CAEN
Tools for Discovery

# Technical Information Manual

**Revision n. 4**

**22 July 2014**

## V6521

*PROGRAMMABLE VME*
*HV POWER SUPPLY*

**NPO: 00116/07:V6521.MUTx/04**

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.

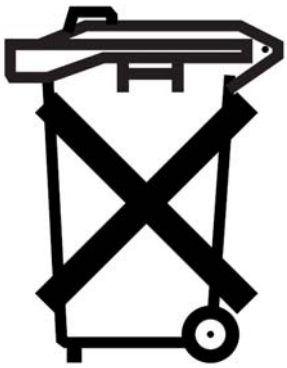
**CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation.**

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.*



**MADE IN ITALY** : We stress the fact that all the boards are made in Italy because in this globalized world, where getting the lowest possible price for products sometimes translates into poor pay and working conditions for the people who make them, at least you know that who made your board was reasonably paid and worked in a safe environment. (this obviously applies only to the boards marked "MADE IN ITALY", we can not attest to the manufacturing process of "third party" boards).

# TABLE OF CONTENTS



# LIST OF FIGURES



# LIST OF TABLES

# 1 General description

## 1.1 Overview

*Fig. 1.1: V6521 6 Channel VME Programmable HV Power Supply*

The V6521 is a 1-unit wide VME 6U module housing 6 High Voltage Power Supply Channels (6KV, 300µA). The board is available with either positive or negative output polarity; mixed version with 3 positive and 3 negative channels is also available.

The channels share a common floating return, which allows on-detector grounding reducing the noise level. HV outputs are delivered through SHV connectors.

The HV output RAMP-UP and RAMP-DOWN rates may be selected independently for each channel in the 1 ÷ 500 V/s range with 1 V/s steps.

Safety features include:

- OVERVOLTAGE and UNDERVOLTAGE warning when the output voltage differs from the programmed value
- Programmable via trimmer HVMAX hardware protection limit
- 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.
- Channels can be enabled or disabled through the Interlock logic.

The modules fit into both VME/VME64 standard and V430 crates. Imon ZOOM x10 option for VME V65xx Programmable HV Power Supply allows to read current monitor either in full range with standard resolution (HIGH RANGE) or in lower 10% range with 10x resolution (LOW RANGE). The option has not any effect on ISET resolution.

Functional parameters can be programmed and monitored via VMEbus; moreover, these units can be managed via CAEN HV Wrapper, a set of ANSI C functions bundled in a library, providing 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. CAEN HV Wrapper is logically located between an higher level application, such as GECO2020, and the lower layer software libraries. It contains a generic software interface independent by the Power Supply models and by the communication path used to exchange data with them.
VMEbus allows to control the V65xx via OPC server, through a complete set of programmable/monitorable items; refer to the CAEN OPC Server User's Manual for detailed description. For more info please visit:

www.caen.it (products>firmware/software section).

*Table 1.1 – Available items*

| Code | Description |
|---|---|
| WV6521MAAAAA | V6521M 6 Ch VME Programmable HV Power Supply (3 ch -6 kV 300 µA, 3 ch +6 kV 300 µA) |
| WV6521XAAAAA | V6521N 6 Ch VME Programmable HV Power Supply (-6 kV 300 µA) |
| WV6521XPAAAA | V6521P 6 Ch VME Programmable HV Power Supply (+-6 kV 300 µA) |
| WA6580XAAAAA | A6580 - DC Power Input Equalizer for V65XX Family |
| WPERS065XX01 | V65XX Customization - Imon Zoom x10 |

# 2 Technical specifications

## 2.1 Packaging

The module is housed in a 6U-high, 1U-wide VME unit. The board is provided the VME P1, and P2 connectors and fits into both VME standard and V430 backplanes.

## 2.2 Power requirements

The power requirements of the modules are as follows:

*Table 2.1 – V6521 power requirements*

| **Ch Configuration** | **Without A6580** | | | **With A6580** | | |
|---|---|---|---|---|---|---|
| | # CH ON | ±12V | +5V | # CH ON | ±12V | +5V |
| Ch OFF | 0 | 0.35 A | <0.2 A | 0 | 0.2 A | 1.4 A |
| 1000V / 10µA | 1 | 0.37 A | <0.2 A | 1 | 0.22 A | 1.48 A |
| | 6 | 0.51 A | <0.2 A | 6 | 0.28 A | 1.88 A |
| 3000V / 150µA | 1 | 0.43 A | <0.2 A | 1 | 0.24 A | 1.64 A |
| | 6 | 0.84 A | <0.2 A | 6 | 0.45 A | 2. 8 A |
| 6000V / 30µA | 1 | 0.45 A | <0.2 A | 1 | 0.25 A | 1.7 A |
| | 6 | 0.85 A | <0.2 A | 6 | 0.45 A | 2.80 A |
| 6000V / 300µA | 1 | 0.5 A | <0.2 A | 1 | 0.28 A | 1.86 A |
| | 6 | 1.42 A | <0.2 A | 6 | 0.73 A | 4.22 A |

## 2.3 Front Panel


*Fig. 2.1: V6521 front panel*

## 2.4 Front panel connections

### 2.4.1 HV Channel Output

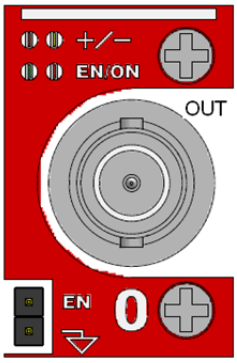



*Fig. 2.2: HV Channel panel and test point electrical scheme*

| NAME: | TYPE: | FUNCTION: |
|---|---|---|
| EN | AMP 280370-2 | Passive/active HV Enable (see below); -15V÷+20V max. ratings |
| *OUT* | RADIALL R317580 SHV | HV Channel Output connector |
| EN | Green LED | HV Channel enabled; turns off as HV Channel is ON |
| ON | Red LED | HV Channel ON |
| +/- | Red / Yellow LED | Polarity: Red = positive; Yellow = negative |

The Board can be provided with either passive or active Channel HV Enable; therefore the HV output can be enabled in the following ways:

| HV ENABLE: | DESCRIPTION: |
|---|---|
| Passive | Channel is enabled with a short circuit or TTL/CMOS[1] LOW level (200µA current) on EN pin. Channel is disabled with either open contact or TTL/CMOS HIGH level (200µA) on EN pin |
| Active | Channel is enabled with a TTL/CMOS HIGH level (200µA) on EN pin. Channel is disabled with open contact, short circuit or TTL/CMOS LOW level (200µA current) on EN pin. |

### 2.4.2 HV Status control section

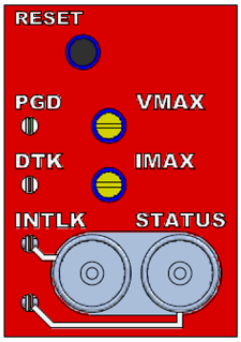



*Fig. 2.3: Status control panel*

| NAME: | TYPE: | SIGNAL: | FUNCTION: |
|---|---|---|---|
| RESET | PUSH-BUTTON | | Board Hardware Reset |
| PGD | GREEN LED | | Board Power OK |
| DTK | GREEN LED | | DATA ACKNOWLEDGE; it lights up each time a VME access is performed |
| VMAX | TRIMMER | | Hardware maximum voltage common to all the channels; can be read out via VME |

[1] TTL/CMOS Levels: H=3.5V÷5V, L=0V÷0.5V; ~200µA

| | | | |
|---|---|---|---|
| IMAX | TRIMMER | | Hardware maximum current common to all the channels; can be read out via VME |
| STATUS | RED LED/LEMO CONN. FISCHER D101A004-32, RED LED | NIM/TTL Out | Alarm status signalled (active LOW, see § 2.6 for internal settings)<br>The front panel LED is ON when the Alarm status is signalled |
| INTERLOCK | RED LED/LEMO CONN. FISCHER D101A004-32, RED LED | TTL/CMOS In[2] | See below for INTERLOCK configuration.<br>The front panel Interlock LED is ON when the INTERLOCK is enabled;<br>as INTERLOCK is enabled, channels are turned off at the fastest available rate, regardless the RAMP DOWN setting.<br>INTERLOCK status can be readout via VMEbus |

The Board INTERLOCK (remote board disable) can be configured in several ways, through internal SW6 and SW7 switches (see § 2.6), as explained below:

| SW6: | SW7: | BOARD ENABLED: | BOARD DISABLED: | DESCRIPTION: |
|---|---|---|---|---|
| RIGHT | RIGHT | TTL/CMOS HIGH level (200µA) provided to the relevant connector or leaving the connector open. | 50Ohm termination inserted into the relevant connector or with a TTL LOW level (200µA current) fed to the connector | cc-disable mode |
| LEFT | LEFT | 50Ohm termination inserted into the relevant connector, leaving the connector open or with a TTL LOW level (200µA current) fed to the connector | TTL/CMOS HIGH level (200µA) provided to the relevant connector. | active-interlock mode |
| LEFT | RIGHT | TTL/CMOS HIGH level (200µA) provided to the relevant connector. | 50Ohm termination inserted into the relevant connector, leaving the connector open or with a TTL/CMOS LOW level (200µA current) fed to the connector | passive-interlock mode |
| RIGHT | LEFT | 50Ohm termination inserted into the relevant connector or with a TTL LOW level (200µA current) fed to the connector. | TTL/CMOS HIGH level (200µA) provided to the relevant connector or leaving the connector open. | cc-enable mode |

[2] TTL/CMOS Levels: H=3.5V÷5V, L=0V÷0.5V; ~200µA

## 2.5 Channel Characteristics Table

*Table 2.2 – Channel characteristics of the V6521 HV Board*

| | |
|---|---|
| **Output channels:** | Positive or Negative Polarity (see Ordering Options § 1.1) |
| **Output ranges:** | 0÷6 kV |
| **Max. Output Current:** | 300 µA, Max. 30 µA with Imon x10 Zoom (optional) |
| **Max. Ch. Output Power:** | 1.8 W |
| **Vset / Vmon Resolution:** | 100 mV |
| **Iset / Imon Resolution:** | 5 nA ; monitor resolution 0.5 nA with Imon x10 Zoom (optional) |
| **VMAX software:** | 0÷6 kV settable for each channel |
| **VMAX software resolution:** | 100 mV |
| **VMAX hardware:** | 0 ÷ 6100 V<br>Absolute maximum HV level that the channel is allowed to reach, independently from the preset value Vset. Output voltage cannot exceed the preset value Vmax. |
| **Vmax hardware resolution:** | ± 1 V |
| **VMAX hardware accuracy:** | 2% of FSR |
| **IMAX hardware:** | 0÷300 µA common to all board channels |
| **IMAX hardware accuracy:** | 2% of FSR |
| **Interlock input:** | LOW: <1V; current~5mA; HIGH: 4÷6 V |
| **Ramp Up/Down:** | 1÷500 Volt/s, 1 Volt/s step |
| **Trip:** | Max. time an "overcurrent" is allowed to last (seconds). A channel in "overcurrent" works as a current generator; output voltage varies in order to keep the output current lower than the programmed value. "Overcurrent" lasting more than set value (1 to 9999) causes the channel to "trip". Output voltage will drop to zero either at the Ramp-down rate or at the fastest available rate, depending on Power Down setting; in both cases the channel is put in the OFF state. If trip= INFINITE, "overcurrent" lasts indefinitely. |
| **Vmon vs. Vout Accuracy:** [3] | typical: ± 0.05% of read value ± 1 V<br>Max: ± 0.05% of read value ± 2 V |
| **Vset vs. Vmon Accuracy:** [3] | typical: ± 0.05% of read value ± 1 V<br>max: ± 0.05% of read value ± 2 V |
| **Imon vs. Iout Accuracy:** [3] | typical: ± 2% of read value ± 0.05 µA<br>max: ± 2% of read value ± 0.1 µA |
| **Iset vs. Imon Accuracy:** [3] | typical: ± 2% of read value ± 0.05 µA<br>max: ± 2% of read value ± 0.1 µA |
| **Voltage Ripple:**[4] | Typical: 3 mV pp<br>Max: 5 mV pp |
| **Humidity range:** | 0 ÷ 80% |
| **Operating temperature:** | 0 ÷ 45°C |
| **Storage temperature:** | -10 ÷ 70°C |
| **Vout / Temperature coefficient:** | Typ: 50 ppm / °C<br>Max: 100 ppm / °C |
| **Imon / Temperature coefficient:** | Max: 100 ppm/°C; Max: 500 ppm/°C with x10 Imon zoom (optional) |
| **Long term stability Vout vs. Vset:** | ± 0.02% (after one week @ constant temperature) |

[3] From 10% to 90% of Full Scale Range
[4] Measured with: 1m cable length; 2nF capacitance, 100MHz band width

## 2.6 Internal components

| | |
|---|---|
| **SW8, 9, 10, 11 "B. Ad. [31:16]"** | Type: 4 rotary switches<br>Function: allow to set the VME base address of the module. |
| **SW3** | Type: Dip Switch<br>Function: allows to select whether the "Standard" (STD=down) or the "Back up" (BKP=up) firmware must be loaded at power on; (default position: STD) |
| **SW5** | Type: Dip Switch<br>Function: allows to select NIM(right)/TTL(left) Level for the STATUS output |
| **SW6, 7** | Type: Dip Switch<br>Function: allow to select INTERLOCK signal operation (see § 2.4.2) |

## 2.7 Imon Zoom

Imon Zoom is an optional feature that allows to monitor the channel current with an increased resolution (10x) in the 0 – 30 µA range; if the Imon Zoom is installed, by selecting Imon Range = LOW (see § 3.2.2.14), the output current is monitored with 0.5nA resolution (instead of 5 nA), in the 0 – 30 µA range. It is important to notice that, if Imon Range = LOW is selected, and the channel draws a current larger than 30 µA, then Overcurrent is signalled.

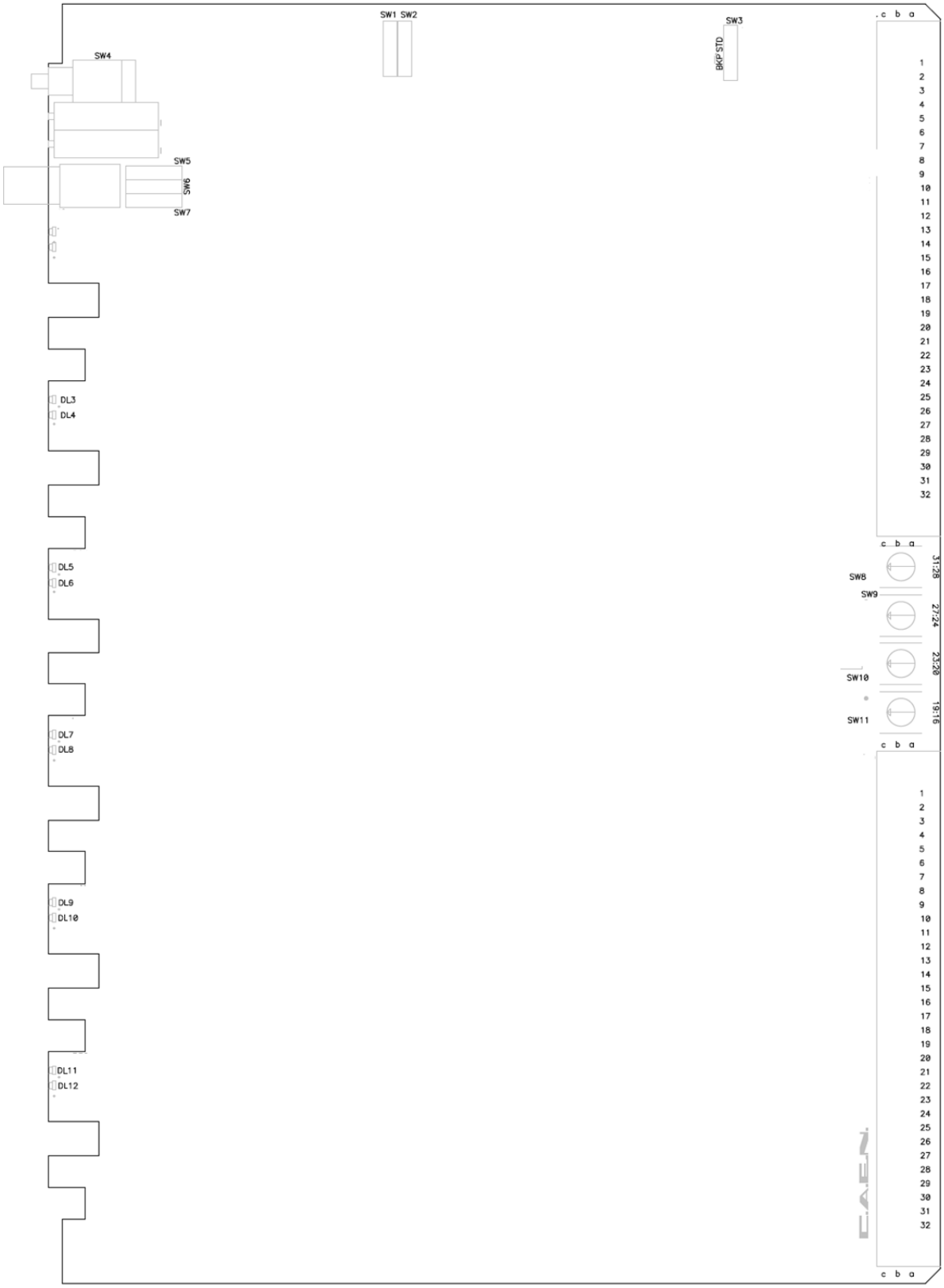



*Fig. 2.4: Rotary and dip switches location*

# 3 VME Interface

## 3.1 Register address map

The Address map for the Model V6521 is listed in Table 3.1. All register addresses are referred to the Base Address of the board, i.e. the addresses reported in the Tables are the offsets to be added to the board Base Address.

⚠ N.B.: registers that are not described in the map are reserved and must not be over written by the User.

*Table 3.1 – Address Map for the V6521*

| BOARD PARAMETERS | | | | |
|---|---|---|---|---|
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0000÷0x004C | Reserved, do not over write! | | | |
| 0x0050 | VMAX | A32/D16 | R | Board Maximum Voltage |
| 0x0054 | IMAX | A32/D16 | R | Board Maximum Current |
| 0x0058 | STATUS | A32/D16 | R | Board Status flags |
| 0x005C | FWREL | A32/D16 | R | Readout of microcontroller Firmware Rel. |
| 0x0060-0x007C | Reserved, do not over write! | | | |
| CHANNEL 0 PARAMETERS | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0080 | VSET | A32/D16 | RW | Set channel voltage |
| 0x0084 | ISET | A32/D16 | RW | Set channel current |
| 0x0088 | VMON | A32/D16 | R | Channel voltage monitor |
| 0x008C | ImonH | A32/D16 | R | Channel current monitor (high range) |
| 0x0090 | PW | A32/D16 | RW | Power |
| 0x0094 | CHSTATUS | A32/D16 | R | Channel Status flags |
| 0x0098 | TRIP_TIME | A32/D16 | RW | Trip Time |
| 0x009C | SVMAX | A32/D16 | RW | Software VMAX |
| 0x00A0 | RAMP DOWN | A32/D16 | RW | Ramp Down Rate |
| 0x00A4 | RAMP UP | A32/D16 | RW | Ramp Up Rate |
| 0x00A8 | PWDOWN | A32/D16 | RW | Power Down Mode |
| 0x00AC | POLARITY | A32/D16 | R | Channel Polarity |
| 0x00B0 | TEMPERATURE | A32/D16 | R | Channel Temperature |
| 0x00B4 | IMON RANGE | A32/D16 | RW | Imon Range control register |
| 0x00B8 | ImonL | A32/D16 | R | Channel current monitor (low range) |
| 0x00BC÷0x00FC | Reserved, do not over write! | | | |
| CHANNEL 1 PARAMETERS | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0100 | VSET | A32/D16 | RW | Set channel voltage |
| 0x0104 | ISET | A32/D16 | RW | Set channel current |
| 0x0108 | VMON | A32/D16 | R | Channel voltage monitor |
| 0x010C | ImonH | A32/D16 | R | Channel current monitor (high range) |
| 0x0110 | PW | A32/D16 | RW | Power |
| 0x0114 | CHSTATUS | A32/D16 | R | Channel Status flags |
| 0x0118 | TRIP_TIME | A32/D16 | RW | Trip Time |
| 0x011C | SVMAX | A32/D16 | RW | Software VMAX |
| 0x0120 | RAMP DOWN | A32/D16 | RW | Ramp Down Rate |
| 0x0124 | RAMP UP | A32/D16 | RW | Ramp Up Rate |
| 0x0128 | PWDOWN | A32/D16 | RW | Power Down Mode |

| | | | | |
|---|---|---|---|---|
| 0x012C | POLARITY | A32/D16 | R | Channel Polarity |
| 0x0130 | TEMPERATURE | A32/D16 | R | Channel Temperature |
| 0x0134 | IMON RANGE | A32/D16 | RW | Imon Range control register |
| 0x0138 | ImonL | A32/D16 | R | Channel current monitor (low range) |
| 0x013C÷0x017C | Reserved, do not over write! | | | |
| CHANNEL 2 PARAMETERS | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0180 | VSET | A32/D16 | RW | Set channel voltage |
| 0x0184 | ISET | A32/D16 | RW | Set channel current |
| 0x0188 | VMON | A32/D16 | R | Channel voltage monitor |
| 0x018C | ImonH | A32/D16 | R | Channel current monitor (high range) |
| 0x0190 | PW | A32/D16 | RW | Power |
| 0x0194 | CHSTATUS | A32/D16 | R | Channel Status flags |
| 0x0198 | TRIP_TIME | A32/D16 | RW | Trip Time |
| 0x019C | SVMAX | A32/D16 | RW | Software VMAX |
| 0x01A0 | RAMP DOWN | A32/D16 | RW | Ramp Down Rate |
| 0x01A4 | RAMP UP | A32/D16 | RW | Ramp Up Rate |
| 0x01A8 | PWDOWN | A32/D16 | RW | Power Down Mode |
| 0x01AC | POLARITY | A32/D16 | R | Channel Polarity |
| 0x01B0 | TEMPERATURE | A32/D16 | R | Channel Temperature |
| 0x01B4 | IMON RANGE | A32/D16 | RW | Imon Range control register |
| 0x01B8 | ImonL | A32/D16 | R | Channel current monitor (low range) |
| 0x01BC÷0x01FC | Reserved, do not over write! | | | |
| CHANNEL 3 PARAMETERS | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0200 | VSET | A32/D16 | RW | Set channel voltage |
| 0x0204 | ISET | A32/D16 | RW | Set channel current |
| 0x0208 | VMON | A32/D16 | R | Channel voltage monitor |
| 0x020C | ImonH | A32/D16 | R | Channel current monitor (high range) |
| 0x0210 | PW | A32/D16 | RW | Power |
| 0x0214 | CHSTATUS | A32/D16 | R | Channel Status flags |
| 0x0218 | TRIP_TIME | A32/D16 | RW | Trip Time |
| 0x021C | SVMAX | A32/D16 | RW | Software VMAX |
| 0x0220 | RAMP DOWN | A32/D16 | RW | Ramp Down Rate |
| 0x0224 | RAMP UP | A32/D16 | RW | Ramp Up Rate |
| 0x0228 | PWDOWN | A32/D16 | RW | Power Down Mode |
| 0x022C | POLARITY | A32/D16 | R | Channel Polarity |
| 0x0230 | TEMPERATURE | A32/D16 | R | Channel Temperature |
| 0x0234 | IMON RANGE | A32/D16 | RW | Imon Range control register |
| 0x0238 | ImonL | A32/D16 | R | Channel current monitor (low range) |
| 0x023C÷0x027C | Reserved, do not over write! | | | |
| CHANNEL 4 PARAMETERS | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0280 | VSET | A32/D16 | RW | Set channel voltage |
| 0x0284 | ISET | A32/D16 | RW | Set channel current |
| 0x0288 | VMON | A32/D16 | R | Channel voltage monitor |
| 0x028C | ImonH | A32/D16 | R | Channel current monitor (high range) |
| 0x0290 | PW | A32/D16 | RW | Power |
| 0x0294 | CHSTATUS | A32/D16 | R | Channel Status flags |
| 0x0298 | TRIP_TIME | A32/D16 | RW | Trip Time |

| | | | | |
|---|---|---|---|---|
| 0x029C | SVMAX | A32/D16 | RW | Software VMAX |
| 0x02A0 | RAMP DOWN | A32/D16 | RW | Ramp Down Rate |
| 0x02A4 | RAMP UP | A32/D16 | RW | Ramp Up Rate |
| 0x02A8 | PWDOWN | A32/D16 | RW | Power Down Mode |
| 0x02AC | POLARITY | A32/D16 | R | Channel Polarity |
| 0x02B0 | TEMPERATURE | A32/D16 | R | Channel Temperature |
| 0x02B4 | IMON RANGE | A32/D16 | RW | Imon Range control register |
| 0x02B8 | ImonL | A32/D16 | R | Channel current monitor (low range) |
| 0x02BC÷0x02FC | Reserved, do not over write! | | | |
| CHANNEL 5 PARAMETERS | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x0300 | VSET | A32/D16 | RW | Set channel voltage |
| 0x0304 | ISET | A32/D16 | RW | Set channel current |
| 0x0308 | VMON | A32/D16 | R | Channel voltage monitor |
| 0x030C | ImonH | A32/D16 | R | Channel current monitor (high range) |
| 0x0310 | PW | A32/D16 | RW | Power |
| 0x0314 | CHSTATUS | A32/D16 | R | Channel Status flags |
| 0x0318 | TRIP_TIME | A32/D16 | RW | Trip Time |
| 0x031C | SVMAX | A32/D16 | RW | Software VMAX |
| 0x0320 | RAMP DOWN | A32/D16 | RW | Ramp Down Rate |
| 0x0324 | RAMP UP | A32/D16 | RW | Ramp Up Rate |
| 0x0328 | PWDOWN | A32/D16 | RW | Power Down Mode |
| 0x032C | POLARITY | A32/D16 | R | Channel Polarity |
| 0x0330 | TEMPERATURE | A32/D16 | R | Channel Temperature |
| 0x0334 | IMON RANGE | A32/D16 | RW | Imon Range control register |
| 0x0338 | ImonL | A32/D16 | R | Channel current monitor (low range) |
| 0x033C÷0x037C | Reserved, do not over write! | | | |
| BOARD CONFIGURATION | | | | |
| *VME Offset* | *Register Name* | *VME Access* | *Mode* | *Function* |
| 0x8100 | CHNUM | A32/D16 | R | Number of channels |
| 0x8102÷0x8114 | DESCR | D16 | R | Board descrition |
| 0x8116÷0x811C | MODEL | D16 | R | 'V6533 *m, n, p*' |
| 0x811E | SERNUM | D16 | R | Board Serial Number |
| 0x8120 | VME_FWREL | D16 | R | VME FPGA Firmware Release |

## 3.2 Register Description

The following sections describe in detail all registers. The parameters value can be calculated, if not otherwise indicated, by multiplying register value * parameter resolution. For example, if the read value of VSET parameter is 3000, then this corresponds to a voltage level of 30000*0.1 = 3000 V.

### 3.2.1 BOARD PARAMETERS

#### *3.2.1.1 VMAX*

| | |
|---|---|
| VME Offset | 0x0050 |
| Range | 0 - 6100 (decimal) |
| Resolution | 1 V |
| Description | This register can be used to read channel maximum allowed voltage. VMAX is a hardware limit, set by the corresponding board front panel trimmer |

#### 3.2.1.2 IMAX

| | |
|---|---|
| VME Offset | 0x0054 |
| Range | 0 - 310 (decimal) |
| Resolution | 1 µA |
| Description | This register can be used to read channel maximum allowed current IMAX is a hardware limit, set by the corresponding board front panel trimmer. |

#### 3.2.1.3 STATUS

| | | |
|---|---|---|
| VME Offset | 0x0058 | |
| Description | STATUS bit | Meaning |
| | 0 | Channel 0 ALARM |
| | 1 | Channel 1 ALARM |
| | 2 | Channel 2 ALARM |
| | 3 | Channel 3 ALARM |
| | 4 | Channel 4 ALARM |
| | 5 | Channel 5 ALARM |
| | 6 | Reserved |
| | 7 | Reserved |
| | 8 | Board POWER FAIL |
| | 9 | Board OVER POWER |
| | 10 | Board MAXV UNCALIBRATED |
| | 11 | Board MAXI UNCALIBRATED |
| | 12..15 | Reserved |

#### 3.2.1.4 FWREL

| | | |
|---|---|---|
| VME Offset | 0x005C | |
| Description | Readout of microcontroller Firmware Release | |
| | Bit | Meaning |
| | [7:0] | Minor Release Number |
| | [15:8] | Major Release Number |

## 3.2.2 CHANNEL PARAMETERS

### 3.2.2.1 VSET

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x80 (channel can be in 0..5 range) |
| Range | 0 – 60000 (6000V/Resolution) |
| Resolution | 0.1 V |
| Description | This register can be used to set channel voltage.<br>The register value must be set to expected voltage divided by resolution. So a 3000V corresponds to setting VSET to 3000/0.1 = 30000. |

### 3.2.2.2 ISET

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x84 (channel can be in 0..5 range) |
| Range | 0 – 62000 (310µA/Resolution) |
| Resolution | 5 nA |
| Description | This register can be used to set channel current.<br>The register must be set to expected current divided by resolution. So a 100µA correspond to setting ISET to 100/0.005 ~ 20000 |

### 3.2.2.3 VMON

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x88 (channel can be in 0..5 range) |
| Range | 0 - 60000 (decimal) |
| Resolution | 0.1 V |
| Description | This register can be used to monitor channel voltage. The register value must be multiplied by resolution to get voltage in Volts. For instance, a value of 30000 corresponds to a current voltage value of 3000 V. |

### 3.2.2.4 ImonH

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x8C (channel can be in 0..5 range) |
| Range | 0 - 60000 (decimal) |
| Resolution | 5 nA |
| Description | This register can be read to get channel current value.<br>The register value has a lower resolution and it is updated when IMON RANGE is set to HIGH.<br>The register range 0-60000 corresponds to 0-300 µA. |

### 3.2.2.5 PW

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x90 (channel can be in 0..5 range) |
| Range | 0 - 1 |
| Description | This is channel ON/OFF control register.<br>Possible register values and meaning are:<br>0: OFF<br>1: ON |

### 3.2.2.6 CHSTATUS

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x94 (channel can be in 0..5 range) |

| | | |
|---|---|---|
| Description | STATUS bit | Meaning |
| | 0 | Channel ON |
| | 1 | Channel RAMP UP |
| | 2 | Channel RAMP DOWN |
| | 3 | Channel OVER CURRENT |
| | 4 | Channel OVER VOLTAGE |
| | 5 | Channel UNDER VOLTAGE |
| | 6 | Channel MAXV |
| | 7 | Channel MAXI |
| | 8 | Channel TRIP |
| | 9 | Channel OVER POWER |
| | 10 | Channel OVER TEMPERATURE |
| | 11 | Channel DISABLED |
| | 12 | Channel INTERLOCK |
| | 13 | Channel UNCALIBRATED |
| | 14..15 | Reserved |

#### 3.2.2.7 TRIP_TIME

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x98 (channel can be in 0..5 range) |
| Range | 0 - 10000 (decimal) |
| Resolution | 0.1 s |
| Description | This register can set TRIP time. TRIP range: 0 ÷ 999.9 s; 1000 s = Infinite. |

#### 3.2.2.8 SVMAX

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0x9C (channel can be in 0..5 range) |
| Range | 0 - 60000 (decimal) |
| Resolution | 0.1 V |
| Description | This register can be used to set a software VMAX. The register value must be set to expected voltage divided by resolution. So a 3000V corresponds to setting SVMAX to 3000/0.1 = 30000.<br>Parameter VSET cannot exceed SVMAX in any case.<br>Board will automatically make VSET = SVMAX, if a SVMAX is lower then VSET |

#### 3.2.2.9 RAMP DOWN

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xA0 (channel can be in 0..5 range) |
| Range | 0 - 500 (decimal) |
| Resolution | 1 V/s |
| Description | This register can be used to set RAMP DOWN rate. |

#### 3.2.2.10 RAMP UP

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xA4 (channel can be in 0..5 range) |
| Range | 0 - 500 (decimal) |
| Resolution | 1 V/s |

| | |
|---|---|
| Description | This register can be used to set RAMP UP rate. |

#### 3.2.2.11 PWDOWN

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xA8 (channel can be in 0..5 range) |
| Range | 0 - 1 |
| Description | This is channel Power Down Mode control register.<br>Possible register values and meaning are:<br>0: KILL<br>1:RAMP |

#### 3.2.2.12 POLARITY

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xAC (channel can be in 0..5 range) |
| Range | 0 - 1 |
| Description | This register reads channel POLARITY.<br>Possible values are:<br>0: NEGATIVE<br>1: POSITIVE |

#### 3.2.2.13 TEMPERATURE

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xB0 (channel can be in 0..5 range) |
| Range | -40 .... +125 (2's complement) |
| Resolution | 1 °C |
| Description | Get current channel temperature. |

#### 3.2.2.14 IMON_RANGE

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xB4 (channel can be in 0..5 range) |
| Range | 0 - 1 |
| Description | This is channel Imon Range control register.<br>Possible register values and meaning are:<br>0: Range High<br>1: Range Low |

#### 3.2.2.15 ImonL

| | |
|---|---|
| VME Offset | (0x80 * Channel) + 0xB8 (channel can be in 0..5 range) |
| Range | 0 - 60000 (decimal) |
| Resolution | 0.5 nA |
| Description | This register can be read to get channel current value<br>*when IMON_RANGE is set "LOW"*<br>The register range 0-60000 corresponds to 0-30 µA. |

### 3.2.3 BOARD CONFIGURATION

#### 3.2.3.1 CHNUM

| VME Offset | 0x8100 |
|---|---|
| Description | It contains the number of channels.<br>Number of Channel is 6 in case of V6521 board. |

#### 3.2.3.2 DESCR

| VME Offset | 0x8102 ÷ 0x8114 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | The DESCR registers reports a description of the board with ASCII codes:<br>V6521 has the following description: '6 Ch 6KV/300 µA' | | | | | | | | | | | | | | | |
| BIT | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x8102 | ' ' | | | | | | | | '6' | | | | | | | |
| 0x8104 | 'h' | | | | | | | | ' C' | | | | | | | |
| 0x8106 | '6' | | | | | | | | ' ' | | | | | | | |
| 0x8108 | 'V' | | | | | | | | 'K' | | | | | | | |
| 0x810A | '3' | | | | | | | | '/ ' | | | | | | | |
| 0x810C | '0' | | | | | | | | '0' | | | | | | | |
| 0x810E | 'A' | | | | | | | | 'u' | | | | | | | |
| 0x8110 | \0 | | | | | | | | \0 | | | | | | | |
| 0x8112 | \0 | | | | | | | | \0 | | | | | | | |
| 0x8114 | \0 | | | | | | | | \0 | | | | | | | |

#### 3.2.3.3 MODEL

| VME Offset | 0x8116 ÷ 0x811C | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | The MODEL registers reports the board name using ASCII codes | | | | | | | | | | | | | | | |
| BIT | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x8116 | '6' | | | | | | | | 'V' | | | | | | | |
| 0x8118 | '2' | | | | | | | | '5' | | | | | | | |
| 0x811A | '*m, n, p*' | | | | | | | | '1' | | | | | | | |
| 0x811C | \0 | | | | | | | | \0 | | | | | | | |

#### 3.2.3.4 SERNUM

| VME Offset | 0x811E |
|---|---|
| Description | This register reports the Board Serial Number. |

#### 3.2.3.5 VME_FWREL

| VME Offset | 0x8120 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | This register reports the FW Release Number | | | | | | | | | | | | | | | |
| BIT | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x8120 | Major_release | | | | | | | | Minor_release | | | | | | | |

# 4 Installation

- The Mod. V6521 fits into all 6U VME crates.
- Use only crates with forced cooling air flow
- Turn the crate OFF before board insertion/removal
- Remove all cables connected to the front panel before board insertion/removal

**CAUTION**

**USE ONLY CRATES WITH FORCED COOLING AIR FLOW SINCE OVERHEAT MAY DAMAGE THE MODULE!**

**CAUTION**

**ALL CABLES MUST BE REMOVED FROM THE FRONT PANEL**

**BEFORE EXTRACTING THE BOARD FROM THE CRATE!**

## 4.1 Safety Earth connection

The connection of shield/return to Earth is fundamental for User safety. The connection must always be at the level of detector. Shield/return connections even if not present or performed incorrectly, due to protection circuits implemented on the V65xx are bound to Earth; in this case the voltage difference between shield/return and Earth is limited to approximately 50V. Please note that this is a status of emergency-protection, not a working one. The best configuration must be determined by the user upon application, the optimal connection depends on many characteristics of the related experiment. The following diagrams show one example of configuration.

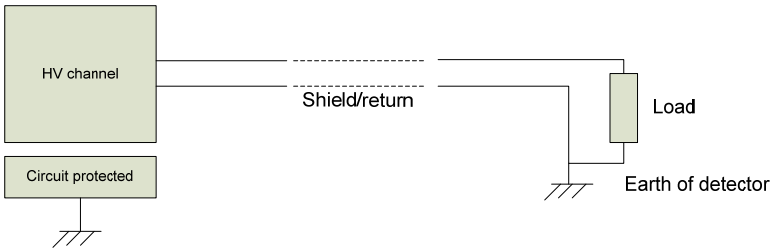



*Fig. 4.1: Shield/return to Earth connection*

## 4.2 Power ON sequence

To power ON the board follow this procedure:

1. insert the V6521 board into the crate
2. power up the crate

At power ON the module registers are set to their default configuration

## 4.3 Firmware upgrade

It is possible to upgrade the board firmware via VME, by writing the Flash: for this purpose, download the software package and the CAENUpgrader tool, available at www.caen.it
The instructions are explained by the Quick User's Guide included.