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**MS Keyfob
Transmitter
Data 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”).

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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.

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MS Keyfob Transmitter

Data Guide



Description

The Linx MS Series Keyfob transmitter is ideal for remote control and command applications. Available in 418 (standard) or 433.92MHz versions, it has been pre-certified for FCC Part 15, Industry Canada, and European CE (433MHz) compliance. This dramatically reduces development cost and time to market. The high-performance synthesized design provides superior frequency accuracy and minimizes body proximity effects. When combined with an LR or LT Series module, the Keyfob can operate at distances of up to 750 feet. Ease of use and security are dramatically enhanced by the on-board MS Series encoder, which allows instant creation of up to 16,777,216 (2^{24}) unique addresses without cumbersome DIP switches or cut traces. When paired with a MS Series decoder, Keyfob identity can be determined and button permissions established. The Keyfob is available with 1 to 5 buttons and can be custom labeled

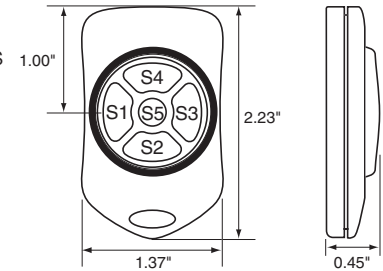


Figure 1: Package Dimensions



Figure 2: Keyfob Button Configurations

OEM Configurations

With a one-time NRE and minimum order, Linx can configure the keypad and label areas. Contact Linx for details.

Features

- FCC, IC and CE pre-certified
- Long range
- Simple user setup
- 2^{24} unique addresses
- 1 to 5 buttons
- Compact, stylish package

Applications

- General remote control
- Keyless entry
- Garage / gate openers
- Lighting control
- Home / industrial automation
- Wire elimination

Ordering Information

Ordering Information	
Part Number	Description
OTX-***-HH-KF#-MS-xxx	MS Keyfob Transmitter
MDEV-***-HH-KF-MS	MS Keyfob Development System

= Number of Buttons, 1 to 5
 *** = 418 (Standard) or 433MHz
 xxx = Color (Leave blank for standard black)
 WHT = White
 CRE = Red
 CGY = Gray

Figure 3: Ordering Information

Electrical Specifications

Keyfob Electrical Specifications						
Parameter	Designation	Min.	Typ.	Max.	Units	Notes
Power Supply						
Operating Voltage	V _{CC}	2.3	3.0	3.6	VDC	
Supply Current	I _{CC}		12.6		mA	
Power-Down Current	I _{PDN}		1.5		μA	1
Transmitter Section						
Transmit Frequency Range	F _C					
OTX-418-HH-KF#-MS			418		MHz	
OTX-433-HH-KF#-MS			433.92		MHz	
Center Frequency Accuracy		-8		+8	kHz	
Data Rate			9,600		bps	
Environmental						
Operating Temperature Range		0		+70	°C	1

1. Characterized, but not tested

Figure 4: Electrical Specifications

Theory of Operation

The MS Series Keyfob Transmitter combines a high-performance synthesized transmitter with an on-board MS Series encoder IC to form a highly reliable, yet cost-effective RF remote control transmitter. The transmitter's advanced synthesized architecture delivers superior stability and frequency accuracy while minimizing the effects of temperature and body proximity.

The advanced MS Series encoder has several advantages over previous solutions. It provides more security by offering 2²⁴ addresses, which is several orders of magnitude greater than older encoders. Furthermore, the address is instantly established with a simple button press, eliminating cumbersome DIP switches and cut traces. When paired with a MS Series decoder, keyfob identity can be determined and distinct transmitter-receiver relationships established.

The Keyfob operates in the following manner: when a button is pressed on the Keyfob, power is applied to the internal circuitry and the encoder IC is enabled. The encoder then detects the logic states of the button data lines. The encoder data is used to modulate the transmitter, which, through the antenna, conveys the data into free space. The transmission cycle continues until the button is released. On the receiver side, an MS Series decoder IC is used to check the transmitter's address bits against the address saved in memory. If a match is confirmed, and if the decoder has permission to recognize the specific button being pressed, the decoder's outputs are set to replicate the transmitter's button states. These outputs can then be used to activate external circuitry required by the application.

The transmitter is compatible with the LT and LR product families. When the Keyfob transmitter is combined with an LR Series receiver and MS Series decoder, ranges of up to 750 feet are possible. Applications operating over shorter distances will also benefit from the increased link reliability and superior noise immunity provided by the LR receiver.

Setting the Transmitter Address

The address is changed by using a paper clip or probe to press the CREATE_ADDR button on the board through the hole in the back of the case. When the button is depressed, an LED lights up on the front of the keyfob, indicating that the address is being created. The address is randomized for as long as the button is held down. When the button is released, the randomized address is saved and the LED begins flashing to indicate that the Control Permissions may now be set.



Figure 5: CREATE_ADDR Button Access

Press the buttons that the Keyfob user will have the authority to access. Press the CREATE_ADDR button with the paper clip again or wait 17 seconds for it to time out. The address and Control Permissions are now set. The decoder needs to learn the address before it accepts any transmissions. Please see the Typical Applications section of this data guide or the MS Series Decoder Data Guide for details.

Button Assignments

The Keyfob is available in five button configurations. Those configurations and the corresponding switch numbers are shown in Figure 6. The table shows which encoder data line has been assigned to each switch. When a button is pressed, the data line goes high, causing the corresponding data line on the decoder to go high if the address has been learned.

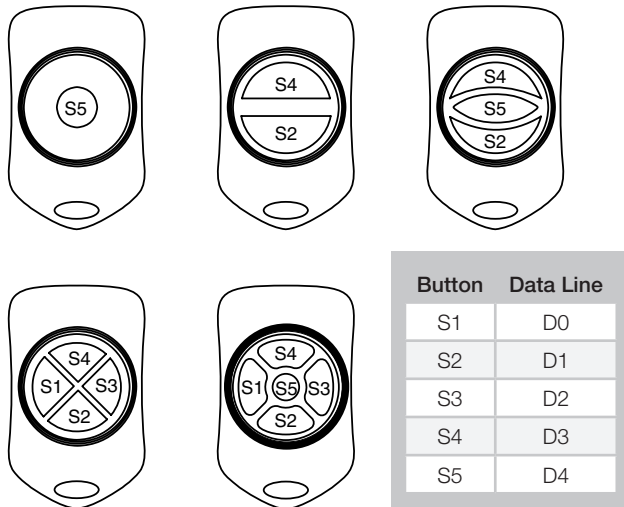


Figure 6: OTX-***-HH-KF#-MS Button Assignments

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 transmitter utilizes a standard CR2032 lithium button cell. In normal use, it provides several years of operation. Access for replacement is accomplished by gently prying apart the two halves of the Keyfob at the seam (fingernails or a coin will do). Once the unit is open, remove the battery by sliding it out from beneath the retainer.

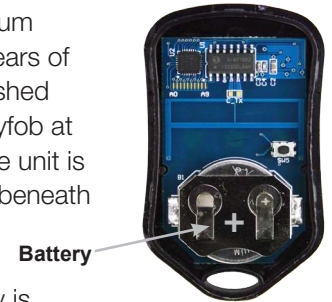


Figure 7: Battery Access

There may be the risk of explosion if the battery is replaced by the wrong type. Replace it with the same type of battery while observing the polarity shown in Figure 7.

Assembly Diagram

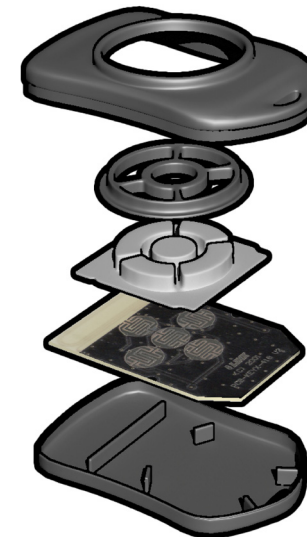


Figure 8: OTX-***-HH-KF#-MS Assembly

Labeling / Instruction Requirements

The transmitter has been pre-certified for FCC Part 15 and Industry Canada license-exempt RSS standards for an intentional radiator. The 433.92MHz version has also been tested for CE compliance for use in the European Union. The 418MHz version is not legal for use in Europe. It has already been labeled in accordance with FCC, Industry Canada and CE regulations. No further labeling of the unit is needed; however, it is necessary to include the following Instruction to the User statement in the end product's instruction manual or insert card.

Europe requires that the final product's instruction manual be provided in the end user's native language.



INSTRUCTION TO THE USER

This device complies with Part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation of this device is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radioexempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Typical Applications

The signal sent by the Keyfob transmitter can be received by the LR Series receiver module or the LT Series transceiver module. The receiver module is connected directly to the MS Series decoder, which decodes the transmitted signal.

When a button is pressed on the transmitter, a corresponding line on the decoder goes high. This can then be connected to external circuitry to perform whatever function is required by the application.

The decoder must learn the transmitter's address before they can work together. This is done by taking the LEARN line on the decoder high, typically with a pushbutton. The MODE_IND line starts switching (if an LED is attached, this causes it to flash) indicating that the decoder is in Learn Mode. Press any of the buttons on the transmitter to initiate a transmission. Take the LEARN line high again to exit Learn Mode and the system is ready for use. Figure 10 shows a schematic for a typical application.



Figure 9: Linx RF Modules

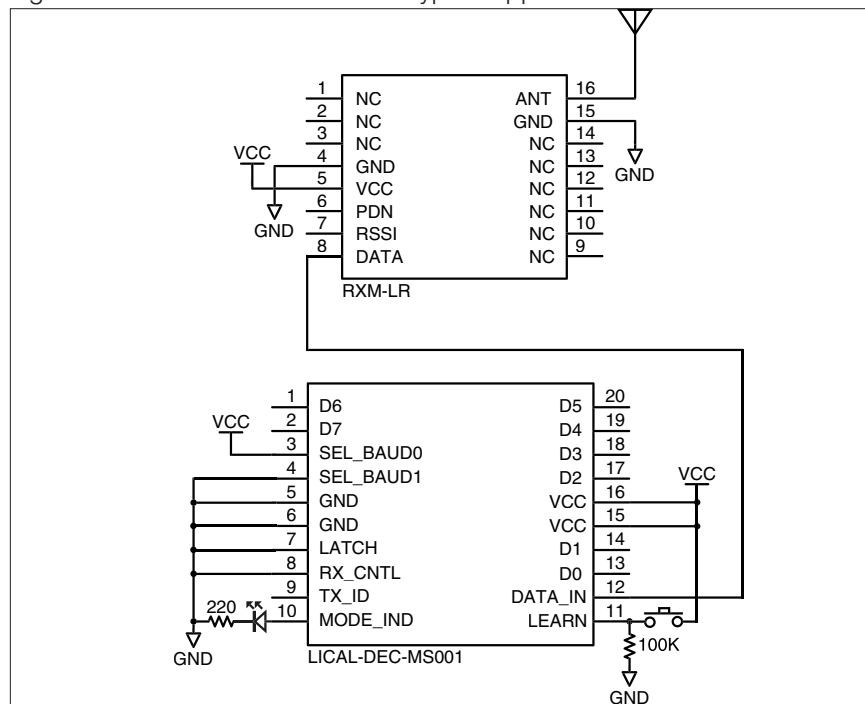


Figure 10: LR Receiver and MS Decoder Schematic

The Keyfob is set to 9,600bps, so SEL_BAUD0 should be tied high and SEL_BAUD1 tied low.

The decoder has several unique features, such as Latch Mode, Receiver Control and TX_ID.

If the LATCH line is tied to V_{CC} , the outputs go high on the first transmission, then low on the second. It is shown tied low, so the outputs are momentary (high for as long as a signal is received instructing the decoder to make them high).

The RX_CNTL line can be connected to the PDN line of the receiver and the decoder activates the receiver with a 10% duty cycle. This greatly reduces the average current consumption of the system. The adjacent figure shows it tied to ground, but to use this feature, connect the RX_CNTL line of the decoder directly to the receiver's PDN line.

The TX_ID line outputs a number associated with the originating transmitter / encoder. Application Note AN-00156 shows how to use this feature.

Data guides for the modules, the MS encoder, and the MS decoder can be found on the Linx Technologies website.

Resources

Support

For technical support, product documentation, application notes, regulatory guidelines and software updates, visit www.linstechnologies.com

RF Design Services

For customers who need help implementing Linx modules, Linx offers design services including board layout assistance, programming, certification advice and packaging design. For more complex RF solutions, Apex Wireless, a division of Linx Technologies, creates optimized designs with RF components and firmware selected for the customer's application. Call +1 800 736 6677 (+1 541 471 6256 if outside the United States) for more information.

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Notes



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