Rev. 05 - 15/07/2015

DT55xx

4 Ch Desktop HV Power Supply Family

CAEN
Tools for Discovery

User Manual
UM2854

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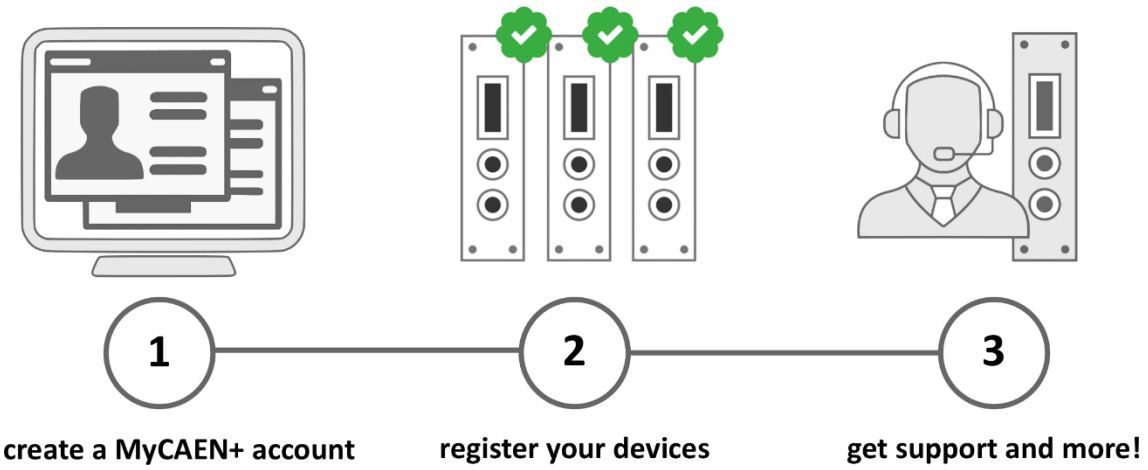
MyCAEN+ dashboard is designed to offer you a direct access to all our after sales services. Registration is totally free, to create an account go to https://www.caen.it/become-mycaenplus-user and fill the registration form with your data.



https://www.caen.it/become-mycaenplus-user/

Purpose of this Manual

This document is the DT55xx User's Manual; it contains information about the installation, the configuration and the use of the Power Supply System.

Change Document Record

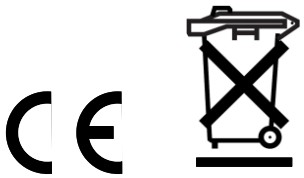
Date	Revision	Changes
30 July 2013	0	Preliminary
6 August	1	New images and minor corrections
10 December 2013	2	Updated overview
5 May 2014	3	Imon range update
29 September 2014	4	Guide to Installation
15 July 2015	5	New update of ripple values

Symbols, abbreviated terms and notation

T.B.D.

Reference Documents

T.B.D.



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1. General description

Overview

Fig. 1: Mod. DT55xx HV Desktop Power Supply

The DT55xx series provide 4 independent High Voltage channels in Desktop package (Powered via external AC/DC stabilized power supply); the following versions are available:

Table 1: Available items

Code	Model
WDT5519XMAAA	DT5519M - 4 Channel HV Desktop 500V/3mA - Mixed
WDT5519XNAAA	DT5519N - 4 Channel HV Desktop 500V/3mA - Negative
WDT5519XPAAA	DT5519P - 4 Channel HV Desktop 500V/3mA - Positive
WDT5521HMAAA	DT5521HM - 4 Channel HV Desktop 6kV/20uA - Mixed
WDT5521HNAAA	DT5521HN - 4 Channel HV Desktop 6kV/20uA - Negative
WDT5521HPAAA	DT5521HP - 4 Channel HV Desktop 6kV/20uA - Positive
WDT5521XMAAA	DT5521M - 4 Channel HV Desktop 6kV/300uA - Mixed
WDT5521XNAAA	DT5521N - 4 Channel HV Desktop 6kV/300uA - Negative
WDT5521XPAAA	DT5521P - 4 Channel HV Desktop 6kV/300uA - Positive
WDT5533XMAAA	DT5533M - 4 Channel HV Desktop 4kV/3mA - Mixed Max 4W/Ch
WDT5533XNAAA	DT5533N - 4 Channel HV Desktop 4kV/3mA - Negative Max 4W/Ch
WDT5533XPAAA	DT5533P - 4 Channel HV Desktop 4kV/3mA - Positive Max 4W/Ch
WDT5534XMAAA	DT5534M - 4 Channel HV Desktop 6kV/1mA - Mixed Max 4W/Ch
WDT5534XNAAA	DT5534N - 4 Channel HV Desktop 6kV/1mA - Negative Max 4W/Ch
WDT5534XPAAA	DT5534P - 4 Channel HV Desktop 6kV/1mA - Positive Max 4W/Ch
WPERS0550001	DT55XX - Customization - Imon Zoom

HV outputs are delivered through SHV connectors.
The HV output RAMP-UP and RAMP-DOWN rates may be selected independently for each channel with 1 V/s steps. The module features 16bit Iset/Imon resolution. Optionally, the modules can be ordered with current monitor resolution extended by 10x in a Lower range (selectable via software).
Safety features include:

- OVERVOLTAGE and UNDERVOLTAGE warning when the output voltage differs from the programmed value
- OVERCURRENT detection: if a channel tries to draw a current larger than its programmed limit, it is turned off
- Channels can be enabled or disabled through the Interlock logic
- Channels individually enabled via front panel jumpers (passive or active mode available)

Functional parameters can be programmed and monitored via USB and Optical Link.

2. Technical specifications

Packaging and Compliancy

The unit is a Desktop module housed in a 154x50x164 mm^3 alloy box.

Power requirements

The module is powered by the external AC/DC stabilized power supply included in the delivered kit.

The board's typical power consumption is 1.5A (@+12V).

Note.: Using a different power supply source, like battery or linear type, it is recommended the source to provide +12V and, at least, 2A; the power jack is a 2.1mm type, a suitable cable is the RS 656-3816 type (or similar).

Optical Link

The unit houses a daisy chainable Optical Link (communication path which uses optical fibre cables as physical transmission line) able to transfer data at 80 MB/s.

Through this path, it is possible to connect up to eight DT55xx to a single Optical Link Controller by using the A2818 PCI card or up to thirty-two DT55xx with the A3818 PCIe card.

For more information, see www.caen.it (path: Products / Front End / PCI/PCIe / Optical Controller).

Front and Back panel

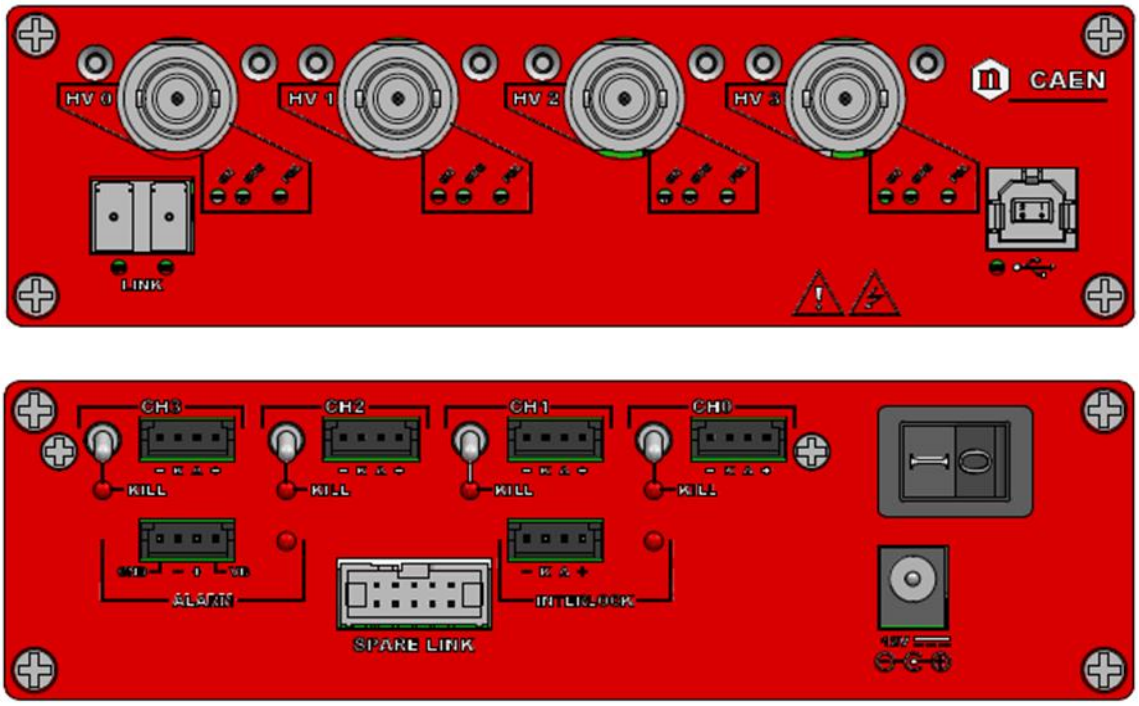

Fig. 2: Mod. DT55xx front and back panel

Front panel components

HV Channel Output

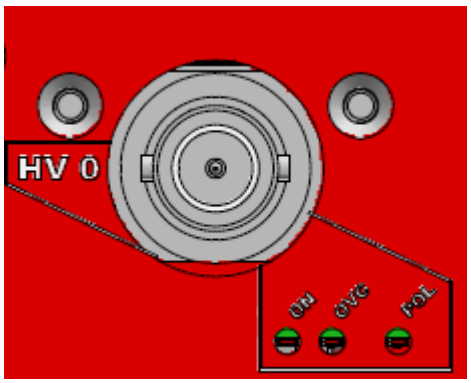

Fig. 3: HV Channel panel and test point electrical scheme

NAME:	TYPE:	FUNCTION:
ON	GREEN LED	lights up when the channel is active
OVC	RED LED	lights up when channel draws a current larger than Iset (OVC detected)
POL	RED/YELLOW LED	lights up RED (positive channel) or YELLOW (negative channel)
HV OUT	SHV (RADIALL R 317 580)	HV Channel Output

Optical LINK connector

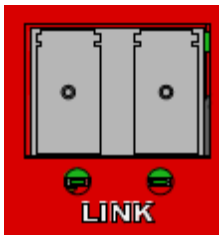

Fig. 4: LC Optical Connector

Table 2: Optical LINK specification

NAME:	TYPE:	SIGNAL:	FUNCTION:
Optical LINK	LC type connector; to be used with Multimode 62.5/125µm cable with LC connectors on both sides	I/O	Optical link for data readout and slow control with transfer rate up to 80MB/s; daisy chainable

USB Port

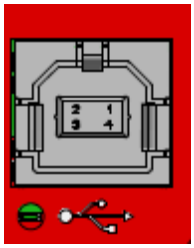

Fig. 5: USB Optical Connector

Table 3: USB specification

NAME:	TYPE:	SIGNAL:	FUNCTION:
USB	B type USB connector	I/O	USB 2.0 and USB 1.1 compliant

Back panel components

Channel control section

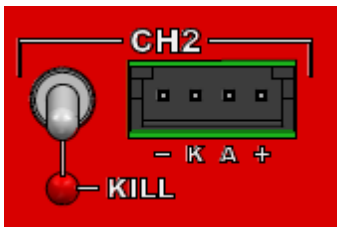

Fig. 6: Channel control panel and Kill scheme

NAME:	TYPE:	FUNCTION:
KILL	PUSH BUTTON	Channel KILL; channel is turned off at the fastest available rate
KILL	RED LED	Signals Channel KILL
REMOTE KILL	AMP 280371-2	Channel KILLED either as the ± contacts are open or a +4÷6Vdc is fed to pin -

HV Status control section

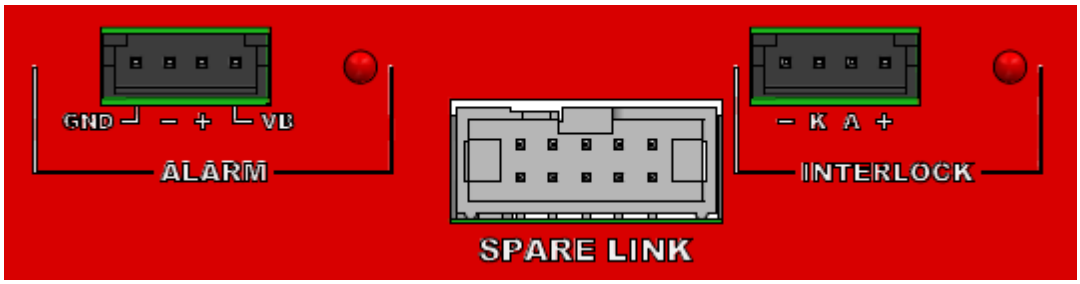

Fig. 7: HV Status control panel

NAME:	TYPE:	SIGNAL:	FUNCTION:
ALARM	RED LED/ AMP 280371-2.	Out	Alarm status signalled (active LOW)
INTERLOCK	RED LED/ AMP 280371-2	In	Interlock signal (channels hardware disabled)
SPARE LINK	3M-7610-5002		T.B.D.

Alarm signal

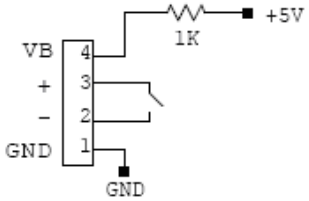

Fig. 8: ALARM electrical scheme

As an Alarm condition is detected (see p.) 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, in order 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 below:

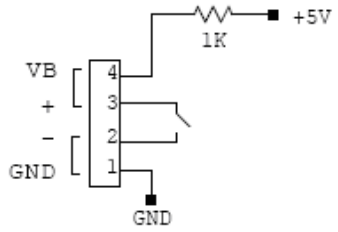

Fig. 9: ALARM TTL configured

Interlock signal

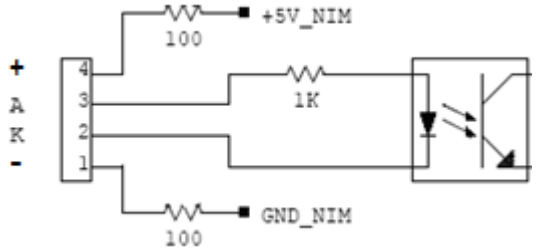

Fig. 10: INTERLOCK electrical scheme

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

Table 4: Interlock operation

CONFIGURATION ↓	INTERLOCK MODE →	*OPEN*	*CLOSE*
leave contact open		INTERLOCK	ENABLED
voltage level (0÷1V, ~5mA current) between pin 2 and pin 3		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 and pin 3		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.

DC Input

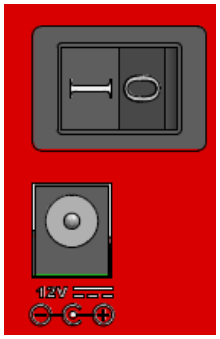

Fig. 11: 12V DC Input

NAME:	TYPE:	SIGNAL:	FUNCTION:
12V In	RAPC722X SWITCHCRAFT PCB 2.1mm DC Power Jack	Input	+12V DC Input
ON/OFF switch	Molveno A11331122000 A1 switch		**O** → power supply OFF. **I** → power supply ON

Imon Range

The channel current can be monitored with an increased resolution (10x) in the following ranges (“low” range):

DT5519	0 – 300 µA
DT5521	0 – 30 µA
DT5521H	0 – 2 µA
DT5533	0 – 300 µA
DT5534	0 – 100 µA

By selecting Imon Range = LOW (bit 2 of CONTROL register; p 14), the output current is monitored with

DT5519	5 nA resolution (instead of 50 nA), in the 0 – 300 µA range
DT5521	500 pA resolution (instead of 5 nA), in the 0 – 30 µA range
DT5521H	100 pA resolution (instead of 1 nA), in the 0 – 2 µA range
DT5533	5 nA resolution (instead of 50 nA), in the 0 - 300 µA range
DT5534	2 nA resolution (instead of 20 nA), in the 0 - 100 µA range

It is important to notice that, if Imon Range = LOW is selected, and the channel draws a current larger than

300 µA	DT5519	
30 µA	DT5521	
2 µA	DT5521H	then Overcurrent is signalled.
300 µA	DT5533	
100 µA	DT5534	

Technical specifications table

Table 5: DT55xx Series Channel technical specifications

Model			DT5519	DT5521	DT5521H	DT5533	DT5534
Packaging			Desktop module housed in a 154x50x164 mm^3 alloy box				
Output channels			Positive, Negative and Mixed (2+2) Polarity available				
Output ranges			500 V/3mA	6kV/300 µA	6kV/20 µA	4kV/3mA	6kV /1mA
Max. Ch. Output Power			1.5 W	1.8 W	180 mW	4W	4W
Vset / Vmon Resolution			10 mV	100 mV	100 mV	100 mV	100 mV
Iset Resolution			50nA	5 nA	1 nA	50 nA	20 nA
Imon Resolution		High range	50nA	5 nA	1 nA	50 nA	20 nA
		Low range[1]	5nA	500 pA	100 pA	5 nA	2 nA
VMAX hardware			0 ÷ 510 V	0 ÷ 6100 V		0 ÷ 4100 V	0 ÷ 6100 V
VMAX hardware resolution			2 V	25 V		20 V	25 V
VMAX hardware accuracy			± 2% of FSR				
IMAX			3100 µA	310 µA	21 µA	3100 µA	1050 µA
Alarm output			Open collector, 100 mA maximum sink current				
Interlock input			LOW: <1V; current~5mA; HIGH: 4÷6 V				
Ramp Up/Down			1÷100 V/s, 1 V/s step	1÷500 Volt/s, 1 Volt/s step			
Accuracy[2]	Vmon vs. Vout		±0.05% of read ±0.5V	±0.05% of read ±1V	±0.05% of read ±1V	±0.05% of read ±1V	±0.05% of read ±1V
	Vset vs. Vmon		±0.05% of read ±0.5V	±0.05% of read ±1V	±0.05% of read ±1V	±0.05% of read ±1V	±0.05% of read ±1V
	Imon vs. Iout	High range	±2% of read ±1µA	±2% of read ±50nA	±2% of read ±5nA	±2% of read ±1µA	±2% of read ±500nA
		Low range	±2% of read ±100nA	±2% of read ±5nA	±2% of read ±500pA	±2% of read ±100nA	±2% of read ±50nA
	Iset vs. Imon	High range	±2% of read ±1µA	±2% of read ±50nA	±2% of read ±5nA	±2% of read ±1µA	±2% of read ±500nA
		Low range	±2% of read ±100nA	±2% of read ±5nA	±2% of read ±500pA	±2% of read ±100nA	±2% of read ±50nA
Voltage Ripple[3]			Typical: 3 mVpp Max: 5 mVpp	Typical: 3 mVpp Max: 5 mVpp	Typical: 3 mVpp Max: 5 mVpp	Typical: 5 mVpp Max: 8 mVpp	Typical: 5 mVpp Max: 8 mVpp
Ventilation Fans			Two Sunon MC35101V1-000U-A99				
Humidity range			0 ÷ 80%				
Operating temperature			0 ÷ 45°C				
Storage temperature			-10 ÷ 70°C				
Vout / Temperature coefficient			max. 50ppm / °C				
Vout /voltage coefficient			max 2ppm/V				
Imon / Temperature coefficient			max 100ppm/C°				
Long term stability Vout vs. Vset			± 0.02% (after one week @ constant temperature)				
Operating temperature			0 ÷ 45°C				
Storage temperature			-10 ÷ 70°C				
Vout / Temperature coefficient			max. 50ppm / °C				

[1] Available as optional customization
[2] Accuracy values are measured from 10% to 90% of Full Scale Range
[3] Measured with: 1m cable length; 2nF capacitance, 100Hz÷100MHz band width

3. Unit operation

Initial inspection

Prior to shipment this unit was 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:

- DT55xx desktop power supply unit;
- AC/DC power supply
- USB cable

Moreover, in order to operate the DT55xx, an external Personal Computer is required.
NOTE: if unit control will take place via Optical Link, the host PC shall have the CAEN A2818 PCI card or the CAEN A3818 PCIe card installed and one CAEN optical fiber cable is required (see A2818 and A3818 documentation; www.caen.it, path: Products / Front End / PCI/PCIe / Optical Controller).

Installation

USB installation

Connect the DT55xx to the AC/DC power supply
Connect the DT55xx to the PC via the USB cable
Download and install the USB driver for your OS, available at the DT55xx page on the www.caen.it site
Switch on the DT55xx (see p. 8)
Now the DT55xx is ready for operation, upon installation of one of the available software tools.

Optical Link installation

Connect the DT55xx to the AC/DC power supply
Connect the DT55xx to the A2818 PCI card or to the A3818 PCIe card via the optical fiber cable
Switch on the DT55xx (see p. 8)
Now the DT55xx is ready for operation, upon installation of one of the available software tools.

Software tools

GECO2020

CAEN GECO2020 is a graphical application that allows to manage the DT55xx HV Desktop Power Supplies (and all other CAEN Power Supplies). Once the DT55xx is correctly installed, download and install the GECO2020 software package related to your OS; follow the instructions in the GECO2020 User manual and the DT55xx 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 LabVIIEW™ 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; in particular, CAENComm and CAENVMELib libraries shall be installed prior to CAEN HV Wrapper deployment, in order to communicate with the DT55xx.

For more info please visit www.caen.it (products>firmware/software section).

4. Internal registers

Address map

This chapter describes the accessible registers of DT55xx board and the format of the read/write data.

Table 6: DT55xx Channel registers

CHANNEL n PARAMETERS (n = 0, 1, 2, 3)				
Address	*Register Name*	*Data type*	*Mode*	*Function*
0x1n20	VSET	16 bit	RW	Set channel voltage
0x1n24	ISET	16 bit	RW	Set channel current
0x1n28	RAMP UP	16 bit	RW	Ramp Up Rate
0x1n2C	RAMP DOWN	16 bit	RW	Ramp Down Rate
0x1n30	VMAX	16 bit	RW	Software VMAX
0x1n34	CONTROL	16 bit	RW	Control register
0x1n38	STATUS	16 bit	R	Channel Status
0x1n40	VMON	16 bit	R	Channel voltage monitor
0x1n44	IMON	16 bit	R	Channel current monitor

Register description

VSET

Address	0x1n20
Range	16 bit
Resolution	See Technical specifications
Description	This register can be used to set channel voltage: the set output voltage is given by the product between register value and Vset resolution; for example in order to set 2500 V with DT5533, set register to 25000 (resolution = 0.1 V).

ISET

Address	0x1n24
Range	16 bit
Resolution	See Technical specifications
Description	This register can be used to set channel current limit: the set current is given by the product between register value and Iset resolution; for example in order to set 2000 µA with DT5533, set register to 40000 (resolution 50 nA).

RAMP UP

Address	0x1n28
Range	9 bit
Resolution	1 V/s
Description	This register can be used to set RAMP UP rate.

RAMP DOWN

Address	0x1n28
Range	9 bit
Resolution	1 V/s
Description	This register can be used to set RAMP DOWN rate.

VMAX

Address	0x1n30
Range	8 bit
Resolution	See Technical specifications
Description	This register can be used to set hardware max voltage, the Vmax is given by the product between register value and resolution.

CONTROL

Address	0x1n34			
Range	16 bit			
Description	BIT	0	Power On/Off	0 : CH OFF 1 : CH ON
	BIT	1	Power Down Mode	0 : KILL 1 : RAMP
	BIT	2	Imon range (available as optional customization)	0: High 1: Low

STATUS

Address	0x1n38
Range	16 bit
Description	this register allows to read STATUS word, whose bits mean: Bit 0 = 1 -> ON Bit 1 = 1 -> Ramp UP Bit 2 = 1 -> Ramp DOWN Bit 3 = 1 -> OVER CURRENT (IMON > ISET) Bit 4 = 1 -> OVER VOLTAGE (VMON > VSET + 2%) Bit 5 = 1 -> UNDER VOLTAGE (VMON < VSET - 2%) Bit 6 = 1 -> MAX VOLTAGE (VOUT > VMAX) Bit 7 = 1 -> MAX CURRENT (IOUT > Absolute Max Iout) Bit 8 = 1 -> TEMPERATURE WARNING (TEMP > 80ºC) Bit 9 = 1 -> OVER TEMPERATURE (TEMP > 125ºC) Bit 10 = 1 -> DISABLED (External Inhibit active) Bit 11 = 1 -> CALIBRATION ERROR Bit 12 = 1 -> Resetting Bit 13 = 1 -> Going Off Bit 14 = 1 -> MAX POWER (OUTPUT POWER > 4W) Bit 15 = 1 -> FAN SPEED HIGH In case of: DISABLED OVER CURRENT OVER TEMPERATURE MAX POWER Channel is turned off according to Power Down Mode (see CONTROL register)

VMON

Address	0x1n40
Range	16 bit
Resolution	See Technical specifications
Description	This register can be used to monitor channel voltage, the VMON value is given by the product between register value and resolution

IMON

Address	0x1n44
Range	16 bit
Resolution	See Technical specifications
Description	This register can be used to monitor channel current, the IMON value is given by the product between register value and resolution

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