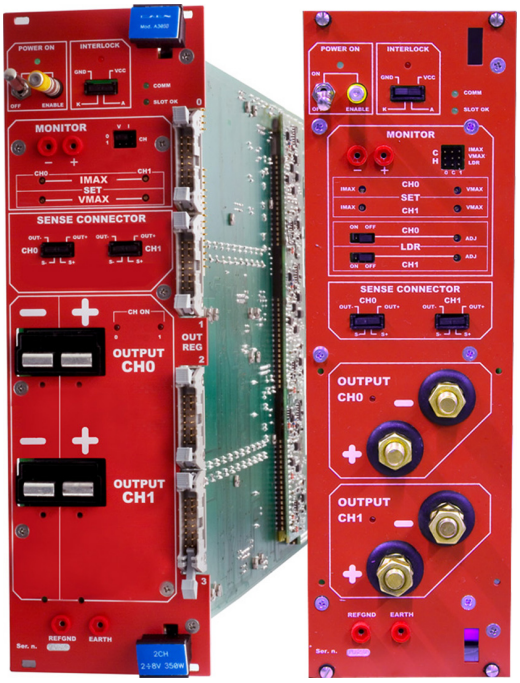
Rev. 15 - 30/10/2009

A3050 / A3050B

2 Channel 8 V / 50 A (300 W) Power Supply Board



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User Manual

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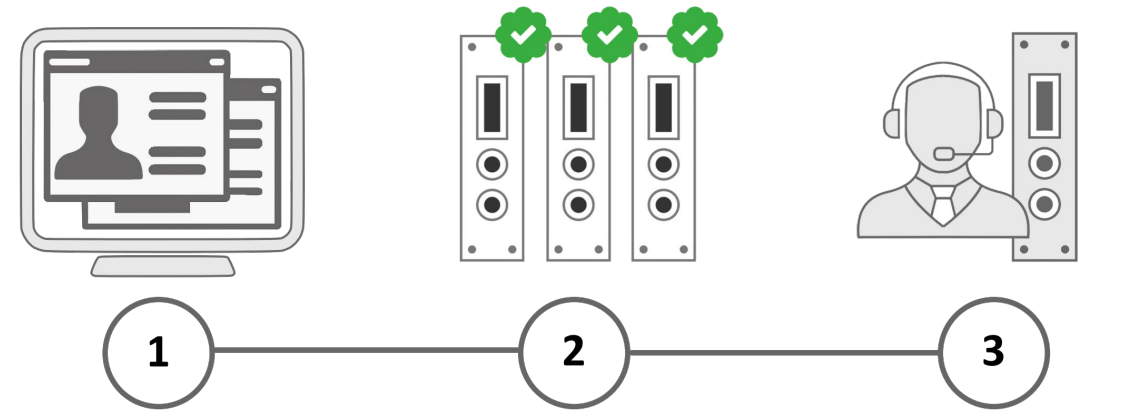

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Technical Information Manual

Revision n. 15
30 October 2009

MOD. A3050/A3050B
2 CH 8 V / 50 A / 300 W
POWER SUPPLY BOARD
MANUAL REV. 15

NPO:
00105/03:A3050.MUTx/15

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.

CE

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. EASY3000 Embedded Assembly System

1.1 Functional description

EASY3000 (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 EASY3000 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 EASY3000 modules provide a wide variety of output voltages to satisfy the requirements of most detectors and front-end electronics. The control of the EASY3000 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 EASY3000 crates: in this way, one SY1527 power supply system, for example, housing up to 16 A1676A boards, can handle up to 96 EASY3000 systems. The EASY3000 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 EASY3000 crate: its role is to configure the EASY3000 channels as if they belong to the supply unit slot in which the branch controller is located. All the channels of the EASY3000 boards will be 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 EASY3000 crate can be used with an air and/or water intercooler and its standard width fit the rack mounting. An optional fan tray (A34FU -EASY3000 Fan Unit) can be used for the stand-alone operation of the EASY3000 crate when no magnetic field is present. EASY3000 is powered by external 48 V DC. The EASY architecture foresees two independent 48 V power supplies: the first (48 V Power) to power the channels regulators, the other (48 V Service) to power the control logic. The use of CAEN 48 V power sources (Mod. A3484 and A3485), allows to integrate into the channels control also the management of the 48 V power supplies.
Fig. 1.1 shows the system's block diagram.

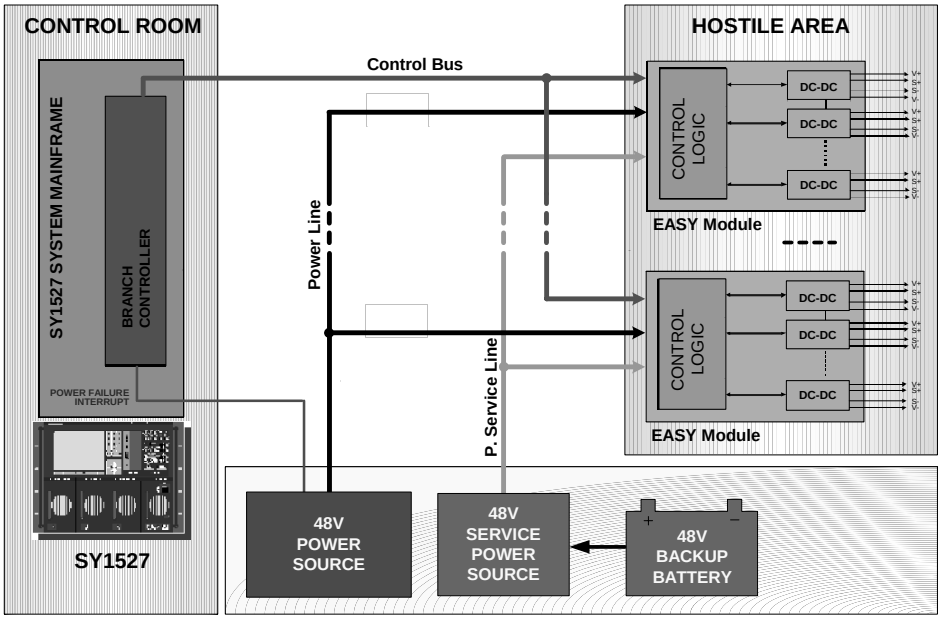


Fig. 1.1 – System's block diagram

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

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

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 EASY3000 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 EASY3000 crate. It configures the EASY3000 channels as if they belong to the slot in which the branch controller is located: the channels of the EASY3000 boards operate as channels of the A1676A. Up to six EASY3000 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.

2. A3050 2 Channel 8 V / 50 A Power Supply Board

2.1 Technical specifications

This document shows the features of the CAEN A3050 2 Channel 8 V / 50 A Power Supply Board, developed for operation in magnetic field and moderate radioactive environment. One A3050 houses 2 floating (reversible polarity) 8 V / 50 A channels (300 W maximum output power per channel).
Two versions are available: Mod. A3050, provided with APP PC5933T output connectors, and Mod. A3050B, provided with screw locks for connecting the output cables.
The connector[1] output voltage range is 2 ÷ 8 V with 5 mV monitor resolution; channel control includes various alarms and protections.
The board is provided with Remote Sensing Lines to compensate for the voltage drop over the connection cables.
If the output voltage differs from the programmed value by more than 3% of voltage full scale range, the channel is signalled to be either in OVER VOLTAGE or UNDER VOLTAGE condition.
Moreover, for each channel, a voltage protection limit SVMAX can be fixed via software with 5 mV resolution and the output voltage can not be programmed beyond this value.
The output current is monitored with 100 mA resolution; if a channel tries to draw a current larger than its programmed limit it is signalled to be in OVERCURRENT condition; the SY 1527 system detects this state as a fault and reacts according to the setting of the TRIP parameter[2], which can be programmed in 0.1s steps from 0 to 1000s. Actually TRIP = 1000 s means *infinite*: in case of TRIP *infinite* the output current is permitted to keep the programmed limit; if the maximum output current value is reached the channel behaves like a constant current generator. In case of TRIP < 1000 s, the output current is permitted to keep the limit only for programmed time interval and then is switched off.
The maximum output voltage (VMAX) and the maximum output current (IMAX) can be fixed for each channel, through trimmers located on the front panel.

[1] A modest voltage drop along the connection lines, depending on the cables' length, must be expected

[2] Refer to the SY1527/SY2527/SY3527 User's Manuals for details about the TRIP Handling.

2.2 Channel Characteristic Table

Table 2.1 – Channel characteristics of the Mod. A3050 Power Supply Board

Polarity:	Floating
Output Voltage[3]:	2 ÷ 8 V (connector output)
Max. Output Current:	50 A
Voltage Set/Monitor Resolution:	10 mV
Current Set/Monitor Resolution:	100 mA
VMAX software:	2 ÷ 8 V
VMAX software resolution:	5 m V
Voltage Ripple: [4]	< 10 mV pp (@ full load)
Voltage Monitor vs. Output Voltage Accuracy: [5]	max. ±50 mV ±0.3% of reading
Voltage Set vs. Output Voltage Accuracy: [5]	max. ±50 mV ±0.3% of reading
Current Monitor vs. Output Current Accuracy: [5]	± 1A ± 2% of reading
Current Set vs. Output Current Accuracy: [5]	± 1A ± 2% of reading
Load Regulation: [5]	± 0.3 % (with sense wires) ± 2 % (without sense wires/SENSE OFF)
Output Power:	300 W
Test Set Up:	cable: length = 30m; ∅= 8mm (for both output and return) with sense wires connected decoupling capacitor: 47µF electrolytic test load: >600W load capacitance: 10µF electrolytic // 100nF ceramic (// to the load)
48Vin (Power & Service)	45÷51Vdc

[3] The board works properly with a Vset larger than 1.25 V and a current on the load larger than 10 A

[4] From 10 Hz to 15 MHz at full load; measured with the line terminated on a 10 µF capacitance and a 100 nF ceramic capacitance in parallel to the load

[5] From 10% to 90% of Full Scale Range

2.3 Front panel components

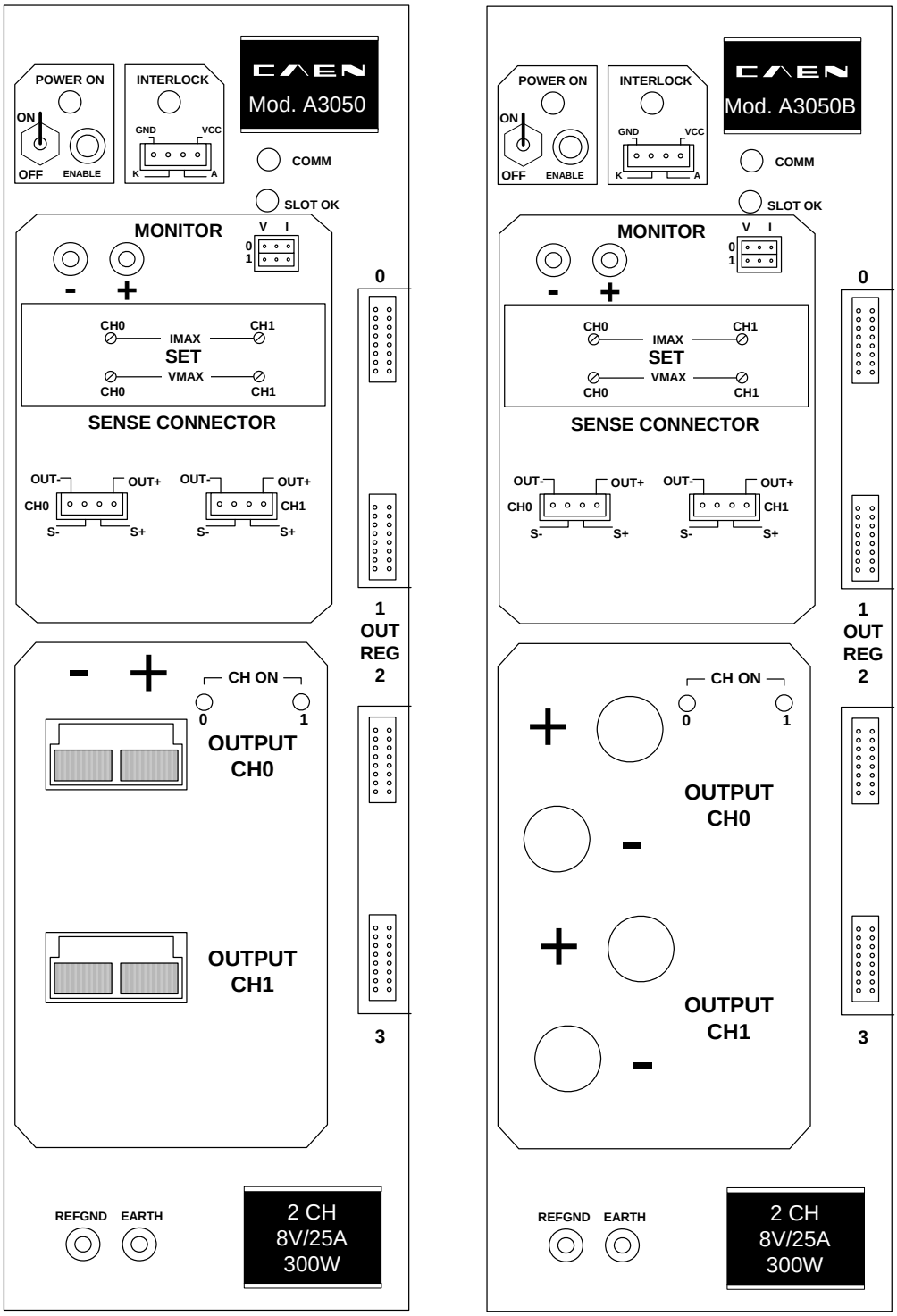


Fig. 2.1 – A3050 Front Panel

2.4 Board features

2.4.1 Packaging

The module is housed in a 16 TE wide, 6U-high mechanics.

2.4.2 Front panel connections

The board front panel houses the following components:

OUTPUT CH 0/1 + : **A3050**: APP PC5933T type **A3050B**: Screw locks
Function: Positive LV output.

OUTPUT CH 0/1 - : **A3050**: APP PC5933T type **A3050B**: Screw locks
Function: Negative LV output.

MONITOR +/-: MONITOR +/-: Type: Radiall R921921 type
Function: Monitor of Vmax and Imax (see § 2.4.3 and § 4.4)

SENSE CH 0/1+/-: Type: AMP 280371-2 type
Function: sensing lines to be connected to the load (see § 4.3)

INTERLOCK: Type: AMP 280371-2 type
Function: Interlock enable jumpers (see § 4.1)

EARTH: Type: RADIALL R921921 type
Function: earth auxiliary reference

REFGND: Type: RADIALL R921921 type
Function: floating return, to be connected to the ground reference of the load.

ENABLE: Type: FISCHER DP101A004-28 (LEMO 00) type
Function: contact must be closed, in order to enable the 48 V Service power supply (general ON/OFF of the module); otherwise, a 50 Ohm termination can be inserted in order to enable the 48 V Service power supply.

OUTPUT REGISTER: Function: 16 bit Output Register (User defined)
Type: 16 pin header type connectors.

2.4.3 Front panel trimmers and switches

The board front panel houses the following trimmers and switches:

VMAX CH 0/1: Allows to set VOUT maximum hardware value (see table)

IMAX CH 0/1: Allows to set IOUT maximum hardware value (see table)

Table 2.2 – Vmax/Imax vs. MON

MON (V)	Vmax (V)		MON (V)	Imax (A)
9	8		6,24	50
7,8	7		5,64	45
6,7	6		5,04	40
5,6	5		4,44	35
4,4	4		3,84	30
3,3	3		3,24	25
2,2	2		2,7	20
			2	15
			1,4	10
			0,8	5

MONITOR is the value read on the voltmeter connected to the MONITOR +/- connectors (see § 2.4.2), Vmax/Imax are the corresponding actual maximum values, set via the VMAX/IMAX trimmers; see also § 4.4.

POWER ON: Allows to enable/disable the 48 V Service power supply (general ON/OFF of the module)

2.4.4 Front Panel Displays

CH ON 0/1 LEDS: *Function:* lights up as the channel is on.
Type: red LED

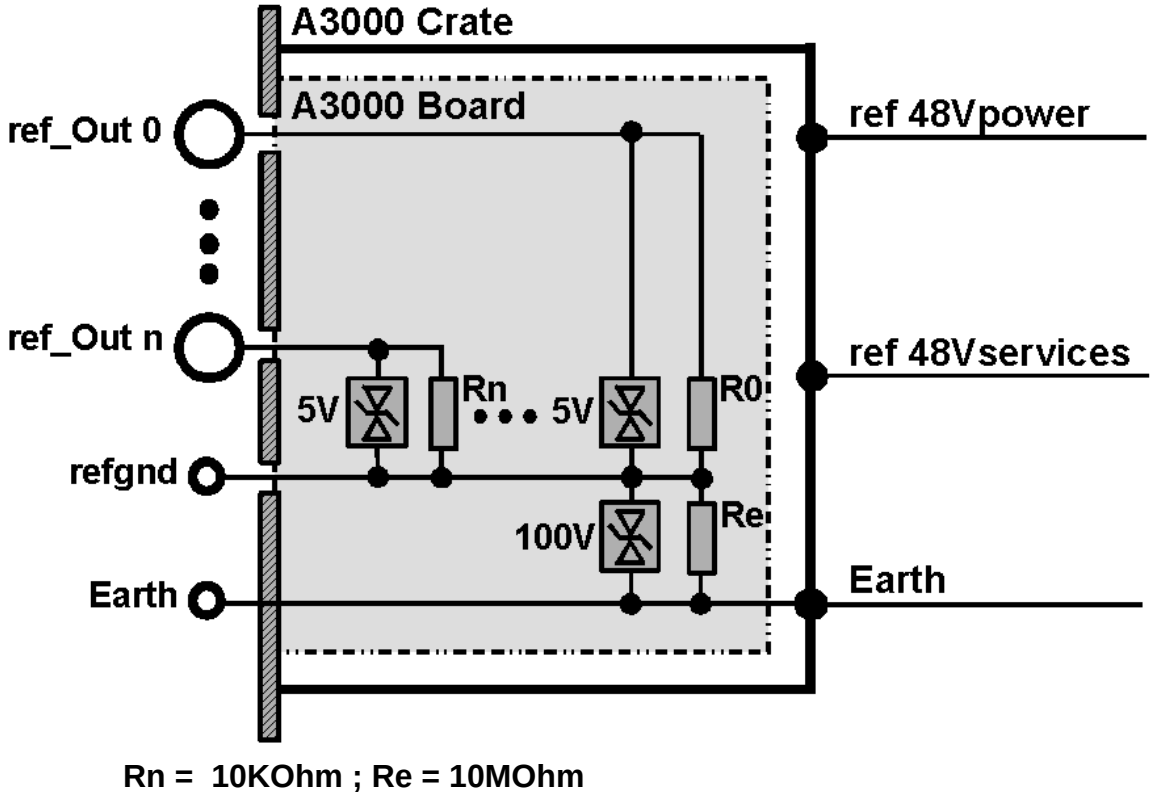
POWER ON LED: *Function:* lights up as the +48 V power, ± 12V supplies are present.
Type: green LED

COMM LED: *Function:* lights up as the communications take place.
Type: green LED

SLOT OK LED: *Function:* lights up as the board is correctly inserted into the crate.
Type: green LED

INTERLOCK LED: *Function:* lights up as the interlock is active.
Type: red LED

2.4.5 Ground scheme



Rn = 10KOhm ; Re = 10MOhm

Fig. 2.2 –Channels ground scheme

3. Safety information and installation requirements

3.1 General safety information

This section contains the fundamental safety rules for the installation and operation of the boards. Read thoroughly this section before starting any procedure of installation or operation of the product.

3.1.1 Injury Precautions

Review the following precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified. Only qualified personnel should perform service procedures.

Avoid Electric Overload.
To avoid electric shock or fire hazard, do not apply a voltage to a load that is outside the range specified for that load.

Avoid Electric Shock.
To avoid injury or loss of life, do not connect or disconnect cables while they are connected to a voltage source.

Do Not Operate Without Covers.
To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions.
To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere.
To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Do Not Operate With Suspected Failures.
If you suspect there is damage to this product, have it inspected by qualified service personnel.

3.2 Safety Terms and Symbols on the Product

These terms may appear on the product:

- **DANGER** indicates an injury hazard immediately accessible as you read the marking.
- **WARNING** indicates an injury hazard not immediately accessible as you read the marking.
- **CAUTION** indicates a hazard to property including the product.

The following symbols may appear on the product:

DANGER

High Voltage

ATTENTION

Refer to Manual

3.3 Installation

The Mod. A3050 is a power supply board which has to be plugged in a EASY3000 Remote Crate for Hostile Area. For more information about operation with the EASY3000 System, please refer to the Mod. A1676A Branch Controller documentation.
The Mod. A1676A is a single-width board for the SY1527/2527/3527 systems. At power ON the SY1527 system processor will scan all the slots in the crate to find out where the module is plugged and what kind of module it is.
The A1676A must be connected to the EASY3000/4000 remote crates through the control lines. The control connectors are placed on the A1676A front panel and on the EASY3000/4000 back or front panel respectively.

3.4 Ventilation

It is necessary to provide the unit the proper ventilation by using for example the CAEN Mod. A3000F Fan Unit; (A34FU Fan Unit must be used when the board is operated with EASY 3000 crate first issue). Ventilation is necessary even when channels and 48VPwS are off (see § 4.1).

Fig. 3.1 – Ventilation-warning Label

4. Operating modes

The EASY3000 System boards can be controlled, either locally or remotely, through the SY 1527 software interface.
For details on the EASY3000 System, please refer to the User's Manual of the A1676A Branch Controller. For details on SY 1527 system operation, please refer to the User's Manual of this product.

ATTENTION

THE MOD. A1676A BOARD REQUIRES
SY 1527 FIRMWARE VERSION 2.01.00 OR LATER

4.1 Output control and monitoring

The control software handles two types of channels: the **Channel 0**, which is a "virtual" internal channel and it is used to manage the board parameters, and the **Channel 1** and **2**, which are the actual output channels. A1676A Branch Controller parameters are listed in the relevant User's Manual.

Table 4.1 – CH0 Parameters (Board parameters)

Name	Dir	Sign	ValType	Min	Max	Res	UM	OnStr	OffStr
Name	SET	UNSIGNED	STRING						
Rel	MON	UNSIGNED	NUMERIC	1.00	99.99	0.01	NONE		
SerNum	MON	UNSIGNED	NUMERIC	1	65535	1	NONE		
RemBdName	MON	UNSIGNED	ON_OFF					A3050	A3050
Temp	MON	SIGNED	NUMERIC	0	70	1	CELSIUS		
12VPwS	MON	UNSIGNED	ON_OFF					Fail	Ok
48VPwS	MON	UNSIGNED	ON_OFF					Fail	Ok
Sync	MON	UNSIGNED	ON_OFF					Fail	Ok
HVSync	MON	UNSIGNED	ON_OFF					Fail	Ok
RemIlk	MON	UNSIGNED	ON_OFF					Yes	No
MainPws	MON	UNSIGNED	ON_OFF					Fail	Ok

Name allows to assign a symbolic name to the board

Rel allows to readout the module firmware release.

SerNum allows to readout the module serial number.

RemBdName allows to readout the module name.

Temp allows to readout the Temperature value.
The returned value is the maximum detected on the channels
N.B.: If **Temp > 70°C** all channels are turned OFF.

12VPwS allows to readout the status of the +/-12V voltages generated inside the module.
N.B.: If **12VPwS = Fail** all channels are turned OFF.

48VPwS allows to readout the status of the external +48V Power voltage.
N.B.: If **48VPwS = Fail** all channels are turned OFF.

Sync allows to readout the status of the 50Hz synchronisation signal (EASY BUS) provided by the A1676A Branch Controller .
N.B.: If **Sync = Fail** all channels are turned OFF.

HVSync allows to readout the status of the 625KHz EASY BUS clock signal provided by the A1676A
N.B.: If **HVSync = Fail** the 625KHz signal is generated by the board itself.

RemIlk allows to readout the status of the **Interlock** signal on the front panel.
N.B.: If **RemIlk = Yes** all the channels are turned OFF.

MainPwS allows to readout the status of the **48V STATUS** Power and Service signals on the back panel of the EASY3000 crate
N.B.: if MainPwS = Fail all the channels are turned OFF.

Table 4.2 – CH1..2 Parameters (output channel parameters)

Name	Dir	Sign	ValType	Min	Max	Res	UM	OnStr	OffStr
Name	SET	UNSIGNED	STRING						
V0Set	SET	UNSIGNED	NUMERIC	2.000	8.000	0.005	VOLT		
SVMax	SET	UNSIGNED	NUMERIC	2.000	8.000	0.005	VOLT		
VMon	MON	UNSIGNED	NUMERIC	0.000	8.000	0.005	VOLT		
VCon	MON	UNSIGNED	NUMERIC	0.000	8.200	0.005	VOLT		
I0Set	SET	UNSIGNED	NUMERIC	00.0	50.0	0.01	AMPERE		
IMon	MON	UNSIGNED	NUMERIC	00.0	50.0	0.01	AMPERE		
Trip	SET	UNSIGNED	NUMERIC	0.0	1000.0	0.1	SEC		
Pw	SET	UNSIGNED	ON_OFF					On	Off
GlbOffEn	SET	UNSIGNED	ON_OFF					En	Dis
GlbOnEn	SET	UNSIGNED	ON_OFF					En	Dis
OutReg	SET	UNSIGNED	BINARY	0	65535	1	HEX		
OutReg	SET	UNSIGNED	BINARY	0	65535	1	HEX		

Name allows to assign a symbolic name to the channel

V0Set allows to set the output voltage.

SVmax allows to set the upper limit of V0Set.
(V0Set cannot exceed SVMax).

VMon allows to readout the voltage on the load.

VCon allows to readout the voltage on the output connector.
N.B.: if **VCon > 8.2V** the channel is turned OFF.

I0Set allows to set the current threshold value.

IMon allows to readout the current value delivered by the channel.

Trip allows to set the Trip time.
N.B.: If the channel Over Current (Imon >= I0set) lasts more than the Trip time, the channel is turned OFF.
TRIP = 1000 s means *infinite*: in case of TRIP *infinite* the output current is permitted to keep the programmed limit; if the maximum output current value is reached the channel behaves like a constant current generator. In case of TRIP < 1000 s, the output current is permitted to keep the limit only for programmed time interval and then is switched off.

Pw allows to send the ON/OFF command to the channel.

GlbOnEn allows to enable the channel to respond to a GlobalOn command provided by the A1676A.
N.B.: All the channels with GlbOnEn = En are turned ON any time the A1676A broadcasts a GlobalOn command.

GlbOffEn allows to enable the channel to respond to a GlobalOff command provided by the A1676A.
N.B.: All the channels with GlbOffEn = En are turned OFF any time the A1676A broadcasts a GlobalOff command.

OutReg allows to set the Output Register bits.

Status allows to readout the channel status value.

Table 4.3 – Status word significant bits

Status	Name	Meaning
Bit 0	ON/OFF	
Bit 3	OVC	Over Current : IMon = I0set
Bit 4	OVV	Over Voltage : VMon > V0set + 0.25V
Bit 5	UNV	Under Voltage : VMon < V0set - 0.25V
Bit 7	HVMAX	Hardware Vmax : Output voltage (load) > value set by panel trimmer And/Or Connector Voltage > 8.2V

Status	Name	Meaning
Bit 9	TRIP	Channel in OVC for a duration > TRIP
Bit 10	CALERR	Calibration error
Bit 11	UNPLUGGED	Fail in communication with A1676A Branch Controller
Bit 13	OVP[6]	Over Voltage Protection : VCon > 8.5V
Bit 14	PWF	Power Fail : output power > 310W
Bit 15	TERR	Temperature Error : temperature > 70°C

N.B.: If a channel is in 'TRIP','HVMAX', 'OVP', 'PWF' or 'TERR', (i.e. the corresponding bits are set) it is turned OFF.

Before turning one channel ON, every fail cause must be removed via the 'Clear Alarm' command, sent by the Sy1527/Sy2527 system.

4.1.1 Internal Channel OPC Items

This chapter describes the items which are available for the control of the internal channel (Channel 0).

The **Name** item allows to assign to the channel a symbolic name.

A read access to the **Temp** item returns the channels temperature.

A read access to the **Temp#EU** item returns a string with the Temp Engineering Units.
A read access to the **Temp#HighEU** item returns the highest possible Temp value.
A read access to the **Temp#LowEU** item returns the lowest possible Temp value.

A read access to the **Rel** item returns a string with the board firmware release.

A read access to the **12VPwS** item returns the internal ±12 V status.
A read access to the **12VPwS#CoOpen** item returns back the label "Off" associated to 12VPwS=OK.
A read access to the **12VPwS#CoClose** item returns back the label "On" associated to 12VPwS=FAIL.

A read access to the **48VPwS** item returns the external +48 V status.
A read access to the **48VPwS#CoOpen** item returns back the label "Off" associated to 48VPwS=OK.
A read access to the **48VPwS#CoClose** item returns back the label "On" associated to 48VPwS=FAIL.

A read access to the **Sync** item returns the external 50 Hz status.
A read access to the **Sync#CoOpen** item returns back the label "Off" associated to Sync=OK.
A read access to the **Sync#CoClose** item returns back the label "On" associated to Sync=FAIL.

[6] This protection must be intended as a further safety limit beyond HVmax

A read access to the **HVSync** item returns the external 625 Hz status.
A read access to the **HVSync#CoOpen** item returns back the label “Off” associated to HVSync=OK.
A read access to the **HVSync#CoClose** item returns back the label “On” associated to HVSync=FAIL.

A read access to the **RemIlk** item returns the remote Interlock status.
A read access to the **RemIlk#CoOpen** item returns back the label “Off” associated to board=NO
A read access to the **RemIlk#CoClose** item returns back the label “On” associated to board=YES

A read access to the **MainPwS** item returns the +48 V Power and Service status.
A read access to the **MainPwS#CoOpen** item returns back the label “Off” associated to MainPwS=OK.
A read access to the **MainPwS#CoClose** item returns back the label “On” associated to MainPwS=FAIL.

A read access to the **SerNum** item returns the board serial number.

A read access to the **RemBdName** item returns the remote board name status.
A read access to the **RemBdName#CoOpen** item returns back the label “Off” associated to RemBdName =NO
A read access to the **RemBdName#CoClose** item returns back the label “On” associated to RemBdName =YES

Table 4.4 – A3050 Internal Channel items

ItemID	Data Type	Access Rights	Description
PowerSupplyName.BoardXX.ChanYYY.Name	String	R/W	Channel name
PowerSupplyName.BoardXX.ChanYYY.Temp	4-byte real	R	Board temperature
PowerSupplyName.BoardXX.ChanYYY.Temp#EU	String	R	Temperature EU
PowerSupplyName.BoardXX.ChanYYY.Temp#HighEU	8-byte real	R	Temp upper limit
PowerSupplyName.BoardXX.ChanYYY.Temp#LowEU	8-byte real	R	Temp lower limit
PowerSupplyName.BoardXX.ChanYYY.Rel	String	R	Board firmware release
PowerSupplyName.BoardXX.ChanYYY.12VPS	boolean	R	12VPS status
PowerSupplyName.BoardXX.ChanYYY.12VPS#CoOpen	string	R	12VPS open label
PowerSupplyName.BoardXX.ChanYYY.12VPS#CoClose	string	R	12VPS close label
PowerSupplyName.BoardXX.ChanYYY.48VPS	boolean	R	48VPS status
PowerSupplyName.BoardXX.ChanYYY.48VPS#CoOpen	string	R	48VPS open label
PowerSupplyName.BoardXX.ChanYYY.48VPS#CoClose	string	R	48VPS close label
PowerSupplyName.BoardXX.ChanYYY.Sync	boolean	R	Sync status
PowerSupplyName.BoardXX.ChanYYY.Sync#CoOpen	string	R	Sync open label
PowerSupplyName.BoardXX.ChanYYY.Sync#CoClose	string	R	Sync close label
PowerSupplyName.BoardXX.ChanYYY.HVSync	boolean	R	HVSync status

ItemID	Data Type	Access Rights	Description
PowerSupplyName.BoardXX.ChanYYY.HVSync#CoOpen	string	R	HVSync open label
PowerSupplyName.BoardXX.ChanYYY.HVSync#CoClose	string	R	HVSync close label
PowerSupplyName.BoardXX.Chan0.RemIlk	boolean	R	RemIlk status
PowerSupplyName.BoardXX.Chan0.RemIlk#CoOpen	string	R	RemIlk open label
PowerSupplyName.BoardXX.Chan0.RemIlk#CoClose	string	R	RemIlk close label
PowerSupplyName.BoardXX.Chan0.MainPwS	boolean	R	MainPwS status
PowerSupplyName.BoardXX.Chan0.MainPwS#CoOpen	string	R	MainPwS open label
PowerSupplyName.BoardXX.Chan0.MainPwS#CoClose	string	R	MainPwS close label
PowerSupplyName.BoardXX.Chan0.SerNum	2-byte int.	R	Board serial number
PowerSupplyName.BoardXX.Chan0.RemBdName	boolean	R	Board name
PowerSupplyName.BoardXX.Chan0.RemBdName#CoOpen	string	R	Board name open label
PowerSupplyName.BoardXX.Chan0.RemBdName#CoClose	string	R	Board name close label

4.1.2 Output Channel OPC Items

This chapter describes the items which are available for the control of the power supply channel (Channel 1 and 2).

The **Name** item allows to assign to the channel a symbolic name.

The **V0set** item allows to set V0.
A read access to the **V0set#EU** item returns a string with the V0set Engineering Units.
A read access to the **V0set#HighEU** item returns the highest possible V0set value.
A read access to the **V0set#LowEU** item returns the lowest possible V0set value.

The **I0set** item allows to set I0.
A read access to the **I0set#EU** item returns a string with the I0set Engineering Units.
A read access to the **I0set#HighEU** item returns the highest possible I0set value.
A read access to the **I0set#LowEU** item returns the lowest possible I0set value.

The **Trip** item allows to program the trip time.
A read access to the **Trip#EU** item returns a string with the Trip Engineering Units.
A read access to the **Trip#HighEU** item returns the highest possible Trip value.
A read access to the **Trip#LowEU** item returns the lowest possible Trip value.

The **SVMax** item allows to set the software voltage limit.
A read access to the **SVMax#EU** item returns a string with the SVMax Engineering Units.
A read access to the **SVMax#HighEU** item returns the highest possible SVMax value.
A read access to the **SVMax#LowEU** item returns the lowest possible SVMax value.

The **VMon** item returns back the VMon value.
A read access to the **VMon#EU** item returns a string with the VMon Engineering Units.
A read access to the **VMon#HighEU** item returns the highest possible VMon value.
A read access to the **VMon#LowEU** item returns the lowest possible VMon value.

The **VCon** item returns back the VCon value.
A read access to the **VCon#EU** item returns a string with the VCon Engineering Units.
A read access to the **VCon#HighEU** item returns the highest possible VCon value.
A read access to the **VCon#LowEU** item returns the lowest possible VCon value.

The **IMon** item returns back the IMon value.
A read access to the **IMon#EU** item returns a string with the IMon Engineering Units.
A read access to the **IMon#HighEU** item returns the highest possible IMon value.
A read access to the **IMon#LowEU** item returns the lowest possible IMon value.

A read access to the **Status** item returns back a 16 bit pattern indicating channel status, as follows:

Bit 0: ON/OFF
Bit 1: don't care
Bit 2: don't care
Bit 3: OverCurrent
Bit 4: OverVoltage
Bit 5: UnderVoltage
Bit 6: don't care
Bit 7: Over HVmax
Bit 8: don't care
Bit 9: Internal Trip
Bit 10: Calibration Error
Bit 11: don't care
Bit 12: don't care
Bit 13: OverVoltage Protection
Bit 14: Power Fail
Bit 15: Temperature Error

The **Pw** item allows to switch ON/OFF the channel.
A read access to the **Pw#CoOpen** returns back the label "Off" associated to Pw=0.
A read access to the **Pw#CoClose** item back the label "On" associated to Pw=1.

The **GlbOn** item enables the channel to respond to the A1676A Global On command.
A read access to **GlbOn#CoOpen** returns back the label "Off" associated to GlbOn=0.
A read access to **GlbOn#CoClose** returns back the label "On" associated to GlbOn=1.

The **GlbOff** item enables the channel to respond to the A1676A Global Off command.
A read access to **GlbOff#CoOpen** returns back the label "On" associated to GlbOff=0.
A read access to **GlbOff#CoClose** returns back the label "Off" associated to GlbOff=1.

A write access to the **OutReg** item allows to set a 16 bit Output Register

Table 4.5 – A3050 Output Channel items

ItemID	Data Type	Access Rights	Description
PowerSupplyName.BoardXX.ChanYYY.Name	String	R/W	Channel name
PowerSupplyName.BoardXX.ChanYYY.V0Set	4-byte real	R/W	Set V0 voltage limit
PowerSupplyName.BoardXX.ChanYYY.V0Set#EU	String	R	V0set EU
PowerSupplyName.BoardXX.ChanYYY.V0Set#HighEU	8-byte real	R	V0set upper limit
PowerSupplyName.BoardXX.ChanYYY.V0Set#LowEU	8-byte real	R	V0set lower limit

ItemID	Data Type	Access Rights	Description
PowerSupplyName.BoardXX.ChanYYY.I0Set	4-byte real	R/W	Set I0 current limit
PowerSupplyName.BoardXX.ChanYYY.I0Set#EU	String	R	I0set EU
PowerSupplyName.BoardXX.ChanYYY.I0Set#HighEU	8-byte real	R	I0set upper limit
PowerSupplyName.BoardXX.ChanYYY.I0Set#LowEU	8-byte real	R	I0set lower limit
PowerSupplyName.BoardXX.ChanYYY.Trip	4-byte real	R/W	Set trip time
PowerSupplyName.BoardXX.ChanYYY.Trip #EU	String	R	Trip time EU
PowerSupplyName.BoardXX.ChanYYY.Trip #HighEU	8-byte real	R	Trip time upper limit
PowerSupplyName.BoardXX.ChanYYY.Trip #LowEU	8-byte real	R	Trip time lower limit
PowerSupplyName.BoardXX.ChanYYY.SVMax	4-byte real	R/W	Set software voltage limit
PowerSupplyName.BoardXX.ChanYYY.SVMax #EU	String	R	SVMax EU
PowerSupplyName.BoardXX.ChanYYY.SVMax#HighU	8-byte real	R	SVMax upper limit
PowerSupplyName.BoardXX.ChanYYY.SVMax#LowEU	8-byte real	R	SVMax lower limit
PowerSupplyName.BoardXX.ChanYYY.VMon	4-byte real	R	VMon
PowerSupplyName.BoardXX.ChanYYY.VMon #EU	string	R	VMon EU
PowerSupplyName.BoardXX.ChanYYY.VMon#HighU	8-byte real	R	VMon upper limit
PowerSupplyName.BoardXX.ChanYYY.VMon#LowEU	8-byte real	R	VMon lower limit
PowerSupplyName.BoardXX.ChanYYY.VCon	4-byte real	R	VCon
PowerSupplyName.BoardXX.ChanYYY. VCon#EU	string	R	VCon EU
PowerSupplyName.BoardXX.ChanYYY. VCon#HighU	8-byte real	R	VCon upper limit
PowerSupplyName.BoardXX.ChanYYY. VCon#LowEU	8-byte real	R	VCon lower limit
PowerSupplyName.BoardXX.ChanYYY.IMon	4-byte real	R	IMon
PowerSupplyName.BoardXX.ChanYYY.IMon #EU	string	R	IMon EU
PowerSupplyName.BoardXX.ChanYYY.IMon#HighU	8-byte real	R	IMon upper limit
PowerSupplyName.BoardXX.ChanYYY.IMon#LowEU	8-byte real	R	IMon lower limit
PowerSupplyName.BoardXX.ChanYYY.Status	2-byte integer	R	Channel status
PowerSupplyName.BoardXX.ChanYYY.Pw	boolean	R/W	Power ON/OFF
PowerSupplyName.BoardXX.ChanYYY.Pw#CoClose	string	R	Pw close label
PowerSupplyName.BoardXX.ChanYYY.Pw#CoOpen	string	R	Pw open label
PowerSupplyName.BoardXX.ChanYYY.GlbOn	boolean	R/W	Enable global ON
PowerSupplyName.BoardXX.ChanYYY.GlbOn#CoClose	string	R	GlbOn close label
PowerSupplyName.BoardXX.ChanYYY.GlbOn#CoOpen	string	R	GlbOn open label
PowerSupplyName.BoardXX.ChanYYY.GlbOff	boolean	R/W	Enable global OFF
PowerSupplyName.BoardXX.ChanYYY.GlbOff#CoClose	string	R	GlbOff close label
PowerSupplyName.BoardXX.ChanYYY.GlbOff#CoOpen	string	R	GlbOff open label

ItemID	Data Type	Access Rights	Description
PowerSupplyName.BoardXX.ChanYYY.OutReg	4-byte integer	R/W	Output register

4.2 Interlock operation

A schematic diagram of the Interlock input is shown in the fig. 4.1 where the diode is part of optocoupler stage.
In order to enable the output channel, the Interlock must be disabled in one of the following ways:
PASSIVE OPERATION: it is necessary to short circuit pin 1 ("GND", the first from left to right) with pin 2 ("K=katode"), and pin 3 ("A=anode") with pin 4 ("VCC").
ACTIVE OPERATION: it is necessary to send a voltage level (for example a TTL; the recommended current is about 10 mA) between pin 2 = katode and pin 3 = anode (high = interlock disabled, the channel can be turned on; low = interlock enabled, the channel cannot be turned on), leaving pin 1 and pin 4 disconnected.
The front panel Interlock LED is ON when the Board is in Interlock.

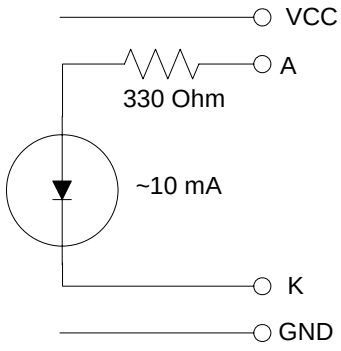


Fig. 4.1 – Interlock diagram

4.3 Voltage sensing

All output channels have a Remote Sensing Line to compensate for the voltage drop over the cable. Voltage is monitored directly at the load by an high input impedance differential amplifier through the sense wires; the voltage sensing circuit is schematically illustrated in the figure below.

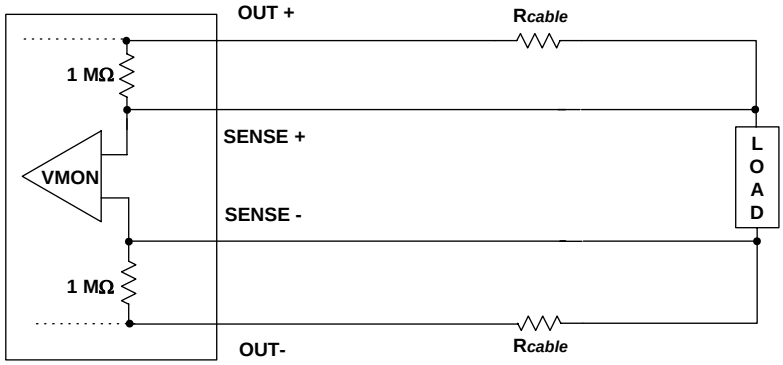


Fig. 4.2 – Remote voltage sensing scheme

When the sense wires are connected to the load, the Vset value equals the voltage on the load; if the sense wires are not connected (to the load), Vset will equal the voltage on the connector. If sense lines are not used, then it is necessary to use jumpers to short circuit OUT+ with SENSE+ and OUT- with SENSE-.

4.4 VMAX and IMAX hardware set

In order to set VMAX: connect the jumpers according to desired setting ("Voltage" fig. 4.3). At this point turn the trimmer until the desired VMAX is reached; its value can be achieved by the Monitor± connectors value (relationship between monitored values and VMAX is explained in § 2.4.3).
Vmax range: 0 .. 9 V; if Vout > VMAX then HVMAX status bit is set

In order to set IMAX: connect the jumpers according to desired setting ("Current" in the figure below). At this point turn the trimmer until the desired IMAX is reached; its value can be achieved by the Monitor± connectors value (relationship between monitored values and IMAX is explained in § 2.4.3).
Imax range 0..25 A; if Iout > IMAX then OVC status bit is set

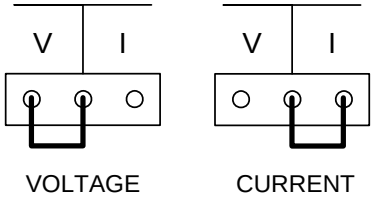


Fig. 4.3 – VMAX / IMAX jumpers setting

4.5 Output Register

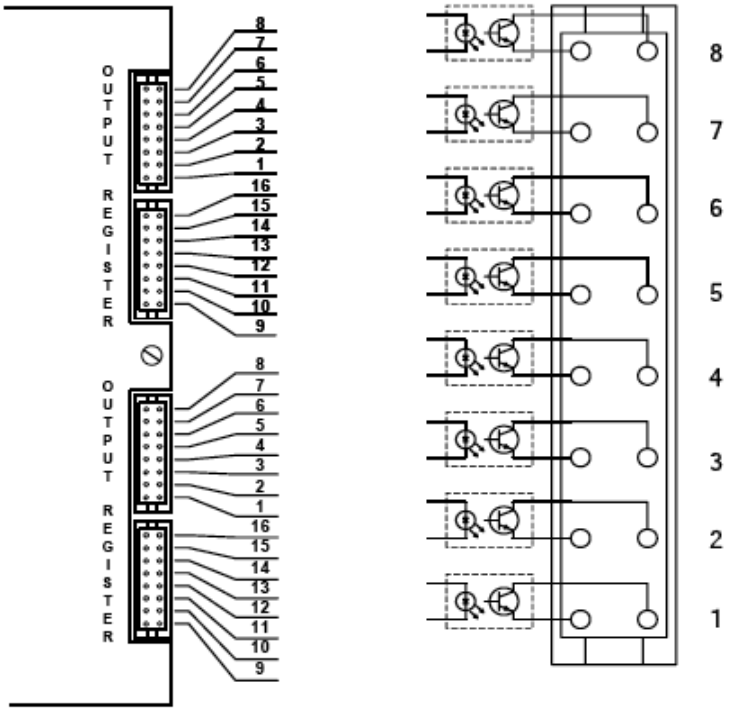


Fig. 4.4 – Output register electrical scheme

Each output is connected to a transistor which is closed according to the bits in the output register. The collectors and emitters are connected as shown in fig. 4.4, so contiguous pin can be short circuited.
"Odd" outputs (1, 3, 5..31) have a pull-up to the FVDD (referred to the front panel REFGND) on the transistor collector, with 1 Kohm resistors; "Even" outputs instead are simply connected to the collector and to the emitter of the transistors.
Then it is possible either to drive high the post regulator enable, connected to the output register, by acting on the Odd outputs or to drive it low, by acting to the Even ones (see fig. 4.5).

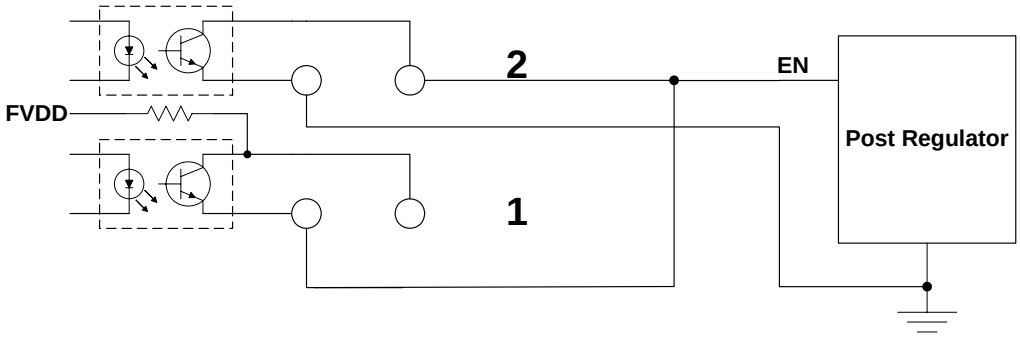


Fig. 4.5 – Connection between post regulator and Output register

ENCODING:
The HEX number written in the output register, translated to binary on 16 bit indicates with "1" the closed outputs and with "0" the open ones. For example, by writing "0x2E96":

Binary	0	0	1	0	1	1	1	0	1	0	0	1	0	1	1	0
Out	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Fig. 4.6 – Output register Encoding

then outputs 14, 12, 11, 10, 8, 5, 3, 2 will be closed.
0 leads to all open, while 2^{33}-1 leads to all closed.

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