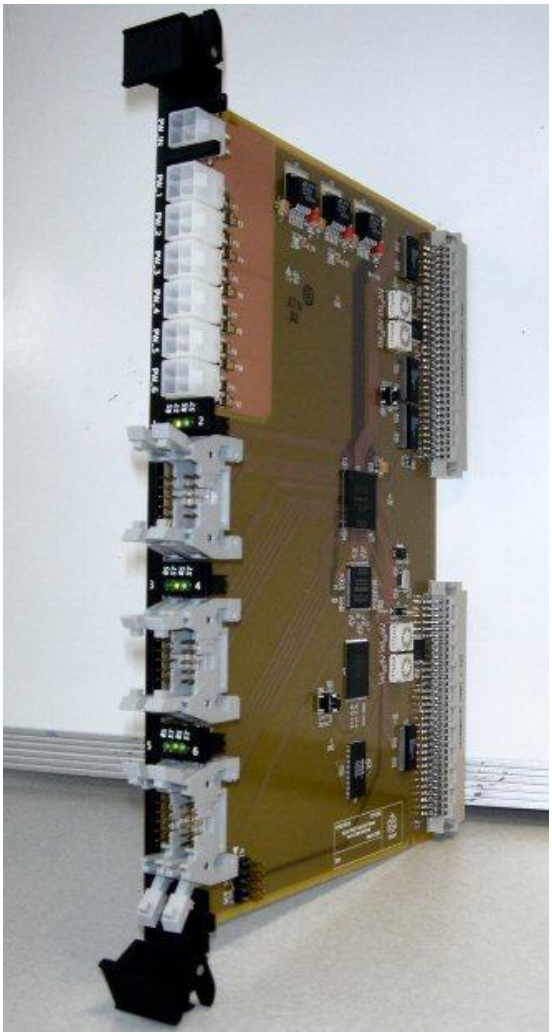
VPC6 Rev. A

6-Port Front-End Power and Control Module
User's Manual



June 2, 2006

Chris Ohlmann

Table of Contents

Introduction

The VPC6 is a 6-port front-end power and control module. It is fully compliant with the VME specification supporting ALL addressing modes and D32 and D16 data access modes. The first version of the firmware supports the ASD01 and Buckeye preamplifier cards, however, it is designed to control any generic serially configurable front end module.

A single VPC6 module, along with the appropriate preamplifiers, may be used in conjunction with VT48 Time-to-Digital Converter (TDC) and VF48 Analog-to-Digital Converter (ADC) modules to provide a complete VME data acquisition system with up to 288 channels. The system can be scaled up to support as many channels as desired.

VME Interface

The VPC6 is fully compliant with the VME specification supporting ALL addressing modes and D32 and D16 data access modes.

Module Addressing

The address of a specific VPC6 module may be set using the four (4) hexadecimal rotary switches: S1, S2, S3, and S4. The switches correspond to A[16..19], A[20..23], A[24..27], and A[28..31] respectively. Depending on the type of cycle presented on the VME bus (as determined by the AM[5..0] lines) the switches are treated differently:

- Extended (A32) mode, all switches are decoded.
- Standard (A24) mode, only switch S1 and S2 are decoded.
- Short (A16) mode, all switches are ignored. This mode is not recommended as only one module may be present on the bus unless a hard coded address is set in the firmware.

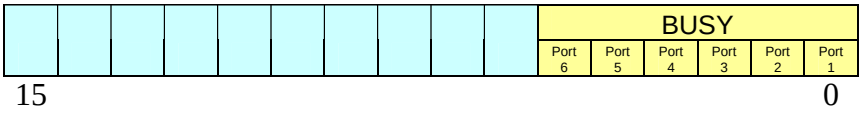
NOTE: J9 – A32 Enable is not used!

Memory Map

Address	Description	Access Type
0x0000	Status Register	Read Only
0x0004	Control Register	Read / Write
0x0008		
0x000C	Command Register	Write Only
0x0010	Port 1 Configuration Data	Read / Write
0x0020	Port 2 Configuration Data	Read / Write
0x0030	Port 3 Configuration Data	Read / Write
0x0040	Port 4 Configuration Data	Read / Write
0x0050	Port 5 Configuration Data	Read / Write
0x0060	Port 6 Configuration Data	Read / Write
0x0110	Port 1 Read-back Data	Read Only
0x0120	Port 2 Read-back Data	Read Only
0x0130	Port 3 Read-back Data	Read Only
0x0140	Port 4 Read-back Data	Read Only
0x0150	Port 5 Read-back Data	Read Only
0x0160	Port 6 Read-back Data	Read Only

Status Register 0x0000, Read Only

The status register is a read only register that contains the current operational status of the VPC6 module.



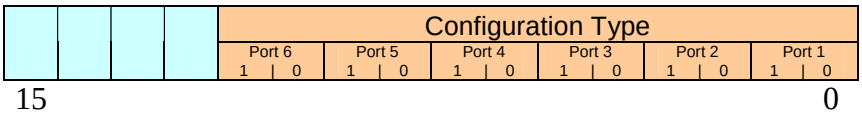
Bits	Description
0	BUSY status for Port 1
1	BUSY status for Port 2
2	BUSY status for Port 3
3	BUSY status for Port 4
4	BUSY status for Port 5
5	BUSY status for Port 6
15..6	Not Used – Available for future use

BUSY

When a BUSY bit is asserted in the status register, the associated port is in the configuration process. Load or Read Configuration commands destined for that port will be ignored until the configuration is completed and the BUSY flag has been cleared.

Control Register 0x0004, Read / Write

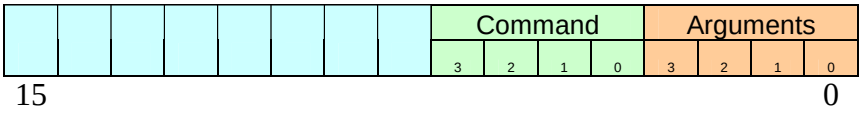
The control register contains configuration parameters for the VPC6 module. On power-up, the control register is cleared setting the configuration type for all ports to ASD01 mode.



Bits	Description	Values
1..0	Configuration Type for Port 1	00 = ASD01 01 = Buckeye 10,11 = N/A (for future use)
3..2	Configuration Type for Port 2	
5..4	Configuration Type for Port 3	
7..6	Configuration Type for Port 4	
9..8	Configuration Type for Port 5	
11..10	Configuration Type for Port 6	
15..12	Not Used – Available for future use	

Command Register 0x000C, Write Only

The command register is a write only register used to issue instructions to the VPC6 for starting complex processes.



Bits	Description
3..0	Command Arguments – Function depends on command that is issued
7..4	Command
15..8	Not Used – Available for future use

Command	Description	Arguments
0x1	Start Configuration	Write Enable[3], Port Select[2..0] Write Enable: 1 = Write, 0 = Read* Port Select: 001 = Port 1, 010 = Port 2, etc… <u>Examples</u> 0001 – Read Port 1 1001 – Write Port 1 1110 – Write Port 6

* A read command is only applicable to devices that support non-destructive reading of the current configuration. To some devices, such as the Buckeye, a read will actually overwrite the current configuration with data from the configuration data register associated with the selected port. For these devices a read functions exactly the same way as a write, loading new configuration data into the device and loading the previous configuration in the appropriate Read-back data register.

Configuration Data Registers 0x0010 – 0x006F, Read / Write

There are six (6) configuration data registers, one for each port on the VP6 module. Each register is 128-bits wide and is made up of four (4) consecutive 32-bit long words. When a start configuration (WRITE) command is written to the command register, the data from the associated configuration data register is loaded into the FE module.

Address	Description
0x0010	Port 1 - [31..0]
0x0014	Port 1 - [63..32]
0x0018	Port 1 - [95..64]
0x001C	Port 1 - [127..96]
.	.
.	.
.	.
0x0060	Port 6 - [31..0]
0x0064	Port 6 - [63..32]
0x0068	Port 6 - [95..64]
0x006C	Port 6 - [127..96]

The actual data structure of each register depends on the type of preamplifier connected to that port, as determined by the configuration type setting in the control register. Configuration data structures for supported front-end modules are defined below:

ASD01 Configuration Data Structure

Bits	Description	Settings
0	Chip Mode	0 = ADC, 1 = ToT
2..1	Channel Mode – Channel 8	00 = ON (active) 01 = ON (active) 10 = Forced LOW 11 = Forced HIGH
4..3	Channel Mode – Channel 7	
6..5	Channel Mode – Channel 6	
8..7	Channel Mode – Channel 5	
10..9	Channel Mode – Channel 4	
12..11	Channel Mode – Channel 3	
14..13	Channel Mode – Channel 2	
16..15	Channel Mode – Channel 1	
19..17	Deadtime	300 – 800 ns
22..20	Wilkinson ADC Rundown Current	2.1 – 7.3 µA
26..23	Wilkinson ADC Integration Gate	8 – 45 ns
30..27	Hysteresis DAC (DISC1)	0 – 20 mV
33..31	Wilkinson ADC Threshold DAC (DISC2)	32 – 256 mV
41..34	Main Threshold DAC (DISC1)	-254 – 256 mV
44..42	Calibration Injection Capacitor Select	50 – 400 fF
52..45	Calibration Mask Register – Channels 1 to 8 (bit 52 = 1)	
63..53	Not Used	
127..64	Same structure as bits 0 through 63 This data is used to configure the second ASD01	

Buckeye Configuration Data Structure

Bits	Description	Settings
2..0	Channel Mode – Channel 15	000 – Normal Operation 001 – Small Internal Capacitor (0.2pF) 010 – Medium Internal Capacitor (0.4pF) 011 – Large Internal Capacitor (0.6pF) 100 – External Capacitor 101 – n/a 110 – n/a 111 – Kill Channel
5..3	Channel Mode – Channel 14	
8..6	Channel Mode – Channel 13	
11..9	Channel Mode – Channel 12	
14..12	Channel Mode – Channel 11	
17..15	Channel Mode – Channel 10	
20..18	Channel Mode – Channel 9	
23..21	Channel Mode – Channel 8	
26..24	Channel Mode – Channel 7	
29..27	Channel Mode – Channel 6	
32..30	Channel Mode – Channel 5	
35..33	Channel Mode – Channel 4	
38..36	Channel Mode – Channel 3	
41..39	Channel Mode – Channel 2	
44..42	Channel Mode – Channel 1	
47..45	Channel Mode – Channel 0	
127..48	Not Used	

Read-back Data Registers 0x0110 – 0x016F, Read Only

There are six (6) read-back data registers, one for each port on the VP6 module. Each register is 128-bits wide and is made up of four (4) consecutive 32-bit long words. When a start configuration (READ or WRITE) command is written to the command register, the data from the FE module is written into the associated read-back data register.

Address	Description
0x0110	Port 1 - [31..0]
0x0114	Port 1 - [63..32]
0x0118	Port 1 - [95..64]
0x011C	Port 1 - [127..96]
.	.
.	.
.	.
0x0160	Port 6 - [31..0]
0x0164	Port 6 - [63..32]
0x0168	Port 6 - [95..64]
0x016C	Port 6 - [127..96]

The actual data structure of each register depends on the type of preamplifier connected to that port, as determined by the configuration type setting in the control register. Configuration data structures for supported front-end modules are the same as defined for the configuration data registers.

Front Panel Interface

Configuration Data Ports

There are six (6) configuration data ports that may be used for controlling front end modules. Each port is clearly labeled with a port number matching those used in the VME control interface. The pin-out for each connector is partially dependent on the front end-module that is connected, but, the VPC6 currently supports the following port configurations:

Pins	**Name**	**Function**	
		ASD01	**Buckeye**
1	Control Line 0	Serial Data Out (from VPC6)	
2	Control Line 5	Test Pulse*	N/A
3	Control Line 1	Serial Clock	
4	Digital Supply – 3.3V	Digital Supply – 3.3V	
5	Control Line 2	Serial Data In (to VPC6)	
6	Digital Supply – 3.3V	Digital Supply – 3.3V	
7	Control Line 3	DOWN	Test Pulse (-)*
8	Digital Ground	Digital Ground	
9	Control Line 4	LOAD	Test Pulse (+)*
10	Digital Ground	Digital Ground	

* Functionality not yet supported in VPC6 firmware.

Front Panel Status LEDs

There are two (2) LEDs on the front panel associated with each port of the VPC6 module. Their functionality is as follows:

BS – Busy LED

ON	The port is in use. Configuration data is being transferred to or from the front end module on that port.
OFF	The port is idle

ST – Status LED

ON	The port is configured to control an ASD01 front end module
OFF	The port is configured to control a Buckeye front end module

Analog Power Distribution

The VPC6 is intended to be used as a power distribution block for the front-end modules that it controls. Two low noise analog power supplies may be connected to the PW_IN connector on the front panel and distributed through the six outputs: PW_1, PW_2, PW_3, PW_4, PW_5, and PW_6. The pin out for the power connectors is as follows:

Pin	Function	Typical Uses
1	GND (analog)	
2	GND (analog)	
3	Supply Voltage 1 (<1.1A)	ASD01 Supply (3.6 – 20V)
4	Supply Voltage 2 (<1.1A)	Buckeye Supply (5.3 – 7V)

Each supply output is fused at 1.1A using a PTC type resetable fuse. To reset a fuse, the analog supply on PW_IN must be cycled.