



ES Series
Master Development System
User's Guide

Wireless made simple[®]



Warning: Linx radio frequency ("RF") products may be used 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. No Linx Technologies product is intended for use in any application without redundancies where the safety of life or property is at risk.

The customers and users of devices and machinery controlled with RF products must understand and must use all appropriate safety procedures in connection with the devices, including without limitation, using appropriate safety procedures to prevent inadvertent triggering by the user of the device and using appropriate security codes to prevent triggering of the remote controlled machine or device by users of other remote controllers.

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. This module does not have data validation built in.

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.

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.

The Master Development System includes 2 development boards, one set up for the transmitter and the other for the receiver, 2 ES Series transmitters*, 2 ES Series receivers*, two CW Series antennas, 2 9V batteries, demonstration software and full documentation.

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

Ordering Information

Ordering Information	
Part Number	Description
MDEV-***-ES-USB	ES Series Master Development System - USB
MDEV-***-ES-232	ES Series Master Development System - RS-232

*** = 869, 916MHz

Figure 2: Ordering Information

ES Series Receiver Development Board

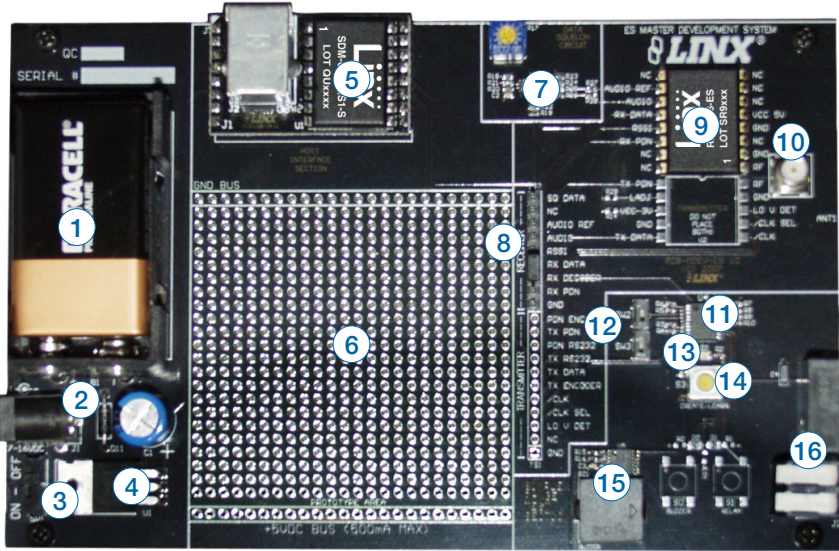


Figure 4: ES Series Receiver Development Board

- | | |
|--------------------------|---------------------------------|
| 1. 9V Battery | 9. ES Series Receiver |
| 2. DC Power Jack | 10. RP-SMA Antenna Connector |
| 3. On-Off Switch | 11. MS Series Decoder |
| 4. Voltage Regulator | 12. Baud Rate Selector Switches |
| 5. Host Interface Module | 13. MODE_IND LED |
| 6. Prototype Area | 14. LEARN Button |
| 7. Data Squelch Circuit | 15. Buzzer |
| 8. Break-Out Header | 16. Relay Output |

The Prototyping Area

In addition to their evaluation functions, the boards may also be used for actual product development. They feature a prototyping area for the addition of application-specific circuitry. 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. The holes are set at 0.1" on center with a 0.04" diameter, making it easy to add most industry-standard SIP and DIP packages to the board. This circuitry can be interfaced with the ES transmitter or receiver through the breakout header to the right. At the bottom of this area is a row connected to the 5V power supply and at the top is a row connected to ground.

Note: The on-board 5-volt regulator has approximately 500mA of headroom available for additional circuitry. If added circuitry requires a higher current, the user must add an additional regulator to the prototype area or power the board from an external supply.

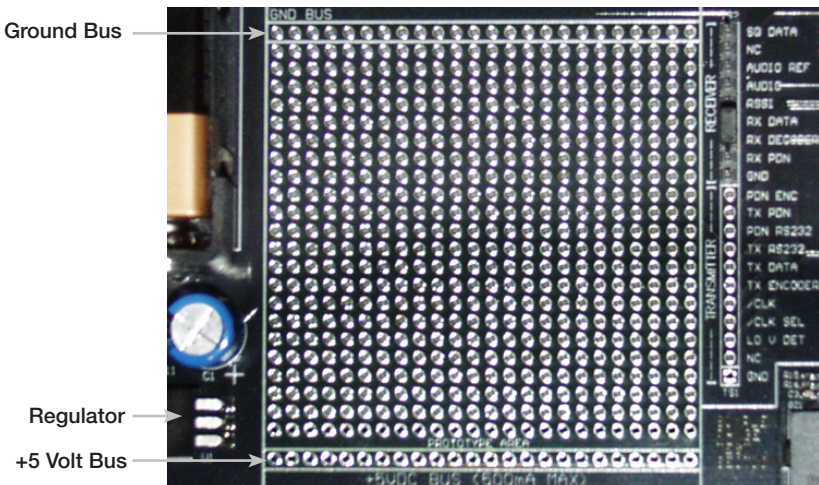


Figure 5: The Development Board Prototyping Area

To get a better idea of the circuit's operation, clip an oscilloscope probe on both RX DATA and SQ. DATA (Squelch Data). With the transmitter off, the SQ. DATA line is high (which means that the output is squelched) while RX DATA is switching randomly. Squelching is accomplished by comparing RSSI with a voltage reference created by R17 (potentiometer), R18, and R21. When the RSSI falls below the voltage set by this reference, the output of the comparator (U6) is pulled to ground. This disables the data slicer created with the additional comparator contained within U6. Figure 14 shows the schematic of this circuit.

Setting a higher squelch threshold reduces the random noise on the DATA line but also reduces range. The squelch level affects only the threshold of the data going to the RS-232 serial port and the SQ DATA line on TS2.

To set squelch, turn off the transmitter and turn on the receiver. Place an oscilloscope probe on the SQ DATA line, and adjust R17 until SQ DATA remains high. Two resistors (R27 and R28) are used to connect the module to the squelch circuit. These may be removed to disconnect the squelch circuit and prevent it from slightly loading the AUDIO and AUDIO REF lines.

Using the Encoder and Decoder

The MS Series encoder and decoder use a 24-bit address to provide uniqueness to the transmission and to prevent unintended activation. The development boards come with a default address. To create a new address, press and hold the CREATE button on the transmitter board. The address is randomized for as long as the button is held down. Once released, the MODE_IND LED begins flashing to indicate that the encoder is ready to accept Control Permissions. Press the Buzzer and/or Relay buttons to tell the encoder that they will be used. Press the Create button again to exit Create Mode, or let the encoder time out after 15 seconds.

On the decoder board, press the LEARN button and the MODE_IND LED begins flashing to indicate that the decoder is ready to learn a new address. Press one of the authorized buttons on the transmitter board to send a signal. Press the LEARN button again to exit Learn Mode, or let the decoder time out after 17 seconds and the system is ready for use.

The encoder and decoder operate on one of four different baud rates as set by the baud rate selector switches. A faster baud rate gives a faster response time. Please see the encoder or decoder data guide for the settings. If the switch is up then it is connected to Vcc, if it is down then it is connected to GND.

Host Interface Module

The ES Master Development System features a Host Interface socket, which allows the use of two different PC interface modules. The first is a USB interface module that uses a standard USB cable to connect to a PC's USB port or a USB hub. The second type of module is a RS-232 interface module that can be connected to a standard serial COM port on a PC using a straight-through 9-pin extension cable (not included). The evaluation board is considered a DCE device and as such is designed to be connected using a straight-thru serial extension cable. Do not use a null-modem cable as the boards will not function.

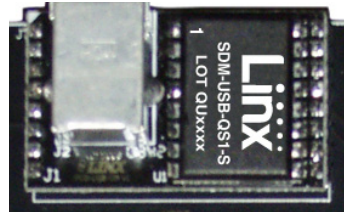


Figure 7: USB Interface Module

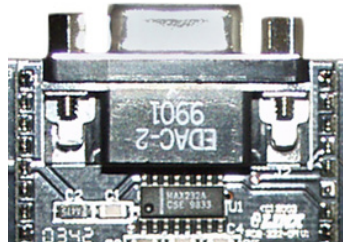


Figure 8: RS-232 Interface Module

To install, select the module to be used and then line up the pins on the module with the headers on the board. Verify that the pin one polarity marks on the board and on the Host Interface Module match. The USB jack or the D-sub connector should face away from the board. Press firmly on the module so that it slides fully into the header.

The development system may be prepared for host operation with the supplied Linx software by setting the jumpers on the header as shown in the adjacent figure. This routes the module's data lines to the Host Interface Module. Despite being electrically interfaced, appropriate protocol must be employed to ensure reliable and error-free data transfer since the ES Series modules do not encode or packetize the data in any manner. It is important to understand that the development boards are transparent; that is, the user's software is entirely responsible for controlling the timing and error correction aspects of the link. The evaluation boards have no provision to check or qualify the incoming data. When designing a protocol to transfer data across a wireless link, it is very important to remember that interference is inevitable. The protocol must

TS1	TS2
• PDN ENC	• SQ. DATA
• TX PDN	• NC
• PDN RS232	• AUDIO REF
• TX RS232	• AUDIO
• TX DATA	• RSSI
• TX ENCODER	• RX DATA
• /CLK	• RX DECODER
• /CLK SEL	• RX PDN
• LO V DET	
• NC	
• GND	
TX	RX

Figure 9: Jumper Configuration

Using the Boards as a Design Reference

The master development boards included in this kit are very simple, yet they illustrate some important techniques that should be incorporated into the board layout. The module's mounting pads extend slightly past the edge of the part. This eases hand assembly and allows for better heat conduction under the part if rework is necessary. A full ground plane fill is placed on the bottom of the board. This ground plane serves three important purposes:

First, since a quarter-wave antenna is employed, the ground plane is critical to serve as a counterpoise (please see Application Note AN-00500 “Antennas: Design, Application, and Performance” for details on how a ground plane affects antenna function).

Second, a ground plane will suppress the transfer of noise between stages of a product, as well as unintentional radiation of noise into free space.

Third, a ground plane allows for the implementation of a microstrip feed between the module and the antenna. The term microstrip refers to a PCB trace running over a ground plane that is designed to serve as a 50-ohm transmission line. See the ES Series data guide or the calculator available on our website for details on microstrip calculations.

In Closing

Here at Linx, “Wireless Made Simple” is more than just our motto, it is our commitment. A commitment to the highest caliber of product, service, and support. That is why, should you have questions or encounter any difficulties using the evaluation kit, you'll be glad to know many resources are available to assist you. First, check carefully for the obvious, then visit our website at www.linxtechnologies.com or call +1 541 471 6256 between 8AM and 4PM Pacific Time to speak with an application engineer.

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Header Section Schematic

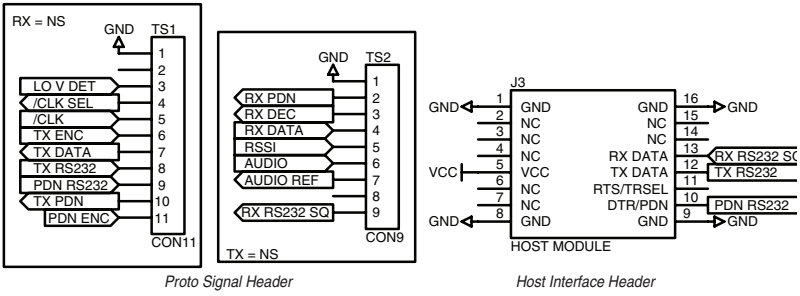


Figure 13: Header Section Schematic

Squelch Circuit Schematic

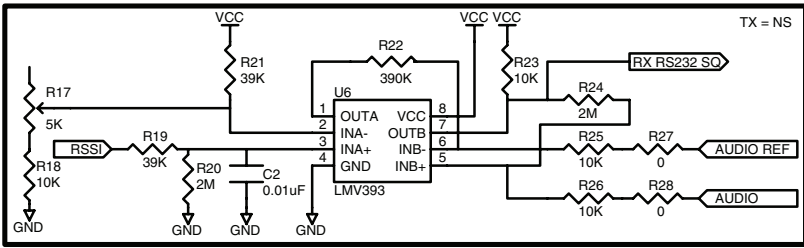


Figure 14: Squelch Circuit Schematic

Power Supply Section Schematic

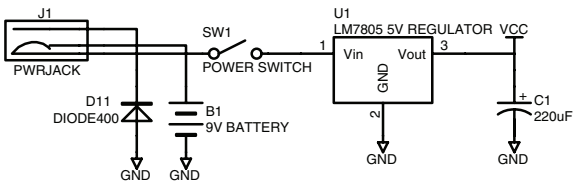


Figure 15: Power Supply Section Schematic



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