

**PRELIMINARY**

# **Technical Information Manual**

Revision n.0  
5 July 2007

**MOD. A4600  
EASY4000 INTERLOCK  
MANUAL REV. 0**

**NPO:  
00110/06:A4600.MUTx/00**

CAEN will repair or replace any product within the guarantee period if the Guarantor declares that the product is defective due to workmanship or materials and has not been caused by mishandling, negligence on behalf of the User, accident or any abnormal conditions or operations.

**CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation.**



*CAEN reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.*

### **Disposal of the Product**

*The product must never be dumped in the Municipal Waste. Please check your local regulations for disposal of electronics products.*



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# 1. EASY Embedded Assembly System

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## 1.1 Functional description

EASY (Embedded Assembly SYstem) is the new CAEN power supply solution for operation in magnetic field and radioactive environment. CAEN has been involved for more than a decade in developing different solutions for the main LHC experiments, where the electronic equipment of the experiment is dealing with high dose radiation and intense magnetic field. In order to provide safe and reliable operations in such hostile areas, CAEN started tests with rad-tolerant components and magnetic field resistant solutions, patenting the new technology that is now used in this new line of products. Moreover, though designed for harsh environment, the EASY modules can work also in normal condition with excellent performance. In the new architecture, the power supply can be located directly in the hostile area, where the EASY modules provide a wide variety of output voltages to satisfy the requirements of most detectors and front-end electronics. The control of the EASY power supply system is done remotely using a Branch Controller (Mod. A1676A) plugged in a SY1527 or SY2527 mainframe located in the control room. Each A1676A branch controller can handle up to 6 EASY crates: in this way, one SY1527 power supply system, for example, housing up to 16 A1676A boards, can handle up to 96 EASY systems. The EASY crate can house up to 10 boards, depending on the boards' width. The branch controller is the interface between the mainframe (SY1527 or SY2527) and the remote boards in the EASY crate: its role is to configure the EASY channels as if they belong to the supply unit slot in which the branch controller is located. All the channels of the EASY boards are considered as channels of the branch control board, thus hugely increasing the number of channels the system can handle. Through the mainframe, the provided and fully reliable OPC server permits an immediate and "automatic" interfacing with the custom control software; moreover, a C-library for Windows and Linux is available as well. The EASY crate can be used with an air and/or water intercooler and its standard width fit the rack mounting. Fig. 1.1 shows the system's block diagram.

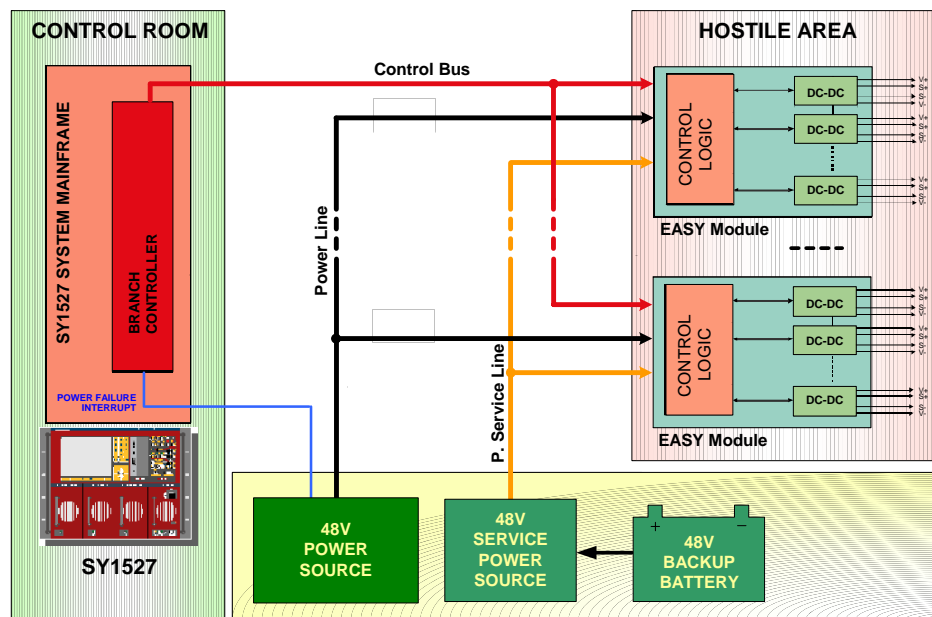


Fig. 1.1 – System's block diagram

## 1.2 The CAEN Multichannel Power Supply System Overview

The SY1527 system is the fully equipped experiment version of a new line of power supply systems which represent CAEN's latest proposal in the matter of High Voltage and Low Voltage Power Supplying. This system outlines a completely new approach to power generation and distribution by allowing the housing, in the same mainframe, of a wide range of boards with different functions, such as High/Low Voltage boards, generic I/O boards (temperature, pressure monitors, etc.) and branch controllers, where the latter are used to control other remote generators and distributors. Modularity, flexibility and reliability are the key-points of its design, enabling this module to meet the requirements needed in a wide range of experimental conditions, which range from those of LHC experiments, where the features of this model find prior application, to those of other less challenging, but still demanding, High Energy Physics experiments.

The mainframe is housed in a 19"-wide, 8U-high euro-mechanics rack and hosts four main sections:

- the Board Section, with 16 slots to house boards, distributors and branch controllers;
- the Fan Tray Section, housing 6 fans arranged on two rows;
- the Power Supply Section, which consists of the primary power supply and up to 3 power supply units;
- the CPU and Front Panel Section which includes all interface facilities.

The User Software Interface features the usual friendliness of the previous CAEN systems which now also includes a 7.7" colour LCD. A wide choice of interface facilities provides full communication compatibility with the previous systems and the feasibility of controlling heterogeneous external devices. Modularity has been one of the leading criteria in the design and development of the system: both the Power Supply Section and the Board Section are completely modular. The Power Supply Section allows different configurations with up to 3 power supply units per mainframe (up to 2250 W), while the Board Section can house up to 16 boards able to fulfil different functions. A complete line of power supply boards and distributors has been specially developed for this new system. The minimum system configuration consists of the primary power supply, one Power Supply Unit and one board. The system allows also to deal with power supply

solutions composed by “branch controllers” (housed in the system main frame) and on-detector “remote boards” (manufactured in order to be magnetic field and radiation tolerant). Channel trip control on other crates is performed via four external differential trip lines. A sophisticated trip handling via software allows to control and correlate trip conditions on the channels of the crate as well as of other crates connected to it. Live insertion and extraction of the boards, which reduces the down time of the global system, and easy access to the computing core and peripherals of the system complete the system flexibility. Easy interfacing is another key-point of the SY1527 system, which can be connected to SY127 and SY527 systems. The Ethernet interface (TCP/IP) allows both an easy Telnet access and the connection via OPC Server to a SCADA control system. Enhanced software programming features a unified command set independent from the interface used to communicate with the system. The Power Supply Section and Board Section can be externally synchronised via front panel connectors. Multi-layered access to the system via Intranet is foreseen through the management of several custom user profiles. In particular, three different access levels have been implemented: Guest, User and Administrator, each of which with password protection. Handy maintenance and upgrading, which constitute a major issue in the reliability of a system, are further guaranteed by the possibility of accessing and servicing the system via network facilities. Actually, the Telnet access facility allows remote debugging and technical support of the system, including future firmware upgrading. For a detailed description of the SY 1527 Universal Multichannel Power Supply System please refer to the *SY 1527 User's Manual*.

**Table 1.1 – Technical specifications of the SY 1527 mainframe**

<b>Packaging</b>	- 19"-wide, 8U-high Euro-mechanics rack; - Depth: 720 mm.
<b>Weight</b>	-Mainframe (*): 24 kg -Mod. A1532: 3.2 kg
<b>Power requirements</b>	<i>Voltage range:</i> 100/230 V <i>Frequency:</i> 50/60 Hz <i>Power:</i> 3400 W
<b>Max. number of boards per crate</b>	16
<b>Max. number of power supply units per crate</b>	3
<b>Primary power supply output (Mod. A 1531)</b>	± 12 V, 8 A +5 V, 20 A
<b>Power supply unit output (Mod. A 1532)</b>	+48 V, 15.6 A
<b>Max. output power</b>	2250 W
<b>Operating temperature</b>	From 0°C (dry atmosphere) to +40°C
<b>Storage temperature</b>	From -20°C (dry atmosphere) to +50°C

(\* ) One Primary Power Supply (Mod. A 1531) and one Power Supply Unit (Mod. A 1532) are included; boards are not included.

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## 1.3 The Mod. A1676A Branch Controller overview

The Mod. A1676A EASY Branch Controller is implemented in a single width SY1527/SY2527 board. Once plugged in, the Branch Controller must be linked to the EASY crates (placed in the "hostile area"), via front panel connectors (Control and Power Supply). The A1676A is the interface between the mainframe and the remote boards in the EASY crate. It configures the EASY channels as if they belong to the slot in which the branch controller is located: the channels of the EASY boards operate as channels of the A1676A. Up to six EASY crates can be controlled by one A1676A. The provided software tool allows the User to configure the A1676A to operate with any EASY crate layout.

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## 2. EASY4000 Interlock

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### 2.1 Interlock at board level

The "Interlock board" purpose is to provide each of the 4 interlock lines (see A4601 and A4602 manuals) with one optocoupler diode that has to be driven continuously in order to avoid the "interlock condition"; this can be done by providing on the 2 DB15 pins of each interlock line, directly the anode and cathode of the Optoisolator diode with a series resistor. The current on the external lines is lower than 10mA and the voltage required is 24V.

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### 2.2 Interlock at crate level

This board implements a presence control, that is: if the board is removed from the crate, all the PSUs in that crate are switched off, with the OPC accessed parameter "MainPwS" set to "FAIL" (it is normally "OK").

The "Interlock board" foresees an "option", to be enabled via an internal dip switch (the only one in the board) ; it is also available a "Crate interlock" through the same DB15 female connector used for the 4 backplane interlock lines on the A4600 Interlock Board front panel. If the dip switch "enables" the "Crate Interlock", then the driving mode that has to be used on the DB15 pins is equal to those of the standard PSU interlock inputs.

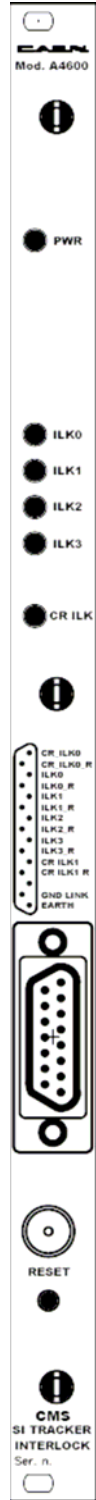
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### 2.3 Reset

A connector and a push button to drive the Reset line of the crate are available on the front panel. The logic is "Normally open": whether the button is pressed or the Lemo 00 connector pins becomes short circuited, there is the Reset event in all the PSM.

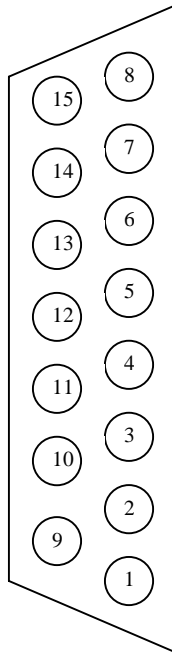


## 2.4 A4600 front panel components



**Fig. 2.1 – A3009 Front Panel**

The main connector is the DB15 female, with the locks for mating the male.

**Fig. 2.2 – Main connector**

- Pin 1 : Earth
- Pin 2 : N.C.
- Pin 3 : N.C.
- Pin 4 : ILK3
- Pin 5 : ILK2
- Pin 6 : ILK1
- Pin 7 : ILK0
- Pin 8 : Crate\_Interlock (Option)
- Pin 9 : Gnd\_link
- Pin 10 : N.C.
- Pin 11 : ILK3\_Return
- Pin 12 : ILK2\_Return
- Pin 13 : ILK1\_Return
- Pin 14 : ILK0\_Return
- Pin 15 : Crate\_Interlock\_Return (Option)

The “Interlock board” front panel houses one Red led for each of the five lines (ILK0..3 and Crate\_ILK) plus one Green led, named “Power”, which allows to understand whether the board is correctly plugged in the slot or not.

Please note that the board can be turned ON only if at least one Power Supply Board is present in the crate.

There is also a Lemo 00 coaxial connector, with a push button in parallel, to drive the Reset line of the Easy bus, locally and remotely.

The pins “Earth” (of the Easy4000 crate) and “Gnd\_link” (communications ground referred to SY1527 “earth”) are available in the DB15 connector for shielding purpose only and their use has to be decided by the customer.