**HS Series Master Development System**

# Software Documentation

## Introduction

This software is designed to provide a complete understanding of how HS Series encoders and decoders work together, as well as describing how they can be used in a system. There are two modes of operation: Software Operation Mode and Development System Operation Mode. Software Operation is the default mode when the program is started and requires no additional equipment. Development System Operation Mode is accessed through the "View Options" label at the top of the main "Linx Encoder / Decoder Demonstration Software" window and requires the MDEV-LICAL-HS Master Development System to be plugged into a USB port on the PC. Help can be found by clicking the "Help" label at the top of the main window or the "Help" button at the bottom of the "View Options" form.

## Getting Started

When the program starts, the Software Operation Mode is initialized. Both encoders and decoders have default baud rates, but Encryption Keys and Control Permissions need to be set up. Each data line is set to control its own function. It is best if you understand the basic operation before making any changes to the settings in the "View Options" form.

Each encoder and decoder combination has three essential variables that must match for successful communication. First is the baud rate. Each encoder and decoder has an option to select one of two baud rates for data transfer. This option is found in the "View Options" form. Second is the Encryption Key, which is created by the user with the decoder and then learned by the encoder. Third are Control Permissions, which determine if an encoder has the authority to activate one of the decoder's data lines.

The encoders are placed in the simulated handheld transmitter and the decoders are placed in the receiving device. The Encryption Key is represented by the background color of the transmitter and receiver, so units with matching keys have matching colors. Detailed instructions are given later in this document.

## Software Operation Mode

The Software Operation Mode is used to simulate operation of the encoders and decoders without any hardware present. It simulates two handheld transmitters as well as two receiving devices. Any combination of these units is allowed. Help can be accessed by clicking the "Help" label at the top of the window.

The simulation starts with no Encryption Key, so the units do not work with each other. An Encryption Key needs to be created and associations made among the units as described in the following sections. Once comfortable with the default settings, various features can be enabled and disabled in the "View Options" form so that the system operation can be simulated. The initial screen is shown in Figure 1.



Figure 1: The Encoder / Decoder Demonstration Software Window in Software Operation Mode

## Creating an Encryption Key

To change the Encryption Key, press the receiver's "Create Key" button ten times. The length of time the button is held down and released is used to gather entropy for the key generator algorithm. This creates a random Encryption Key, which is represented by the background color of the receiver.
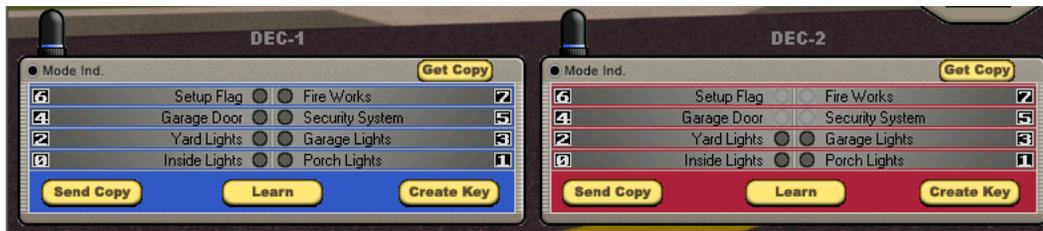


Figure 2: Background Colors Represent Associated Encryption Keys

The decoder now starts sending the key out, which is simulated by a glowing spot coming out of the receiver.



Figure 3: The Send Key Symbol

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Press the "Get Key" button on the desired transmitter and the Encryption Key is sent to this device. When the device receives the Encryption Key, the background color of the transmitter matches the color of the sending receiver. The Get Key function has a 15-second time limit before the button needs to be pressed again.



Figure 4: The Transmitters After Programming

## Learning Control Permissions

Once the encoder has gotten the key, the decoder needs to learn its permissions. To do this, press the "Learn" button on the receiver. The "Mode Ind." LED at the top-left corner of the receiver unit begins flashing. Press each of the data line buttons on the desired handheld transmitter that are to be used. Press the "Learn" button again to exit Learn Mode and the units are now in sync and ready to use.



Figure 5: The Encoder / Decoder Demonstration Software Window in Software Operation Mode After Programming

## Assigning Data Line Functions

Once the encoder and decoder are synchronized, any of the enabled data line buttons on the encoder can be pressed to operate the function of that data line on the corresponding decoder. These functions can be changed in the "View Options" form. The data line's LED on the receiver changes from grey to green and the corresponding function, which is displayed next to the LED, operates. For example, if data line "0" is set to operate "Inside Lights," and data line button "0" is pressed on the transmitter, the LED next to data line "0" turns green and the house's inside lights turn on. The User ID is also be displayed to the right of the receiver's antenna, showing which encoder has been used to activate the data line.

To erase all users from the decoder's memory, press and hold down the "Learn" button for 10 seconds. The decoder's background color returns to black to indicate that all users have been erased. To return to the default settings, the program may be shut down and re-started, though it should be noted that actual encoders and decoders can not be returned to the default state by powering down the units.



Figure 6: Activating a Data Line

Once comfortable with the operation to this point, open the "View Options" form and change some of the available settings to simulate the options available to the HS Series encoders and decoders. Remember to match baud rates for each encoder / decoder pair or they can't communicate.

## Development System Operation Mode

This mode is only available if the decoder board in the MDEV-LICAL-HS kit is plugged into a USB port on the PC. The available options for this mode are the settings for the data line functions. These settings can be accessed by clicking on the "View Options" label at the top of the main program window. All other settings should be set on the evaluation boards. The encoder and decoder must be synced on the evaluation boards as well. This is done in the same manner as the Software Operation Mode simulated. The HS Series Master Development System User's Guide explains in detail how to set up the boards.

If the LEDs on the evaluation board turn on, then the LEDs in the program should also turn on and activate the corresponding data line function. If you get a warning message when trying to use the Development System Operation Mode, then the PC doesn't recognize the decoder evaluation board. If this happens, unplug the USB cable and then plug it back in again. If it still will not function, check to make sure the correct drivers are installed. The drivers are on the CD included with the Master Development System or can be downloaded from the Linx website at www.linxtechnologies.com. If problems persist, contact Linx Technologies for support at +1 800 736 6677 or techsupport@linxtechnologies.com.



Figure 7: The Encoder / Decoder Demonstration Software Window in Development System Operation Mode

## View Options

This form is used to make changes to the program operation. Once the changes are made, press the "OK" button to save changes. To cancel any unwanted changes, press the "Cancel" button. For help, click the "Help" button. The options are divided into six areas: Operation Mode, Enable Enc / Dec's, Encoder 1, Decoder 1, Encoder 2 and Decoder 2.



Figure 8: The View Options Form

### Operation Mode

This option is used to determine which mode of operation to enable. If the Software Operation Mode is selected, no hardware is needed. If the Development System Operation Mode is selected, then the MDEV-LICAL-HS Master Development System should be connected to the PC with a USB cable. Once either of these is selected, the available options for each mode are enabled. All options are available for the Software Operation Mode, while only the data line options are available for the Development System Operation Mode. The rest of the options need to be set on the Master Development System board.



Figure 9: The Operation Mode Area

### Enable Enc / Dec's

This option allows the user to select which encoder / decoder combination to simulate. The checked selections are enabled and visible in the main window.
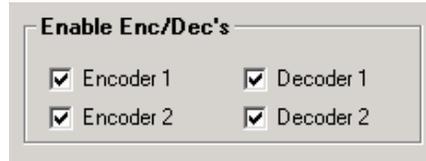


Figure 10: The Enable Enc / Dec's Area

### Encoder 1 and Encoder 2

These options are used to simulate the Power Down, PIN, and Baud Rate settings of the HS Series encoder. When placed into Power Down Mode, the encoder toggles the TX_PDN line, which can be connected to the transmitter. This is simulated in the software by selecting the "Power Down Enabled" setting. The TX_PDN line is low and keeps the transmitter powered down until the user presses one of the data line buttons on the handheld transmitter. At this point, the TX_PDN line goes high and powers-up the transmitter so that it may send the data generated by the encoder. The "ENC-1" label above the transmitter is grey when the line is low and green when it is high. The "Select Baud Rate" setting includes values of 4,800 or 28,800bps. The encoder's baud rate must match the decoder's baud rate in order for operation to occur.
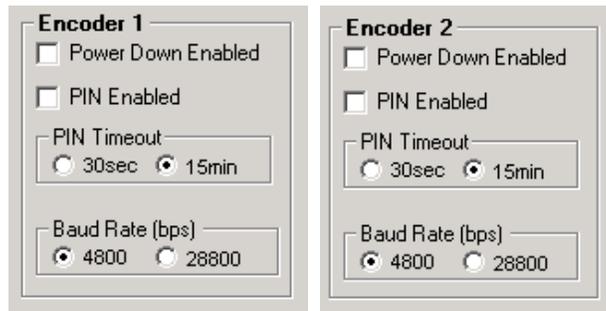


Figure 11: The Encoder 1 and Encoder 2 Area

The encoder's PIN is enabled by checking the "PIN Enabled" box. The user can select 30 seconds or 15 minutes before the PIN expires and needs to be entered in order to be able to access the transmitter. This is set by selecting the desired time in the "PIN Timeout" section. Enabling this causes another button labeled PIN to be added to the transmitter.



Figure 12: The Transmitter With the PIN Enabled

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Pressing this "PIN" button causes the Mode IND. LED to flash for 15 seconds. While it is flashing, press any 4-button combination for the PIN. After the fourth button is pressed, the Mode Ind LED turns off. Re-enter the PIN to confirm it, and it is enabled. After the transmitter has been idle for the length of time selected in the "View Options" form, the PIN needs to be re-entered to enable the transmitter for use again. The only way to erase the PIN is to learn a new Encryption Key.

## Decoder 1 and Decoder 2

These options are used to simulate the baud rate and data line function settings available on the HS Series decoders. To change the data line function settings, click on the dropdown box for that data line to view the available functions. If no function is desired, select "No Connect". To set the baud rate of the decoder, select one of the available values. This baud rate selection must match the baud rate of the desired encoder in order for operation to occur.
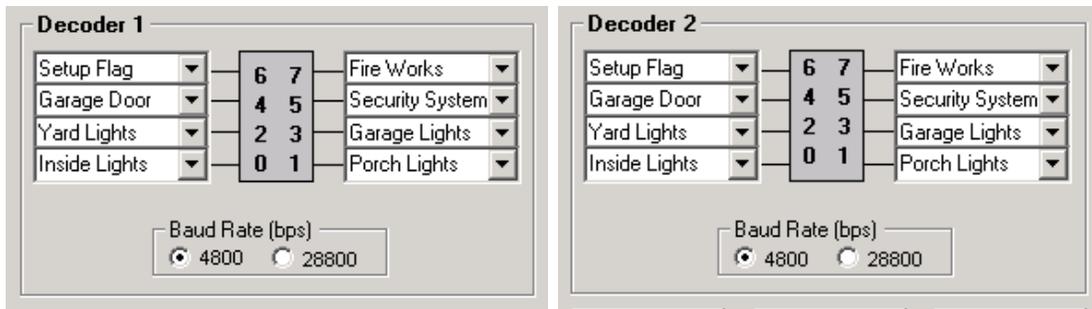


Figure 13: The Decoder 1 and Decoder 2 Area

## Seven Simple Steps to Establish a Working Relationship

1. Ensure matching baud rates.

2. Press the "Create Key" button ten times to create an Encryption Key and start the exchange process.

3. Press the "Get Key" button on the transmitter to get the key from the decoder.

4. Press the "Learn" button on the receiver to initiate Learn Mode.

5. Press each button on the transmitter that will be used in the application.

6. Press the "Learn" button again to exit Learn Mode or let the decoder time out after 15 seconds.

7. Press one of the learned data line buttons to test operation.