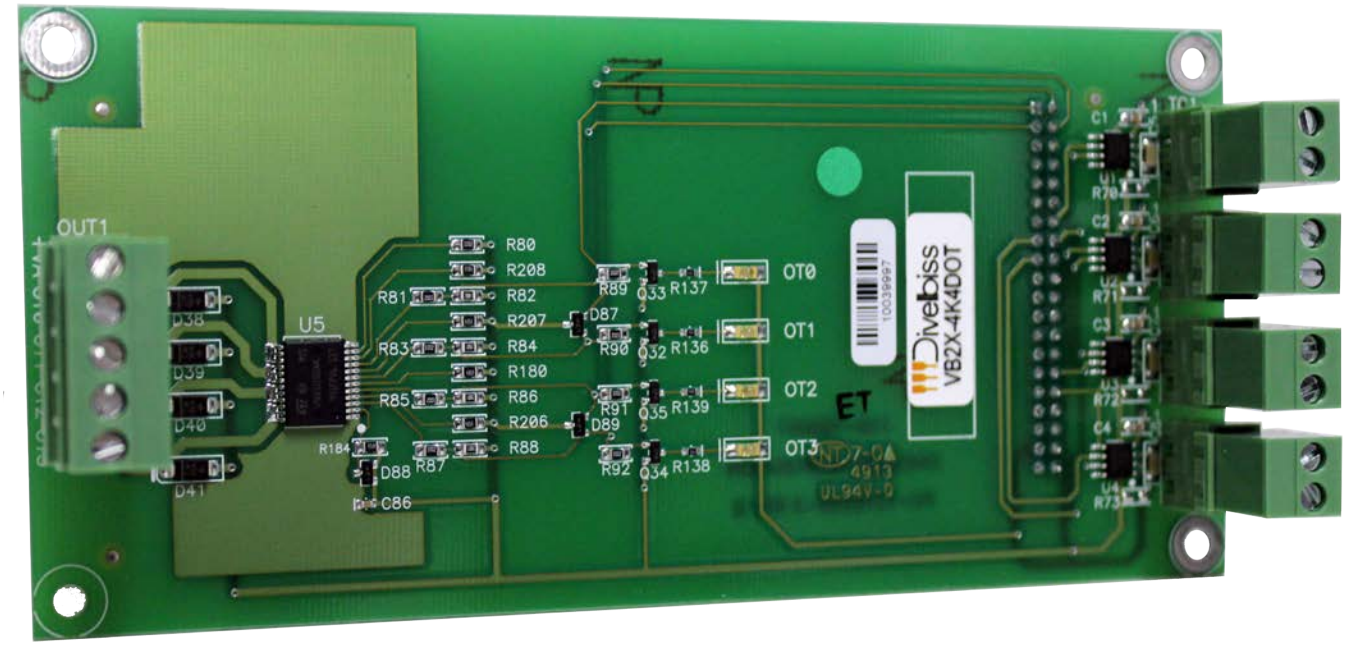
USER'S MANUAL

Revision: 0



VB2X-TCDOT THERMOCOUPLE EXPANDER /OUTPUT BOARD

Covered Models: **VB2X-4K4DOT**

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2014002.0

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WARNING!!

The VB-2XXX with the VB2X-TCDOT installed, as with other programmable controllers must not be used alone in applications which could be hazardous to personnel in the event of failure of this device. Precautions must be taken by the user to provide mechanical and/or electrical safeguards external to this device. This device is NOT APPROVED for domestic or human medical use.

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Getting Started

This section explains how to read this manual and understand the symbols and information that it contains.

To begin using your VB2X-TCDOT Expander, you will need to follow these steps:

- Install the VB2X-TCDOT on the VB-2XXX Controller
- Configure the VB-2XXX Controller to use the VB2X-TCDOT in the EZ LADDER Toolkit Project Settings.

Refer to the appropriate sections of this manual for details on the above items.

How to Use this Manual

In this manual, the following conventions are used to distinguish elements of text:

BOLD	Denotes labeling, commands, and literal portions of syntax that must appear exactly as shown.
italic	Used for variables and placeholders that represent the type of text to be entered by the user.
SMALL CAPS	Used to show key sequences or actual buttons, such as OK, where the user clicks the OK button.

In addition, the following symbols appear periodically in the left margin to call the readers attention to specific details in the text:

Warns the reader of a potential danger or hazard associated with certain actions.

Appears when the text contains a tip that is especially useful.

Indicates the text contains information to which the reader should pay particularly close attention.

All Specifications and Information Subject to Change without Notice

Install the VB2X-TCDOT Expander on the VB-2XXX Controller

The VB-2XXX and VB2X-TCDOT are purchased separately. Before the VB2X-TCDOT may be used, it must be installed as the expansion option on the VB-2XXX controller. You will need full access to the VB-2XXX top and bottom. It is recommended to disconnect and un-mount the VB-2XXX prior to beginning this installation.

To Install the VB2X-TCDOT (example: VB2X-4K4DOT)

1. Un-mount and disconnect the VB-2XXX Controller

2. Using the 4 metal spacers and 4 of the screws provided, install the spacers on the VB-2XXX controller in the provided expansion holes as shown in Figure 1-1. The male side (threaded post) of the spacer will go through the VB-2XXX board from the top to bottom. Install 4 Lock washer and 4 nuts to the spacers (on the back side).

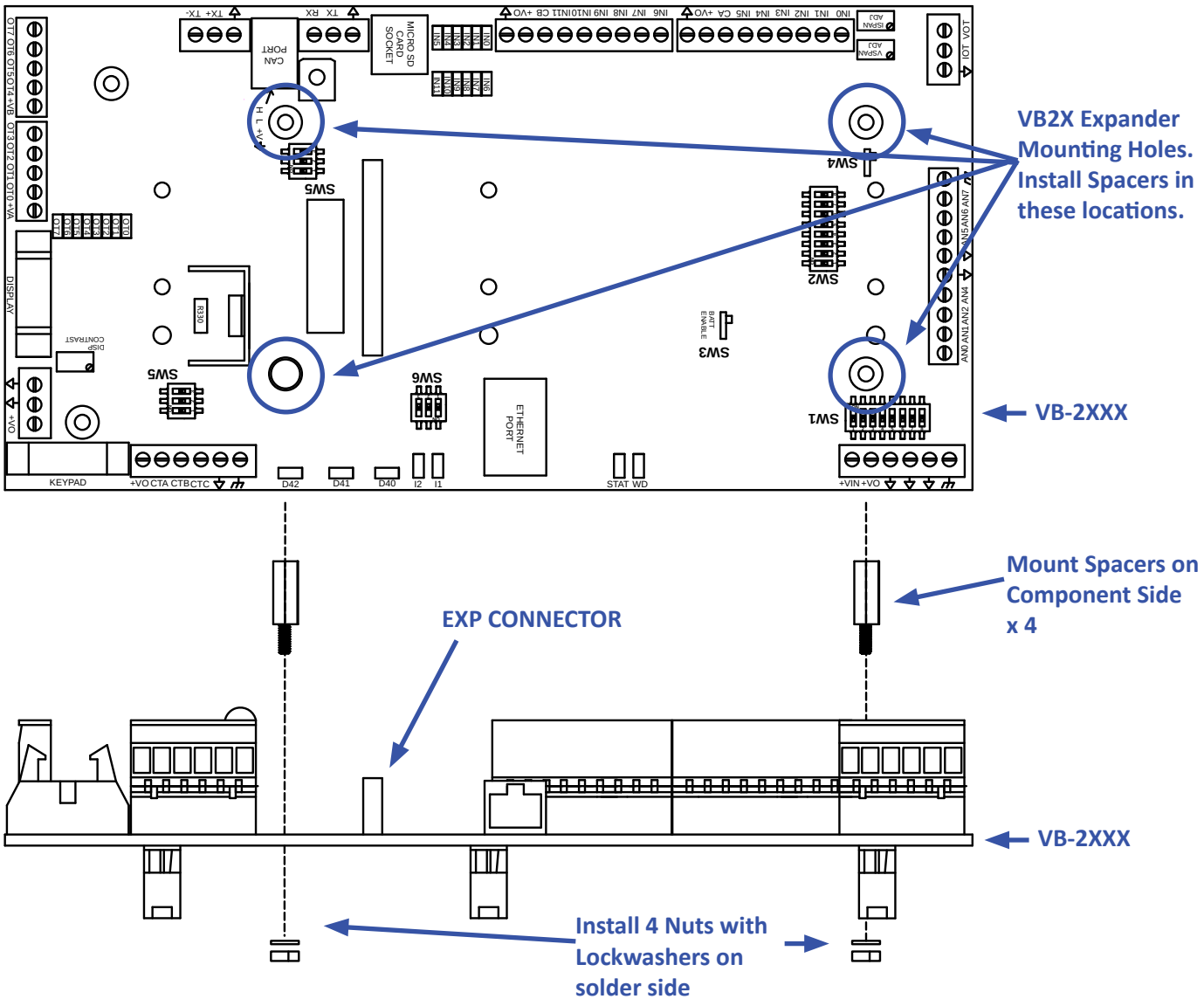

Figure 1-1 - Installation of Spacers

3. Carefully aligning the VB2X-TCDOT with the installed spacers, gently plug the VB2X-TCDOT into the EXP connector on the VB-2XXX. Ensure proper alignment on EXP. When installed correctly, all the VB2X-TCDOT pins will be plugged into the EXP connector and the VB2X-TCDOT will be placed against the spacers and the mounting holes will align with the spacers correctly. Refer to Figure 1-2.

4. Install the remaining 4 screws and lockwashers provided to secure the VB2X-TCDOT to the VB-2XXX controller (installed spacers).

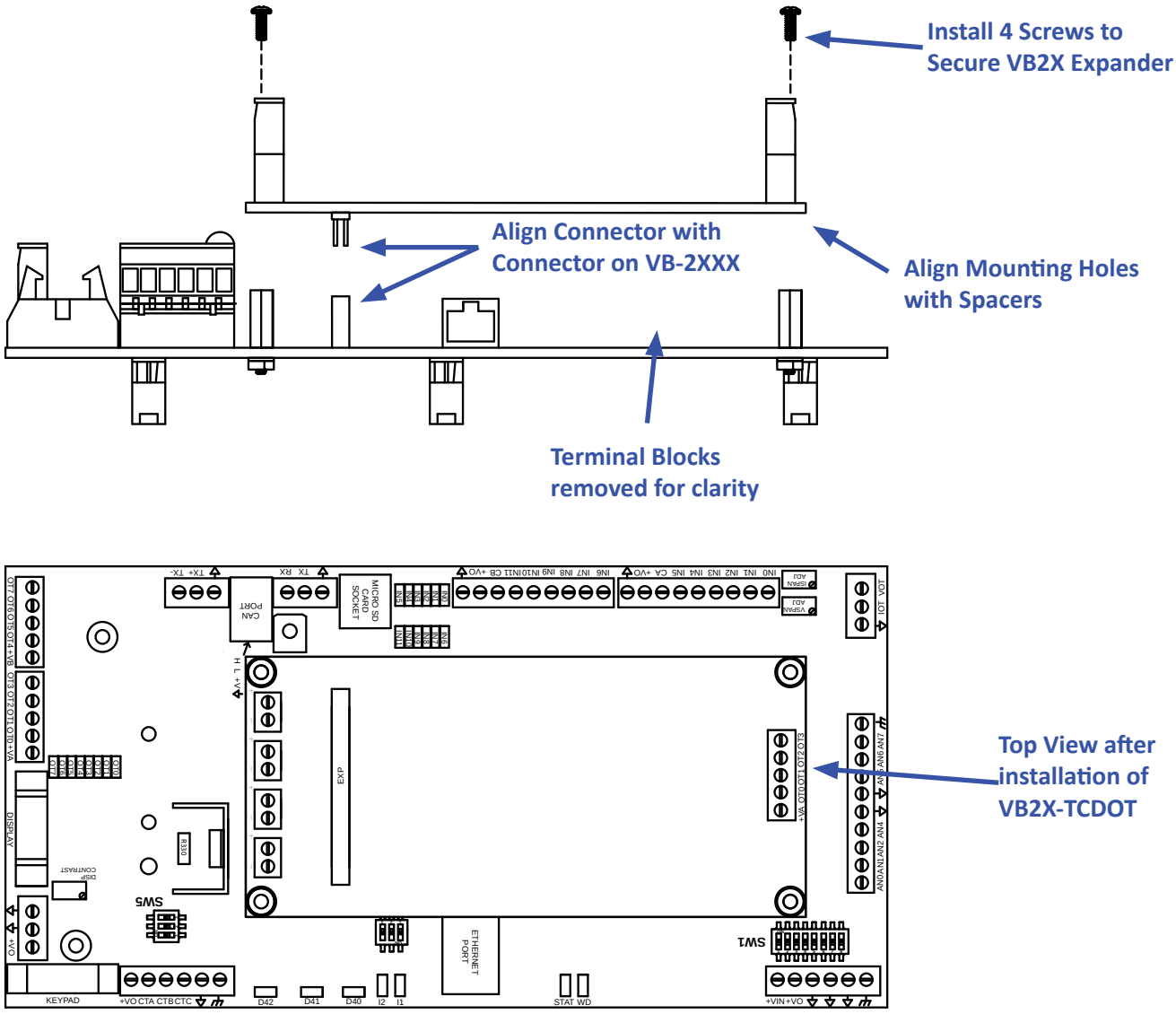

Figure 1-2 - Mounting the VB2X-TCDOT

Configuring the VB2X-TC in EZ LADDER Toolkit

It is assumed that you are familiar with the VB-2XXX before installing this expansion option. Please refer to the VB-2XXX User Manual for details regarding the VB-2XXX.

Before you can begin using features on the VB2X-TCDOT, it must be configured as an option for the VB-2XXX target within the EZ LADDER Toolkit. For help with installing or using EZ LADDER, please refer to the P-Series EZ LADDER Toolkit Manual.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **VB-2000** as the target from the choices. Refer to Figure 1-3.

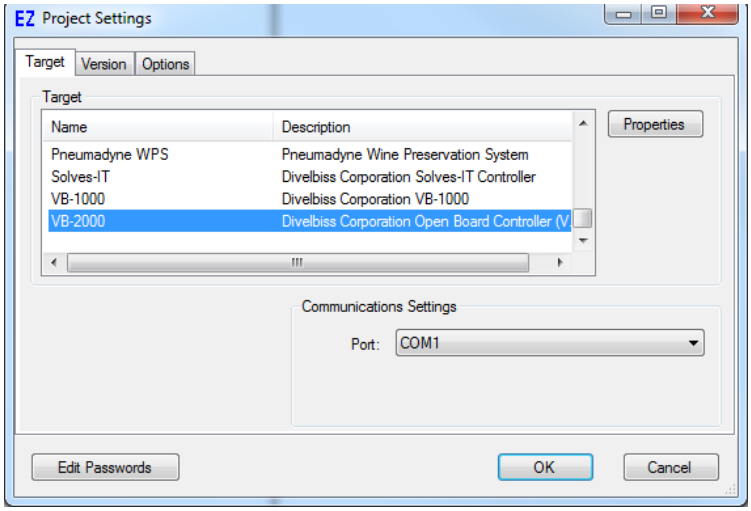

Figure 1-3 - Project Settings Window

2. Click the **PROPERTIES** button to the right side of the window. The VB-2000 Properties Window will open. Make sure the proper model is selected in the drop-down menu. If any expansion board was installed previously, it would be listed in the **Expansion Pane**.

3. Highlight the ***I/O Expansion*** in the list and click the **PROPERTIES** button on the right side of the Expansion pane in the VB-2000 Properties Window. The I/O Expansion Properties Window will open. Refer to Figure 1-4.

4. Select the VB2X-4K4DOT expansion board from the list of Expansion boards. Refer to Figure 1-4. The Details section of the window will update with the devices supported on the expander (for reference only) that will be installed in the project settings of the program.

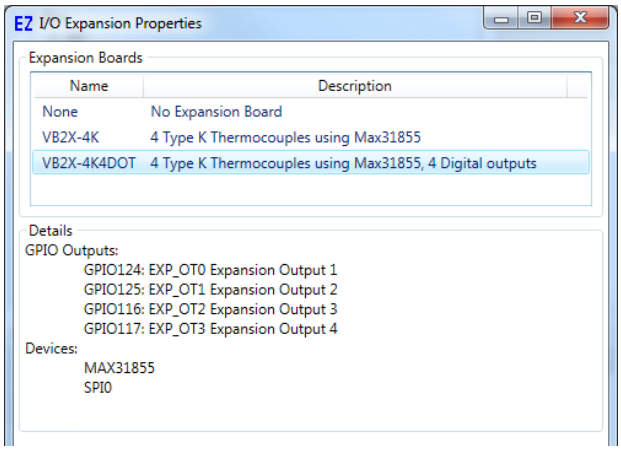

Figure 1-4 - I/O Expansion Properties

5. Click **OK** to accept the VB2X-4K4DOT and close the I/O Expansion Properties Window.

6. Click **OK** to close the *VB-2000 Properties* window. Click **OK** to close the Project Settings window.

7. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The VB2X-4K4DOT expander is now installed. The real variables TC1-TC4 are automatically created and represent the temperature of each thermocouple input channel (1-4) in degrees C. The four output boolean variables EXP_OT0 - EXP_OT3 are automatically created.

Getting to Know the VB2X-TCDOT

The VB2X-TCDOT is an expander for the VB-2XXX controller. The VBEX-TCDOT provides up to 4 Thermocouple inputs and 4 Digital Sourcing Outputs. The following models are supported as VB2X-TCDOT expanders. See Figure 1-5.

Model #	Description
VB2X-4K4DOT:	VB2X-TCDOT expander with 4 Type K Thermocouples, 4 Sourcing Digital Outputs

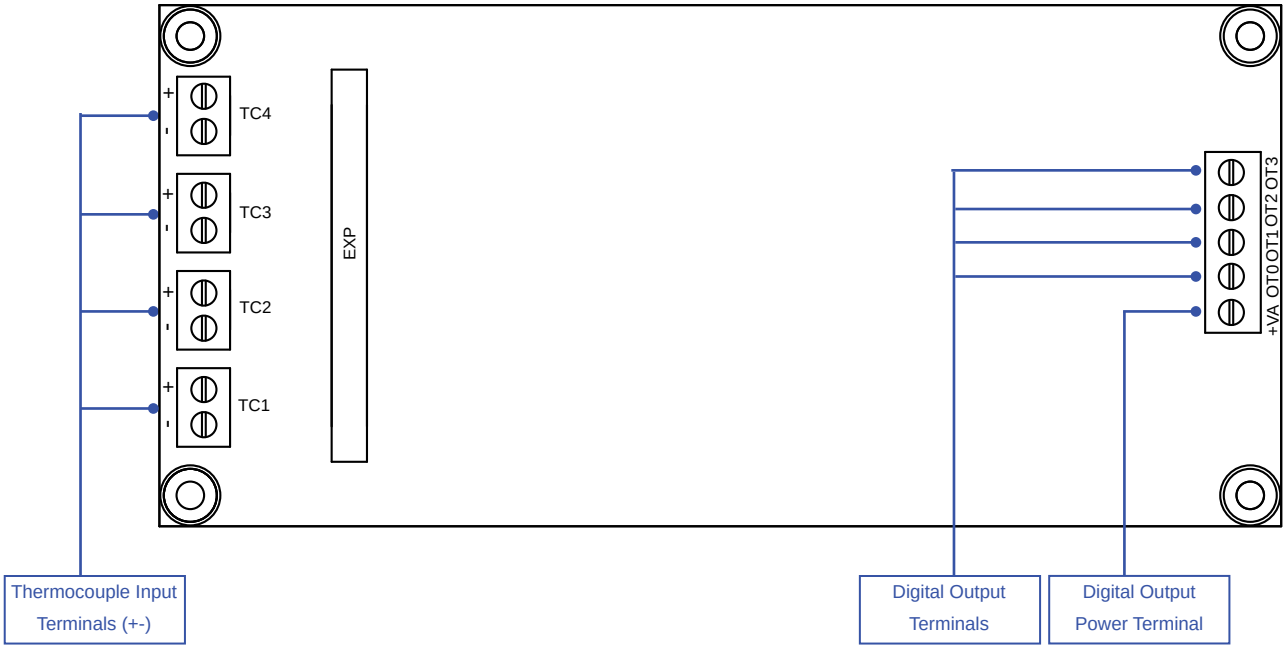

Figure 1-5 - VB2X-TCDOT Features

Additional Thermocouple Types

Other thermocouple types, (J, N, R, S) are available upon request. Please consult the factory for availability of VB2X expansion with these thermocouple types.

VB2X-TCDOT Features

This section explains the VB2X-TCDOT Expander hardware features, options and information regarding EZ LADDER Toolkit for basic operation.

Thermocouple Inputs

The VB2X-TC provides up to 4 Thermocouples. The type and quantity of each thermocouple input is based on the actual Model Number of the Expander ordered.

Model #	Description
VB2X-4K4DOT:	VBEX-TCDOT expander with 4 Type K Thermocouples

Each thermcouple input is represented in the EZ LADDER Toolkit ladder diagram using (Real) variables labeled TC1 - TC4. These variables were created automatically when the VB2X-TCDOT expander was configured as the expansion option for the VB-2XXX target.

Each variable (TC1- TC4) will represent the actual temperature read by the connected thermocouple in degrees Celsius. If you wish to have temperatures in degrees Fahrenheit, you must convert the values using mathematical function blocks in your ladder diagram program. Each thermocouple channel internally has all the required cold-junction compensation and linearization required.

Thermocouple Input Connections

For each of the thermocouple inputs (TC1-TC4), a + and - terminal are provided. Refer to Figure 1.5 for locations of the thermocouple input terminals and their polarity. Figure 2-1 illustrates a typical thermocouple connection.

When connecting thermocouples, connect the thermocouple wire directly to the terminals provided. When mounted in an enclosure, ensure that only thermocouple wire of the appropriate type is used for the connections between the VBEX-TC thermocouple terminals and the actual enclosure entry. Failure to use the proper thermocouple wire will result in incorrect temperature readings.

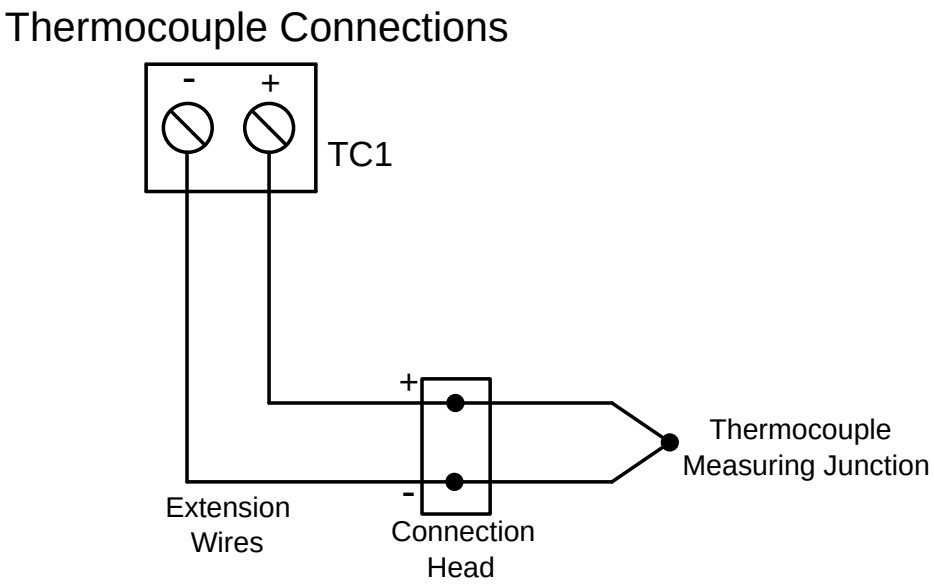

Figure 2-1 - Typical Thermocouple Input Connection

The operating temperature range of the expander may vary based on model number. The VB-2XXX is rated for -40°C to +80°C, but some expanders may not operate under this full range. The controller and expander should only be installed where the temperature range of the narrowest window between the controller and the expander is sufficient.

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Digital Outputs

The VB2X-TCDOT includes 4 on-board digital outputs. They are identified in the EZ LADDER Toolkit and this manual as EXP_OT0 - EXP_OT3 (on the expander as OT0 - OT3) and these variables are automatically created when the VB2X-TCDOT is selected as the VB-2XXX Expansion. These outputs are sourcing, therefore an energized output will source an output voltage equal to the controller input voltage. Refer to Figure 2-2 for typical output connections.

An external power connection and source is required to supply power for the outputs. Power is supplied by the +VA terminal using the 18 AWG wire or larger. The +VA terminal and expander outputs allow for expander output loads to be controlled at different voltages from the controller I/O. The expander outputs will operate at any voltage from 8-32VDC.

The Expander outputs and controller outputs may be connected to different voltages, but the power supplies connected must have the same common (ground). Failure to use the same common for the expander outputs, controller outputs and controller power may cause unwanted operation and may cause damage to the VB-2XXX.

Each output can drive a load up to maximum current rating listed in the specifications section (resistive) and includes an automatic over-current shutdown safety. In the event an over current condition exists, the output will shut down. This shut down condition is reset when the output is turned off (set to false) in the ladder diagram.

Each output requires a minimum load to operate correctly. Depending upon the device connected to an output, a minimum load resistor may be required. If the output is ON or true regardless of the ladder diagram program, connect a 470Ω to 1KΩ load from the output to input power common.

To control a digital output in a ladder diagram, place and connect the appropriate coil for your needs. The DIRECT COIL and INVERTED COIL functions are used to control digital outputs in the ladder diagram. When placing the coil, verify you select the correct output address (EXP_OT0 - EXP_OT3) from the provided drop-down menu.

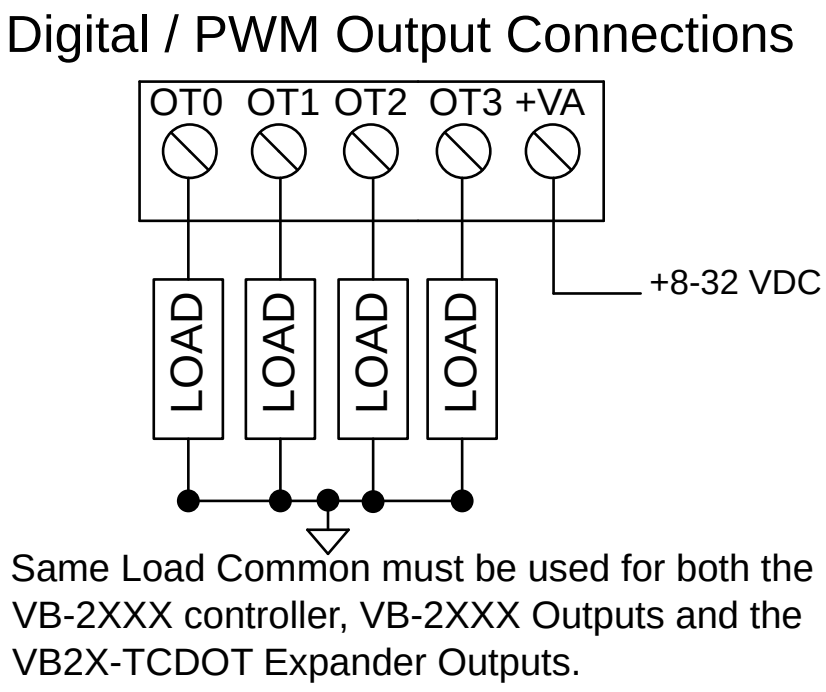

Figure 2-2 - Typical Digital / PWM Output Connections

Each expander output will may be operated as a digital on/off output or as a pulse width modulated (PWM) output. To operate one or more digital outputs as PWM output, it must must be configured in the EZ LADDER Toolkit Project Settings.

PWM Outputs

The VB2X-TCDOT's 4 digital outputs may also be used as Pulse Width Modulation (PWM) outputs instead of digital (on/off) outputs. The outputs whether used as digital on/off outputs or PWM outputs connect to loads the same and will only operate at the specifications listed in the Specifications section of this manual. Refer to Figure 2-2 for connections.

By default, the PWM functionality is not enabled (as it is enabled for digital on/off output functionality). Each output may only be used as either a digital output (on/off) or PWM. Outputs to be used as PWM channels must be configured in EZ LADDER Toolkit using the Project Settings Menu.

The following are the PWM channel assignments for the digital output channels OT0 - OT3 (as listed on the expander in silkscreen).

VB2X-TCDOT Terminal Labeling	PWM Channel	Digital Output Channel / EZ LADDER Variable
OT0	PWM4	EXP_OT0
OT1	PWM5	EXP_OT1
OT2	PWM10	EXP_OT2
OT3	PWM11	EXP_OT3

It is assumed that you are familiar with the VB-2XXX before installing PWM. Please refer to the VB-2XXX User Manual for details regarding the VB-2XXX. Refer to the P-Series EZ LADDER Toolkit Manual for more details on configuring PWM and other options in EZ LADDER Toolkit.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **VB-2000** as the target from the choices. Refer to Figure 2-3.

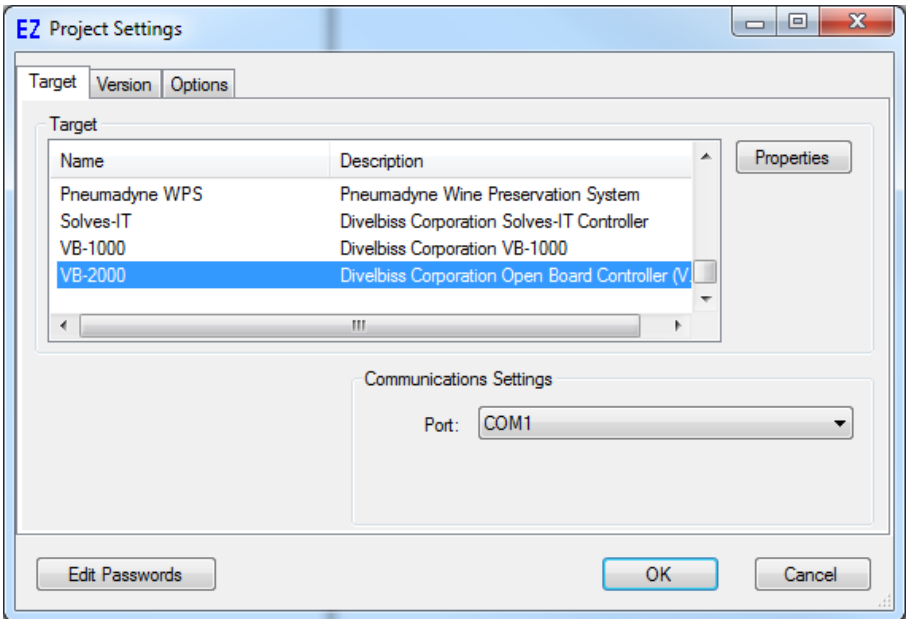

Figure 2-3 - Project Settings Window

2. Click the **PROPERTIES** button to the right side of the window. The VB-2000 Properties Window will open. Make sure the proper model is selected in the drop-down menu. The VB2X-4K4DOT should already be installed prior to configuring the PWM channels.

3. If PWM is listed under the ***Internal*** heading, then PWM has been installed (for outputs on the VB-2XXX controller). Only the VB2X-4K4DOT PWM channels need to be configured. If PWM is listed under ***Internal***, highlight (select) it and click **PROPERTIES**, othewise, click the **ADD DEVICE** button. Refer to Figure 2-4.

4. The PWM Properties window will open. Refer to Figure 2-5. The channels listed were previously configured. To add additional channels, click the **ADD** button. The Add PWM Dialog will open. Refer to Figure 2-6.

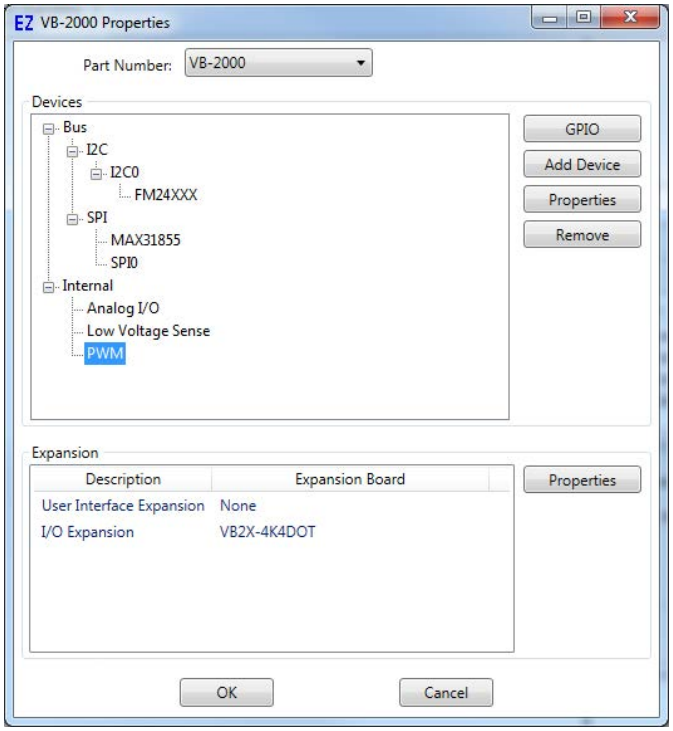

Figure 2-4 - VB-2XXX Properties

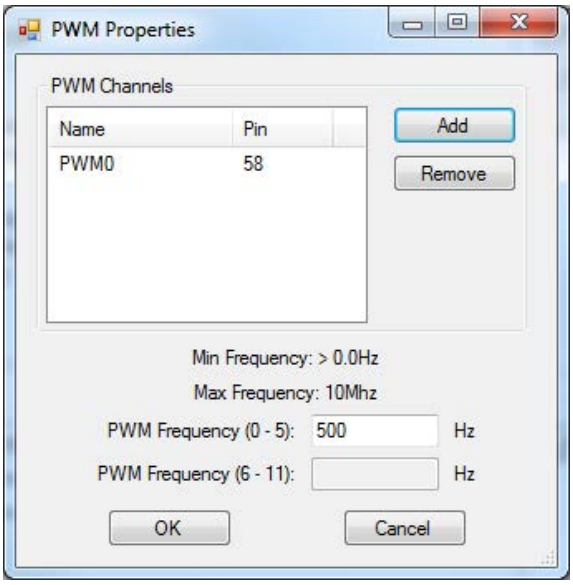

Figure 2-5 - PWM Properties

5. Click to highlight the channels need to add. Refer to the list of PWM channels supported on the VB2X-4K4DOT listed earlier in this section. Holding the CTRL key while clicking on PWM channels will allow multiiple selections. Click **OK** to accept the selected PWM channels.

6. Enter the base PWM frequency for the channel groups as needed (channels 0-5 use one frequency while channels 6-11 use another frequency setting. PWM channels in each group are based on the frequency for each group. The frequencies may be the same, but the frequency must be entered in both boxes. Refer to Figure 2-5.

7. Click **OK** to close the PWM Properties window. Click **OK** to close the *VB-2000 Properties* window. Click **OK** to close the Project Settings window.

8. Save your ladder diagram using the menu **FILE** and **SAVE** or **SAVE AS** to save the current settings in your program.

The VB2X-4K4DOT PWM channel(s) are now installed. The channels may be used in the ladder diagram by the PWM and PWM_FREQ function blocks.

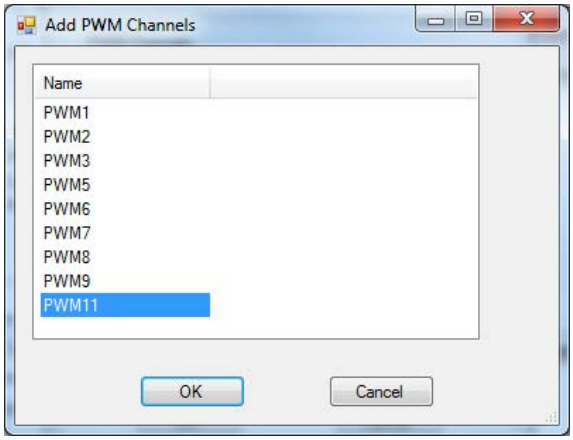

Figure 2-6 - Add PWM Channels

VB2X-TCDOT Specifications

Type K Thermocouple Inputs:	Qty up to 4 Measurement Range: -270°C to 1372°C Resolution: 14 Bit, 0.25°C per bit Accuracy -200°C to +700°C: +/- 2°C (Ambient -20°C to 80°C) Accuracy +700°C to +1350°C: +/- 4°C (Ambient -20°C to 80°C) Accuracy - 270°C to +1372°C: +/- 6°C (Ambient -40°C to 80°C)
Digital I/O:	4 Digital Outputs on-board Outputs rated 2A Max per output, Over-current protected. LED Indicators Sourcing as Group of 4 Outputs, External Power Source Required on +VA, 8-32VDC
Operating Temp:	-40°C to 80°C
Dimensions:	2.9” Wide x 6.4” Length x .1.35” Tall.
Mounting:	Installs on VB-2XXX Controller, Stack Mount using #6 spacers and screws
Type:	Open Board
Storage Temperature:	-40 to 85°C