User's Guide

Smartpack

Monitoring and Control Unit

Flatpack2 DC Power Supply Systems

Eltek

350003.013

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NS-EN ISO 14001 Certified
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Safety Precautions

- ☑ The equipment described in this manual must only be operated by Eltek Energy personnel or by persons who have attended a suitable Eltek Energy 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

350003.013 Issue 5, 2006 Nov

Published 2006-11-25

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1. Welcome

The *Smartpack* controller is a powerful and cost-effective module, developed for monitoring and controlling a wide range of *Eltek'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.

Read also the generic and site specific documentation that was delivered with your *Smartpack*-based DC power system.

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 *PowerSuite* application is used for remote operation and system configuration.

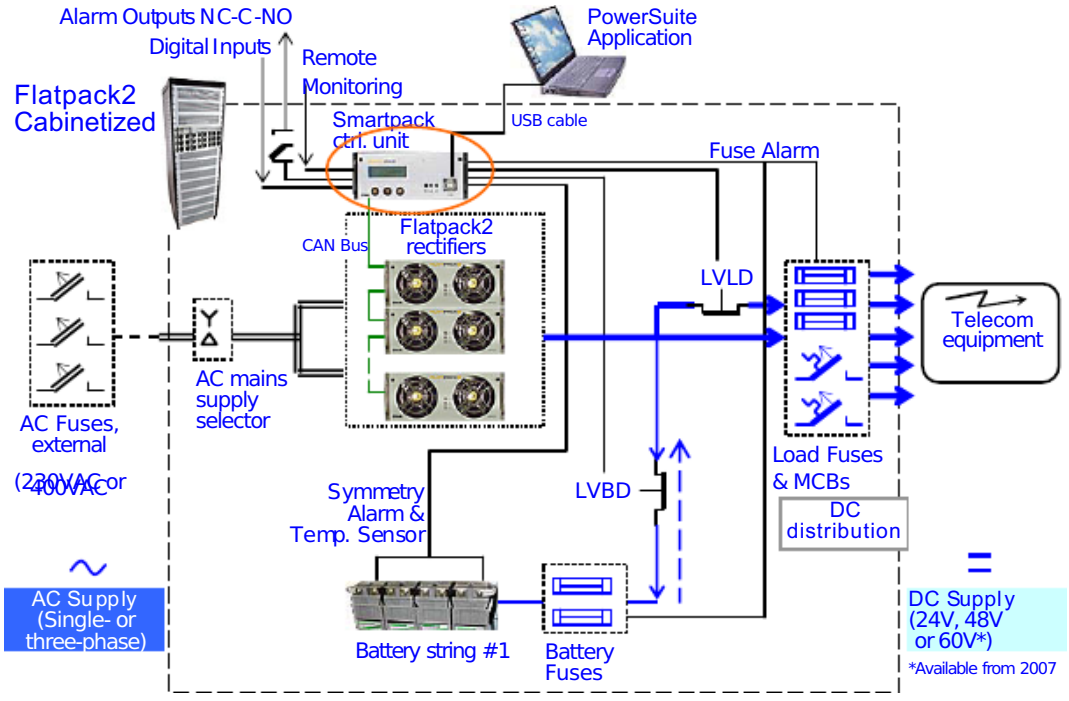


Figure 1 Example of a typical Flatpack2 PS *system for DC power supply of telecom equipment. The system is fed from an external AC mains supply, and consists of rectifiers in power shelves, a control unit and DC distribution unit. Battery banks, LVD contactors, etc. are typically also a part of the system.*

2. 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'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 21.

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

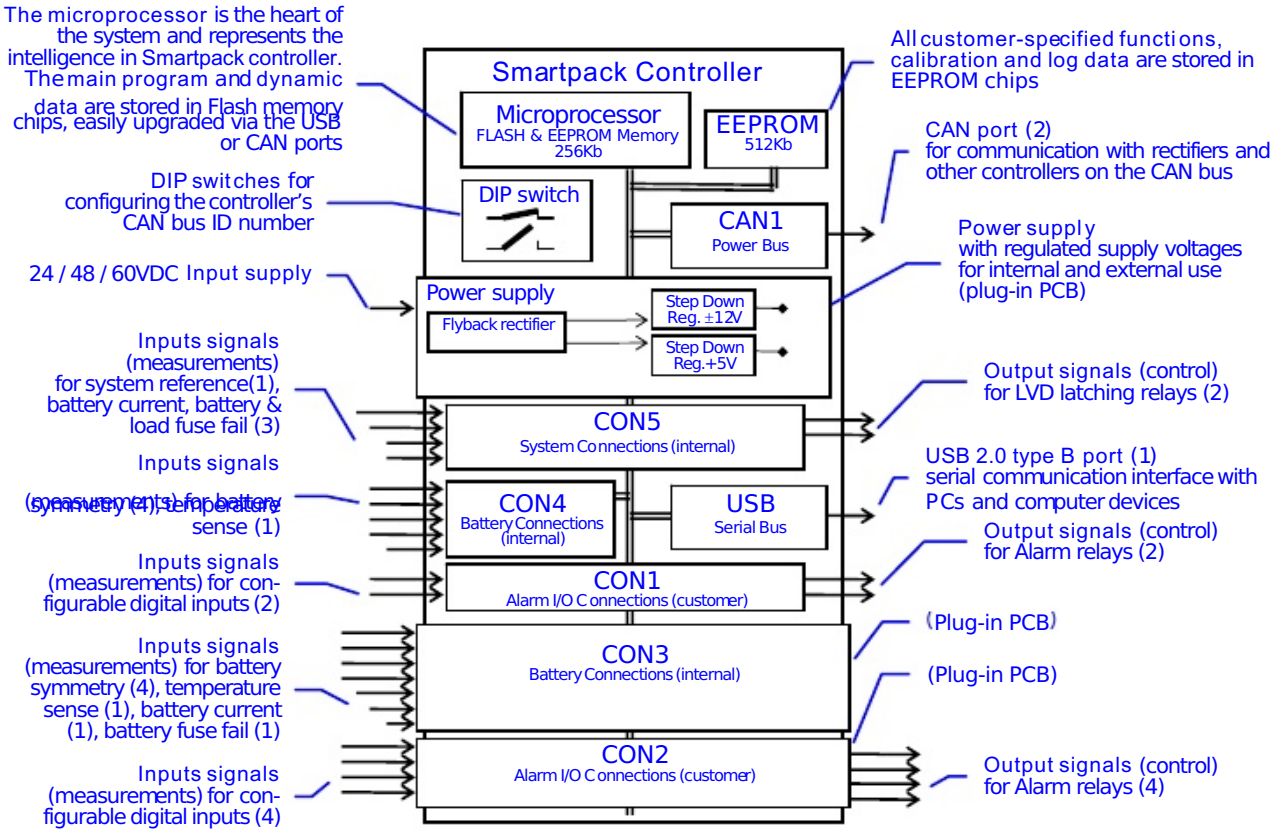


Figure 2 Block diagram of the Smartpack *Battery Extended controller showing the module's main functions*

Typical Applications

The *Smartpack* controller employs CAN bus communication with the rectifiers in the *Smartpack*-based DC power system — and other bus-connected *Smartpack* controllers 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.

On the controller's rear panel —see Figure 4 — 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 10.

Figure 3 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.

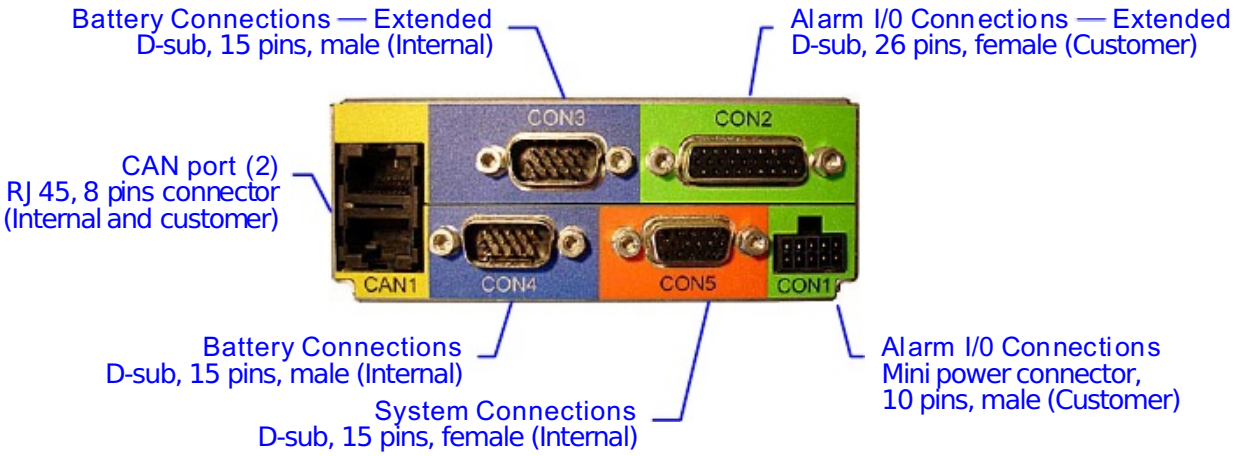
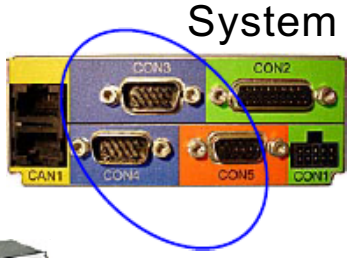


Figure 4 Rear plug connections on a Smartpack *Battery Extended controller*

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 5. See your system's specific arrangement drawings.

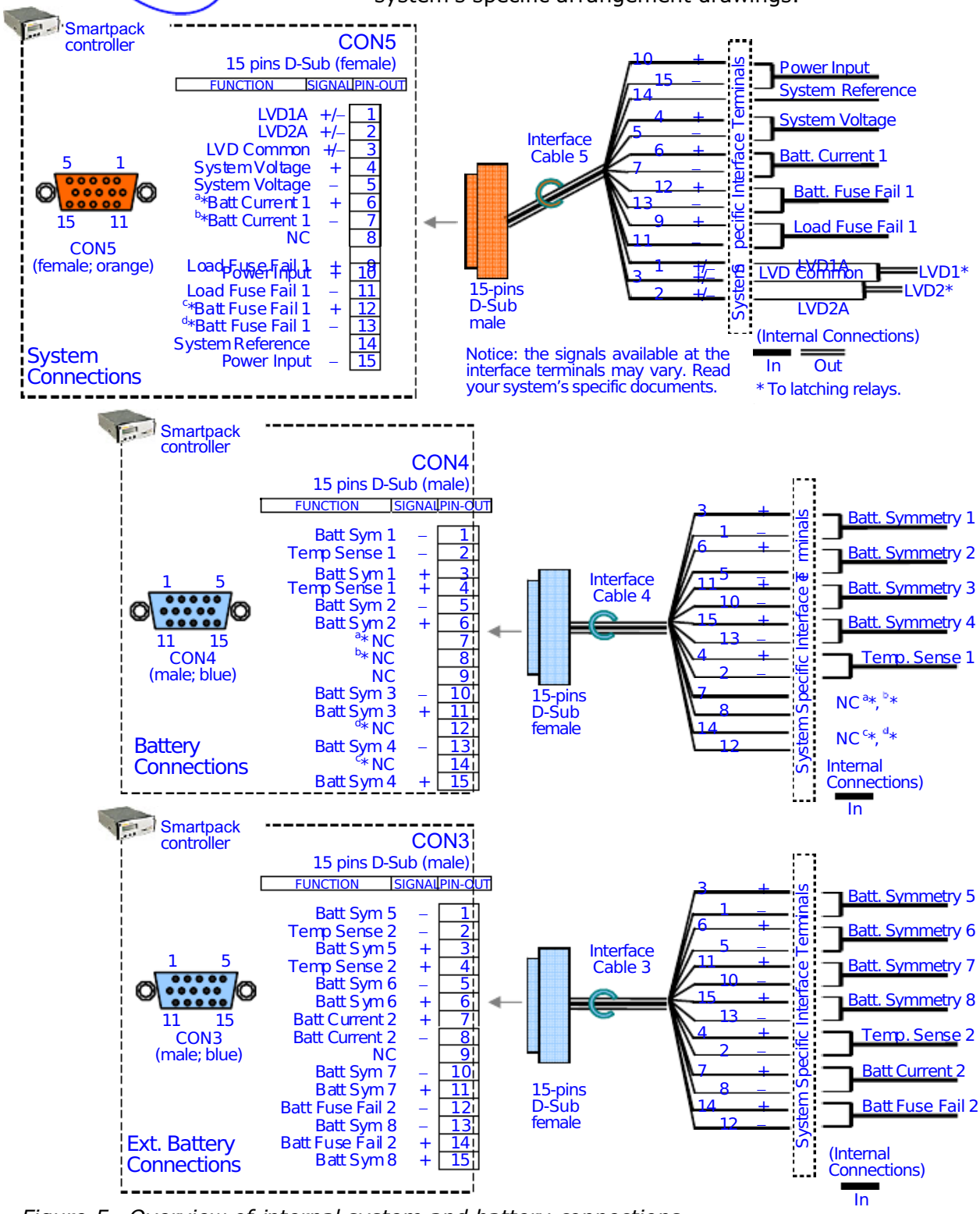


Figure 5 Overview of internal system and battery connections

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 6. See also your system's specific arrangement drawings.

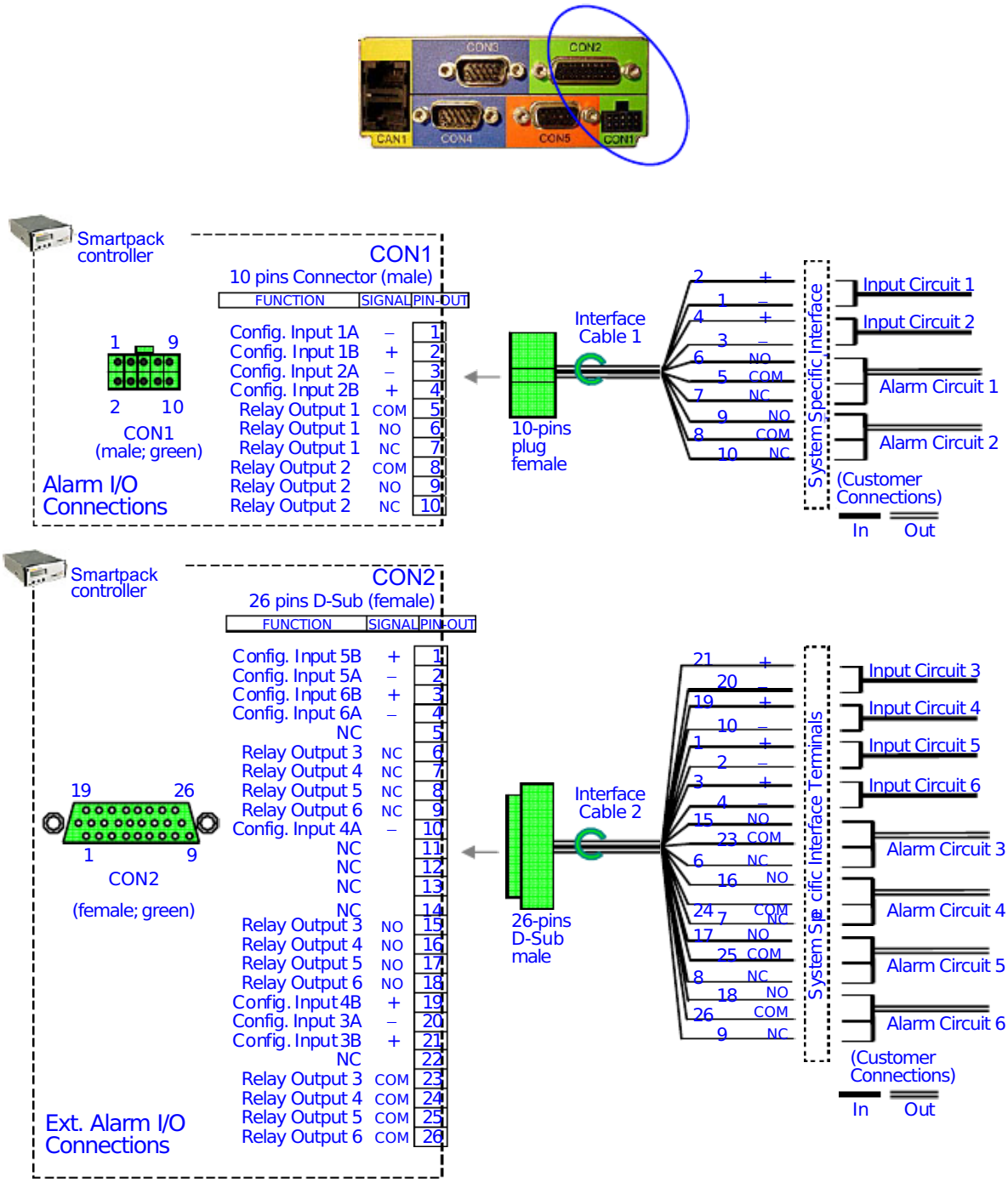
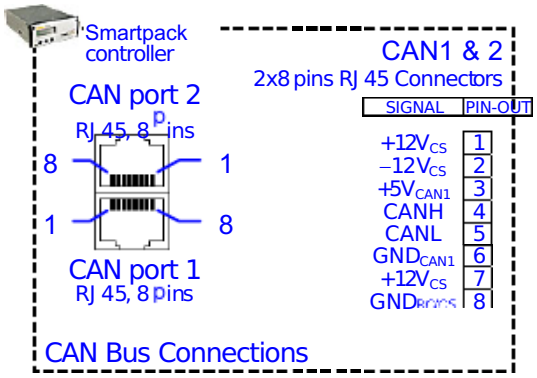


Figure 6 Overview of customer connections — alarm relay & digital input signals

CAN Port Signals — Internal Connections



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 8, page 11.

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

Figur 7 CAN port signals

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 controllers and each of the rectifiers.

CAN bus Addressing

Eltek's CAN bus may address a maximum of 60 nodes. Among them, you may connect a maximum of 8 *Smartpack* controllers and or 50 rectifiers.

Hardware Assignment — Controllers

The *Smartpack* controller is factory configured with a unique CAN bus ID number, using DIP switches on the side of controller (hardware-assignment). See Figure 3, page 7.

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 9, page 11.

Controller	*ID #*	*DIP Switch Position 1 — 2 — 3 — 4*
Master	1	OFF—OFF—OFF—OFF
Slave 1	2	**ON**—OFF—OFF—OFF
Slave 2	3	OFF— **ON**—OFF—OFF
Slave 3	4	**ON**— **ON**—OFF—OFF

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

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. Read "Software Assignment", page 11.

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

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.

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 8. The CAN bus is connected using CAT5 twisted-pair cables.

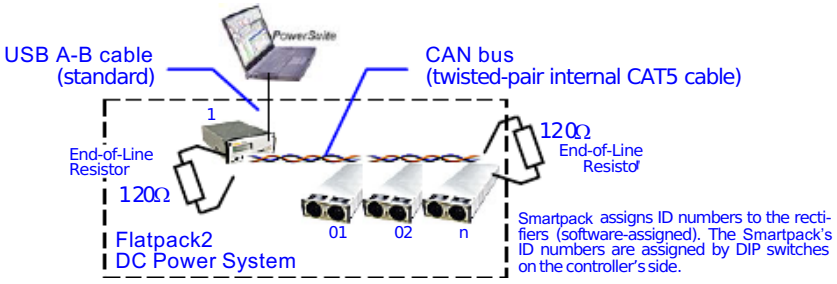


Figure 8 CAN bus terminated with a 120Ω resistor on both line ends (60Ω bus impedance)

The example in Figure 9 shows a *Flatpack2* DC power system expanded with a slave controller to implement additional digital inputs, relay outputs or similar functionality.

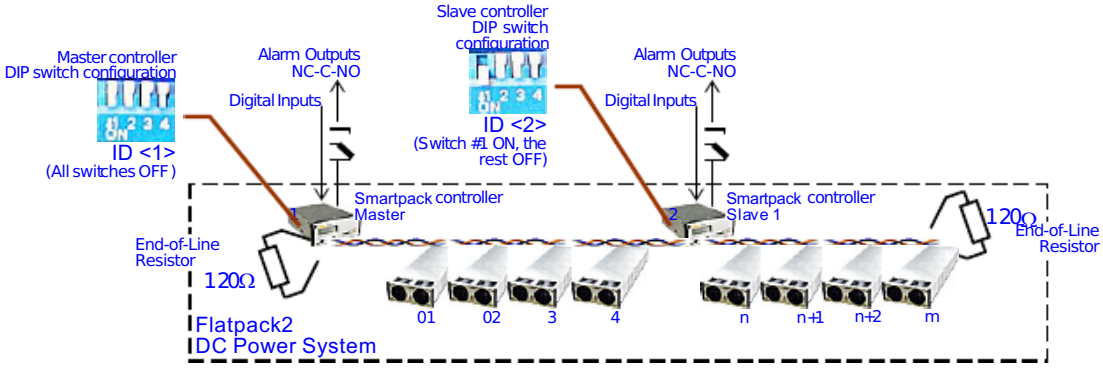


Figure 9 A Flatpack2 *DC power system expanded with two controllers*

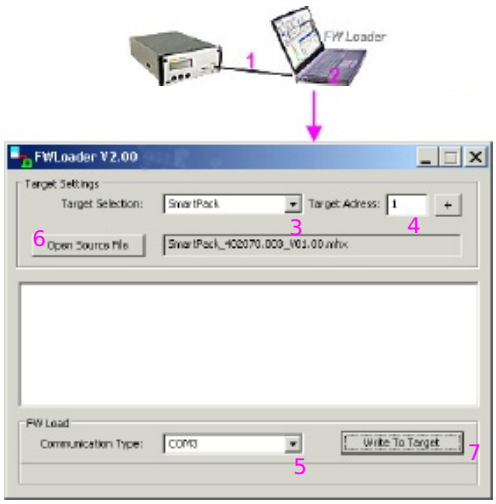
Firmware Upgrade of the Smartpack controller

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 23. 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



FWLoader dialog box Figure 10

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's Service Dep.

Module 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.

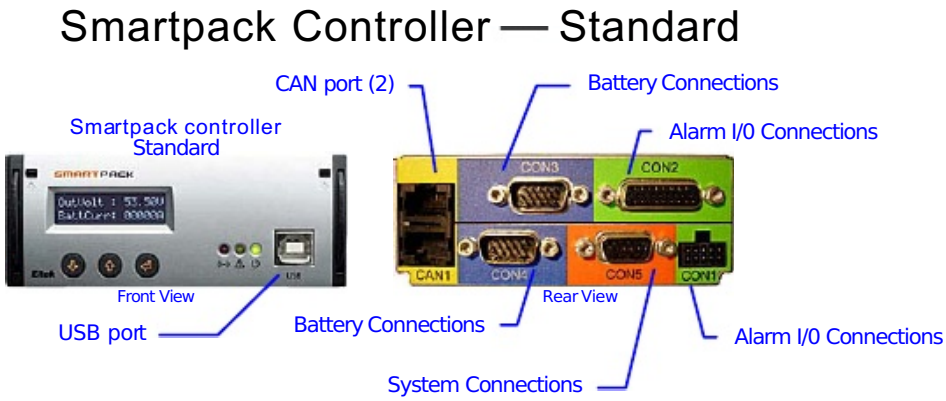


Figure 11 The standard Smartpack *controller. Front and rear connections*

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 9, page 11.
For more detailed description of connectors, see Figure 4, page 7.

Figure 12 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 6, page 9.

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's* stand-alone *WebPower* unit (Ethernet support).

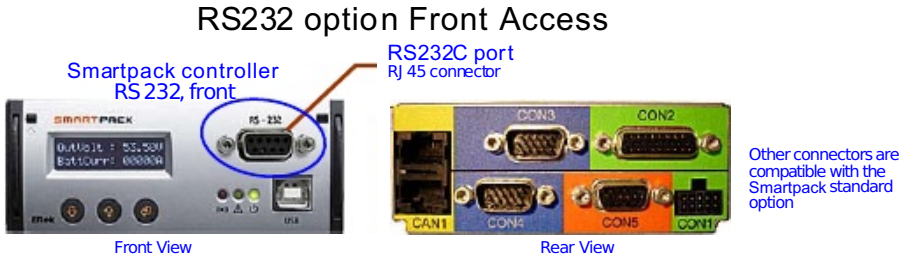
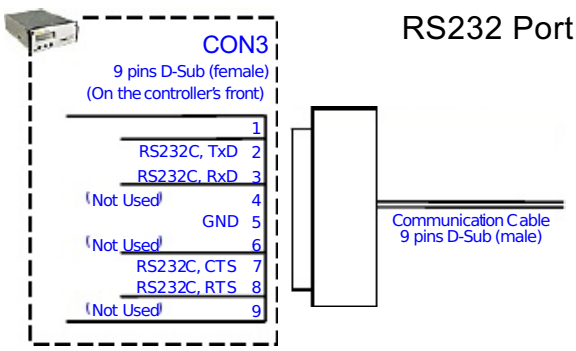


Figure 13 The Smartpack *controller, RS232 option, front. Front and rear connections*

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

Figure 14 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 5, page 8.



RS232 Port Signals

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 15 RS232 port signals

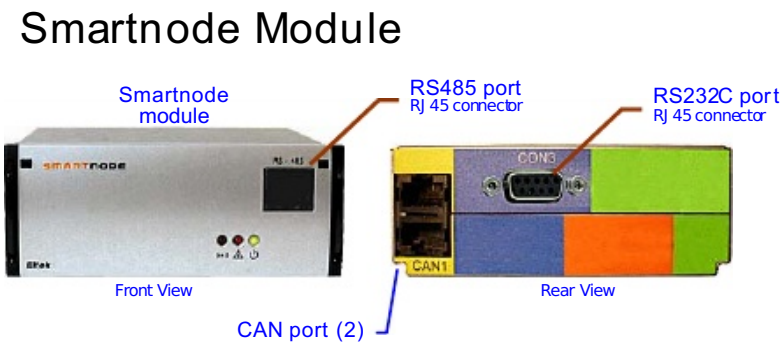


Figure 16 The Smartnode *module. Front and rear connections*

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.

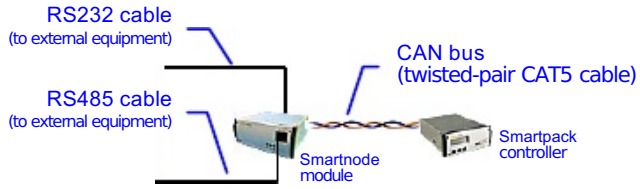


Figure 17 The Smartpack *controller communicating with the* Smartnode *module*

The example in Figure 17 shows schematics of how the *Smartpack* controller can communicate with external equipment with specific protocols, using the *Smartnode* as a protocol translator.

3. 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 18 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.

4.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 7 and 16.

Figure 19 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 18.

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:

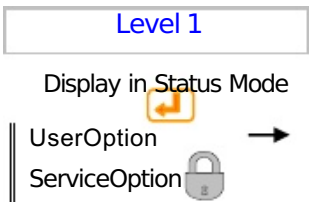
- The upper line shows the name of the active menu or sub-menu
- The lower line indicates which key to press

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 authorised personnel have access to them).



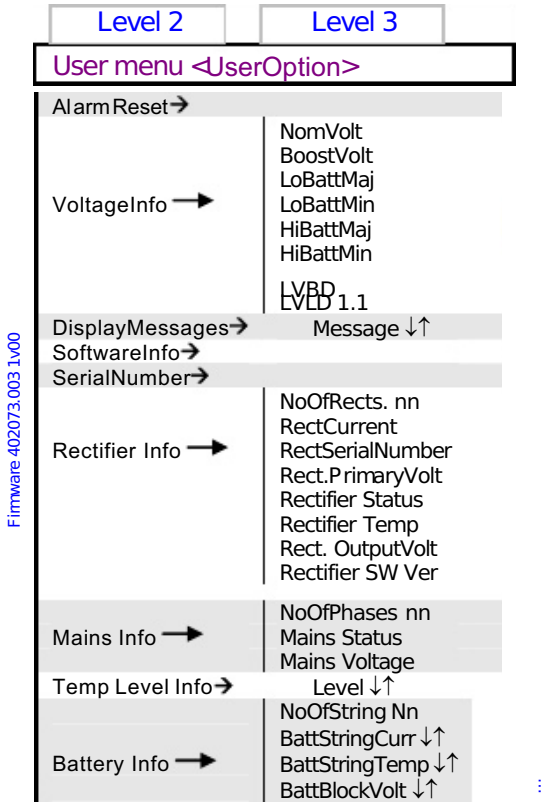
Special, not so frequently used options — such as calibration and adjustments — are accessible in the *Service Options* sub-menus.

User Options UO

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 22. Also, refer to the *PowerSuite* online Help system.

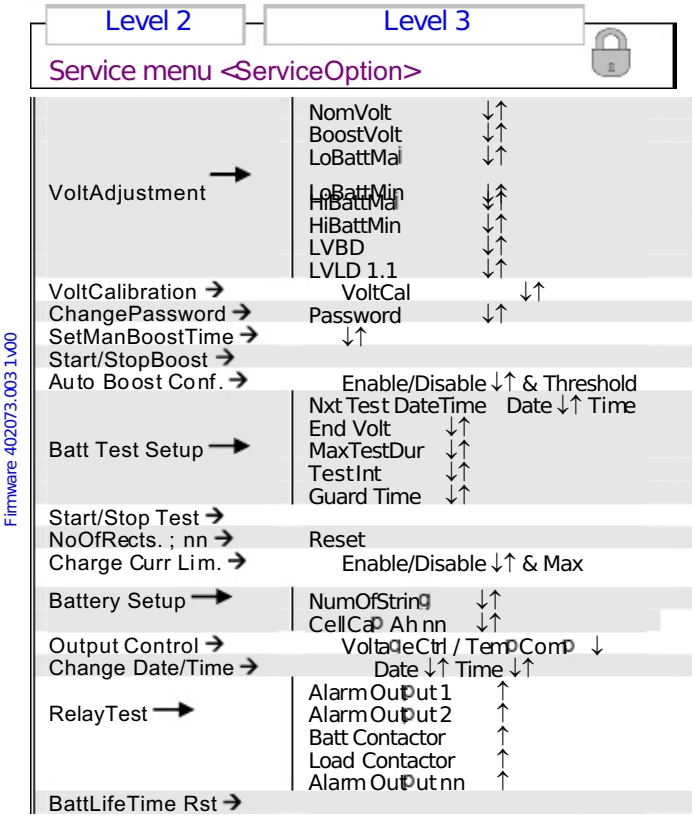
Service Options SO

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.

5. Technical Specifications

Remote Monitoring / Control

From a PC running Windows-based communication software (PowerSuite)
With the 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.

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

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

Local Monitoring / Control

From a PC running Windows-based communication software (PowerSuite)
Windows-based comm. 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.

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 Over voltage Protection
Rectifier Current

Specifications

Input Voltage	24/48/60 VDC (Nominal system voltages)
Firmware	The Smartpack main program can be upgraded via the USB port, using a PC running the FWLoader application
Dimensions	109 x 44 (1U) x 140mm (wxhxd) (4.3 x 1.7 x 5.5")

6. Functionality Description

In this chapter you can find helpful and more detailed descriptions of expressions, technical terms, functions, etc. used in *Smartpack*-based DC power systems.

Alarm Reset

UO (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

UO (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)

UO (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 UO (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 UO (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 UO (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 24.

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.

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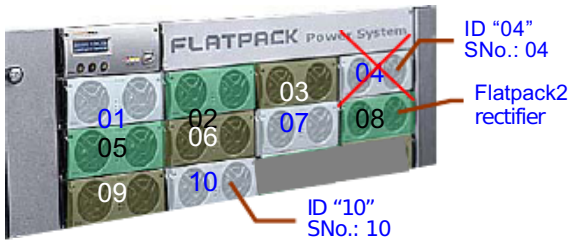
[4] 4AC Power Shelves (Single AC feed: 4 AC inputs per shelf, each feeding 1 rectifier).
[5] 2AC Power Shelves (Dual AC feed: 2 AC inputs per shelf, each feeding 2 rectifiers).

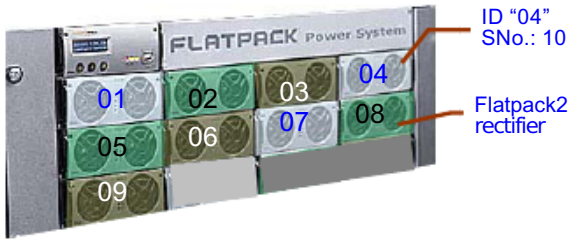
Example: Flatpack2 DC power system with malfunctioning rectifier;
3 power shelves with 10 rectifiers (rectifier ID #04 malfunctions)

Rectifier ID 01 Serial No. 01	Rectifier ID 02 Serial No. 02	Rectifier ID 03 Serial No. 03	Rectifier ID 04 Serial No. 04
Rectifier ID 05 Serial No. 05	Rectifier ID 06 Serial No. 06	Rectifier ID 07 Serial No. 07	Rectifier ID 08 Serial No. 08
Rectifier ID 09 Serial No. 09	Rectifier ID 10 Serial No. 10		



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

Rectifier ID 01 Serial No. 01	Rectifier ID 02 Serial No. 02	Rectifier ID 03 Serial No. 03	Rectifier ID 04 Serial No. 10
Rectifier ID 05 Serial No. 05	Rectifier ID 06 Serial No. 06	Rectifier ID 07 Serial No. 07	Rectifier ID 08 Serial No. 08
Rectifier ID 09 Serial No. 09			



Display System Mains Data

UO (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

UO (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 configure the Battery Lifetime Temperature monitor to automatically activate an alarm when the system's battery bank has been within a temperature range (or level) longer that a certain period of time. For each of the 10 temperature ranges, you can configure the upper and lower temperature values, and the time limit.

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

UO (BatteryInfo)

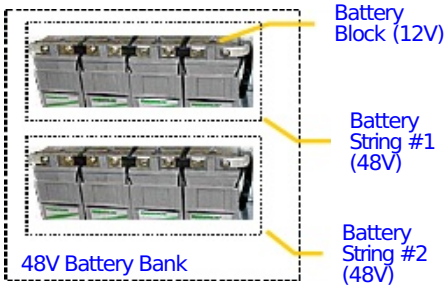
You can display information about the power system's battery bank by selecting "*UserOption>Battery Info*", via the *Smartpack* controller's front keys.

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 26 and to the "Quick Start Guide *Flatpack2* PS System", Art. 356804.103.

About Battery Banks, Strings and Blocks



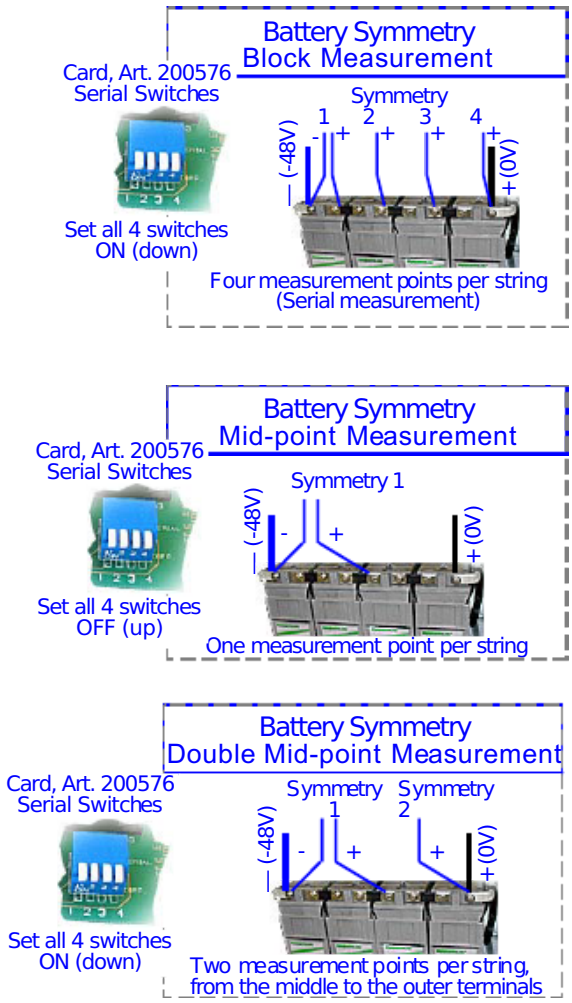
Normally, battery banks are implemented by connecting in parallel several battery strings; each string is formed by battery blocks connected in series.

Figure 20 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

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

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