VT1532A
Eight-Channel Current Output Signal Conditioning Plug-on

User's Manual

Enclosed is the User's Manual for the VT1532A Signal Conditioning Plug-on. Insert this manual in your VXI Module's User's Manual behind the "Signal Conditioning Plug-ons" divider.

APPLICABILITY
This SCP is used with the VT1415A and VT1419A.

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Eight-Channel Current Output Signal Conditioning Plug-on

Introduction

The VT1532A provides an eight channel non-isolated current source. Each output can source ±10 mA with up to ±15 volt compliance. Each VT1532A output can detect an over-voltage condition.

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 VTI Technology part number on the connector side of the SCP to the left of the serial number bar code. For the VT1532A, the part number is: VT1532A.

Field Wiring

Since this Current Output SCP is NOT ISOLATED, it is extremely important not to introduce ground current loops in the individual channel wiring. To avoid this, make sure you follow the recommended wiring diagram that follows.

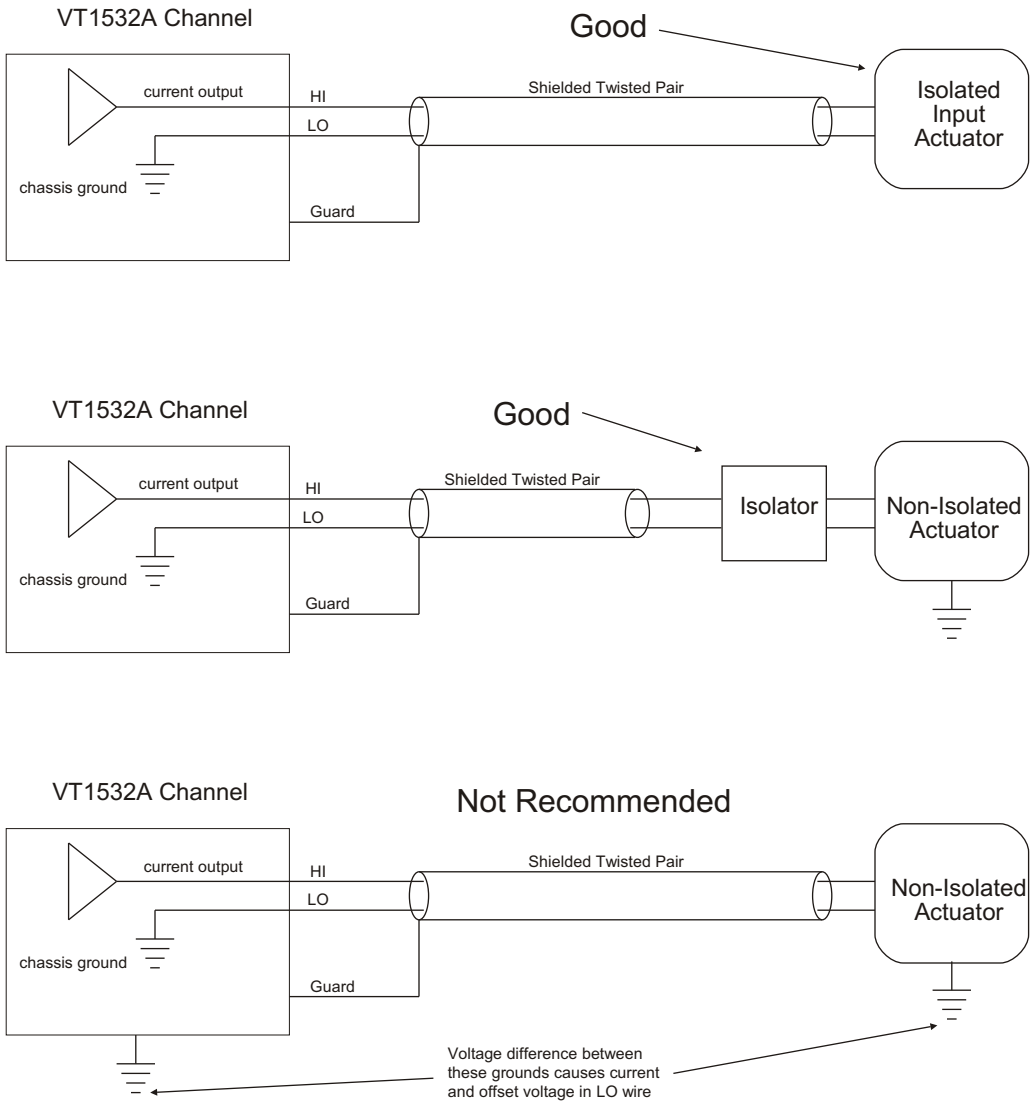

Figure 1 Recommended Field Wiring

The following table maps SCP channels to Terminal Module terminal names. Also see the Terminal Module labels supplied with your VT1532A.

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 used to query the SCP's identification string. Your VXI Module may or may not support SCPI commands to control the SCP's output amplitude. Check for OUTPut subsystem commands in the SCPI Command Reference of your VXI Module's User's Manual.

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. 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 VT1532A SCP is:
HEWLETT-PACKARD,E1532A 8-Channel Current 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 VT1415A 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 VT1419A

```
                first algorithm source in string variable
alg_string = "  static float chan_0, chan_1, chan_2, chan_3;  /* define algorithm variable. these*/
                static float chan_4, chan_5, chan_6, chan_7;  /* will default to zero at first */
                O100 = chan_0;                                /* algorithm execution */
                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)

Algorithm sets starting channel values to zero. The following example shows how your application program can change channel output values while the algorithm is running

```
ALG:SCALAR ‘ALG1’,’chan_0’,-0.010
ALG:SCALAR ‘ALG1’,’chan_1’,0.010
ALG:SCALAR ‘ALG1’,’chan_2’,0.005
ALG:SCALAR ‘ALG1’,’chan_3’,-0.001
ALG:SCALAR ‘ALG1’,’chan_4’,0.008
ALG:SCALAR ‘ALG1’,’chan_5’,0.010
ALG:SCALAR ‘ALG1’,’chan_6’,-0.095
ALG:SCALAR ‘ALG1’,’chan_7’,0.000
```

ALG:UPDATE must command VT1415A to update the algorithm variable

Sensing Output Current

Each channel has a 69 Ohm current sense resistor in series with its output. The analog input channel associated with each output channel is connected across this current sense resistor. Reading a channel returns the voltage developed across its current sense resistor. The value input from these channels is related to the output current by the formula:

$$Current \quad \frac{VoltageRead}{69}$$ for example:

```
O100 = current_output  /* program the output current for channel 0    */
readback = I100 / 69   /* current sense channel divided by 69 Ohms */
```

Notes

1. This readback value is only an approximation of the actual output current. The SCP’s output current is calibrated to specification each time you execute the *CAL? command. The input channels for this SCP are not calibrated by *CAL?. The programmed current output value will be more accurate than the sense value. The sense value is used only to verify the approximate programmed current.
2. An overload reading returned from one of the sense channels does not indicate an overcurrent condition. It indicates that the channel’s HI terminal has exceeded the voltage input range of the channel. This can occur when the channel output is programmed to 0 but is not connected to a load. This will occur when the channel is programmed to output current and is not connected to a load.

Over-Voltage Protection

As was mentioned in the first paragraph, the VT1532A 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 21 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 by issuing the command *RST or by cycling power to the module.

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

During execution of *RST, *CAL? and *TST?, the outputs of the VT1532A will be disconnected momentarily from your system. When the operation is completed, outputs will be programmed to output approximately 0 mA. 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 VT1415A calibrates all channels of this SCP when the *CAL? or CALibration:SETup commands are sent. If this SCP is replaced with a different VT1532A or this SCP is moved to a different SCP location, the calibration must be repeated. By default, the VT1415A uses the Least Squares Curve Fitting method to determine the gain and offset calibration constants for each VT1532A 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 3.3 μA error at this point. By sending then DIAG:CAL:SETUP 1 command before you send the *CAL? or CAL:SET commands, all VT1532A and VT1531A 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 VT1532A’s ±125 μA point. The specifications then become ±0.06% of expected output ±5.7 μA offset. DIAG:CAL:SETUP 1 or *RST before the next *CAL? restores the Least Squares Fit calibration.

Specifications

These specifications for the VT1532A 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
Current Output Range		at least ±10 mA Full Scale at greater than ±15 Volt compliance (multiple channels can be connected in parallel to provide additional current.)
Current Resolution		16 bits (monotonic to 16 bits) = 316 nA
Output Impedance		greater than ±600 k
Noise		<2 μA rms (20 Hz - 250 kHz, into 250)
Output Settling Time		350 μs with 250 load
Temperature Coefficient		(for change in temperature from *CAL after 1 hr. warm up) Accuracy: ±0.004%/°C Offset Error: 0.3 μA/ C
Current Output Accuracy		(90 days) 23°C±1 C (with *CAL? done after 1 hr warm up and applied load is 500) (±0.06% of expected output)±(3.3 μA Offset Error)
Power Required	+5 Volts:	Typical 11 mA, Maximum 15 mA
	±24 Volts:	With 0 mA into 250 : Typical 60 mA, Max 75mA With outputs at 10mA: Typical 135 mA, Max 150 mA