HP E1531
Eight-Channel Voltage Output Signal Conditioning Plug-on

User's Manual

Enclosed is the User's Manual for the HP E1531 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 and HP E1419.

E1531-90002

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Introduction

The HP E1531 provides an eight channel non-isolated voltage source. Each output can source ±16 volts at up to 5mA output current. Each HP E1531 output is current-limited to protect it from short-circuits.

About this Manual

This manual shows you how to control 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 E1531, the part number is : E1531-63501

Field Wiring

Since this Voltage Output SCP is NOT ISOLATED, it is extremely important not to introduce ground current-loops in the channel LO wires. To avoid this, we recommend the load be isolated from ground. See the wiring diagram that follows.

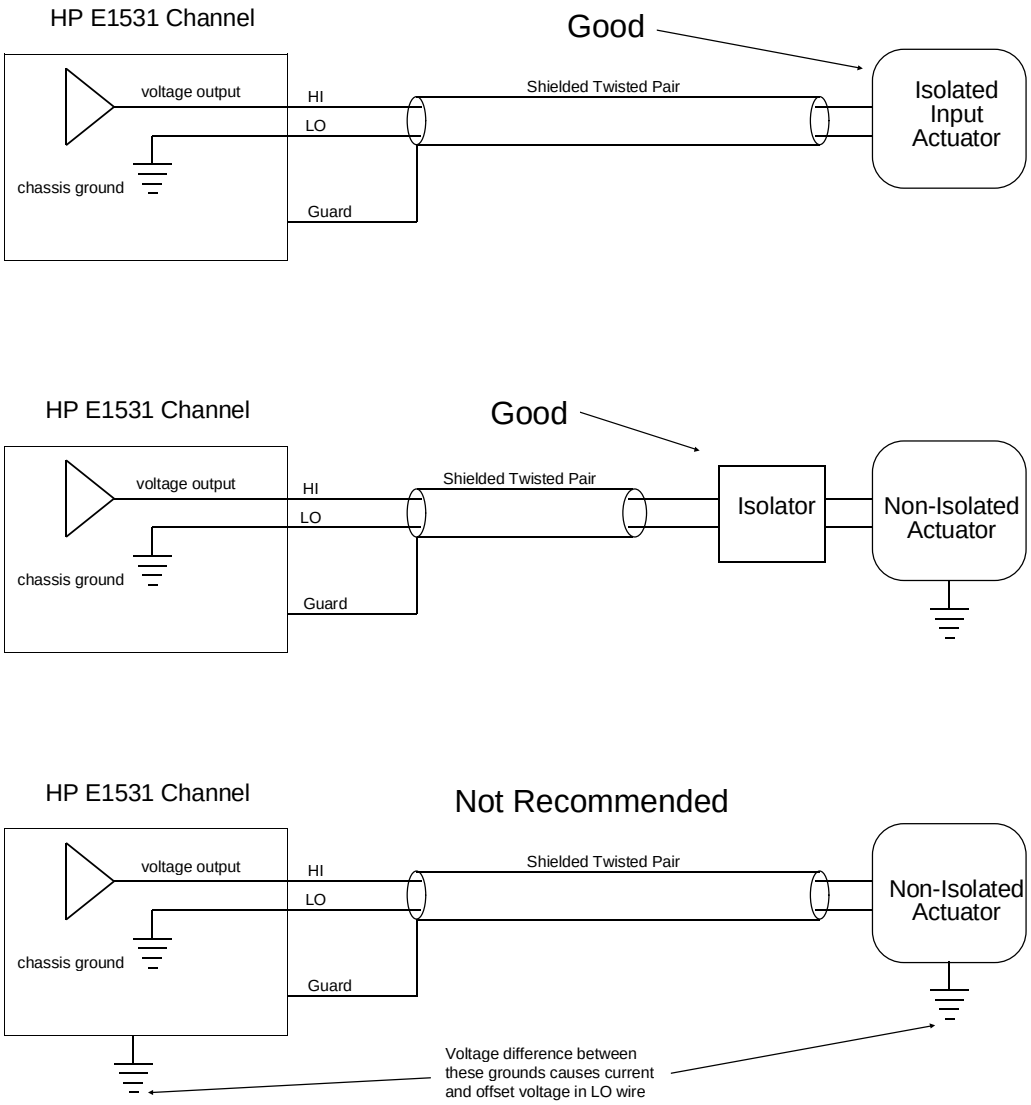

Figure 1 Recommended Field Wiring

The following table maps SCP channels to Terminal Module terminal names. Also see the Terminal Module labels supplied with your HP E1531.

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

Programming With SCPI Commands

The only SCPI command shown here is to query the SCP's identification string. The HP E1415 doesn't provide SCPI commands to control the SCP's output amplitude. See the following section for an example output control 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 E1531 SCP is:

HEWLETT-PACKARD,E1531A 8-Channel Voltage Output SCP,0,0

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

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

Programming with the HP E1415 Algorithm Language

The following example shows the command sequence (platform/language independent) to send values to the SCP output channels. It assumes the SCP is installed in SCP position 0. Use SCP positions 4 - 7 for the HP E1419A.

```
                    first define the algorithm source string
alg_string = "   static float chan_0 = 0, chan_1 = 1, chan_2 = 2; /* these lines define variables and */
                 static float chan_3 = 3, chan_4 = 4, chan_5 = 5; /* preset them to arbitrary startup *
                 static float chan_6 = 6, chan_7 = 7;  /* values that match their channel number */
                 O100 = chan_0;
```

```
                O101 = chan_1;
                O102 = chan_2;
                O103 = chan_3;
                O104 = chan_4;
                O105 = chan_5;
                O106 = chan_6;
                O107 = chan_7; "

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

INIT                                 start algorithm (using default trig sys setup)

   The algorithm has preset output values for each channel, but the following example
   is how your application program can modify those values while the algorithm is running
ALG:SCALAR 'ALG1','chan_0',1.25
ALG:SCALAR 'ALG1','chan_1',-2.17
ALG:SCALAR 'ALG1','chan_2',12.2
ALG:SCALAR 'ALG1','chan_3',5.0
ALG:SCALAR 'ALG1','chan_4',-8.33
ALG:SCALAR 'ALG1','chan_5',9.0
ALG:SCALAR 'ALG1','chan_6',0.45
ALG:SCALAR 'ALG1','chan_7',-6.66

ALG:UPDATE          must command HP E1415 to update the algorithm variables
```

Sensing Output Voltage

Each output channel is also an analog input channel. By reading the value on this input channel, you can verify the output value programmed. See the following algorithm language example:

```
O100 = voltage_output   /* program the output current for channel 0    */
readback = I100      /* sense channel voltage */
```

In the example above it is important to remember that all inputs are measured BEFORE outputs are updated. This means that the programmed output value is not sensed until the next algorithm cycle.

Notes

This readback value is only an approximation of the actual output voltage. The SCP's output is calibrated to specification each time you execute the *CAL? command. The input channels for this SCP are not calibrated by *CAL?. The programmed output value can be more accurate than the sense value. The sense value is used only to verify the approximate programmed output.

Over-Voltage Protection

The HP E1531 can sense an over-voltage condition on any of its outputs. This is to protect the SCP and the module it is installed on from damaging voltage levels applied to its outputs. If greater than approximately 20 volts is applied to an output channel, the SCP may 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 can only be reset with *RST

Short Circuit Protection

As mentioned in the first paragraph, the HP E1531 will current limit to protect itself. The SCP will typically current limit between 24 and 60mA. No error message will be generated, and the Overvoltage Protect relays will not open.

*RST *CAL? and *TST? (important!)

During execution of *RST, *CAL?, and *TST?, the outputs of the HP E1531 will be disconnected momentarily from your system. When the operation is completed, outputs will be programmed to output approximately 0 volts. The *RST command is typically used at the beginning of all application programs. Make sure the design of your system takes into account this *RST behavior.

SCP Calibration

The HP E1415 calibrates all channels of this SCP when the *CAL? or CALibration:SETup commands are sent. If this SCP is replaced with a different HP E1531, or this SCP is moved to a different SCP location, the calibration must be repeated. By default, the HP E1415 uses the Least Squares Curve Fitting method to determine the gain and offset calibration constants for each HP E1531 channel. This maximizes the overall channel accuracy (see "Voltage Output Accuracy" in specifications section).

Because the Least Squares Curve Fit method does not force the output at a programmed zero to be zero, there can be up to 3.6mV error at this point. By sending then DIAG:CAL:SETUP 0 command before you send the *CAL?, or CAL:SET commands, all HP E1531 and HP E1532 outputs will be calibrated to reduce the error at their programmed zero point. The trade-off is that this can approximately double the error at the HP E1531's ±2 Volt point. The specifications then become ±0.02% of expected output ±6.5mV offset. DIAG:CAL:SETUP 1 or *RST before the next *CAL? restores the Least Squares Fit calibration.

Specifications

These specifications for the HP E1531 reflect its performance while installed on your VXI module. These specifications are not to be added to those presented in your VXI module User's Manual.

General Specifications

Maximum voltage applied to any output Hi terminal		Damage level: > ±42 V peak
Voltage Output Range		at least ±16 Volts Full Scale at up to 5 mA
Voltage Resolution		16 bits (monotonic to 16 bits) = 500 µV
Noise		<1.2mV rms (20Hz - 250KHz)
Output Settling Time		300 µsec
Temperature Coefficient		(for change in temperature from *CAL after 1 hr. warm up) Accuracy: ±0.004%/°C Offset Error: 0.2mV/°C
Voltage Output Accuracy		(90 days) 23°C ±1°C (with *CAL? done after 1 hr. warm up, and applied load is >=100 KΩ) (±0.02% of expected output)±(3.6mV Offset Error)
Output Impedance		50 Ohms , 15 Ohms through Common Mode Choke
Power Required	+5 Volts:	Typical 11mA, Maximum 15mA
	±24 Volts:	With 0 output: Typical 60mA, Max 75mA With outputs at 5mA: Typical 100mA, Max 115mA