



**OVERVIEW and CALIBRATION MANUAL**  
**for the**  
**VT7, VT8, CT7 & CT8**  
**VOLTAGE and CURRENT TRANSDUCERS**

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VT7, VT8, CT7 & CT8 Manual  
OSI Drawing # A-7004-10 Rev D, 2/2005

# **Preface to the “VT7 Family” of Voltage and Current Transducers**

## **Product Revision Anomalies**

**All models manufactured prior to November 2001 and all modified models with the suffix Y01 through Y99 provide 1500 volts AC isolation from the input.**

**Starting November 1, 2001 Ohio Semitronics, Inc. began manufacturing the standard models of these transducers with an AC/DC universal switching power supply. They will operate from 85 to 265 volts AC or 110 to 370 volts DC. All previous units that operated on 120V or 220Vac were manufactured with linear power supplies. Please check the label on the transducer to see what the power supply voltage requirements are for your VT7, VT8, CT7, or CT8 transducer. If desired, you may still purchase the linear power supply versions. They are manufactured under options -11 & -22. See page 3 for details.**

**All catalog listed models manufactured starting with November 1, 2001 have 2500 volts AC isolation input / output / case, except models with dash numbers -12, -15, -24, -37, & -48. They are rated at 1500Vac.**

**On DC powered models (-12, -15, -24, -37, & -48) with the option "E" designation, the output is common with the power supply input.**

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# OVERVIEW

## THE VT7 FAMILY of VOLTAGE AND CURRENT TRANSDUCERS

The VT7 family of transducers consists of four separate model types, all of which share the same circuit boards and type of enclosure. All inputs and outputs are electrically isolated from each other, and instrument power. Below is a summary of the models and a brief description of their functionality.

### VOLTAGE TRANSDUCERS

**VT7** Intended for measuring DC or instantaneous voltages.  
Output is a replica of the input waveform, both magnitude and polarity.  
Models are available from a 50mV input, to a 1000 Volt input.  
Frequency range is DC through 10 kilohertz.

**VT8** Intended to measure DC or AC voltages.  
Output is a DC level, and proportional to the true RMS value of the input.  
Models are available from a 50mV input, to a 1000 Volt input.  
Frequency range for RMS conversion is DC through 10 kilohertz

### CURRENT TRANSDUCERS

**CT7** Intended for measuring DC or instantaneous currents.  
Output is a replica of the input waveform, both magnitude and polarity.  
Models are available from a 0.1 Amp input, to a 20.0 Amp input.  
Frequency range is DC through 500Hz

**CT8** Intended to measure DC or AC currents.  
Output is a DC level, and proportional to the true RMS value of the input.  
Models are available from a 0.1 Amp input, to a 20.0 Amp input.  
Frequency range for RMS conversion is DC through 500Hz

### HIGHER CURRENT INPUTS

For higher current use the VT7-015, VT7-016, VT8-015, or VT8-016 with an external shunt.

### OUTPUTS

There are a variety of standard output scalings available. The type of analog output is specified in the model number by the suffix B, D, E, or X5

- Suffix “B”            0 to 1 mADC
- Suffix “D”            0 to 10 volts DC
- Suffix “E”            4 to 20 mADC
- Suffix “X5”           0 to 5 volts DC

The 4 to 20 mADC output is not bi-directional. If a bi-directional 4 to 20 mADC output is required, please contact the factory. This is referred to as a 4-12-20mA output. NOTE: The CT8 and VT8 are not available in bi-directional outputs due to the nature of the RMS conversion.

## SPECIFICATIONS VT7 SERIES

Input Voltage  
DC or peak value

0 to $\pm 0.050$	VT7-015*
0 to $\pm 0.100$	VT7-016*
0 to $\pm 0.200$	VT7-017*
0 to $\pm 0.250$	VT7-018*
0 to $\pm 10$	VT7-001*
0 to $\pm 25$	VT7-002*
0 to $\pm 50$	VT7-003*
0 to $\pm 100$	VT7-004*
0 to $\pm 150$	VT7-005*
0 to $\pm 250$	VT7-006*
0 to $\pm 300$	VT7-007*
0 to $\pm 400$	VT7-008*
0 to $\pm 500$	VT7-009*
0 to $\pm 600$	VT7-010*
0 to $\pm 700$ †	VT7-011*
0 to $\pm 800$ †	VT7-012*
0 to $\pm 900$ †	VT7-013*
0 to $\pm 1000$ †	VT7-014*

† Models supplied with external resistor box.

\* Output Option B, D, E, or X5

## SPECIFICATIONS VT8 SERIES

Input Voltage  
AC or DC

0 to 0.050	VT8-015*
0 to 0.100	VT8-016*
0 to 0.200	VT8-017*
0 to 0.250	VT8-018*
0 to 10	VT8-001*
0 to 25	VT8-002*
0 to 50	VT8-003*
0 to 100	VT8-004*
0 to 150	VT8-005*
0 to 250	VT8-006*
0 to 300	VT8-007*
0 to 400	VT8-008*
0 to 500	VT8-009*
0 to 600	VT8-010*
0 to 700†	VT8-011*
0 to 800†	VT8-012*
0 to 900†	VT8-013*
0 to 1000†	VT8-014*

† Models supplied with external resistor box.

\* Output Option B, D, E, or X5

## SPECIFICATIONS CT7 SERIES

Input Current  
DC or peak value

0 to $\pm 0.1$	CT7-002*
0 to $\pm 0.5$	CT7-004*
0 to $\pm 1.0$	CT7-006*
0 to $\pm 1.5$	CT7-007*
0 to $\pm 2.0$	CT7-008*
0 to $\pm 5$	CT7-014*
0 to $\pm 10$	CT7-015*
0 to $\pm 15$	CT7-016*
0 to $\pm 20$	CT7-017*

\* Output Option B, D, E, or X5

## SPECIFICATIONS CT8 SERIES

Input Current  
AC or DC

0 to 0.1	CT8-002*
0 to 0.5	CT8-004*
0 to 1.0	CT8-006*
0 to 1.5	CT8-007*
0 to 2.0	CT8-008*
0 to 5	CT8-014*
0 to 10	CT8-015*
0 to 15	CT8-016*
0 to 20	CT8-017*

\* Output Option B, D, E, or X5

## SPECIFICATIONS continued

### Dielectric Test:

(Input/Output/Case): 1500Vac, or 2500Vac depending on model and manufactured date. (See page i for more detail)

### Input Frequency Range:

VT7	DC to 10 KHz
VT8	DC to 10 KHz
CT7	DC to 500 Hz
CT8	DC to 500 Hz

### Accuracy:

VT7	$\pm 0.25\%$ at DC
VT8	$\pm 0.25\%$ 50 to 400 hertz
CT7	$\pm 0.25\%$ at DC
CT8	$\pm 0.25\%$ 50 to 400 hertz

### Output:

	VT8 or CT8	VT7 or CT7
Option "B"	0 to +1 mADC	0 to $\pm 1$ mADC
Option "D"	0 to +10 volts DC	0 to $\pm 10$ volts DC
Option "E"	4 to 20 mADC	4 to 20 mADC
Option "X5"	0 to +5 volts DC	0 to $\pm 5$ volts DC

### Output Response:

VT7	50 uSec.
VT8	100 mSec.
CT7	1 mSec.
CT8	100 mSec.

### Output Loading:

Option B	0 to 1 mADC	0 to 10,000 Ohms
Option D	0 to 10 volts	2000 Ohms or more
Option E	4 to 20 mADC	0 to 500 Ohms
Option X5	0 to 5 volts	2000 Ohms or more

### Instrument Power:

Suffix following the Output option.

No dash number *	120 volts AC, (linear supply)
No dash number **	85-265AC/110-370DC, (switching supply)
-11	120 volts AC, (linear supply)
-12	12 volts DC
-22	220 volts AC, (linear supply)
-15	15 volts DC
-24	24 volts DC
-37	37 volts DC
-48	48 volts DC

\* Standard power supply - before Nov. 1, 2001.

\*\* Standard power supply - after Nov. 1, 2001.

(Refer to page i for more details)

## CALIBRATION

The VT7, VT8, CT7, and CT8 transducers are calibrated at the factory against standards that are traceable to the National Institute of Standards and Technology (NIST) and are tagged with a calibration sticker. Certificates of calibration are available at an additional cost. There are several different types of certificates available. Contact the Sales Department for more information.

Periodic checks of calibration are recommended every 12 months.

### TEST EQUIPMENT REQUIRED for the VT8 and CT8

- 1.) AC sine wave voltage or current source capable of supplying 60 hertz or the desired frequency at the full scale specified voltage or current.
- 2.) Voltmeter or ammeter to measure the input voltage or current with an accuracy of  $\pm 0.05\%$  or better.
- 3.) DC milliamperemeter or voltmeter to measure the output with an accuracy of  $\pm 0.05\%$  or better. A precision resistor may be substituted to measure transducers with a milliamperemeter output. Recommended values are:

1k Ohm resistor for 0 to 1mADC.

250 Ohm resistor for 4 to 20 mADC.

(Tolerances of these resistors must be  $\pm 0.05\%$  or better.)

### CONNECTIONS AND ADJUSTMENTS for the VT8 and CT8

Connect the VT8 or CT8 as shown in figures 1 and 2. All calibration adjustments are made through the lid. Remove the plastic caps from models manufactured prior to November 2001 and use a 1/8-inch wide screwdriver to make the adjustments to the potentiometers. Units manufactured after Nov. 2001 will have a label over the adjustment holes. Simply pierce a hole in the label to get to the adjustments. Hole plugs can be obtained by contacting the Sales Department.

#### Zero Adjust for Options B, D, or X5

Connect the two input terminals together. Apply instrument power and allow the transducer to “warm up” for 15 minutes. Measuring the output, adjust the zero potentiometer for 0.000 mADC for models numbers that have option B, or 0.000 volts on models numbers with options D or X5.

#### Zero Adjust for Option E

Connect the two input terminals together. Apply instrument power and allow the transducer to “warm up” for 15 minutes. Measuring the output, adjust the zero potentiometer for 4.000 mADC. (NOTE: If you are using a 250-ohm load resistor, set the potentiometer for 1.000 volt DC.)

#### Calibration Adjust

The calibration adjustment sets the output for the full-scale input voltage or current. Calibration should be done at the frequency at which the transducer will be used. Be sure to use a calibration source for your desired frequency.

Remove the short that connects the input terminals together. Connect an appropriate voltage or current source to the input terminals. Refer to figure 1 and 2.

### **Calibration Adjust for Option B**

- 1.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 2.) If you are using a milliamperemeter adjust the "Cal" potentiometer for an output of 1.000 mADC.
- 3.) If you are using a voltmeter and 1000 ohm resistor to load the output, adjust the "Cal" potentiometer for 1.000 volt.

### **Calibration Adjust for Option D**

- 1.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 2.) Adjust the "Cal" potentiometer for an output of 10.000 volts.

### **Calibration Adjust for Option X5**

- 1.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 2.) Adjust the "Cal" potentiometer for an output of 5.000 volts.

### **Calibration Adjust for Option E**

- 1.) Perform the zero adjust first.
- 2.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 3.) Adjust the "Cal" potentiometer for an output of 20 mADC
- 4.) If you are using a 250-ohm load resistor and a voltmeter, adjust the "Cal" potentiometer for an output of 5.000 volts.

### **TEST EQUIPMENT REQUIRED for the VT7 and CT7**

- 1.) DC voltage or current source capable of supplying the full scale specified voltage or current.
- 2.) Voltmeter or ammeter to measure the input voltage with an accuracy of  $\pm 0.05\%$  or better.
- 3.) DC milliamperemeter or voltmeter to measure the output with an accuracy of  $\pm 0.05\%$  or better. A precision resistor may be substituted to measure transducers with a milliamperemeter output. Recommended values are:

For 0 to 1mADC use a 1000-ohm resistor.

For 4 to 20 mADC use a 250-ohm resistor.

(Tolerances must be  $\pm 0.05\%$  or better.)

### **CONNECTIONS AND ADJUSTMENTS for the VT7 and CT7**

Connect the VT7 or CT7 as shown in figures 1 and 2. All calibration adjustments are made through the lid. Remove the plastic caps from models manufactured prior to November 2001 and use a 1/8-inch wide screwdriver to make the adjustments to the potentiometers. Units manufactured after Nov. 2001 will have a label over the adjustment holes. Simply pierce a hole in the label to get to the adjustments. Hole plugs can be obtained by contacting the Sales Department.



### **Zero Adjust for options B, D, or X5**

Connect the two input terminals together. Apply instrument power and allow the transducer to “warm up” for 15 minutes. Adjust the zero potentiometer for 0.000 mADC on option B, or 0.000 volts on models with options D or X5.

### **Zero Adjust for Option E**

Connect the two input terminals together. Apply instrument power and allow the transducer to “warm up” for 15 minutes. Adjust the zero potentiometer for 4.000 mADC. (NOTE: If you are using a 250-ohm load resistor, set the potentiometer for 1.000 volt DC.)

### **Calibration Adjustment**

The calibration adjustment sets the output for the full-scale input voltage or current. Calibration should be done at the frequency at which the transducer will be used. Be sure to use a calibration source for your desired frequency.

Remove the short that connects the input terminals together. Connect an appropriate voltage or current source to the input terminals. Refer to figure 1 and 2.

### **Calibration Adjust for Option B**

The “Cal” adjustment sets the output for the full-scale input voltage or current.

- 1.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 2.) If you are using a milliamperemeter adjust the “Cal” potentiometer for an output of 1.000 mADC.
- 3.) If you are using a voltmeter and 1000 ohm resistor to load the output, adjust the “Cal” potentiometer for 1.000 volt.

### **Calibration Adjust for Option D**

Adjust the input voltage or current for the full scale rating of the transducer being calibrated. Adjust the “Cal” potentiometer for an output of 10.000 volts.

### **Calibration Adjust for Option X5**

- 1.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 2.) Adjust the “Cal” potentiometer for an output of 5.000 volts.

### **Calibration Adjust for Option E**

- 1.) Perform the zero adjust first.
- 2.) Adjust the input voltage or current for the full scale rating of the transducer being calibrated.
- 3.) Adjust the “Cal” potentiometer for an output of 20 mADC
- 4.) If you are using a 250-ohm load resistor and a voltmeter, adjust the “Cal” potentiometer for an output of 5.000 volts.

## LINEARITY CHECK for the VT7, VT8, CT7, and CT8

Starting at 100% of the full-scale current or voltage and measuring the analog output of the transducer you may check linearity of the current transducers.

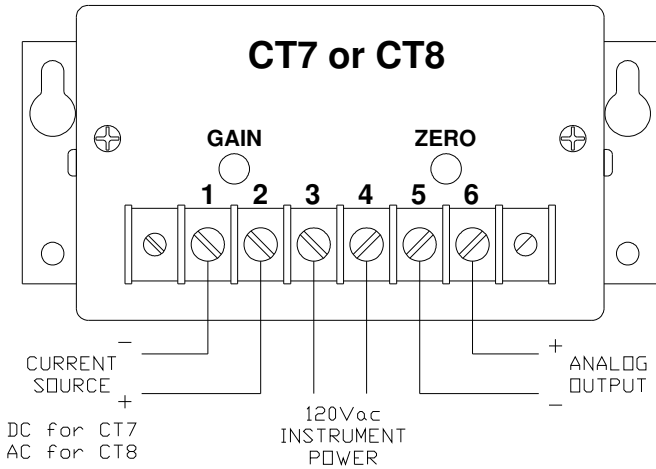
Reduce the current in steps of 20% from full scale to zero, measuring the analog output at each step. Record your input and output data. Please refer to Table 1.

Should a transducer fail to meet the linearity check, try adjusting the full scale output slightly up or down to bring the entire output range into the specified accuracy for the transducer. If this does not bring the linearity into specification, consider returning the transducer to Ohio Semitronics, Inc. for linearization.

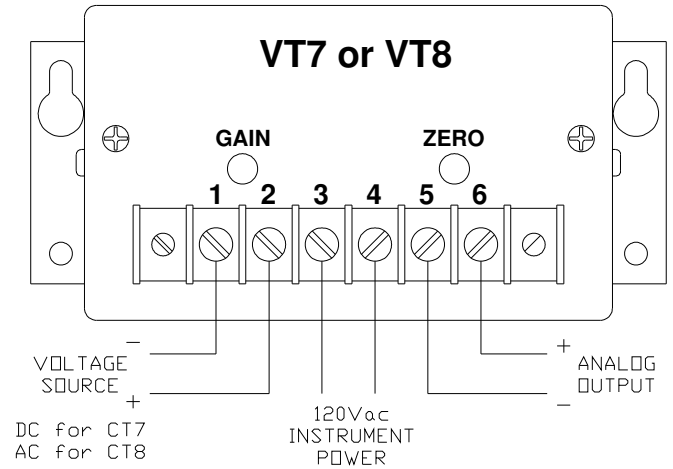
This completes the calibration of the current transducer. Reinstall the plastic caps over the access holes.

	<b>OUTPUT FROM TRANSDUCER.</b>					
<b>Rated Full Scale</b>	<b>1 mADC</b>	<b>1 volt DC</b>	<b>5 volt DC</b>	<b>10 volt DC</b>	<b>4 to 20 mADC</b>	<b>1 to 5 volts DC</b>
<b>Percent of Full Scale</b>						
100%	1.0 mADC	1.0 volts DC	5.0 volts DC	10.0 volts DC	20.0 mA	5.0 volts
80%	0.8 mADC	0.8 volts DC	4.0 volts DC	8.0 volts DC	16.8 mA	4.2 volts
60%	0.6 mADC	0.6 volts DC	3.0 volts DC	6.0 volts DC	13.6 mA	3.4 volts
40%	0.4 mADC	0.4 volts DC	2.0 volts DC	4.0 volts DC	10.4 mA	2.6 volts
20%	0.2 mADC	0.2 volts DC	1.0 volts DC	2.0 volts DC	7.2 mA	1.8 volts
0%	0.0 mADC	0.0 volts DC	0.0 volts DC	0.0 volts DC	4.0 mA	1.0 volts
Allowed error 0.5% Units	±0.005 mA	±0.005 volts	±0.025 volts	±0.05 volts	±0.08 mA	±0.02 volts
Allowed error 0.25% Units	±0.0025 mA	±0.0025 volts	±0.0125 volts	±0.025 volts	±0.04 mA	±0.01 volts

**Table 1 For Checking Linearity of Voltage and Current Transducers**



**Fig. 1**



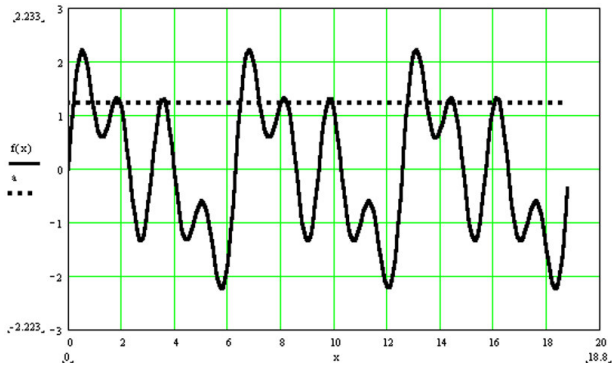
**Fig.2**

**Connection diagram for calibrating the VT7 family of voltage and current transducers.**

The standard instrument power for these transducers is 120 volts AC.  
 Please check the model number suffix to ensure applying the correct instrument power.

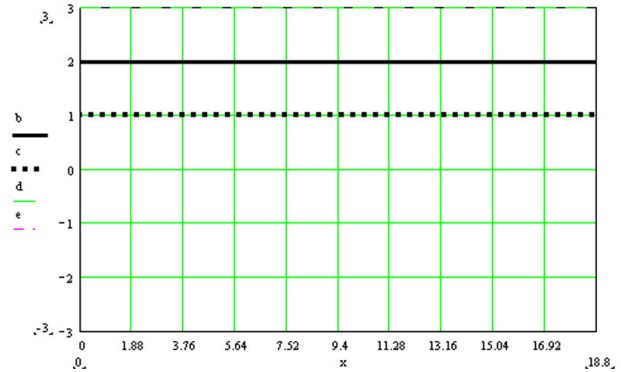
## Input VS Output — What to expect.

**Figure 1 - Simulated VT8**

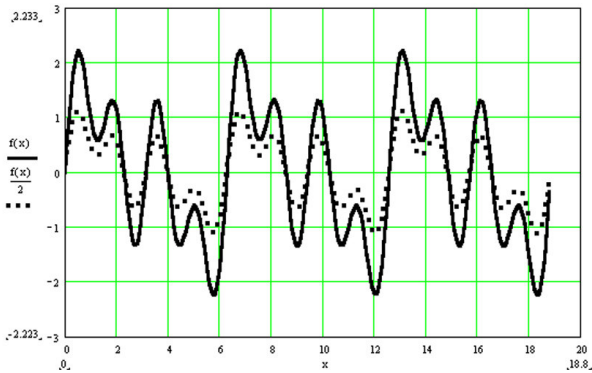


In figure 1 above the solid line represents the voltage input to a VT8 true rms measuring voltage transducer. The dotted line represents the output.

**Figure 3 - Simulated VT8**

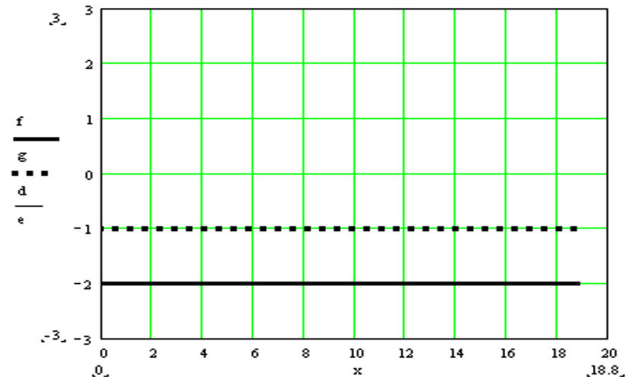


In figure 3 above the solid line represents the voltage input to a VT8 true rms measuring voltage transducer. The dotted line represents the output.



**Figure 2 - Simulated VT7**

In figure 2 above the solid line represents the voltage input to a VT7 voltage transducer. The dotted line represents the output. Note that the output signal tracks the input.



**Figure 4 - Simulated VT7**

In figure 4 above the solid line represents the voltage input to a VT7 voltage transducer. The dotted line represents the output.