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**HP 75000 SERIES C**

# **Eight-Channel Straight-Through Signal Conditioning Plug-on HP E1413/E1313 Option 11**

## **User's Manual**

Enclosed is the User's Manual for the HP E1413/E1313 Option 11 Signal Conditioning Plug-on. Insert this manual in your HP E1413/E1313 manual behind the "Signal Conditioning Plug-ons" divider.



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# HP E1413/E1313 Option 11 Eight-Channel Straight-Through Signal Conditioning Plug-on

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## Introduction

The HP E1413/E1313 Option 11 is the most basic Signal Conditioning Plug-on. The Option 11 provides 8 hard wired paths that do not modify the input signal at all. The Option 11 SCP provides input over-voltage detection and open transducer 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. The contents of this manual are:

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## Installation

Installation for this Plug-on is common to several others and is covered in Chapters 1 and 2 of your HP E1413/E1313 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 E1413/E1313 Option 11, the part number is : E1413-63511

# 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 Option 11 SCP is:

HEWLETT-PACKARD,E1413 Opt 11 8-Channel Straight-Through SCP,0,0

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

`SYST:CTYP? (@100)`

*enter statement here*

*query SCP type @ ch 0*

*enter response string*

## Querying the Filter Cutoff Frequency

While the Option 11 does not provide any filtering, the cutoff frequency can be queried. Response to this query will always be 0 (zero). To query any channel for its cutoff frequency use the

`INPut:FILTer[:LPASs]:FREQuency? (@<channel>)` command. The `INP:FILT:FREQ?` command returns the numeric cutoff value currently set for the channel specified.

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

To query the cutoff frequency of channel 6 send

`INP:FILT:FREQ? (@106)`

*enter statement here*

*query channel 6*

## Querying the Filter State

While the Option 11 does not provide any filtering, the state of the filter can be queried. Response to this query will always be 0 (zero). To query any channel to determine if it is enabled or disabled use the

`INPut:FILTer[:LPASs][:STATe]? (@<channel>)` command. The `INP:FILT?` command returns a 0 if the channel is OFF or a 1 if the channel is ON.

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

To query the filter state of channel 2 send

INP:FILT? (@102)

*query channel 2*

*enter statement here*

## Querying the Channel Gain

While the Option 11 does not provide amplifiers, the channel gain can be queried. Response to this query will always be 1. To query any channel to determine its gain setting use the INPut:GAIN? (@<channel>) command. The INP:GAIN? command returns the current gain value for the specified channel.

- The channel parameter must specify a single channel.

To query the gain setting of channel 8 send

INP:GAIN? (@108)

*query channel 8*

*enter statement here*

## Detecting Open Transducers

This SCP provides a method to detect open transducers. When Open Transducer Detect (OTD) is enabled, the SCP injects a small current into the HIGH and LOW input of each channel. The polarity of the current pulls the HIGH inputs toward +17 volts and the LOW inputs towards -17 volts. If a transducer is open, measuring that channel will return an over-voltage condition. OTD is available on a per SCP basic. all eight channels of an SCP are enabled or disabled together. See Figure 1 for a simplified schematic diagram of the OTD circuit.

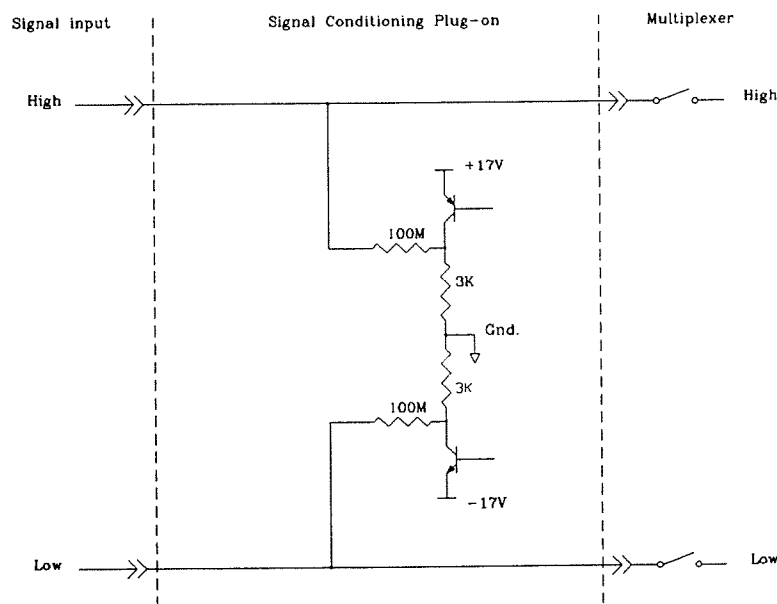


Figure 1 Open Transducer Detect Circuit

## NOTE

When OTD is enabled, the inputs have up to 0.2 $\mu$ A injected into them. If this current will adversely affect your measurement, but you still want to check for open transducers, you can enable OTD, make a single scan, check the CVT for bad measurements, then disable OTD and make your regular measurement scans. The specifications apply only when OTD is off.

To enable or disable Open Transducer Detection, use the DIAGnostic:OTDetect *<enable>*, (@*<ch\_list>*) command.

- The *enable* parameter can specify ON or OFF
- An SCP is addressed when the *ch\_list* parameter specifies a channel number contained on the SCP. The first channel on each SCP is:  
0, 8, 16, 24, 32, 40, 48, and 56

To enable Open Transducer Detection on all channels on SCPs 1 and 3:

DIAG:OTD ON, (@100,116) *0 is on SCP 1 and 16 is on SCP3*

To disable Open Transducer Detection on all channels on SCPs 1 and 3:

DIAG:OTD OFF, (@100,116)

## 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 you will use the Register Commands:

SCBWRITE *<regaddr>* *<regvalue>*

and

SCBREAD? *<regaddr>*

### HP E1413/E1313 Option 11 Register Map

| Read (returned value)        | Write( <i>&lt;regvalue&gt;</i> ) | SCP Register    | <i>&lt;regaddr&gt;</i> Value |
|------------------------------|----------------------------------|-----------------|------------------------------|
| SCP ID (2020 <sub>16</sub> ) |                                  | Whole SCP Reg 0 | 00ppp000000 <sub>2</sub>     |

ppp=Plug-on  
ccc=SCP channel

In addition you will access bits in the Card Control register to control Open Transducer Detection.

## 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<sub>16</sub>) to the Command Register. The ID value will be written to the Query Response Register.

## Detecting Open Transducers

Open Transducer Detection (OTD) is controlled by bits in the Card Control Register. For more information on OTD see Figure 1.

**Card Control Register**

**(Base + 12<sub>16</sub>)**

| 15            | 14        | 14-13  | 12         | 11    | 10-8       | 7-0                    |
|---------------|-----------|--------|------------|-------|------------|------------------------|
| PSI Pwr Reset | FIFO Mode | unused | FIFO Clear | VPPEN | A24 Window | Open Transducer Detect |

Writing a one (1) to a bit enables open transducer detect on that signal conditioning module. Writing a zero (0) to a bit disables open transducer detect. See following table.

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|-------|-------|-------|-------|-------|-------|-------|-------|
| SCP 7 | SCP 6 | SCP 5 | SCP 4 | SCP 3 | SCP 2 | SCP 1 | SCP 0 |

# Specifications

These specifications for the HP E1413/E1313 Option 11 reflect the combined performance of the HP E1413/E1313 and the Option 11 Signal Conditioning Plug-on. These specifications are not to be added to those presented in the HP E1413/E1313 User's Manual.

## General Specifications

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### Measurement ranges

|             |                                                                                                                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DC Volts    | (Opt 11) $\pm 62.5\text{mV}$ to $\pm 16\text{V}$ Full Scale                                                                                                                                                |
| Temperature | Thermocouples - $-200$ to $+1700\text{ }^{\circ}\text{C}$<br>Thermistors - (Opt 15 required) $-80$ to $+160\text{ }^{\circ}\text{C}$<br>RTD's - (Opt 15 required) $-200$ to $+850\text{ }^{\circ}\text{C}$ |
| Resistance  | (Opt 15 with opt 11) $512\text{ ohms}$ to $131\text{ Kohms FS}$                                                                                                                                            |
| Strain      | $25,000\text{ }\mu\text{e}$ or limit of linear range of strain gage                                                                                                                                        |

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|                                                                |                                                                            |
|----------------------------------------------------------------|----------------------------------------------------------------------------|
| <b>Maximum input voltage</b><br>(Normal mode plus common mode) | Operating: $< \pm 16\text{ V peak}$ Damage level: $> \pm 42\text{ V peak}$ |
|----------------------------------------------------------------|----------------------------------------------------------------------------|

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|                                    |                                                                            |
|------------------------------------|----------------------------------------------------------------------------|
| <b>Maximum common mode voltage</b> | Operating: $< \pm 16\text{ V peak}$ Damage level: $> \pm 42\text{ V peak}$ |
|------------------------------------|----------------------------------------------------------------------------|

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|                              |                                      |
|------------------------------|--------------------------------------|
| <b>Common mode rejection</b> | $0$ to $60\text{Hz}$ $-105\text{dB}$ |
|------------------------------|--------------------------------------|

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|                        |                                             |
|------------------------|---------------------------------------------|
| <b>Input impedance</b> | greater than $100\text{ Mohm}$ differential |
|------------------------|---------------------------------------------|

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|                                |                                                         |
|--------------------------------|---------------------------------------------------------|
| <b>Maximum tare cal offset</b> | (Maximum tare offset depends on A/D range and SCP gain) |
|--------------------------------|---------------------------------------------------------|

| A/D range<br>$\pm\text{V F. Scale}$ | 16     | 4      | 1      | 0.25   | 0.0625 |
|-------------------------------------|--------|--------|--------|--------|--------|
| Max Offset                          | 3.2213 | .82101 | .23061 | .07581 | .03792 |



## Measurement accuracy DC Volts

(90 days) 23°C ±1°C (with \*CAL? done after 1 hr warm up and CAL:ZERO? within 5 min.). If autoranging is ON, add ±.02% FS to accuracy specifications. For E1313, multiply Noise Spec. by 1.4.

| A/D range<br>±V F.Scale | Linearity<br>% of reading | Offset Error | Noise<br>3 sigma | Noise*<br>3 sigma |
|-------------------------|---------------------------|--------------|------------------|-------------------|
| .0625                   | 0.01%                     | 5.3 µV       | 18 µV            | 8 µV              |
| .25                     | 0.01%                     | 10.3 µV      | 45 µV            | 24 µV             |
| 1                       | 0.01%                     | 31 µV        | 110 µV           | 90 µV             |
| 4                       | 0.01%                     | 122 µV       | 450 µV           | 366 µV            |
| 16                      | 0.01%                     | 488 µV       | 1.8 mV           | 1.5 mV            |

\* [SENSe:]FILTer[:LPASs][:STATe] ON (max scan rate - 100 rdgs/sec/channel)

Temperature Coefficients: Gain - 10ppm/°C. Offset - (0 - 40°C) .14µV/°C, (40 - 55°C) .8µV+.38µV/°C

## Measurement accuracy Temperature

(90 days) 23°C ±1°C (with \*CAL? done after 1 hr warm up and CAL:ZERO? within 5 min.). If autoranging is ON, add ±.02% FS to accuracy specifications.

(simplified specifications, see temperature accuracy graphs in HP E1413/E1313 manual for details)

The temperature accuracy specifications include instrument and firmware linearization errors. The linearization algorithm used is based on the IPTS-68(78) standard transducer curves. Add your transducer accuracy to determine total measurement error.

### Thermocouples

|                |            |                  |                  |                  |                  |
|----------------|------------|------------------|------------------|------------------|------------------|
| Type E         | A/D Filter | -200 to 0 °C     | 0 to 200 °C      | 200 to 400 °C    | 400 to 800 °C    |
|                | OFF<br>ON* | 2.25°C<br>1.65°C | 0.37°C<br>0.22°C | 0.27°C<br>0.15°C | 0.25°C<br>0.15°C |
| Type EExtended | A/D Filter | -200 to 0 °C     | 0 to 200 °C      | 200 to 800 °C    | 800 to 1000 °C   |
|                | OFF<br>ON* | 13.3°C<br>12.7°C | 0.70°C<br>0.40°C | 0.30°C<br>0.20°C | 0.60°C<br>0.30°C |
| Type J         | A/D Filter | -200 to 0 °C     | 0 to 200 °C      | 200 to 600 °C    | 600 to 775 °C    |
|                | OFF<br>ON* | 2.10°C<br>1.75°C | 0.45°C<br>0.25°C | 0.35°C<br>0.20°C | 0.35°C<br>0.20°C |
| Type K         | A/D Filter | -200 to 0 °C     | 0 to 400 °C      | 400 to 800 °C    | 800 to 1400°C    |
|                | OFF<br>ON* | 3.50°C<br>3.10°C | 0.60°C<br>0.30°C | 0.50°C<br>0.25°C | 0.60°C<br>0.35°C |
| Type R         | A/D Filter | 0 to 100 °C      | 100 to 200 °C    | 200 to 600 °C    | 600 to 1000 °C   |
|                | OFF<br>ON* | 4.25°C<br>2.60°C | 2.75°C<br>1.65°C | 2.25°C<br>1.20°C | 1.70°C<br>0.90°C |

\* [SENSe:]FILTer[:LPASs][:STATe] ON (max scan rate - 100 rdgs/sec/channel)

**Measurement accuracy  
Temperature (cont.)**

(simplified specifications, see temperature accuracy graphs in  
HP E1413/E1313 manual for details)

**Thermocouples (cont.)**

| Type S | A/D Filter | 0 to 100 °C      | 100 to 200 °C    | 200 to 800 °C    | 800 to 1750 °C   |
|--------|------------|------------------|------------------|------------------|------------------|
|        | OFF<br>ON* | 5.50°C<br>4.00°C | 3.50°C<br>2.30°C | 2.50°C<br>1.50°C | 1.80°C<br>0.90°C |

| Type T | A/D Filter | -200 to -100°C   | -100 to 0 °C     | 0 to 200 °C      | 200 to 400 °C    |
|--------|------------|------------------|------------------|------------------|------------------|
|        | OFF<br>ON* | 2.38°C<br>1.78°C | 0.80°C<br>0.50°C | 0.55°C<br>0.30°C | 0.38°C<br>0.20°C |

**5K $\Omega$  Reference Thermistor**

| A/D Filter | -10 to 65 °C        | 65 to 85 °C         |
|------------|---------------------|---------------------|
| OFF<br>ON* | 0.012°C<br>0.0095°C | 0.016°C<br>0.0100°C |

**100 $\Omega$  Reference RTD**

| A/D Filter | -125 to 75°C     |
|------------|------------------|
| OFF<br>ON* | 0.40°C<br>0.21°C |

**100 $\Omega$  RTD**

| A/D Filter | -200 to 75 °C    | 75 to 300 °C     | 300 to 600 °C    | 600 to 970 °C    |
|------------|------------------|------------------|------------------|------------------|
| OFF<br>ON* | 0.12°C<br>0.07°C | 0.28°C<br>0.18°C | 0.35°C<br>0.25°C | 0.45°C<br>0.36°C |

**2252 $\Omega$  Thermistor**

| A/D Filter | 0 to 30 °C         | 30 to 70 °C        | 70 to 80 °C        | 80 to 100 °C       |
|------------|--------------------|--------------------|--------------------|--------------------|
| OFF<br>ON* | 0.012°C<br>0.010°C | 0.013°C<br>0.012°C | 0.012°C<br>0.008°C | 0.019°C<br>0.013°C |

**5K $\Omega$  Thermistor**

| A/D Filter | 0 to 30 °C         | 30 to 70 °C        | 70 to 85 °C        |
|------------|--------------------|--------------------|--------------------|
| OFF<br>ON* | 0.014°C<br>0.011°C | 0.020°C<br>0.014°C | 0.028°C<br>0.019°C |

**10K $\Omega$  Thermistor**

| A/D Filter | 0 to 30 °C         | 30 to 60 °C        | 60 to 90 °C        | 90 to 115 °C       |
|------------|--------------------|--------------------|--------------------|--------------------|
| OFF<br>ON* | 0.015°C<br>0.013°C | 0.020°C<br>0.014°C | 0.023°C<br>0.017°C | 0.035°C<br>0.023°C |