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HP 75000 SERIES B and C

Eight-Channel Current Source Signal Conditioning Plug-on HP E1505

User's Manual

The HP E1505 manual also applies to HP E1413Bs as HP E1413 Option 15.

Enclosed is the User's Manual for the HP E1505 Signal Conditioning Plug-on. Insert this manual in your HP E1413/E1313 manual behind the "Signal Conditioning Plug-ons" divider.

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E1505-90002

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HP E1505
Current Source
Signal Conditioning Plug-on

Introduction

The HP E1505 is a Signal Conditioning Plug-on that provides eight current sources programmable to one of two current levels. Each current source can be programmed to provide either 30µA, or 488µA. Also provided is input over-voltage detection on each channel.

About this Manual

This manual shows you how to control the Signal Conditioning Plug-on (SCP) using SCPI commands as well as Register-Based commands, and explains the capabilities of this SCP. Finally, it covers specifications for this SCP. Installation for this Plug-on is common to several others and is covered in Chapter 1 your HP E1413/E1313 manual. The contents of this manual are:

- Field Wiring 3
- Connecting To The Terminal Module 5
- Programming With SCPI Commands 7
- Programming With Register Commands 9
- Specifications 10

Field Wiring

The E1505 SCP is used to supply excitation current to resistance and resistance-temperature measurements. Figure 1 shows the general method of connection for both 4-wire and 2-wire connections.

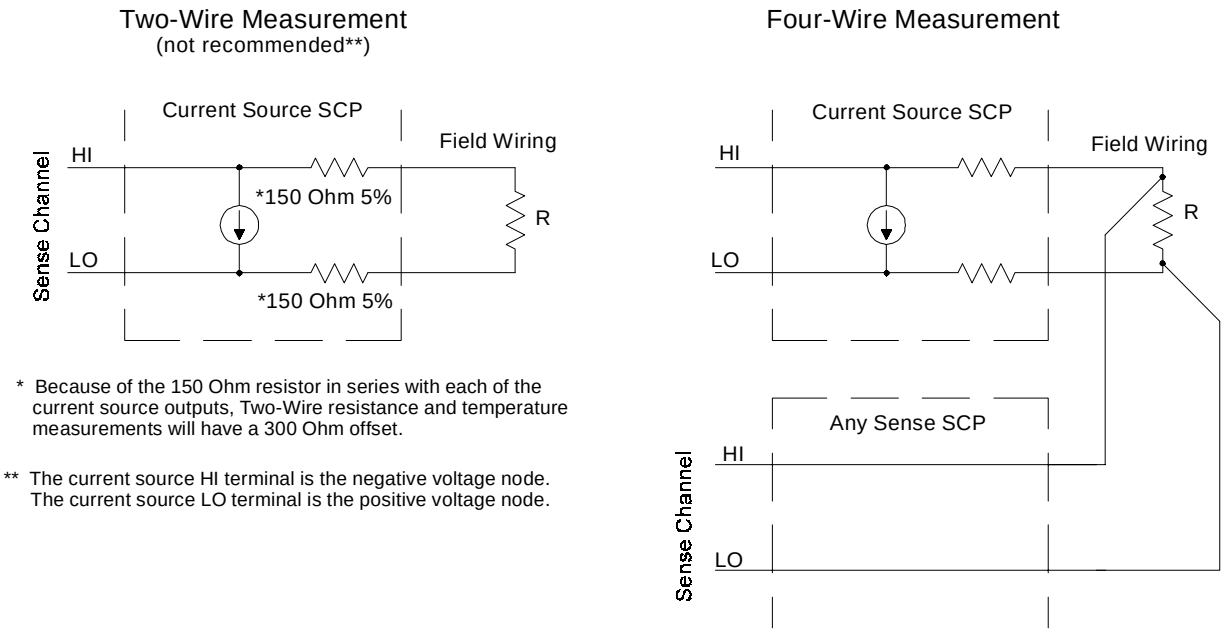


Figure 1 Wiring for Resistance and Temperature

Connecting To The Terminal Module

This section shows how to make connections to the Terminal Module.

The SCP connections for the Terminal Modules are shown on the stick-on labels that came with the SCP. Use the appropriate label for the type of Terminal Module you have. The connections and appropriate stickers are as follows:

- For HP E1413C and above Terminal Modules, use stickers for HP E1505 SCPs. The connections are shown in Figure 2.
- For HP E1313 Terminal Moduless, use stickers for HP E1505 SCPs. The connections are shown in Figures 3 and 4.
- For HP E1413B and below Terminal Modules, use stickers for HP E1413 Option 15 SCPs. The connections are shown in Figure 5.

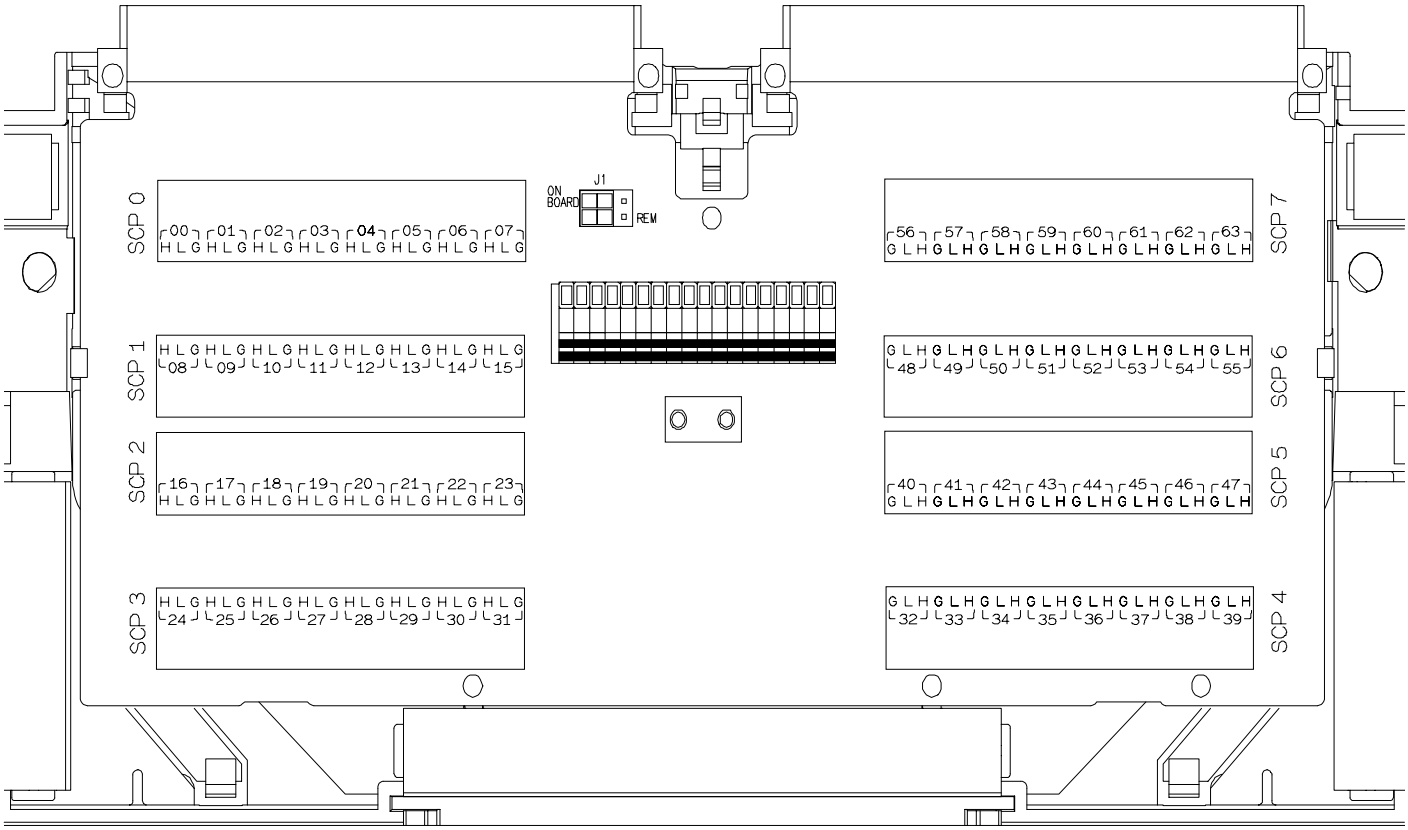


Figure 2 HP E1505 C-Size Terminal Module Connections

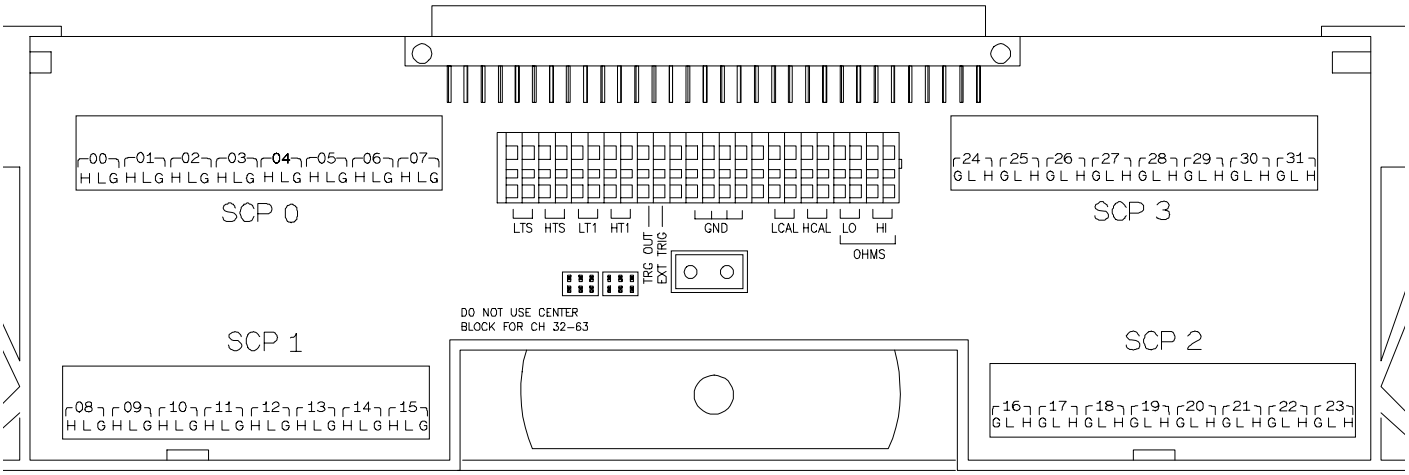


Figure 3 HP E1505 B-size Terminal Module Connections (Ch 00-31)

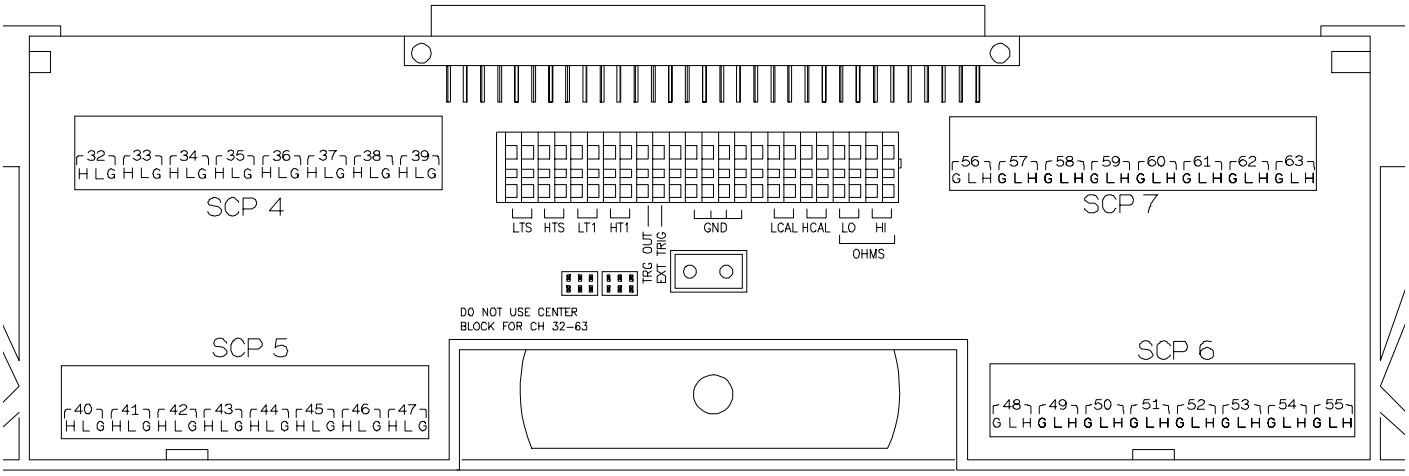


Figure 4 HP E1505 B-size Terminal Module Connections (Ch 32-63)

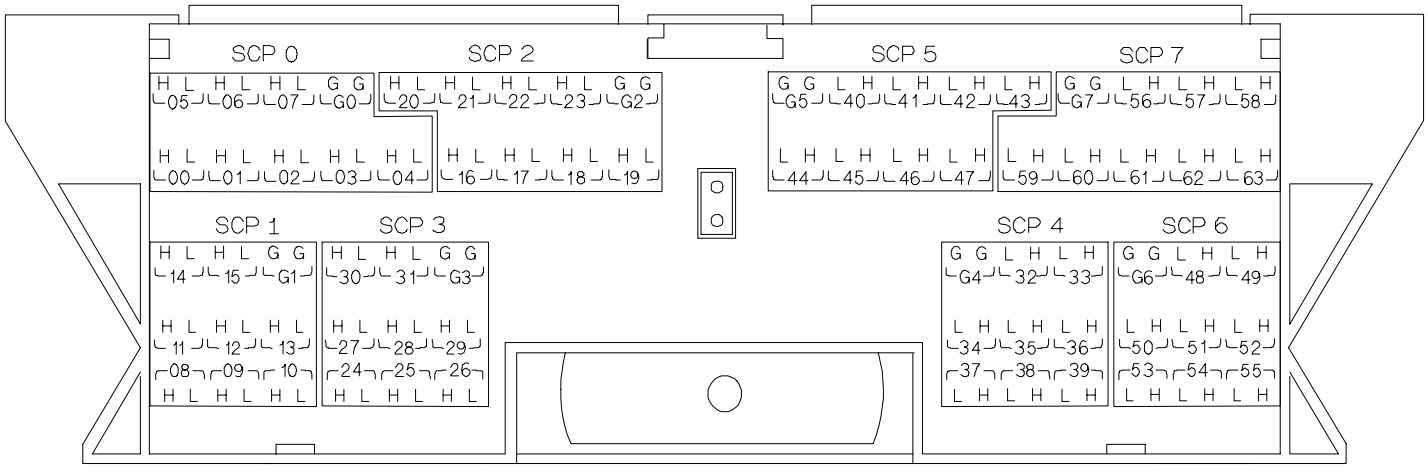


Figure 5 HP E1413 Option 15 Terminal Module Connections

Programming With SCPI Commands

The SCPI commands shown here are covered in Chapters 3 and 5 of your HP E1413/E1313 manual. This section will relate those commands to the parameter values which are specific to this Plug-on.

Checking the ID of the SCP

To verify the SCP type(s) installed on the HP E1413/E1313 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 SCP in an HP E1413B is:
HEWLETT-PACKARD,E1413 Opt 15 8-Channel Current Source SCP,0,0

The value returned for the SCP in an HP E1313A/E1413C is:
HEWLETT-PACKARD,E1505 8-Channel Current Source 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*

Setting Current Output Level

To set the current output level use the OUTPut:CURRent:AMPLitude <*level*>,(@<*ch_list*>) command.

- The *level* parameter can set the current output level to either 30µA or 488µA. The default unit for *level* is Amps DC. You may also include a units suffix to specify milliamps (ma), or microamps (ua). The level parameter will also accept MIN (30µA) and MAX (488µA). Use 488µA for resistance measurements under 8000 Ohms and 30µA for resistances of 8000 Ohms and greater.

Notes

1. 30µA is the *RST and Power-On amplitude for all filter channels.
2. Whenever you change the current amplitude, you must execute *CAL? or CAL:SETup then CAL:SETup? to calibrate the newly selected output amplitude.

To set channels 0 through 15 and 20 to measure < 8K Ohm, send

OUTP:CURR:AMPL 488E-6, (@100:115,120)

To set channels 16 through 31 to measure 8K Ohm or greater, send

```
OUTP:CURR:AMPL  30ua,(@116:131)
```

Querying the Current Level

To query any channel to determine the current level use the OUTPut:CURRent:AMPLitude? (@<*channel*>) command. The OUTP:CURR? command returns either +4.88E-4 or +3.0E-5.

- The *channel* parameter must specify a single channel.

To query the current level of channel 2 send

```
OUTP:CURR:AMPL? (@102)          query channel 2
enter statement here            returns 4.88e-4 or 3.0e-5
```

Turning Current Source Channels Off and On

To Disable and re-enable the current source channel use OUTPut:CURRent[:STATe] <*enable*>,(@<*ch_list*>) command.

- The *enable* parameter can take the values ON or 1, and OFF or 0.

To disable current source channels 0 through 15 and 20, send

```
OUTP:CURR:STAT   OFF, (@100:115,120)
```

To enable current source channels 16 through 31, send

```
OUTP:CURR:STAT  ON,(@116:131)
```

Note The *RST and Power-On state for all Current Source SCP channels is OFF.

Querying the Current Source State

To query any channel to determine the current source output state use the OUTPut:CURRent[:STATe]? (@<*channel*>) command. The OUTP:CURR? command returns either a 1 for ON or a 0 for OFF.

- The *channel* parameter must specify a single channel.

To query the current state of channel 2 send

```
OUTP:CURR:STAT?  (@102)         query channel 2
enter statement here            returns 1 or 0
```

Register Based Programming

The register-based commands shown here are covered in Appendix D of the HP E1413/E1313 manual. You should read that section first to become familiar with accessing registers and executing Register-Based Commands. This section will relate those commands to the parameter values which are specific to this Plug-on.

When Register Programming an SCP most communication is through the Signal Conditioning Bus. For that we'll use the Register Commands:

SCBWRITE <*regaddr*> <*regvalue*>

and

SCBREAD? <*regaddr*>

HP E1505 Register Map

Read (returned value)	Write(<*regvalue*>)	SCP Register	<*regaddr*> Value
SCP ID ($A0A0_{16}$)		Whole SCP Reg 0	$00ppp000000_2$
SCP Gain Scale ($XXX0_{16}$)		Whole SCP Reg 1	$00ppp000001_2$
Channel Control ($XXX0_{16}$=Off&Low, $XXX1_{16}$=Off&High, $XXX2_{16}$=On&Low, $XXX3_{16}$=On&High)		Channel Reg 0	$01pppccc000_2$
Channel Gain ($XXX0_{16}$)		Channel Reg 1	$01pppccc001_2$
	Calibration ($Xnnn_{16}$) where nnn=Cal Value	Channel Reg 7	$01pppccc111_2$

XX=don't care

ppp=Plug-on
ccc=SCP channel

Checking ID of SCP

To query an SCP for its ID value, write the following value to Parameter Register 1:

($SCP\ number$) $\times 40_{16}$

Then write the opcode for SCBREAD? (0800_{16}) to the Command Register. The ID value will be written to the Query Response Register.

Controlling Current Source Channels

To set current amplitude and enable or disable an SCP channel, write the following SCP channel address to Parameter Register 1:

200_{16} + ($SCP\ number$) $\times 40_{16}$ + ($SCP\ channel\ number$) $\times 8_{16}$

Write one of the following control values to Parameter Register 2:

0000_{16} = current low, output off
0001_{16} = current high, output off
0002_{16} = current low, output on
0003_{16} = current high, output on

Then write the opcode for SCBWRITE (0810_{16}) to the Command Register.

Channel Calibration Register

The channel calibration registers control DACs that adjust the current output of each current source channel. The Register-Based command CARDCAL? (1000_{16}) controls these registers and the user should not write to them.

Specifications

The general specifications for the HP E1505 reflect the performance of the Signal Conditioning Plug-on itself. The resistance performance specification reflects the combined performance of the HP E1413/E1313 and the SCP.

General Specifications

Compliance

L terminal is at ground
H terminal ±16 V with respect to ground

Output Accuracy

(90 days) 23°C ±1°C (with *CAL? done after 1 hr warm up)

Current Amplitude µA	Output Accuracy
30.518	±9 nA
488.28	± 60 nA

Temperature Coefficient

Current Amplitude µA	Temperature Coefficient
30.518	±0.9 nA/°C
488.28	± 6 nA/°C

Ripple and Noise

(7.5 KOhm resistor to L, 3 sigma)

Current Amplitude µA	Ripple and Noise
30.518	±9 nA
488.28	± 15 nA

Off Leakage Current

(7.5 KOhm resistor to L)

0 - 30 °C	Less than ±10 nA
30 - 55 °C	±10 nA + 1.6 nA/°C

Resistance Specifications

(90 days) 23°C ±1°C (with *CAL? done after 1 hr warm up and CAL:ZERO? within 5 min.).

Range Ohms FS	Current Amplitude μA	(A/D Range VDC)	Maximum Resolution Ω
131.1 K	30.518	4	4
32.77 K	30.518	1	1
8.192 K	30.518	.25	.25
8.192 K	488.28	4	.25
2.048 KΩ	488.28	1	.0625
512	488.28	.25	.015
128	488.28	.0625	.0039

Resistance Accuracy

(Four-Wire connection)

Gain:

Current Amplitude	Resistance Accuracy
30.518 μA	.035% of reading
488.28 μA	.02% of reading

Offset: Ω

$$\frac{\textit{offset of input SCP (in Volts)}}{\textit{current source value (in Amps)}}$$

Noise: Ω

$$\frac{\textit{noise of input SCP (in Volts)}}{\textit{current source value (in Amps)}}$$

Notes

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