) x 140mm<br>4.3 x 1.7 x 5.5” |

Specifications are subject to change without notice

242100.100.DS3– v6

Ordering Information

| Part no. | Description |
|---|---|
| 242100.110 | Smartpack Extended |
| 242100.111 | Smartpack RS-232 front |
| 242100.112 | Smartpack RS-232 rear |
| 242100.113 | Smartpack WEB/SNMP |
| 242100.000 | Smartpack Basic Slave (without display, buttons & internal power for distributed systems) |

# Controller Options

The *Smartpack* is a scalable controller with modular design. It can be optimized for different requirements by means of plug-in-kits. Various *Smartpack* controller options are available offering remote control management via modem, Web, e-mail and SNMP.

## Smartpack Controller — Standard

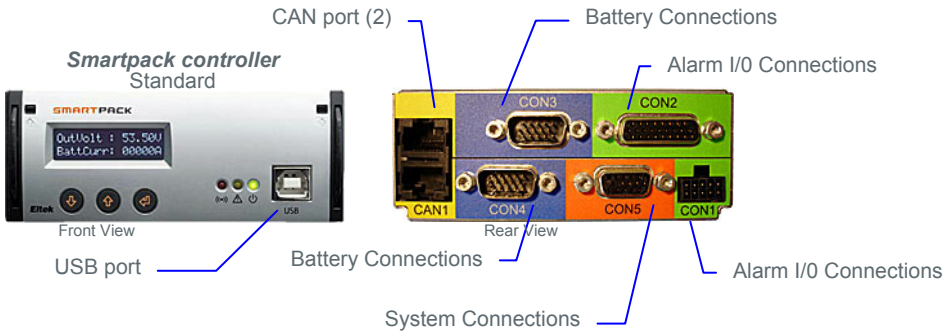



*Figure 13 The standard* Smartpack *controller. Front and rear connections*

The *Smartpack* controller – in standard option, Art 242100.110 – allows local monitoring and control via the module's front keys, LED lamps, LCD display and via a PC connected to the USB port.

The controller's functionality can be expanded by connecting several *Smartpack* controllers to the CAN bus (distributed DC power system). See Figure 3, page 8.

For more detailed description of connectors, see Figure 6, page 10.

## Smartpack Controller — Ethernet


*Figure 14 The* Smartpack *controller, Ethernet option. Front and rear connections*

The *Smartpack* controller – in Ethernet option, Art 242100.113 – allows remote system monitoring and control via the Ethernet port, using TCP/IP network protocol. Connect a 10/100 Base T screened Ethernet cable to the Ethernet port.

The Ethernet plug-in-kit incorporates an embedded Web adapter, supporting Web/HTML interface, remote logon by *PowerSuite*, SNMP protocol (Get, Set, Traps) and e-mail alert via your network e-mail server. For description of the functionality provided by the embedded the Web adapter, read the *WebPower Adapter* manual, Art. 356943.013.

The *Smartpack's* Standard and Ethernet options offer otherwise the same functionality, except for the Alarm I/O Connections on CON2, which are replaced by the Ethernet plug-in-kit.

Thus the Ethernet module option supports fewer I/O connections -- four input circuits and four relay output circuits less. See Figure 8, page 12.

# Smartpack Controller — RS232

The *Smartpack* controllers – in RS232 option, Art 242100.111 (front access) and Art 242100.112 (rear access) – allow remote system monitoring and control by connecting to the RS232 port either a modem or *Eltek Valere's* stand-alone *WebPower* unit (Ethernet support).

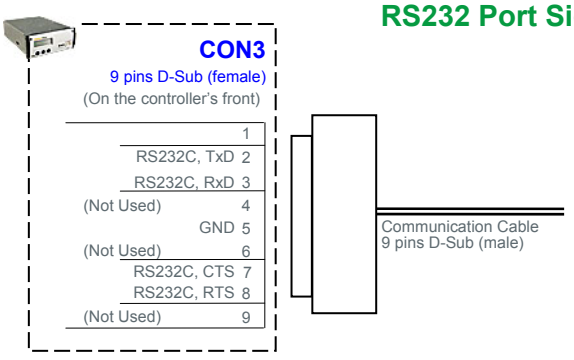

*Figure 15 The* Smartpack *controller, RS232 option, front. Front and rear connections*

The *Smartpack's* Standard and front-access RS232 options offer otherwise the same functionality.


*Figure 16 The* Smartpack *controller, RS232 option, rear. Front and rear connections*

The *Smartpack's* Standard and rear-access RS232 options offer otherwise the same functionality, except for the Battery Connections on CON3, which are replaced by the RS232 plug-in-kit.

Thus the rear-access RS232 module option supports fewer battery connections – seven battery monitoring input circuits less. See Figure 7, page 11.




The RS232 ports on the front-access and the rear-access module options are electrically identical.

Connect an end of the RS232 cable to the *Smartpack's* RS232 port, and the other end to the modem's or *WebPower's* RS232 port.

Verify that both units have the same communication parameters (Baud rate, parity, etc.)

*Figure 17 RS232 port signals*

## Smartpack Controller — Basic Slave

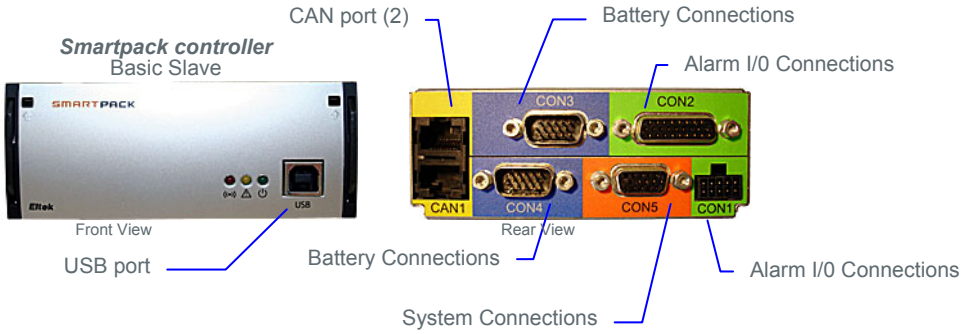



*Figure 18 The* Smartpack *controller Basic Slave. Front and rear connections*

The *Smartpack* controller Basic Slave, Art 242100.000, is a cost-effective module equipped with the same I/O connections and functionality as the *Smartpack's* Standard option, Art. 242100.110.

The only difference between the *Smartpack's* Standard and Basic Slave options is that the latter lacks LCD display, front keys and internal power supply.

The power system's *Smartpack* master controller supplies the Basic Slave modules with power via the CAN bus, and a maximum of two Basic Slave modules may be connected to the bus.

Both the master and the Basic Slave modules must run firmware 402073.009, version 2.0 or higher.

For information about connecting several *Smartpack* controllers to the CAN bus (distributed DC power system), take a look at Figure 3, page 8. For more detailed description of connectors, see Figure 6, page 10.

# 4. CAN Bus Nodes – Options

The CAN Bus Nodes are control units connected to the power system's CAN bus. They have dedicated inputs and outputs that expand the system monitoring.

## Key Features

The CAN Bus Nodes have a rugged sealed-plastic design, with DIN-rail or Velcro tabs as standard mounting options.

When the CAN bus address is configured and the unit connected to the bus, it will automatically communicate with the *Smartpack* controller ("plug and play").

## Smartnode Control Unit

The *Smartnode* module is a software protocol translator. It can be customized to enable the *Smartpack* controller to communicate with third-party equipment using specific RS232 and RS485 serial protocols.

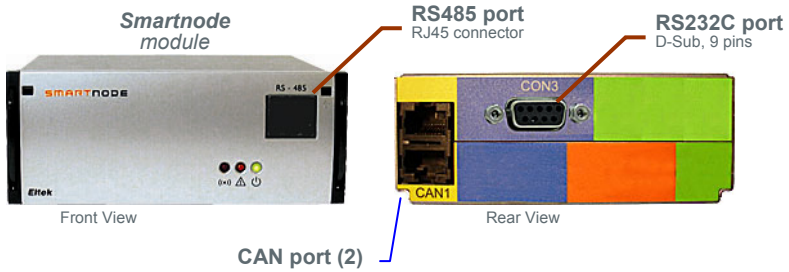



*Figure 19 The* Smartnode *module. Front and rear connections*

The example in Figure 20 shows schematics of how the *Smartpack* controller can communicate with external equipment with specific protocols, using the *Smartnode* as a protocol translator.

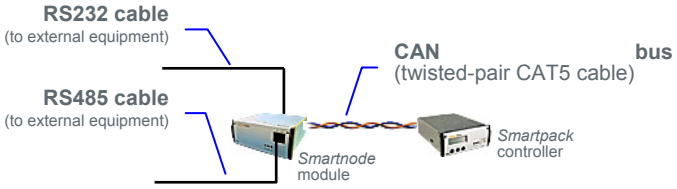



*Figure 20 The* Smartpack *controller communicating with the* Smartnode *module*

# Battery Monitor

The *Battery Monitor CAN Bus Node* enables you to decentralize and increase the number of battery symmetry measurements in your *Smartpack* based DC power supply system. Also, it monitors the battery compartment temperature – using the built-in sensor – the battery fuse – with a fuse monitoring input – and the battery current – via a current sense input.

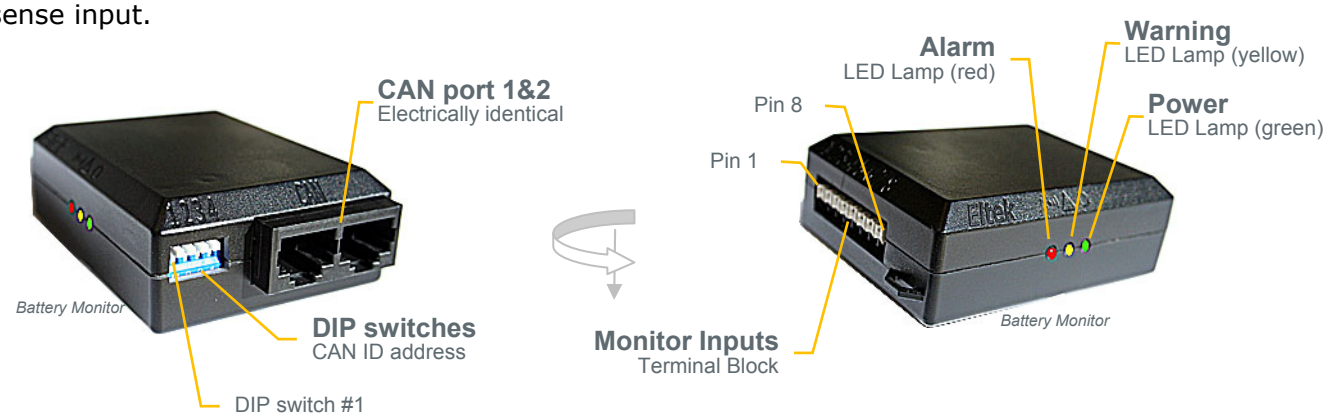


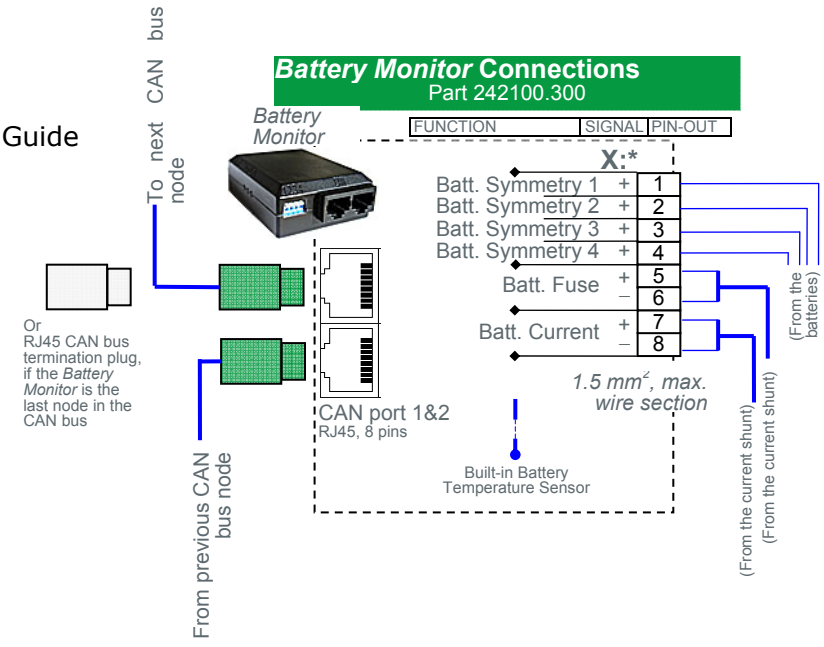

*Figure 21 Location of terminals, DIP switches, CAN ports and LED indicators in the Battery Monitor*

| Battery Monitor | |
|---|---|
| Inputs | ○ 4x Symmetry Voltage<br>○ 1x Configurable (Fuse failure)<br>○ 1x Current sense |
| Accuracy based on resolution (calibrated) | ○ Voltage: 76mV<br>○ Current (200A): +/- 1A |
| Functionality | ○ Symmetry measurement 2, 6, 12, 24, 30 or 36V<br>○ Fuse failure NO, NC or Diode Matrix<br>○ Current sense 50mV or 60mV shunt<br>○ Temperature measurement Embedded in unit |
| SW Part number | 402086.009 |
| Max. CAN Power consumption | 90mA |

Specifications are subject to change without notice
242100.CAN.DS3 – v2(part)

*Figure 22 Technical Specification Battery Monitor and Connection Drawing*

For additional specifications, read chapter "Technical Specifications — CAN Bus Nodes" on page 29.




Read also the "Installation Guide Battery Monitor CAN Node", document 351507.033.

# Load Monitor

The *Load Monitor CAN Bus Node* enables you to decentralize and increase the number of input fuse monitoring and current sense signals in your *Smartpack* based DC power supply system. The fuse monitoring inputs are suitable for monitoring a wide range of breakers in both positive and negative DC distributions.

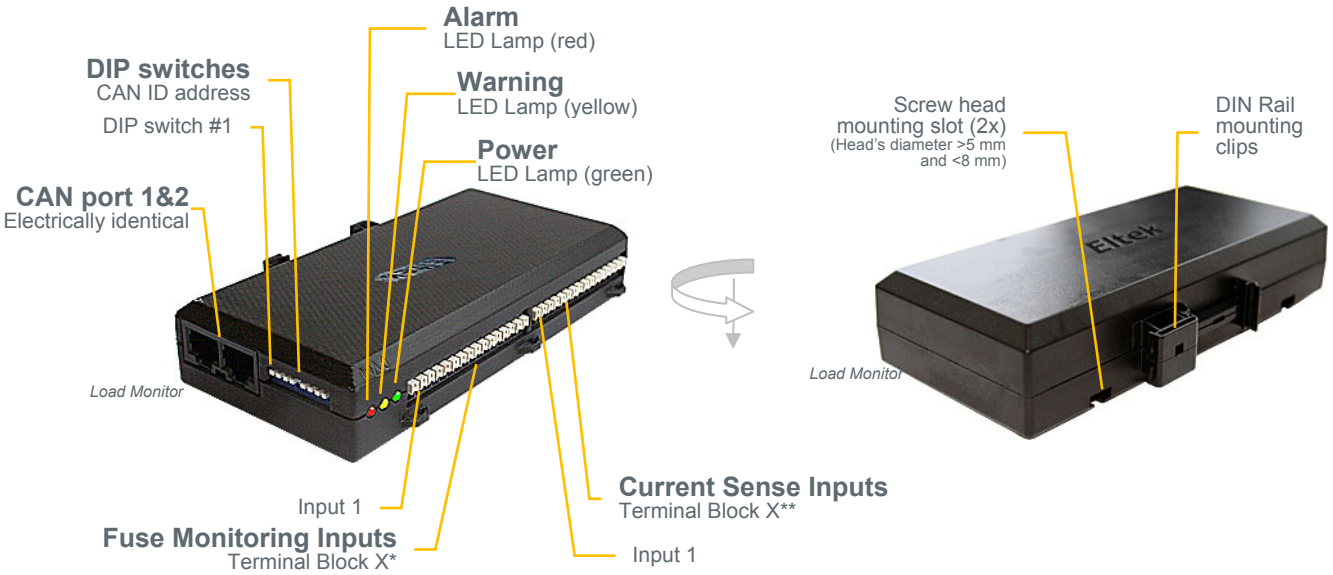
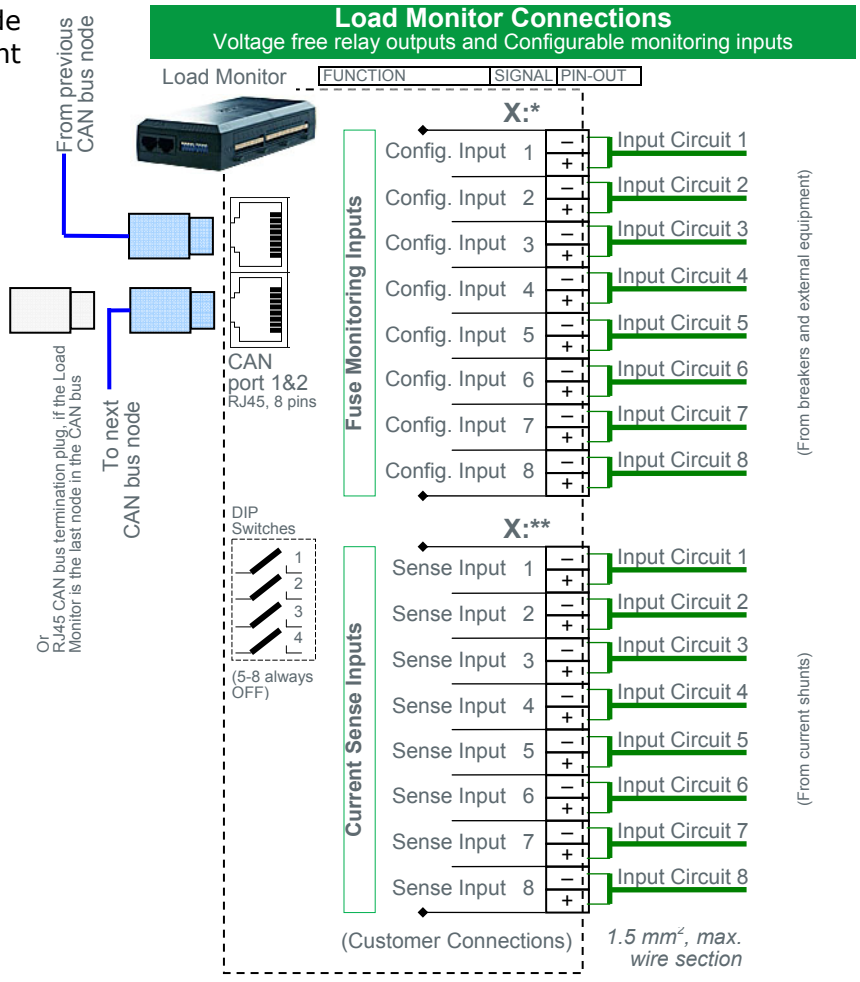



*Figure 23 Location of terminals, DIP switches, CAN ports and LED indicators in the Load Monitor*

Read also the "Installation Guide Load Monitor CAN Node", document 351506.033.

*Figure 24 Technical Specification Load Monitor and Connection Drawing*

For additional specifications, read chapter "Technical Specifications — CAN Bus Nodes" on page 29.




| Load Monitor | |
|---|---|
| Inputs | ○ 8x Configurable (Fuse failure)<br>○ 8x Current sense |
| Accuracy based on resolution (calibrated) | Current (200A): +/- 1A |
| Functionality | ○ Fuse failure NO, NC or Diode Matrix<br>○ Current sense 50mV or 60mV shunt |
| SW Part number | 402087.009 |
| Max. CAN Power consumption | 120mA |

Specifications are subject to change without notice
242100.CAN.DS3 – v2(part)

## I/O Monitor

The *I/O Monitor CAN Bus Node* enables you to decentralize and increase the number of input monitoring and output controlling signals in your *Smartpack* based DC power supply system. Also, it monitors and controls the compartment temperature inside fan-cooled outdoor cabinets.

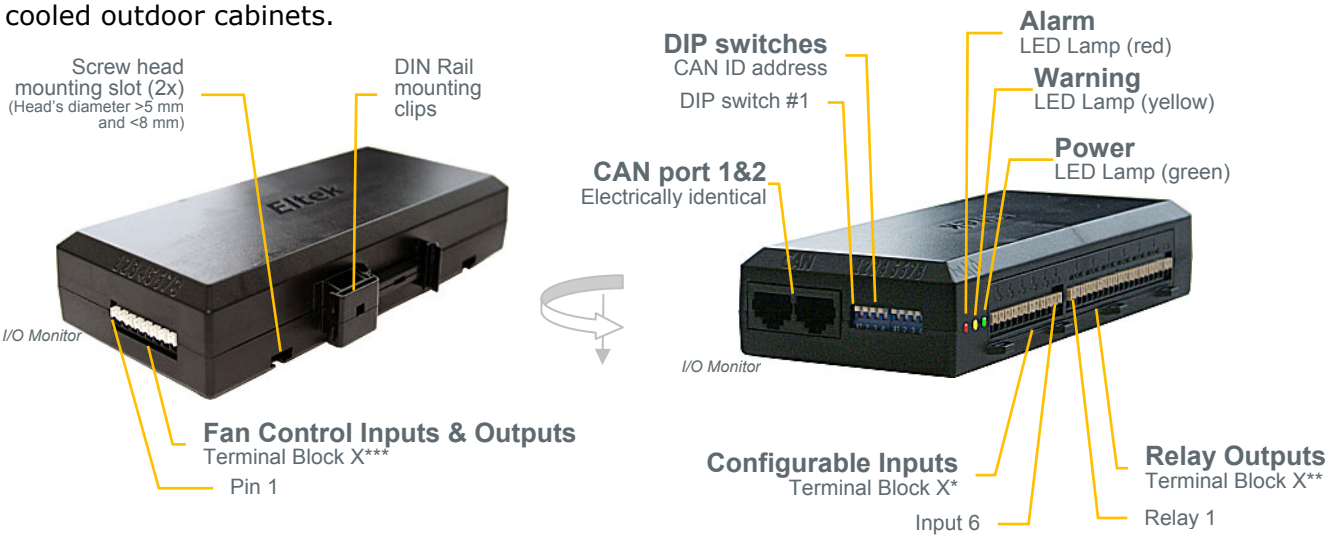



*Figure 25 Location of terminals, DIP switches, CAN ports and LED indicators in the I/O Monitor*

| I/O Monitor (Outdoor) | |
|---|---|
| Inputs | ○ 6x Configurable ("digital")<br>○ 2x Tacho<br>○ 2x Temperature probe |
| Outputs | ○ 6x Relay – Dry/Form C<br>4x signal 1A /60V [no. 1,2,3,4]<br>2x power 5A /60V [no. 5,6]<br>○ 2x Analogue linear (Max. 0-10V) |
| Functionality | ○ Relay Alarming<br>Normally activated or deactivated<br>○ Configurable inputs<br>NO, NC or Diode Matrix<br>○ Climate control<br>Fan speed regulation and monitoring<br>○ Data logging (non-volatile memory)<br>10000 time stamped logs<br>4 user selectable data points<br>Default: 2x Temp. 2x Fan Speed |
| SW Part number | 402088.009 |
| Max. CAN Power consumption | 160mA |

Specifications are subject to change without notice
242100.CAN.DS3 – v2(part)

*Figure 26 Technical Specification I/O Monitor*

For additional specifications, read chapter "Technical Specifications — CAN Bus Nodes" on page 29.

Read also the "Installation Guide I/O Monitor CAN Node", document 351503.033.

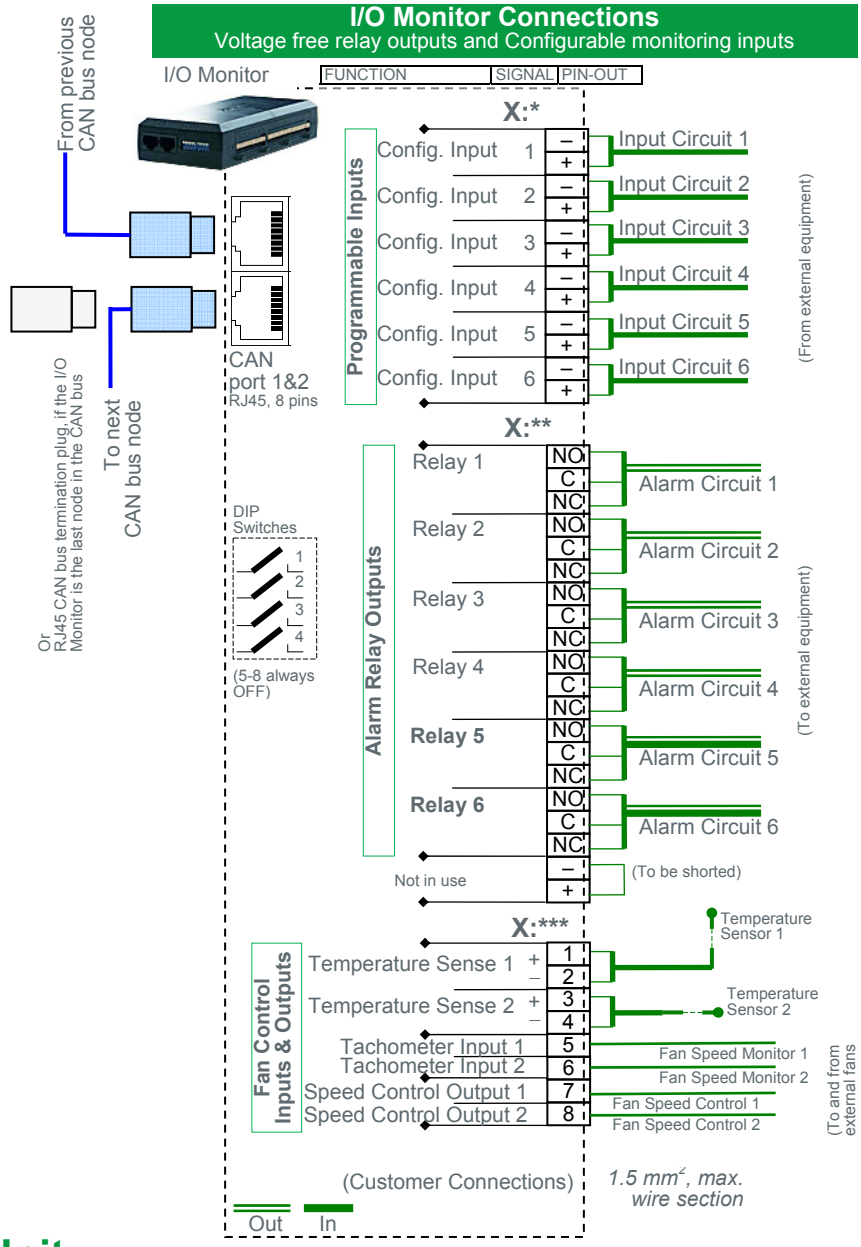



*Figure 27 Connection Drawing I/O Monitor*

## CAN Power Unit

All CAN bus nodes are powered by the distributed power supplied on the CAN bus.

If the CAN bus needs to be isolated, or additional CAN bus power is needed, the CAN Power Unit can be connected to supplement the available power.

For additional specifications, read chapter "Technical Specifications — CAN Bus Nodes" on page 29.

| CAN Power Unit | |
|---|---|
| Input | 20-75Vdc<br>Screw terminals |
| Outputs | +/-15V, 500mA<br>Dual RJ45 connector |
| Functionality | ○ Isolates the power distributed on the CAN bus<br>○ Increase the maximum number of CAN nodes in system |
| *Note: 500mA is supplied per Smartpack* | |

Specifications are subject to change without notice
242100.CAN.DS3 – v2(part)

## Technical Specifications — CAN Bus Nodes

Following Technical Specifications apply to all CAN Bus Nodes.

| CAN Nodes | | | |
|---|---|---|---|
| Max. nodes | 14 units of same type can be added a single CAN bus | | |
| Mounting | Slotted groove for post mounting or DIN rail | | |
| Visual Indication | 3xLED (1xLED CAN Power)<br>○ GREEN: Power<br>○ YELLOW: Warning<br>○ RED: Alarm (Flashing LED: insufficient power) | | |
| SW Upload tools | FWLoader v3.25 or newer and IXXAT USB-to-CAN Converter (p/n: 208565) | | |
| Casing material | Plastic - V0 rated / Steel (CAN Power) | | |
| Operating temp | -40 to 70°C (-40 to 158°F) | Storage temp | -40 to 85°C (-40 to 185°F) |

| Applicable Standards | |
|---|---|
| Electrical safety | IEC 60950-1<br>UL 60950-1<br>CSA C22.2 |
| EMC | IEC 61000-6-1<br>IEC 61000-6-2<br>IEC 61000-6-3 /A1<br>IEC 61000-6-4<br>ETSI EN 300 386 v1.3.3<br>FCC Part 15B Subpart 109 |
| Environment | 2002/95/EC (RoHS) & 2002/96/EC (WEEE)<br>ETS 300 019-2-1 Class 1.2<br>ETS 300 019-2-2 Class 2.3<br>ETS 300 019-2-3 Class 3.2 |

Specifications are subject to change without notice
242100.CAN.DS3 – v2(part)

# 5. Functionality Description

In this chapter you can find detailed description of the User menu options, and helpful information about expressions, technical terms and functions used in *Smartpack*-based DC power systems.

For description of the Service menu options, refer to the *PowerSuite* online Help system.

## Alarm Reset (AlarmReset)

You can reset all active alarms by selecting "***UserOption>AlarmReset***", via the *Smartpack* controller's front keys. The controller will immediately report alarm conditions that are still active.

The *Smartpack*-based DC power system can be configured with *automatic* or *manual* alarm reset.

When *Automatic Alarm Reset* is enabled (default) — and the alarm condition no longer exists — the *Smartpack* controller will deactivate the alarm lamps and relays to indicate that normal operation is established.

When *Manual Alarm Reset* is enabled — and the alarm condition no longer exists — the operator must reset the alarm manually.

## Display System Voltages (VoltageInfo)

You can display important system voltages by selecting ***"UserOption>VoltageInfo"***, via the *Smartpack* controller's front keys.

Following voltages may be displayed selecting the *VoltageInfo* sub options (level 3):

| Option | ***Description*** |
|---|---|
| ***NomVolt*** | Nominal output voltage |
| ***BoostVolt*** | Battery boost-charging voltage |
| ***LoBattMaj*** | Voltage limit for *Low Battery Major Alarm* |
| ***LoBattMin*** | Voltage limit for *Low Battery Minor Alarm* |
| ***HiBattMaj*** | Voltage limit for *High Battery Major Alarm* |
| ***HiBattMin*** | Voltage limit for *High Battery Minor Alarm* |
| ***LVBD*** | Voltage limit for *Low Voltage Battery Disconnect* |
| ***LVLD 1.1*** | Voltage limit for *Low Voltage Load Disconnect* |

## Display Alarm Messages, (Log) (DisplayMessages)

You can browse through the stored system alarm messages (alarm log) by selecting ***"UserOption>DisplayMessages"***, via the *Smartpack* controller's front keys.

The *Smartpack* controller's alarm log may store up to 1000 chronological events. Each log entry contains event text, event action, time and date. When the log is full, the oldest value is overwritten. The log is stored in EEPROM.

## Display Controller's Firmware Version (SoftwareInfo)

You can display the *Smartpack* controller's firmware[3] and version numbers by selecting ***"UserOption>SoftwareInfo"***, via the *Smartpack* controller's front keys.

The firmware and version numbers are displayed in the format <nnnnnn.yys vv.vv>.

The "nnnnnn.yys" represents the firmware number. The "s" is a code for the firmware language: 1= Norwegian, 2= Swedish, 3= English, 4= German, 5= French, 6= Spanish, etc.

The "vv.vv" represents the firmware's version number.

## Display Controllers' Serial Numbers (SerialNumber)

You can display the *Smartpack* controllers' serial numbers by selecting ***"UserOption>SerialNumber"***, via the *Smartpack* controller's front keys.

The serial numbers are displayed in the format <cc: nnnnnnnnnnnn>.

The "cc:" represents the ID or CAN bus address of the *Smartpack* controller with serial number "nnnnnnnnnnnn". Press the ↑ or ↓ keys to display the serial numbers of other controllers in the CAN network.

## Display Rectifier Information (Rectifier Info)

You can display information about the rectifiers communicating in the *Smartpack*-based DC power system, by selecting ***"UserOption>Rectifier Info"***, via the *Smartpack* controller's front keys.

Following information may be displayed selecting the *Rectifier Info* sub options (level 3):

| Option | ***Description*** |
|---|---|
| ***NoOfRects. Nn*** | Number of rectifiers installed in the system. |
| ***RectCurrent*** | Rectifier's current |
| ***RectSerialNumber*** | Rectifier's ID and serial number |
| ***Rect.PrimaryVolt*** | Rectifier's input voltage |
| ***Rectifier Status*** | Rectifier's status |
| ***Rectifier Temp*** | Rectifier's temperature |
| ***Rect. OutputVolt*** | Rectifier's output voltage |
| ***Rectifier SW Ver*** | Rectifier's firmware version |

While the controller is accessing information from a specific rectifier, the green LED on the rectifier's front panel flashes.

The *Smartpack* controller sends out status messages every 200ms to all the rectifiers connected to the CAN bus, such as:

- The *Smartpack* controller's status
- Current Limit Reference
- Measured Output Voltage
- Reference Output Voltage
- Over-voltage Protection Reference
- Etc.

[3] The main program (firmware) is stored in flash memory chips.

## Plug-and-Play Rectifier

When a rectifier is **hot plugged in a power shelf for the first time**, the *Smartpack* controller assigns the next available ID number to the rectifier, starting with "01". This ID number (or CAN bus address) and the rectifier's serial number are stored in both modules.

When a **previously installed (hot plugged)** rectifier is inserted in a power shelf, the *Smartpack* controller "recognises" the module, and assigns the same ID to rectifier.

In other words, the controller and the rectifier "remember" the assigned ID and serial numbers, even after removing and reinserting the rectifier in the shelf.

To achieve a more controlled ID assignment, you should always insert & hot-plug **new** rectifiers **in the indicated power shelf position, one module at a time, starting with ID number 1**, 2, 3 and so on. The sequence is indifferent after ID# 6. Read chapter "Mains Phase Assignment versus Rectifier ID", page 32.

The rectifiers' power shelf positions vary with the type of AC mains and the type of power shelves installed in your system. Refer to your system's quick start guide and specific documentation for more information.

**Do not relocate** already pre-installed rectifiers.

## Mains Phase Assignment versus Rectifier ID

In systems with 3 phase AC feed, the *Smartpack* controller can be configured to report a warning if one phase fails, and to report an alarm if two phases fail, for example.

The 230V phases of *Flatpack2* systems' mains AC feed are routed to the rectifiers' inputs in a special pattern that loads the 3 phases evenly. The routing of the phases is implemented via internal wiring and the use of either **4AC Power Shelves**[4] or **2AC Power Shelves**[5]. Refer to your system's quick start guide and specific documentation for more information.

To be able to display correct information about the phases, the *Smartpack* controller must "know" which phase is connected to which rectifier ID number.

*Flatpack2* DC power systems are shipped from factory with empty power shelves. The rectifier modules are shipped in separate packaging, and you have to install the modules in **the correct position in the power shelves**, with respect to their ID number (or CAN bus address).

This relationship is very important, as the *Smartpack* controller always uses rectifier ID 01, 02 and 03 to monitor mains phase L1, L2 and L3 respectively. If these rectifiers malfunction, rectifier ID 04, 05 and 06 will automatically take over.

For example: accidentally inserting a rectifier with ID 02 in a power shelf position internally connected to mains phase L1, will cause the controller to monitor L1 "thinking" it monitors L2. Then a phase 1 fault will be alarmed as a phase 2 fault.

## Resetting the Number of Rectifiers

When a rectifier reset is activated, the number of rectifiers is recalculated, and only the number of communicating modules at the moment will be counted.

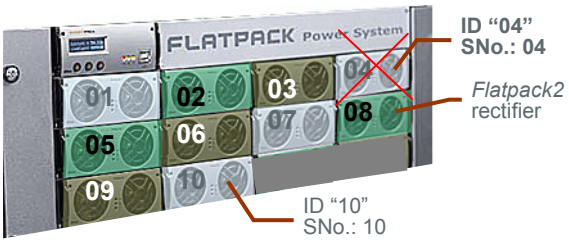
For instance: in a *Flatpack2* DC power system equipped with 10 rectifiers, rectifier with ID number "04" malfunctions. If you insert rectifier ID#10 in the position of the failing ID#04, and then activate a rectifier reset, the *Smartpack* controller recalculates the number of communicating rectifiers to only 9. At the same time the controller reassigns rectifier with ID#10 to ID#04, thus filling the gap.

---

[4] 4AC Power Shelves (Single AC feed: 4 AC inputs per shelf, each feeding 1 rectifier).
[5] 2AC Power Shelves (Dual AC feed: 2 AC inputs per shelf, each feeding 2 rectifiers).

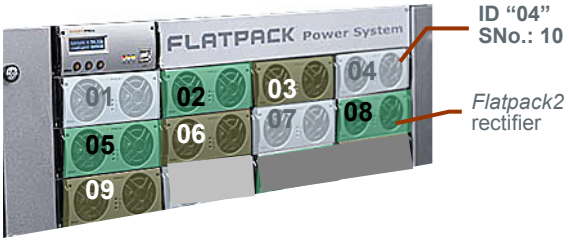
***Example: Flatpack2 DC power system with malfunctioning rectifier;***
*3 power shelves with 10 rectifiers (rectifier ID #04 malfunctions)*

| | | | |
|---|---|---|---|
| Rectifier ID 01<br>Serial No. 01 | Rectifier ID 02<br>Serial No. 02 | Rectifier ID 03<br>Serial No. 03 | Rectifier ID 04<br>Serial No. 04 |
| Rectifier ID 05<br>Serial No. 05 | Rectifier ID 06<br>Serial No. 06 | Rectifier ID 07<br>Serial No. 07 | Rectifier ID 08<br>Serial No. 08 |
| Rectifier ID 09<br>Serial No. 09 | Rectifier ID 10<br>Serial No. 10 | | |




***After rectifier reset****:*
*3 power shelves with 9 rectifiers*
*(rectifier ID #10 reassigned to #04)*

| | | | |
|---|---|---|---|
| Rectifier ID 01<br>Serial No. 01 | Rectifier ID 02<br>Serial No. 02 | Rectifier ID 03<br>Serial No. 03 | Rectifier ID 04<br>Serial No. 10 |
| Rectifier ID 05<br>Serial No. 05 | Rectifier ID 06<br>Serial No. 06 | Rectifier ID 07<br>Serial No. 07 | Rectifier ID 08<br>Serial No. 08 |
| Rectifier ID 09<br>Serial No. 09 | | | |




## Display System Mains Data (Mains Info)

You can display information about the power system's AC feed by selecting ***"UserOption>Mains Info"***, via the *Smartpack* controller's front keys.

Following data may be displayed selecting the *Mains Info* sub options (level 3):

| Option | ***Description*** |
|---|---|
| ***NoOfPhases nn*** | Number of Mains phases in the system's AC feed |
| ***Mains Status*** | The status of each of the phases |
| ***Mains Voltage*** | The AC voltage of each of the phases |

## Display Battery Temperature Levels (TempLevel Info)

You can display how many hours the system's battery bank has been within a certain temperature range (level) by selecting ***"UserOption>TempLevel Info"***, via the *Smartpack* controller's front keys.

The information is displayed in the format [nn: <ddC hhhhhH], which means:

- nn: The number of the temperature range or level (01 through 10)
- <ddC The range's upper temperature value, in degrees Celsius
- hhhhhH The number of hours the battery bank has been within the temperature range

Using the *PowerSuite* program, you can configure the upper and lower temperature limits for each of the 10 temperature ranges. *PowerSuite's* Battery Lifetime Temperature alarm monitor supervises all the temperature ranges, and calculates the total number of days the battery bank has been within the specified ranges. The monitor can be configured to automatically activate a Major and a Minor alarm when the number of days has exceeded a certain period of time.

The table shows an example of values entered in the Battery Lifetime Temperature monitor.

| Temperature Range | | | *Time within Range* |
|---|---|---|---|
| Range # | Low Limit, °C | High Limit, °C | Hours |
| 01 | 00 | 10 | 10 |
| 02 | 11 | 20 | 20 |
| 03 | 21 | 30 | 60 |
| 04 | 31 | 40 | 40 |
| 05 | 41 | 50 | 05 |
| 06 | 51 | 60 | 00 |
| 07 | 61 | 65 | 00 |
| 08 | 66 | 70 | 00 |
| 09 | 71 | 75 | 00 |
| 10 | 76 | 99 | 00 |

You can reset the values in the Battery Lifetime Temperature monitor either by selecting "*ServiceOption>BattLifeTime Rst*", via the *Smartpack* controller's front keys, or using *PowerSuite*.

## Display Battery Information (BatteryInfo)

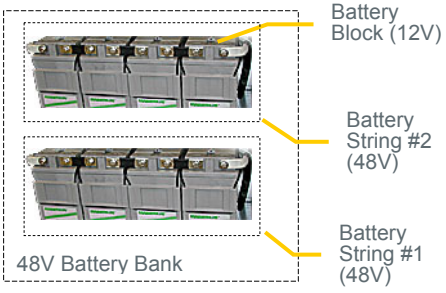
You can display information about the power system's battery bank by selecting **"*UserOption>Battery Info*"**, via the *Smartpack* controller's front keys.

Following data may be displayed selecting the *Battery Info* sub options (level 3):

| Option | ***Description*** |
|---|---|
| ***NoOfString Nn*** | Number of battery strings |
| ***BattStringCurr*** | Each battery string's current |
| ***BattStringTemp*** | Temperature of each battery string |
| ***BattBlockVolt*** | Voltage of each battery block |

For battery terminology, refer to chapter "About Battery Banks, Strings and Blocks", page 34 and to the "Quick Start Guide *Flatpack2* PS System", Art. 356804.103.

## About Battery Banks, Strings and Blocks



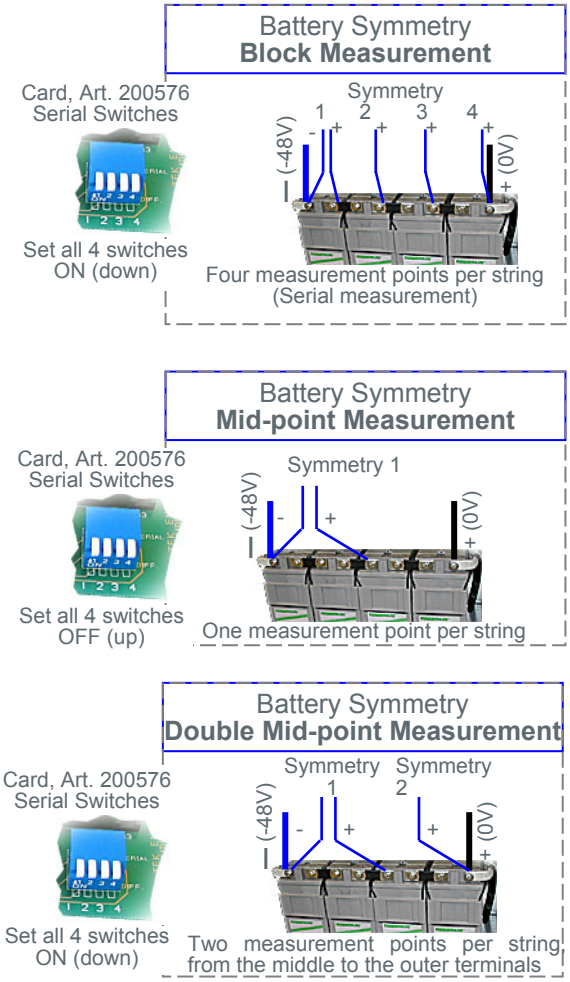

Normally, battery banks are implemented by connecting in parallel several battery strings; each string is formed by battery blocks connected in series.

*Figure 28 Example of a 48V battery bank implemented with two 48V battery strings; each string consists of four 12V battery blocks*

## Battery Symmetry Measurements, 48V Systems — Controller

Symmetry measurement is a battery monitoring method for automatically detecting unbalanced battery blocks.

For information about 24V systems symmetry measurements, read the "Quick Start Guide *Flatpack2* PS System" Art. 356804.103.




Symmetry monitoring of a 48V battery string may be performed after three different methods:

- **Block measurement method**
  Measuring each battery block
- **Mid-point measurement method**
  Measuring from the mid-point of the battery string to one end
- **Double mid-point measurement method**
  Measuring from the mid-point of the string to both ends

The *mid-point measurement method* requires 2 symmetry wires per battery string; the double *mid-point measurement method* requires 3 symmetry wires per battery string, while the *block measurement method* requires 5 symmetry wires per battery string. Refer to the system's quick start guide for connections.

Cabinetized DC power systems are normally delivered with the symmetry measurement method and the number of measurement points already preprogrammed in the *Smartpack* controller. Any deviation from factory settings requires Symmetry reconfiguration via the *PowerSuite* PC program.

Each *Smartpack* controller is equipped with 8 battery symmetry inputs (on CON4 and CON3), enabling symmetry measurement of:

- 2 battery strings (block meas. method)
- 4 battery strings (double mid-point meas. method)
- 8 battery strings (mid-point meas. method)

*Figure 29 Example of terminal connection points for Symmetry Block, Mid-point and Double Mid-point measurement methods in 48V systems*

## Battery Symmetry Measurements, — Battery Monitor

In addition to using the Smartpack controller's inputs, you can connect Battery Monitor CAN Bus Nodes to perform symmetry monitoring of 48V battery strings.

For more information, read chapter "Battery Monitor" on page 25, and the "Installation Guide Battery Monitor CAN Node" document 351507.033.

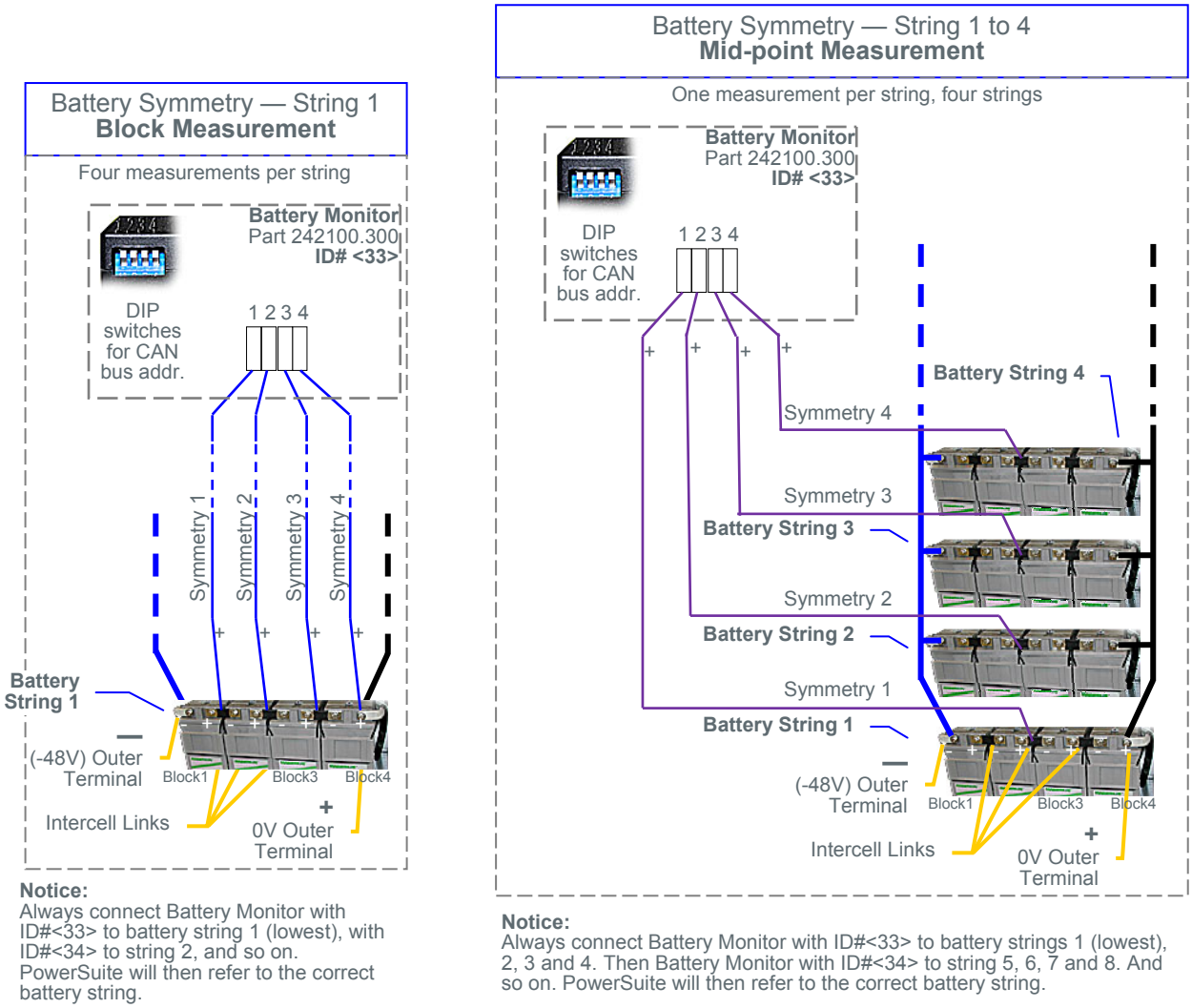



*Figure 30 Example of battery symmetry connections in 48v DC power systems*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