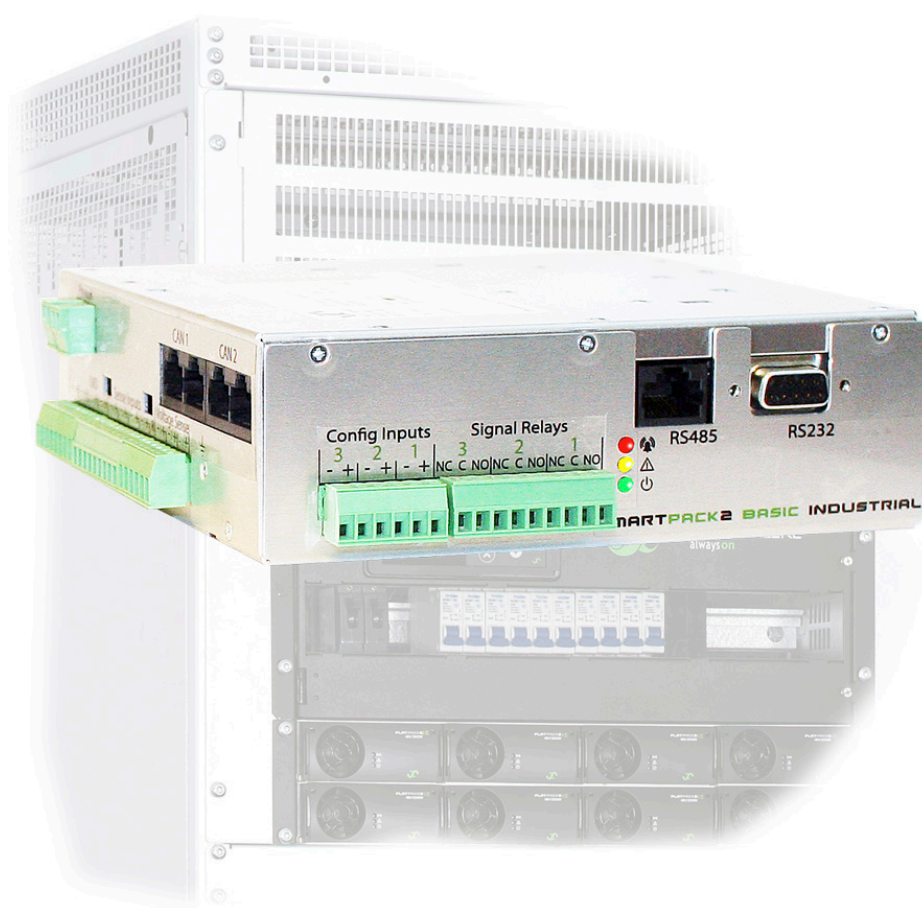


User's Guide

Smartpack2 Basic Industrial



Monitoring and Control Unit
Flatpack2 DC Power Supply Systems

SAFETY and ENVIRONMENTAL PRECAUTIONS

The **product warranty** becomes invalid if the following safety precautions are not followed during handling, installation, commissioning and general use/operation of *Eltek* DC power supply system.

General Precautions



CAUTION: Even though the product incorporates protection circuitry and other safeguards, it can be **damaged, perform poorly or have a reduced life cycle** if it is exposed to **incorrect treatment** during transport, installation or service. Always handle the equipment using proper lifting techniques, do not roll, climb or drill hole in the cabinets or enclosures.

G1



WARNING: Opening the equipment may cause terminal injury — even if the mains AC supply is disconnected. Hazardous voltages may be present inside, as large capacitors may still be charged.

G2

Environmental Precautions



CAUTION: To avoid damage the equipment, **keep objects clear of system ventilation inlets, outlets and system fans**, if any, ensuring the **airflow** through the units is **not obstructed**, and that the fans rotate freely. Use caution with rectifiers, as they can reach **extreme temperatures** under load and normal operation.

E1



WARNING: The installer/user is responsible for ensuring that the DC power system is not damaged by current surges, over-voltages, etc. caused by external transients, lightning, electrostatic discharge, etc. To avoid damage and obtain the expected system reliability, it is mandatory to always install SPDs in Eltek's power supply systems. Follow the instructions given in "Guidelines for Lightning and Surge Protection", doc. 2024623.

E2



WARNING: The electronics in the power supply system are designed for indoor, clean environment. When installed in outdoor enclosures, it is important to keep the door closed during operation, and replace the filters on a regular basis. Indoor installations in dusty or humid areas require appropriate air filtering of the room, or filtering of the air entering the DC power system. Follow the instructions given in "Generic Guidelines Environmental Protection.", doc. 2038879

E3

Precautions during Installation



CAUTION: Read the user documentation carefully before installing and using the equipment, as installation and operation is to be performed as described in it. Always tighten screws and bolts with the **torque values recommended** in the documentation. For safety reasons, the **commissioning and configuration of the equipment is only to be performed** by *Eltek's* personnel or by authorized and qualified persons.

I1



CAUTION: The **installer is responsible** for ensuring that the EMC properties of this product/ system do not deteriorate during installation, and that it is performed in accordance with applying regulations. **Installations in USA and Canada** must comply with NEC/CEC requirements.

I2



CAUTION: Before you start the electrical installation, you must **always disconnect** all external AC supply fuses, as well as internal battery and load fuses/ breakers, if any.

I3



WARNING: For safety reasons (high leakage current / high touch current) you must always connect the AC earth wire (PE) to the terminals, before you connect the AC input cable(s).
The batteries, if any, represent a major energy hazard. To avoid short-circuit of battery poles, you must always remove metallic objects — uninsulated tools, rings, watches, etc. — from the vicinity of the batteries.

I4



WARNING: 60V DC power systems are only to be installed in Restricted Access Locations (RAL). Access must be limited by use of tool, i.e. lock and key.

I5

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Safety Precautions

- △ The equipment described in this guide must only be operated by *Eltek* personnel or by persons who have attended a suitable *Eltek* 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 guide carefully before using the equipment

Eltek's Part Number: 242100.601 *Smartpack2* Basic Industrial Controller

Doc No: 350025.033
mafen0

Issue 1.0, 2012 Mai DRAFT2
Published 2012-05-31

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1. Introduction

The *Smartpack2 Basic Industrial* controllers are reliable, versatile and cost-effective modules used as slave controllers in *Smartpack2*-based power systems for industrial and telecom applications.

About this Guide

This booklet describes the building blocks, external connections and technical specifications for the *Smartpack2 Basic Industrial* controller.

For detailed functionality description, browse and search through the *Functionality Description Help* file (or Doc 350020.073) or *Online Help* files for *WebPower* or *PowerSuite*. The user guide for the *Smartpack2 Master* controller (Doc 350020.013) might also be helpful.

Short about Industrial Power Systems

Many industrial loads are very sensitive to voltage dips and other disturbances originating from the grid. Industrial power systems solve, among other things, specific power quality problems in industrial applications. Read also “3. *Typical Industrial Applications*” on page 19.

What are Industrial Applications

The term “industrial applications” in this guide refers to power supply systems used in the business of manufacturing products, power generation and transportation, such as: process industry, power generation & distribution, rail and marine & offshore.

Industrial power systems may employ AC/DC rectifiers, DC/DC converters, DC/AC inverters, etc. with system voltages 24V, 48V, 60V, 110V, 125V and 220V. Also, the systems typically implement 2-pole floating DC output (not earthed or floating earth).

System Diagram ~ Industrial FP2 System with SP2BI

The generic *Smartpack2* (SP2) distributed control system — used in *Flatpack2* PS systems for industrial applications — monitors and controls the whole system, and consists of the *Smartpack2 Master* (SP2M) controller and the *Smartpack2 Basic Industrial* controller (SP2BI).

The *Smartpack2 Master* controller serves as the local user interface between you and the system. The *Smartpack2 Basic Industrial* controller monitors and controls the power system's internal wiring and supplies both CAN bus systems with power. It also provides the system with input monitoring and output controlling signals. The *WebPower* application enables system configuration via a standard web browser.

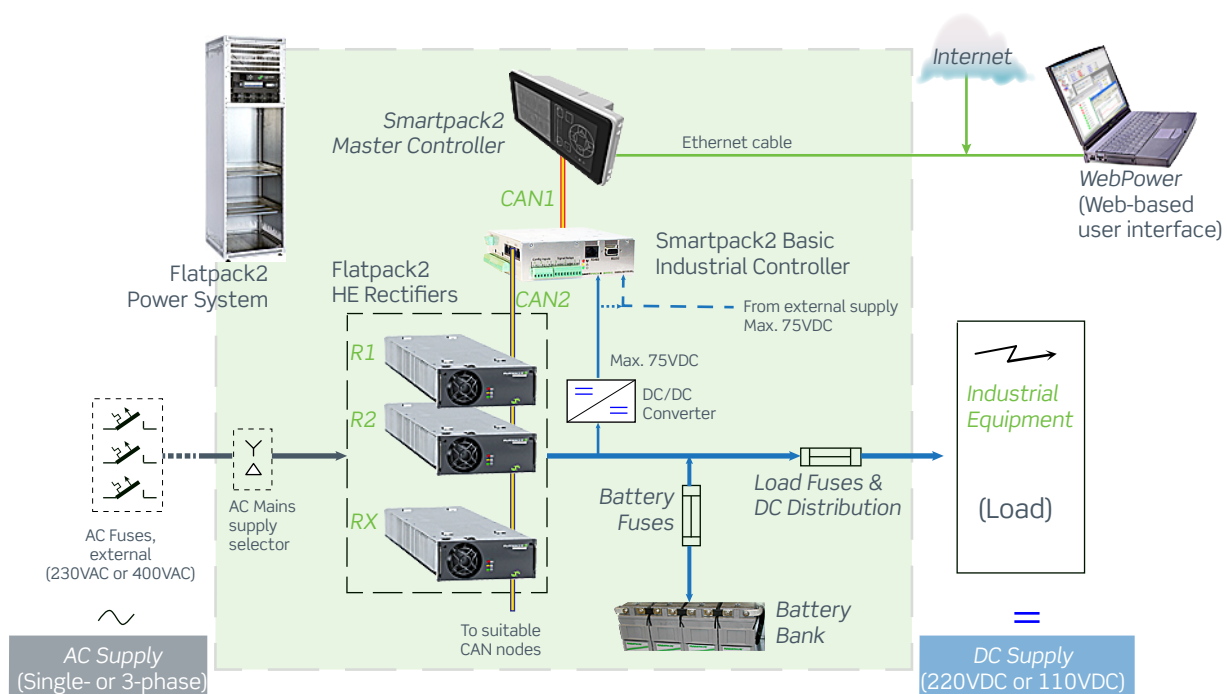


Figure 1. Example of a typical Flatpack2 DC power supply system for 220 or 110VDC industrial equipment. The system is fed from an external AC mains supply, and consists of rectifiers in power shelves, master and industrial basic controllers and 2-pole DC distribution unit. Battery banks are typically also a part of the system

2. The Smartpack2 Basic Industrial Controller

The *Smartpack2 Basic Industrial* controllers are reliable and versatile modules used as **slave controllers** in the distributed control system of *Smartpack2*-based power applications. They can also operate in **stand-alone mode**, maintaining the system in normal operation, thus providing redundancy and improving system reliability.

The versatile *Smartpack2 Basic Industrial* controllers can be used in typical industrial and telecom power supply applications, with system voltage ranging from **12VDC to 430VDC**, and using **negative-, positive- and floating DC distribution** units. Read also chapter “3. Typical Industrial Applications” on page 19.

They are developed for monitoring and controlling the power system’s internal functionality, and provide two isolated distributed power sources for CAN nodes connected to **two separated CAN bus systems with floating voltage references**. While the two CAN bus systems are used for internal system communication, the SP2BI controllers may also communicate with external systems via **isolated RS232 and RS485** serial ports.

For increased reliability, the controllers may be **fed from two external supplies**, as the two internal switch mode power supplies feed one CAN interface each, and both feed the controller’s measuring circuitry. The core functionality and one CAN interface will still function normally, even after the loss of one of the external power inputs.

The *Smartpack2 Basic Industrial* controllers implement — among many other features — isolated and floating measuring circuitry with **selectable measuring reference point**, with voltage sense inputs ranging from **0 to 430VDC**.

Key Features

A wide range of features are implemented in the *Smartpack2 Basic Industrial* controllers:

- ◇ 3 LED lamps for local visual alarming (Major, Minor, Power ON)
- ◇ 2 separated CAN bus systems with distributed power for connected CAN nodes
- ◇ 2 serial communication ports, RS232C and RS485, for external equipment
- ◇ 5 sense inputs for internal monitoring: 3 voltage sense inputs and 2 current sense inputs
- ◇ 2 configurable inputs for load and battery fuse monitoring
- ◇ 1 internal isolation sense input for Earth fault detection
- ◇ 3 configurable multipurpose inputs (temperature, digital inputs or analog signals)
- ◇ 3 LVD control outputs, configurable for latching and non-latching contacts
- ◇ 3 user programmable NC-C-NO relay outputs for remote control
- ◇ Up to 10 *Smartpack2 Basic Industrial* controllers may be connected each CAN bus

- ◇ CAN bus addressing via DIP switches
- ◇ Compatible with telecom and industrial system voltages up to 430VDC
- ◇ Suitable for power systems with negative-, positive- and floating DC distribution
- ◇ Controller's electronics implemented in 7 different isolated sections
- ◇ Configuration via the master controller's front keys or *WebPower* on a standard web browser
- ◇ Firmware upgrade via the CAN bus (refer to [page 18](#))

Read also chapter *“Technical Specifications”* on [page 17](#), for more details.

Block Diagram

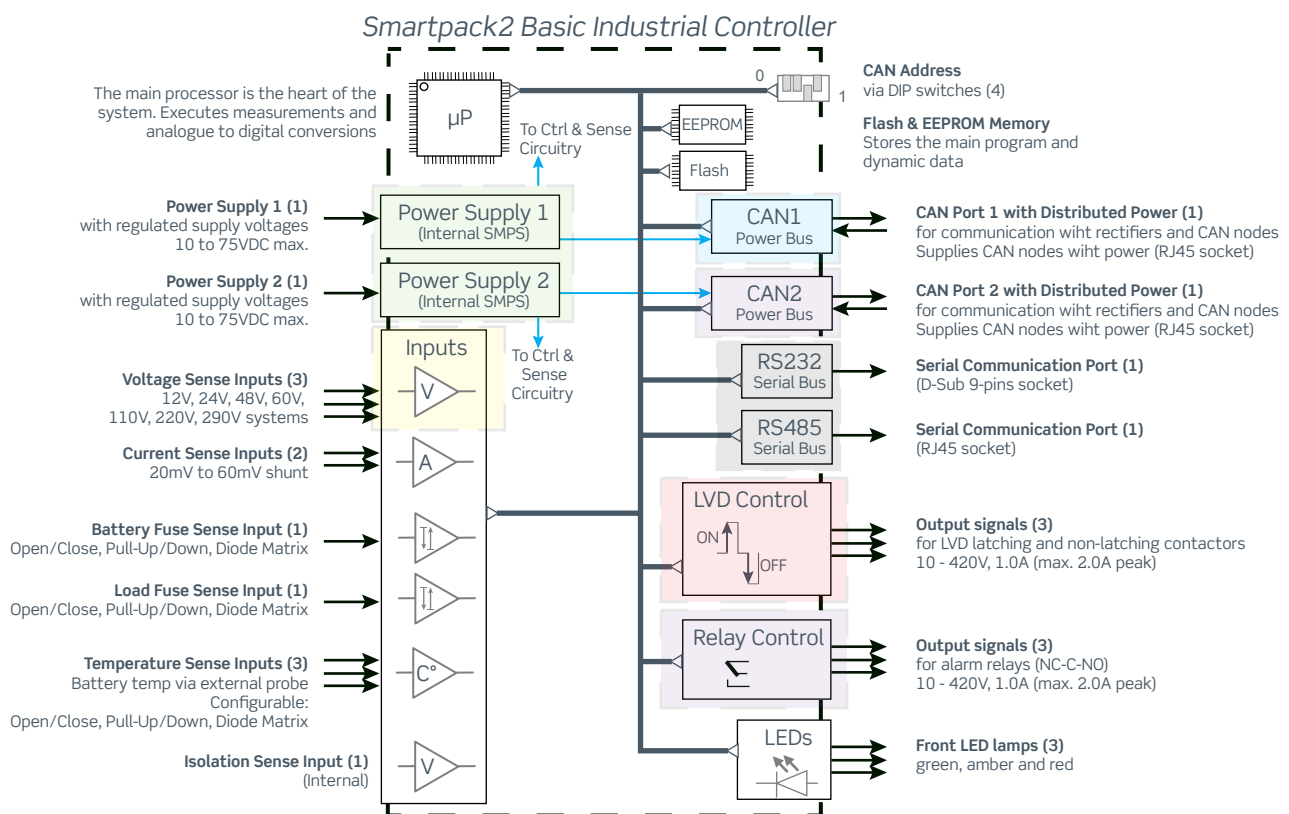


Figure 2. Block diagram for the Smartpack2 Basic Industrial controller, indicating the 7 different isolated sections

Location of Components

Terminal Blocks, Ports and LEDs

For a complete list of signals, pin-out, etc., refer to chapter “*Connection Drawing*” on page 13.

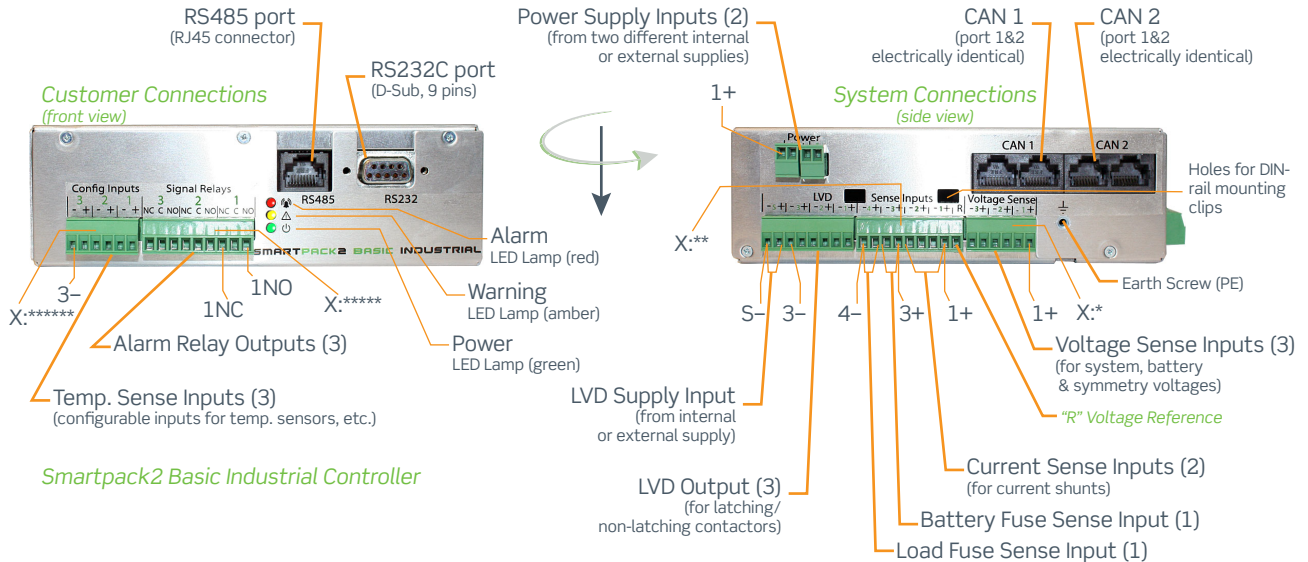


Figure 3. Location of pluggable terminal blocks, CAN ports, RS232C, RS485 serial ports and LED indicators in the Smartpack2 Basic Industrial controller. (The pluggable terminals may be black or green)

CAN1 port 1 and 2 and CAN2 port 1 and 2 are electrically identical, and are used to enable connection of the CAN bus incoming and outgoing cables, or the RJ45 CAN bus termination plug.

To increase reliability, the **two power supply inputs** are to be connected to two different power sources. When only one power source is used, the power input terminals must be connected together or paralleled (+ & + and – & –).

To obtain accurate voltage measurements, the “R” terminal (Voltage Reference) must be connected to the system’s positive- or negative bus-bar, where the system’s current shunt are installed. When no current shunts are used, the “R” terminal is to be connected to either the system’s positive- or negative bus-bar.

For interpreting the LED lamps indications, refer to *Table 1 on page 9*.

LED Indicator	Illumination Status	Description
Power	OFF ON green Flashing green	The controller is OFF, has NO supply ON or Supply healthy Distributed Power Fault
Warning	OFF ON amber Flashing amber	No Warning Warning (Minor alarm, non-critical alarm) Communications Fault
Alarm	OFF ON red Flashing red	No Alarm Alarm (Major Alarm, critical alarm) SW Fault or Boot Loader Mode

Table 1. Description of the Smartpack2 Basic Industrial controller’s LED illumination status

Jumpers and DIP Switches

An Isolation Sense jumper and four DIP switches are located on the controller's bottom.

By default, the Isolation Sense jumper (JP401) is always inserted, thus the Earth Fault Detection measuring circuitry is active. The jumper may be removed during isolation tests at the factory, for disconnecting the ground from the measuring circuitry.

The four DIP switches are used for configuring the controller's unique CAN bus ID number, refer to chapter *"CAN Bus Addressing"* on page 15.

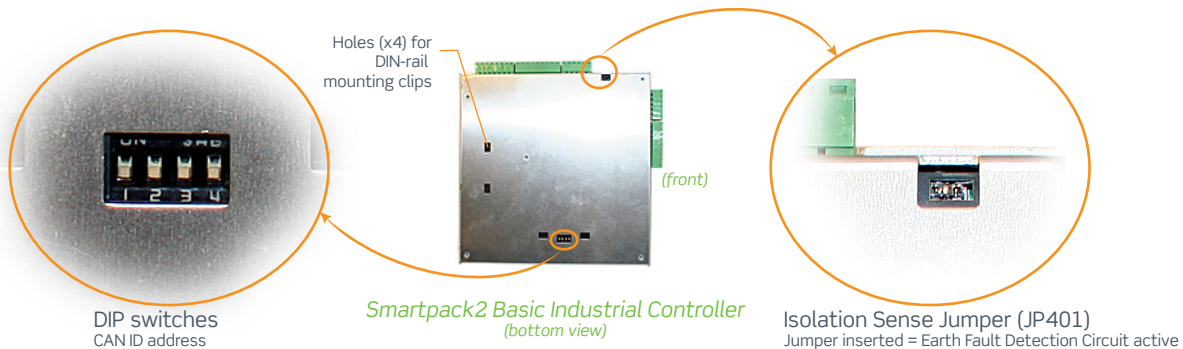


Figure 4. Location of DIP switches, and Isolation jumper in the Smartpack2 Basic Industrial controller

The RS485 EOL resistor jumper (JP300) is located on the controller's top.

When the jumper is inserted, the RS485 serial line is automatically terminated with a 150Ω end-of-line resistor at the controller's side.

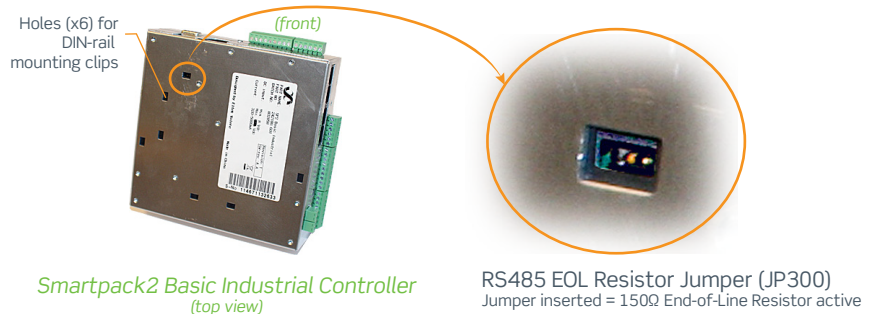


Figure 5. Location of the RS485 EOL resistor jumper in the Smartpack2 Basic Industrial controller

Installation of the SP2BI Controller

The *Smartpack2 Basic Industrial* controller is **usually factory installed** in *Flatpack2* PS systems that are pre-engineered with this controller.

The controller's metal enclosure can be mounted anywhere in the system cabinet or subassembly, snapping the two DIN rail clips directly on a suitable internal DIN rail.

You can snap the controller on the DIN rail with different orientations, depending on which holes on the metal enclosure you use to fasten the DIN rail clips, see *Figure 4* and *Figure 5* on page 10.

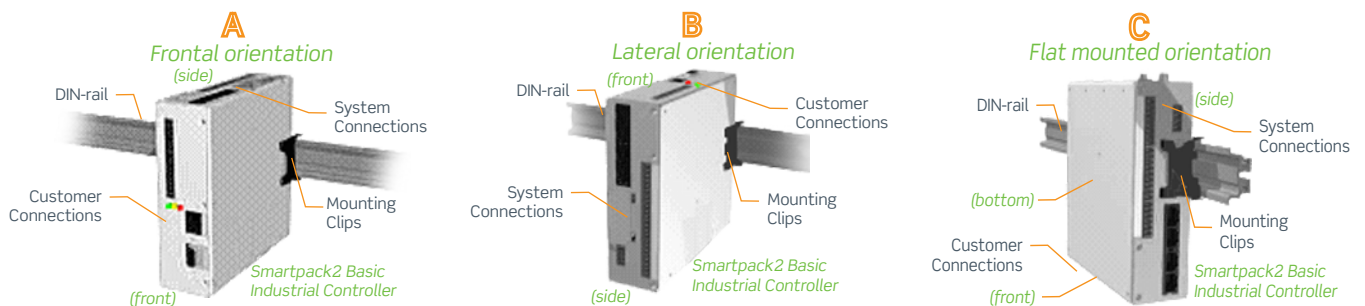


Figure 6. *Smartpack2 Basic Industrial* controller's mounting orientation

Frontal orientation (A) provides easy front access to the customer connection terminals, good visibility of the LED lamps and top access for the system connection terminals.

Lateral orientation (B) offers easy access to the system connection terminals and top access to the customer connection terminals.

Flat-mounted orientation (C) is suitable when there is little space in front of the DIN rail.

The controller can also be fixed on any place inside the system, using screws and special mounting clips.

The length of the controller's connection cables must be adapted to the actual mounting location. Refer to chapter "*Connection Drawing*" on page 13.

If you need to replace the *Smartpack2 Basic Industrial* controller with a new one, always follow the precautions relevant for installation, commissioning and general handling of the *Smartpack* and *Smartpack2*-based DC power systems.

CAUTION: For safety reasons, the **commissioning and configuration of the equipment is only to be performed** by Eltek's personnel or by authorized and qualified persons; otherwise the warranty may be invalidated. Please, **read the user documentation carefully** before installing and using the equipment, as installation and operation is to be performed as described in it.



You need standard installation tools and equipment used by an authorized electrician. NOTE: All tools must be insulated.

Fastening the Controller to the DIN Rail

Before fastening the controller inside the DC power cabinet or subassembly, configure its CAN ID address — refer to chapter “CAN Bus Addressing” on page 15 — and switch OFF the power system.

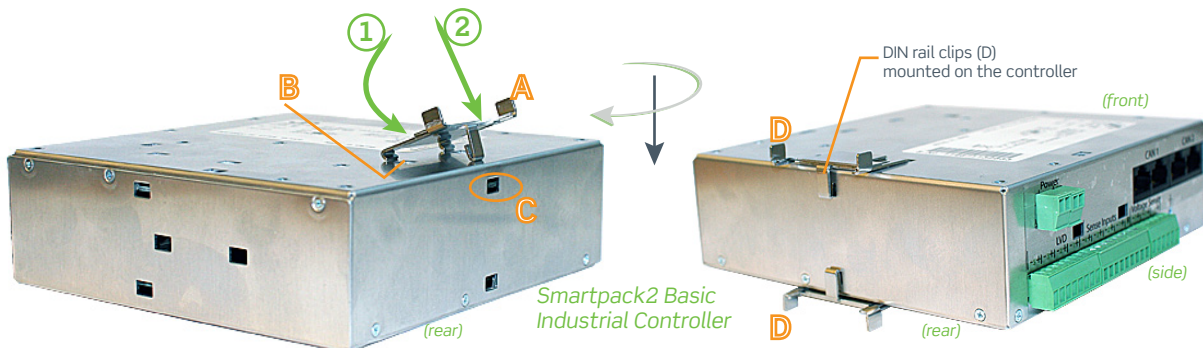


Figure 7. Mounting DIN rail clips on the Smartpack2 Basic Industrial controller

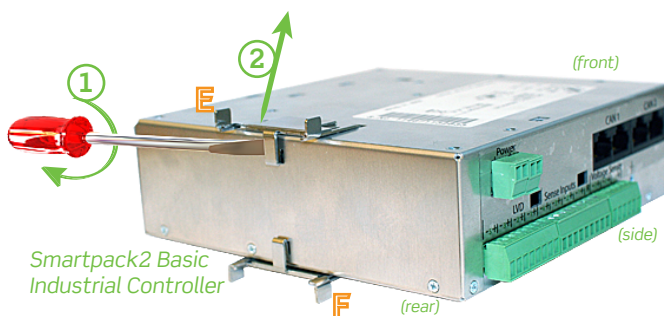
To fasten the *Smartpack2 Basic Industrial* controller to a DIN rail inside the DC power cabinet or subassembly, use the two dedicated DIN rail clips.

Carry out the following, see *Figure 7 on page 12*:

Power is OFF!

1. Hook DIN rail clip (A) in the controller's suitable holes (B)
2. Press the clip's front (A) down until it snaps in hole (C)

Repeat steps 1 and 2 to mount the second DIN rail clip, as shown (D)(D), and finally snap the controller's clips fast into a suitable location on the DIN rail.



To remove the DIN rail clips from the controller — to change its mounting orientation, or for other reasons — carry out the following, see *Figure 8 on page 12*

1. Press a flat screwdriver between the clip's single hook and the controller, and then turn the screwdriver to disengage the clip's hook from the controller
2. Lift the clip (E) to unhook it completely from the controller

Repeat steps 1 and 2 to remove the second DIN rail clip (F).

Connection Drawing

Use this drawing as a connection reference for all cabling. You find the exact location of connection terminals, plugs, DIP switches, jumpers, etc. by referring to chapter “*Location of Components*” on page 9. Notice that **power input 1 & 2** are to be paralleled, when only one supply is used.

The LVD control outputs may be configured for both latching and non-latching contactors using the *WebPower* via a standard web browser.

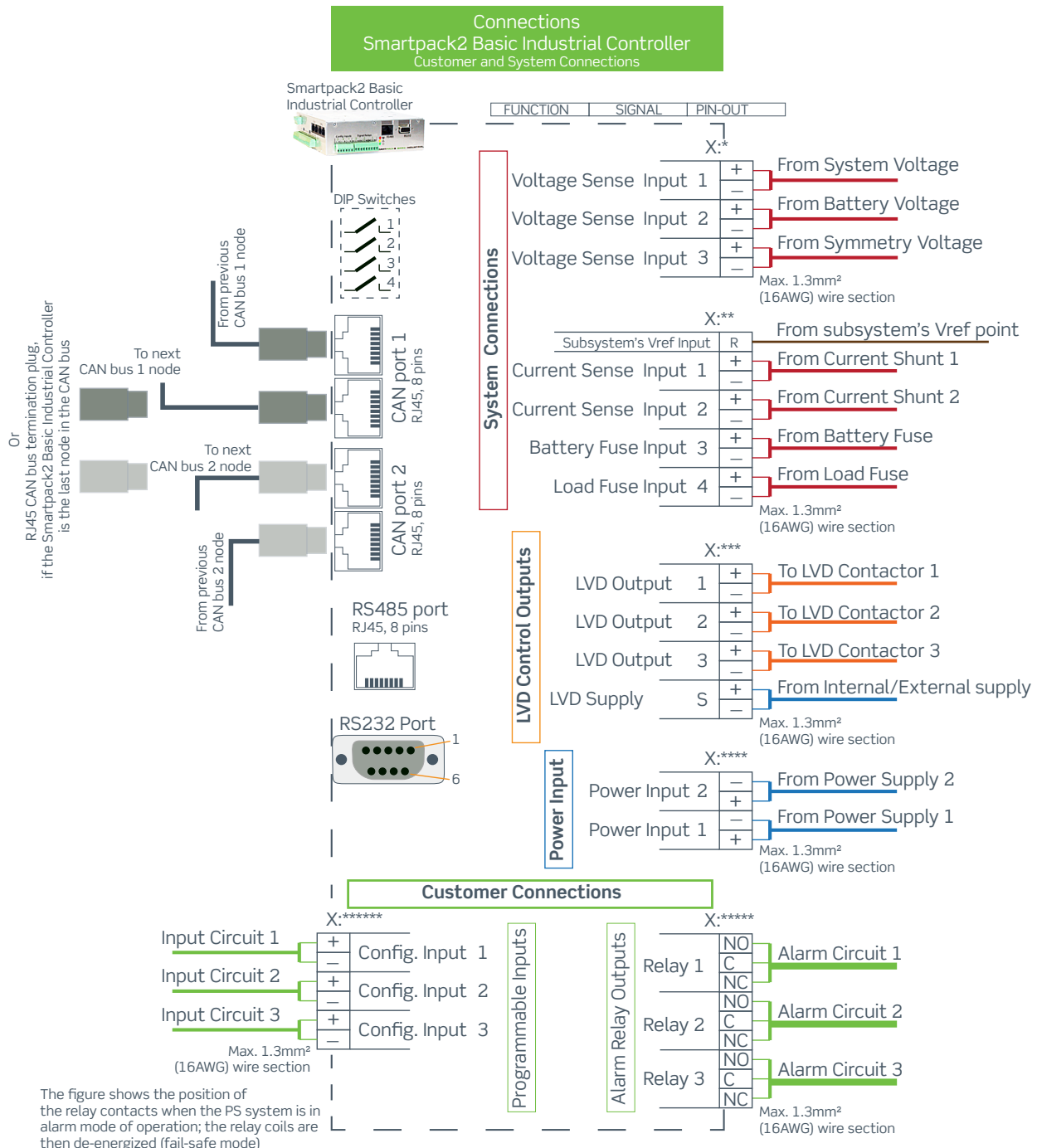


Figure 9. Connection Drawing for Smartpack2 Basic Industrial controller. Torque recommendation for terminal connections: 0.4 Nm ($\pm 10\%$)

Read also chapter “*Technical Specifications*” on page 17.

CAN Bus Termination

To ensure a correct bus communication and avoid data reflection, you must always terminate the CAN bus with two 120Ω resistors, one at each end of the line (60Ω bus impedance).

Smartpack and *Smartpack2*-based DC power systems are shipped from factory with the CAN buses already terminated with 120Ω resistors. The CAN bus termination is implemented with a special RJ45 plug with built-in 120Ω end-of-line resistor.

When connecting more CAN nodes to the bus, you have to remove the CAN bus termination plug from one of the CAN bus ends, and plug it in one of the CAN ports on the last connected CAN node.

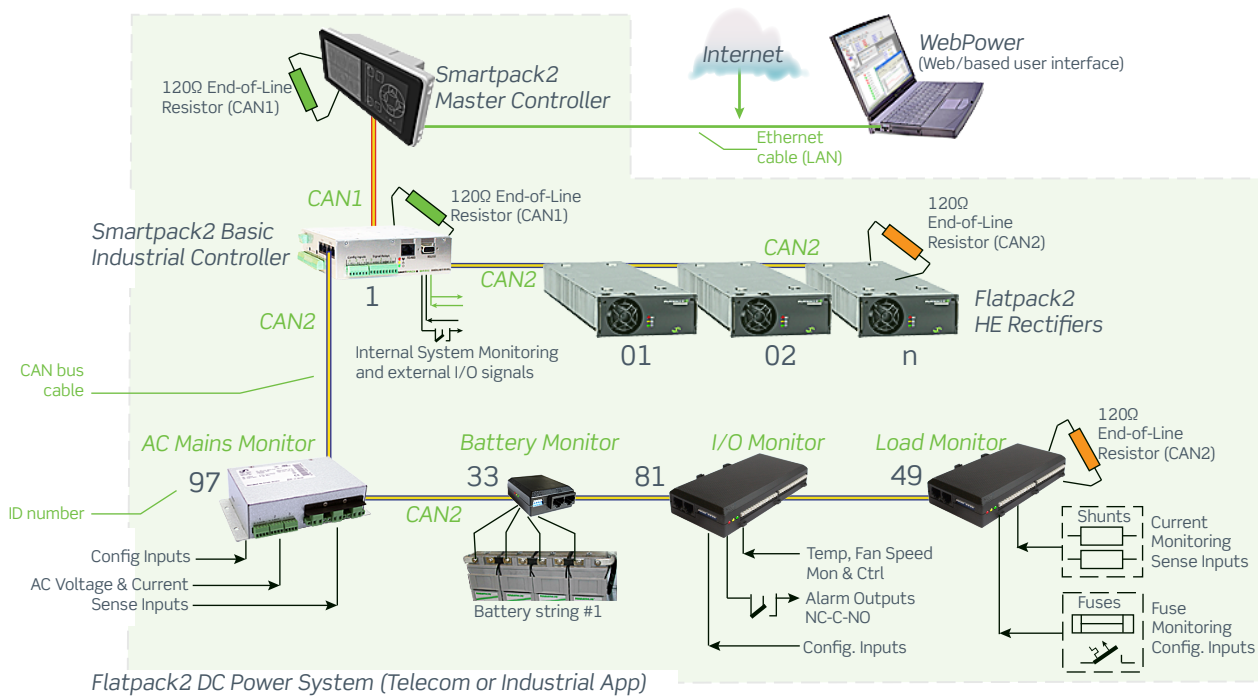


Figure 10. Example of CAN bus addressing and termination in a Flatpack2 power system using the Smartpack2 Basic Industrial controller to implement two CAN buses

Smartpack2-based DC power systems implemented with the *Smartpack2 Basic Industrial* controller have more than one CAN bus, as this industrial controller has two separated buses: CAN1 and CAN2.

All the CAN buses in the system are to be terminated with two 120Ω resistors.

Usually, the systems are engineered using CAN1 bus for communication among controllers and CAN2 bus to communicate with rectifiers and other CAN nodes. But any controller, rectifier and CAN node can be connected to any of the system's buses. Refer to chapter "3. Typical Industrial Applications" on page 19.

Configuration

By the default, *Smartpack2*-based power systems are shipped from factory with one or several *Smartpack2* Basic controllers or *Smartpack2 Basic Industrial* controllers correctly installed and configured inside the power system.

CAN Bus Addressing

The power system's master controller dynamically software-assigns ID numbers to rectifiers. The master controller registers the rectifiers' ID numbers — or CAN bus address (01, 02...) — together with their Serial Numbers (**software assignment**).

Other control units make use of DIP switches for configuring their unique CAN bus ID number (**hardware assignment**).

The *Smartpack2 Basic Industrial* controller's ID numbers (1, 2...10) are assigned by DIP switches on the controller's bottom, refer to chapter "*Jumpers and DIP Switches*" on page 10.

A maximum of 10 *Smartpack2 Basic Industrial* controllers may be connected to the CAN bus.

<i>Smartpack2 Basic Industrial Controller</i> **	ID #	DIP Switch Position			
		1	2	3	4
1st Controller	1	OFF	OFF	OFF	OFF
2nd Controller	2	ON	OFF	OFF	OFF
3rd Controller	3	OFF	ON	OFF	OFF
4th Controller	4	ON	ON	OFF	OFF
5th Controller	5	OFF	OFF	ON	OFF
6th Controller	6	ON	OFF	ON	OFF
7th Controller	7	OFF	ON	ON	OFF
8th Controller	8	ON	ON	ON	OFF
9th Controller	9	OFF	OFF	OFF	ON
10th Controller	10	ON	OFF	OFF	ON

AC Mains Monitor
DIP switch configuration
ID <1>
(All Switches OFF)



** The DIP switch positions above applies to all controllers, except for *Smartpack2 Master* and *Compact* controllers, which have unchangeable ID# 11 and 1 respectively

Note:

The Controller's ID # corresponds to the DIP switch's binary value plus 97

Table 2. *Smartpack2 Basic Industrial* controller's DIP switch addressing

System Configuration

By the default, *Smartpack2 Basic Industrial* controllers are shipped from factory correctly configured inside the power system.

The *Eltek* DC power supply system's functionality represents a vast **set of functions, characteristics or capabilities** implemented in the hardware and software of the controllers, control units and nodes connected to the system's CAN buses.

You can use following types of **user interfaces** to access the functions and parameters:

- ◇ **The controllers' front panel keypad, if any**
using software menus and submenu options
- ◇ **A standard web browser**
to access the *WebPower* firmware, a platform-independent graphical user interface (GUI) built-in the master controllers
- ◇ **The PowerSuite program**
A PC application run on computers using MS Windows operating systems

All the mentioned functions, characteristics and parameters are **fully configurable**, and are organized in following **system-oriented** logical groups:

- ◇ Power System
- ◇ Mains
- ◇ Generator
- ◇ Rectifiers
- ◇ Battery
- ◇ Load
- ◇ Control System

Also, these functions, characteristics and parameters are presented in following **task-oriented** logical groups:

1. System Status
2. System Configuration
3. Alarm Configuration
4. Commands
5. Logs and Reports
6. Statistics
7. Commissioning
8. Up/Download

For detailed functionality description, browse and search through the *Functionality Description Help* file (or Doc 350020.073) or *Online Help* files for *WebPower* or *PowerSuite*.

Technical Specifications

The technical specifications for the *Smartpack2 Basic Industrial* controller described in this chapter may have being updated or improved.

Refer to *Eltek's* data sheet about this controller, which you can download from our web site, to read the controller's latest and freshest technical specifications.

Specifications	Smartpack2 Basic Industrial controller
Input Voltage (2 separated power inputs)	10 - 75 VDC Shutdown: < 10 VDC
Storage Temperature Operating Temperature	-40 to +85°C (-40 to 185°F) -20 to +70°C (-4 to 158°F)
Current Consumption	Max 1.6A
Electric Isolation	7 different isolated sections
Customer Connections • Configurable Inputs • Relay Outputs • Serial Communication	3x NO/NC/Temperature: NTC probe 3x NO-C-NO 430VDC/0.1A, configurable RS232C port and RS485 port
System Connections • Voltage Sense Inputs • Current Sense Inputs • Battery Fuse Sense Inputs • Load Fuse Sense Inputs • LVD Contactor Outputs • CAN interface • Earth Fault Detection	Max. 420VDC on LVD outputs and Voltage Sense Inputs Max. 290VDC on system connections 3x system & battery monitoring 2x for 20mV to 60mV current shunts 1x Open/Close, Pull-Up/Down, Diode Matrix 1x Open/Close, Pull-Up/Down, Diode Matrix 3x configurable as latching or non-latching 2 x CAN bus systems (separated and isolated) 1x internal Isolation input
Power System compatibility	Industrial & Telecom Positive, negative and floating DC distributions Max. 420VDC on LVD outputs and Voltage Sense Inputs Max. 290VDC on system connections
Frontal indicators	3x LED lamps (green, amber, red)
Max number of controller nodes	10 units on a single CAN-bus, in addition to <i>Smartpack2 Master</i> controller
Controller configuration	Front keys in the master controller and via <i>WebPower</i> in standard Web browser
Firmware upgrade	Via the CAN bus, using SD card or from PC
Dimensions (WxHxD)	146.0 x 146.0 x 45.6 mm (5.7 x 5.7 x 1.8")

Specifications are subject to change without notice

242100.???DS3- vX

Applicable	Standards
Electrical safety	IEC 60950-1 UL 60950-1
EMC	IEC 61000-6-1 IEC 61000-6-2 IEC 61000-6-3 /A1 IEC 61000-6-4 IEC 61000-6-5 FCC Part 15B Subpart 109
Environment	ETSI EN 300 019-2-1 V2.1.2 ETSI EN 300 019-1-3 v2.3.2 2002/95/EC (RoHS) & 2002/96/EC (WEEE)
Marine	DNV - 05 - D202

Part No.:	Description
242100.601	Smartpack2 Basic Industrial Controller
242100.501	Smartpack2 Basic Controller (Telecom)
242100.500	Smartpack2 Master Controller
242100.502	I/O Monitor2 CAN node (type 2 G2)

Firmware Upgrade Controller

Upgrade of the *Smartpack2 Basic Industrial* controller's firmware is performed via the power system's CAN bus, while the system is live. Upgrading the firmware does not delete or change any of the configuration and calibration values stored in the *Smartpack2 Basic Industrial* controller.

You can upgrade the *Smartpack2 Basic Industrial* controller's firmware using one of the following two methods. Refer to *Figure 11 on page 18*.

A. From the Smartpack2 Master controller's SD Card

Insert in the *Smartpack2 Master* controller an SD card containing the *Smartpack2 Basic Industrial* controller's firmware source file <SP2BASIN.MHX>.

Use then the front keys to download the firmware.

Refer to the "Functionality Description Online Help" file (or Doc 350020.073) for a detailed description.

Notice: The files stored in the SD Card must have specific file names.

For example, if your firmware source file name is "*Smartpack2_Basic_Industrial_405007.???_V1.1.mhx*", rename it to "SP2BASIN.MHX" before copying it to the SD Card.

B. From a Personal Computer

You must connect a PC — via an USB-to-CAN Converter (art. 208565) — to one of the power system's CAN bus ends, and move the end-of-line resistor to one of the converter's CAN ports.

Run then the FWLoader program on the PC to download the firmware <SP2BASIN_x.xx.MHX> or <*Smartpack2_Basic_Industrial_405007.???_Vx.x.mhx*> to the *Smartpack2 Basic Industrial* controller.

You find a detailed description by browsing and searching through the *FWLoader Online Help* file.

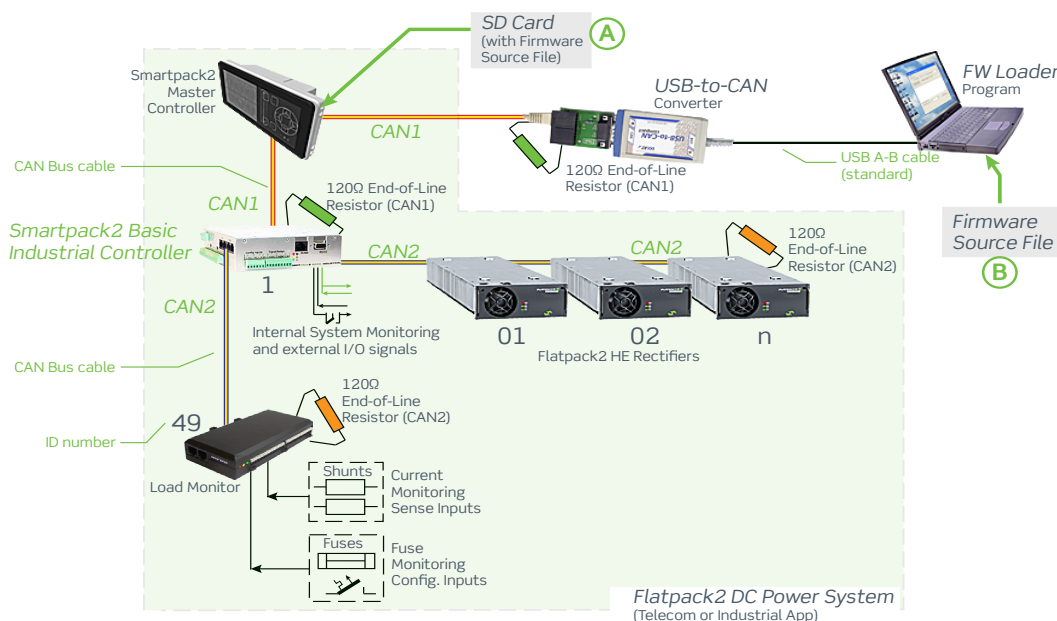


Figure 11. Example of *Smartpack2 Basic Industrial* controller's firmware upgrade via SD card (A) or via PC (B)

3. Typical Industrial Applications

The *Smartpack2 Basic Industrial* controllers are reliable and versatile modules used as **secondary controllers** or **bay controllers** in the distributed control system of *Smartpack2*-based power applications.

These flexible controllers are developed to meet industrial requirements within the same power supply system, such as:

- ◇ Power system with one or with **different DC output voltages** (App. 1 & 2)
- ◇ Systems with **High DC output voltage** (App. 3)
- ◇ One **large, expandable system**, with 960 rectifiers maximum (App. 4)
- ◇ Paralleling the DC outputs of two systems, A and B (App. 5)

Usually, the systems are engineered using CAN1 bus for communication among controllers, and CAN2 bus to communicate with rectifiers and other CAN nodes. But any controller, rectifier and CAN node can be connected to any of the system's buses. For a complete list of signals, pin-out, etc., refer to chapter "*Connection Drawing*" on page 13.

Generic System

App 1: Telecom System, +24V or -48V

Application 1 is an example of a generic telecom +24VDC power system implemented with a *Smartpack2 Basic Industrial* controller as secondary controller.

All parameters are collected in one *Smartpack2 Master* controller (SP2M).

The industrial controller's measuring reference ("R" or Ref) is to be connected to the pole where the current shunts are connected.

Similarly, a generic telecom -48V power system with negative DC distribution could be implemented with the *Smartpack2 Basic Industrial* controller.

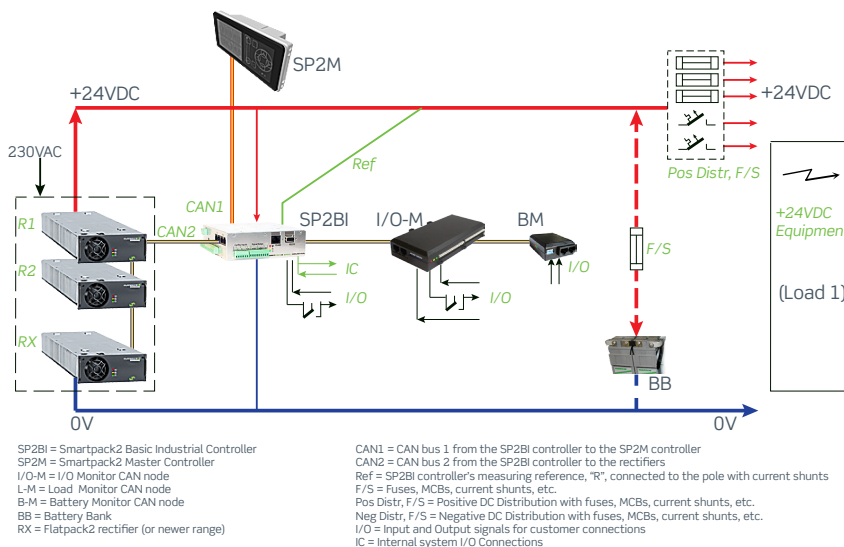


Figure 12. Application 1

Different DC Output Voltages

App 2: Industrial System 220 & 24 & 48VDC

Application 2 is an example of an industrial power system implementing different DC output voltages: 220VDC, 48VDC and 24VDC.

Installing one *Smartpack2 Basic Industrial* controller for each output voltage section (**secondary controllers**) enables to measure system parameters with different voltage references (e.g. 220VDC, 48VDC and 24VDC) in a floating or earthed system.

All parameters are collected in one *Smartpack2 Master* controller (SP2M).

Each industrial controller's measuring reference ("R" or Ref) is to be connected to the pole where the current shunts are connected.

In the 220VDC section, an external DC/DC converter is to be used to feed the *Smartpack2 Basic Industrial* controller (max. 75VDC). The 220VDC output section supplies Load 1, and DC-feeds both the 48VDC and the 24VDC sections, which separately supply Load 2 and 3 respectively.

The two *Flatpack2* rectifier groups — in the 48 and 24VDC sections — work as DC/DC converters, and are identified as Converter Groups in the *Smartpack2 Master* controller's user interface and in *PowerSuite* and *WebPower*.

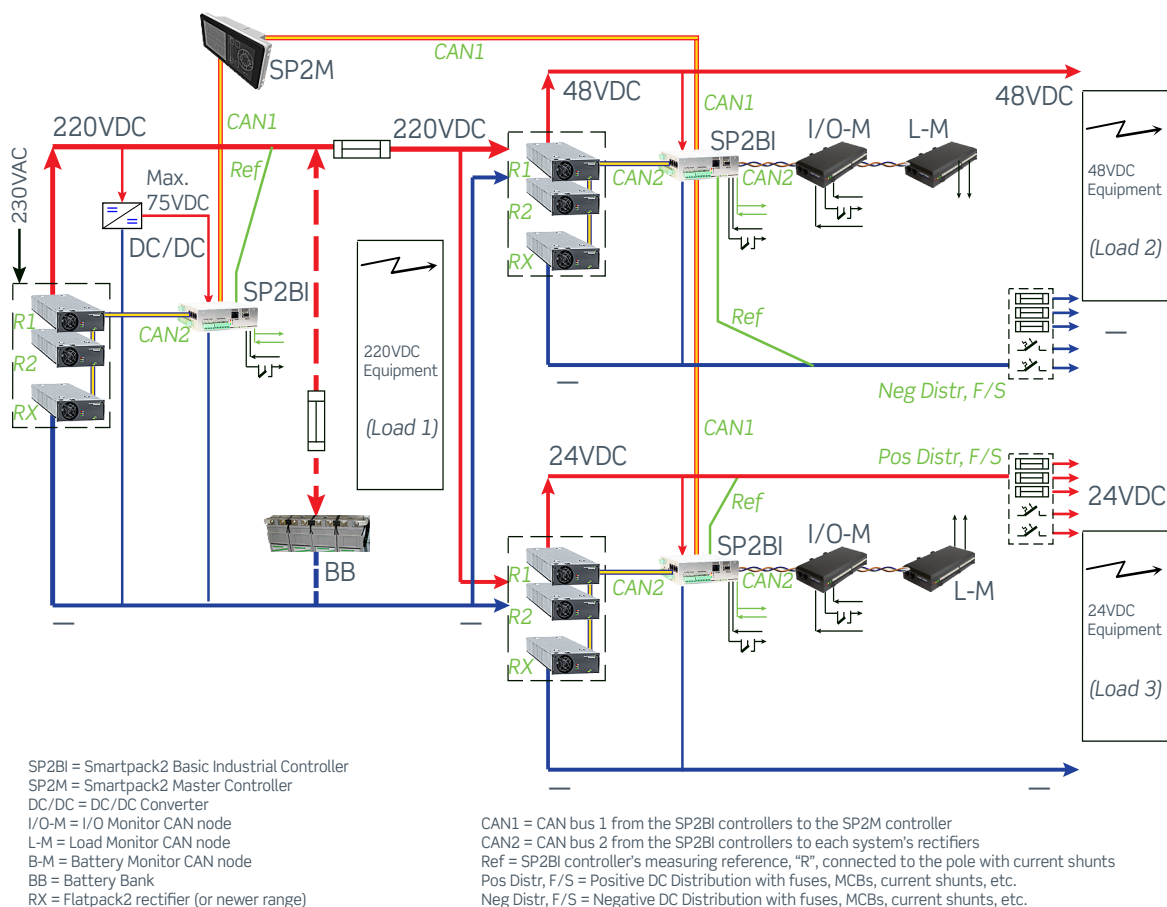
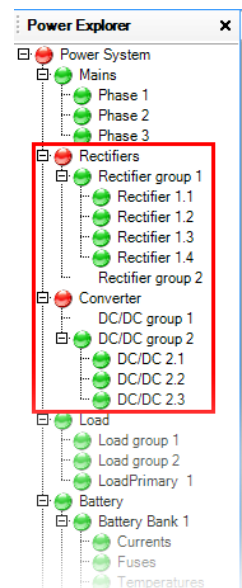


Figure 13. Application 2

High DC Output Voltages

App 3: Industrial System 110 or 220VDC

Application 3 is an example of a generic industrial power system for high DC output voltage: 220VDC. An industrial 110VDC power system could also be implemented.

Installing a *Smartpack2 Basic Industrial* controller (**secondary controller**) enables to measure and monitor high DC system voltages up to 430VDC in a floating or earthed system.

All parameters are collected in the *Smartpack2 Master* controller (SP2M).

The controller's measuring reference ("R" or Ref) is to be connected to the pole where the current shunts are connected.

An external DC/DC converter is to be used to feed the *Smartpack2 Basic Industrial* controller (max. 75VDC).

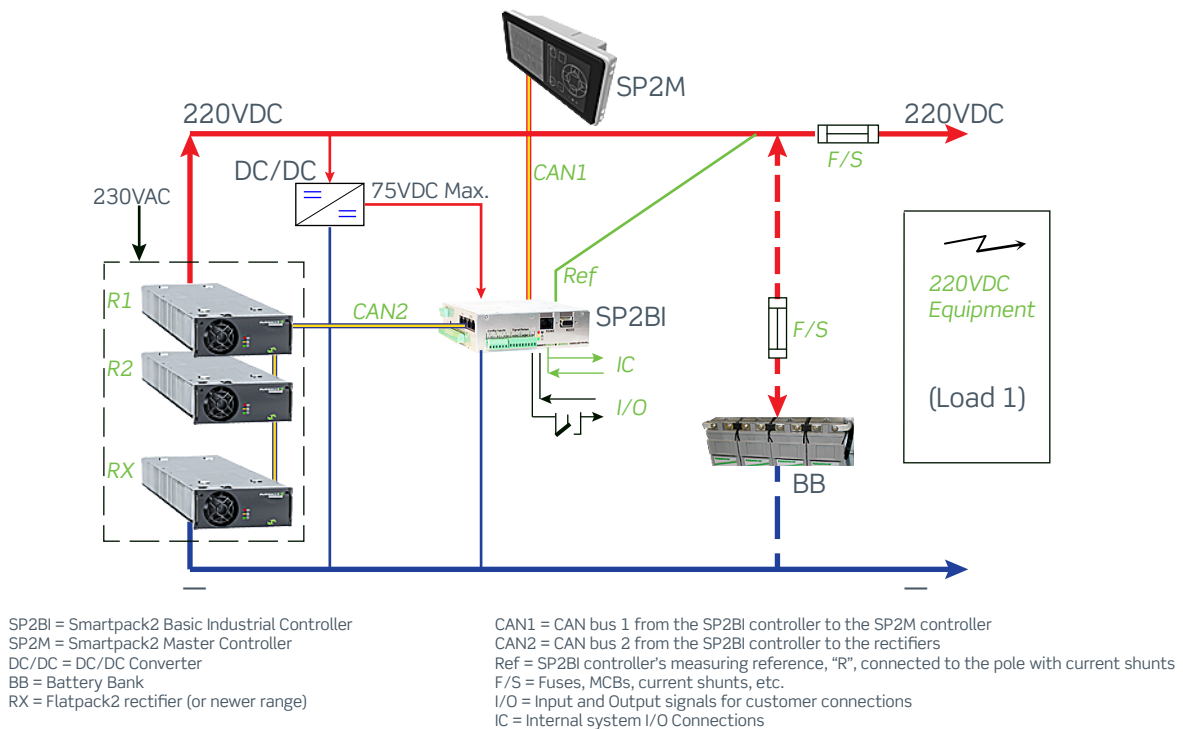


Figure 14. Application 3

Large, Expandable Power Systems

App 4: Telecom & Industrial System (over 96 Rectifiers)

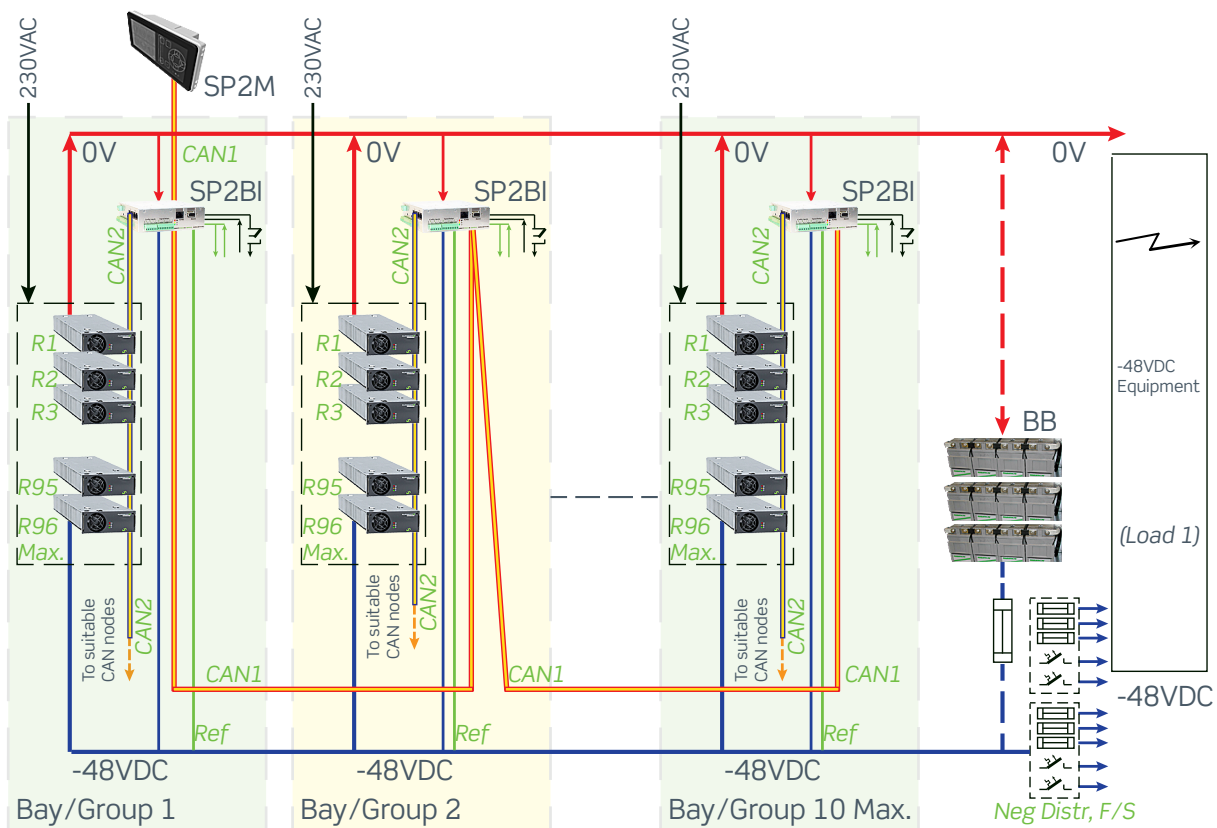
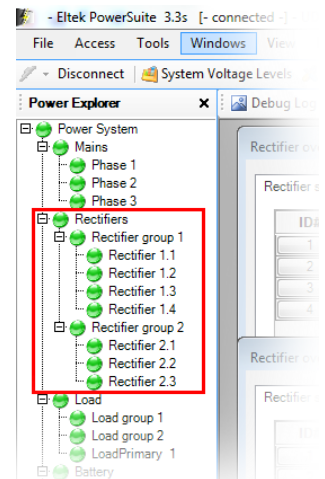
Application 4 is an example of a large industrial and telecom -48V power system implemented by several subsystems or groups, each in its cabinet or bay, with all their DC outputs paralleled to supply the load and recharge the battery bank.

Installing one *Smartpack2 Basic Industrial* controller in each subsystem (**bay controllers**) enables to implement up to 96 rectifiers in each bay or group, and parallel up to 10 subsystems or bays. This large power system with a maximum of 960 rectifiers may then supply a vast load. The system implements current sharing among all the rectifiers, both within a group and within the bays.

All parameters are collected in one *Smartpack2 Master* controller (SP2M).

Each industrial controller's measuring reference ("R" or Ref) is to be connected to the pole where the current shunts are connected.

The *Flatpack2* rectifiers are displayed in groups or bays in the *Smartpack2 Master* controller's user interface and in *PowerSuite* and *WebPower*.



SP2BI = Smartpack2 Basic Industrial Controller
 SP2M = Smartpack2 Master Controller
 BB = Battery Bank
 RX = Flatpack2 rectifier (or newer range)

CAN1 = CAN bus 1 from the SP2BI controllers to the SP2M controller
 CAN2 = CAN bus 2 from the SP2BI controllers to each system's rectifiers and local CAN nodes
 Ref = SP2BI controller's measuring reference, "R", connected to the pole with current shunts
 Neg Distr, F/S = Negative DC Distribution with fuses, MCBs, current shunts, etc.

Figure 15. Application 4

App 5: Telecom & Industrial A+B System

Application 5 is an example of two industrial or telecom 48VDC power systems A and B — each with one *Smartpack2 Basic Industrial* controller (**secondary controller**).

All parameters are collected and displayed in one *Smartpack2 Master* controller (SP2M), otherwise the two systems are electrically isolated from each other.

Each *Smartpack2 Basic Industrial* controller uses their local voltage and current measurements to control the rectifiers on their CAN2 bus, e.g. for implementation of local current sharing. But the rectifiers in system A and B have no common current sharing.

The controller's measuring reference ("R" or Ref) is to be connected to the pole where the current shunts are connected.

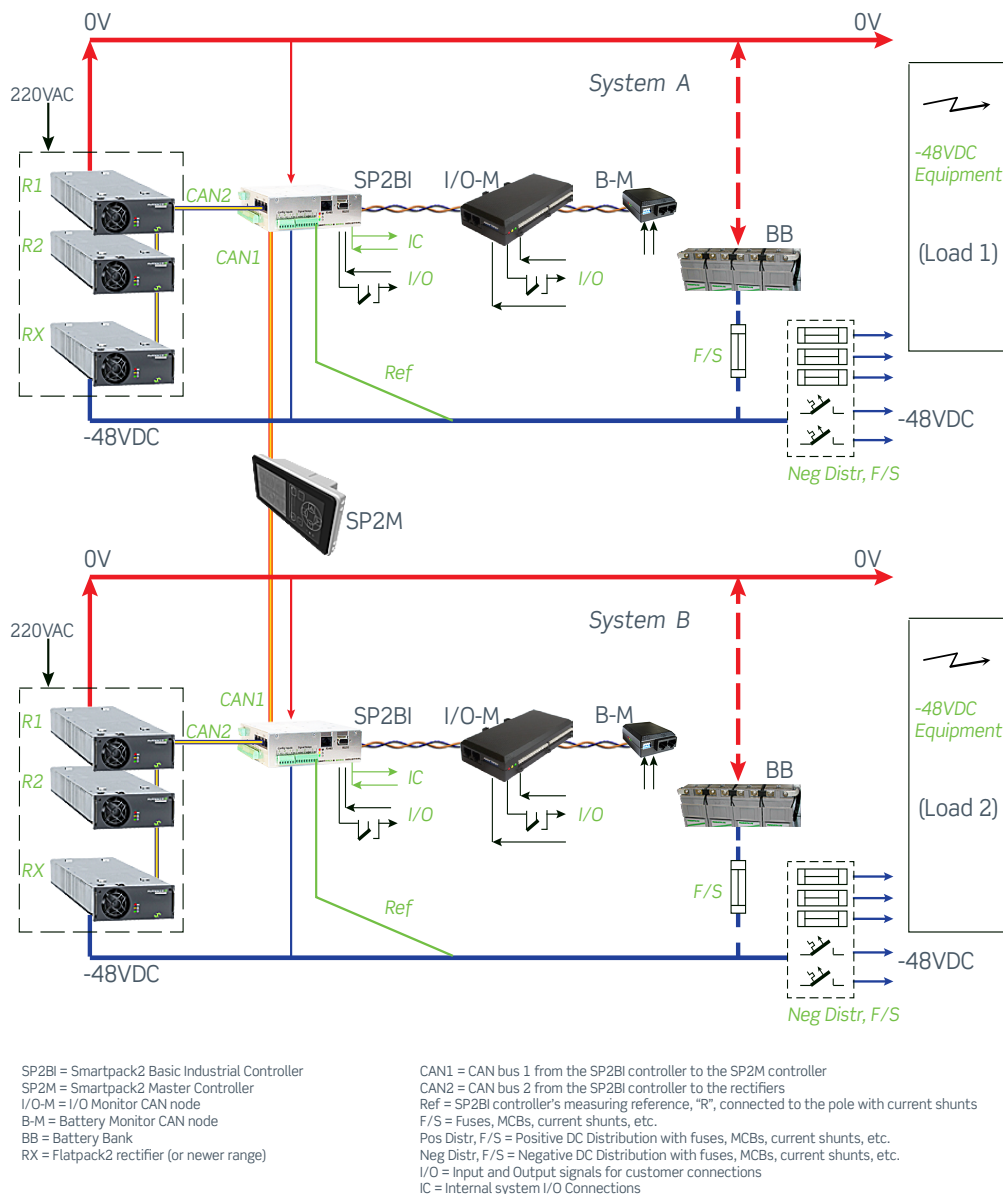


Figure 16. Application 5



www.eltek.com

Headquarters: **Eltek**
Visitor address: Gråterudveien 8, 3036 Drammen, Norway
Phone: +47 32 20 32 00 Fax: +47 32 20 32 10