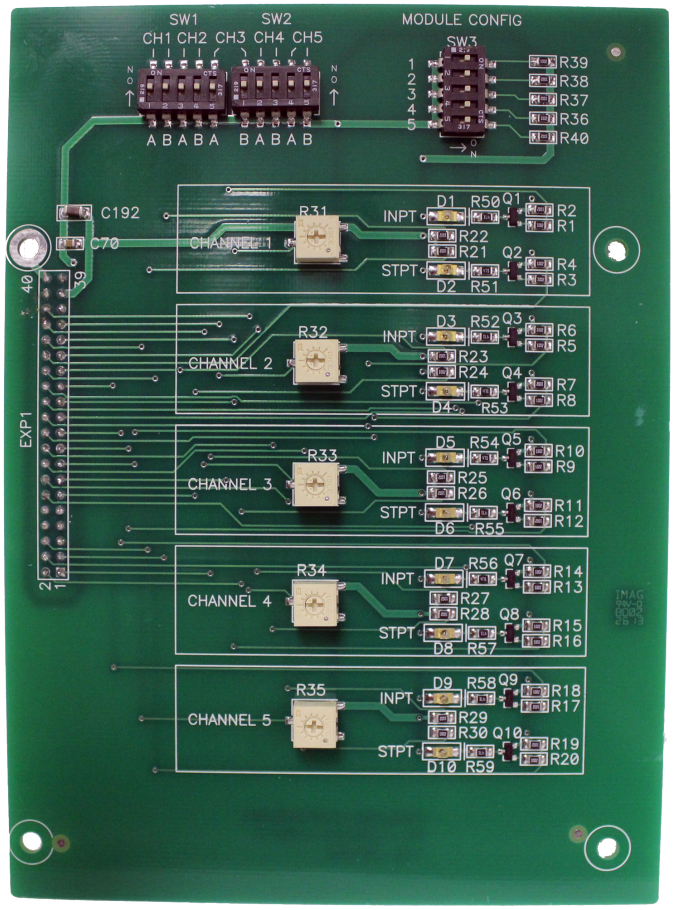
USER'S MANUAL

Revision: 1

For P13 -Series Bear Bones Controllers



Bear Bones Programmble User Interface

Covered Models: **ICM-PUI-01**

Divelbiss CORPORATION

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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 Programmble User Interface Board (for P-Series Bear Bones), you will need to follow these steps:

- Configure jumpers on the Bear Bones Controller
- Mount / Install the ICM-PUI-01 to the Bear Bones Controller
- Configure the Programmable User Interface Switches*

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

* If using as an ICM-TM-0x functional replacement with Divelbiss provided program / Structured Text function block.

WARNING!!

The ICM-PUI-01 Board must not be used 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.

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

The Programmable User Interface (ICM-PUI-01) Overview

The ICM-PUI-01, Programmable User Interface is an expansion board for the P-Series Bear Bones controller(s). This expander provides optional functionality. The expander provides a total of 10 LED indicators, 15 silde switches and 5 potentiometers which can be monitored or controlled via the ladder diagram (as digital inputs, outputs and analog inputs) of the P-Series Bear Bones controller.

Optionally, using Divelbiss provided software (ladder diagram and structured text function block), the ICM-PUI-01 may be configured to operate with the same functionality of the ICM-TM-01, ICM-TM-02 and ICM-TM-03 of the legacy Bear Bones product. The switches on the board configure the type of timer functionality with the same ranges from the original legacy bear bones timers. The potentiometers are fed into the analog inputs to provide the timer setpoint and LED indicators are provided to identify timer start and completion.

Getting to Know the ICM-PUI-01

The ICM-PUI-01 is shipped as an open-board expander that connects directly to the P-Series Bear Bones controller via it's EXP1 expansion connector. The expander mounts to the controller using provided hardware including stand-offs, screws and nuts. Figure 1.1 illustrates the ICM-PUI-01 expander board.

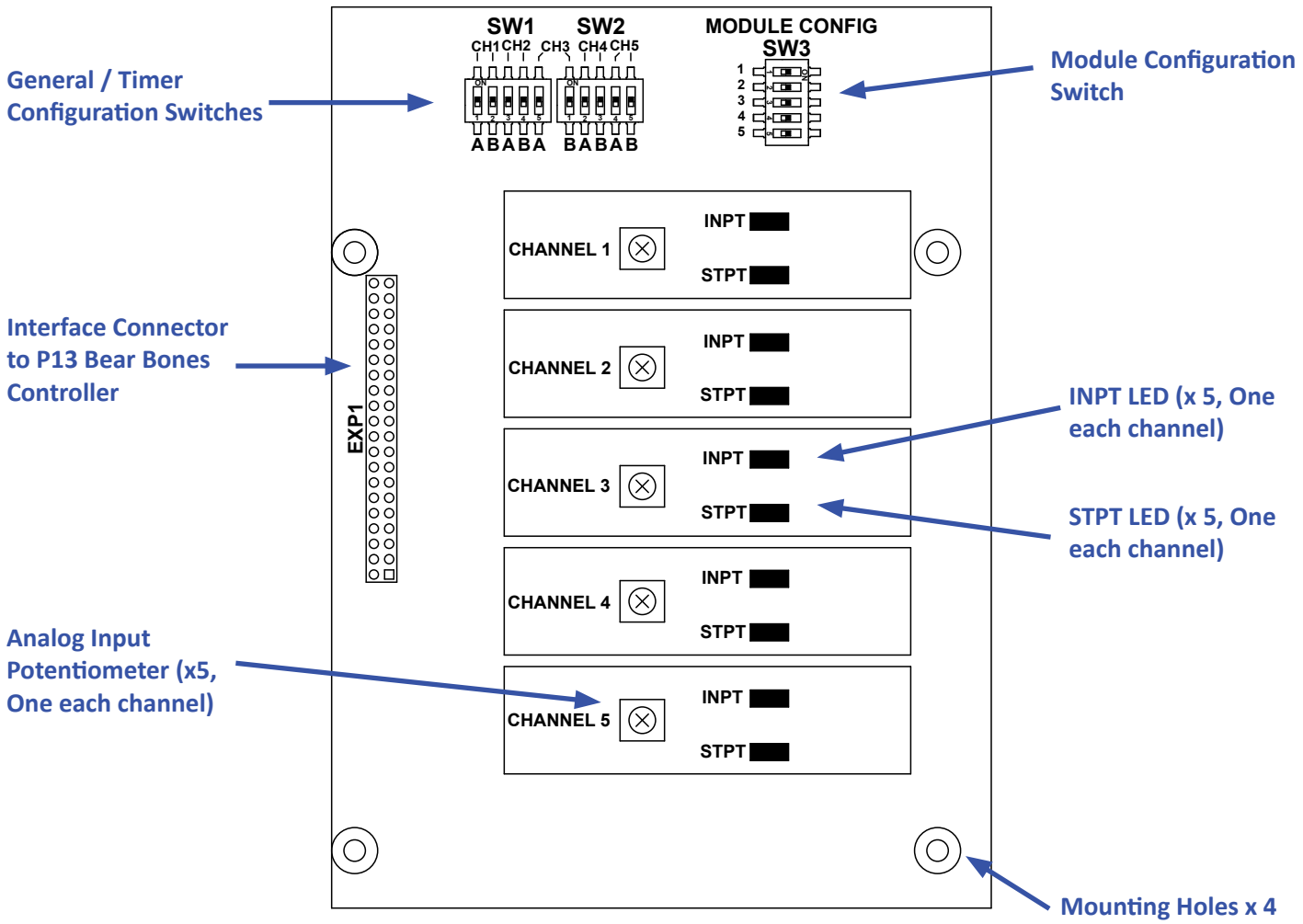

Figure 1-1 - ICM-PUI-01 Illustration

Installing the ICM-PUI-01

The ICM-PU-01 installs directly on a P13 Series Bear Bones controller using the provided hardware.

The ICM-PUI-01 when installed blocks access to several configuration jumpers on the P13 Series Bear Bones Controller. These jumpers should be configured prior to installing the ICM-PUI-01. **Refer to later sections of this manual or the P13 Series Bear Bones Manual** for proper jumper configurations**.**

1. Install the a stand-off (4-40x5/8”) provided into each of the the P13 Bear Bones Controller’s 4 mounting holes provided and secure using one star lockwasher and one 4-40 nut provided. See Figure 1-2 for mounting hole locations. The male end of the stand-off should be installed through the P13 Series Bear Bones Controller from the top side with the lockwasher and nut installed on the back side.

2. Align the ICM-PUI-01 board over the four stand-offs installed in step 1 and align the EXP1 connector of the ICM-PUI-01 with the EXP1 connector of the P13 Series Bear Bones Controller. The connector should align as well as all the mounting holes. Carefully plug the module into EXP1.

3. Install a 4-40 screw and star lockwasher into each of the mounting hole and into the stand-off female end. Tighten to secure the ICM-PUI-01. Figure 1-3 represents the installed ICM-PUI-01.

The ICM-PUI-01 should be configured prior to applying power to the P13 Series Bear Bones Controller.

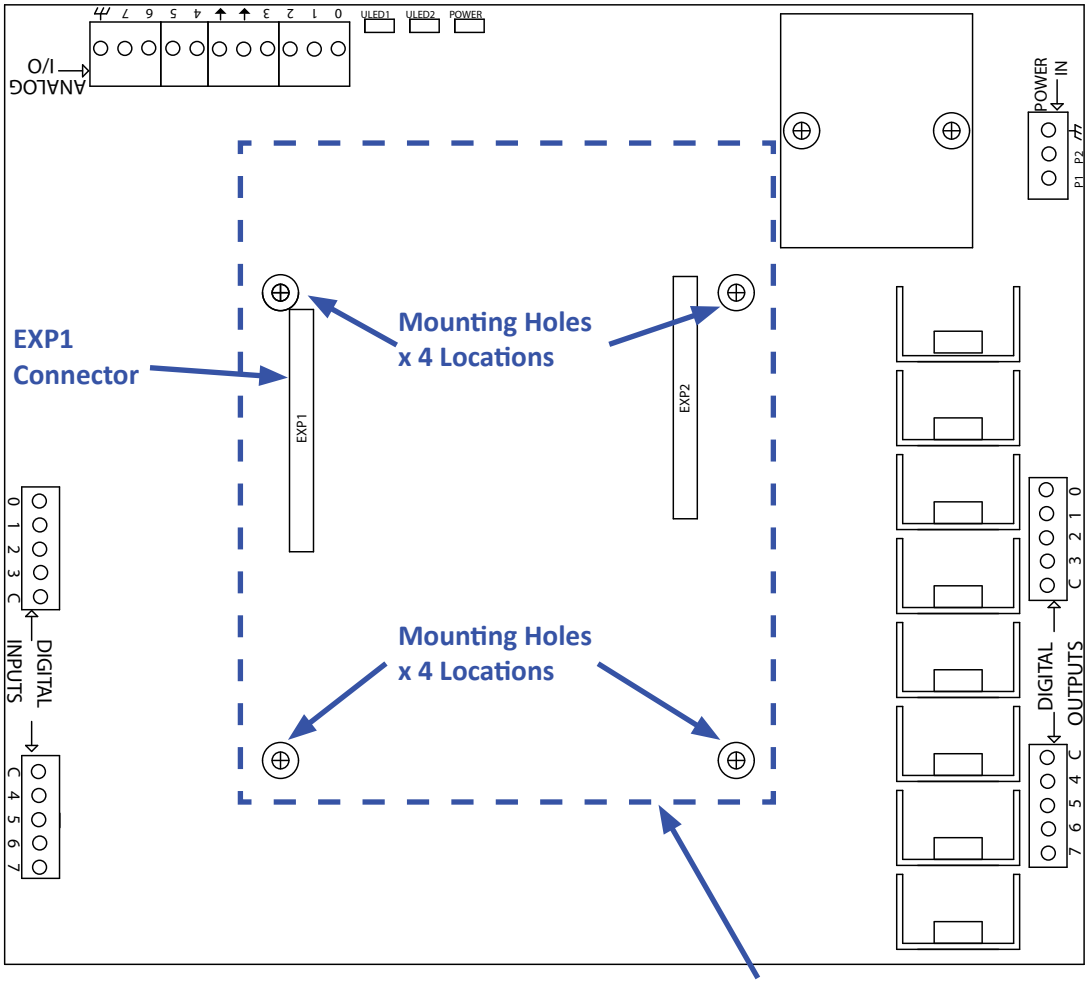

Figure 1-2 -Mounting Holes

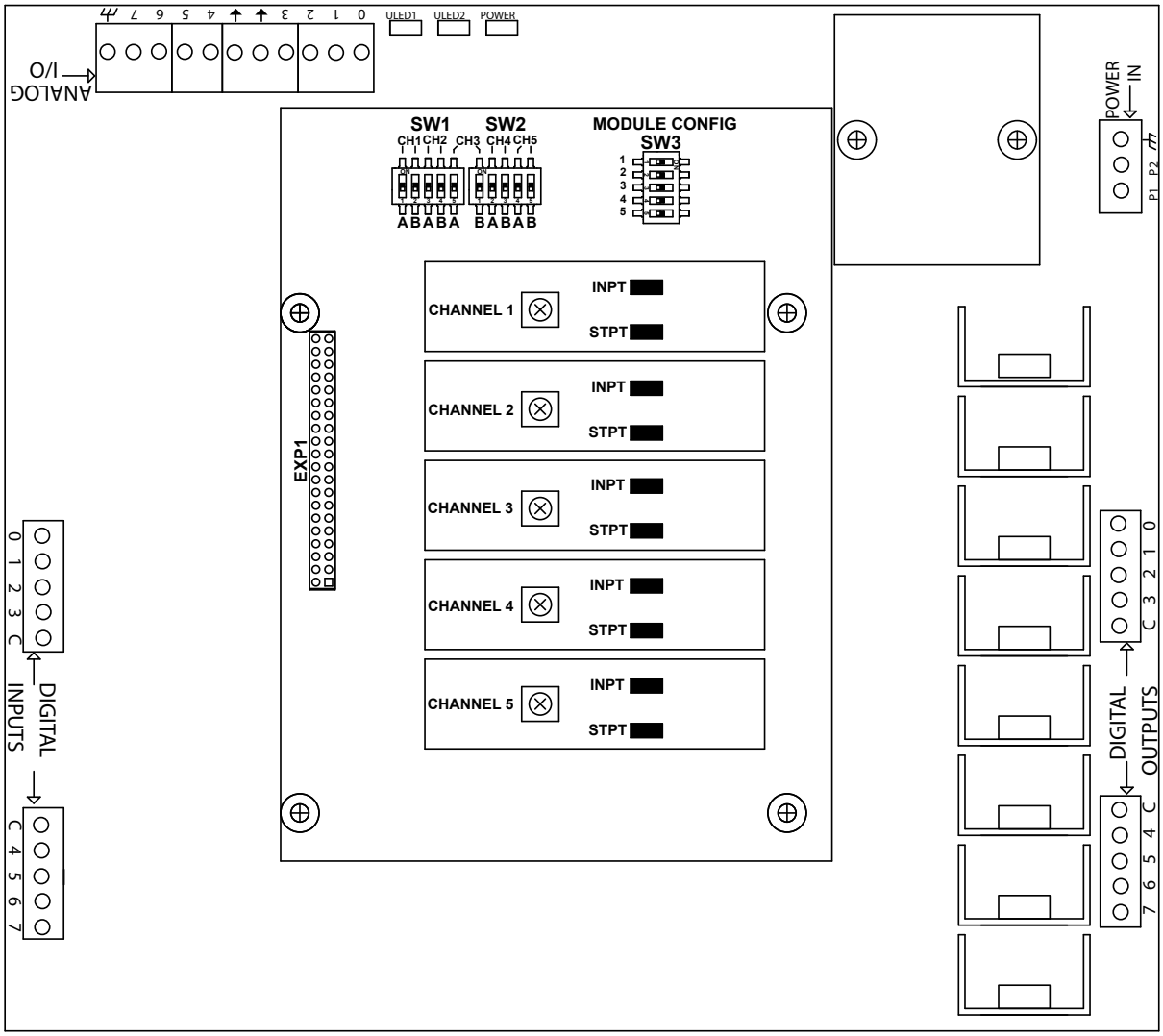

Figure 1-3 - ICM-PUI-01 Installed

Hardware Specifications

Digital Inputs:	15 Digital Inputs via 3 switch blocks of 5 individual switches.
Digital Outputs:	10 Digital Outputs via 10 LED indicators
Analog Inputs:	5 Potentiometer inputs via controller based analog inputs (requires jumper configuration) and detracts from total analog inputs available on controller.
Type:	Open Board Style. Mounts to stand-offs (hardware included).
# of Channels:	5 Timer Channels (Legacy Timer Support).

ICM-PUI-01 Functions

This section explains the ICM-PUI-01 generic functionality including available user interface points (LEDs, switches, etc.).

General ICM-PUI-01 Functionality

The ICM-PUI-01 is a user interface board that provides functionality to the controller as digital inputs using dip switches, outputs as LED indicators and analog inputs from potentiometers. These I/O points can be accessed in the P13 Series Bear Bones controller ladder diagram.

When using the ICM-PUI-01 not as a legacy timer (ICM-TM-0x), it has the following I/O that may be accessed in the ladder diagram. Refer to Figure 2-1 for an illustration of the available I/O locations.

-15 Inputs via dip switch locations
-10 LED Indicators
- 5 Potentiometers (read via analog inputs)

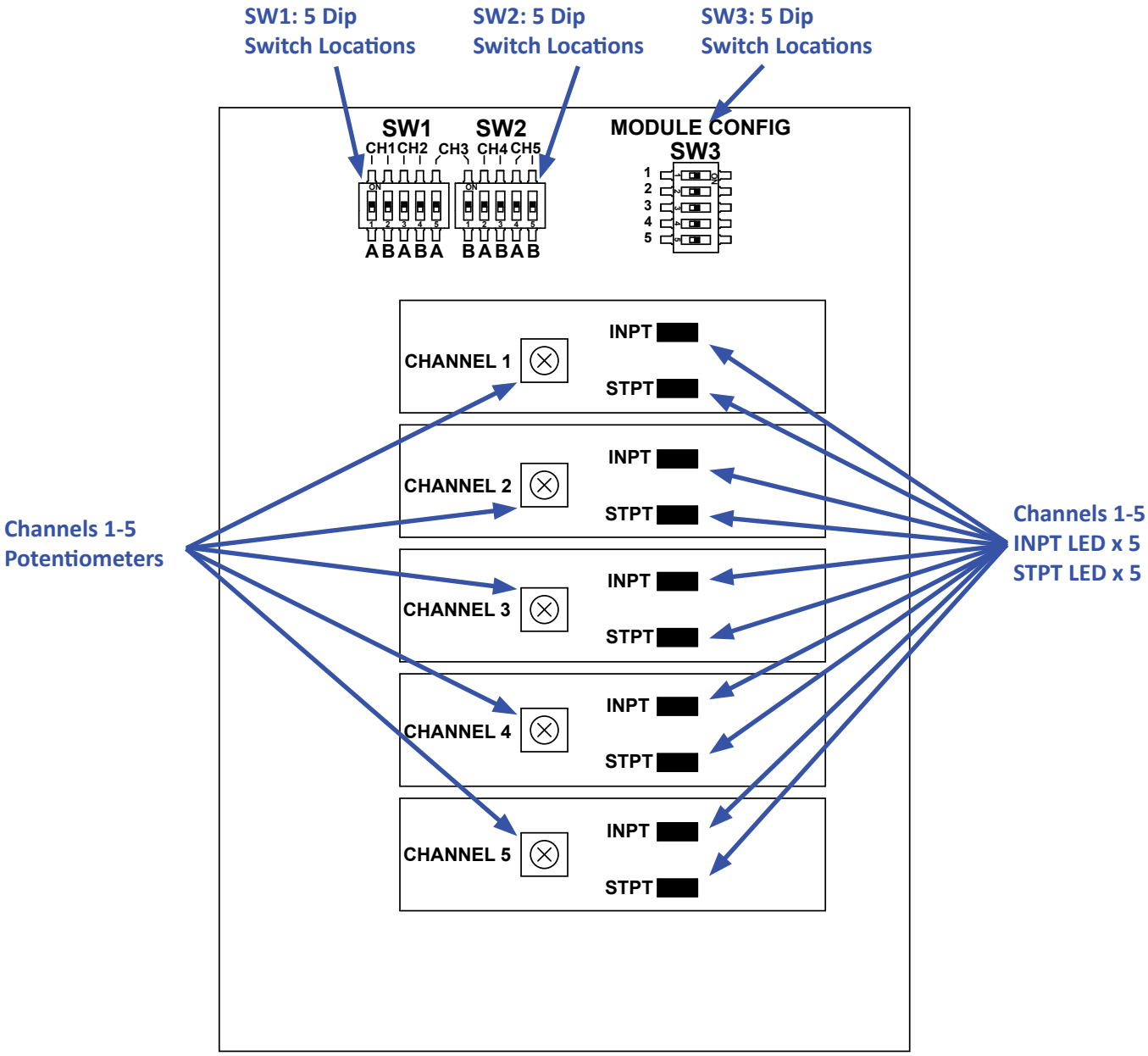

Figure 2-1 - ICM-PUI-01 I/O Feature Locations

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The ICM-PUI-01 may be used in the ladder diagram by two methods: with contacts and coils or by Structured Text. To use the contacts and coils method, the ICM-PUI-01 expansion options must be configured in the EZ LADDER Toolkit's Project Settings. When using Structured Text, the I/O can be configured from the Structured text language and does not require the ICM-PUI-01 to be configured in the Project Settings.

Configuring the ICM-PUI-01 Expansion Option in EZ LADDER

Before you can use the ICM-PUI-01 I/O as contacts and coils, it must be configured as a expansion option of the P13 Series Bear Bones controller within the EZ LADDER Toolkit. For help with installing or using EZ LADDER, please refer to the P-Series EZ LADDER User's Manual.

1. In EZ LADDER, from the File Menu at the top, click **PROJECT** then **SETTINGS**. This will open the Project Settings Window. Select **ICM-BB-P13-XX** as the target from the choices. Refer to Figure 2-2. Verify the correct COM Port is selected.

2. Click the **PROPERTIES** button to the right side of the window. The ICM-BB-P13-XX Properties Window will open.

3. Using the Drop-down Part Number select box, select the model of the ICM-BB-P13-XX. Refer to Figure 2-3. With the model selected, the Devices pane will update with the currently selected features for the ICM-BB-P13-XX.

4. Click (highlight) the ***Expansion Port*** in the list box in the lower left (Expansion section then click the **PROPERTIES** button located in the lower right (Expansion section). This will open the *Expansion Port Properties* window.

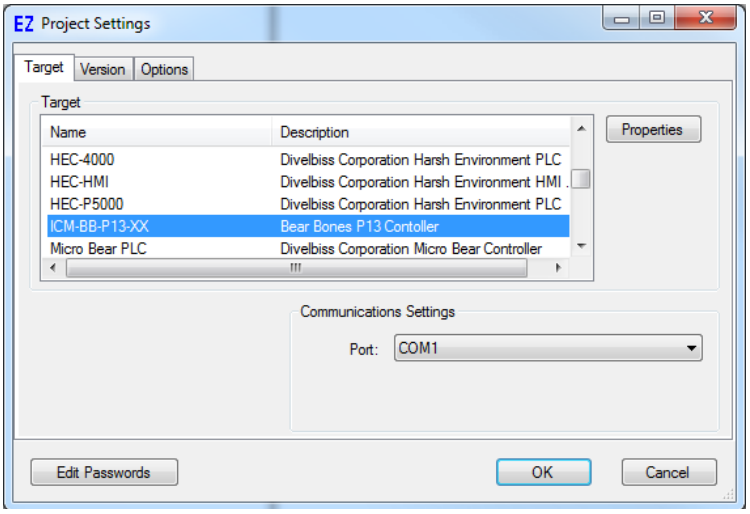

Figure 2-2 - Project Settings

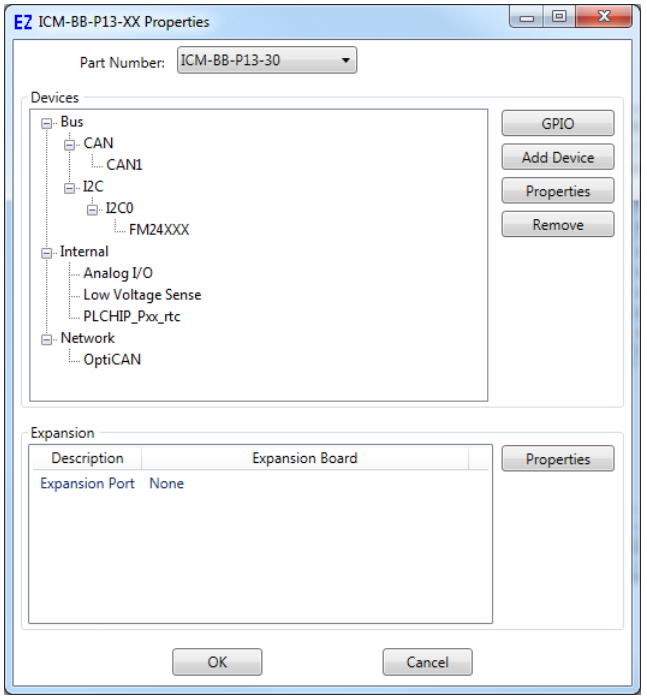

Figure 2-3 - Target Properties

5. Select the ICM-PUI-01 from the Expansion Boards list. Refer to figure 2-4. The Details pane will update with the I/O list on the selected expander.

6. Click **OK**. This will install the ICM-PUI-01 expander and close the *Expansion Port Properties* window. the ICM-BB-P13-XX Properties window should now list the ICM-PUI-01 as an installed expander (Expansion Pane at bottom). Refer to Figure 2-5.

7. Click **OK**. This will close the ICM-BB-P13-XX Properties window and save any changes made.

8. Click **OK**. This will close the Project Settings Window. Use the **SAVE** or **SAVEAS** menu to save the ladder diagram project.

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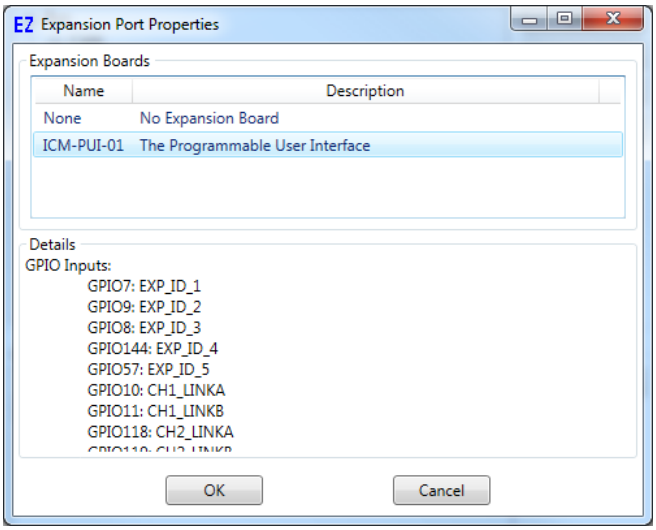

Figure 2-4 - Expansion Port Properties

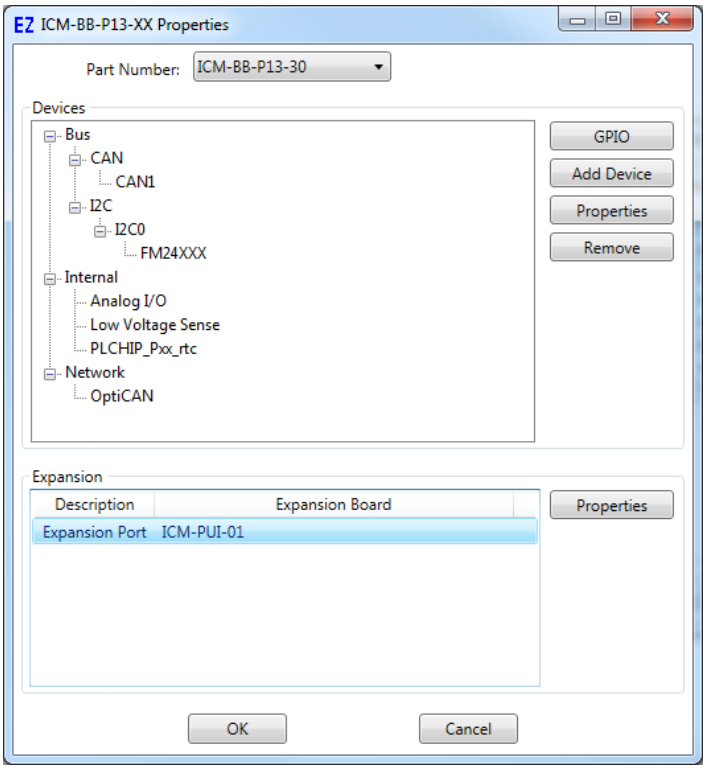

Figure 2-5 - Installed Expander

ICM-PUI-01 I/O Assignments

When the ICM-PUI-01 is installed in the Project Settings, the I/O are automatically named and configured and appear as boolean variables in EZ LADDER Toolkit. If you are going to use Strutured Text to access the I/O, the following I/O addressing is needed.

Switch #	Variable Name	I/O Address	LED	Variable Name	I/O Address
SW1	CH1_LINKA	GPIO10	INPT	CH1_LED1	GPIO122
SW1	CH1_LINKB	GPIO11	STPT	CH1_LED2	GPIO123
SW1	CH2_LINKA	GPIO118	INPT	CH2_LED1	GPIO124
SW1	CH2_LINKB	GPIO119	STPT	CH2_LED2	GPIO125
SW1	CH3_LINKA	GPIO145	INPT	CH3_LED1	GPIO112
SW2	CH3_LINKB	GPIO146	STPT	CH3_LED2	GPIO113
SW2	CH4_LINKA	GPIO164	INPT	CH4_LED1	GPIO114
SW2	CH4_LINKB	GPIO163	STPT	CH4_LED2	GPIO115
SW2	CH5_LINKA	GPIO120	INPT	CH5_LED1	GPIO116
SW2	CH5_LINKB	GPIO121	STPT	CH5_LED2	GPIO117
SW3	EXP_ID_1	GPIO7			
SW3	EXP_ID_2	GPIO9			
SW3	EXP_ID_3	GPIO8			
SW3	EXP_ID_4	GPIO144			
SW3	EXP_ID_5	GPIO57			

Analog Pots - Jumper Configurations

The ICM-PUI-01 potentiometers are designed to connect to the P13 Series Bear Bones controller's analog inputs and provide a direct 0-5VDC signal (approximate). The P13 Series Bear Bones controllers have on-board configuration jumpers for the analog circuits that configure the source of the analog input (on-board terminal block or ICM-PUI-01), the type of analog input (0-5VDC, 0-10VDC or 0-20mADC) and an additional jumper configures one channel as an analog input or an analog output. The factory default settings for the jumper configure the source as on-board the controller.

Before the potentiometers on the ICM-PUI-01 may be used, these jumpers must be configured (or verified) in the proper positions. Each channel of the ICM-PUI-01 supports a potentiometer (analog input via controller). As each channel is independent of the other channels, channels may be configured as necessary individually (ie: some may be configured as on-board terminal block analog inputs and some may be configured as sourced from the ICM-PUI-01). This is entirely dependent upon your application needs. The ICM-PUI-01 supports up to 5 channels (5 potentiometers via 5 analog inputs).

For each channel needed on the ICM-PUI-01, configure the on-board ICM-BB-P13-XX controller's analog jumpers as required. Only the configuration required for ICM-PUI-01 use is shown. For details on configurations of the analog inputs sourced on the P13 Series Bear Bones controller, refer to the P13 Series Bear Bones Controller manual. The jumpers are configured using the movable shunts installed. Pin 1 is identified and all jumper pins are in order 1, 2, 3..etc. The shunt should be installed on the pins identified below.

Channel	JMP4	JMP29	JMP5	Analog Input
1	1-2	2-3	1-2	AI0

Channel	JMP8	JMP30	JMP9	Analog Input
2	1-2	2-3	1-2	AI1

Channel	JMP10	JMP31	JMP12	Analog Input
3	1-2	2-3	1-2	AI2

Channel	JMP11	JMP32	JMP13	JMP34	Analog Input
4	1-2	3-4	1-2	1-2	AI3

Channel	JMP15	JMP33	JMP17	Analog Input
5	1-2	2-3	1-2	AI4

Configuring the jumpers incorrectly may result in no operation or incorrect operation. Damage to the controller or expander may result.

Dip Switch Inputs - General Use

The dip switches on the ICM-PUI-01 may be used in the ladder program as digital inputs. With the ICM-PUI-01 installed and configured as an expander in the Project Settings, each dip switch will have an associated boolean variable. This boolean variable may be used in the ladder diagram as a contact (or inserted as a boolean for function blocks) as needed. The I/O addressing is automatically configured as shown in the section ***ICM-PUI-01 I/O Assignements.*** To use, just place the contact or variable in the program.

If using Structured Text, the I/O may be accessed directly from the Structured Text code. For the I/O addresses, see the section ***ICM-PUI-01 I/O Assignements*** in this manual.

LED Outputs - General Use

The LED indicatorson the ICM-PUI-01 may be used in the ladder program as digital outputs. With the ICM-PUI-01 installed and configured as an expander in the Project Settings, each LED Indicator will have an associated boolean variable. This boolean variable may be used in the ladder diagram as a coil (or inserted as a boolean for function blocks) as needed. The I/O addressing is automatically configured as shown in the section ***ICM-PUI-01 I/O Assignements.*** To use, just place the coil or variable in the program.

If using Structured Text, the I/O may be accessed directly from the Structured Text code. For the I/O addresses, see the section ***ICM-PUI-01 I/O Assignements*** in this manual.

Potentiometer Analog Inputs - General Use

The five potentiometers of the ICM-PUI-01 may be used to drive analog inputs on the P13 Series Bear Bones Controller. These potentiometers are connected to the P13 Series Bear Bones controller's analog inputs. As the potentiometers are adjusted, the analog input (AI0 - AI4) will adjust accordingly. These analog inputs are monitored in the ladder diagram as integer variables with a range of approximately 80 to 4095.

Before the analog inputs may be used in conjunction with the potentiometers on the ICM-PUI-01, the actual analog inputs must be installed in the Project Settings of the P13 Series Bear Bones controller. Refer to the P13 Series Bear Bones Controller Manual for details on installing the analog inputs.

Before the analog inputs may be used in conjunction with the potentiometers on the ICM-PUI-01, the analog input jumpers must be configured. Refer to the P13 Series Bear Bones Controller Manual for details on jumper configurations.

The analog inputs (potentiometers) are read in the ladder diagram by integer variables AN0 to AN4. Each variable is automatically updated with the current value of the analog input by the P13 Series Bear Bones software. All that is required is to use the variable in the ladder diagram as needed.

Based on specific application needs, the analog inputs may need to be averaged for stability using standard ladder diagram function blocks (MAVG, etc.).

Only the analog inputs configured by the on-board P13 Series Bear Bones controller's jumpers are connected to the ICM-PUI-01. This allows, based on jumper configuration; that only some or all of the 5 channels may be used by the potentiometers of the ICM-PUI-01. Channels not configured for use of the ICM-PUI-01 may still be used as analog inputs on the P13 Series Bear Bones Controller (using on-board terminal blocks).

ICM-TM-0x Legacy Functions

This sections explains the use of the ICM-PUI-01 to operate with the same functionality as legacy Bear Bones Timer cards (ICM-TM-0x). The original Bear Bones used these timer cards to provide potentiometer adjustable timers for use in the ladder diagram and also to provide LED indicators for each channel's start timing and completed timing functions.

The ICM-PUI-01 may be configured to operate as an ICM-TM-01, ICM-TM-02 or ICM-TM-03. This functionality requires the use of a ladder diagram / custom structured text function block provided by Divelbiss Corporation.

Pre-Installation Configuration as ICM-TM-0x

There are several configuration items required to use the ICM-PUI-01 as an ICM-TM-0x timer card. Some of these configuration items are required prior to installation since jumper configuration items on the P13 Series Bear Bones controller will be hidden once the ICM-PUI-01 is installed.

The first step is to configure the P13 Series Bear Bones controller's analog configuration jumpers. These jumpers configure the analog inputs source to the ICM-PUI-01 and set the correct range (0-5VDC). These jumpers must be configured as shown for proper operation as an ICM-TM-0x timer.

Channel	JMP4	JMP29	JMP5	Analog Input
1	1-2	2-3	1-2	AI0

Channel	JMP8	JMP30	JMP9	Analog Input
2	1-2	2-3	1-2	AI1

Channel	JMP10	JMP31	JMP12	Analog Input
3	1-2	2-3	1-2	AI2

Channel	JMP11	JMP32	JMP13	JMP34	Analog Input
4	1-2	3-4	1-2	1-2	AI3

Channel	JMP15	JMP33	JMP17	Analog Input
5	1-2	2-3	1-2	AI4

Configure the dip switches on the ICM-PUI-01. These switches configure the type of module and timer ranges.

MODULE CONFIG switch (SW3)

The MODULE CONFIG switch is used to identify the type of timer module.

Type	1	2	3	4	5
ICM-TM-01	OFF	ON	OFF	XX	XX
ICM-TM-02	OFF	OFF	ON	XX	XX
ICM-TM-03	OFF	ON	ON	XX	XX

XX = Don't Care

CHANNEL switchs (SW1, SW2)

The CHANNEL switches operate as the original ICM-TM-0x timer card Link jumpers. By setting the state of the switches, the timing range of each channel may be configured independently of the others. Each CHANNEL switch is labeled by channel number and by A or B. Configure the switches as required for the ranges needed as shown below.

Configured as ICM-TM-01 (x = channel #)		
Range	Channel x - A	Channel x - B
1.4 Min - 11.4 Min	OFF	OFF
.3 Sec - 2.7 Sec	OFF	ON
1.3 Sec - 10.7 Sec	ON	OFF
10.3 Sec - 85.6 Sec	ON	ON

Configured as ICM-TM-02 (x = channel #)		
Range	Channel x - A	Channel x - B
0.3 Min - 8.0 Min	OFF	OFF
.1 Sec - 1.5 Sec	OFF	ON
0.3 Sec - 7.0 Sec	ON	OFF
2.5 Sec - 60.0 Sec	ON	ON

Configured as ICM-TM-03 (x = channel #)		
Range	**Channel x - A**	**Channel x - B**
1.0 Sec - 50.0 Sec	OFF	OFF
.01 Sec - 0.15 Sec	OFF	ON
0.02 Sec - 0.75 Sec	ON	OFF
0.13 Sec - 6.5 Sec	ON	ON

With the switches and jumpers configured, the ICM-PUI-01 may now be installed. Refer to the ***Installing the ICM-PUI-01*** section of this manual.

When setting the switch configurations after installation, the program must be stopped and restarted using the STOP / GO or cycling power to the controller. Some of the switch configurations are only read when the program is started. If the program is not started after changing switch settings, the changes may not take effect until a power cycle is done.

Using the ICM-PUI-01 Legacy Timer Functions

To use the ICM-PUI-01 Legacy timer functions, Divelbiss provides a ladder diagram sample (with a custom structured text function block) that allows easy use similar to the original timer card functions. This ladder diagram / custom structured text function block is availabe from our website (www.divelbiss.com). Browse to the ICM-PUI-01 product page and select the 'Documents / Downloads' tab in the page. Located in the 'Software' section will be the sample function block (ICM-PUI-01FBLD.zip). Download and unzip this file to have access to the ladder diagram file with the custom structured text function block.

This ladder diagram program includes several comment blocks regarding switch configurations and information on how to use the function block provided.

For each placed instance of the custom structured text function block (named TMR), there are a few inputs and outputs that must be connected. See Figure 3-1.

Ena (Enable): Boolean. The enable input must be true for the function block instance to operate.

CH (Channel): Integer. The channel input identifies the channel on the ICM-PUI-01 to use (Channels 1-5 are valid only).

IN: Boolean. The IN input causes the timer to begin timing and continue timing as long as IN is true (until the setpoint is reached).

STP (Setpoint): Integer. The STP input is the setpoint of the timer. This must be connected to the analog input of the timer channel connected to the channel input of the function block (AI0 for Channel 1, AI1 for Channel 2, etc). The analog inputs are tied to the potentiometers of the ICM-PUI-01 channels and adjust as the potentiometers are changed. The function block scales this value to the correct range internally.

OT: Boolean. The OT output goes true when the timer has reached it's setpoint.

CV: Integer. The CV is the current value of the timer as it is timiing (in milliseconds).

The timer setpoint is set using the channel potentiometers. For each channel, a INPT LED indicates when the timer has begun (or is timing) and a STPT LED idicates when the timer has reached its setpoint (completed timing).

Using the variables connected to the IN and OT are used to control when the timer begins and to signal when the timer has completed its timing cycle.

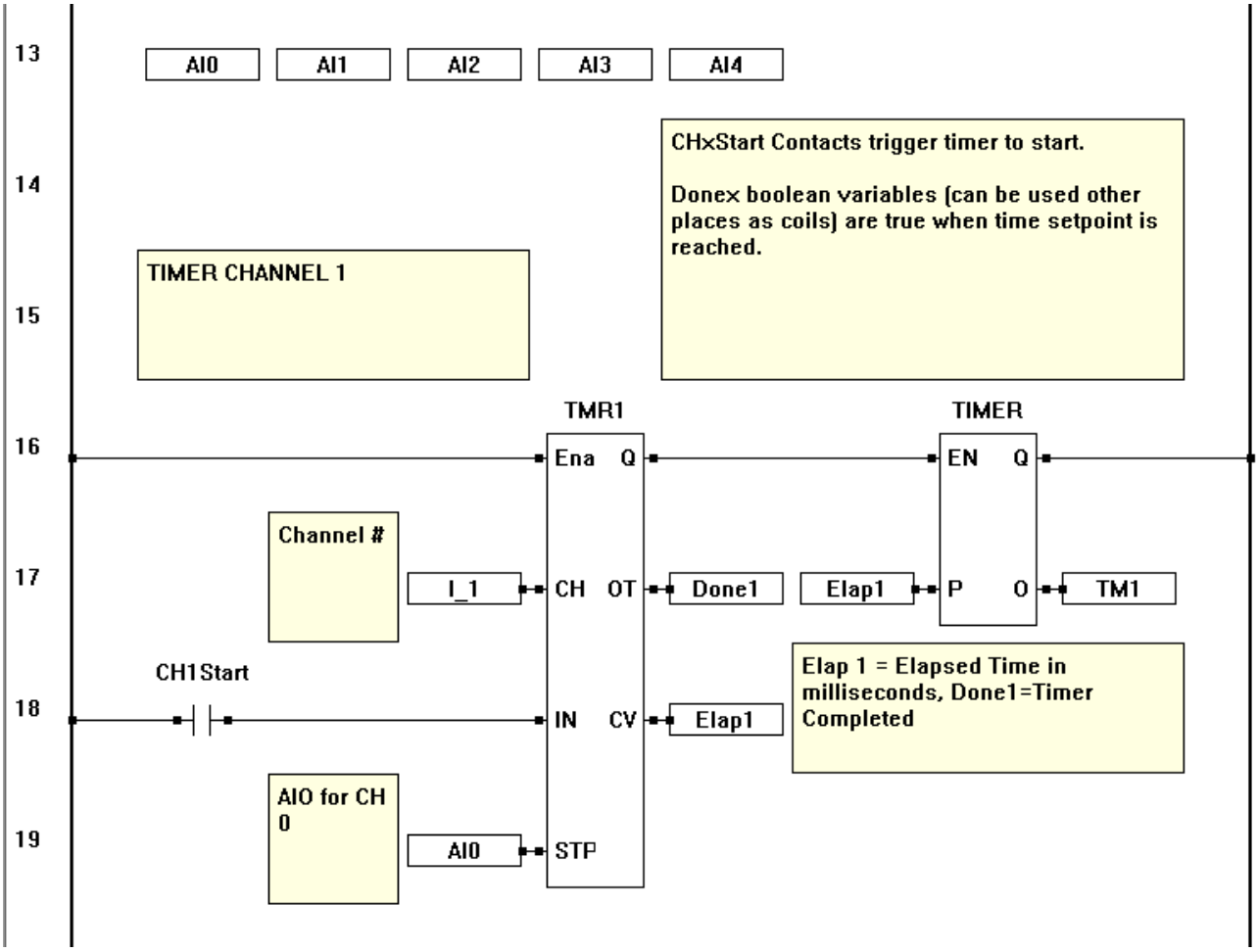

Figure 3-1 - Custom ST Function Block

As shown in Figure 3-1, the CH1Start boolean variable (contact) starts the timer. When the timer setpoint is reached, the Done1 boolean variable will be true (1). This variable may be placed elsewhere in the program as a boolean variable or as a contact. The AI0 is the analog input for Channel 1. The Elap1 variable is the current timer value in milliseconds and the TM1 variable is shown only for example with the Elap1 converted to a timer (seconds, minutes, etc). The CH input is connected to I_1 which is an integer with a default value of 1 always.

If more stability is required for the analog inputs, the use of an MAVG function block (moving average) should be sufficient.