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**LX3302A 50mm Linear  
Inductive Position Sensor Nano Kit  
(LXK3302AL012) Basic User Guide**

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# LX3302A 50 MM LINEAR INDUCTIVE POSITION SENSOR NANO KIT BASIC USER GUIDE

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# LX3302A 50 MM LINEAR INDUCTIVE POSITION SENSOR NANO KIT BASIC USER GUIDE

## Preface

### NOTICE TO CUSTOMERS

All documentation becomes dated, and this basic user guide 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](http://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 LX3302A 50 mm Linear Inductive Position Sensor Nano Kit. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [The Microchip Website](#)
- [Customer Support](#)
- [Document Revision History](#)

### DOCUMENT LAYOUT

This document describes how to use the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – This chapter describes the most important features of the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit, as well as the contents of the kit and a step-by-step Quick Start Guide.
- **Chapter 2. “Technical Information”** – This chapter provides technical details important for the operation of the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit.

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENTATION CONVENTIONS

Description	Represents	Examples
<b>Arial font:</b>		
Italic characters	Referenced books	<i>MPLAB® IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> 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	<u>File</u> > <i>Save</i>
Bold characters	A dialog button	Click <b>OK</b>
	A tab	Click the <b>Power</b> 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>
<b>Courier New font:</b>		
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	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets [ ]	Optional arguments	mcc18 [options] <i>file</i> [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) { ... }

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Embedded System Engineer (ESE)
- Technical Support

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Technical support is available through the website at:

<http://www.microchip.com/support>.

### DOCUMENT REVISION HISTORY

#### Revision A (February 2022)

- Initial release of this document.

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## Chapter 1. Product Overview

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### 1.1 INTRODUCTION

This chapter provides an overview of the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit, as well as a Quick Start Guide.

The LX3302A 50 mm Linear Inductive Position Sensor Nano Kit combines a 50 mm linear position sensor with a Microchip PIC<sup>®</sup> microcontroller. The kit provides higher accuracy, is immune to motor noise and does not need a magnetic target, thus accelerating sensor development.

The LX3302A 50 mm Linear Inductive Position Sensor Nano Kit has many of the features of the Microchip PRO kits, but in a smaller footprint. The linear Nano Kit along with the IPCE software allow evaluating, auto-calibrating and customizing the LX3302A sensor to suit the application. The PIC18F microcontroller can then be repurposed to be used in the end-application, further accelerating product development.

### 1.2 LX3302A 50 MM LINEAR INDUCTIVE POSITION SENSOR NANO KIT OVERVIEW

#### 1.2.1 LX3302A 50 mm Linear Inductive Position Sensor Nano Kit Features

The key features of the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit are:

- A complete Sensor with Programmer solution (sensor IC and PIC18F TSS)
  - The Linear sensor featured with the LXX3302AL012 kit is great for fluid-level sensing
- Fully IPCE compatible: Programming, Calibration and Auto-Detection in the IPCE software
- MPLAB<sup>®</sup> IDE customizable: PICkit<sup>™</sup> programmer connector available

#### 1.2.2 LX3302A 50 mm Linear Inductive Position Sensor Nano Kit Contents

The LX3302A 50 mm Linear Inductive Position Sensor Nano Kit contains the following items:

- Inductive position sensor PCB with target assembly
- USB power cable
- The IPCE software can be downloaded from [www.microchip.com](http://www.microchip.com).

[Figure 1-1](#) shows an example of the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit.



**FIGURE 1-1:** LX3302A 50 mm Linear Inductive Position Sensor Nano Kit (LXK3302AL012).

## 1.3 QUICK START GUIDE

The Linear Nano Kit 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 LX3302A 50 mm Linear Inductive Position Sensor Nano Kit:

1. To download the IPCE software, go to [www.microchip.com](http://www.microchip.com) and navigate to the LX3302A inductive sensor product page. The download link to the Microchip IPCE 2.x Installer can be found under the “*Embedded Software*” section.
2. Download and install the program, then open IPCE.
3. Connect the USB cable included in the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit.
4. As the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit comes with preloaded firmware in the PIC18F MCU and Golden parameters into the inductive sensor IC, the IPCE will automatically detect the sensor and start displaying the live data of the sensor in IPCE.

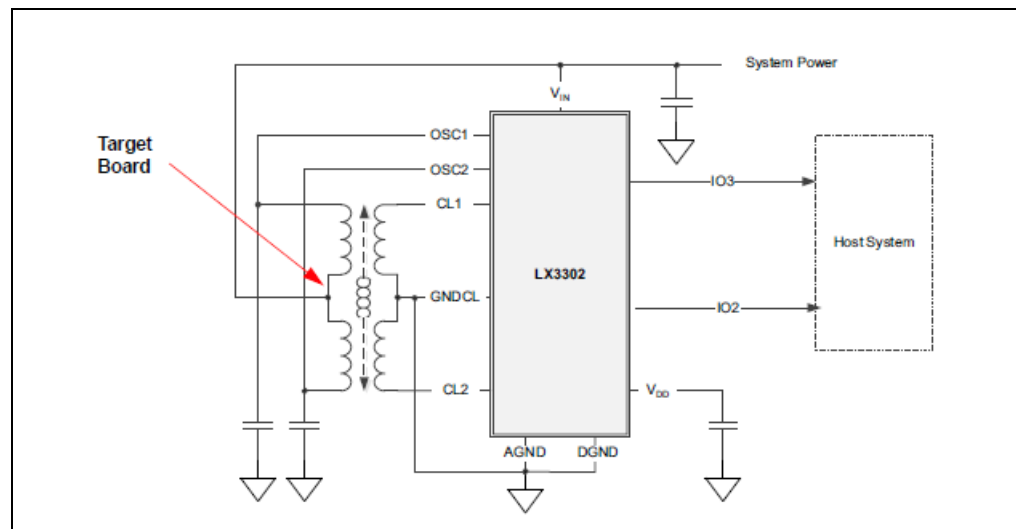
## Chapter 2. Technical Information

This chapter explains the key technical aspects of the LX3302A 50 mm Linear Inductive Position Sensor Nano Kit. It begins with a brief discussion of the system operation of the 50 mm Linear Nano Kit, features a picture of the board and connector pinout instructions, and concludes with an example diagram of linearity.

### 2.1 SYSTEM OPERATION

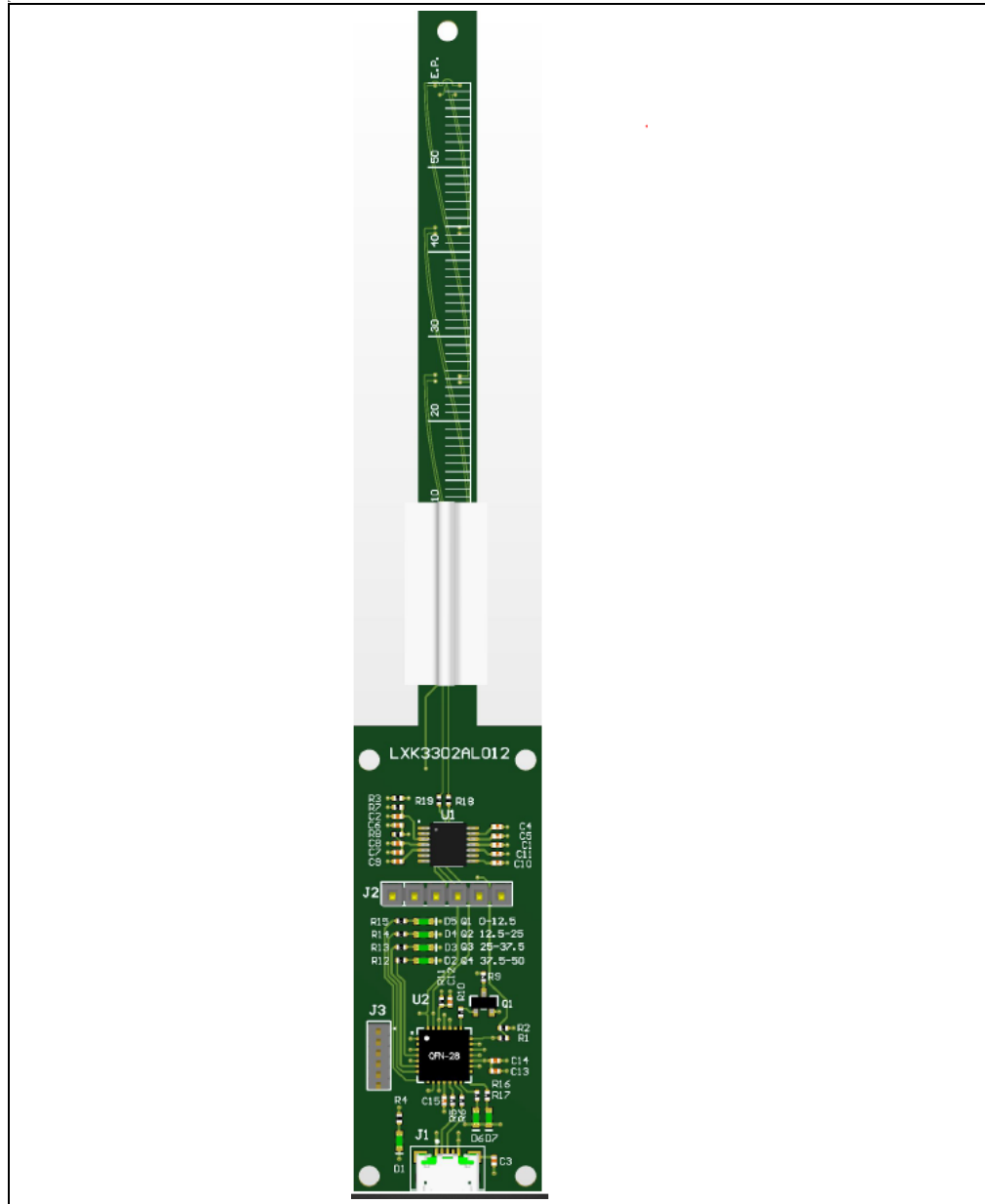
The LX3302A 50 mm Linear Inductive Position Sensor Nano Kit has been factory calibrated and is ready to use. Default operation requires a +5V DC power source which can be supplied either by an external DC power supply or the IPCE programmer connected to PC via USB.

The Linear Nano Kit constitutes of a main sensor board and a movable target PCB. The main sensor board contains two oscillator coils (OSC1 and OSC2) and two pickup coils (CL1 and CL2). 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 an output signal representative of the relative difference between the CL1 and CL2 signals (see [Figure 2.1](#)).



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

## 2.2 DETAILS OF CONNECTORS ON SENSOR BOARD



**FIGURE 2-2:** LX3302A 50 mm Linear Inductive Position Sensor Nano Board.

The LX3302A 50 mm Linear Inductive Position Sensor Nano Kit features three different connectors numbered J1 to J3 (see [Figure 2-2](#)):

- J1 is a USB 2.0 Micro-B cable connector which connects the Linear Nano Kit to a PC
- J2 is a vertical test pin connector which allows reading out various types of output of the Linear Nano Kit
- J3 is a vertical test pin connector that serves as the programming interface for the PIC18F microcontroller.

[Table 2-1](#) and [Table 2-2](#) show the pinouts of J2 and J3.

**TABLE 2-1: J2 CONNECTOR PINOUT (PART NO.: PEC06SAAN)**

Pin Number	Pin Name	Functional Description
1	GND	Ground
2	V <sub>IN</sub>	+5V Supply
3	IO1	LX3302AQPW IO1 output can be programmed to PWM/SENT
4	IO2	LX3302AQPW IO2 output can be programmed to PWM/SENT
5	IO3	LX3302AQPW IO3 output can be programmed to DAC analog output
6	IO4	Only used for Digital Programming mode

**TABLE 2-2: J3 CONNECTOR PINOUT (PART NO.: GRPB061VWVN-RC)**

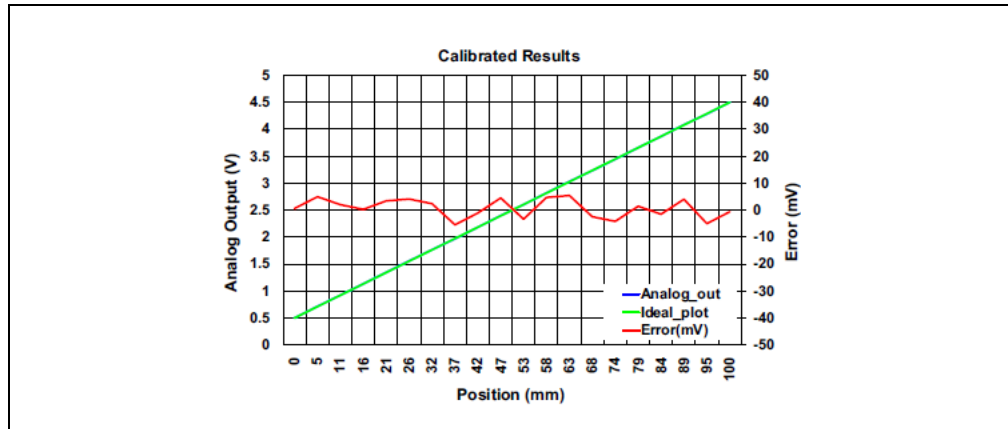
Pin Number	Pin Name	Functional Description
1	MCLR	Master Clear (used for programming internal microcontroller)
2	VDD	Internal device supply
3	VSS(GND)	Ground
4	ICSPDAT/PGD	Data Line for programming internal microcontroller (PIC18F25K50)
5	ICSPCLK/PGC	Clock for programming internal microcontroller (PIC18F25K50)
6	NC	Not Connected

The board shown in [Figure 2-2](#) also features a number of LEDs numbered D1 to D7, as follows:

- D1 – Board Power LED for PIC18F MCU and LX3302A. LED ON indicates board is powered up.
- D2 – LED ON indicates the Target position is at 0 to 90 degrees electrical angle (Quadrant 1)
- D3 – LED ON indicates the Target position is at 90 to 180 degrees electrical angle (Quadrant 2)
- D4 – LED ON indicates the Target position is at 180 to 270 degrees electrical angle (Quadrant 3)
- D5 – LED ON indicates the Target position is at 270 to 360 degrees electrical angle (Quadrant 4)
- D6 – LED ON indicates USB Serial Data TX from PIC18F MCU to IPCE
- D7 – LED ON indicates USB Serial Data RX to PIC18F MCU from IPCE.

## 2.3 INDUCTIVE SENSOR BOARD TYPICAL CHARACTERISTICS

The plot in [Figure 2-3](#) shows an example of linearity achievable with the inductive sensor with an analog output. Other output formats will have the same accuracy.



**FIGURE 2-3:** An Example of Typical Inductive Sensor Board Linearity (Calibrated).

## 2.4 RESTORING THE MCU TO THE FACTORY DEFAULT

In order to restore the PIC18F IC firmware to the factory default, load the hex file available at the path shown below using MPLAB® IPE and the PICKit™ 3/4 programmer.

The latest factory default firmware is available in the IPCE software folders. The default path is:

```
C:\IPCE_2.X\IPCE\driver\Nano_Sensor_Rotary_Board_Firmware\.
```



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