TECHNICAL DATASHEET #TD2014AX

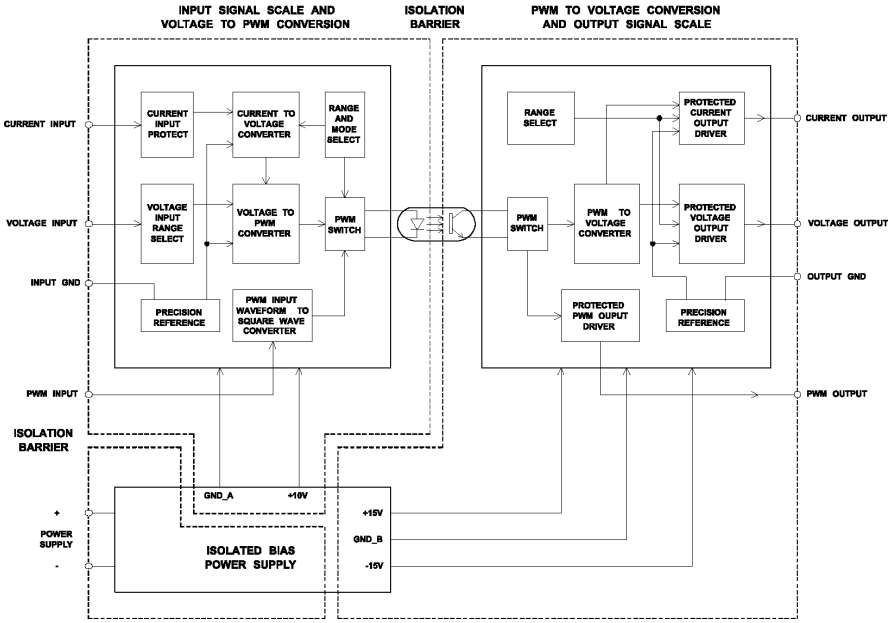
UNIVERSAL SIGNAL CONVERTER

with Three-way Isolation

P/N: USC-CVB225-01

Description: The universal signal converter offers three-way isolation and translates one input control signal into one to three simultaneous outputs. Switches allow the user to select the desired input and output(s) from the following options. A choice of PWM signal, 4-20 mA, 0-20 mA, -20 to +20 mA, 0-2.5V, 0-5V, 0-10V, +/-2.5V, +/-5V or +/-10V analog signal input is accepted. PWM, voltage and current outputs are simultaneously available. Refer to the technical specifications for more details.

Span and zero adjust with multi-turn pots for both voltage and current outputs. A rugged power supply interface accepts 8-48VDC and is appropriate for machine applications. The circuitry is conformal coated and packaged in a Lexan DIN rail enclosure designed for installation in a control panel. Plug-in screw terminal connections are provided for a minimum of 6-wires. It operates from -40 to 85°C (-40 to 185°F).



Applications: The signal converter provides precise signal conversion and isolation between sensors, PLC's and other controls. Applications include industrial automation, test equipment and off-highway machine automation. For harsh environments, the module should be mounted in a protective control panel. Three-way isolation is used to eliminate ground loops causing signal errors. Also, control systems with limited channels can use the converter when each channel requires a different configuration. For example, the three-way isolation permits the device to provide a sinking input and sourcing output.

Ordering Part Numbers:

Universal Signal Converter: **USC-CVB225-01**

NOTE: Not all input and output combinations are available. Review the INPUT and OUTPUT SWITCH SELECTION CHARTS, prior to ordering.

Universal Signal Converter with a 4-20mA input and +/- 10V output: **USC-CVB225-B10V**

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Technical Specifications:

Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/Limitations and Return Materials Process as described on https://www.axiomatic.com/service/.

Input Specifications

Isolation	1500 VDC Three-way isolation provided between power, input and output circuits.
Input Impedance	Current input: 50 Ohms Voltage input: >250 KOhms
Power Supply Input - Nominal	12 or 24VDC nominal 8…48VDC power supply range Transient and surge protection is provided
Reverse Polarity	Reverse polarity protection is provided.
Input Selection – **Analog Signal Input**	A single input can be selected via DIP switch (Voltage, Current or PWM). Input Selector Switch, DIP switches 1 – 8 configure the converter for the desired input from the following choices. All outputs follow the input, simultaneously. <u>Voltage Input:</u> 0-2.5V 0-5V 0-10V -2.5 to +2.5V -5 to +5V -10 to +10V <u>Current Input:</u> 4-20 mA 0-20 mA -20 to +20 mA *NB. For a 4-20 mA input and +/-10V output, order model USC-CVB225-B10V.* Refer to the INPUT and OUTPUT SWITCH SELECTION CHARTS for details. NOTE: Not all input and output combinations are available. Review the SWITCH SELECTION CHARTS, prior to ordering. *(Contact the manufacturer for instructions on more than one input combination.)*
Input Selection - **PWM Input (to PWM Output)**	<u>PWM Input:</u> 0-5,000 Hz PWM input frequency range 0-100% PWM input Duty Cycle range *NB. Selecting a PWM input disables the analog input capability.* *Output PWM D.C. is the inverse of the input PWM D.C.* *All outputs follow the input, simultaneously.*
Input Selection - **PWM Input (to Voltage or Current Output)**	<u>PWM Input:</u> 2,000 to 5,000Hz PWM input frequency range 10% PWM D.C. input is equal to output maximum. 90% PWM D. C. input is equal to output minimum. *NB. Output voltage or current cannot be calibrated when PWM input is used.* *All outputs follow the input, simultaneously.*
Ground Connections	A current input GND is provided. A voltage input GND is provided. When using PWM input, connect to the current input GND.

Output Specifications

Signal Output Selection	Up to 3 output signals can be selected (Current, Voltage and PWM). All outputs follow the input, simultaneously. Output Selector Switch, DIP switches 2 – 8 configure the converter for the desired output from the following choices. Refer to the INPUT and OUTPUT SWITCH SELECTION CHARTS for details. <u>Voltage Output:</u> 0-2.5V 0-5V 0-10V -1.25 to +1.25V -2.5 to +2.5V -5 to +5V -10 to +10V

	NB. For a 4-20 mA input and +/-10V output, order model USC-CVB225-B10V. Voltage output current limitation is 30 mA. Current Output: 4-20 mA 0-20 mA -20 to +20 mA -12 to +20 mA PWM Output: With an analog input, the PWM output is fixed at 3,500 Hz, 5V amplitude and the Duty Cycle is scaled to the input. With a PWM input, the PWM output follows the input within the range of 0-5000Hz, 5V amplitude and the Duty Cycle output is the inverse of the input D.C. (0-100% D.C.). *With a PWM input but a voltage output, the frequency follows the input frequency and the output Duty Cycle is the inverse of the input Duty Cycle. (Refer to the Input and Output Selection Chart for input Duty Cycle.)* CALIBRATION USING the ZERO and SPAN trim pots is required during initial installation. Output current and voltage cannot be calibrated when using PWM input. NOTE: Not all input and output combinations are available. Review the SWITCH SELECTION CHARTS, prior to ordering.
Load Impedance	2KOhm minimum, voltage output 500 Ohm maximum, current output
Linearity Error	0.01% of full-scale output
Accuracy	+/-0.05%/°C
Settling Time	<3.5 mSec to 0.1% of full-scale output.

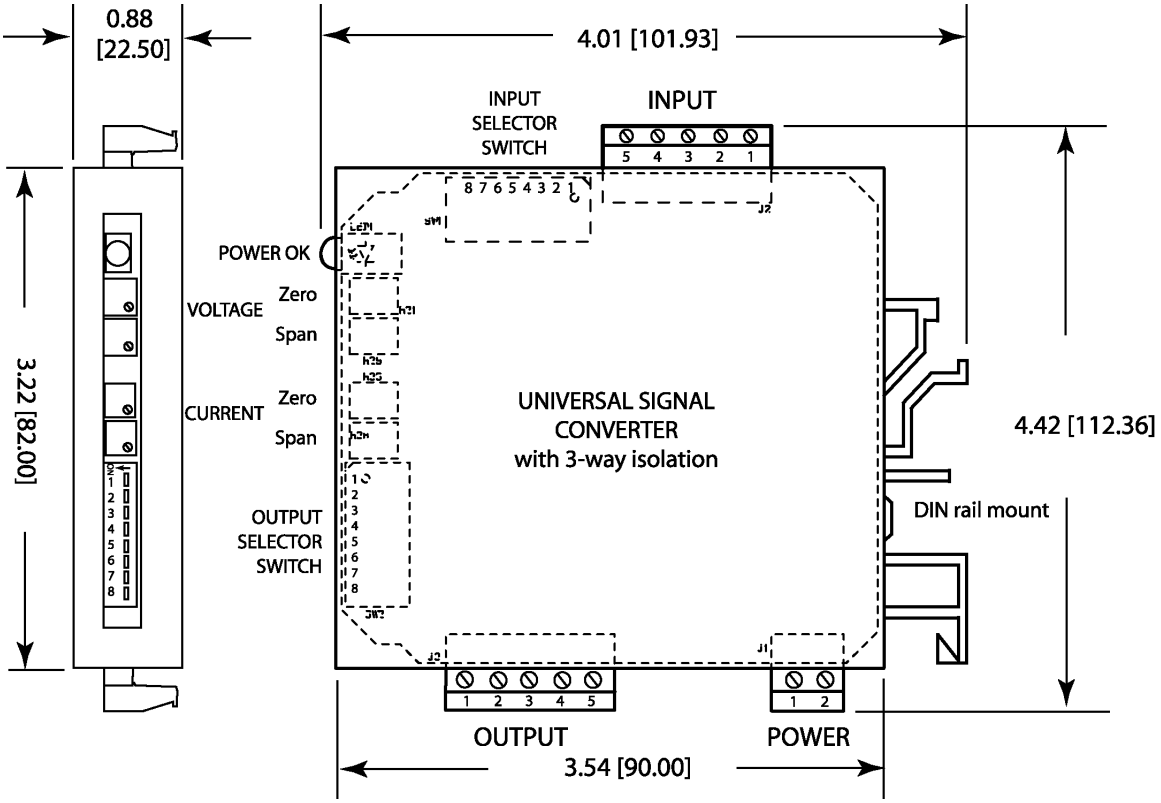
General Specifications

Quiescent Current	30 mA @24VDC
Fusing	Resettable fuse is integrated into design.
LED	ON = Power OK
Electrical Connections	2-5mm plug-in screw terminal for power (Phoenix P/N: 1754449) 5-5mm plug-in screw terminal for input (Phoenix P/N: 1754504) 5-5mm plug-in screw terminal for output (Phoenix P/N: 1754504) Accept 2.5mm^2 solid or 1.5mm^2 stranded and terminated
Packaging and Dimensions	DIN rail mount, 35 mm Camden Electronics UL 94V0 Lexan enclosure (CVB225) 0.88 x 3.23 x 3.54 inches 22.5 x 82.0 x 90.0 mm (W x L x H excluding mating plug-in screw terminals)
Operating Conditions	-40 to 85°C (-40 to 185°F)
Weight	0.20 lbs. (0.09 kg)
Protection	IP00 Unit is conformal coated within the housing. For harsh environments, place converter in a protective control panel.

Screw Terminal Connections

#	Power Supply Input	#	Input	#	Output(s)
1	Power +	1	Voltage_IN	1	Voltage_OUT
2	Power -	2	Voltage_IN_GND	2	Voltage_OUT_GND
		3	Current_IN	3	Current_OUT
		4	Current IN_GND (and PWM_IN_GND)	4	Current_OUT_GND (and PWM_OUT_GND)
		5	PWM IN	5	PWM_OUT

Dimensions, Connections, Switches:



Dimensions: inches [mm]

INSTALLATION INSTRUCTIONS:
Input and Output configuration is selected by DIP Switches. In the Input Selector Switch, DIP Switch 1 – 8 switches select the desired input. In the Output Selector Switch, DIP Switch 2 – 8 switches select the desired output from the following choices. Refer to the Input and Output Switch Selection Charts below. All outputs follow the input, simultaneously.

CALIBRATION USING the ZERO and SPAN trim pots is required during initial installation to achieve the desired functionality of the device. The unit should be powered when calibrating. Output current and voltage cannot be calibrated when using PWM input.

NB. If needed, linearity of the device can be confirmed by applying a signal level in the mid-point of the input range and measuring the corresponding output in the center of its range.
In order to achieve accurate results, precision instruments must be used to monitor the input and output signals.

Voltage Zero	Adjustable from +/- 25% of full-scale input. (10 turn trim pot) Apply the minimum command input and adjust the ZERO potentiometer to achieve the desired minimum output. Double check the adjustments
Voltage Span	Adjustable from +/- 25% of full-scale input. (10 turn trim pot) Apply the maximum command input and adjust the SPAN potentiometer to achieve the desired maximum output. Double check the adjustments.
Current Zero	Adjustable from +/- 7.5% of full-scale output. (10 turn trim pot) Apply the minimum command input and adjust the ZERO potentiometer to achieve the desired minimum output. Double check the adjustments
Current Span	Adjustable from +/- 10% of full-scale output. (10 turn trim pot) Apply the maximum command input and adjust the SPAN potentiometer to achieve the desired maximum output. Double check the adjustments

INPUT AND OUTPUT SWITCH SELECTION CHARTS

INPUT VOLTAGE	INPUT SWITCH	OUTPUT SWITCH	OUTPUT VOLTAGE	OUTPUT CURRENT	OUTPUT PWM	Input vs. Output over Full Range	NOTES
[V]	[ON]	[ON]	[V]	[mA]	[%]		
-2.5 to +2.5	3 , 7	8	- 2.5 to +2.5	-20 to +20	10 to 90	- 2.5 V => -2.5 V (-5, -10), 0V => 0 V, +2.5 V => +2.5 V (+5, +10)	*
		7	-5 to +5			- 2.5 V => -20 mA, 0V => 0mA, +2.5 V => +20mA	*
		none	-10 to +10			- 2.5 V => 10% DC, 0V => 50% DC, +2.5 V => 90% DC	
-5 to +5	4 , 7	8	- 2.5 to +2.5	-20 to +20	10 to 90	- 5 V => -2.5 V (-5, -10), 0V => 0 V, +5 V => +2.5 V (+5, +10)	*
		7	-5 to +5			- 5 V => -20 mA, 0V => 0mA, +5 V => +20mA	*
		none	-10 to +10			- 5 V => 10% DC, 0V => 50% DC, +5 V => 90% DC	
-10 to +10	5 , 7	8	- 2.5 to +2.5	-20 to +20	10 to 90	- 10 V => -2.5 V (-5, -10), 0V => 0 V, +2.5 V => +10 V (+5, +10)	*
		7	-5 to +5			- 10 V => -20 mA, 0V => 0mA, +10 V => +20mA	*
		none	-10 to +10			- 10 V => 10% DC, 0V => 50% DC, +10 V => 90% DC	
0 to +2.5	3 , 7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	0V => 0 V, +2.5 V => +2.5 V (+5, +10)	*
		5, 6, 7	0 to +5			0V => 4mA, +2.5 V => +20mA	*
		5, 6	0 to +10			0V => 50% DC, +2.5 V => 90% DC	
0 to +5	4 , 7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	0V => 0 V, +5 V => +2.5 V (+5, +10)	*
		5, 6, 7	0 to +5			0V => 4mA, +5 V => +20mA	*
		5, 6	0 to +10			0V => 50% DC, +5 V => 90% DC	
0 to +10	5 , 7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	0V => 0 V, +10 V => +2.5 V (+5, +10)	*
		5, 6, 7	0 to +5			0V => 4mA, +10 V => +20mA	*
		5, 6	0 to +10			0V => 50% DC, +10 V => 90% DC	
0 to +2.5	3 , 7	3, 5, 6	-5 to +5	+4 to +20	50 to 90	0V => -5 V, 1.25 V => 0 V, +2.5 V => +5 V	*
						0V => 4mA, +2.5 V => +20mA	*
						0V => 50% DC, +2.5 V => 90% DC	
0 to +5	4 , 7	3, 5, 6	-5 to +5	+4 to +20	50 to 90	0V => -5 V, +2.5 V => 0 V, +5 V => +5 V	*
						0V => 4mA, +5 V => +20mA	*
						0V => 50% DC, +5 V => 90% DC	
0 to +10	5 , 7	3, 5, 6	-5 to +5	+4 to +20	50 to 90	0V => -5 V, +5 V => 0 V, +10 V => +5 V	*
						0V => 4mA, +10 V => +20mA	*
						0V => 50% DC, +10 V => 90% DC	
0 to +2.5	3 , 7	3, 5, 6, 8	-1.25 to +1.25	+4 to +20	50 to 90	0V => -1.25 V (-2.5), 1.25 V => 0 V, +2.5 V => +1.25 V (+2.5)	*
		3, 5, 6, 7	-2.5 to +2.5			0V => 4mA, +2.5 V => +20mA	*
						0V => 50% DC, +2.5 V => 90% DC	
0 to +5	4 , 7	3, 5, 6, 8	-1.25 to +1.25	+4 to +20	50 to 90	0V => -1.25 V (-2.5), 2.5 V => 0 V, +5 V => +1.25 V (+2.5)	*
		3, 5, 6, 7	-2.5 to +2.5			0V => 4mA, +5 V => +20mA	*
						0V => 50% DC, +5 V => 90% DC	
0 to +10	5 , 7	3, 5, 6, 8	-1.25 to +1.25	+4 to +20	50 to 90	0V => -1.25 V (-2.5), +5 V => 0 V, +10 V => +1.25 V (+2.5)	*
		3, 5, 6, 7	-2.5 to +2.5			0V => 4mA, +10 V => +20mA	*
						0V => 50% DC, +10 V => 90% DC	
-2.5 to 0	2, 3 , 7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	-2.5 V => 0 V, +0 V => +2.5 V (+5, +10)	*
		5, 6, 7	0 to +5			-2.5 V => 4mA, 0 V => +20mA	*
		5, 6	0 to +10			-2.5 V => 50% DC, 0 V => 90% DC	
-5 to 0	2, 4 , 7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	-5 V => 0 V, +0 V => +2.5 V (+5, +10)	*
		5, 6, 7	0 to +5			-5 V => 4mA, 0 V => +20mA	*
		5, 6	0 to +10			-5 V => 50% DC, 0 V => 90% DC	
-10 to 0	2, 5 , 7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	-10 V => 0 V, +0 V => +2.5 V (+5, +10)	*
		5, 6, 7	0 to +5			-10 V => 4mA, 0 V => +20mA	*
		5, 6	0 to +10			-10 V => 50% DC, 0 V => 90% DC	

NOTES:

* May require some minor calibration using the ZERO and SPAN voltage trim pots

Set input to minimum command signal and adjust the ZERO trim pot until desired zero value is obtained.

Set Input to maximum command signal and adjust the SPAN trim pot until desired maximum value is obtained.

Repeat the steps above until the range is correct.

INPUT CURRENT	INPUT SWITCH	OUTPUT SWITCH	OUTPUT VOLTAGE	OUTPUT CURRENT	OUTPUT PWM	Input vs. Output over Full Range	NOTES
[mA]	[ON]	[ON]	[V]	[mA]	[%]		
0 to 20	7	8	0 to +2.5	0 to +20	50 to 90	0 mA => 0 V, 20 mA => +2.5 V (+5, +10)	**
		7	0 to +5			0 mA => 0 mA, 20 mA => +20 mA	**
		none	0 to +10			0 mA => 50% DC, 20 mA => 90% DC	**
0 to 20	7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	0 mA => 0 V, 20 mA => +2.5 V (+5, +10)	**
		5, 6, 7	0 to +5			0 mA => 4 mA, 20 mA => +20 mA	**
		5, 6	0 to +10			0 mA => 50% DC, 20 mA => 90% DC	**
0 to 20	1, 7	8	- 2.5 to 0	-20 to 0	10 to 50	0 mA => -2.5 V (-5, -10), 0 mA => 0 V	**
		7	-5 to 0			0 mA => -20 mA, 0 mA => 0mA	**
		none	-10 to 0			0 mA => 10 % DC, 20 mA => 50 % DC	**
-20 to 20	7	8	- 2.5 to +2.5	-20 to +20	10 to 90	-20 mA => -2.5 V (-5, -10), 0 mA => 0 V, +20 mA => +2.5 V (+5, +10)	**
		7	-5 to +5			-20 mA => -20 mA, 0 mA => 0mA, +20 mA => +20 mA	**
		none	-10 to +10			-20 mA => 10 % DC, 0 mA => 50 % DC, +20 mA => 90 % DC	**
4 to 20	7	8	0 to +2.5	0 to +20	50 to 90	4 mA => 0 V, 20 mA => +2.5 V (+5, +10)	***
		7	0 to +5			4 mA => 0 mA, 20 mA => +20 mA	***
		none	0 to +10			4 mA => 50% DC, 20 mA => 90% DC	***
4 to 20	7	5, 6, 8	0 to +2.5	+4 to +20	50 to 90	4 mA => 0 V, 20 mA => +2.5 V (+5, +10)	***
		5, 6, 7	0 to +5			4 mA => 4 mA, 20 mA => +20 mA	***
		5, 6	0 to +10			4 mA => 50% DC, 20 mA => 90% DC	***
4 to 20	7	3, 8	-1.25 to +1.25	0 to +20	50 to 90	4 mA => -1.25 V (-2.5, -5), 0 mA => 0 V, +20 mA => +1.25 V (+2.5, +5)	***
		3, 7	-2.5 to +2.5			4 mA => 0 mA, 20 mA => +20 mA	***
		3	-5 to +5			4 mA => 50% DC, 20 mA => 90% DC	***
4 to 20	7	3, 5, 6, 8	-1.25 to +1.25	4 to +20	50 to 90	4 mA => -1.25 V (-2.5, -5), 0 mA => 0 V, +20 mA => +1.25 V (+2.5, +5)	***
		3, 5, 6, 7	-2.5 to +2.5			4 mA => 4 mA, 20 mA => +20 mA	***
		3, 5, 6	-5 to +5			4 mA => 50% DC, 20 mA => 90% DC	***

NOTES:

** May require some calibration using the ZERO and SPAN current trim pots

Set input to minimum command signal and adjust the ZERO trim pot until desired zero value is obtained.

Set input to maximum command signal and adjust the SPAN trim pot until desired maximum value is obtained.

Repeat the steps above until the range is correct.

*** May require major calibration using the ZERO and SPAN trim pots of both voltage and current

Set current input to 4 mA and adjust the ZERO voltage trim pot until the output current value is as close as possible to the desired zero value.

Then use the ZERO current trim pot to fine tune the desired output current.

Set current input to 20mA and adjust the SPAN voltage trim pot until the output current value is as close as possible to the desired maximum value.

Then use the SPAN current trim pot to fine tune the desired output current.

The voltage trim pots act as a coarse adjustment for the current output type while the current trim pots act as a fine tuner.

NOTE: Order Model USC-CVB225-B10V when applying a 4-20 mA input and a +/- 10V output.

INPUT CURRENT	INPUT SWITCH	OUTPUT SWITCH	OUTPUT VOLTAGE	OUTPUT CURRENT	OUTPUT PWM
4 to +20mA	1,7	NONE	- / +10V	Not Used	Not Used
4 to +20mA	1,7	NONE	- / +10V	Not Used	Not Used
4 to +20mA	1,7	NONE	- / +10V	Not Used	Not Used

NB. Adjust current zero pot for offset of 4 mA.

INPUT PWM	INPUT SWITCH	OUTPUT SWITCH	OUTPUT VOLTAGE	OUTPUT CURRENT	OUTPUT PWM	Input vs. Output over Full Range	NOTES
[Khz]***** [%]	[ON]	[ON]	[V]	[mA]	[%]		
+10 to +90	8	8	+2.5 to -2.5	+20 to -20	+90 to +10	+10 % => +2.5 V (+5, +10), 50 % => 0 V, +90 % => -2.5 (-5, -10)	****
		7	+5 to -5			+10 % => +20 mA, +90 % => -20 mA	****
		none	+10 to -10			+10 % => +90 %, +90 % => +10 %	****
+10 to +90	8	5, 6, 8	+2.5 to -2.5	+20 to -12 (4 mA@50%)	+90 to +10	+10 % => +2.5 V (+5, +10), 50 % => 0 V, +90 % => -2.5 (-5, -10)	****
		5, 6, 7	+5 to -5			+10 % => +20 mA, +50 %+=> 4 mA, 90 % => -20 mA	****
		none	+10 to -10			+10 % => +90 %, +90 % => +10 %	****

NOTES:

****	Logic is reversed. A 10 % duty cycle yields positive values and +90 % duty cycle output.
	(This product is an inverter when used in PWM input and output mode.)
*****	PWM input to PWM output: PWM range is 0-5kHz. PWM input to voltage or current output has a PWM range of 2-5kHz.
	Output Voltage and Current cannot be calibrated when using PWM input.

Form: TD2014AX-06/09/23