CAEN
Tools for Discovery

Electronic Instrumentation

DT1415ET 8 Ch Floating Reversible 1kV/1mA (600 mW) Desktop Power Supply for MPGD

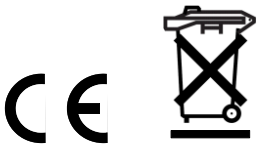
Rev. 16 - 12 November 2024

Purpose of this Manual

This document is the **DT1415ET 8 Ch Floating Reversible 1kV/1mA (600 mW) Desktop Power Supply for MPGD** User's Manual; it contains information about the installation, the configuration and the use of the Power Supply System.

Change Document Record

Date	Revision	Changes
20 December 2017	0	Preliminary
3 January 2018	1	Updated Communication Protocol
6 March 2018	2	Updated: External connections, Operating modes
21 June 2018	3	Updated Communication Protocol
27 July 2018	4	New Examples of stacking channels
18 April 2019	5	HV Channel Output
9 July 2019	6	Updated: Technical specifications table
24 July 2019	7	Updated: Technical specifications table
8 November 2019	8	Updated: Communication Protocol
8 July 2020	9	Updated Channels settings, Communication Protocol, Technical specifications table
14 October 2020	10	Updated: Channel control and output section
16 February 2021	11	Updated: Technical specifications table
23 March 2021	12	Updated: Technical specifications table
13 May 2021	13	Updated Software Tools
14 June 2024	14	Updated: Technical specifications table
22 July 2024	15	Discontinued EPICS service
12 November 2024	16	Updated: External connections, Technical specifications table



Index

1. General description

Overview

The DT1415ET provides 8 independent High Voltage 1 kV / 1mA (0.6W) channels in a desktop package; the unit is 110/220V AC Powered.

Channels can be used with either positive or negative polarity, independently from each other. The channels have independent floating return, insulated up to 5 kV one from another (Full Floating channel).

Each channel is provided with one connector for the positive output and two “bridged” for the negative one, thus allowing to “stack” two or more adjacent channels.

Module control can take place either locally, assisted by a 2.8" Touchscreen Graphic color LCD display or remotely, via USB, or Ethernet.

HV outputs are delivered through SHV connectors.

Safety features include:

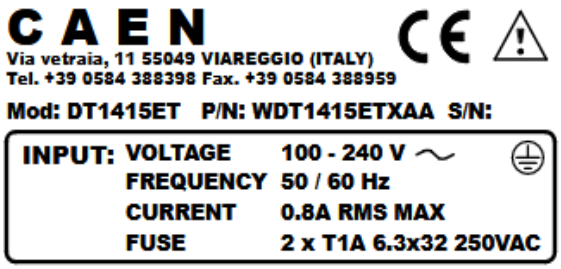
- OVERVOLTAGE and UNDERVOLTAGE warning when the output voltage differs from the programmed value by more than ±1% ±2V of set value.
- OVERCURRENT detection: if a channel tries to draw a current larger than its programmed limit, it enters TRIP status, keeping the maximum allowed value for a programmable time (TRIP), before being switched off
- Common Interlock logic for channels enable/disable and individual inputs signal for channel Kill function.

2. Technical specifications

Packaging

Desktop package (255x140x330mm); Weight: ~5.2kg.

Power requirements



Front panel

External connections

Local control section

2.8” LED Touch Screen Parameter and Mode setting; Local settings monitoring

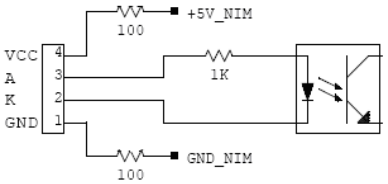
Channel control and output section

Channel control

3 POS. SWITCH with lock	HV_EN/OFF/KILL	*Channel Enable and turning OFF/KILL*
RED LED	ON	*HV On enabled*
RED LED	KILL	*Ch. Disable, according to "Power Down" setting (KILL or RAMP)*

When the channels are assigned to a group (see p.12), they can be turned ON only if the corresponding front panel switches are all ON; to turn all channels in a group OFF, it is sufficient that only one switch of the group is OFF. When OFF, the channel is turned down according to Ramp Down setting; when KILL, it is turned down according to Power Down mode.

Kill signal



A schematic diagram of the Kill input is shown in the figure on the left, where the diode is part of opto-coupler stage. Kill means that channels are hardware turned off. The following table explains the Kill operation

CONFIGURATION ↓	**KILL** MODE →	*OPEN*	*CLOSE*
leave contact open		Killed	ENABLED
voltage level (0÷1V, ~5mA current) between pin 2 (high) and pin 3 (low)		Killed	ENABLED
short circuit pin 1 with pin 2, and pin 3 with pin 4		ENABLED	Killed
voltage level (4÷6V, ~5mA current) between pin 2 (high) and pin 3 (low)		ENABLED	Killed

HV Channel Output

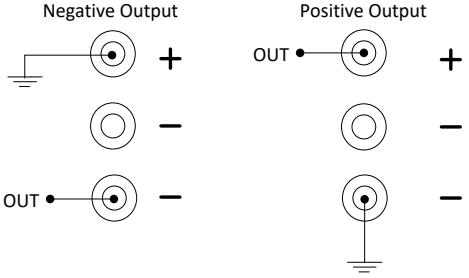
This section is provided with one connector for the positive output and two "bridged" for the negative one, thus allowing to stack two or more adjacent channels. Output ratings: max voltage: 1 kV (Floating up to 5 kV); max current: 1 mA; max power: 0.6W

WARNING! These connectors produce extremely hazardous high voltages at a potentially lethal current level; never connect or disconnect the HV OUT connector with the power ON/OFF switch ON; always switch power OFF and wait at least 30s before connecting or disconnecting HV cables.

OUT *HV Channel Out*: 3 x SHV RADIALL R317580; Impedance: 50 Ohm; Frequency range: 0 – 2 GHz; VSWR: <1.20 + 0.3 F (GHz) – (plug and jack); Test voltage: 10kV DC – 1mn (unmated connectors); Ratings: 12kV DC – 1mn (mated pairs); Current rating: 10 A

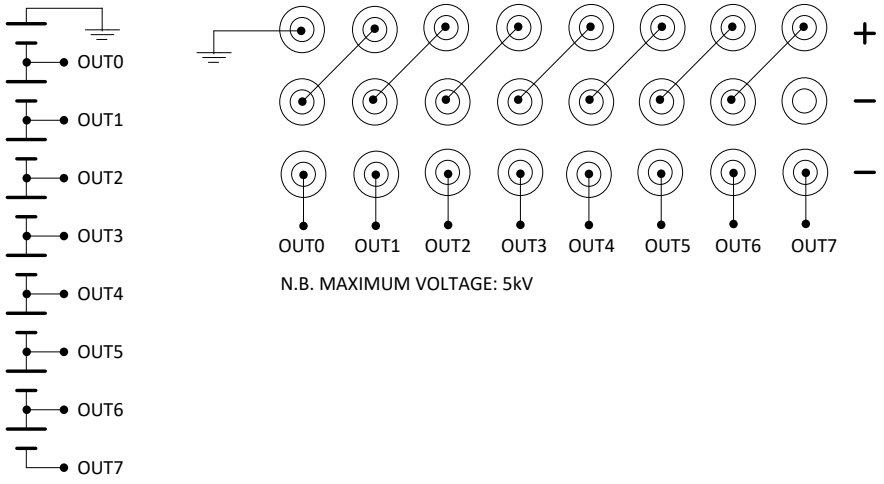
Maximum 5kV Absolute Voltage: the maximum allowed output voltage with stacked channels is 5kV; see also p.7. The unit only guarantees that this limit is not exceeded for the voltage set value when the channels are operated in Group Mode. It is up to the User to verify that the 5kV limit is not exceeded in other cases, for example with stacked channels operated individually or in Group Mode during transitions (i.e. when the channels are ramping).

When the channels are used independently from each other, in order to configure the output polarity, the SHV connectors must be connected in these ways:

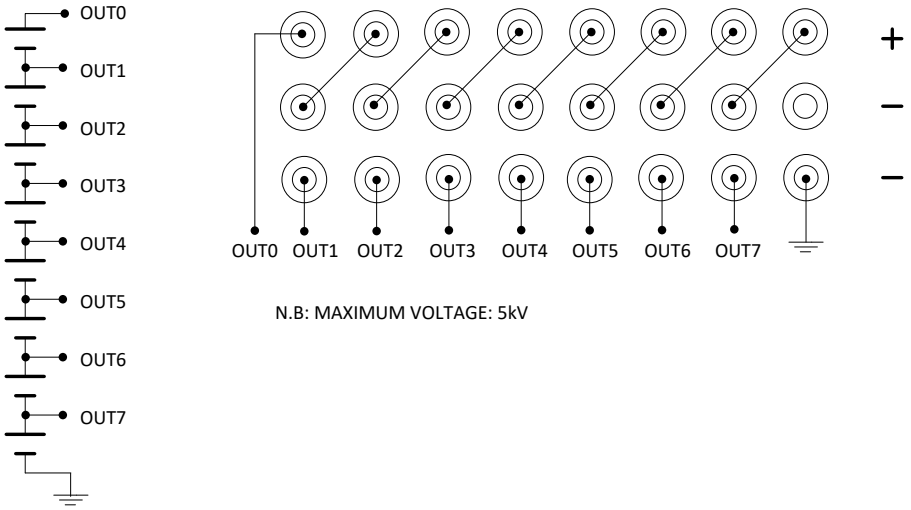


Examples of stacking channels

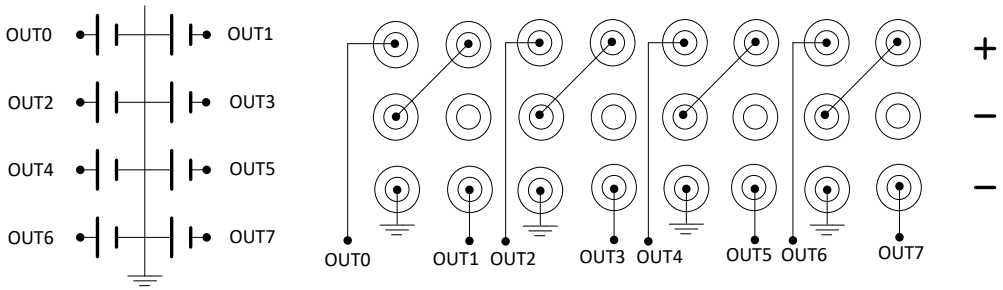
The following diagrams show electrical schemes and hardware connections of possible configurations of stacked channels.

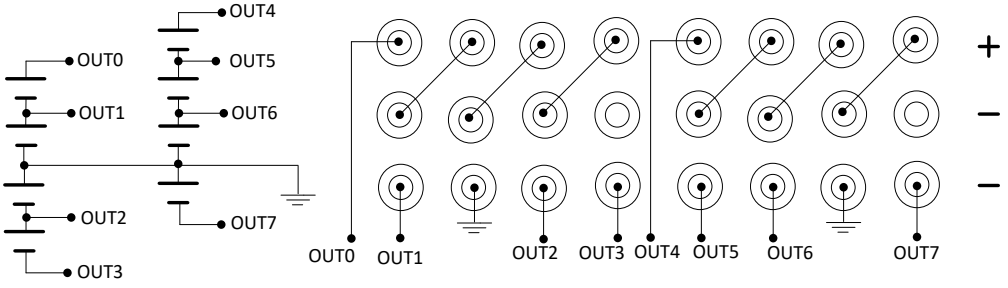


N.B. MAXIMUM VOLTAGE: 5kV

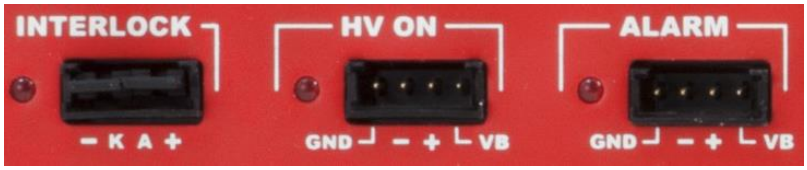


N.B: MAXIMUM VOLTAGE: 5kV



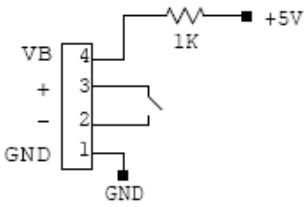


HV Status control section



ALARM	RED LED/ AMP 280371-2	Out	*Alarm status signalled (active LOW)*
HV ON	RED LED/ AMP 280371-2	Out	*HV On enabled (at least one channel ON)*
INTERLOCK	RED LED/ AMP 280371-2	In	*Interlock signal*

Alarm signal

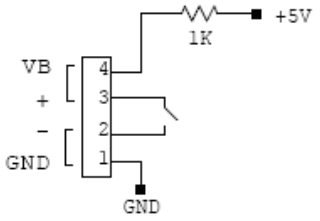


As an Alarm condition is detected (see p. 24 and 25) pins 2 and 3 (- and +) are closed; the contact can be used to switch an external device supplied by an external source, otherwise the VB and GND references can be used to provide a TTL compatible level on pin 2 and 3

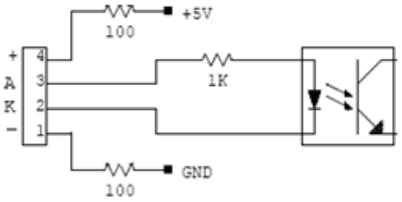
In the first case (externally supplied device) the maximum allowed ratings are:

- Maximum voltage between + and -: 12V
- Maximum sink current across + and -: 100mA

In the latter case, to produce a TTL compatible Alarm Out, pin 3 (+) must be connected with pin 4 (VB) and pin 1 (GND) with pin 2 (-); see the diagram on the right:



Interlock signal

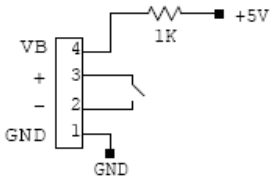


A schematic diagram of the Interlock input is shown in the figure on the left, where the diode is part of opto-coupler stage.
Interlock means that channels are hardware disabled. The following table explains the interlock operation:

CONFIGURATION ↓ INTERLOCK MODE →	*UNDRIVEN*	*DRIVEN*
leave contact open	INTERLOCK	ENABLED
voltage level (0÷1V, ~5mA current) between pin 2 (high) and pin 3 (low)	INTERLOCK	ENABLED
short circuit pin 1 with pin 2, and pin 3 with pin 4	ENABLED	INTERLOCK
voltage level (4÷6V, ~5mA current) between pin 2 (high) and pin 3 (low)	ENABLED	INTERLOCK

The front panel Interlock LED is ON when the INTERLOCK is active; as INTERLOCK is active, channels are turned off at the fastest available rate, regardless the RAMP DOWN setting. To reset the Interlock flag, all switches must be placed on KILL and then on OFF.

HV ON signal

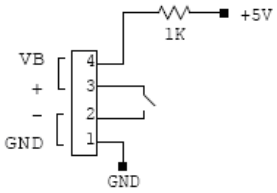


As at least one HV Channel is ON, pins 2 and 3 (- and +) are closed; the contact can be used to switch an external device supplied by an external source, otherwise the VB and GND references can be used to provide a TTL compatible level on pin 2 and 3.

In the first case (externally supplied device) the maximum allowed ratings are:

- Maximum voltage between + and -: 12V
- Maximum sink current across + and -: 100mA

In the latter case, to produce a TTL compatible HV ON Out, pin 3 (+) must be connected with pin 4 (VB) and pin 1 (GND) with pin 2 (-); see the diagram on the right



Remote communication control section

USB	B TYPE USB	*USB2.0 compliant*
ETH	10/100 Base-T female connector	TCP/IP

AC Input (back panel)

TE CONNECT PS0S0DS3B Socket with switch;
to be connected to Mains 100 - 240 Vac (50 - 60 Hz)
via provided power cord.
Two Fuses: 6.3x32 (1A); Retarded 250VAC

Channel Kill (back panel)

REMOTE KILL	AMP 280371-2	contact open: KILL voltage level (0÷1V, ~5mA current) between pin 2 and 3: KILL short circuit pin 1 with pin 2, and pin 3 with pin 4: ENABLED voltage level (4÷6V, ~5mA current) between pin 2 and pin 3: ENABLED

Technical specifications table[1]

Packaging			Desktop package (255x140x330mm); Weight: ~5.2kg
No. of Channels			8
Output Voltage			1 kV
Polarity			Floating up to 5 kV
Max. Output Current			1 mA
Max. Channel Power			0.6W
Voltage Set/Monitor Resolution			20 mV
Current Set Resolution			20 nA
Current Monitor Resolution	**High Power**		1 nA
	High Resolution[2]		100 pA
Minimum Load			Minimum set voltage and current 50V and 500nA respectively
Ramp Up/Down			1÷100 Volt/sec, 1 Volt/sec step, settable for each channel
Software VMax			0 ÷ 1000V; 1V resolution
Trip			Max. time an "overcurrent" is allowed to last. A channel in "overcurrent" works as a current generator; output voltage varies to keep the output current lower than the programmed value. Overcurrent lasting more than set value, causes the channel to "trip". Output voltage will drop to zero at the Rampdown rate; in this case the channel is put in the off state. If trip= INFINITE, "overcurrent" lasts indefinitely. TRIP range: 0 ÷ 999.9 s; 1000 s = Infinite. Step = 0.1 s
"Zero" current			Zero Current Detect channel parameter allows to sample the present IMon value; this value (IMonZero) can be then subtracted via the Zero Current Adjust parameter ENABLE, from the monitored current (IMon), to compensate the current offset; if ZCAdjust = Enabled, then the IMon value is compensated. After the IMonZero value is sampled, Zero Current Detect, returns to Off. Allowed IMonZero values are from 0 to full scale. If Zero Current Adjust is DISABLED, the IMonZero compensation is neglected.
Voltage Ripple	**differential mode**	**0 ÷ 1000 Hz** **Typ**	<10mVpp
		Max	<15 mVpp
		1 ÷ 20000 kHz **Typ**	<5 mVpp
		Max	<10 mVpp
	common mode	**Typ**	<10mVpp
		Max	<15mVpp
Voltage Monitor vs. Output Voltage Accuracy			±0.2% of VSet ± 0.2V from 10% to 100% f.s. ±0.2% of VSet ± 0.5V from 3% to 10% f.s.
Voltage Set vs. Output Voltage Accuracy			±0.2% of VSet ± 0.2V from 10% to 100% f.s. ±0.2% of VSet ± 0.5V from 3% to 10% f.s
Iset vs Output current accuracy			±0.5% of ISet ± 0.5µA from 3% to 100% f.s.
Imon vs Output current accuracy			±0,5% of Iout ± 5nA from 10% to 100% f.s. and constant voltage ±2% of Iout ± 5nA from 1% to 10% f.s. and constant voltage
Power requirements			100-240Vac; 50/60Hz; 0.8A rms max; fuse: 2xT1A 6.3x32 250Vac
EMC qualification			CE Standards
Safety Standard			ROHS
Altitude			3000 m
Humidity range			0 ÷ 80% non condensing
Operating temperature			0 ÷ 45°C
Storage temperature			-10 ÷ 70°C
MTBF			28000 hours
Temperature coefficient			±50ppm/°C
Stability			< 150mV (Vset = 750V; No Load; one day after 1 hour warm up)
Long term stability			< 200mV (Vset = 750V; No Load; one week after 1 hour warm up)
Load regulation			< 0.2% (Vset = 600V, Iout from 60µA to 850µA)

[1] Technical specifications validity range: 3% to 100%

[2] When High Resolution is selected (ImRange = LOW), Maximum Current (ISET) can be set in the 0 ÷ 100 µA range

3. Operating modes

Safety requirements and Initial inspection

N.B. read carefully the "Precautions for Handling, Storage and Installation" document provided with the product before starting any operation!

The following HAZARD SYMBOLS are reported on the unit:

CAUTION: indicates the need to consult the "Precautions for Handling, Storage and Installation" document provided with the product. **A potential risk exists if the operating instructions are not followed**

HIGH VOLTAGE: indicates the presence of electric shock hazards. Enclosures marked with these symbols should only be opened by CAEN authorized personnel.
To avoid risk of injury from electric shock, do not open this enclosure

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 power a load outside of its specified range.

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 this product to be damaged, have it inspected by qualified service personnel.

Product cleaning

If required, the unit may be cleaned with isopropyl alcohol or deionised water and air dried. Clean the exterior of the product only. Do not apply cleaner directly to the items or allow liquids to enter or spill on the product.

Initial inspection

Prior to shipment, these units are inspected and found free of mechanical or electrical defects. Upon unpacking of the unit, inspect for any damage, which may have occurred in transport. The inspection should confirm that there is no exterior damage to the unit, such as broken knobs or connectors, and that the panels are not scratched or cracked. Keep all packing material until the inspection has been completed. If damage is detected, file a claim with carrier immediately and notify CAEN. Before installing the unit, make sure you have read thoroughly the safety rules and installation requirements, then place the package content onto your bench; you shall find the following parts:

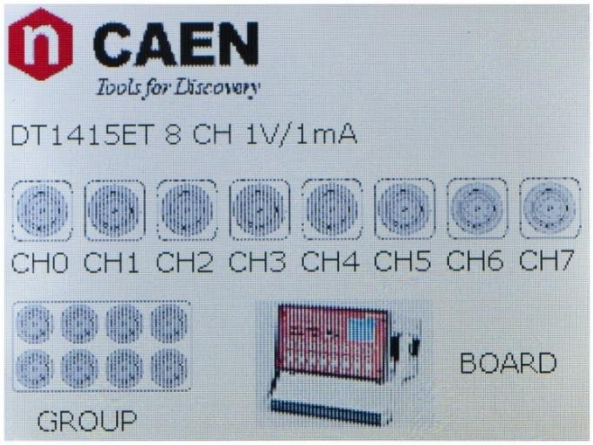
- DT1415ET HV Power Supply;
- USB cable
- 10/100 BASE-T Ethernet cable
- Power cord

DT1415ET is housed in a Desktop package. The DT1415ET is an equipment for BUILDING-IN: it must be used on flat solid surfaces, such as a table.

Unit control can take place either locally, assisted by a 2.8" Touchscreen LCD or remotely, via USB, or Ethernet (see p. 17).

Local Control

To use the DT1415ET with Local control, connect the HV Channel Output to the load, connect the DT1415ET to the Mains through the power cord, provided with the kit, and switch it ON, via the backpanel switch. At power ON the Display shows the Main Menu:



At this point the module is ready to be operated locally. Tap on:

- BOARD icon to access BOARD parameters
- CHx icon to access CHANNELS parameters
- GROUP icon to access CHANNEL GROUP parameters

BOARD Settings

General board parameters (CONTROL can be operated both in LOCAL and REMOTE mode; other settings are allowed in LOCAL mode only; monitor is possible also with remote control) include:

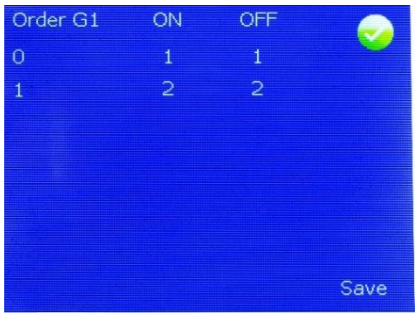
Parameter:	Type:	Function:
Ethernet Configuration	Monitor/Set	Allows to access Ethernet Settings
INTERLOCK	Monitor/Set	Undriven / Driven (see p.8)
CONTROL	Monitor/Set	REMOTE: the module is controlled remotely; local monitor is allowed; LOCAL: the module is controlled locally; remote monitor is allowed
Ch to Group	Set	Allows to associate one or more channels to up to 4 groups
Configure	Set	Allows to save and load up to 5 group configurations

Tap on the Red “back” arrow to return to main Menu.

Group Configuration Menu

"Ch To Group" in the Board settings allows to access the following menu:

Tapping on the Boxes, the virtual keypad will allow to add channels to the relevant Group; confirm with "Enter",
Tapping on the Group index, it will be possible to select the Turning ON/OFF sequence of the group channels: tap on ON (OFF) index to increase the channel Turning ON (OFF) priority; the Channel with lowest priority number will be turned ON/OFF first, the next one will be turned ON/OFF as the ON/OFF ramp of the previous is completed; see figure below:



When the desired sequence is set, tap "Save", then the green button (right upper corner) to go back to Group Configuration Menu. When the channels are assigned to a group, they can be turned ON only if the corresponding front panel switches are all ON; to turn all channels in a group OFF, it is sufficient that only one switch of the group is OFF.
Tap on the Red "back" arrow to return to Board Parameters.

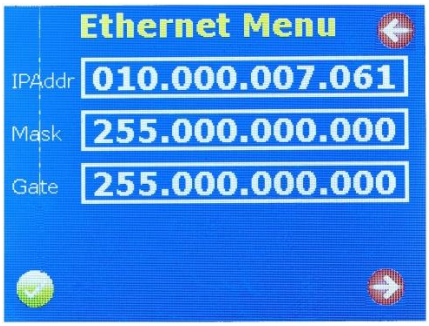
Configuration Menu

"Configure in the Board settings allows to access the following menu:

This Menu allows to save the channel configuration (see previous section) with all set parameters, into a Board Configuration with a custom name. Tapping on the configuration Index, it will be possible to increase it (0 to 4) and to save the corresponding configuration with such index and custom name.
Tap on the large Box: the virtual keyboard will allow to type the configuration name; confirm with "enter".
Tapping on "Configuration", the corresponding configuration can be monitored.
Once the configuration is done, it can be recorded with "Save" option.
To move to another configuration, shift by tapping the configuration index, and when the desired one is displayed, tap "Load" to make it effective.
Tap on the Red "back" arrow to return to Board Parameters.

Ethernet configuration

"Network" Icon in the Board settings allows to access Ethernet configuration menu



This option allows to configure the Ethernet settings; once they are done, tap the green button, but changes will only become effective at the next power ON. Tap the upper red arrow to go back.
The lower red arrow allows to access to DHCP settings:

If a DHCP Server is available, then the module can be enabled or disabled as DHCP client; tap green button to save the new setting and go back to Main Menu: the DHCP server will automatically assign a new IP to the module at next Power On. Tap the upper red arrow to go back without changes.

Channel settings

From the Main Menu, tap the relevant channel icon (Ch#), to access its settings:

For each channel the following parameters can be programmed and monitored either locally or remotely (see p.17):

Parameter:	Function:	Unit:
Vmon	High Voltage Monitored value	Volt
Imon	Current Monitored value	µA
Status	ON/OFF; Ramp UP/DOWN; OVV; UNV; OVC; OVP; TRIP; OVT; KILL; INTLK; EN; DIS; LOCK	
Vset	High Voltage programmed value	Volt
Iset	Current Limit programmed value	µA
Ramp-Up	High Voltage increase rate	V/s
Ramp-Down	High Voltage decrease rate	V/s
Power Down	Power Down mode after channel TRIP or KILL	KILL or RAMP
Trip	Max time "overcurrent" allowed to last (1000 = infinite)	s
Imon Range	Current Monitor Zoom	H or L
ZC Detect	Stores IMOn value (IMonZero) into memory for “zero current compensation”	ON/OFF
ZC Adjust	Subtracts IMonZero from “non compensated” current value	EN/DIS

To set one parameter, tap on the relevant name, and change and/or enter the desired value through the “virtual keypad”; confirm with “Enter”. Tap the red arrow to go back to Main Menu.

The meaning of STATUS flag is as follows:

ON	Channel ON
OFF	Visible with channel turned OFF in local mode
UP	Channel ramping up
DOWN	Channel ramping down
OVV	Overvoltage: VMON > VSET + (2% of VSET) + 2V
UNV	Undervoltage: VMON < VSET - (2% of VSET) - 2V
OVC	Overcurrent, channel works as current generator and keeps current = ISET
OVP	Channel turned off because exceeded available power. In local mode, the flag is reset with channel control switch to KILL and then OFF. In remote mode, the flag is reset with Alarm reset.
TRIP	Channel turned off because OVC duration exceeded TRIP time. In local mode, the flag is reset with channel control switch to KILL and then OFF. In remote mode, the flag is reset with Alarm reset.
OVT	Over Temperature: channel temperature > 65°C.
KILL	Channel is off because was sent a KILL (front panel switch or back panel connector). In local mode, the flag is reset with channel control switch to KILL and then OFF. In remote mode, the flag is reset with Alarm reset.
INTLK	Channels are off because were sent an INTERLOCK. After the condition is removed, the flag must be reset. In local mode, the flag is reset with channel control switch to KILL and then OFF. In remote mode, the flag is reset with Alarm reset.
EN	Displayed in remote control mode and control switch set to ON/EN. Channel can be turned on.
DIS	Displayed in remote control mode and control switch set to OFF. Channel cannot be turned on.
LOCK	Ch control switch on ON/EN and one of these conditions is TRUE: - Power On in local mode - Switch from remote to local - New groups configuration in local mode In local mode, the flag is reset with channel control switch to KILL and then OFF. In remote mode, the flag is reset with Alarm reset.

Three types of Icon in the display status area indicate:

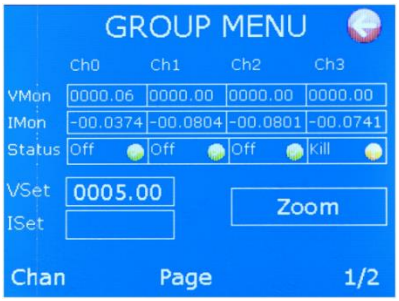
√ OK status

! WARNING status

! ALARM status

Group Settings

From the Main Menu, tap the Group icon, to access its settings:



For the Group of all channels, same parameters of single channels can be programmed and monitored either locally or remotely (see p.17):

To set one parameter, tap on the relevant name, and change and/or enter the desired value through the “virtual keypad”; confirm with “Enter”. Tap the red arrow to go back to Main Menu. “Zoom” option allows to display large sized Vmon and Imon values.

Remote Control

Module control can take place remotely, via USB or Ethernet; an external PC is required (supported OS: Windows 7 or later; Linux kernel Rel. 2.4 or later). The connection can be performed via VT emulators (such as Tera Term), or via one of the available tools (see below).
The DT1415ET is identified as **SMART HV** by the available software tools.

Software tools (coming soon)

GECO2020

CAEN GECO2020 is a graphical application that allows to control the DT1415ET HV Desktop Power Supplies (and all other CAEN Power Supplies). Once the DT1415ET is correctly installed, download and install the GECO2020 software package related to your OS; follow the instructions in the GECO2020 User manual and the DT1415ET will be ready to be operated. For more info please visit www.caen.it (products>firmware/software section).

CAEN HV Wrapper

CAEN HV Wrapper is a library, available either as a set of ANSI C functions or LabVIEW™ VI's. Such set provides the software developer an unified software interface for the control of CAEN Power Supplies. This is a low-level application in which the writing of the Control SW is assigned to the user. It contains a generic software interface independent by the Power Supply models and by the communication path used to exchange data with them.

CAEN HV Wrapper is logically located between an higher level application, such as GECO2020, and the lower layer software libraries. For more info please visit www.caen.it (products>firmware/software section).

Power Supply Modules LabVIEW Instrument Driver

Power Supply Modules LabVIEW Instrument Driver is a set of VI'S, developed for LabVIEW 2017 and later releases (LabVIEW™ is a Trademark of National Instruments Corp.), that allow to configure and monitor all parameters of remotely controlled CAEN Programmable HV Power Supply modules. Host PC shall run LabVIEW 2017 or later releases and NI-VISA Run-Time Engine 17.

To install the Power Supply Modules LabVIEW Instrument Driver, go to CAEN web site in the "Software" area, download the Power Supply Modules LabVIEW Instrument Driver installation package and follow the Set Up instructions.

Unit installation

USB installation
Connect the HV Channel Output to the load
Connect the DT1415ET to the Mains (AC) via the separate power cord
Connect the DT1415ET to the PC via the USB cable
Power up the unit through the ON/OFF rear switch
Download and install the USB driver for your OS, available at the DT1415ET page on the www.caen.it site[3]
Now the DT1415ET is ready for operation, upon installation of one of the available software tools

Ethernet installation
Connect the HV Channel Output to the load
Connect the DT1415ET to the Mains (AC) via the separate power cord
Connect the Ethernet port of the unit to the relevant port of the PC, using the 10BASE-T Ethernet cable
Power up the unit through the ON/OFF rear switch
Now the unit is ready for operation, upon installation of one of the available software tools

[3] Linux OS Users: the Unit is automatically recognised by Kernel Linux 2.6.9 and higher; unit name is assigned to serial port with name /dev/ttyACM[x], where [x] is device number; for example 1st module connected is /dev/ttyACM0, 2nd module is /dev/ttyACM1 etc.

Module access via VT emulator

The connection can be performed via VT emulators; we suggest using Tera Term (see https://ttssh2.osdn.jp/index.html.en)

USB
Launch the terminal emulator, select the serial communication link and set the virtual communication port associated to the module. Select USB connection and the used port number; set port as follows

baud rate 9600

Data bits: 8

Parity: none

stop bit: 1

Flow control: none

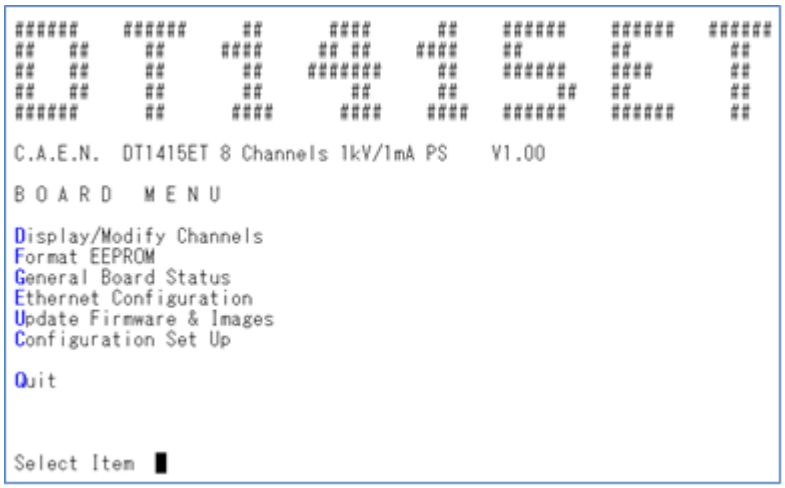
Launch communication

Type caen then <enter>;

Ethernet
Launch the terminal emulator, select port number **1470**
Please note that line editing must be disabled prior to Ethernet access (EnableLineMode=off in the Teraterm.ini configuration file).
Default settings are:

IP address 192.168.0.250
Subnet mask 255.255.255.0
Gateway 0.0.0.0
Launch communication
Type caen then <enter>;

as the communication is established, the Terminal Board Menu will be displayed:



Channels settings

By typing D on Terminal Board Menu, it is possible to access channels settings

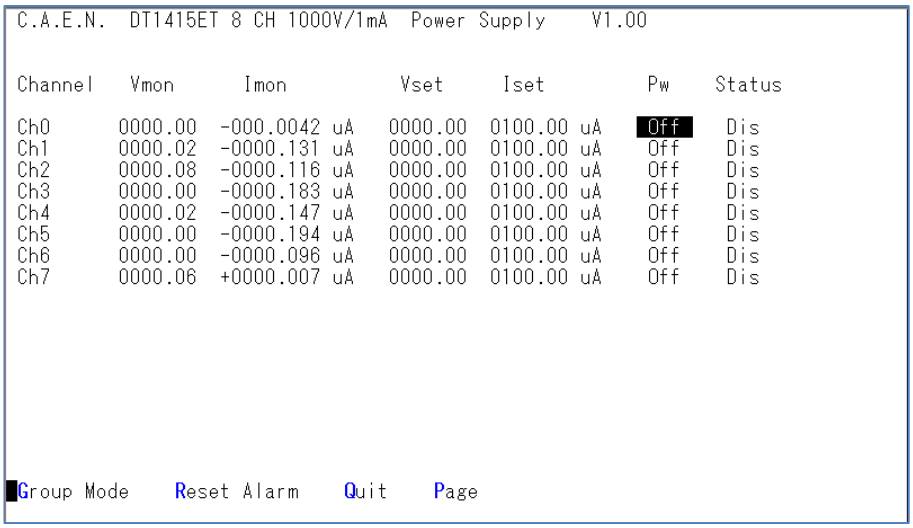
To change one parameter: point the parameter with the “arrow keys”, and type the desired value, confirm by pressing <Enter>; Imon range, ZCDtc, ZCAdj, Power and Power Down can be changed using the <Space> bar.

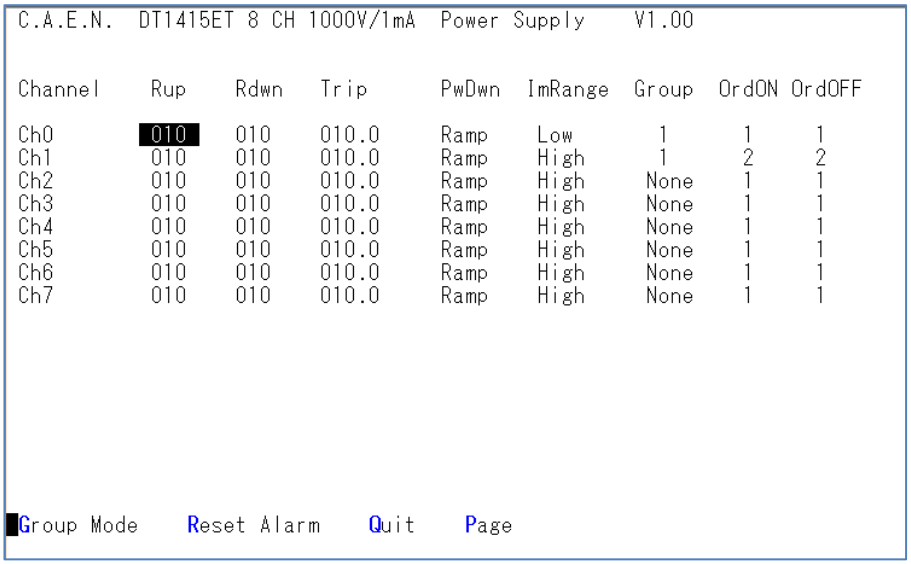
By typing G, the channels are accessed in “group” mode (one setting applies to all channels).

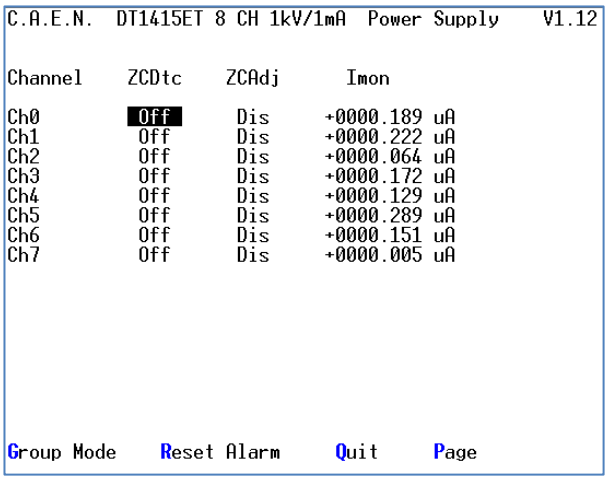
By typing P, it is possible to move from parameters page 1 to 2 and back

By typing R, it is possible to reset channels alarm status

By typing Q, it is possible to go back to Terminal Board Menu







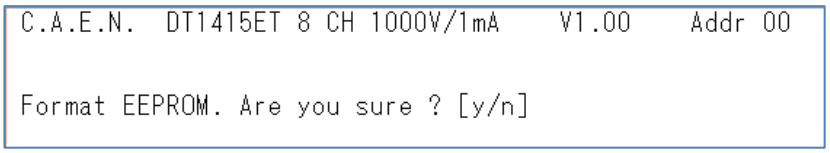
Parameter:	**Function:**	**Unit:**
Power	Channel HV enable	ON/OFF
Vmon	High Voltage Monitored value	Volt
Imon	Current Monitored value	µA
Status (see p.14)	ON/OFF; Ramp UP/DOWN; OVV; UNV; OVC; OVP; TRIP; OVT; KILL; INTLK; EN; DIS; LOCK	
Vset	High Voltage programmed value	Volt
Iset	Current Limit programmed value	µA

Ramp-Up	Maximum High Voltage increase rate	V/s
Ramp-Down	Maximum High Voltage decrease rate	V/s
Power Down	Power Down mode after channel TRIP	KILL or RAMP
Trip	Max time "overcurrent" allowed to last (1000 = ∞)	s
Imon Range	Current Monitor Zoom	H or L
Group	Assign channel to one group	1 to 4
OrdON	Channel turning ON priority in a group (1 = highest)	1 to group multiplicity
OrdOFF	Channel turning OFF priority in a group (1 = highest)	1 to group multiplicity

Format EEPROM

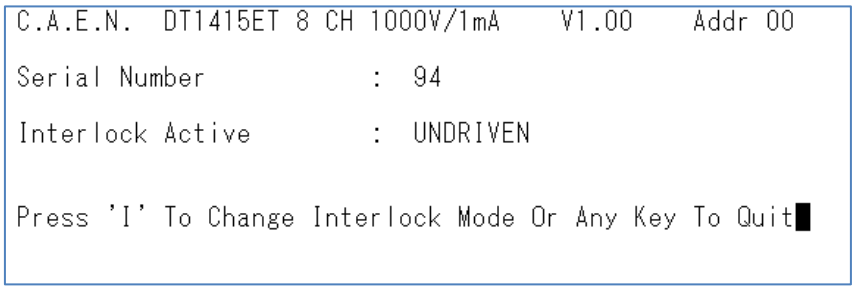
By typing F on Terminal Board Menu it is possible to access the format EEPROM menu (restores factory settings).

Type y to format or n to go back to Terminal Board Menu.



General Board Menu

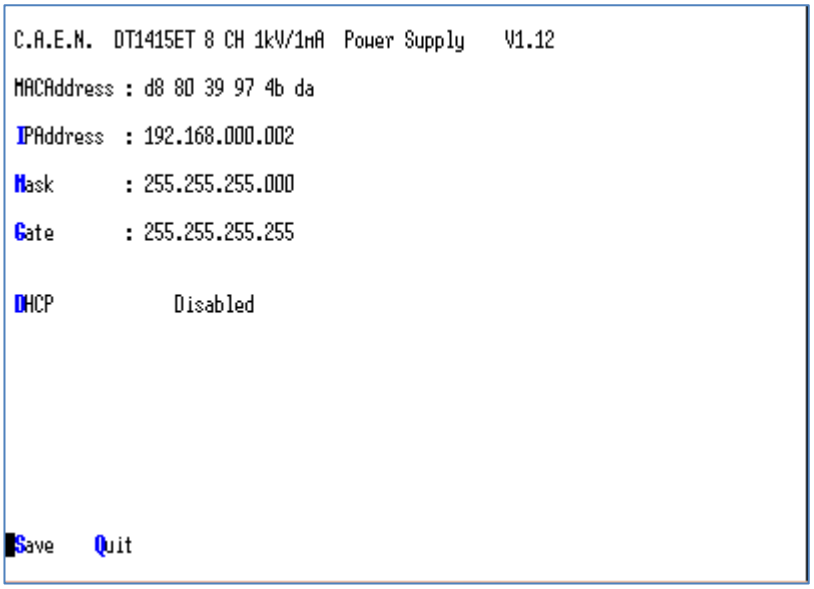
By Typing G, it is possible to access General Board settings:



To change Interlock Mode (Undriven/Driven, see p. 8), type I; any key to return to Main menu

Ethernet configuration

To configure the Ethernet Port, Type E; the following screen will open:



At first Power On the module is configured with default static IP (factory setting); such IP can be updated using the I(PAddress), M(ask) or G(ate) to select the fields, typing the new values and confirming with <Enter>.

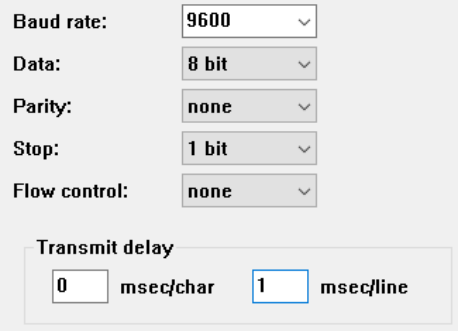
Type S to save the new setting in the EEPROM and go back to Main Menu, Q to go back without changes.

The new setting will become active at next Power On; if a DHCP Server is available, then the module can be enabled or disabled as DHCP client; type S to save the new setting in the EEPROM and go back to Main Menu: the DHCP server will automatically assign a new IP to the module at next Power On.

Upgrade Menu

It is possible to either upgrade the unit firmware or the display images and font (only via USB).
To upgrade them:

- download from www.caen.it unit page the required file for your module
- connect to the module via USB using Tera Term VT Emulator
- in the Tera Term options, select “set up” > “serial port” and enter the following settings



- click OK to confirm
- type U to access the upgrade menu in the Terminal Board Menu:

```
C.A.E.N.  DT1415ET 8 CH 1000V/1mA    V1.00    Addr 00


Firmware and Image Update Menu

1: Update firmware
2: Update image and font

Q: Quit
```

For example, select 1 = update firmware; (for option 2, the update procedure is the same)

```
C.A.E.N.  DT1415ET 8 CH 1000V/1mA    V1.00    Addr 00


Firmware Update. Are you sure ? [y/n]
```

- Type y
- The following message will be shown:

```
Disconnect link and cable then reconnect to enter boot mode.
```

- Select “File” > disconnect
- unplug the USB cable
- do not turn off the module!
- connect once again to the module, via USB
- the following message will be shown:

```
!!! Checksum Error
Firmware Update...press any key to start
```

- Press any key

- Wait until the following message is shown:

```
Flash Erased!!!

Send file to upload
```

- Select “File” > send file
- Browse the image file (for example DT1415.102)
- Select “open”
- Wait the upload to complete until this message is shown:

```
File Loaded.

Disconnect link and cable then reconnect to launch application...
```

- Select “File” > disconnect
- unplug the USB cable
- connect once again to the module, via USB

now the unit is ready to operate running the upgraded firmware

Board Configuration page

By typing C on Terminal Board Menu, it is possible to access the module Configuration

This Menu allows to “freeze” the present Group configuration (see p. 18), into a Board Configuration with a custom name.
Typing P, it will be possible to increase it (0 to 4) and to save the corresponding configuration with such index and custom name, by typing S.
Typing N will allow to write the configuration name; confirm with “enter”.
To move to another configuration, shift by typing P, and when the desired one is displayed, type L, to make it effective.
Type Q to go back to Terminal Board Menu.

```
C.A.E.N.  DT1415ET 8 CH 1000V/1mA  Power Supply    V1.00

Configuration 0 : ASD


      Vset     Iset    Rup  Rdwn  Trip  PwDwn  ImRange  Group OrdON OrdOFF

CH0  0000.00  0100.00  010  010   010.0 Ramp     Low       1     1      1
CH1  0000.00  0100.00  010  010   010.0 Ramp     Low       1     2      2
CH2  0000.00  0100.00  010  010   010.0 Ramp     Low     None    1      1
CH3  0000.00  0100.00  010  010   010.0 Ramp     Low     None    1      1
CH4  0000.00  0100.00  010  010   010.0 Ramp     Low     None    1      1
CH5  0000.00  0100.00  010  010   010.0 Ramp     Low     None    1      1
CH6  0000.00  0100.00  010  010   010.0 Ramp     Low     None    1      1
CH7  0000.00  0100.00  010  010   010.0 Ramp     Low     None    1      1




Save     Load     Name     Quit     Page
```

Communication Protocol

The Protocol is based on commands made of ASCII characters strings.

Command Format

The Format of a command string is the following :
$CMD:***,CH:*,PAR:***,VAL:xxx.xx<CR,LF> con
CMD : SET,MON
CH : Channel (0..NUMCH)
PAR : VSET,ISET,ON ...
VAL : value
NUMCH = 8
CH = NUMCH command related to all channels (group).

Response format :
#CMD:***,VAL:xxx.xx<CR,LF> con
CMD : OK,ERR
VAL : numerical value must have a Format compatible with resolution and range

Format of response string

Format response in case of error

String	Function
#CMD:ERR	Wrong command Format or command not recognized
#CH:ERR	Channel Field not present or wrong Channel value
#PAR:ERR	Field parameter not present or parameter not recognized
#VAL:ERR	Wrong set value (<Min or >Max)
#LOC:ERR	Command SET with module in LOCAL mode

Each string is terminated by **< CR, LF >**

Format response in case of correct command

String	Function
#CMD:OK	command Ok
#CMD:OK,VAL:*	command Ok * = value for command to individual Channel
#CMD:OK,VAL:*;*;*;*	command Ok *;*;*;* = values Ch0..NUMCH for command to all Channels

Numerical value Field **'VAL'** has Format compatible (comma and decimal part) with the resolution and the range related to the parameter. Each string is terminated by **< CR, LF >**

MONITOR commands related to the Channels

The following table contains the strings to be used to handle monitor commands related to the Channels.
The '**X**' in the Field 'Channel' can be set in the '**0..NUMCH**' range.
When '**X=NUMCH**' the module returns the values of the parameter of all Channels.

String	Function	Units
$CMD:MON,CH:X,PAR:VSET	Read out VSET value	V
$CMD:MON,CH:X,PAR:VMIN	Read out VSET minimum value	V
$CMD:MON,CH:X,PAR:VMAX	Read out VSET maximum value	V
$CMD:MON,CH:X,PAR:VDEC	Read out VSET number of decimal digits	
$CMD:MON,CH:X,PAR:VRES	Read out VSET VMON resolution	V
$CMD:MON,CH:X,PAR:VMON	Read out VMON value	V
$CMD:MON,CH:X,PAR:ISET	Read out ISET value	µA
$CMD:MON,CH:X,PAR:IMIN	Read out ISET minimum value	µA
$CMD:MON,CH:X,PAR:IMAX	Read out ISET max value	µA
$CMD:MON,CH:X,PAR:IMON	Read out IMON value	µA
$CMD:MON,CH:X,PAR:IMRES	Read out IMON resolution	µA

String	Function	Units
$CMD:MON,CH:X,PAR:ISRES	Read out ISET resolution	µA
$CMD:MON,CH:X,PAR:IMRANGE	Read out IMON RANGE value	HIGH / LOW
$CMD:MON,CH:X,PAR:IMDEC	Read out IMON number of decimal digits	
$CMD:MON,CH:X,PAR:ISDEC	Read out ISET number of decimal digits	
$CMD:MON,CH:X,PAR:SWVMAX	Read out software VMAX value	V
$CMD:MON,CH:X,PAR:RUP	Read out RAMP UP value	V/S
$CMD:MON,CH:X,PAR:RUPMIN	Read out RAMP UP minimum value	V/S
$CMD:MON,CH:X,PAR:RUPMAX	Read out RAMP UP maximum value	V/S
$CMD:MON,CH:X,PAR:RUPDEC	Read out RAMP UP number of decimal digits	
$CMD:MON,CH:X,PAR:RUPRES	Read out RAMP UP resolution	V/S
$CMD:MON,CH:X,PAR:RDWN	Read out RAMP DOWN value	V/S
$CMD:MON,CH:X,PAR:RDWMIN	Read out RAMP DOWN minimum value	V/S
$CMD:MON,CH:X,PAR:RDWMAX	Read out RAMP DOWN maximum value	V/S
$CMD:MON,CH:X,PAR:RDWRES	Read out RAMP DOWN resolution	V/S
$CMD:MON,CH:X,PAR:RDWDEC	Read out RAMP DOWN number of decimal digits	
$CMD:MON,CH:X,PAR:TRIP	Read out TRIP time value	S
$CMD:MON,CH:X,PAR:TRIPMIN	Read out TRIP time minimum value	S
$CMD:MON,CH:X,PAR:TRIPMAX	Read out TRIP time maximum value	S
$CMD:MON,CH:X,PAR:TRIPRES	Read out TRIP time resolution	S
$CMD:MON,CH:X,PAR:TRIPDEC	Read out TRIP time number of decimal digits	
$CMD:MON,CH:X,PAR:PDWN	Read out POWER DOWN value	RAMP / KILL
$CMD:MON,CH:X,PAR:STATUS	Read out Channel status value (XXXXX)	
$CMD:MON,CH:X,PAR:CHTOGR	Returns the group # to which channel x is assigned	
$CMD:MON,CH:X,PAR:ONORD	Returns Turning On priority of ch.x; (1 = channel turned on 1st)	
$CMD:MON,CH:X,PAR:OFFORD	Returns Turning Off priority of ch.x; (1 = channel turned on 1st)	
$CMD:MON,CH:<ch>,PAR:ZCDTC	Status of ZC Detect; ON = offset current is getting stored; OFF = ready to store offset current	
$CMD:MON,CH:<ch>,PAR:ZCADJ	Status of ZC Adjust (EN/DIS)	

Meaning of STATUS bits (value read in decimal Format)

Bit	Function
Bit 0 → ON	1 : ON 0 : OFF
Bit 1 → RUP	1 : Channel Ramp UP
Bit 2 → RDW	1 : Channel Ramp DOWN
Bit 3 → OVC	1 : IMON >= ISET
Bit 4 → OVV	1 : VMON > VSET + (2% of VSET) + 2V
Bit 5 → UNV	1 : VMON < VSET – VSET - (2% of VSET) - 2V
Bit 6 → TRIP	1 : Ch OFF via TRIP (Imon >= Iset during TRIP)
Bit 7 → OVP	1 : Output Power > Max
Bit 8 → TWN	1: Temperature Warning
Bit 9 → OVT	1: TEMP > 65°C
Bit 10 → KILL	1 : Ch in KILL via front panel and back panel
Bit 11 → INTLK	1 : Ch in INTERLOCK via front
Bit 12 -> ISDIS	1: Ch is disabled
Bit 13 -> FAIL	1: Generic fail
Bit 14 -> LOCK	1: Ch control switch on ON/EN and one of these condition is TRUE: - Power On in local mode - Switch from remote to local - New groups configuration in local mode

MONITOR commands related to the module

The following table shows the strings to be used to handle monitor commands related to the module.

String	Function
$CMD:MON,PAR:BDNAME	Read out module name
$CMD:MON,PAR:BDNCH	Read out module Channels number
$CMD:MON,PAR:BDFREL	Read out Firmware Release
$CMD:MON,PAR:BDSNUM	Read out module serial number
$CMD:MON,PAR:BDILK	Read out INTERLOCK status (YES/NO)
$CMD:MON,PAR:BDILKM	Read out INTERLOCK mode (DRIVEN/UNDRIVEN)
$CMD:MON,PAR:BDCTR	Read out Control Mode (LOCAL/REMOTE)
$CMD:MON,PAR:BDALARM	Read out Board Alarm status value (XXXXX)
$CMD:MON,PAR:BDCFRD0..4	Readout of configuration 0..4; returns Configuration name; VSET0..LastCH (5 decimal digits; multiply for VSRES to obtain VSET); SVMAX0..LastCH (5 decimal digits); ISET0..LastCH (5 decimal digits; multiply for ISETRES to obtain ISET); RUP0..LastCH (3 decimal digits); RDW0..LastCH (3 decimal digits); TRIP0..LastCH (5 decimal digits; multiply for TRIPRES to obtain TRIP); GROUP0..LastCH (1 decimal digit); OrdON0..LastCH (1 decimal digit); OrdOFF0..LastCH (1 decimal digit); FLAG0..LastCH (1 decimal digit; bit 0: Power Down Mode, 0 = Kill, 1 0 Ramp; bit 1 = IMRANGE, 0 = Low, 1 = High); N.B.: each value is separated by ";"

Meaning of Board Alarm value

Value	Function
0x22C0	= alarm bits mask The board is in Internal Comm Fail or Some channels are in TRIP or in OverPower or in OverTemperature bit 13 -> INT COMM FAIL bit 9 -> OVT bit 7 -> OVP bit 6 -> TRIP

SET commands related to the Channels

The following table contains the strings to be used to handle set commands related to the Channels.
The '**X**' in the Field 'Channel' can be set to the '**0..NUMCH**' range.
When '**X=NUMCH**' the command is issued to all Channels.

String	Function	Units
$CMD:SET,CH:X,PAR:VSET,VAL:value	Set VSET value	V
$CMD:SET,CH:X,PAR:ISET,VAL:value	Set ISET value	µA
$CMD:SET,CH:X,PAR:SWVMAX,VAL:value	Set MAXVSET value	V
$CMD:SET,CH:X,PAR:RUP,VAL:value	Set RAMP UP value	V/s
$CMD:SET,CH:X,PAR:RDWN,VAL:value	Set RAMP DOWN value	V/s
$CMD:SET,CH:X,PAR:TRIP,VAL:value	Set TRIP time value	s
$CMD:SET,CH:X,PAR:PDWN,VAL:RAMP/KILL	Set POWER DOWN mode	RAMP / KILL
$CMD:SET,CH:X,PAR:IMRANGE,VAL:HIGH/LOW	Set IMON RANGE	HIGH / LOW
$CMD:SET,CH:X,PAR:ON	Set Ch ON	
$CMD:SET,CH:X,PAR:OFF	Set Ch OFF	
$CMD:SET,CH:X,PAR:CHTOGR,VAL:value	Assign ch. "x" to group "value"=1..NUMGR; NUMGR=4; 0: ch removed from group	
$CMD:SET,CH:X,PAR:ONORD,VAL:value	Ch. Turning On priority; val = 1.. NUMGR (1 = channel turned on 1st); if the parameter is changed for an active channel (ch. ON or in an active group), then error is reported #CH:ERR. If a channel is assigned priority larger than group multiplicity or 0, then #VAL:ERR error is reported.	
$CMD:SET,CH:X,PAR:OFFORD,VAL:value	Ch. Turning Off priority; val = 1.. NUMGR (1 = channel turned off 1st); if the parameter is changed for an active channel (ch. ON or in an active group), then error is reported #CH:ERR. If a channel is assigned priority larger than group multiplicity or 0, then #VAL:ERR error is reported.	

$CMD:SET,CH:<ch>,PAR:ZCDTC,VAL:ON $CMD:SET,CH:<ch>,PAR:ZCDTC,VAL:OFF	If ON, it stores the present IMon value (IMonZero) into memory for “zero current compensation” purposes (see description below); if OFF, the unit is ready to store IMon as IMonZero. After IMonZero is stored, the parameter returns to OFF
$CMD:SET,CH:<ch>,PAR:ZCADJ,VAL:EN	The stored IMonZero value via ZCDetect option is subtracted from the measured, “non compensated” IMON value. The returned “compensated” IMON value will be then the difference between measured and stored values;
$CMD:SET,CH:<ch>,PAR:ZCADJ,VAL:DIS	The returned IMON value is not compensated

SET commands related to the module

String	Function
$CMD:SET,PAR:BDILKM,VAL: DRIVEN/UNDRIVEN	Set Interlock Mode
$CMD:SET,PAR:BDCLR	Clear alarm signal
$CMD:SET,PAR:BDCFWR0..4	Write configuration 0..4
$CMD:SET,PAR:BDCFLD0..4	Load configuration 0..4
$CMD:SET,PAR:BDCNAME0..4,VAL:XXXX	Name of configuration

CAEN SpA is acknowledged as the only company in the world providing a complete range of High/Low Voltage Power Supply systems and Front-End/Data Acquisition modules which meet IEEE Standards for Nuclear and Particle Physics. Extensive Research and Development capabilities have allowed CAEN SpA to play an important, long term role in this field. Our activities have always been at the forefront of technology, thanks to years of intensive collaborations with the most important Research Centres of the world. Our products appeal to a wide range of customers including engineers, scientists and technical professionals who all trust them to help achieve their goals faster and more effectively.

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