Linx TECHNOLOGIES

HS Compact Handheld Transmitter Master Development System

User´s Guide

Wireless made simple®

Warning: Some customers may want Linx radio frequency ("RF") products to control machinery or devices remotely, including machinery or devices that can cause death, bodily injuries, and/or property damage if improperly or inadvertently triggered, particularly in industrial settings or other applications implicating life-safety concerns ("Life and Property Safety Situations").

NO OEM LINX REMOTE CONTROL OR FUNCTION MODULE SHOULD EVER BE USED IN LIFE AND PROPERTY SAFETY SITUATIONS. No OEM Linx Remote Control or Function Module should be modified for Life and Property Safety Situations. Such modification cannot provide sufficient safety and will void the product's regulatory certification and warranty.

Customers may use our (non-Function) Modules, Antenna and Connectors as part of other systems in Life Safety Situations, but only with necessary and industry appropriate redundancies and in compliance with applicable safety standards, including without limitation, ANSI and NFPA standards. It is solely the responsibility of any Linx customer who uses one or more of these products to incorporate appropriate redundancies and safety standards for the Life and Property Safety Situation application.

Do not use this or any Linx product to trigger an action directly from the data line or RSSI lines without a protocol or encoder/decoder to validate the data. Without validation, any signal from another unrelated transmitter in the environment received by the module could inadvertently trigger the action.

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 a frequency hopping protocol built in.

Do not use any Linx product over the limits in this data guide. Excessive voltage or extended operation at the maximum voltage could cause product failure. Exceeding the reflow temperature profile could cause product failure which is not immediately evident.

Do not make any physical or electrical modifications to any Linx product. This will void the warranty and regulatory and UL certifications and may cause product failure which is not immediately evident.

Ordering Information

Ordering Information	
Part Number	**Description**
MDEV-***-HH-CP8-HS	HS Compact Transmitter Master Development System

*** = 315, 418 (Standard) or 433.92MHz

Figure 2: Ordering Information

HS Series Decoder Development Board

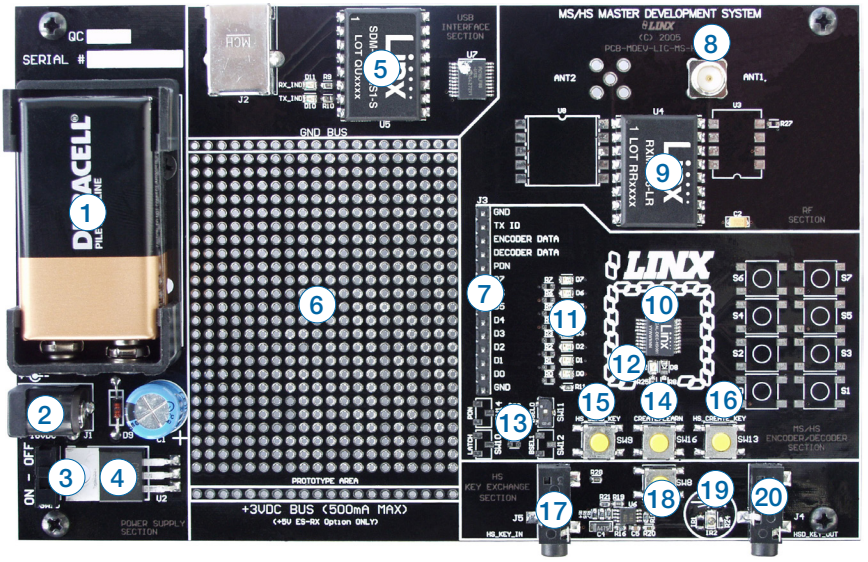

Figure 3: The HS Series Decoder Development Board

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. RP-SMA Antenna Connector
9. LR Series Receiver
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 (for hardwire key transfer)
18. IR Receiver Enable Button
19. IR Key Transfer Phototransistor and Diode (for IR key transfer)
20. Key Output Jack (for hardwire key transfer)

Security Overview

The HS Compact Handheld transmitter uses the HS Series encoder, which is based on CipherLinx™ technology. CipherLinx™ is a high-security encryption algorithm and wireless protocol designed for remote control and remote keyless entry applications. It provides a much greater level of security and many more features than older technologies on the market, such as fixed address or “rolling code” systems. Additionally, the CipherLinx™ transmission protocol is much more advanced than the simple PWM method employed by many systems. By utilizing an advanced serial protocol for data, CipherLinx™ is able to offer superior noise immunity, greater range, and increased link reliability, all of which are key factors in a wireless system.

Figure 4: CipherLinx Logo

CipherLinx™ never sends or accepts the same data twice, never loses sync, and changes codes with every packet, not just every button press. CipherLinx™ encryption is based on the Skipjack cipher developed by the U.S. National Security Agency (NSA), and is widely considered one of the most secure ciphers available. There have been no known successful attacks on the full Skipjack algorithm. Skipjack is a block cipher that has 80-bit keys and 64-bit data blocks. Since each packet is longer that 64 bits, Skipjack is employed in an encryption mode. The particular encryption mode chosen for CipherLinx™ is based on the CMC encryption mode, so that the resulting cipher is a special kind of function known as a “strong PRP” (sPRP). The encryption mode uses several invocations of Skipjack to encrypt the 128 bits in each message.

The Skipjack algorithm used by Linx has been proven secure and is not modified to avoid any compromise of strength. CipherLinx™ is far more than just a Skipjack implementation. CipherLinx's patent-pending technology combines multiple calls to the encryption algorithm with a proprietary mixing algorithm. CipherLinx™ encryption, as implemented in the Linx HS Series, has been independently evaluated by Independent Security Evaluators (ISE), a respected security firm that is widely recognized for its expertise in electronic security. They concluded that “the CipherLinx(™) protocol in the HS Series is well-designed and is an excellent choice for applications requiring a secure unidirectional link.” ISE’s full evaluation report can be found at www.linxtechnologies.com. In summary, CipherLinx™ is a powerful, independently verified, secure encryption technology that is well-suited to a wide range of applications.

Typical System Setup

The HS Series Compact Handheld Transmitter is intended to make user setup straightforward while ensuring the highest possible security. This inherent ease of use can be illustrated by a typical user setup. The Typical Applications section of the HS Series Decoder Data Guide shows the circuit schematics on which the receiver examples are based.

1. **Create an exchange a key from a decoder to the transmitter.**
   The handheld transmitter includes an on-board infrared receiver designed to optically receive the decoder's key transmission. Sending the key in this manner preserves security while avoiding the need for a hardwire connection.

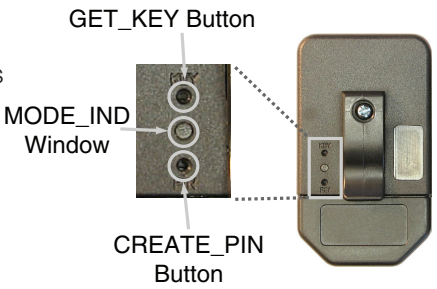

Figure 5: Button Access Holes

   The high security key is created and exchanged by placing the decoder in the Create Key Mode. The decoder's MODE_IND LED lights to indicate that the decoder has entered Create Key Mode. The decoder's CREATE_KEY button is then pressed ten times to create the key. After the tenth press, the MODE_IND LED turns off and the decoder outputs the key via a 900nm infrared diode on the KEY_OUT line. A paper clip is used to press the GET_KEY button on the back of the transmitter. Hold the back of the transmitter near the decoder's infrared diode within twenty seconds. Once the key has been transferred, the MODE_IND LEDs on both the transmitter and decoder illuminate to indicate success.

2. **Establish Control Permissions**
   Next, the user defines which buttons on the transmitter should be acknowledged by the decoder. The HS Series Control Permissions allow each transmitter in a system to activate different data lines. This is especially useful in applications where differing user access or activation capabilities are desired.

   Consider this example: a three-door garage houses Dad's Corvette, Mom's Mercedes, and Son's Yugo. With most competitive products, any keyfob could open any garage door as long as the addresses match. In an HS-based system, the keyfobs could easily be configured

Contention Considerations

It is important to understand that only one transmitter at a time can be activated within a reception area. While the transmitted signal consists of encoded digital data, only one carrier of any particular frequency can occupy airspace without contention at any given time. If two transmitters are activated in the same area at the same time, then the signals will interfere with each other and the decoder will not see a valid transmission, so it will not take any action.

Battery Replacement

The remote unit utilizes a standard CR2032 lithium button cell. In normal use, it provides 1 to 2 years of operation. To replace the battery, remove the access cover by pressing firmly on the label area and sliding it off. Once the unit is open, remove the battery by sliding it from beneath the holder. Replace it with the same type of battery while observing the polarity shown in Figure 6.

There may be the risk of explosion if the battery is replaced by the wrong type.

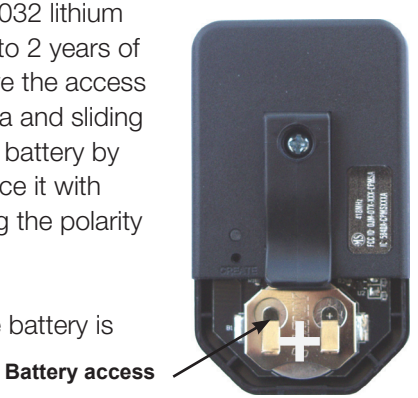

Figure 6: Battery Access

OTX-***-HH-CP8-HS Button Assignments

Figure 7 illustrates the relationship between the button locations and encoder data lines.

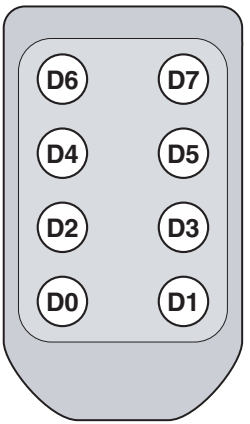

Figure 7: OTX-***-HH-CP8-HS Button Assignments

The Decoder Board

The decoder board has six main sections of interest: the decoder area, the RF area, the USB area, the key exchange area, the power supply and the prototyping area.

The Decoder Area

Figure 9 shows the decoder area of the development board.

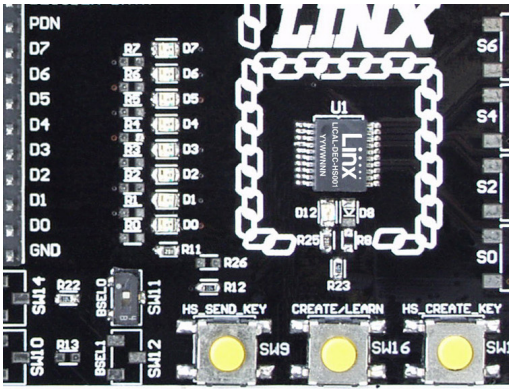

Figure 9: The Decoder Area

The decoder is located in the center beneath the Linx logo. To the left are LEDs which are connected to the decoder data lines. These 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 lights 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 causes 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 Control Permissions from the encoder and, with the other two buttons, to make the decoder enter special modes. The CREATE_KEY button causes 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.

The Decoder Board USB Area

The decoder development board has a Linx SDM-USB-QS-S module for use with the included development software. This module is powered by the USB bus, so it does not pull any current from the battery. Figure 12 shows the USB area on the decoder board.

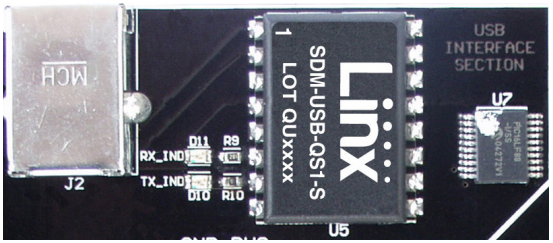

Figure 12: The Decoder Board USB Area

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 flashes to indicate that data is being received from the microcontroller.

The Decoder Board Key Exchange Area

Figure 13 shows the key exchange area of the development board.

Figure 13: The Decoder Board Key Exchange Area

The key is created in the decoder and transferred to the transmitter with an infrared (IR) link. This consists of an infrared diode (IR2) that is modulated by the KEY_OUT line of the decoder and an infrared receiver built into the transmitter. Once the key is created, the decoder outputs the key information through this circuit. The clear plastic window on the back of the transmitter should be held within a few inches of the infrared diode and the key transfer happens automatically. Jack J4 is also connected to the KEY_OUT line and is available for wired transfer of the key, but the handheld transmitter is not adapted to accept a wired connection. The rest of the circuitry is used for sending and receiving copies of the decoder's User Data, as described in the HS Series Decoder Data Guide, but is not required for operation of this development system.

The Prototyping Area

The prototyping area 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 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 decoder DATA_IN and TX_ID lines are also available on the header, as well as the PDN line from the receiver. This allows complete control of the entire system from the prototyping area, giving the designer a great deal of flexibility in using the boards.

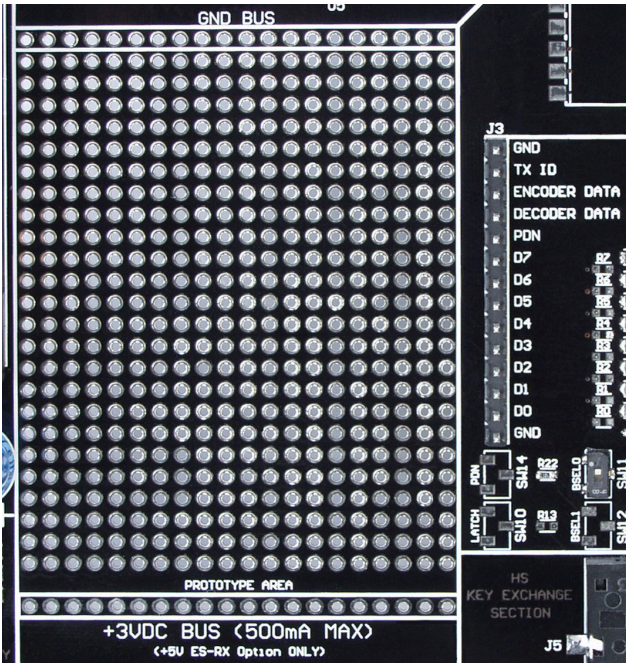

Figure 15: The Prototyping Area

Master Development Software

This software gives a complete understanding of how the HS Series encoders and decoders work together, as well as showing how they are used in a system.

The Master Development software can be used in one of two modes. The default mode is a software simulation of the system and does not require any hardware. It simulates two handheld transmitters as well as two receiving devices. This is a good way to illustrate how the HS Series works in a system by turning on lights and opening doors.

The second mode is for use with the Master Development System. When the decoder board is plugged into a USB port on the PC, the transmitter can be used to activate the features in the software. If the LEDs on the evaluation board turn on, then the LEDs in the program turn on and activate the corresponding data line function.

Figure 17 is a screen shot of the program set up in Software Operation Mode for simulating the operation of the system.

Figure 17: HS Encoder / Decoder Demonstration Software

The transmitters are on the right hand side and the receivers are at the bottom. Complete instructions for using the software can be found by clicking on the Help label at the top right of the window.

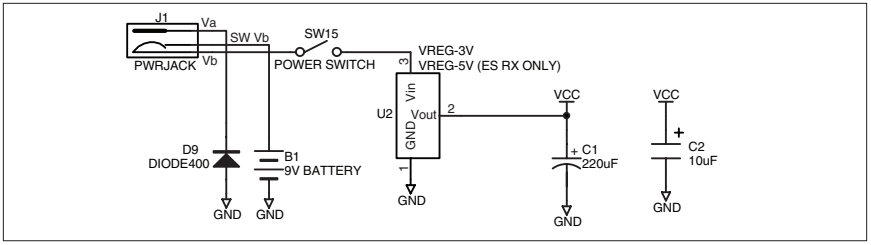

Figure 19: Power Supply Section Schematic Diagram

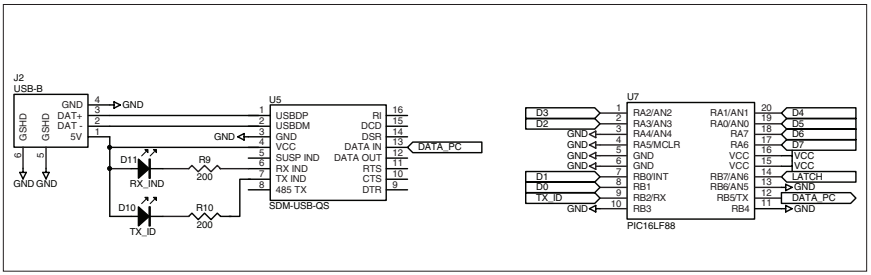

Figure 20: USB Section Schematic Diagram

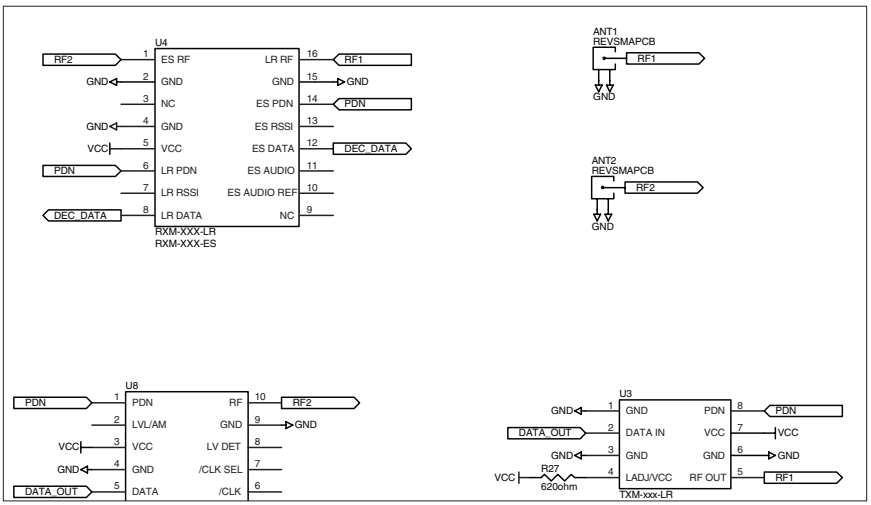

Figure 21: RF Section Schematic Diagram

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