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# **VPI3331 VME CONTROLLER CARD (and PCI 5331 Personality Card)**

## **USERS MANUAL**

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## 1. PRODUCT DESCRIPTION

The VPI 3331 "VIPER" PC/VME Interface Set consists of a 3331 Personal Computer VME Interface/Controller module, a PCI personality card and an interconnecting cable three metres long.

Normally, the 3331 interface and personality card will be supplied set up as the "first crate" i.e.

Base Address - Assigned by PC BIOS  
Crate Select - Crate 0  
Master/Slave Sel. - Master Controller (see sect. 2.3)  
Interrupt Request - Assigned by PC BIOS

## 2. 3331 Setting Up

### 2.1 Crate Select Switch.

This is a 10-position rotary switch, only 0 to 7 are valid.

Note that the standard configuration of the Personality Card Address Decode allows only FOUR Crates to be connected, i.e. Crate 0 to Crate 3. (Other arrangements to special order – contact Hytec for details).

### 2.2 Private Bus Termination.

Except where multiple 3331's are "daisy-chained" onto the same private bus cable, the 3331 will be the only device on this bus, so terminating packs RN1, 2, 3, 4, 5, 6, 7 and 8 should be fitted. In multi-crate situations only the last controller on the bus should have the resistor packs fitted. The maximum recommended length for the bus is 20 metres.

### 2.3 Slot 1 Enable.

JP 5 selects whether the 3331 is the Slot 1 Master/Arbiter or not. JP 5 IN (default) = Master/Arbiter enabled. Arbitration takes place on level 3, other request/grant signals are passed through. JP 5 OUT = Master acting with external level 3 Arbiter.

### 2.4 IACK Driver Select.

JP 1 and JP 2 select the internal IACK Daisy Chain driver, which is also a Slot 1 function.

JP 2 IN, JP 1 OUT - Slot 1 Driver enabled (default).  
JP 1 IN, JP 2 OUT - IACK bypassed, not Slot 1.



## 2.5 Bus Error Interrupt Select.

JP 3 and JP 4 decide whether Bus Error generates an Interrupt or not.

JP 4 IN, JP 3 OUT - Bus Error gives Interrupt  
JP 3 IN, JP 4 OUT - No Interrupt for Bus Error. (default)

## 2.6 PC Reset Enable/Disable

If JP 6 is fitted, then the RESET signal from the PC Main Board will generate an internal 3331 reset. If the 3331 is configured as Slot 1, then SYSRESET on the VME bus will also be generated. If JP 6 is OUT, PC Reset has no effect.

## 2.7 3331 Standard Configuration

Crate Select	Set for Crate 0
RN1-8	Fitted
JP 5 IN	Slot 1 Master
JP 2 IN, JP 1 OUT	IACK driver enabled
JP 3 IN, JP 4 OUT	No Interrupt for Bus Error

## 3. 3331 Front Panel

The 3331 Front Panel carries the 50-way IDC plug private bus connector, a hole for access to the PCB-mounted Crate Select switch, six LED's and a reset button.

### 3.1 Private Bus Connector

Standard 50-way IDC header connector. Pin 1 is bottom right.



### 3.2 Indicator LEDs

ADDRESSED LED - flashes when the 3331 detects its own crate address from the personality card. Stretched to 10 mSec.

MASTER LED - flashes when the 3331 is performing a VME cycle, stretched to 10 mSec.

INTERRUPT LED - comes on to show that an interrupt is being sent to the computer. This will happen if the selected VME IRQ line is asserted while Interrupts are Enabled, or if there is a Bus Error - see sect. 2.5.

BUS ERROR LED - shows the state of the Bus Error flag for the last VME cycle. Cleared by loading the Address Modifier.

AM5, AM4 LEDs - show the last loaded top two bits of the address modifier, indicating Short, Standard or Long addressing.

### 3.3 Reset Push-button

This performs a "Power-on-Reset" on the whole module. In particular, it resets the following:

- The BUSCON VME Bus Master chip
- The Control and Status Register
- The VME Cycle Sequencer

Whilst pressed, therefore, it stops the 3331 doing anything. If the 3331 is configured as Slot 1, SYSRESET will also be output onto the VME bus.

## 4. PCI 5331 Personality Card - Setting Up

The BASE ADDRESS and INTERRUPT REQUEST LEVEL selection is made automatically by the PC BIOS at boot time and is therefore not chosen by the user at all. All the user has to do is determine from the operating system what the actual base address and IRQ level are, once the system has started. Refer to PCI5331 Installation Guide for details.

There are two jumper positions on the personality card – these are reserved for future use only and currently have no effect.



## 5. Installation, Operating and Programming

### 5.1 IBM PC/AT and Compatibles

Remove the top cover of the computer and install the personality card in a free PCI expansion slot.

Having chosen the expansion slot in which to fit the Personality Card, install the card, securing it with the fixing screw.

If fitting seems awkward, loosen the bracket fixing screws where some latitude is available for accommodating slight mechanical differences which do occur on some PC's.

Plug in the private bus cable. Before replacing the cover, check that the personality card is seated correctly.

### 5.2 The VME Crate

If the 3331 is in a "Stand-alone" system, i.e. it is the only Master, then fit JP 5, JP 2, and JP 3, leaving the other links out, and put it in Slot 1, otherwise place it in the arbitration chain to the right of the slot 1 Master, taking care that the Bus Grant IN/OUT chain is continuous. Plug in the private bus cable at both ends.

Switch ON the computer, monitor and VME crate. Note that powering down the crate and 3331 will not affect the computer.

IF THE COMPUTER FAILS TO BOOT, CHECK THAT THERE IS AN INTERRUPT AVAILABLE ON YOUR SYSTEM. THE 5331 REQUESTS AN INTERRUPT, AND IF NONE ARE AVAILABLE, THIS WILL CAUSE PROBLEMS. IT IS ALSO WORTH TRYING A DIFFERENT SLOT IF THE MACHINE FAILS TO START.

When the computer has booted up into DOS or Windows, run BASIC or GWBASIC and type in this program:

```
10 VME=&HE000      '3331 REGISTERS START AT HEX E000 (for example)
20 OUT VME,0       'Send DATA 0, do a VME cycle
30 FOR I=1 TO 1000 'Delay loop
40 NEXT I
50 GOTO 20         'Do it again
```

Running this program should flash the ADDRESSED and MASTER LEDs, provided the base address is selected to be HEX 300 (otherwise change line 10) and the 3331 should now be doing VME cycles. If you have a VME Bus Display Module, such as the Hytec VDS 2081, you will be able to observe this happening.

BUS ERROR will be lit, since the address in the 3331's registers will be "garbage", as will the address modifier.



If all is not well, check that the cable is firmly plugged in and all your selections on the 3331 and on the personality card are correct and try again.

You are now ready to load your CATY\_VME Software, which you will have received on a floppy disk. Install it in your machine and copy the two files CATY\_VME.EXE and VKYMSG.TXT into a prepared sub-directory of your hard disk.

## 6. VME Tutorial

Before you try to use the VPI 3331 to address a VME module, possibly with the CATY\_VME Software, it is important that you understand the steps involved and the reasons behind them.

Suppose for a moment that you wish to test a VME module which has some registers that you can read and write. The first thing you need to know is what bus address they are located at; the second is what address width to use, and hence what address modifier, and the third is what data width the registers have.

Hopefully, you have a manual on the module and by looking at the tables and the jumper settings on the unit, you work out that it is set bus address 1C0000 HEX, say, which is a 24-bit or STANDARD address, which involves the use of address modifiers HEX 39 or 3D. In many circumstances, there will be a choice of Standard (24-bit) or Short (16-bit) addressing, so remember to change the modifier accordingly - 29 or 2D for SHORT addressing, 09 or 0D for LONG (32-bit) addressing.

Using the CATY\_VME Software, you can now address this module and write and read its registers. You know the crate address, set on the front panel switch, the bus address (HEX 1C0000 in our example) and the address modifier (HEX 39 in our example). CATY\_VME uses <'X'> as an abbreviation for HEX; <'> means OCTAL; no prefix means decimal.

### 6.1 How to address VME through the VPI 3331

Again, using CATY\_VME, this is very straightforward. In the example above, suppose there is a register at the base address that we can write and read back and let's say it is 16 bits wide. Our program might look something like this:

```
10 MOD=0,'X1C0000','X39   ;Crate 0, Addr 1C0000 HEX, AM 39 HEX
20 FOR D=0 TO 65535       ;FULL 16 BIT PATTERN
30 VW16 MOD,D             ;WRITE THE DATA
40 VR16 MOD,X             ;READ IT BACK
50 IF X=D GOTO 70         ;IS IT RIGHT?
60 PRINT "DATA ERROR, WROTE",D,"READ",X ;MESSAGE
70 NEXT D
80 STOP
```

What happens here is that CATY\_VME now knows where the module is and how to load up the 3331 registers to talk to it.

The question at start-up told it what the base address is, so with the crate number, it knows the PC I/O page address of all the 3331 registers.

Referring to the data sheet, we can see that it will load the Address Modifier into Base+8, then load the top and bottom halves of the bus address into Base+6 and Base+4. Since this is a 16-bit access, it will now either write or read a 16-bit word to or from the Data Low location at the base address, which will cause a VME cycle to take place. Had the PC done an 8-bit operation, then only 8 bits of data would have been passed, on either D0-7 or D8-15 on the VME bus, depending on the state of the least significant address



bit (A00) in the 3331. A00 is not passed to the VMEbus, but it controls the routing of 8-bit data to either D00-D07 with strobe DS0 when A00 is '0' or D08-D15 with strobe DS1 when A00='1' (this is known as D08(EO) addressing).

There are two other registers in the 3331, namely the Control and Status Register (CSR), at base address + C (HEX) and the Interrupt Acknowledge register (IACK) at base address + A (HEX).

Looking at the data sheet, we see that the CSR allows us to select an IRQ line to handle VMEbus interrupts on, enable interrupts, generate a 'software interrupt', generate a 'reset', enable auto-address-increment (see section 8.1) and put the interface 'off-line'. All these are self-explanatory except off-line, which

is used by Hytec for testing (it stops the 3331 doing a VME cycle when data is written or read at base address).

The Interrupt Acknowledge register. When this is read, an IACK cycle is invoked, using the level selected in the CSR. Either 8 or 16 bits of data are requested from the slave, depending on whether the PC did an 8 or 16 bit IO operation. In the case of a Hytec slave module, a 16-bit read would obtain an 8-bit vector on D0-7 and 'reason' bits on D8-15.

## 7. CATY\_VME Software

CATY\_VME is a form of compiled BASIC with embedded mnemonic commands for manipulating VME from a PC via the VPI 3331.

First, start the software by typing CATY\_VME <CR>, where <CR> means Carriage Return and <\_> means the "underline" character. The compiler will start up and ask you a question about the selected address on the personality card. Hit return for 300 HEX (standard).

You should now have the standard CATY\_VME prompt <.>.

Refer to the CATY\_VME manual for a full description of the commands and syntax to use, a summary of commands and statements is included below.





## 7.1 CATY\_VME Command and Statement Summary

Compiler Command Summary. (All start with <!>)

!AB Abort to DOS  
 !DU filename.ext Dump program to disk  
 !RD filename.ext Read program from disk  
 !PA Page-list program  
 !ST Start program running  
 !NE Clear program area  
 500!ED Edit line no. 500.

Notes: The <ESC> or ESCAPE key stops a program running. To enter a program, simply type a line number and a statement, and auto line numbering is invoked. To exit line entry, simply delete the last line number offered or type !PA.

Special CATY\_VME statements (in addition to the usual BASIC statements, like FOR-NEXT, PRINT etc.).

VR8 c,a,m,d  
 VR16 8, 16 or 32 bit read of crate "c",  
 VR32 at address "a", using modifier "m", putting result in variable "d".

VW8 c,a,m,d  
 VW16 8, 16 or 32 bit write, as above, using  
 VW32 data from variable d.

VRST c,x Read CSR of crate "c" controller into "x"  
 VWST c,x Write CSR of crate "c" contr., data "x"

IN8 8 or 16 bit IO read of a PC register. r,v Could be in 3331 or not. Similar to INP in  
 IN16 BASIC. "r" is address of IO register.

OUT8 8 or 16 bit IO write of a PC register, r,d could be in 3331 or not. Similar to OUT in  
 OUT16BASIC.

INTR c,i,p,v Introduces Interrupt handling for crate "c"  
 or c,i,\* on IRQ level "i", expecting a returned  
 or c,i,p vector pattern "p", with the full 16-bit  
 or c,i,\*,v IACK Status ID word passed in variable "v".

Notes: "v" may be omitted  
 "p" may be replaced by "\*" for any pattern  
 only one IRQ line may be used in a program.

NOTE: ALWAYS REMEMBER - IF YOU GET STUCK OR DON'T UNDERSTAND SOMETHING,  
 JUST RING AND WE WILL HELP!

## 8. Special Operational Features



## 8.1 Address Auto-increment

This is a hardware feature incorporated in the 3331 to allow a block of VME memory to be read out or written to without having to reload a new address for each cycle. It is invoked by setting the Auto-Increment bit to '1' in the 3331 CSR (bit 5), then after each VME cycle the counter which forms the bottom 8 bits of the address register will be incremented by either 1,2 or 4 depending on whether an 8,16 or 32-bit data cycle was performed. Every time a 256-byte boundary is crossed, a full new address will need to be reloaded.

The intended use of this feature is for reading out a block of VME memory which does not have 'Block Mode' access, i.e. it does not have its own auto-incrementing pointer.

## 9. Circuit Description

This circuit description should be read in conjunction with the following Circuit Diagrams:

CCT/5331/A/1/2.0	5331	Personality Card Circuit Diagram Sheet 1
CCT/5331/A/2/2.0	5331	Personality Card Circuit Diagram Sheet 2
HL 1060	3331	Circuit Diagram - sheet 1
HL 1061	3331	Circuit Diagram - sheet 2

### 9.1 Personality Card

Note: The 3331 Personality card is the same as that used for the HYTEC 1331 CAMAC controller - hence references to '1331' on circuit diagram and parts list.

On the left of the diagram CCT/5331/A/1/2.0 we see the System Board PCI edge connectors. The card is powered from the System Board +5V (VCC) and GND (ground) power rails. It consumes about 200 mA.

On the right of this sheet we see the PCI9052 PCI-Local Bus bridge chip which converts the PCI bus to our local bus for talking to the 3331.

The left-hand side of the chip shows mainly the PCIbus connections, while the right-hand side shows the local bus signals.

The local bus signals are:

PD0-15	16-bit local data bus
IA2-5	Local address bus for register and crate selection
BE0-3	Byte enable signals (only 0 and 1 are used)
/RD, /WR, /LW_R	Local bus read/write control
/LRDY	Ready signal from local bus logic
ALE, /AS	Connected but not used.

Notice also the SPROM, IC8, which loads up the 9052 registers at power-up so that it requests the correct resources and locates the local registers correctly.

On sheet 2, we see IC3, the MACH local bus logic chip, which converts the 9052 local bus signals into the format required by the 3331 (and also the 1331 and 1330). Also there are drivers for the signal cable bus signals and connector positions for the 50-way CO1 for 1331/3331 and 34-way J1 for the 1330.



## 9.2 3331 VME Module

Starting with sheet HL 1060, bottom left we see the 50-way IO cable connector, bringing the data bus to its terminators and buffers, then to the ITB (Internal Transfer Bus) which is 16 bits wide. Above this, we see more terminators and buffers receiving the Crate Select lines (CS0-CS2) which are compared with the rotary switch setting to generate DS (Device Select); Register select lines RS0-RS2; /RD indicating a Read command; /WR – Write command; /RESET - reset from the PC; /CS16 - denoting a 16-bit operation and IMODE which comes from the personality card CSR and controls the Hold/release function of the BUSCON chip (IC 41).

Two open-collector output drivers here send two signals to the PC - /BUSY - insert wait states in the PC IO cycle, and /INTR - Interrupt the processor.

The Register Select signals (IRS0 - IRS2), together with Device Select (DS), and the read/write command lines /RD, /WR go to all three decoding PALs ICs 26, 27 and 28. These produce signals which either clock data into or enable outputs from various registers inside the 3331, as well as the following "special" signals:

/ENXO - Enable crossover buffer, usually for an 8-bit read/write of the top half of a register.

/VMECYC - Invoke the VME cycle sequencer

/CLRBFLG - Clear the internal byte flag

/RDINTR - Read Interrupt Acknowledge register, do IACK cycle

/CKBFLAG - Toggle the byte flag for next 8-bit operation

The names of the other signals are fairly self-explanatory, e.g.

/RBA8-15 - read back address bits 8-15

/RA24-31 - read address bits 24-31

/CKABD16 - clock A to B register for data 16-23

/CKA8-15 - load address register for address 8-15

Just to the left of IC28, we see a monostable which produces a 200 nSec pulse at the beginning of all PC IO cycles. When the VME cycle generator is invoked, this signal is used to "hold up" the PC until the sequencer puts up its own BUSY signal. Top centre is the VME cycle sequencer itself, IC 44 a PLS105 logic sequencer. This responds to either /VMECYC or /RDINTR and invokes the BUSCON chip, IC 41, causing it to do a VME cycle.

The sequencer's outputs are:

/DSI - Internal Data Strobe

/MAS - Master Address Strobe

/IBUSY - Sequencer busy - hold PC cycle

/VME - start VME cycle

COUNT - enable auto-increment counter

R/W - Read/Write select



When it sees /VME and /MAS, the BUSCON chip arbitrates for the VME bus on level 3 and then cycles VMEEN (address and modifier driver enable), DEN (Data driver enable) and DSEN (data strobe enable). It expects to receive either /DTACK (data transfer acknowledge) or /BERR (bus error), which it sends back to the sequencer as LDTK and LBERR.

Bottom right we see the clock oscillator, IC32, the CSR store and readback buffer (ICs 8 and 7) and latches for the byte flag and the 8/16-bit mode flag.

On sheet 2 of the circuit diagram, HL 1061, starting on the right we see the VME bus connectors, then the bus drivers/receivers for all the address/data and modifier lines together with their stores/readback latches. Notice the 8-bit counter, an LS593, used for the bottom address lines A00-A07.

Downwards from top left, we see the Bus Error Flag latch, set if /LBE (local bus error) ever becomes true while we are in charge of the bus (/MAS true). BERR FLAG is visible through the CSR and is also (if jumpered) a source of Interrupt.

IC6 is a data selector, which chooses one of the VME IRQ lines, based on the state of CSR lines IPL0-2 (Interrupt Priority Level). Below this we can see Bus Error Timeout Counter together with bus drivers for SYSCLK, BG3IN, SYSRESET and BERR, all enabled if Slot 1 is enabled, and also for BIK, buffered IACK, used in our Slot 1 IACK daisy-chain driver, the remainder of which is just to the left.

Further down we see IC38, the Data Strobe Decoding PAL which produces DS0, DS1 and LWORD depending on whether this is an 8 bit (Upper or Lower) 16 or 32 data bit cycle, and also enables upper or lower data bus drivers (DENLO, DENHI).

Just below this is our IACK driver, and a buffer to put out our Interrupt Acknowledge code (IPL0-2) onto address lines A01-A03 during the cycle. Still further down we see some LED drivers and monostables for front panel displays and also the crossover buffer (top half to bottom half of Internal Transfer Bus) used during 8 bit cycles.

## 10. ON BOARD FEATURES

The configuration and control of the 3331 module is via registers:

Base	Offset	Register	Description
Base +	0	Data Low Register	Lower 16 Bits of Data Register (Read / Write)
Base +	2	Data High Register	Upper 16 Bits of Data Register (Read / Write)
Base +	4	Address Low Register	Lower 16 Bits of Address Register (Read / Write)
Base +	6	Address High Register	Upper 16 Bits of Address Register (Read / Write)
Base +	8	Address Modifier	Address Register (Read / Write)
Base +	A	Interrupt Acknowledgement	Interrupt Vector Captured from Interrupting Device (Read)
Base +	C	Control & Status Register	Set up and Status Monitoring Register (Read / Write)

### 3331 On-Board Registers

#### 10.1 Data Low Register (Read/Write)

Address: Read = Base + 00, Write = Base + 00

D15	D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	D00

**Note: reading or writing data low causes a VME cycle to take place.**

#### 10.2 Data High Register (Read/Write)

Address: Read = Base + 02, Write = Base + 02

D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16

X= don't care

#### 10.3 Address Low Register (Read/Write)

Address: Read = Base + 04 Write = Base + 04

D15	D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	D00

#### 10.4 Address High Register (Read/Write)

Address: Read = Base + 06 Write = Base + 06

D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16

X= don't care

### 10.5 Address Modifier (Read/Write)

Address: Read = Base + 08 Write = Base + 08

D15	D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	D00
X	X	X	X	X	X	X	X	LW	X	AM5	AM4	AM3	AM2	AM1	AM0

X= don't care

**Note: setting the LW bit signifies a 32-bit VME cycle and will set \*LWORD true.**

### 10.6 Interrupt Acknowledge (Read only)

Address: Read = Base + 0A

D15	D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	D00
X	X	X	X	X	X	X	X								

X= don't care

Note: reading the IACK register causes an interrupt acknowledge cycle on VME at the level selected in the CSR (see below).

### 10.7 Control & Status Register

**Control** (Write)

Address: Base + 0C

D15	D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	D00
X	X	X	X	X	X	X	X	RST	SOFT INT	ADD INC	INTEN	OFF LINE	INTSEL 2	INTSEL 1	INTSE L0

**Status** (Read)

Address: Base + 0C

D15	D14	D13	D12	D11	D10	D09	D08	D07	D06	D05	D04	D03	D02	D01	D00
X	X	X	X	X	X	X	X	X	INT FLAG	ADD INC	INTEN	OFF LINE	INTSEL 2	INTSEL 1	INTSE L0

**INTSELO** Select VME interrupt level.

**INTSEL1** Select VME interrupt level. (Full Details - See section 11).

**INTSEL2** Select VME interrupt level.

**OFF LINE** Off Line - Test Mode (no VME cycles) for Register Tests.

**INTEN** Enable Interrupt from VMEbus backplane.

**ADD INC** Enable Address Increment – Allows Automatic Incrementing of the Bottom 8 Address Bits by 1, 2, or 4 According to Data Width (set as required according to the set Address Modifier).

**SOFT INT** Software Selectable Interrupt.

**INT FLAG** Indicates that the selected Interrupt line is 'true'.

**RST** Soft Reset: Clears status register to zero when written as a '1'.



## 10.8 VME Soft Reset

### 10.8.1 A reset generated from the CSR bit 7 will clear the following registers:

- All writeable CSR bits.
- The VME cycle generator
- Address bits 0 to 7
- The bus error flag.
- Generates SYSRESET on VME.

## 11. INTERRUPT SETTINGS

The interrupt level monitored by the 3331 is set using the CSR register bits INTSEL0 (bit 0), INTSEL1 (bit 1) INTSEL2 (bit 2). These select the VME IRQ line as follows:

Interrupt Level	INTSEL 2	INTSEL 1	INTSEL 0
None	0	0	0
IRQ 1	0	0	1
IRQ 2	0	1	0
IRQ 3	0	1	1
IRQ 4	1	0	0
IRQ 5	1	0	1
IRQ 6	1	1	0
IRQ 7	1	1	1

Interrupt Level Select

Note that this selection allows only one VME interrupt line to be monitored at a time. The user must ensure that all slave modules generating interrupts use this line. This register also selects the level at which VME interrupt acknowledge cycles are performed when reading the IACK register at offset 0x0A.

## APPENDIX A PCB JUMPERS

### Hytec 3331 Board

See section 2.

## APPENDIX B Parts List and Assembly Details

### VPI 3331 VME Module

#### Integrated Circuits

Type	Qty	Component Reference
74LS00	1	IC50
74LS04	1	IC25
74LS08	1	IC22
74LS14	2	IC43, IC45
74LS32	1	IC9
74F38	1	IC24
74LS74	3	IC34, IC36, IC42
74LS85	1	IC37
74LS123	1	IC40
74S132	1	IC32
74LS151	1	IC6
74LS174	1	IC35
74F244	1	IC39
74LS244	3	IC7, IC48, IC49
74LS245	4	IC20, IC29, IC46, IC47
74LS273	1	IC8
74LS373	2	IC16, IC17
74LS393	1	IC33
74LS593	1	IC21
74ALS645A-1	9	IC1, IC2, IC3, IC4, IC5, IC10, IC11, IC12, IC30
74LS652	6	IC13, IC14, IC15, IC18, IC19, IC31
SCB68172	1	IC41 (on socket)
SN75452	1	IC23
PAL22V10	3	IC26 "3331 P26" (on socket) IC27 "3331 P27" (on socket) IC28 "3331 P28" (on socket)
PAL18P8	1	IC38 "3331 P38" (on socket)
PLS105	1	IC44 "3331 V5" (on socket)

#### Discrete Semiconductors

1N4148	1	D1
BAT85	1	D2

#### Passive Components

470R x 8 Res.Pk	5	RN1,RN2,RN5,RN6 (on sockets), RN10
560R x 8 Res.Pk	4	RN3,RN4,RN7,RN8 (on sockets)
10K x 8 Res. Pk	1	RN9
470R	1	R8
560R	2	R11, R12
1K0	2	R5, R6
2K2	2	R2, R3
4K7	1	R1
10K	2	R7, R13
47K	1	R9
100K	2	R4, R10





10pF cer.	1	C3
47pF cer.	1	C4
100pF cer.	2	C1, C5
100nF cer.	30	"C"- all decouplers
1uF 35V tant.	2	C6, C7
10uF 25V tant.	1	C2
100uF 20V tant.	1	C8

#### Miscellaneous

Complementary BCD rotary switch "Crate Select"	1
50-way IDC header front panel connector	1

#### 5331 Personality Card

#### Integrated Circuits

Type	Qty	Component Reference
PCI9052	1	IC1
74LS14	1	IC2
M4-128N64	1	IC3 '5331V15'
74LS245	4	IC4, IC5, IC6, IC7
NM93C46AN	1	IC8 '5331'

#### Discrete Semiconductors

1N4148	1	D1
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#### Passive Components

470R x 8 SIL	3	RN1, RN2, RN3
680R x 8 SIL	3	RN4, RN5, RN6
47R 0.25W	1	R3.
470R	2	R8, R9.
680R	2	R10, R11.
1K0	3	R4, R6, R7
10K	7	R1, R5, R12, R13, R14, R15, R16.
33K	1	R2.
100nF cer.	16	C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18.
47uF 16V tant.	2	C1, C2.

### PRODUCT SPECIFICATIONS

#### Power Requirements

+5V @ 1500mA typical

#### Operating Temperature Range

0 to +45 deg Celsius ambient.

#### Mechanical

6U single width VME module with access to 3-row P1 and P2 connectors.

**VME PIN ASSIGNMENTS**

P1 ROW A	SIGNAL	P1 ROW B	SIGNAL	P1 ROW C	SIGNAL
P1.A01	D00	P1.B01	N/C	P1.C01	D08
P1.A02	D01	P1.B02	N/C	P1.C02	D09
P1.A03	D02	P1.B03	N/C	P1.C03	D10
P1.A04	D03	P1.B04	BG0IN*	P1.C04	D11
P1.A05	D04	P1.B05	BG0OUT*	P1.C05	D12
P1.A06	D05	P1.B06	BG1IN*	P1.C06	D13
P1.A07	D06	P1.B07	BG1OUT*	P1.C07	D14
P1.A08	D07	P1.B08	BG2IN*	P1.C08	D15
P1.A09	GND	P1.B09	BG2OUT*	P1.C09	GND
P1.A10	N/C	P1.B10	BG3IN*	P1.C10	N/C
P1.A11	GND	P1.B11	BG3OUT*	P1.C11	BERR*
P1.A12	DS1*	P1.B12	N/C	P1.C12	RESET
P1.A13	DS0*	P1.B13	N/C	P1.C13	LWORD*
P1.A14	WRITE	P1.B14	N/C	P1.C14	AM5
P1.A15	GND	P1.B15	N/C	P1.C15	A23
P1.A16	DTACK*	P1.B16	AM0	P1.C16	A22
P1.A17	GND	P1.B17	AM1	P1.C17	A21
P1.A18	AS	P1.B18	AM2	P1.C18	A20
P1.A19	GND	P1.B19	AM3	P1.C19	A19
P1.A20	IACK	P1.B20	GND	P1.C20	A18
P1.A21	IACKIN*	P1.B21	N/C	P1.C21	A17
P1.A22	IACKOUT	P1.B22	N/C	P1.C22	A16
P1.A23	AM4	P1.B23	GND	P1.C23	A15
P1.A24	A07	P1.B24	IRQ7*	P1.C24	A14
P1.A25	A06	P1.B25	IRQ6*	P1.C25	A13
P1.A26	A05	P1.B26	IRQ5*	P1.C26	A12
P1.A27	A04	P1.B27	IRQ4*	P1.C27	A11
P1.A28	A03	P1.B28	IRQ3*	P1.C28	A10
P1.A29	A02	P1.B29	IRQ2*	P1.C29	A09
P1.A30	A01	P1.B30	IRQ1*	P1.C30	A08
P1.A31	-12V	P1.B31	N/C	P1.C31	+12V
P1.A32	+5V	P1.B32	+5V	P1.C32	+5V

**P1 Pin Assignments**

ROWA	SIG	ROWB	SIG	ROWC	SIG
P2.A01	N/C	P2.B01	+5V	P2.C01	N/C
P2.A02	N/C	P2.B02	GND	P2.C02	N/C
P2.A03	N/C	P2.B03	N/C	P2.C03	N/C
P2.A04	N/C	P2.B04	A24	P2.C04	N/C
P2.A05	N/C	P2.B05	A25	P2.C05	N/C
P2.A06	N/C	P2.B06	A26	P2.C06	N/C
P2.A07	N/C	P2.B07	A27	P2.C07	N/C
P2.A08	N/C	P2.B08	A28	P2.C08	N/C
P2.A09	N/C	P2.B09	A29	P2.C09	N/C
P2.A10	N/C	P2.B10	A30	P2.C10	N/C
P2.A11	N/C	P2.B11	A31	P2.C11	N/C
P2.A12	N/C	P2.B12	GND	P2.C12	N/C
P2.A13	N/C	P2.B13	+5V	P2.C13	N/C
P2.A14	N/C	P2.B14	D16	P2.C14	N/C
P2.A15	N/C	P2.B15	D17	P2.C15	N/C
P2.A16	N/C	P2.B16	D18	P2.C16	N/C
P2.A17	N/C	P2.B17	D19	P2.C17	N/C
P2.A18	N/C	P2.B18	D20	P2.C18	N/C
P2.A19	N/C	P2.B19	D21	P2.C19	N/C
P2.A20	N/C	P2.B20	D22	P2.C20	N/C
P2.A21	N/C	P2.B21	D23	P2.C21	N/C
P2.A22	N/C	P2.B22	GND	P2.C22	N/C
P2.A23	N/C	P2.B23	D24	P2.C23	N/C
P2.A24	N/C	P2.B24	D25	P2.C24	N/C
P2.A25	N/C	P2.B25	D26	P2.C25	N/C
P2.A26	N/C	P2.B26	D27	P2.C26	N/C
P2.A27	N/C	P2.B27	D28	P2.C27	N/C



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P2.A28	N/C	P2.B28	D29	P2.C28	N/C
P2.A29	N/C	P2.B29	D30	P2.C29	N/C
P2.A30	N/C	P2.B30	D31	P2.C30	N/C
P2.A31	N/C	P2.B31	GND	P2.C31	N/C
P2.A32	N/C	P2.B32	Out+5V	P2.C32	N/C

## P2 pin assignments