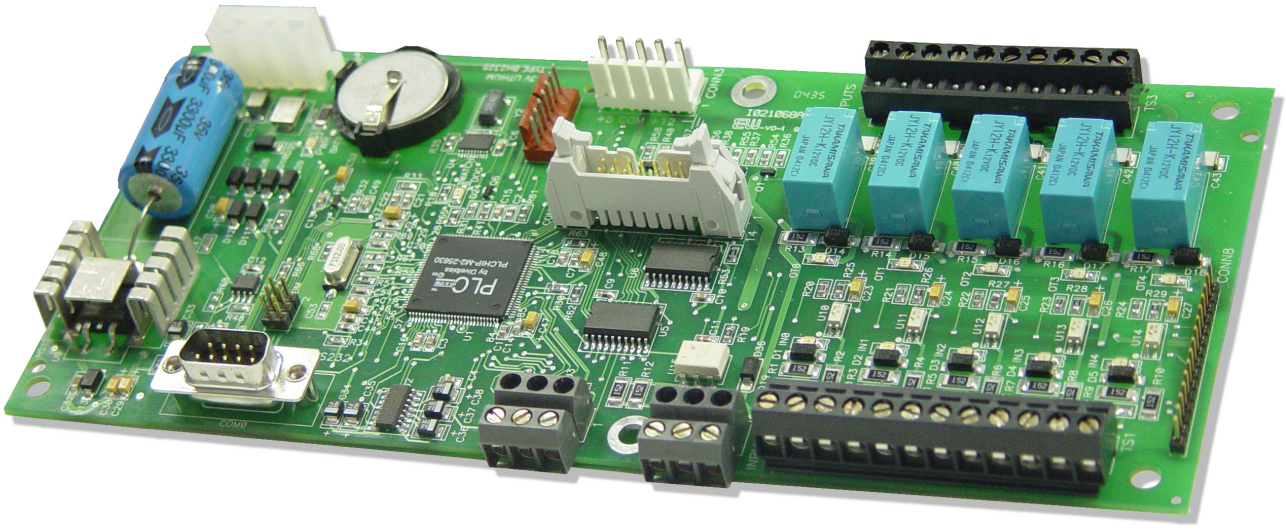
USER'S MANUAL

Revision: 9



ICM-EBB-XXX

Enhanced Baby Bear Controller

Covered Models:

ICM-EBB-100	ICM-EBB-400	ICM-EBB-700
ICM-EBB-200	ICM-EBB-500	
ICM-EBB-300	ICM-EBB-600	

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WARNING!!

The ICM-EBB-XXX, 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 Enhanced Baby Bear Controller, you will need to follow these steps:

- Install EZ LADDER Toolkit if not already installed (not included).
- Configure the Enhanced Baby Bear Controller in the EZ LADDER Toolkit Project Settings.
- Using purchased or self-made cables, connect the Input Power and Programming Port.
- Write a ladder diagram program.
- Download and run the program on the Enhanced Baby Bear Controller.

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

Configuring the ICM-EBB-XXX Target in EZ LADDER Toolkit

Before you can program and use the ICM-EBB-XXX Controller, it must be configured as a target within the EZ LADDER Toolkit. For help with installing or using EZ LADDER, please refer to the 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 **Enhanced Baby Bear (128K) or Enhanced Baby Bear (256K) based on you actual model** from the choices. Refer to Figure 1.1.

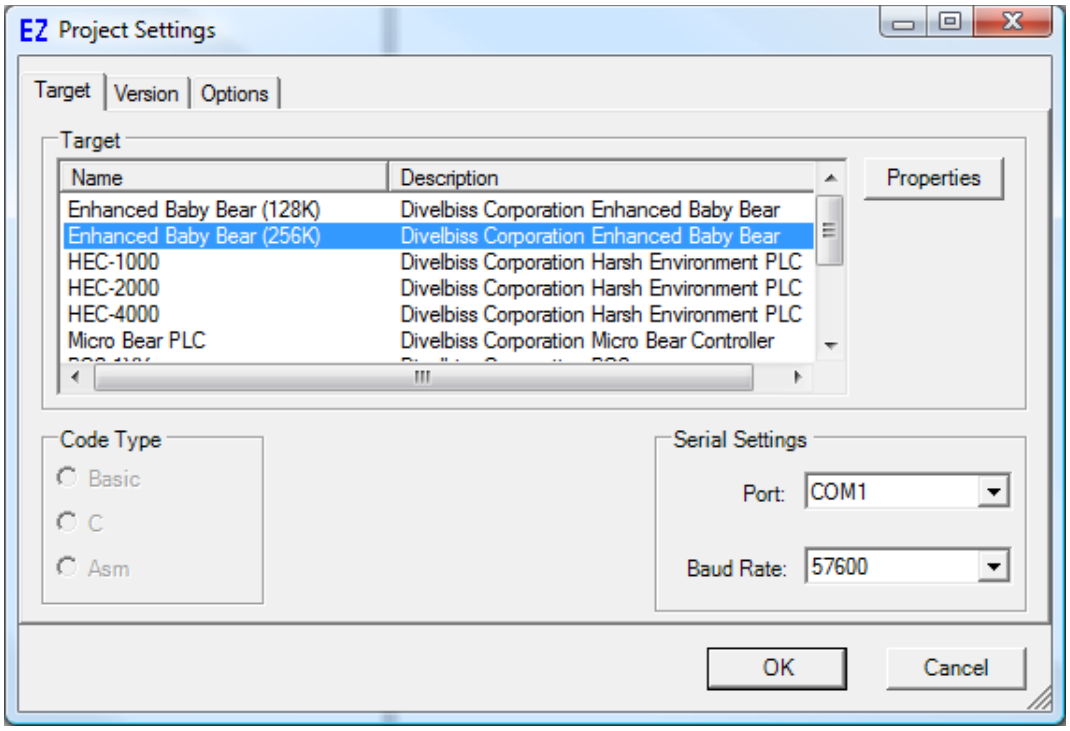


Figure 1.1 - Project Settings Window

2. A new window will open. Select the Model number of the Enhanced Baby Bear from the drop-down menu. Click **OK**. This will close the Enhanced Baby Bear Properties dialog box.

3. Click **OK**. This will close the Project Settings Window, saving the EBB Model selected as the target for this ladder diagram project.

Loading the ICM-EBB-XXX Kernel

THE ICM-EBB-XXX WILL NOT FUNCTION UNLESS THIS STEP (KERNEL LOADING) IS COMPLETED.

The kernel is the firmware for the controller and to provide greater flexibility and reliability, Enhanced Baby Bear Controller shipments are factory shipped **without** a kernel. If this is a new unit from the factory, it will be necessary to load the kernel before a ladder program can be downloaded. If the kernel is already loaded, this step is not required. To upgrade a kernel, see the EZ LADDER User's Manual.

To install the ICM-EBB-XXX's kernel:

1. Verify the target has been configured (see *Configuring the ICM-EBB-XXX Target in EZ LADDER Toolkit*).

2. Connect the Programming cable(s) from the computer to the ICM-EBB-XXX. See *Programming Port* in the *ICM-EBB-XXX Features* section.

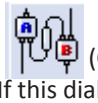
3. Create a small one-rung program with a normally open (direct contact) and an output tied together. You may also open a pre-existing program for the EBB. EZ LADDER version 1.0.4.4 and later includes a sub-directory (...EZ LADDER\Kernel Install Start Programs\)which has starter programs for each target to load the kernel. Choose ***GetStarted_ICM-EBB-128K.dld*** or ***GetStarted_ICM-EBB-256K.dld*** based on the model number.

4. Click the 

(Compile) button

5. Click the 

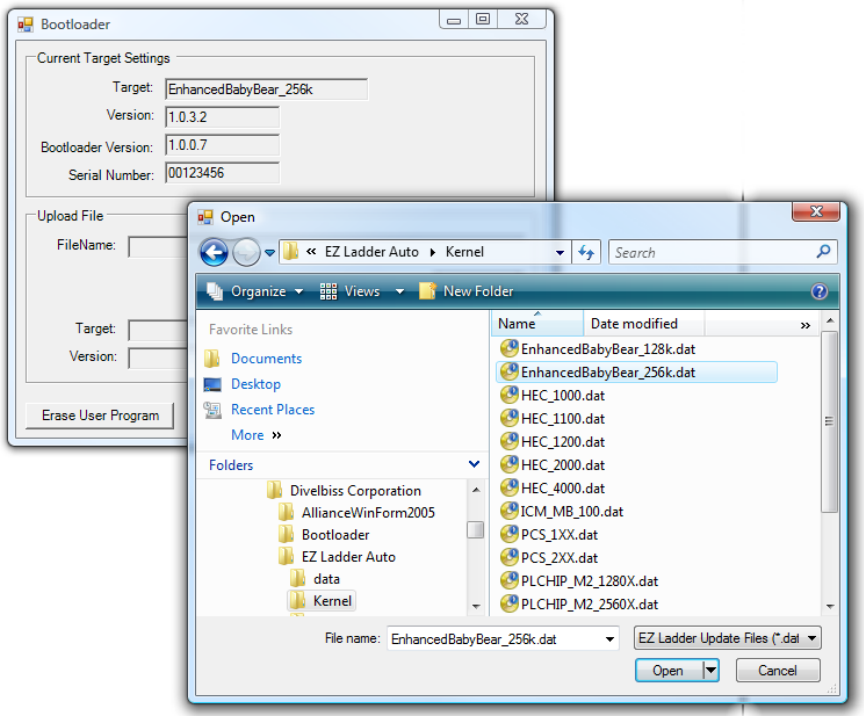
(Monitor) button to change from the 'Edit' to 'Monitor' Mode.

6. Click the 
(Connect) button to connect to the target. A dialog will appear automatically when no kernel is loaded. If this dialog does not appear, click **PROJECT** then **BOOTLOADER**.

7. Click the **BROWSE** button and select the target's kernel (by part number) located by default at C:\Program Files\EZ Ladder\Kernel\

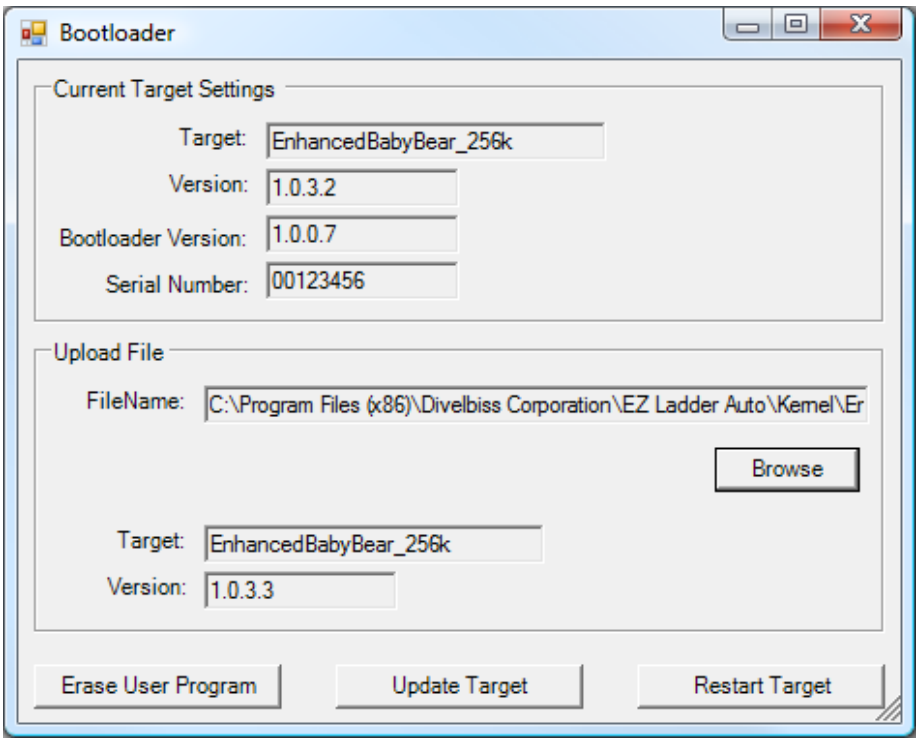
The following are kernel names and descriptions:

File Name	Description	To be Used on (Partnumber)
EnhancedBabyBear_128k.dat	Kernel for 128K EBB	ICM-EBB-100, ICM-EBB-200, ICM-EBB-300, ICM-EBB-400, ICM-EBB-500,
EnhancedBabyBear_256k.dat	Kernel for 256K EBB	ICM-EBB-600, ICM-EBB-700



8. Click the **OPEN** button to finish the kernel selection. Make sure the correct kernel is chosen.

9. Click the **UPDATE TARGET** button to install the kernel.



10. A dialog box will appear to show the status of the kernel installation. This could take a couple of minutes to install.

11. When the dialog windows close, the installation is complete. The Enhanced Baby Bear is ready to use and may be connected to and programs may be downloaded.

The Enhanced Baby Bear Serial Number is factory set and cannot be changed.

Getting to Know the ICM-EBB-XXX

The ICM-EBB-XXX is available in multiple configurations based on the model number. While many features are offered, the actual supported features depends on the model number. Figure 1.2 lists these features.

The ICM-EBB-XXX Controller is designed to provide powerful programmable features in an open-board format. Connections are made via terminal blocks and connectors. Refer to Figure 1.3, as it illustrates the ICM-EBB-XXX.

Model	Flash Memory		On-Board I/O	Expansion I/O		Networking			Real Time Clock	Program Port	High Speed Counter
	128K	256K	5 Inputs 5 Outputs	EBB I/O	HDIO	OptiCAN	J1939	Serial/ Modbus Port*			
ICM-EBB-100	✓		✓							✓	
ICM-EBB-200	✓		✓							✓	✓
ICM-EBB-300	✓		✓						✓	✓	✓
ICM-EBB-400	✓		✓	✓					✓	✓	✓
ICM-EBB-500	✓		✓		✓				✓	✓	✓
ICM-EBB-600		✓	✓	✓		✓	✓	✓	✓	✓	✓
ICM-EBB-700		✓	✓		✓	✓	✓	✓	✓	✓	✓

*Modbus/Serial Option requires optional Serial Port Module (specify RS232, RS422 or RS485).

Refer to the Specifications Section for details on operating parameters for all features.

Figure 1.2 - ICM-EBB-XXX Features

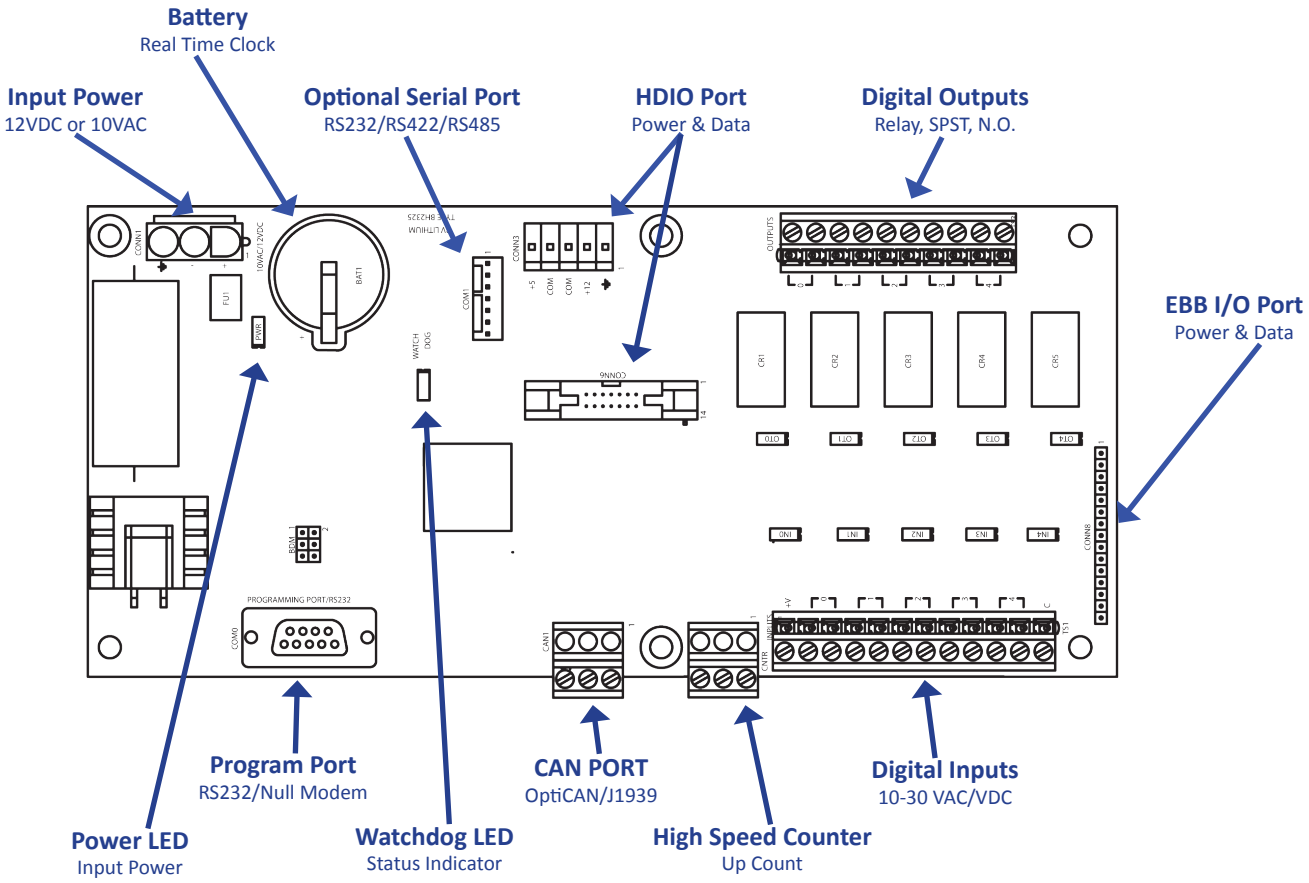


Figure 1.3 - ICM-EBB-XXX

ICM-EBB-XXX Features

This section explains the Enhanced Baby Bear Controller (ICM-EBB-XXX) hardware features, options and information regarding EZ LADDER Toolkit for basic operation.

Programming Port

The ICM-EBB-XXX is programmed using its Programming Port (COM 0). This RS232 serial port is only to be used for programming using Divelbiss EZ LADDER Toolkit software. This is not a general purpose port and may not be used in any other capacity than programming the controller itself.

The Programming Port defaults to:

Baud:	57600
Parity:	None
Data Bits:	8
Stop Bits :	1

To program the ICM-EBB-XXX, a null modem cable is required between the computer serial port and the controller's programming port. This cable can be self made, purchased locally or ordered from Divelbiss. Use Divelbiss Part Number 126-102860. Figure 2.1 provides the Programming Port Pinout.

RS232 Programming Port

Pin #	ID	Description
1	--	Not Connected
2	RX	Receive Data
3	TX	Transmit Data
4	--	Not Connected
5	GND	Signal Ground
6	--	Not Connected
7	RTS	Request To Send
8	CTS	Clear To Send
9	--	Not Connected

Figure 2.1 - Programming Port Pin-Out

Watchdog LED

The operating status of the ICM-EBB-XXX can be determined the by Watchdog LED. When the Watchdog LED is flashing at a slow rate, approximately once per second, then there is no ladder program executing. When the Watchdog LED is flashing at a fast rate, approximately 10 times per second, a program has been loaded and it is executing.

Should the Watchdog LED not flash at all, first check the input power. If the input power is correct and there is still no Watchdog LED, contact Divelbiss Technical Services.

Input Power

The ICM-EBB-XXX may be powered using 10VAC or 12VDC. Apply power to CONN1 using the provided input power cable assembly (PIMS-CA-6). Refer to the input power schematic for details. The transformer shown is optional.

The ICM-EBB-XXX is protected by a *resetable* fuse. If the fuse should open (the power LED is not illuminated), remove the input power for 30 seconds and then reconnect the input power. The fuse will automatically reset when the power is removed.

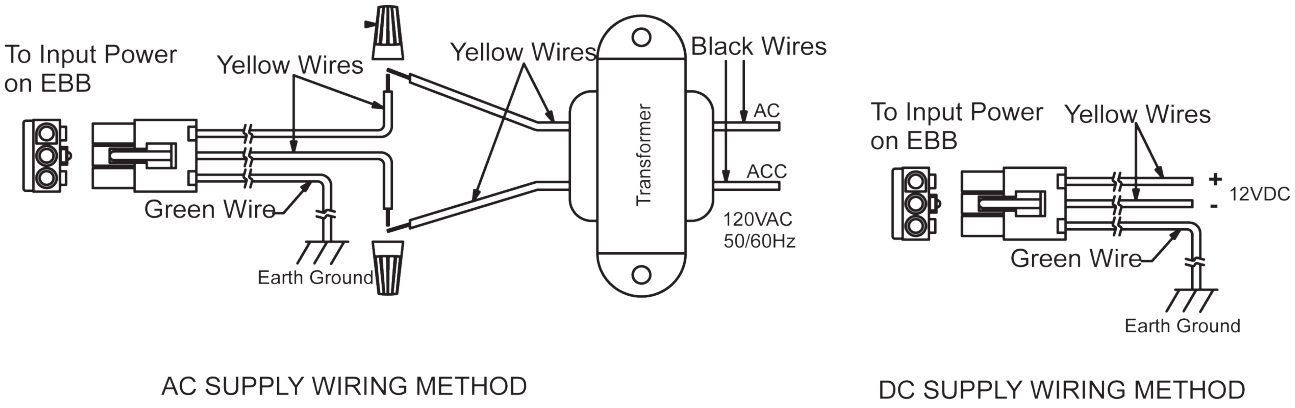


Figure 2.2 - Input Power Connections

Input Power LED

The ICM-EBB-XXX provides a visible status of the input power via the Input Power LED. When illuminated, the input power is ok.

Mounting & Dimensions

The ICM-EBB-XXX mounts to any sub-plate using standard hardware including standoffs and screws. See Figure 2.3.

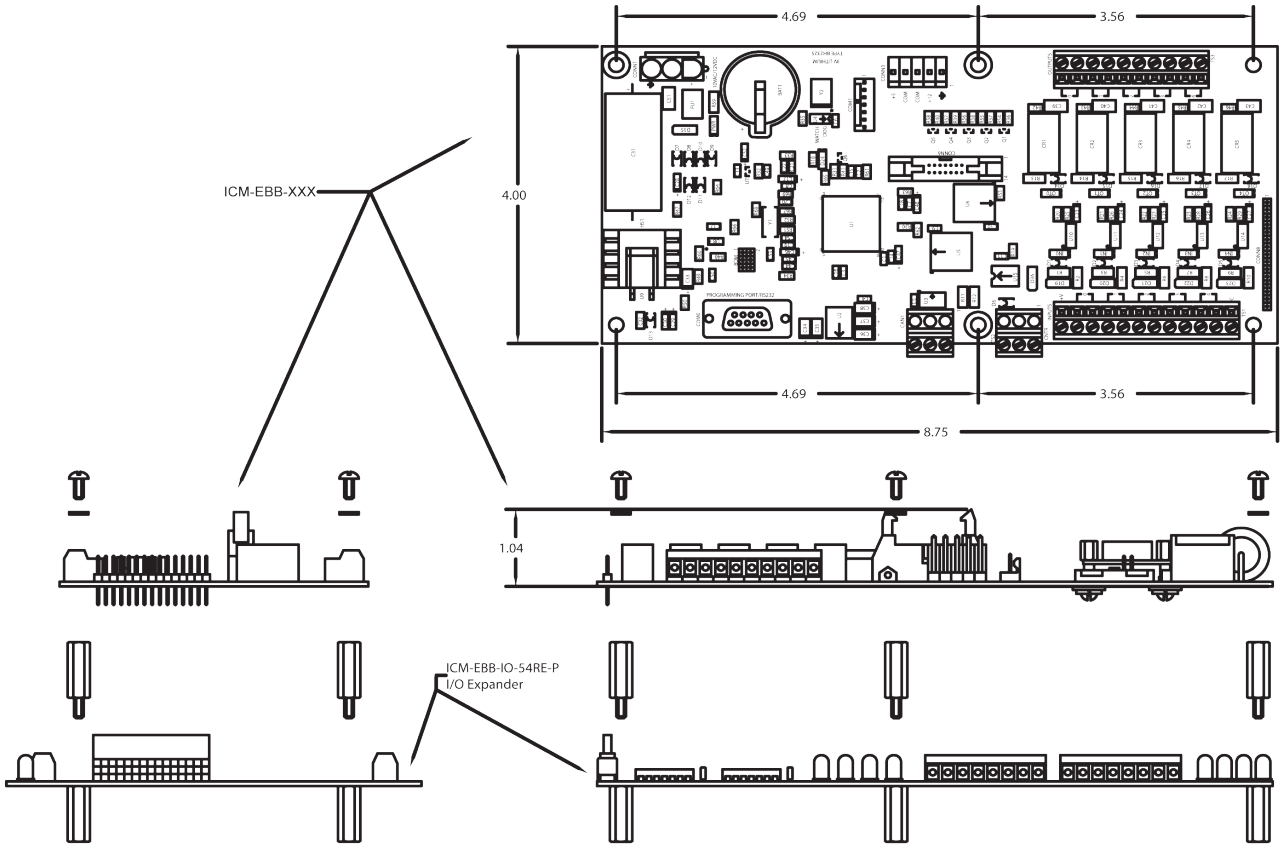


Figure 2.3 - Mounting & Dimensions

Digital Inputs

The ICM-EBB-XXX includes 5 on-board digital inputs. They are identified in EZ LADDER Toolkit and this manual as DI1.03 through DI1.07. Each digital input can accept an input voltage of 10-30 VAC or DC. The inputs may be wired as either sinking or sourcing and are wired through the provided terminal block (TS1). See Figure 2.4 for typical wiring diagrams for sinking and sourcing inputs.

The inputs are labeled on the printed circuit board as *0-4* (representing DI1.03 through DI1.07 respectively). As these inputs are isolated, both the + and - terminals for each must be connected for the input to operate properly. For convenience, terminals labeled *+V* and *C* are provided. These terminals are quick wiring points to wire devices to the inputs. The *+V* is approximately 12VDC while the *C* is the ground or common. See Figure 2.6.

To read a digital input status in a ladder diagram, place and connect the appropriate contact for your needs. The DIRECT CONTACT and INVERTED CONTACT functions are used to read digital inputs in the ladder diagram. When placing the contact, verify you select the correct input address (DI1.03 - DI1.07) from the provided drop-down menu. Depending upon the EZ LADDER version, these variables may be created automatically (DI1_03 - DI1_07). If not automatically created, you must create them. Refer to the EZ LADDER User's Manual.

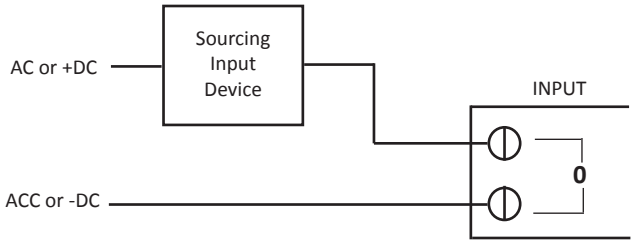


Figure 2.4 - Typical Sinking Input Circuit

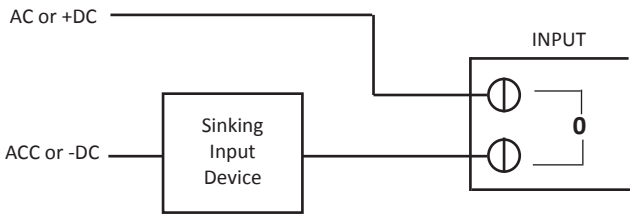


Figure 2.5 - Typical Sourcing Input Circuit

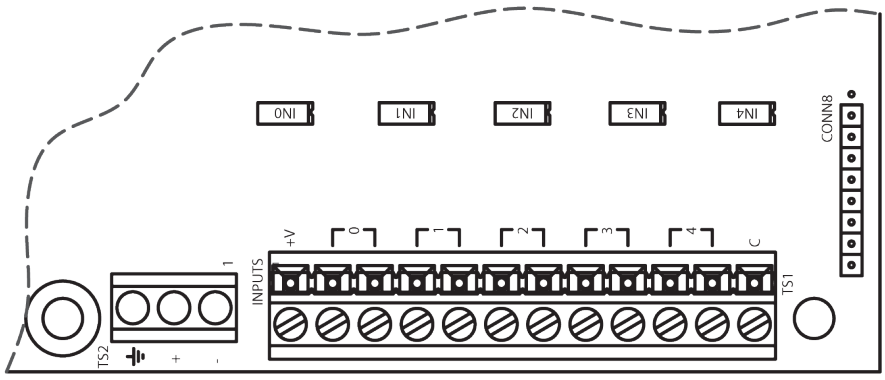


Figure 2.6 - Input Terminations

Digital Outputs

The ICM-EBB-XXX includes 5 on-board digital outputs (relay). They are identified in the EZ LADDER Toolkit and this manual as DO1.03 - DO1.07. These relay outputs are Form A (SPST) and Normally Open.

Commutating diodes or Metal Oxide Varistors (MOVs) should be installed on all output channels for noise immunity based on the voltage being used (AC or DC). See Figure 2.7.

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 (DO1.03 - DO1.07) from the provided drop-down menu. Depending upon the EZ LADDER version, these variables may be created automatically (DO1_03 - DIO_07). If not automatically created, you must create them. Refer to the EZ LADDER User's Manual. All outputs connections are wired through the provided terminal block (TS3). See Figure 2.8.

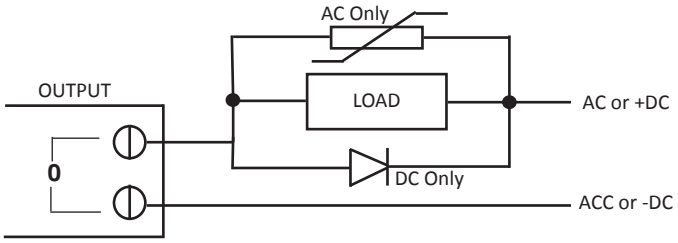


Figure 2.7 - Typical Output Circuits

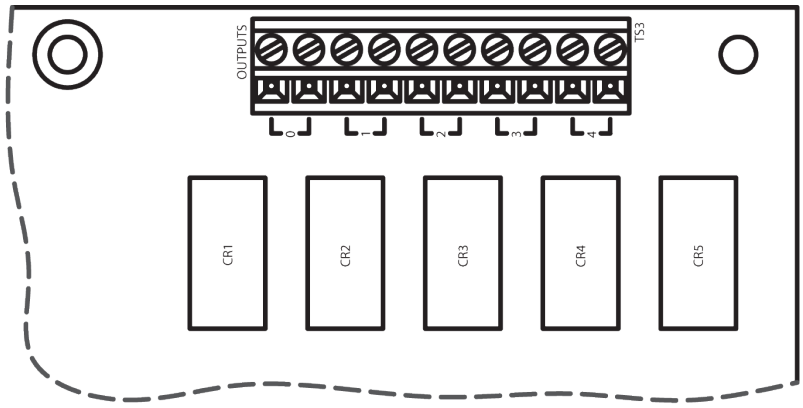


Figure 2.8 - Output Terminations

Counter Input

The ICM-EBB-XXX provides an optional on-board counter input (model dependent). This is an up counter input that can operate up to 100 KHz. It is ideal for connecting pulse output devices, such as flow meters and other sensors.

Figure 2.9 illustrates the counter input circuit. Figure 2.10 illustrates a typical sourcing input device (the device sources the voltage) connected to the counter, while Figure 2.11 illustrates a typical sinking input device (the devices sinks the input to ground or common)connected to the counter.

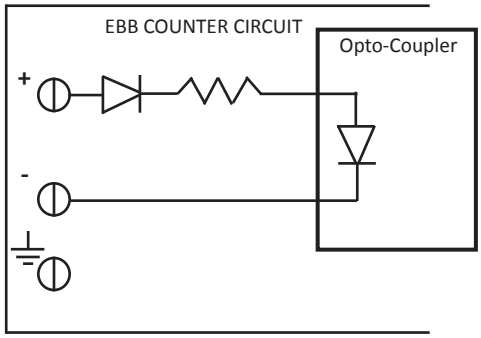


Figure 2.9 - Counter Input Circuit

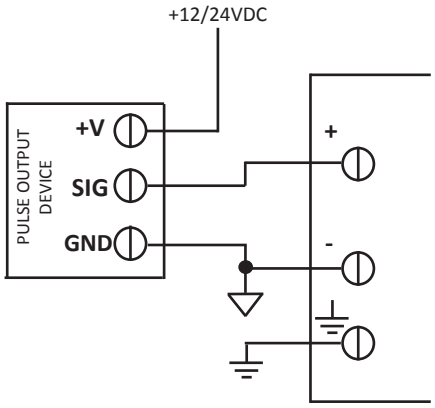


Figure 2.10 - Sourcing Counter Input

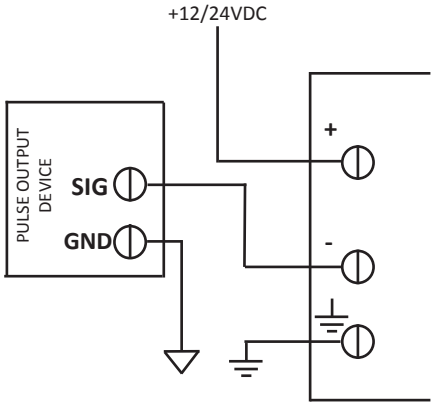


Figure 2.11 - Sinking Counter Input

To use the high speed counter, you must use the CNTRMR function block. This block, when placed in the ladder diagram, will provide a drop-down menu to select channel 1. Refer to the EZ LADDER Toolkit User's Manual for details on the CNTRTMR and other function blocks. The High Speed Counter is always Channel 1.

General Purpose Serial Port

The ICM-EBB-600 and ICM-EBB-700 support an optional second serial port (COM 1). This serial port is a general purpose serial port that supports serial printing. This port may also be used to communicate to a Modbus Master Device (the ICM-EBB-XXX is a Modbus Slave). At this time, the general purpose serial port is an output device only as there is no software support to read a serial input.

This port may be factory ordered as ICM-EBB-RS232 (RS232), ICM-EBB-RS422 (RS422) or ICM-EBB-RS485 (RS485). This serial port module plugs into and mounts to the ICM-EBB-XXX Controller. For mounting the serial port module to the ICM-EBB-XXX controller, see Figure 2.12. For pin assignments, refer to Figure 2.13.

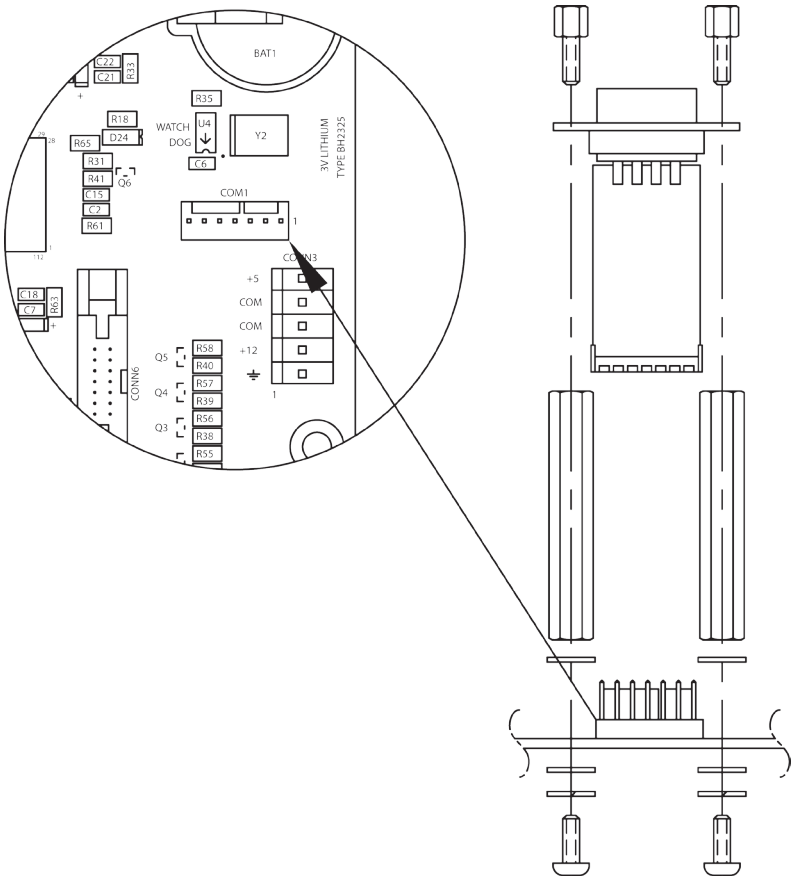


Figure 2.12 - General Purpose Serial Port Mounting

RS232 Serial Port - ICM-EBB-RS232

Pin	ID	Description
1	-----	Not Connected
2	RX	Receive Data
3	TX	Transmit Data
4	-----	Not Connected
5	GND	Ground
6	------	Not Connected
7	RTS	Request to Send
8	CTS	Clear to Send
9	------	Not Connected

RS422 Serial Port - ICM-EBB-RS422

Pin	ID	Description
1	TX-	Transmit Data -
2	-----	Not Connected
3	-----	Not Connected
4	RX-	Receive Data -
5	GND	Ground
6	RX+	Receive Data +
7	-----	Not Connected
8	-----	Not Connected
9	TX+	Transmit Data +

RS485 Serial Port - ICM-EBB-RS485

Pin	ID	Description	Pin	ID	Description
1	TX-	Transmit Data -	6	-----	Not Connected
2	-----	Not Connected	7	-----	Not Connected
3	-----	Not Connected	8	-----	Not Connected
4	-----	Not Connected	9	TX+	Transmit Data +
5	GND	Ground			

Figure 2.13 - General Purpose Serial Port Pin Assignments

Real Time Clock

The ICM-EBB-XXX includes an optional Real Time Clock. The real time clock (after set) provides Month, Day, Day of the Week, Year, Hour, Minute and Second. The real time clock maintains time when power is lost via lithium battery.

The life of the battery for the real time clock generally has years of life before replacement is needed. Should the battery need to be replaced, replace the battery with the same type and size as the original.

The battery is a Lithium Coin Cell, Type BR2325.

CAN Networking Ports

A CAN port is provided for networking including SAE J1939 and the Divelbiss proprietary OptiCAN Network.

The on-board CAN port is CAN 0. To use the ICM-EBB-XXX's CAN port as either SAE J1939 or OptiCAN, it will be necessary to configure certain parameters. These parameters may be configured from the ICM-EBB-XXX Properties Window in the Project Settings. As these settings vary greatly and are software based only, please refer to the EZ LADDER Toolkit User's Manual for details on configuring, using and implementing CAN port networking including all relevant function blocks.

The CAN ports should be wired according to established practices for CAN networks. Figure 2.14 illustrates typical CAN Port connections.

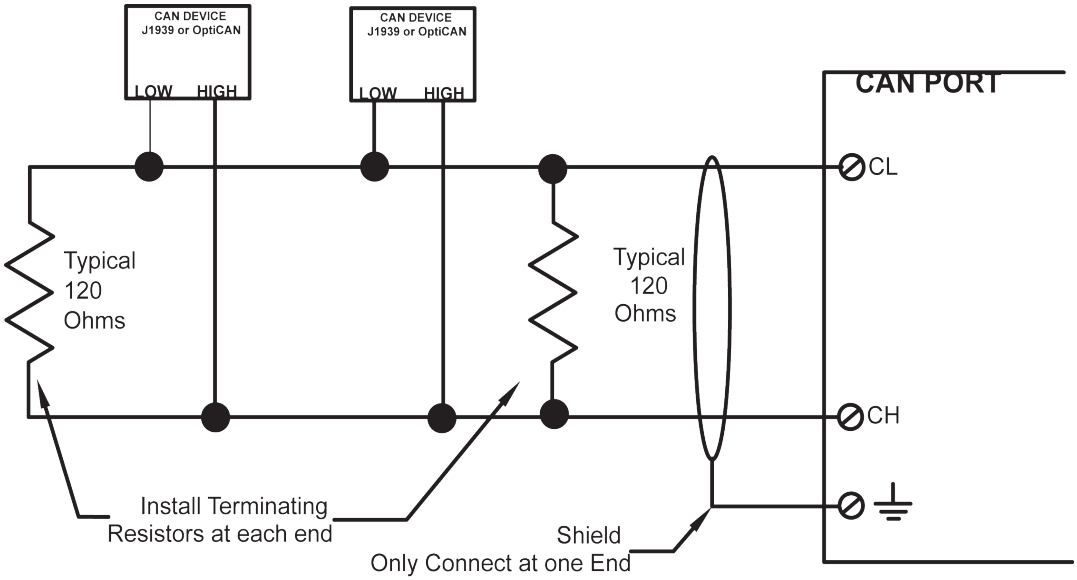


Figure 2.14 - Typical CAN Port Connections

I/O Expansion

Certain models of the Enhanced Baby Bear Controller allow for I/O Expansion using one of two methods. Depending upon the model, the controllers I/O may be expanded using the Divelbiss High Density I/O product line (cables and I/O cards) or the Enhanced Baby Bear I/O Expansion. The High Density I/O products connect using a cable set to the controller and are DIN rail mounted. The Enhanced Baby Bear I/O mounts to the controller in a stacking configuration.

High Density I/O Expansion

The ICM-EBB-500 and ICM-EBB-700 I/O can be expanded with up to an additional 120 Inputs and 120 Outputs using the ICM-HDIO-XX series I/O Expander boards. The ICM-HDIO-XX series provides a wide range of input and output types and voltages.

High Density I/O Expanders use the ICM-EBB-XXX's CONN6 (for data) and CONN3 (for power). These connections are made via cables. The ICM-HDIO-XX boards are din rail mounted. Their addressing is set via on-board jumpers.

The High Density I/O uses the same type of I/O assignments as the Enhanced Baby Bear where either DI or DO for Digital Input or Digital Output, the Page Number(0-7) and then actual I/O point (.00-.15)

The I/O addressing for the ICM-HDIO-XX I/O are as follows:

Digital Inputs: DI0.00 - DI0.15
DI1.00 - DI1.07 are used on board the ICM-EBB-XX and are NOT valid.
DI1.08 - DI7.15

Digital Outputs: DO0.00 - DO0.15
DO1.00 - DO1.07 are used on board the ICM-EBB-XX and are NOT valid.
DO1.08 - DO7.15

Enhanced Baby Bear I/O Expansion

The ICM-EBB-400 and ICM-EBB-600 I/O can be expanded with an additional 8 Inputs rated 10-32 VDC and 8 Relay Outputs using the ICM-EBB-IO-54RE-P.

Baby Bear Expanders use the ICM-EBB-XXX's CONN8. The ICM-EBB-IO-54P connects directly to CONN8 and is mounted to the ICM-EBB-XXX (stacking configuration). The ICM-EBB-IO-54RE-P is factory addressed and cannot be changed.

The Enhanced Baby Bear I/O uses the same type of I/O assignments as the Enhanced Baby Bear where either DI or DO for Digital Input or Digital Output, the Page Number(1) and then actual I/O point (.08-.15)

The I/O addressing for the ICM-EBB-IO-54P is always as follows:

Digital Inputs: DI1.08 - DI1.15

Digital Outputs: DO1.08 - DO1.15

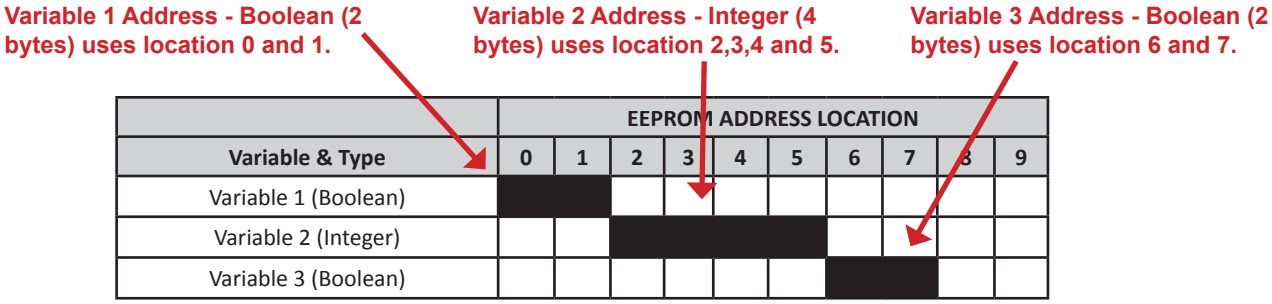
For mounting the Enhanced Baby Bear with a stacking I/O Expander, please see the Mounting and Dimensions section this manual.

EEPROM Memory

As one of the standard features of PLC on a Chip™ and EZ LADDER Toolkit, the ICM-EBB-XXX supports the use EEPROM memory that may be used to store and recall boolean, integer, real and timer values in non-volatile memory in the ladder diagram. This can be used to store field adjustable set points and more.

The ICM-EBB-XXX supports 1768 Bytes of EEPROM memory (Models 100, 200, 300, 400, 500) and 2792 bytes of EEPROM memory (Models 600, 700). This memory is accessed in the ladder diagram using the EEPROM_READ and EEPROM_WRITE Function blocks. The same variable type that writes to the EEPROM location should be used to read the EEPROM location. A memory map is recommended for organizing variables stored in EEPROM.

Each EEPROM address is absolute and is one byte in size. Boolean variables fill two bytes while all other variable types fill four bytes of EEPROM. When writing a boolean to address 0, the actual variable will use addresses 0 and 1 (two bytes). Should you write an integer variable into address 0, then it would use addresses 0-3. A memory map should be created and used to assign variable types and addresses prior to coding to ensure that variable size and types are accounted for.



	EEPROM ADDRESS LOCATION									
Variable & Type	0	1	2	3	4	5	6	7	8	9
Variable 1 (Boolean)	■	■								
Variable 2 (Integer)			■	■	■	■				
Variable 3 (Boolean)							■	■		

Figure 2.15 - EEPROM Memory Locations

EEPROM storage area has a limited number of write cycles; therefore it shouldn't be used to store data which changes often and must be re-written often. Writing often to the same location can cause the location to fail.

ICM-EBB-XXX Target Setting Options

To use some of the function blocks and features on the ICM-EBB-XXX, it may be required to configure additional target properties in the Project Settings Dialog Box. Click **PROJECT** then **SETTINGS**. With the **Enhanced Baby Bear model** selected, click **PROPERTIES**.

The following are items that must be configured in the Enhanced Baby Bear Project Settings, Properties Dialog.

J1939 Properties This is where SAE J1939 Communications is enabled and configured. Refer to the J1939 section of the EZ LADDER Manual.

OptiCAN Properties This is where OptiCAN Communications is enabled and configured. Refer to the OptiCAN section of the EZ LADDER Manual.

Serial Print Properties This is used if the Serial Print function block is to be used to transmit data to an external device using the General Purpose Serial port. The serial port is configured here.

Specifications

Processor:	PLC on a Chip™
Memory:	128K/256K Flash, 8K/12K RAM, 1768 Bytes / 2792 Bytes EEPROM (Model Dependent)
Serial Ports:	1 Programming Port 1 Optional Multipurpose Port, RS232, RS422 or RS485 (Sold Separately), Supports Modbus Slave
Networking:	1 CAN Port for Divelbiss OptiCAN or J1939 Communications
Digital Inputs:	5 Inputs rated 10-30 VAC/VDC., Optically Isolated, with Indicator LEDs Typical Turn On: 4.5 VAC/VDC Typical Turn Off: 3.5 VAC/VDC Typical Input Current: 9mA @ 30VAC/VDC
Digital Inputs:	5 Relay Outputs, Normally Open (Dry Contacts), with Indicator LEDs Relay Ratings: 1/8HP, 125VAC/250VAC, 5A @ 30VDC/250VAC
Counters:	1 High Speed Counter Channel, Count Up, Optically Isolated, 100KHz Max. Frequency.
I/O Expansion:	Up to 120 total Inputs & 120 total Outputs using High Density I/O Line or 12 total Inputs & 12 total Outputs using Enhanced Baby Bear I/O Expansion.
Input Power:	10VAC or 12VDC (115VAC with Optional Transformer)
Operating Temp:	-40-60° C
Program Language:	Ladder Logic using Divelbiss EZ LADDER Toolkit.
Real Time Clock:	Optional, Moth, Day, Year, Day of Wee, Hour Minute Second Battery Type, Lithium Coin, BR2325 (3VDC)
Dimensions:	4.00” Wide x 8.75” Length x 1.04” Tall.
Mounting:	Panel Mount (requires standoffs or other hardware - Sold Separately)
Type:	Open Board
Storage Temperature:	-40-60° C

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