VXI bus

HP E1533A
Sixteen-Bit Digital I/O
Signal Conditioning Plug-on

User's Manual

Enclosed is the User's Manual for the HP E1533 Signal Conditioning Plug-on. Insert this manual in your VXI Module's User's Manual behind the "Signal Conditionining Plug-ons" divider.

APPLICABILITY
This SCP is used with the HP E1415.

HEWLETT® PACKARD

E1533-90002

HP E1533
Digital Input/Output
Signal Conditioning Plug-on

Introduction

The HP E1533 Digital I/O SCP provides 16 TTL compatible bits. They are grouped as two, eight-bit "channels". Each channel can be configured as an 8-bit input port, or an 8-bit output port. Further each channel when configured for output can be either passive (resistor) pull-up or active (transistor) pull-up.

About this Manual

This manual shows you how to configure the Signal Conditioning Plug-on (SCP) using SCPI commands and explains the capabilities of this SCP. The contents of this manual are:

Installation

Installation for this Plug-on is common to several others and is covered in Chapter 1 of your VXI Module User's Manual.

Identifying the Plug-on

You'll find the HP part number on the connector side of the SCP to the left of the serial number bar code. For the HP E1533, the part number is : E1533-66501

Field Wiring

Since this Digital I/O SCP is NOT ISOLATED, it is extremely important not to introduce ground current-loops in the digital ground wires. The use of isolators in your system is highly recommended.Please note a significant difference in the connection scheme for this SCP relative to other SCPs. In order to provide connection to 16 bits, the SCP position's 8 HI and 8 LO terminals are used as digital input/output connections. They are labeled D0 - D7 for each channel position. Even numbered bits connect to L terminals and odd numbered connect to H terminals. Four terminals for digital ground are provided (labeled G) for each of the two channels. The digital grounds are all connected together so are not related to specific bits.

Mapping Bits to Terminals

The relationship of bit numbers to the channel HI or channel LO terminals is dependent on the SCP's installed position. For the specific relationship between channel bits and connector terminals, see the Terminal Module labels supplied with the HP E1533 SCP or the following table.

SCP's Channel.bit	SCP 0 channels	SCP 1 channels	SCP 2 channels	SCP3 channels	SCP 4 channels	SCP 5 channels	SCP 6 channels	SCP 7 channels
0.B0 & 0.B1	0 L & H	8 L & H	16 L & H	24 L & H	32 L & H	40 L & H	48 L & H	56 L & H
0.B2 & 0.B3	1 L & H	9 L & H	17 L & H	25 L & H	33 L & H	41 L & H	49 L & H	57 L & H
0.B4 & 0.B5	2 L & H	10 L & H	18 L & H	26 L & H	34 L & H	42 L & H	50 L & H	58 L & H
0.B6 & 0.B7	3 L & H	11 L & H	19 L & H	27 L & H	35 L & H	43 L & H	51 L & H	59 L & H
1.B0 & 1.B1	4 L & H	12 L & H	20 L & H	28 L & H	36 L & H	44 L & H	52 L & H	60 L & H
1.B2 & 1.B3	5 L & H	13 L & H	21 L & H	29 L & H	37 L & H	45 L & H	53 L & H	61 L & H
1.B4 & 1.B5	6 L & H	14 L & H	22 L & H	30 L & H	38 L & H	46 L & H	54 L & H	62 L & H
1.B6 & 1.B7	7 L & H	15 L & H	23 L & H	31 L & H	39 L & H	47 L & H	55 L & H	63 L & H

Programming With SCPI Commands

The SCPI commands shown here query the SCP's identification string, and configure the two digital channels. The HP E1415 doesn't provide SCPI commands to read an input channel or control an output channel. See the following section for a digital input/output example.

Checking the ID of the SCP

To verify the SCP type(s) installed on your VXI module, use the SYSTem:CTYPE? (@<channel>) command.

- The *channel* parameter specifies a single channel in the channel range covered by the SCP of interest. The first channel number for each of the eight SCP positions are; 0,8,16,24,32,40,48, and 56.

The value returned for the HP E1533 SCP is:
HEWLETT-PACKARD,E1533A Digital I/O SCP,0,0

To determine the type of SCP installed on channels 0 through 7 send

SYST:CTYPE?   (@100)   *query SCP type @ ch 0*
enter statement here   *enter response string*

Configuring the Two Channels

The HP E1533 has two eight-bit ports. Each of these groups of eight bits is accessed as a channel. The allowable channels are the first two channels in the SCP's current SCP position. For instance, if the SCP is installed in SCP position 0, the allowable channels would be 0 and 1. If in position 7, the channels would be 56 and 57. The first channel number for each of the eight SCP positions are; 0,8,16,24,32,40,48, and 56.

Configuring for Input

To configure HP E1533 channels as 8-bit input ports use the command:
[SENSe:]FUNCtion:CONDition (@<*ch_list*>)

- The *ch_list* parameter specifies the first and/or second channel in the channel range covered by the SCP's position. *Ch_list* can include channels from multiple SCP positions.

To configure channels 40 and 41 as inputs

SENS:FUNC:COND (@140,141)

Configuring Input Polarity

To configure input channel polarity use the command:
INPut:POLarity INVerted | NORMal,(@<*ch_list*>)

To configure low channel to input inverted and high channel to input normal polarity for SCP at position 4 send:

INP:POL INV,(@132)
INP:POL NORM,(@133)   *NORM is *RST default*

Configuring for Output

To configure HP E1533 channels as 8-bit output ports use the command:
SOURce:FUNCtion[:SHAPe]:CONDition (@<*ch_list*>)

- The *ch_list* parameter specifies the first and/or second channel in the channel range covered by the SCP's position. *Ch_list* can include channels from multiple SCP positions.

To configure all channels as outputs on the two HP E1533s at SCP positions 4 and 5 send:

SOUR:FUNC:COND (@ 132:133,140:141)

Configuring Output Polarity

To configure output channel polarity use the command:
OUTPut:POLarity INVerted | NORMal,(@<*ch_list*>)

To configure low channel to output inverted, and high channel to output normal polarity for SCP at position 5 send:

```
OUTP:POL  INV,(@140)
OUTP:POL  NORM,(@141)                          NORM is *RST  default
```

Setting Output Type   Use OUTPut:TYPE ACTive | PASSive to set output drive type.

To configure first channels as active pull-ups and second channels as
passive pull-ups on the two HP E1533s at SCP positions 4 and 5 send:

```
OUTP:TYPE  ACTIVE,(@ 132,140)

OUTP:TYPE  PASSIVE,(@ 133,141)
```

Programming with the HP E1415 Algorithm Language

The following example shows the command sequence (platform/language
independent) to transfer the digital states from the 8 channel 0 inputs to the
8 channel 1 outputs. It assumes the SCP is installed in SCP position 0
(covers channels 0 and 1).

```
alg_string = "  O101.B0 = I100.B0;        put algorithm source in string var
                O101.B1 = I100.B1;
                O101.B2 = I100.B2;
                O101.B3 = I100.B3;        each input channel bit sent to an output channel bit
                O101.B4 = I100.B4;
                O101.B5 = I100.B5;
                O101.B6 = I100.B6;
                O101.B7 = I100.B7;  "

ALG:DEF 'ALG1,'alg_string'               send SCPI command to define algorithm "ALG1"

SOUR:FUNC:COND (@101)                    set 8 bits in channel 1 to output mode
INIT                                     start algorithm (using default trig sys setup)
```

When the algorithm is run, digital state on bits in channel 0 will be output
on corresponding bits in channel 1.

Over-Voltage Protection

As was mentioned in the first paragraph, the HP E1533 can sense an
over-voltage condition on any of its digital I/O terminals. This is to protect
the SCP and the module it is installed on from damaging voltage levels. If
greater than approximately 6 volts is applied to an I/O terminal, the SCP
will signal the VXI module to open all of its Calibration/Protection relays.
The module will then generate an error message in its error queue (read by
SYST:ERR?), and set a status bit in its STAT:QUES:COND register.

Note   The over-voltage protect condition is reset by issuing *RST.

---

*RST and *TST (important!)

The electrical model of a HP E1533 input is essentially a 1.2KΩ resistor in series with 3 volts DC. This circuit will look like a high logic level to a another TTL compatible digital input. When *RST or *TST? is executed, HP E1533 channels configured as outputs return to their default settings as inputs. The *RST condition for channel POLarity returns to NORM as well. You should keep this behavior in mind when applying the HP E1415 to your system. It is best to have your system digital inputs use a high input as their quiescent or safe state.

Specifications

These specifications for the HP E1533 reflect its performance while installed on your VXI module.

General Specifications

Output Characteristics	Characteristic	OUTPut:TYPE ACTive	OUTPut:TYPE PASSive
	current source (logic 1)	5 mA	0
	current sink (logic 0)	48 mA	48 mA
	Voltage (logic 1)	2.5V Min @ 5mA load	NA
	Voltage (logic 0)	.5 Max @ 48mA load	.5 Max @ 48mA load

Input Characteristics	Characteristic	
	Equivalent circuit	1.2 KΩ connected to 3 Volts
	Maximum input low	0.8 Volts
	Minimum input high	2 Volts

Maximum voltage applied to any input/output terminal	+5.5 V (inputs clamped at -.8V, must limit -current)

NOTE   For detailed information on I/O characteristics, refer to a data sheet for the 75ALS160 Interface Bus Transceiver