




# **MS Long-Range Handheld Transmitter Data Guide**

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 **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 have a frequency hopping protocol built in, but the developer should still be aware of the risk of interference.

**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 Long-Range Handheld Transmitter

## Data Guide



### Description

The Linx OTX-\*\*\*-HH-LR8-MS Long-Range Handheld Transmitter is ideal for general-purpose remote control and command applications that require longer transmission distances. This unit has been pre-certified for FCC Part 15, Industry Canada, and European CE (433MHz only) compliance, reducing costs and time to market. Available in 315, 418 (standard), or 433.92MHz, this small remote has a transmission range of up to 1,000 feet (300m) when combined with an LR or LT Series module. It can be configured with 1 to 8 buttons and the keypad and labeling can be customized. 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 an MS Series decoder, transmitter identity can be determined and button permissions established. The unit uses a single 3V CR2032 lithium button cell.

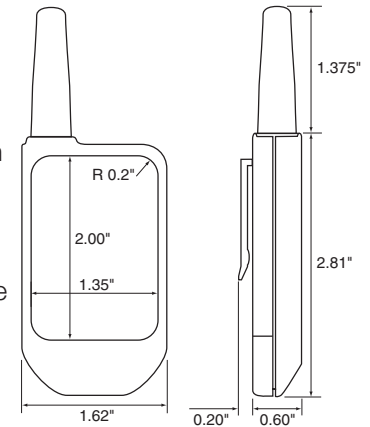


Figure 1: Package Dimensions



Figure 2: With a one-time NRE and minimum order, Linx can configure the keypad and label areas to meet your specific requirements.

### Features

- FCC, Canada and CE pre-certified
- 1 to 8 buttons
- Small package
- Customizable keypad

### Applications

- General remote control
- Keyless entry
- Garage / gate openers
- Lighting control
- Call systems
- Home / industrial automation

## Ordering Information

Ordering Information	
Part Number	Description
OTX-***-HH-LR8-MS-xxx	MS Long-Range Handheld Transmitter
MDEV-***-HH-LR8-MS	MS Long-Range Transmitter Master Development System
*** = 315, 418 (Standard) or 433.92MHz	
xxx = Custom color, leave blank for black	

Figure 3: Ordering Information

## Electrical Specifications

Electrical Specifications						
Parameter	Designation	Min.	Typ.	Max.	Units	Notes
Power Supply						
Operating Voltage	$V_{CC}$	2.1	3.0	3.6	VDC	
Supply Current	$I_{CC}$		3.4		mA	
Power-Down Current	$I_{PDN}$		5.0		nA	1
Transmitter Section						
Transmit Frequency Range	$F_C$					
OTX-315-HH-LR8-MS			315		MHz	
OTX-418-HH-LR8-MS			418		MHz	
OTX-433-HH-LR8-MS			433.92		MHz	
Center Frequency Accuracy		-50		+50	kHz	
Environmental						
Operating Temperature Range		-40		+85	°C	1
1. Characterized, but not tested						

Figure 4: Electrical Specifications

## Theory of Operation

The OTX-\*\*\*-HH-LR8-MS Long-Range Handheld Transmitter combines an LR Series transmitter and an antenna with an on-board MS Series encoder to form a simple, yet highly reliable RF remote-control transmitter. The LR Series transmitter is a low-cost, high-performance synthesized ASK / OOK transmitter. The transmitter's synthesized architecture delivers outstanding stability and frequency accuracy, while minimizing the effects of antenna port loading and mismatching. This reduces or eliminates frequency pulling, bit contraction, and other negative effects that are common to SAW-based transmitter architectures, providing a significantly higher level of performance and reliability.

When a button is pressed on the transmitter, power is applied to the internal circuitry and the encoder is enabled. The encoder then detects the logic states of the button data lines. These states are formatted into a 2-word transmission cycle which continues until the button is released. The encoder data is used to modulate the transmitter which conveys the data into free space through the antenna. Once data is received, a decoder IC is used to check the transmitter's address against an address saved in memory. If a match is confirmed, 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. For applications where range is critical, the LR Series receiver is the best choice due to its outstanding sensitivity. When the transmitter is combined with an LR Series receiver and an MS Series decoder, ranges of up to 1,000 feet (300m) are possible. Applications operating over shorter distances also benefit from the increased link reliability and superior noise immunity provided by the LR Series receiver.

## Setting the Transmitter Address

The MS Long-Range Handheld Transmitter allows the selection of one of 16,777,216 ( $2^{24}$ ) unique addresses. All transmitters are supplied set to a unique address to avoid contention with other units; however, the address can be changed. This is accomplished by using a paper clip or probe to press the CREATE button on the board through the hole in the back of the case. Press the button and an LED lights up in the MODE\_IND window, indicating that the address is being created. The address is randomized for as long as the button is held down. Release the button and the randomized address is saved and the LED begins flashing to indicate that the Control Permissions may now be set. Press the buttons that the transmitter should have the authority to access. Press the CREATE 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 will accept any transmissions. Please see the Typical Applications section of this data guide or the MS Series Decoder Data Guide for details.



Figure 5: CREATE Button Access

## OTX-\*\*\*-HH-LR8-MS Button Assignments

Figure 6 illustrates the relationship between the button locations and encoder data lines.

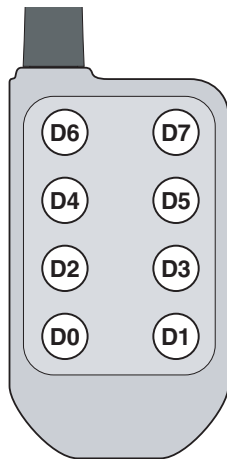


Figure 6: OTX-\*\*\*-HH-LR8-MS Button Assignments

## 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 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 7.

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



Figure 7: Battery Access

## Assembly Diagram

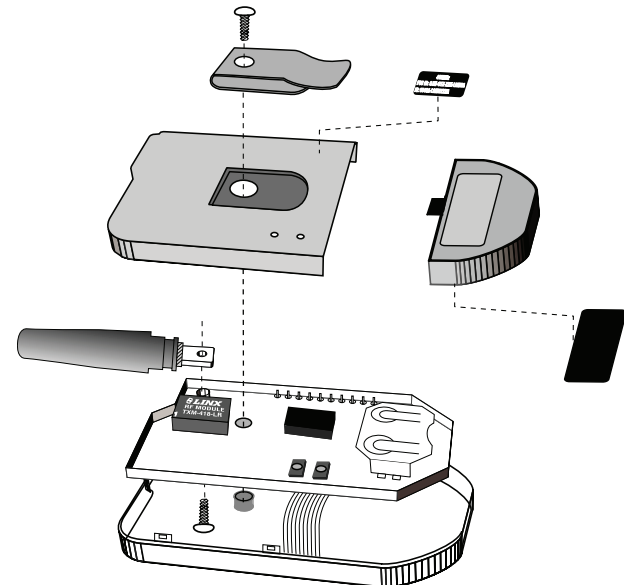


Figure 8: OTX-\*\*\*-HH-LR8-MS Assembly

## 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 315MHz and 418MHz versions are 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 statement in the end product's instruction manual or insert card. EU does not require a statement.

### 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 MS Long-Range Transmitter can be received by an LR Series receiver module or LT Series transceiver module. The outstanding sensitivity of the LR Series receiver offers the best range when used with a Linx OEM transmitter. The receiver module is then connected directly to an MS Series decoder, which decodes the received signal.

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



Figure 9: Receiver and Decoder

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 switch. The MODE\_IND line starts switching (if a 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: LR Receiver and MS Decoder Schematic" on page Figure 10 shows a schematic for a typical application.

The MS Long-Range Transmitter 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. Figure 10 shows it tied low, so the outputs are momentary (high for as long as a signal is received that instructs 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 receivers, the MS encoder, and the MS decoder can be found on the Linx Technologies website at [www.linxtechnologies.com](http://www.linxtechnologies.com).

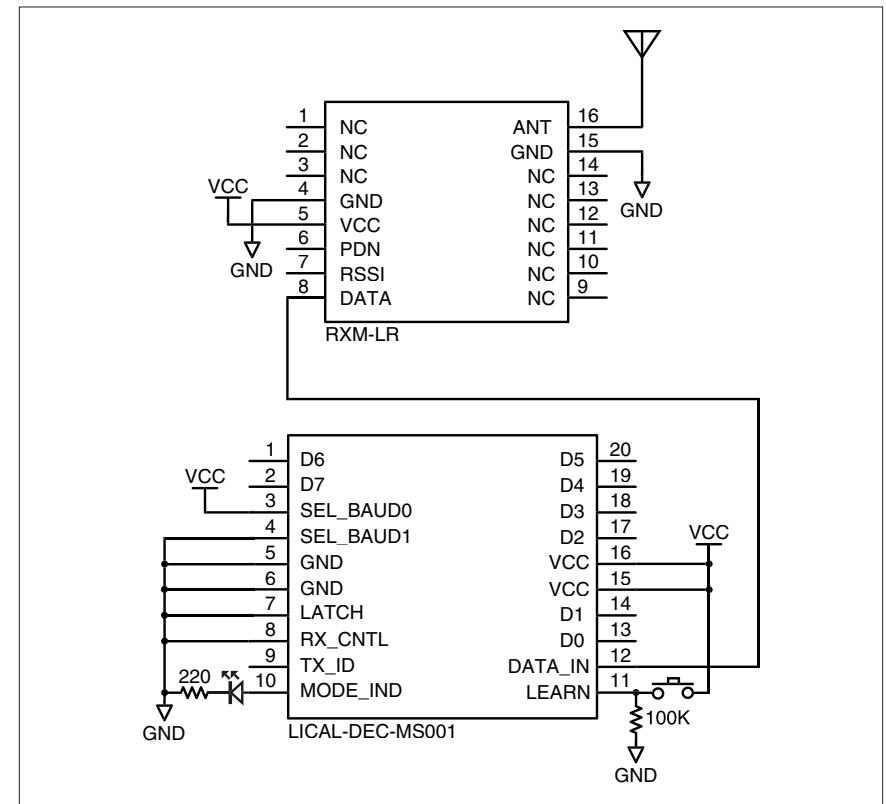
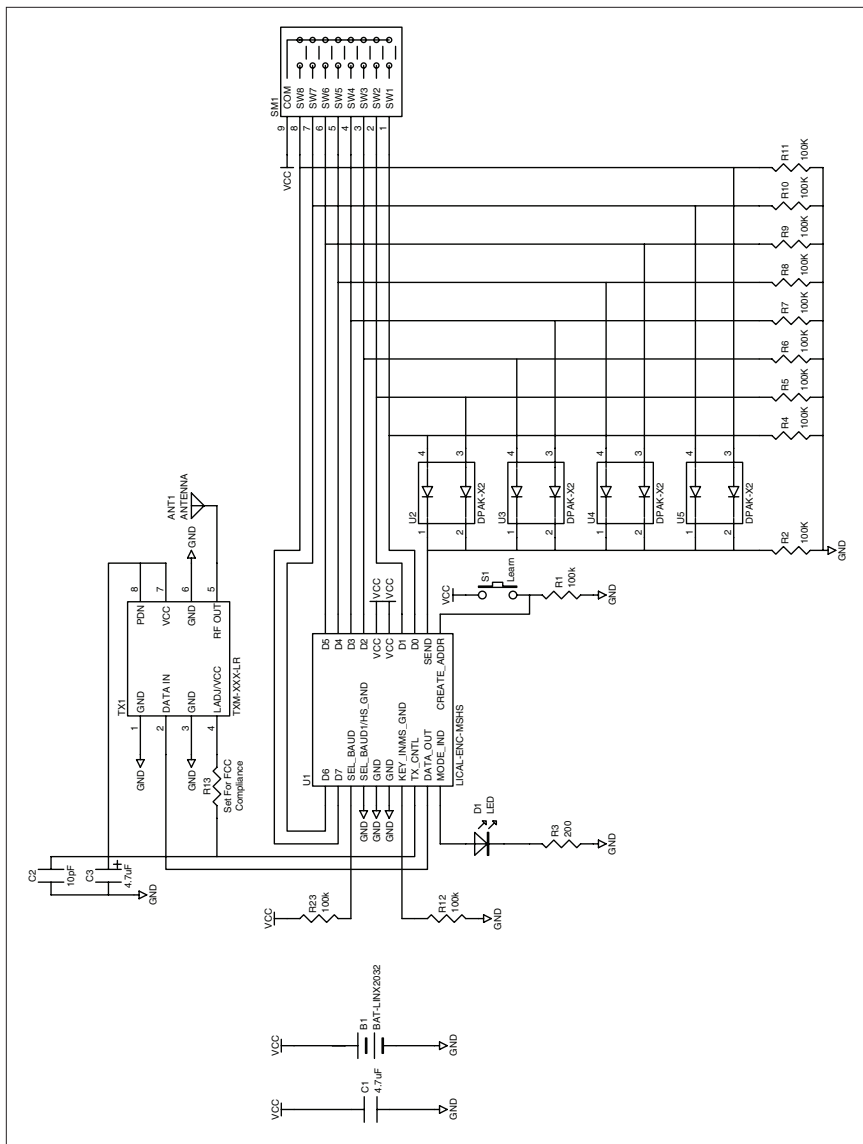


Figure 10: LR Receiver and MS Decoder Schematic







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