Linx
TECHNOLOGIES

HumPRC™ 868MHz Long-Range Handheld Transmitter
Data Guide

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Data Guide

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Description

The OTX-868-HH-LR8-PRC Long-Range Handheld Transmitter is ideal for general-purpose remote control and command applications that require longer transmission distances. This unit is in conformance with the European Radio Equipment Directive (RED) and carries the CE marking, reducing costs and time to market. Operating in the 868MHz band, this small remote has a transmission range of up to 0.8 mile (1,300m) depending on the receiver antenna and operating environment.

34.93 mm (1.38 in)

R 5.08 mm (0.20 in)

50.80 mm (2.00 in)

34.29 mm (1.35 in)

71.37 mm (2.81 in)

41.15 mm (1.62 in)

5.08 mm (0.20 in)   15.24 mm (0.60 in)
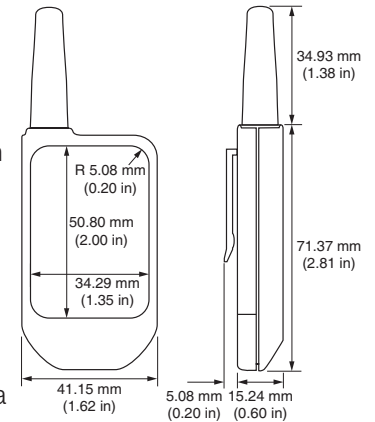
Figure 1: Package Dimensions

The transmitter incorporates the HumPRC™ Series transceiver module. This module uses an Adaptive Frequency Agility (AFA) protocol to achieve longer range and higher noise immunity than narrowband radios. An automatic acknowledgement LED indicates the receiver got the transmission.

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

The transmitter can be configured with 1 to 8 buttons and the keypad, LED and labeling can be customized. It uses a single 3V CR2032 lithium button cell.

Features

- CE Compliant (RED)
- 1 to 8 buttons
- Small package
- Customizable keypad

Applications

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

Ordering Information

Ordering Information	
Part Number	**Description**
OTX-868-HH-LR8-PRC	868MHz HumPRC™ Long-Range Handheld Transmitter
HUM-868-PRC	868MHz HumPRC™ Series Remote Control Transceiver, Castellation Interface, External Antenna Connection
HUM-868-PRC-CAS	868MHz HumPRC™ Series Remote Control Transceiver, Certified, Castellation Interface, External Antenna Connection
HUM-868-PRC-UFL	868MHz HumPRC™ Series Remote Control Transceiver, Certified, Castellation Interface, u.FL Connector
HUM-868-PRO	868MHz HumPRO™ Series Data Transceiver, Castellation Interface, External Antenna Connection
HUM-868-PRO-CAS	868MHz HumPRO™ Series Data Transceiver, Certified, Castellation Interface, External Antenna Connection
HUM-868-PRO-UFL	868MHz HumPRO™ Series Data Transceiver, Certified, Castellation Interface, u.FL Connector
MDEV-868-PRC	868MHz HumPRC™ Series Master Development System

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}		39		mA	1
Power-Down Current	I_{PDN}			1.0	µA	
Transmitter Section						
Transmit Frequency Range	F_C	863		870		MHz
Environmental						
Operating Temperature Range		−40		+85	°C	2,3

1. For a 1-second button press
2. Characterized, but not tested
3. The coin cell battery may limit the operating temperature range; check the manufacturer's reccomendations

Figure 4: Electrical Specifications

Theory of Operation

The OTX-868-HH-LR8-PRC Long-Range Handheld Transmitter uses a HumPRC™ Series transceiver to form a simple, yet highly reliable RF remote control transmitter. The HumPRC™ Series transceiver is a low-cost, high performance FSK radio that utilizes a proprietary Adaptive Frequency Agility (AFA) technique and over-the-air protocol. The AFA offers much greater noise immunity and range than traditional narrow-band transmitters.

When a button is pressed on the transmitter, power is applied to the internal circuitry and the module is enabled. The module detects the logic states of the button data lines. These states are formatted into a packet and transmitted repeatedly until the button is released.

The receiving module checks the addressing in the received packet (and encryption, if enabled). If the packet is valid and intended for the receiver, then the module replicates the transmitter's button states on its outputs. These outputs can then be used to activate whatever external circuitry is required by the application.

The transmitter is compatible with the HumPRC™ and HumPRO™ product families. Ranges of up to 0.8 mile (1,300m) are possible with good antennas and a quiet, line-of-sight environment. Applications operating over shorter distances also benefit from the increased link reliability and superior noise immunity provided by the radio and protocol.

By building on the HumPRO™ Series data module, it is simple to create mixed-mode systems that combine data transmissions with remote control functionality. For example, a single HumPRO™ Series transceiver can accept remote control commands from the handheld transmitter as well as sensor values from other devices in system. This greatly reduces system cost and complexity and opens up many options for the creative designer.

Contention Considerations

While it is still possible for interference to interrupt the transmissions, the HumPRC™ Series minimizes this risk by meeting the Polite Spectrum Access requirements in the RED standard. Part of this is a Clear Channel Assessment (CCA). The module briefly listens in on a channel before it begins a transmission to ensure that there are no other transmitters currently using the same frequency. If the module detects other RF signals on the same frequency it will either wait for short random amounts of time for the other transmission to end or jump to the next channel to make its transmission.

Button Assignments

Figure 5 illustrates the relationship between the button locations and encoder data lines.
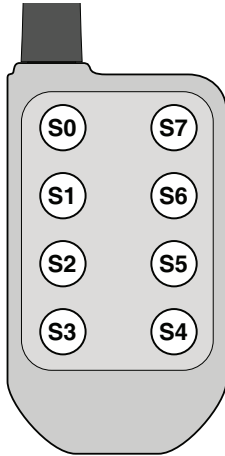

Figure 5: Button Assignments
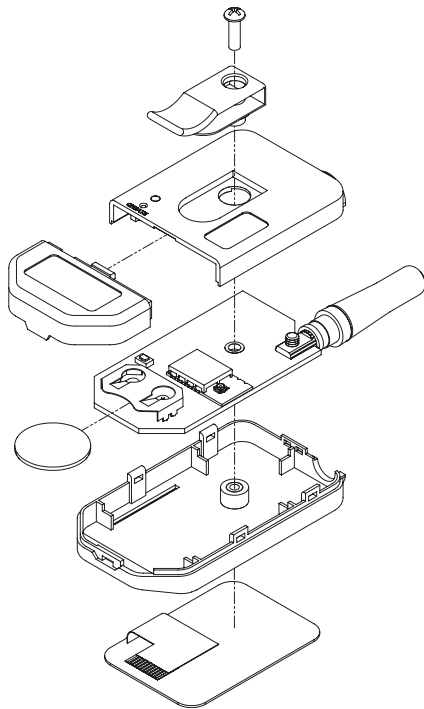
Assembly Diagram

Figure 6: Assembly Diagram

Battery Replacement

The remote unit utilizes a CR2032 lithium button cell. In normal use with five 2-second activations per day, the battery provides approximately two 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.

Battery access

Figure 7: Battery Access

Joining a Transmitter

The handheld transmitter is associated with a receiver using the built-in Join Process. This process configures a star network with the central unit as the system Administrator. Other units are added to the network as nodes one at a time. Typically, the handheld transmitter is added as a node to a module that has been configured as an administrator.

The schematic for a HumPRC™ Series transceiver configured as a receiver is shown in the Typical Applications section. The transceiver is set as an Administrator by pressing and holding the PAIR button for 30 seconds. While the button is held, the MODE_IND line is on. After 30 seconds, the MODE_IND line repeats a double blink, indicating that the operation has begun. When the button is released the key and address generation are complete and the module is an Administrator. A full explanation of this operation is in the HumPRC™ Series data guide.

The handheld transmitter is joined to an Administrator by pressing and releasing the PAIR buttons on both units. The modules automatically search for each other using a special protocol. When they find each other, the administrator sends the node the encryption key, UMASK and its network address. The UDESTID is set to the address of the administrator. The values are encrypted using a special factory-defined key. Once the JOIN process is complete, the MODE_IND blinks on both units and they now operate together.
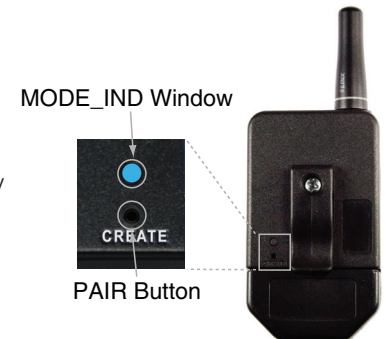

MODE_IND Window

PAIR Button

Figure 8: PAIR Button Access

Regulatory Considerations

The handheld transmitter has been tested and conforms to the requirements of the current Radio Equipment Directive (RED) standards. The handheld's test report and Declaration of Conformity (DoC) are available from Linx Technologies upon request. Reference Guide RG-00111 outlines the test setup and radio configurations that were used in the testing and certification of this device.

The Handheld Transmitter is an RF transceiver operating in the h1.3 band (ERC 70-03) using AFA +LBT (Also known as Polite Spectrum Access). It falls under Equipment Class I (EN 301 489-3 v1.6.1) and Receiver Category 2 (EN 300 220-1 v3.1.1)

It is important to note that the HUM-868-PRO is not declared as an FHSS system. Rather, it is declared as an RF transceiver using Adaptive Frequency Agility (AFA). The AFA system uses periodic channel adaptivity with 70 available channels.

The OTX-868-HH-LR8-PRC transmitter has been tested and conforms to EN 60950-1:2006 +A11:2009 + A1:2010 + A12:2011 +A2: 2013, EN 300 220-1 V3.1.1, EN 300 220-2 v3.1.1, EN 301 489-1 V1.9.2, and EN 301 489-3 v1.6.1.

To maintain validity of the Declaration of Conformity (DoC), the transmitter, including the label, shall not be modified.

The integrator must maintain a copy of the OTX-868-HH-LR8-PRC Data Guide and ensure that the final product does not exceed the specified power ratings, antenna specifications, firmware settings, and/or installation requirements as specified in the data guide.

Depending on the end application, additional testing may be required. The integrator is solely responsible for ensuring that the final product complies with all regulatory requirements in the specific country where the end device is marketed.

> **Note:** The integrator must ensure compliance of the final product with the Radio Equipment Directive (RED). A Declaration of Conformity must be issued for each standard and kept on file as described in the Radio Equipment Directive.

All Linx products are designed with the approval process in mind and thus much of the frustration that is typically experienced with a discrete design is eliminated. Linx Technologies has aided many customers through the certification process and we are available to answer any questions and provide any assistance that is required.

Regulatory Standards Tested

- Operating Frequency - EN 300 220-1 v3.1.1 (2017-02) Section 5.1.2
- Unwanted Emissions in the Spurious Domain - EN 300 220-1 v3.1.1 (2017-02) Section 5.9.2
- Effective Radiated Power - EN 300 220-1 v3.1.1 (2017-02) Section 5.2.2
- Occupied Bandwidth - EN 300 220-1 v3.1.1 (2017-02) Section 5.6.2
- TX out of band Emissions - EN 300 220-1 v3.1.1 (2017-02) Section 5.8.2
- Transient Power - EN 300 220-1 v3.1.1 (2017-02) Section 5.10.2
- TX Behavior under Low Voltage Conditions - EN 300 220-1 v3.1.1 (2017-02) Section 5.12.2
- RX Sensitivity - EN 300 220-1 v3.1.1 (2017-02) Section 5.14.2
- Blocking - EN 300 220-1 v3.1.1 (2017-02) Section 5.14.2
- Clear Channel Assessment Method - EN 300 220-1 v3.1.1 (2017-02) Section 5.21.2
- Polite Spectrum Access Timing Parameters - EN 300 220-1 v3.1.1 (2017-02) Section 5.21.3
- Adaptive Frequency Agility - EN 300 220-1 v3.1.1 (2017-02) Section 5.21.4
- Indirect ESD, ±2.0 kV and ±4.0 kV (HCP and VCP) - EN 301 489-3 v1.6.1
- Radiated RF EM Field Test - EN301 489-3 v1.6.1

Typical Applications

The signal sent by the PRC Long-Range Handheld Transmitter can be received by a HumPRC™ Series transceiver. When a button is pressed on the transmitter, a corresponding line on the transceiver goes high. This is then connected to external circuitry to perform whatever function is required by the application.

Figure 9: Standard (top) and Pre-certified (bottom) HumPRC™ Modules

The transmitter and transceiver must first learn each other's addresses. This is done by taking the PAIR line high on the transceiver, typically with a pushbutton switch. At the same time, the PAIR button is pressed on the back of the transmitter, typically with a paper clip or similar probe. The MODE_IND line on the transceiver and the LED on the back of the transmitter begin flashing, indicating that the Pair Process has been started. The devices automatically find each other and swap addresses. The MODE_IND line and LED flash to indicate that the process was successful and the devices are ready to use.

Figure 10 shows a typical schematic for the HumPRC™ Series transceiver being used as a receiver only. The C0 and C1 lines are pulled to ground, setting all of the status lines as outputs.

The MODE_IND line is connected to an LED to provide visual feedback to the user that an action is taking place.

The PAIR line is connected to a pushbutton switch for activating the Join Process.

The ACK_EN line is pulled to supply so that the module will send an acknowledgement as soon as it receives a signal. Alternatively, this line can be connected to external circuitry to take the line high when an action has taken place. For example, a circuit can take the line high when a motor has actually stopped or a door has actually locked. This way the LED on the handheld lights up only when the desired action has occurred.

Additional features can be enabled through the module's Command Data Interface. The data guide and additional documentation for the HumPRC™ Series transceiver can be found on the Linx Technologies website at www.linxtechnologies.com.
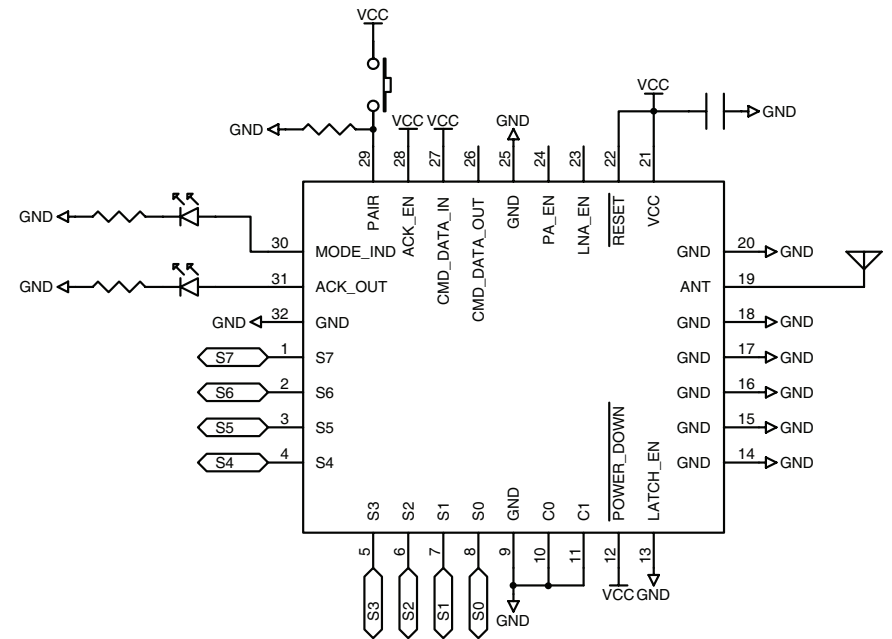

Figure 10: HumPRC™ Series as a Receiver Schematic

Operation with the HumPRO™ Series

The commands from the handheld transmitter can be received by a HumPRO™ Series transceiver. The transmitter should be joined to the HumPRO™ Series module in the same manner as it would be joined to a HumPRC™ Series module. The transmitter sends a Remote Activation command and accepts a Remote Confirm command.

Remote Activation

The transmission output consists of six bytes:

0x03 0x00 0x00 0x00 0x10 <STATUS>

The first byte is 0x03 with the next three bytes 0x00. Byte five is 0x10 which indicates a Remote Activation. Byte six is the STATUS byte, which is a bit map of the button states. Bit 0 corresponds to button S0 and so forth. Each bit is 1 if the corresponding line is high. The external microcontroller connected to the HumPRO™ module can read out the header from the transmission and know which transmitter sent the command. It can then take whatever action is required by the STATUS bits. Additional information about reading out the header is available in the HumPRO™ Series Transceiver data guide.

Remote Confirm

The handheld transmitter accepts a Remote Confirm command over the air to control the LED in the membrane switch. This command has the following format:

0x00 0x11 <DURATION> <ALIVE>

The first two bytes are 0x00 0x11 and indicate that the packet is a remote confirm packet.

The DURATION byte indicates the amount of time that the LED should be held high. This value is multiplied by 10ms. If the value is 0, the LED output is immediately taken low.

The ALIVE byte indicates how long after the transmission the module should stay awake in receive mode. This value is multiplied by 0.1s. Once this duration expires, the module returns to sleep mode.

This message is transmitted to the handheld transmitter's address. It must be received by the handheld transmitter within one second of initial transmission or within the ALIVE interval of the previous Remote Confirm message.
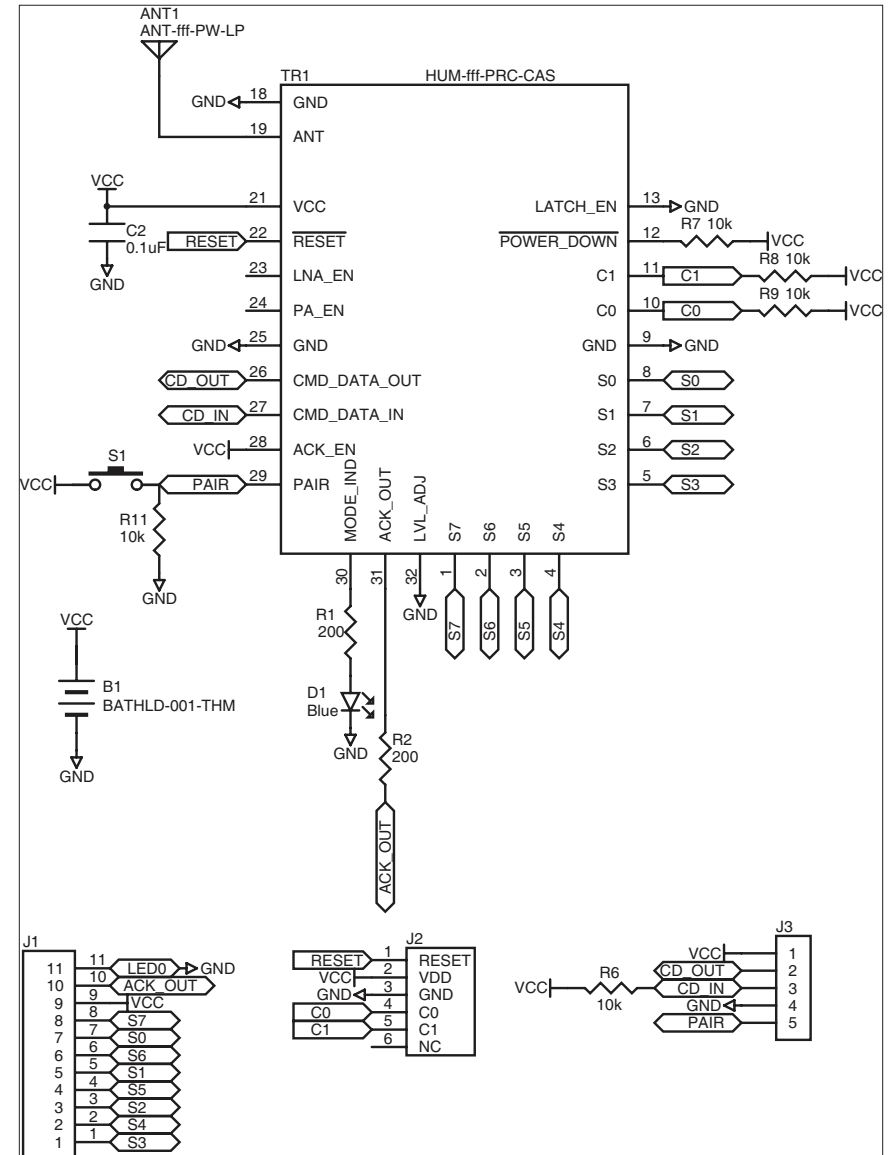
Transmitter Schematic

Figure 11: OTX-868-HH-LR8-PRC Schematic Diagram

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