LX34070
Inductive Position Sensor
EVB (EV65W60A)/Kit (EV39W84A)
User's Guide

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our website (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXXXXA", where "XXXXXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A). Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Website
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A) as a development tool to emulate and debug firmware on a target board. The user's guide layout is as follows:

- **Chapter 1. "Product Overview"** – This chapter describes the most important features of the LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A), as well as the contents of the kit and a step-by-step Quick Start Guide.
- **Chapter 2. "Technical Operation"** – This chapter provides technical details important for the operation of the LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A).

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

RECOMMENDED READING

This user's guide describes how to use the LX34070 90 Degree Rotary EVB/Kit. Other useful and supplemental documents will be listed here when they become available:

THE MICROCHIP WEBSITE

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- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

It is recommended that customers contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the website at:
http://www.microchip.com/support

DOCUMENT REVISION HISTORY

Revision B (October 2022)

- Updated **Section 1.4 "Quick Start Guide"**.

Revision A (March 2022)

- Initial release of this document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A), as well as a Quick Start Guide.

Sensor development with an LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A) offers differential outputs, higher accuracy, high speed applications; it is immune to motor noise and does not need a magnetic target. The sensor system consists of the inductive position sensor IC (LX34070), its printed circuit board sensor and the target. A target metal is attached to the moving mechanical housing, which provides position relative to the fixed position of the sensor Printed Circuit Board (PCB).

For remote sensor applications, the sensor module will communicate analog position information to a host processing system over a 8-wire cable; the necessary signals to the processor are power, ground, and the two differential analog position signals.

1.2 FEATURES

The LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A) has the following features.

- Differential outputs for low noise and output signal distortion.
- High bandwidth: 100 kHZ (<5 µs latency), so the sensor is used for high-speed resolver applications.
- Independently adjustable offset and gain for output analog signals.
- Programming via power pin or GPIO pin using LXM9518 programmer.

1.3 LX34070 90 DEGREE ROTARY EVB (EV65W60A)/KIT (EV39W84A) CONTENTS

The LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A) contains the following items:

1. Inductive position sensor PCB with target assembly
2. Interfacing cable for the LXM9518 programmer
3. Interfacing cable for monitoring the outputs
4. LXM9518 with USB cable to connect to PC (Kit only)
5. The IPCE software can be downloaded from www.microchip.com

Figure 1-1 shows a picture of LX34070 90 Degree Rotary EVB (EV65W60A)

Figure 1-2 shows a picture of LX34070 90 Degree Rotary Kit (EV39W84A)

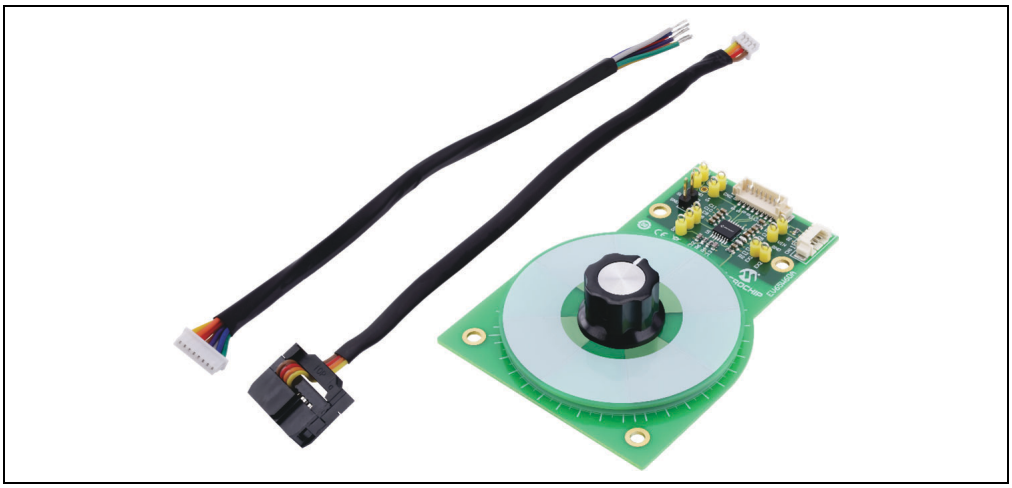

FIGURE 1-1: *LX34070 90 Degree Rotary EVB (EV65W60A).*

FIGURE 1-2: *LX3470 90 Degree Rotary Kit (EV39W84A).*

1.4 QUICK START GUIDE

The LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A) includes an Integrated Programming and Calibration Environment (IPCE) to facilitate system calibration and configuration. The integrated programming environment contains an EEPROM programming tool and data measuring system.

Follow these steps to install and start operating the LX34070 90 Degree Rotary EVB (EV65W60A)/Kit (EV39W84A):

1. Go to www.microchip.com, navigate to the LX34070 product page and under the "Embedded Software" section, download the Sensor Evaluation and Calibration Software (IPCE software), from myMicrochip account.
2. Install the program.
3. Connect the supplied USB cable to the LXM9518 programmer and the PC. With the 10pin to 4 pin connector, connect the 10 pin connector cable to the LXM9518 programmer and the 4 pin connector to the sensor EVB.
4. Open the installed IPCE program and if required follow the instructions shown on the IPCE to update the firmware for the LXM9518 programmer.
5. As the Inductive sensor IC is pre-loaded with Golden parameters and the programmer is updated with respective firmware, the IPCE will automatically detects the sensor.
6. At this point, the sensor can be customized to the user's needs. To optimize the system performance, the manual calibration guide should be downloaded and

the steps in the document followed.

Chapter 2. Technical Operation

2.1 INTRODUCTION

This chapter explains the key technical aspects of the LX34070 90 Degree Rotary EVB/Kit. It begins with a brief discussion of the system operation of the LX34070 90 Degree Rotary EVB/Kit, features a picture of the board and connector pinout instructions, and concludes with an example diagram of linearity

2.2 SYSTEM OPERATION

The LX34070 90 Degree Rotary EVB/Kit has been factory calibrated and is ready to use. The EVB constitutes a main sensor board and a movable target PCB. The main sensor board contains two oscillator coils (EX1 and EX2) and two pickup coils (RM1 and RM2). The IC energizes the two oscillator coils. The position of the target varies the reception of the two pickup coils relative to each other. The IC demodulates the two received signals and generates sine and cosine differential analog output signals (OUT1P, OUT1N, OUT2P and OUT2N) representative of the relative difference between the RM1 and RM2 signals, see Figure 2-1.

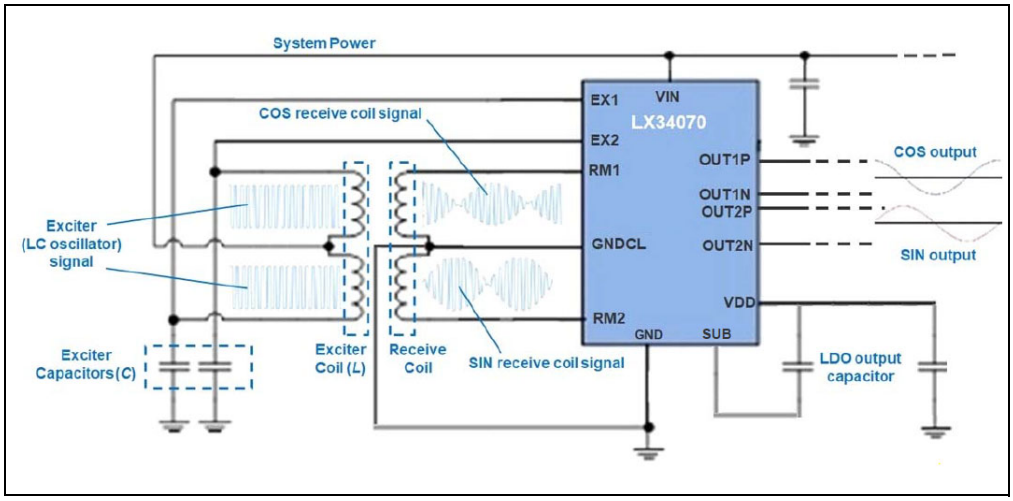

FIGURE 2-1: *Inductive Sensor Operation Principle.*

2.3 DETAILS OF CONNECTORS ON SENSOR BOARD

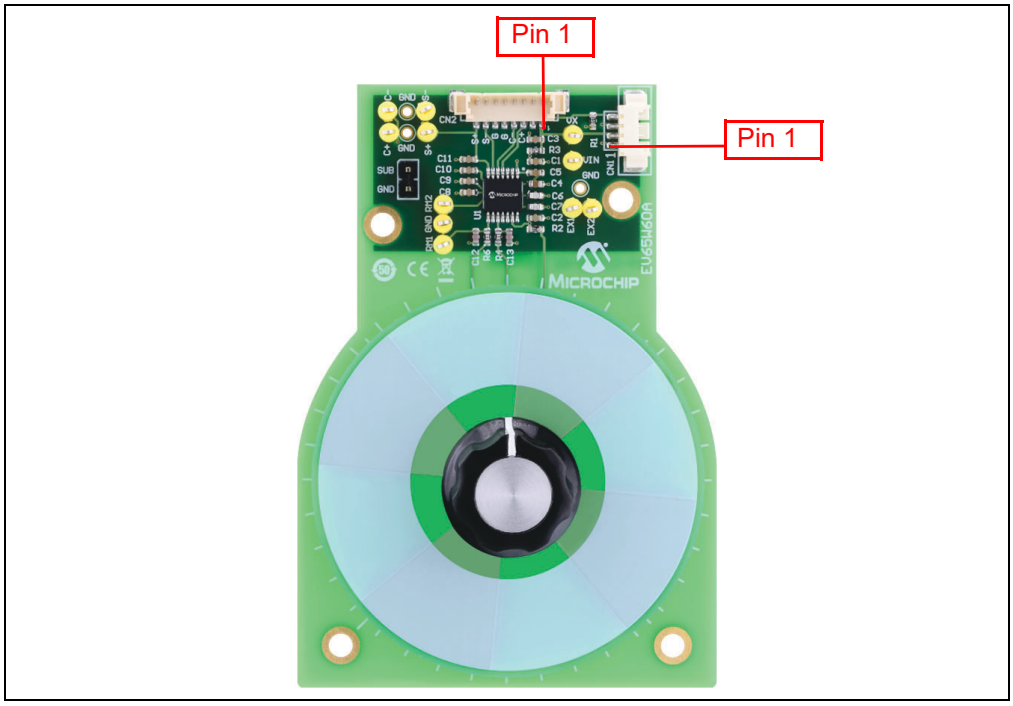

FIGURE 2-2: *LX34070 90 Degree Rotary EVB (EV65W60A).*

The sensor assembly comes with a 4-pin (CN1) to 10-pin connector for programming using LXM9518 programmer (Table 2-2 and Table 2-3 shows the pinout of this connector) and 8 -pin (CN2) connector for outputs monitoring (Table 2-1 shows the pinout of this connector).

TABLE 2-1: CN2 CONNECTOR PINOUT

Pin#	Pin Name	Functional Description
1	VIN	External +5V supply
2	GND	Ground
3	OUT2P	Demodulated SIN receives coil positive (+) output
4	OUT2N	Demodulated SIN receives coil negative (-) output
5	GND	Ground
6	GND	Ground
7	OUT1N	Demodulated COS receives coil negative (-) output
8	OUT1P	Demodulated SIN receives coil positive (+) output

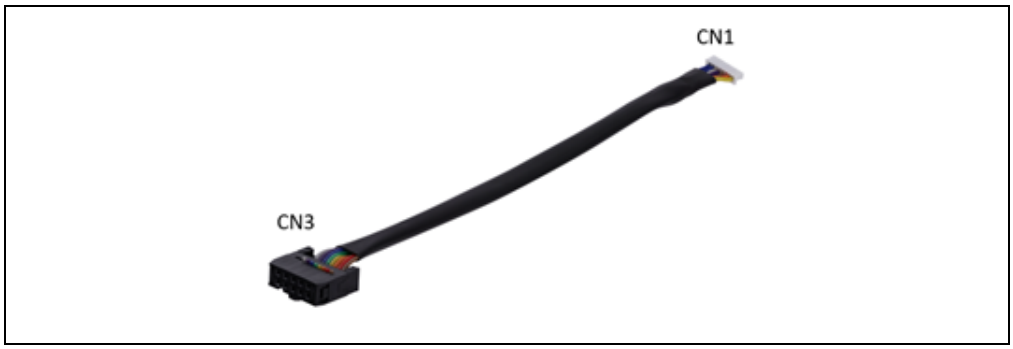

FIGURE 2-3: *4-pin (CN1) to 10-pin (CN3) Connector.*

TABLE 2-2: CN1 CONNECTOR PINOUT

Pin#	Pin Name	Functional Description
1	GND	Ground
2	VIN	+5V Supply
3	TEST	GPIO program pin for the device
4	OUT1N	Digital Input/Output pin for EEPROM programming

TABLE 2-3: CN3 CONNECTOR PINOUT

Pin#	Pin Name	Functional Description
1	OUT1N	Digital Input/Output pin for EEPROM programming
2	TEST	GPIO program pin for the device
3	VIN	+5V Supply
4	GND	Ground
5	SDA	I2C serial data (internal purpose only, not for external use) Reserved
6	SCL	I2C serial clock (internal purpose only, not for external use) Reserved
7	IO1 (ICSPCLK)	Only used for digital programming mode (Clock for programming internal microcontroller)
8	IO4 (ICSPDAT)	Only used for digital programming mode (Data line for programming internal microcontroller)
9	MCLR	Master Clear (used for programming internal microcontroller)
10	VDD	Internal device supply

2.4 INDUCTIVE SENSOR BOARD TYPICAL CHARACTERISTICS

The plot in Figure 2-4 displays an example of linearity achievable with the inductive sensor (5 pole pair) with an analog output. The Error plot is the zoomed difference between the ideal slope (red) and the Analog output (blue).

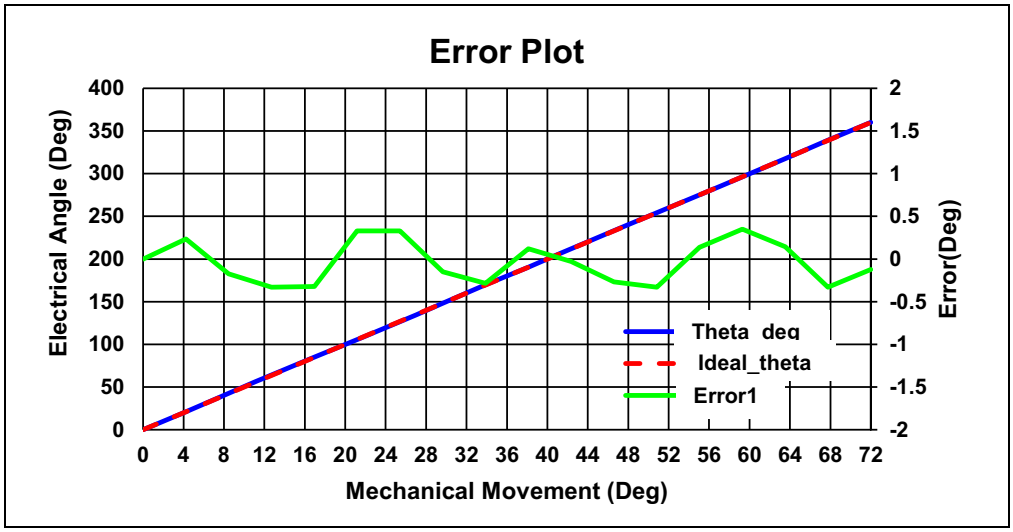

FIGURE 2-4: *An Example of Typical Inductive Sensor Board Linearity.*

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