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Reference Manual

VL-IPI-1
VL-IPI-2
VL-IPI-3
VL-IPI-4
VL-IPI-5

Isolated Power Interface
Card for the STD Bus

STD

VERSALOGIC CORPORATION

VL-IPI-1
VL-IPI-2
VL-IPI-3
VL-IPI-4
VL-IPI-5

Isolated Power Interface
Card for the STD Bus

Model VL-IPI-1/5

Isolated Power Interface Card for the STD Bus

REFERENCE MANUAL

VL-IPI-1 Rev. 0.00
VL-IPI-2 Rev. 0.00
VL-IPI-3 Rev. 0.00
VL-IPI-4 Rev. 0.00
VL-IPI-5 Rev. 0.00
Doc. Rev. 04/21/94

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MIPI1/5

Model STD IPI-1/5
Isolated Power Interface Cards for the STD BUS
Part Number 2311/2315

REFERENCE MANUAL

TABLE OF CONTENTS

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3888 Stewart Road
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PN D-2311 4/85

OVERVIEW

The STD IPI (Isolated Power Interface) board provides a simple, direct interface between the STD BUS and "real world" devices. Available in five configurations, the IPI board includes AC/DC inputs (4 to 250 volts), relay outputs, and solid state AC relay outputs. The following configurations are available.

P/N	Name	Function
2311	IPI-1	8 AC/DC input channels.
2312	IPI-2	8 relay output channels.
2313	IPI-3	8 solid state AC relay output channels.
2314	IPI-4	4 AC/DC input + 4 relay output channels.
2315	IPI-5	4 AC/DC input + 4 solid state AC relay output channels.

Operating Description

The IPI board contains eight I/O channels that are mapped into a single system I/O address. Each input or output channel represents one of eight bits that are simultaneously read or written to the board by the processor. Circuitry is included to drive eight LED indicators at the edge of the board. They display the current on or off state of each channel.

AC/DC Inputs: Each AC/DC input channel can sense the presence or absence (i.e., ON or OFF state) of an external voltage between 4 and 250 volts. The input voltage is passed from the input connector, through a jumper selectable current limiting resistor (for voltage range selection), a full wave bridge, and into a sensitive LED within an opto-isolator device. The output (sensor) of the opto-isolator connects to a resistor/capacitor network (to convert AC inputs to DC signals) and to a data bus interface that can be read by system processor at any time. The signal is also used to drive an on-board LED that displays the current state of each input channel.

Relay outputs: Relay output channels are activated when data is written into the on-board data latch. The coil of each relay is in turn driven by its own transistor driver. The coil of each relay is connected to a buffer that drives an on-board status LED, and also connects to the data input register allowing the system processor to read the state of each output channel. An on-board snubbing network is provided across each relay's contacts to absorb the turn-on/turn-off transients that cause power line and RFI noise.

Solid State AC Relay Outputs: The solid state relay output channels are activated when data is written into the on-board data latch. Each optically isolated solid state switch is turned on by its own transistor driver. The driver is also connected to a buffer that drives an on-board status LED, and connects to the data input register allowing the system processor to read the state of each output channel. The solid state switches automatically delay turn-on and off until the zero voltage/zero current portion of the AC cycle, to eliminate switching transients. An on-board snubbing network is provided across the outputs to absorb any transients that may be generated by the device itself.

STD BUS COMPATIBILITY

The STD IPI board is compatible with both 8085/Z80 and 65/6800 type STD BUS systems (65/6800 systems must include I/O addressing). It requires only +5V (regulated) power for operation.

When inserting the IPI board into an STD BUS card cage, be certain that the card ejector (pin 1 edge of the card) is aligned in the same direction as other cards in the system (usually upward). The IPI board has a key slot cut between pins 25 and 27. It is recommended that a matching key be installed in the STD BUS motherboard connector to prevent the card from being installed upside down.

The STD IPI board should be inserted or removed from the STD BUS card cage only when the power to the bus is turned off.

STD BUS Pinout

Connections from the IPI board to the STD BUS are shown below. Pins 1 and 2 are at the top (card ejector) edge of the board. As noted below the odd numbered pins are on the component side of the board while the even numbered pins are on the solder side. Direction of signal flow is referenced to the IPI board.

COMPONENT SIDE				SOLDER SIDE			
PIN	SIGNAL	FLOW	DESCRIPTION	PIN	SIGNAL	FLOW	DESCRIPTION
1	+5V	In	+5 volt power	2	+5V	In	+5 volt power
3	GND	In	Digital ground	4	GND	In	Digital ground
5	VBB/VBAT	-	-5V or bat. backup	6	-5V	-	-5V power
7	D3	I/O	Data bus	8	D7	I/O	Data bus
9	D2	I/O	Data bus	10	D6	I/O	Data bus
11	D1	I/O	Data bus	12	D5	I/O	Data bus
13	D0	I/O	Data bus	14	D4	I/O	Data bus
15	A7	In	Address bus	16	A15	-	Address bus
17	A6	In	Address bus	18	A14	-	Address bus
19	A5	In	Address bus	20	A13	-	Address bus
21	A4	In	Address bus	22	A12	-	Address bus
23	A3	In	Address bus	24	A11	-	Address bus
25	A2	In	Address bus	26	A10	-	Address bus
27	A1	In	Address bus	28	A9	-	Address bus
29	A0	In	Address bus	30	A8	-	Address bus
31	WR*	In	Write strobe	32	RD*	In	Read strobe
33	IORQ*	In	I/O addr. select	34	MEMRQ*	-	Memory addr. select
35	IOEXP*	In	I/O expansion	36	MEMEX*	-	Memory expansion
37	REFRESH*	-	Refresh timing	38	MCSYNC*	-	Machine cycle sync.
39	STATUS1*	-	CPU status	40	STATUS0*	-	CPU status
41	BUSAK*	-	Bus acknowledge	42	BUSRQ*	-	Bus request
43	INTAK*	-	Interrupt acknowl.	44	INTRQ*	-	Interrupt request
45	WAITRQ*	-	Wait request	46	NMIRQ*	-	Non-maskable interrupt
47	SYSRESET*	In	System reset	48	PBRESET*	-	Push button reset
49	CLOCK*	-	CPU clock	50	CNTRL*	-	AUX timing
51	PC0	-	Priority chain out	52	PCI	-	Priority chain in
53	AUXGND	-	±12 volt ground	54	AUXGND	-	±12 volt ground
55	AUX+V	-	+12 volt input	56	AUX-V	-	-12 volt input

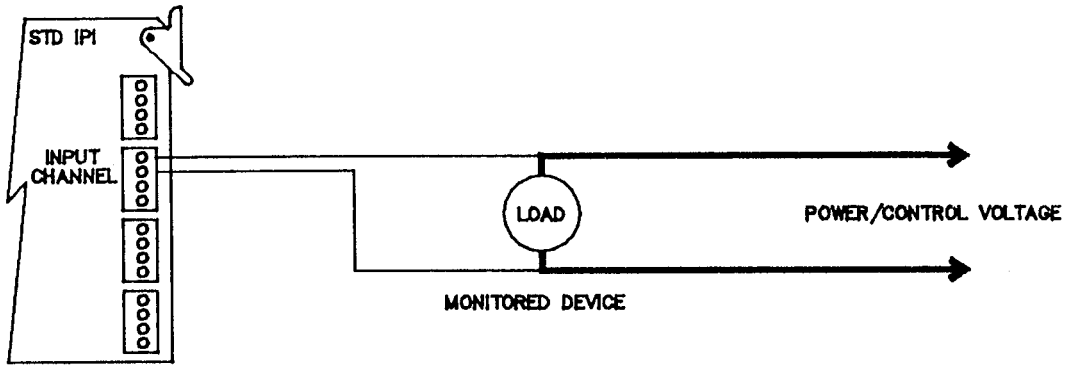
I/O CONNECTION

Input and output connections to the IPI board are made using the screw type terminals at the board edge. These terminals accept bare (tinned) leads and each terminal block can be removed from the board for easier access while installing.

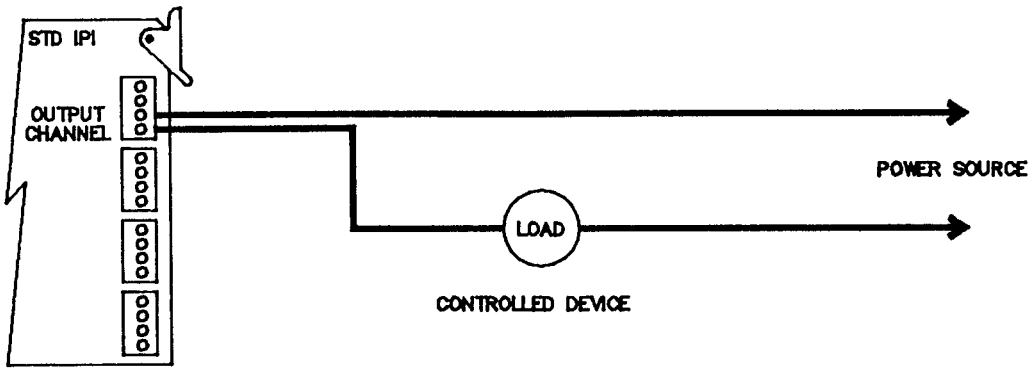
Each terminal block accepts four wires for two channels each. The connections for each of the eight channels, 0-7, are marked at the board edge, near the LED indicator for each channel. The connections for each channel are not polarized and may be connected to either of the two marked terminals.

See the diagrams below for typical connection of input and output channels.

USE CAUTION WHEN CONNECTING OR DISCONNECTING ANY DEVICES FROM THE IPI BOARD. EXTERNAL DEVICES MAY BE ENERGIZED AND HIGH VOLTAGE PRESENT ON THE IPI BOARD WHETHER OR NOT THE STD BUS SYSTEM IS TURNED ON OR IS OPERATING.



INPUT CONNECTION



OUTPUT CONNECTION

I/O DEVICES

The IPI board is compatible with a wide variety of I/O devices. Typically no special provisions are required for use of external devices with the board, however, the following special situations should be noted.

Output Channels

Devices connected to IPI board output channels must be within the specified ratings for that channel type. See the Specifications section in this reference manual for details. To prolong relay life, DC powered inductive loads should include a reversed biased diode connected directly across the load.

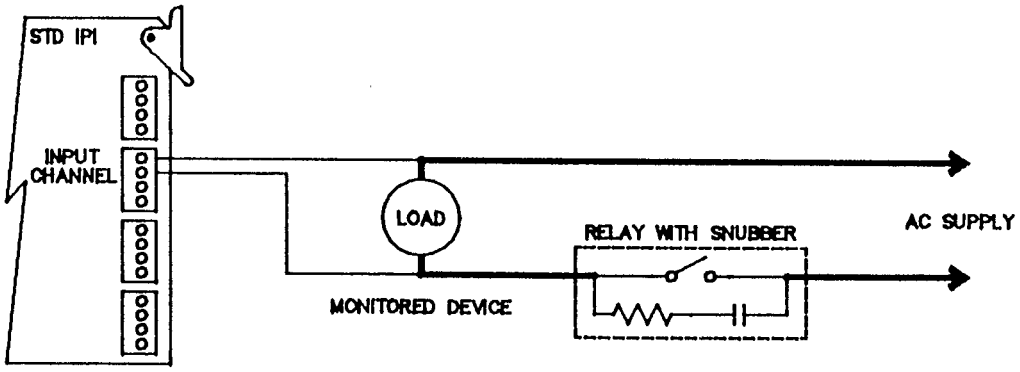
Input Channels

It should be noted that the IPI board input channels are very sensitive. They can be activated by as little as 0.5 ma of input current. This may lead to unexpected "ON" readings, due to current leakage, in some special cases.

The most probable occurrence of this situation is when a load is both controlled by an IPI output channel, and monitored by an IPI input channel. As shown below, output channels include a snubber circuit which is wired in across the relay contacts. In the off state the slight leakage of current through the snubber usually has no effect on circuit operation (and will be shunted across the load if it occurs).

If the load becomes open however, this current leakage can activate the input channel and give an "ON" reading even though the circuit is not fully energized. The only common load that is subject to this situation is a light bulb when it burns out.

Depending on the voltage driving the bulb, this "problem" can actually be used to detect burned out bulbs. By setting the output channel off, and reading the associated input channel, an instant determination can be made that the filament is still intact.



CURRENT LEAKAGE EXAMPLE

CONFIGURATION

Address Selection

The IPI board is an I/O mapped board which occupies one I/O port locations. An on-board ten position switch (labeled "Address") is used to select the address of the board. The table below shows the ten possible selections and the resulting I/O port location of the board.

Switch Setting	Location (Hex)	Location (Decimal)
0	00	0
1	10	16
2	20	32
3	30	48
4	40	64
5	50	80
6	60	96
7	70	112
8	80	128
9	90	144

Addressing of the IPI board is also controlled by the "A1", "A2", "A3", and "IOX" jumpers. The "A1", "A2", and "A3" jumpers allow the board to be located at 70 additional port locations if necessary. The "IOX" jumper allows the IPI board to be located in the extended (or "secondary") I/O map rather than the normal one. These pads should only be jumpered for special applications. See Jumper Options for more information.

Input Range

If the IPI board includes any input channels they must be set for the desired input voltage range. THE BOARD MAY BE DAMAGED IF THE VOLTAGE RANGE IS INCORRECTLY SET. The input range is set by moving the shorting jumper plugs to the desired position as noted below. The protective cover on the top of the board must be removed for access to the jumpers which are located directly behind the terminal blocks. The input ranges are:

L - 4 to 20 volts.
M - 20 to 80 volts.
H - 80 to 250 volts.

These ranges are also noted on the board's protective cover for reference.

SOFTWARE INTERFACE

The IPI board is operated through a single system I/O port. The data port is used to read or write eight bits of data to or from the board. Data may be read or written to the board at any time.

Data Port

The data port, which consists of eight data bits, contains one bit for each channel on the IPI board. The highest (most significant) bit corresponds to channel 7, the lowest (least significant) bit corresponds to channel 0.

When data is read from the IPI board, bits corresponding to input channels will be set high (1) if the input voltage is present, and low (0) if it is not.

When data is written to the IPI board, bits corresponding to output channels will turn the channel on if high (1) or off if low (0).

Data bits which are written to input channels have no effect; they may be either high or low.

Date bits read from output channels will reflect the current setting of that output channal. That is, high (1) if on, low (0) if off.

The data bit/channel functions are as follows for the different IPI board configurations.

P/N	Name	D7 D6 D5 D4	D3 D2 D1 D0
2311	IPI-1	-------- AC/DC Inputs --------	
2312	IPI-2	-------- Relay Ouputs --------	
2313	IPI-3	------- AC SSR Outputs -------	
2314	IPI-4	AC/DC Inputs	Relay Outputs
2315	IPI-5	AC/DC Inputs	AC SSR Outputs

SOFTWARE EXAMPLES

Operation of the IPI board is straightforward. It involves reading or writing data from the board, and selecting the desired data bit (channel number) to examine or change. This can be done directly (as shown in the assembly language examples) or with a short subroutine (as shown in the BASIC language examples). The C4 BASIC language from VersaLogic includes the special relay board commands (RIN and ROUT) which are directly compatible with the IPI board.

The examples below assume that the board has been addressed at hex port 20 (decimal 32).

Assembly Language

The following 8085/Z80 program fragments illustrate how the STD IPI board can be used in an assembly language environment.

```
                ;Defining the port location.
0020 =          IPI     = 20H           ;Address switch is set to "2".

                ;Reading an input channel
0100 DB20       IN   IPI                ;Read the I/O port.
0102 E640       ANI  01000000B          ;Mask out all channels except #6.
0104 C20002     JNZ  SOMEWHERE          ;Jump to somewhere if channel is ON.

                ;Setting an output channel ON.
0107 DB20       IN  IPI                 ;Read the current state of the outputs.
0109 F620       ORI 00100000B           ;Set the channel 5 bit ON.
010B D320       OUT IPI                 ;Write it to the port.

                ;Setting a channel OFF.
010D DB20       IN  IPI                 ;Read the current state of the outputs.
010F E6EF       ANI 11101111B           ;Set the channel 4 bit OFF.
0111 D320       OUT IPI                 ;Write it to the port.
```

Standard BASIC Language

The following subroutines and program fragments illustrate how the IPI board can be used with standard BASICs (or other high level languages) that include logical AND, OR, and XOR functions (the examples below are written in Microsoft BASIC-80).

Users of VersaLogic's C4 BASIC language should simply use the RIN and ROUT statements which are included for relay board interface. C4 BASIC examples are shown following the Microsoft BASIC section below.

Notice: These routines may not operate correctly with some BASICs or be suitable for your application.

```
10 REM Example for IPI use with Microsoft BASIC
 .
50 REM Set base address of MIO-24 board (20 hex = 32 decimal)
60 IPI = 32
 .
 .
 .
100 REM Turn ON channel 3
101 CHAN=3: GOSUB 570
 .
 .
150 REM Read channel 0 and do something if it's ON.
151 CHAN=0: GOSUB 510
152 IF STATE = 1 THEN GOTO 1000
 .
170 REM Turn channel 7 OFF.
171 CHAN=7: GOSUB 540
 .
 .

500 REM SUBROUTINES FOR IPI BOARD.
501 REM These routines are called with the channel # in "CHAN".
502 REM Input data is returned in "STATE" (1=ON, 0=OFF).

510 REM Read the channel in "CHAN" (0-7)
520 STATE=INP(IPI) AND 2^(CHAN+1)
530 RETURN

540 REM Turn OFF channel "CHAN" (0-7)
550 OUT IPI,(INP(IPI) AND (255 XOR 2^CHAN))
560 RETURN

570 REM Turn ON channel "CHAN" (0-7)
580 OUT IPI,(INP(IPI) OR 2^CHAN)
590 RETURN
```

C4 BASIC Language

The C4 BASIC language from VersaLogic includes the RIN and ROUT statements specifically for relay type boards. It is used as follows:

```
100 REM read channel 5 (for a board at I/O port 30 hex)
110 S=RIN(&30,5)

100 REM A subroutine to read channel C and return with status in S
110 S=RIN(&30,C) : RETURN

200 REM Turn channel 6 ON (for a board at I/O port 48 decimal)
210 ROUT 48,6,1

200 REM Turn channel C OFF (for a board at I/O port I)
210 ROUT I,C,0
```

JUMPER OPTIONS

The jumper options for the IPI board are as follows.

Name - Description

L, M, H - Sets the voltage range for each input channel. The shorting plug can be positioned to L (4-20V), M (20-80V), or H (80-250V). These jumpers are located near the terminal blocks.

C, O - Normally open/closed relay contact option. Allows each relay output channel to be jumpered for normally closed operation if desired. Remove the "O" (open) jumper and install a jumper across the "C" (closed) pads for normally closed operation. These jumpers are located just above the relay on each output channel. Note: This option applies to standard relay channels only. Solid state relay channels must have the "O" jumper installed.

A1, A2, A3 - Allows the board to be addressed to locations in addition to the ten provided by the "Address" rotary switch. The board will be selected when address lines A1-A3 are low (open) or high (jumpered). For special addressing requirements contact the factory for assistance.

IOX - Allows the board to be used in systems that include extended I/O addressing. The board may be located in either the normal (IOX open) or extended (IOX jumpered) I/O maps. Most systems will require this jumper to be open.

SPECIFICATIONS

General

I/O Channels: Eight.

Addressing: 10 position rotary switch, occupies one I/O port.

Extended Addressing: IOEXP line high or low.

Power Requirements:
- IPI-1, 3 and 5: +5V (+/-5%) @ 225 ma typical.
- IPI-2: +5V (+/-5%) @ 860 ma typical.
- IPI-4: +5V (+/-5%) @ 500 ma typical.

Operating Temperature: 0 to 55° C.

Size: 4.5" X 6.5" X .8"

Connectors:
- STD BUS: 56 pin .125" card edge.
- Input/Output: Detachable terminal blocks.

High Voltage Protection: Safety shields, front and back.

Construction: Epoxy glass PC board with solder mask and gold plated connector fingers.

Input Channels

Input Type: AC or DC voltage.

Isolation: Optically isolated to 1500 VAC.

Input Range: Selectable by channel.
- -Low: 4-20 volts AC/DC.
- -Mid: 20-80 volts AC/DC.
- -High: 80-250 volts AC/DC.

Input Current: 0.5 - 9 ma.

Delay at Turn-On: 5 ms typical.

Delay at Turn-Off: 30 ms typical.

Relay Output Channels

Contact Configuration: SPST, normally open or normally closed (jumper selectable).

Contact Life: 100,000 operations at rated AC load.

Switched Voltage: 100 VDC, 125 VAC max.

Switched Current: 1.25A max.

Switched Power: 30W (DC), 60VA (AC) resistive.

Turn-On Time: 6.5 ms typical.

Turn-Off Time: 5.5 ms typical.

AC Solid State Relay Outputs

Switching Configuration: SPST, normally open.

Switching Type: Zero crossing turn-on/turn-off.

Life: 10,000,000,000 oper. at full load, 25° C.

Switched Voltage: 5-250 VAC.

Switched Current: 1A max. (@ 5-250 VAC).

STD IPI-1 PARTS LIST

10/1/87
Rev. 0.1

Capacitors

OC2-7C2	.01 uf
OC3-7C3	1 uf 35V tantalum
C5	22 uf 25V elect.
C7	270 pf NPO

Integrated Circuits

U4	74LS273
U5	74LS244
U6	74LS240
U7, U8	74LS136
U9	74LS138

Resistors

OR1-7R1	130K ohm, 5%, 1/2W
OR2-7R2	27K ohm, 5%, 1/4W
OR3-7R3	2.2K ohm, 5%, 1/4W
OR4-7R4	56K ohm, 5%, 1/4W
R10-R17	150 ohm, 5%, 1/4W
R18	1K ohm, 5%, 1/4W
R19	10K ohm, 5%, 1/4W
RP1	10K ohm, 8 pin SIP

Semiconductors

OU1-7U1	1A, 50V FWB
OU3-7U3	4N33 opto-isolator

Miscellaneous

D10-D17	Red T1 LED, .055" L.S.
SP1	BCD rotary DIP switch
J1-J4	4 pos. removable terminal

STD IPI-2 PARTS LIST

5/1/84
Rev. 0.0

Capacitors

OC1-7C1	.033 uf 400V polyester
OC2-7C2	.01 uf
C5	22 uf 25V elect.
C7	270 pf NPO

Integrated Circuits

U4	74LS273
U5	74LS244
U6	74LS240
U7, U8	74LS136
U9	74LS138

Resistors

OR3-7R3	27 ohm, 5%, 1/4W
OR4-7R4	10K ohm, 5%, 1/4W
OR5-7R5	3K3 ohm, 5%, 1/4W
R10-R17	150 ohm, 5%, 1/4W
R18	1K ohm, 5%, 1/4W
R19	10K ohm, 5%, 1/4W
RP1	10K ohm, 8 pin SIP

Semiconductors

OD1-7D1	1N4148 diode
OQ1-7Q1	PN 2222 transistor

Miscellaneous

OU2-7U2	SPDT miniature relay
D10-D17	Red T1 LED, .055" L.S.
SP1	BCD rotary DIP switch
J1-J4	4 pos. removable terminal

STD IPI-3 PARTS LIST

5/1/84
Rev. 0.0

Capacitors

0C1-7C1	.033 uf 400V polyester
0C2-7C2	.01 uf
C5	22 uf 25V elect.
C7	270 pf NPO

Integrated Circuits

U4	74LS273
U5	74LS244
U6	74LS240
U7, U8	74LS136
U9	74LS138

Resistors

0R3-7R3	27 ohm, 5%, 1/4W
0R4-7R4	10K ohm, 5%, 1/4W
0R5-7R5	3K3 ohm, 5%, 1/4W
R10-R17	150 ohm, 5%, 1/4W
R18	1K ohm, 5%, 1/4W
R19	10K ohm, 5%, 1/4W
RP1	10K ohm, 8 pin SIP

Semiconductors

0D1-7D1	1N4148 diode
0Q1-7Q1	PN 2222 transistor