Linx
TECHNOLOGIES

HS Series
Master Development System
User´s Guide

Wireless made simple®

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All RF products are susceptible to RF interference that can prevent communication. RF products without frequency agility or hopping implemented are more subject to interference. This module does not have frequency agility built in, but the developer can implement frequency agility with a microcontroller and the example code in Linx Reference Guide RG-00101.

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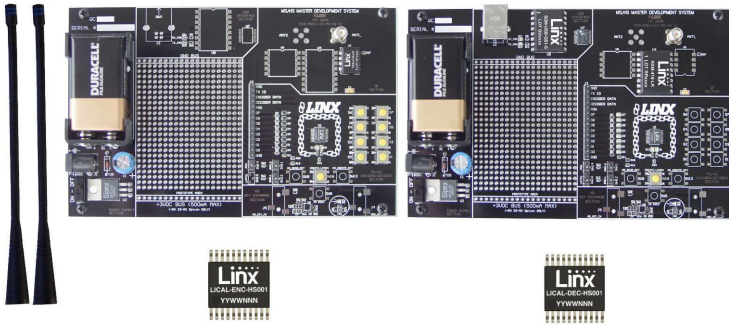
User´s Guide

Figure 1: Package Dimensions

Introduction

The HS Series encoders and decoders are ideal for remote control and command, security, keyless entry, status monitoring, and a host of similar applications. They encode the status of up to eight buttons or contacts into a highly secure serial output intended for transmission via an RF or infrared link. The Master Development System is intended to give a designer all the tools necessary to incorporate the encoder and decoder into a product. This guide will show how to take full advantage of the development boards included with the system. Data Guides for the encoder and decoder are included with the system or may be downloaded from the Linx Technologies website at www.linxtechnologies.com. The Master Development System serves several important functions:

- Rapid Evaluation: It allows the performance and features of the HS Series encoder and decoder to be quickly evaluated.

- Design: It shows how to design with the encoder and decoder and how to interface with other components. It also demonstrates the overall system function, making it easy to develop the initial system design.

- Prototype Development: It allows for additional circuitry to be placed directly on the board so that it can act as the first prototype of the product. All of the signals are available on a wire-wrap header for easy connection to external circuitry.

Revised 11/23/12

The Master Development System includes 2 development boards, one set up for the encoder and the other for the decoder, 2 HS Series encoders*, 2 HS Series decoders*, and two CW Series antennas. The boards may be populated with either the LR Series or the ES Series RF modules. The decoder board is also populated with 1 QS Series USB module.

*One part is soldered to the board, one extra is for use on your first prototype board.

Ordering Information

Ordering Information	
Part Number	**Description**
MDEV-LICAL-HS	HS Series Master Development System with LR Series
MDEV-LICAL-HS-ES	HS Series Master Development System with ES Series

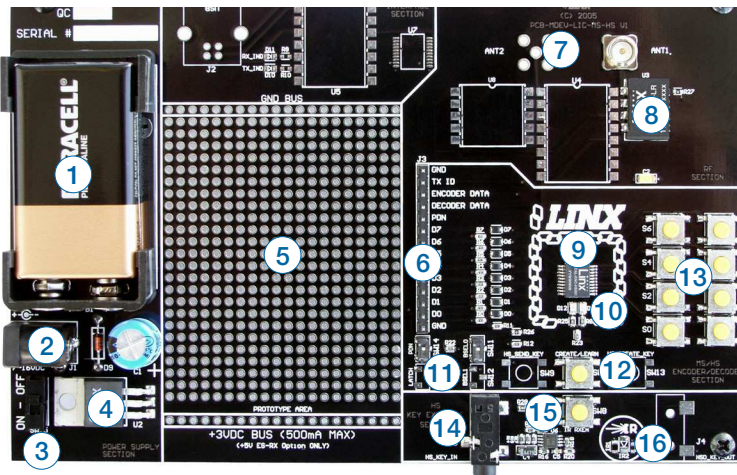Figure 2: Ordering Information

HS Series Encoder Development Board

Figure 3: MS Series Encoder Development Board

1. 9V Battery
2. Power Jack
3. On-Off Switch
4. Voltage Regulator
5. Prototype Area
6. Break-Out Header
7. Reverse-Polarity SMA Antenna Connector
8. LR Series Transmitter Module
9. HS Series Encoder
10. Indicator LEDs
11. Function Switches
12. CREATE Button
13. Data Line Buttons
14. Key Input Jack
15. IR Receiver Enable Button
16. IR Key Transfer Phototransistor

HS Series Deccoder Development Board

Figure 4: MS Series Deccoder Development Board

1. 9V Battery
2. Power Jack
3. On-Off Switch
4. Voltage Regulator
5. QS Series USB Module
6. Prototype Area
7. Break-Out Header
8. Reverse-Polarity SMA Antenna Connector
9. LR Series Transmitter Module
10. HS Series Decoder

11. Data Line LEDs
12. Indicator LEDs
13. Function Switches
14. LEARN Button
15. SEND_KEY Button
16. CREATE_KEY Button
17. Key Input Jack
18. IR Receiver Enable Button
19. IR Key Transfer Phototransistor and Diode
20. Key Output Jack

Using the Development Boards

After unpacking the development system, attach an antenna to each board, install the supplied 9V battery, and turn on the power switches. The encoder and decoder will be set at the factory and will work straight out of the box. To create a new operational setup, follow these steps:

1. On the decoder board, press the LEARN button and then the CREATE_KEY button to enter Create Key Mode. Release the LEARN button and press the CREATE_KEY button ten times to generate the KEY.

2. To use the infrared key transfer, press the IR_RXEN button on the encoder board to activate the infrared receiver. Hold the encoder and decoder boards close until the MODE_IND LEDs on both boards light up.

3. To set Control Permissions, press the LEARN button on the decoder board.

4. While the decoder's MODE_IND line is flashing, press each data line button on the encoder that is needed for the application.

5. After all the desired data lines have been transmitted, press the LEARN button again, or wait until the 15 second time-out occurs. The permissions will now be saved in the decoder.

6. Transmit with one or all the data lines held high to confirm that the learn process was successful.

Troubleshooting

If the boards fail to work out of the box, then try the following:

*   Check the battery to make sure it is not dead.

*   Make sure that the baud rate switches are set the same on both boards.

*   Make sure that the antenna is connected.

*   Check to see if the PDN switch is on, placing the encoder and decoder into Power Down Mode. In most cases, the encoder PDN switch should be on.

*   Make sure that you set the Encryption Key correctly. This key is created by the decoder and needs to be sent to the encoder before they will communicate.

- Make sure that you set your Control Permissions correctly. If you have not set the encoder to use a particular line, then when you press a button on the encoder board, the MODE_IND LED on the decoder board will light up, but the data line LED will not light up.

If all of these appear to be in order, then you can call +1 800 736 6677 or email techsupport@linxtechnologies.com for technical support.

The Prototyping Area

The prototyping area is the same on both boards and contains a large area of plated through holes so that external circuitry can be placed on the board. This circuitry can be interfaced with the HS encoder or decoder through the breakout header to the right. At the bottom of this area is a row connected to the 3V power supply and at the top is a row connected to ground.

All of the data lines are connected to a wire-wrap header to the right, allowing easy access from the prototyping area. The DATA_IN, DATA_OUT, and TX_ID lines are also available on the header, as well as the PDN lines from the RF modules. This allows complete control of the entire system from the prototyping area, giving the designer a great deal of flexibility in using the boards.
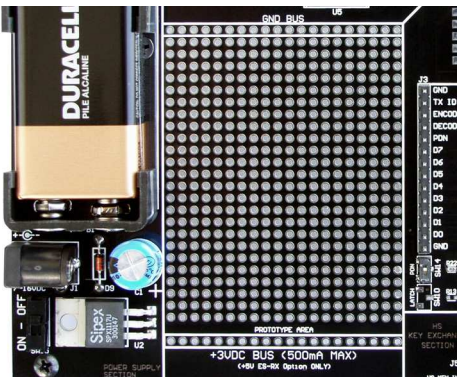

Figure 5: The Prototyping Area and Power Supply

The Power Supply

The power supply is the same on both boards and consists of a standard 9V battery and a power jack connected to a 3.0V voltage regulator. The regulator can provide approximately 500mA of current to the prototyping area. If the added circuitry will need more than this, then the designer must add an external supply. If the circuit will consistently draw more than 100mA of current, it might be better to use the power jack, as the battery may run down fairly quickly, reducing testing and development time.

The jack accepts a standard 5.5mm plug with the tip ground and the outer shell 7 to 16VDC positive supply. A reverse voltage protection diode has been included on the board to protect the circuitry in case the voltage on the plug is reversed, but it is still a good idea to double-check the polarity.

The Encoder Board

The encoder board has two sections that are of primary interest: the encoder area and the transmitter area.

The Encoder Area

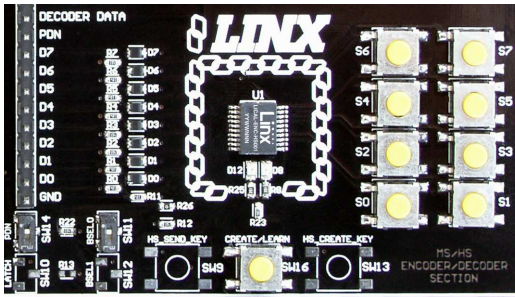Figure 6 shows the encoder area of the development board.

Figure 6: The Encoder Area

The encoder is located in the center beneath the Linx logo. To the right are buttons that will pull the encoder data lines high when pressed. Button S0 corresponds to data line D0, button S1 to data line D1 and so forth.

The diodes to the left isolate the data lines from each other while allowing any line to activate the SEND line.

Beneath the encoder are two LEDs. D12 is connected to the MODE_IND line and will light up as described in the MS Encoder Data Guide. D8 is connected to the TX_CNTL line and will provide visual feedback by lighting up when the encoder sends a word.

Beneath the LEDs is a button that is connected to the CREATE line. This button is used to create the Code Word and set the Control Permissions as described in the MS Series Encoder Data Guide.

There are three function switches to the left of the CREATE button. BSEL0 and BSEL1 are used to set the baud rate of the encoder as described in the Figure 7 below.

Note: The decoder board must be set to the same baud rate in order for the signal to be received correctly.

Baud Rate Selection Table		
SEL_BAUD1	SEL_BAUD0	Baud Rate (bps)
0	0	2,400
0	1	9,600
1	0	19,200
1	1	28,800

Figure 7: Baud Rate Selection Table

The maximum baud rate for the LR Series is 10,000bps, so only 2,400 and 9,600bps can be used on boards populated with these modules. The ES Series can use all four baud rates.

The PDN switch will connect the TX_CNTL line of the encoder to the PDN line of the transmitter so that the TX Control Mode of the encoder can be tested. This mode is described in the HS Series Encoder Data Guide.

If a BSEL switch is up, then the line is high (1, V_{CC}); if down, then the line is low (0, GND). If the PDN switch is up, then the encoder's TX_CNTL line is connected to the transmitter's PDN line; if down, it is not connected and the LR Series transmitter will not be activated unless the PDN line is pulled high externally. The ES Series transmitter has an internal pull-up, so will be active unless pulled low.

The Encoder Board RF Area
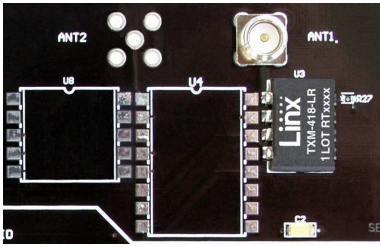Figure 8 shows the RF area of the development board.

Figure 8: Baud Rate Selection Table

This board can be populated with either the LR Series transmitter (as shown) or the ES Series transmitter. The LR Series transmitter will be placed on the right side and the ANT1 connector will be populated. The ES Series transmitter will be placed on the left and the ANT2 connector will be populated. R27 is connected to the LADJ line of the LR transmitter to reduce the output power to approximately 0dBm. The LR Series transmitter is capable of producing more output power than may be legally acceptable, so by reducing the output power, the range experienced with the evaluation kit will more closely resemble the range that can be achieved with a final certified product.

The Encoder Board Key Exchange Area
Figure 9 below shows the key exchange area of the development board.

Figure 9: The Encoder Board Key Exchange Area

This section allows for both a wire and infrared transfer of the Encryption Key. The encoder can only receive a key, so only the infrared receiver and KEY_IN jack are populated. The jack is simply connected directly to the KEY_IN line on the encoder. The infrared receiver is more complex. A schematic diagram of this circuit is shown in Figure 10.
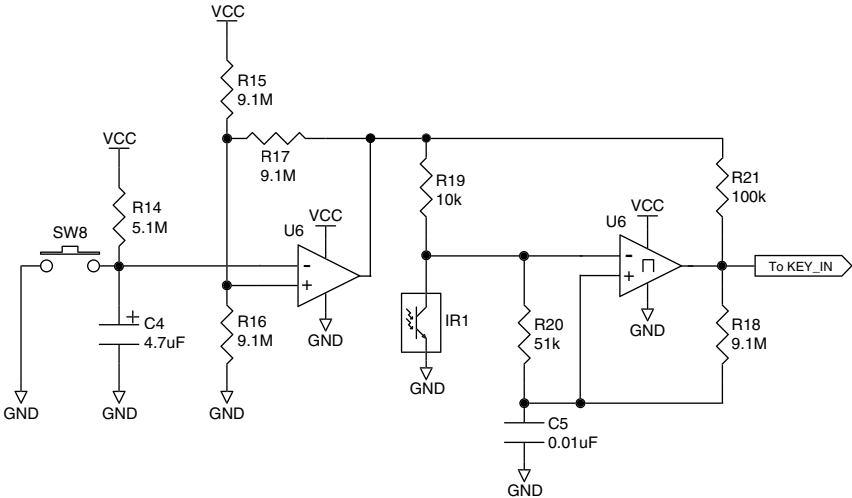
Figure 10: The Infrared Receiver Circuit

The left side of the circuit consists of an op-amp that is set up as a timer to feed current into the phototransistor for a specific amount of time after the button is pressed. Since the phototransistor can pick up infrared radiation from many sources, including lights, this keeps the output from randomly switching and keeping the encoder awake. This circuit will keep the phototransistor from constantly pulling current and will allow the encoder to enter sleep mode, preventing it from also constantly pulling full current.

The circuit works in the following way: when SW8 is pressed, capacitor C4 will discharge and pull the negative input of the op amp low. This will make the output of the op amp go high and supply current to the phototransistor (IR1). C4 will begin to recharge through R14 as soon as SW8 is released. At 5.1MΩ, it will take approximately 20 seconds for the voltage to get high enough to make the output of the op amp go low and deactivate IR1.

The right half of the circuit uses a comparator as a data slicer to make the output of the phototransistor into a square wave that is easier for the encoder to read. The output of the comparator is then connected to the KEY_IN line on the encoder. The Master Development board has a 10kΩ resistor in series to prevent the jack from shorting the comparator out, but it may not be necessary in a custom design.

The Decoder Board

The decoder board has three main sections of interest: the decoder area, the receiver area, and the USB area.

The Decoder Area

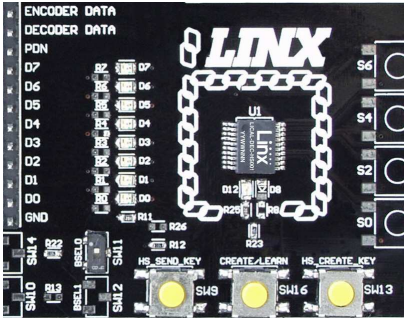Figure 11 shows the decoder area of the development board.

Figure 11: The Decoder Area

The decoder is placed in the center beneath the Linx logo. To the left are LEDs that are connected to the decoder data lines. These will light up when the decoder receives a signal from the encoder to take the data line high. LED D0 corresponds to data line D0 and so forth.

Beneath the decoder is an LED that is connected to the MODE_IND line. This will light up as described in the HS Series Decoder Data Guide.

Beneath the LED are three buttons. The one on the left labeled HS_SEND_KEY is connected to the SEND_COPY line on the decoder. The one in the middle is connected to the LEARN line, and the one on the right is connected to the CREATE_KEY line. The HS_SEND_KEY button will cause the decoder to begin sending a copy of its User Data when pressed at the same time as the LEARN button. The LEARN button is used to learn the Code Word from the encoder and, with the other two buttons, to make the decoder enter special modes. The CREATE_KEY button will cause the decoder to create a new key when pressed at the same time as the LEARN button. All of these functions are described in detail in the HS Series Decoder Data Guide.

There is one function switch to the left of the CREATE button. BSEL0 is used to set the baud rate of the decoder as described in Figure 7.

The Decoder Board RF Area

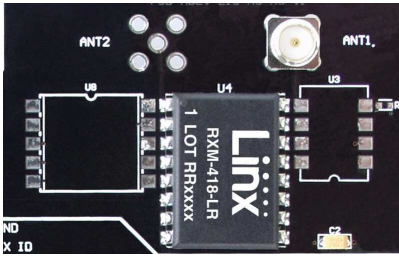Figure 12 below shows the RF area of the development board.

Figure 12: The Decoder Board RF Area

This board can be populated with either the LR Series receiver (as shown) or the ES Series receiver. Both modules can be placed on the same pads in the center of the section, but the ANT1 connector will be populated for the LR receiver and the ANT2 connector will be populated for the ES receiver.

The Decoder Board USB Area

The development boards have a Linx SDM-USB-QS-S module for use with the included development software. This module is powered by the USB bus so will not pull any current from the battery. Figure 13 shows this section.
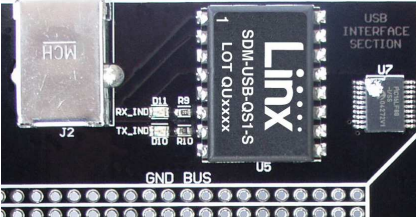

Figure 13: The Decoder Board USB Area

The microcontroller on the right monitors the decoder data lines and generates commands that are sent to the development software on the PC via the QS Series USB module. The RX_IND LED to the left of the module will flash to indicate that data is being received from the microcontroller.

The Decoder Board Key Exchange Area

Figure 14 below shows the key exchange area of the development board.
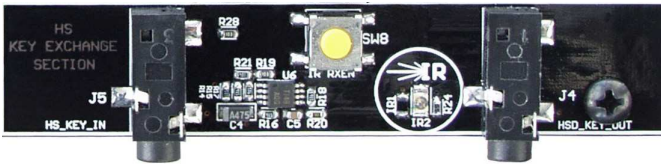

Figure 14: The Decoder Board Key Exchange Area

The KEY_IN jack and the IR receiver circuit are identical to the encoder board. Since the decoder must also send a key to an encoder and / or another decoder, the KEY_OUT jack is populated. The infrared portion consists of an infrared diode (IR2) that is modulated by the KEY_OUT line of the decoder. When the SEND_KEY and LEARN buttons are pressed and released, the decoder will begin sending the key to the jack and diode. Simply plug a wire into the KEY_OUT jack on the decoder board and the KEY_IN jack on the encoder board or activate the infrared receiver on the encoder board to send the key across.

HS Series Master Development System Software

The MS Series Master Development System software can be used in one of two modes. The default mode is as a simulation of the system. This is a good way of showing how the MS Series can work in a system for activating lights and doors.

The second mode is for use with the development system. When the decoder board is plugged into the USB port, the kit can be used to activate the features in the software. When a data line goes high on the decoder, the microcontroller will send a command to the computer to control the functions in the software. Please see the documentation included with the software for details.

Figure 15: The HS Series Master Development Software

Installing the Software and Drivers

The software included with the Master Development System uses the QS Series Direct Drivers and cannot be used with the Virtual COM Port Drivers. For this reason, only the Direct Drivers are included on the CD with the software.

The first time a QS module is plugged into a computer, Windows will display the Found New Hardware Wizard, which will guide you through installing the drivers. Application Note AN-00201 "Installing the SDM-USB-QS-S Drivers" describes the installation of the drivers in detail. The drivers should be installed before running the development software.

The HS Series Master Development System Software will automatically start when the CD is inserted and the player in Figure 16 will appear.

Figure 16: Software Installer

Pressing the Install Software button will start the Installation Wizard, which will guide you through the installation of the development software. The View Documentation button will show a list of the application notes and manuals related to the HS Series. Selecting one of these will open the file in Adobe Acrobat. The Play Movie button will play a short video about Linx on the Player Screen, which can be controlled with the Selection Keypad. Clicking the button on the bottom right of the player will open the Linx Technologies homepage in the computer's default browser.

The View Documentation list also allows for the installation of Adobe Acrobat Reader so that the documents may be viewed. There is also the

option of installing Flash, which may be required if the Linx video does not play correctly.

The Read Me file found in the View Documentation list will have extra information on the software that may not be in the software documentation, so it is a good idea to read this file before using the software.

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Resources

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