



## 4-POSITION RELAY FUNCTION MODULE 2 DATA GUIDE

### DESCRIPTION

The Relay Function Module 2 is a member of the Linx pre-certified OEM product line. The modules have been tested for FCC, Industry Canada, and European CE (433MHz only) compliance and can be quickly customized to meet a specific OEM's labeling requirements. This greatly reduces the time and expense of bringing an RF-based product to market. The Relay Function Modules provide four latched or momentary relay outputs that are capable of switching external AC or DC powered loads of up to 7 amps. The Relay Modules incorporate a Linx LR Series receiver. Selectable addressing provides security and allows the creation of 256 distinct transmitter / receiver relationships to avoid unwanted interaction when multiple systems are in use. When paired with a compatible Holtek based Linx OEM Handheld transmitter or transmitter module, the Relay Function Module 2 serves as a reliable wireless switching device at distances of up to 750 feet.

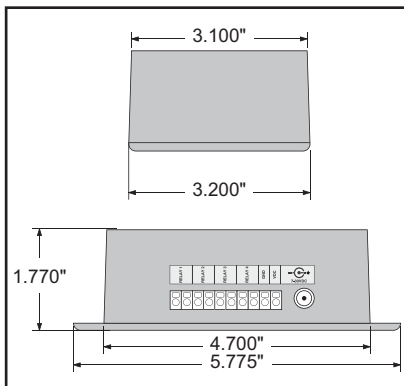


Figure 1: Package Dimensions

### FEATURES

- FCC, Canada, and CE pre-tested
- Wide operational voltage (7 to 30VDC)
- Dual power inputs
- 4 long-life relays, switch AC or DC
- Flange-mount case
- Quick-attach heavy-duty device connectors
- 256 unique addresses
- Can be cosmetically customized for OEM applications

### APPLICATIONS INCLUDE

- General Remote Control
- Motor Control
- Garage / Gate Openers
- Lighting Control
- Call Systems
- Home / Industrial Automation
- Wire Elimination

### ORDERING INFORMATION

| PART #          | DESCRIPTION                      |
|-----------------|----------------------------------|
| FCTN-RLY4-315-2 | Relay Function Module 2 - 315MHz |
| FCTN-RLY4-418-2 | Relay Function Module 2 - 418MHz |
| FCTN-RLY4-433-2 | Relay Function Module 2 - 433MHz |

## ELECTRICAL SPECIFICATIONS

| Parameter                    | Designation     | Min. | Typical                        | Max.  | Units      | Notes |
|------------------------------|-----------------|------|--------------------------------|-------|------------|-------|
| <b>POWER SUPPLY</b>          |                 |      |                                |       |            |       |
| Operating Voltage            | V <sub>CC</sub> | 7.0  | –                              | 30.0  | VDC        | –     |
| Supply Current               | I <sub>CC</sub> |      |                                |       |            |       |
| RX Only                      |                 | 4.0  | 7.0                            | 15.0  | mA         | 1     |
| RX and 1 Relay               |                 | 16.0 | 36.0                           | 65.0  | mA         | 1     |
| RX and 2 Relays              |                 | 26.0 | 65.0                           | 120.0 | mA         | 1     |
| RX and 3 Relays              |                 | 35.0 | 95.0                           | 175.0 | mA         | 1     |
| RX and 4 Relays              |                 | 45.0 | 125.0                          | 225.0 | mA         | 1     |
| <b>RECEIVER SECTION</b>      |                 |      |                                |       |            |       |
| Receive Frequency Range      | F <sub>C</sub>  |      |                                |       |            |       |
| FCTN-RLY4-315                |                 | –    | 315                            | –     | MHz        | –     |
| FCTN-RLY4-418                |                 | –    | 418                            | –     | MHz        | –     |
| FCTN-RLY4-433                |                 | –    | 433.92                         | –     | MHz        | –     |
| Center Frequency Accuracy    | –               | -50  | –                              | +50   | kHz        | –     |
| Receiver Sensitivity         | –               | -106 | -112                           | -118  | dBm        | 3     |
| <b>RELAY CHARACTERISTICS</b> |                 |      |                                |       |            |       |
| Arrangement                  | –               |      | SPST                           |       |            |       |
| Switched Power               | –               | –    | –                              | 480   | watts      | –     |
|                              | –               | –    | –                              | 4000  | VA         | –     |
| Relay Switching Voltage      | –               | 0.0  | –                              | 30.0  | VDC        | –     |
|                              | –               | 0.0  | –                              | 300.0 | VAC        | –     |
| Switched Device Current      | –               | 0.6  | –                              | 7.0   | A          | –     |
| Operate Time                 | –               | –    | 10.0                           | –     | mS         | –     |
| Release Time                 | –               | –    | 5.0                            | –     | mS         | –     |
| Life Expectancy              |                 |      |                                |       |            |       |
| Mechanical                   | –               |      | 1x10 <sup>7</sup>              |       | Operations | 2     |
| Electrical                   | –               |      | 1x10 <sup>5</sup> @ 10A, 277VA |       |            |       |
| Contact Dielectric Strength  | –               |      | 1000Vrms across contacts       |       |            |       |
| (at sea level for 1 minute)  | –               |      | 1750Vrms contact-to-coil       |       |            |       |
| <b>ENVIRONMENTAL</b>         |                 |      |                                |       |            |       |
| Operating Temperature Range  | –               | -40  | –                              | +70   | °C         | 2     |
| Storage Temperature Range    | –               | -45  | –                              | +70   | °C         | 2     |

### Notes

1. Typical values at 12V and 25°C; Max and Min values are over the full voltage and temperature range.
2. Characterized, but not tested.
3. For BER of 10<sup>-5</sup> at 1,200bps.

## RELAY FUNCTION MODULE FEATURES

1. Antenna
2. DC Power Connector (7 to 30VDC)
3. “Quick-Connect” Alternate DC Input
4. Switched Device Connectors
5. Address Selector DIP Switches



Figure 2: Relay Module Features

## THEORY OF OPERATION

The FCTN-RLY4-\*\*\*-2 module combines the popular Linx LR Series receiver with a decoder IC and four relays that are capable of switching a variety of AC or DC loads. The Relay Function Module is designed to receive a wireless signal transmitted from a compatible Linx RF module or pre-certified OEM transmitter. When transmitted data is received, the data is presented to the decoder. The decoder detects the logic states of the DIP switch address lines, and if they match the address settings of the encoder, the decoder's outputs are set to replicate the state of the encoder's data lines. Figure 3 shows the inside of the module. The four position DIP switch, S2, allows each relay to be set to latched (LAT) or momentary (MOM) operation.

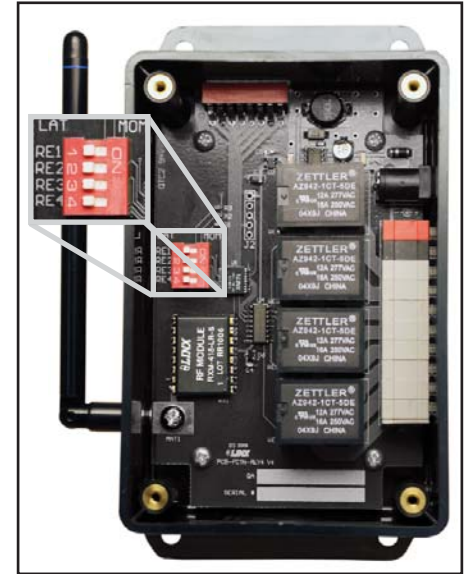


Figure 3: Latched / Momentary DIP Switch

## POWER SUPPLY CONSIDERATIONS

The module should be powered from a DC source that is free of noise and high ripple. The best results are normally obtained using a battery or high quality AC wall adapter capable of providing the supply currents indicated in the Electrical Specifications section. Two supply connection options are provided: black (ground) and red (+) quick-connect terminals or a barrel jack (for a 5.5mm shell, 2.1mm tip plug, tip +7 to 30VDC, shell ground). Only one connection should be used at a time and proper supply polarity should be observed.

## SETTING THE MODULE ADDRESS

The Relay Function Module provides a total of 256 unique addresses to avoid contention with other units or to create unique relationships. Address selection is made via eight externally accessible DIP switches as shown in the adjacent figure.

If the switch is on, the address line is connected to ground, otherwise it is floating. The transmitter's address must match exactly in order for the units to communicate. Application Note AN-00300 describes in detail how to set the address to match any of the Holtek-based transmitters offered by Linx. This application note can be found in the Support section of the Linx website, [www.linxtechnologies.com](http://www.linxtechnologies.com).



Figure 4: Address DIP Switches

RELAY LATCHING

The relays can be set to either latching or momentary operation. When latched, the relays close when an activation command is received and stay closed until a deactivation command is received. When momentary, the relays close for as long as an activation command is received. When the activation command ceases, the relays open. The four-position DIP switch, S2, sets the individual relays to either latching or momentary operation. The table to the right identifies the data line activations that affect relay operation.

| Data Line | Relay Operation |
|-----------|-----------------|
| D0        | Relay 4 ON      |
| D1        | Relay 4 OFF     |
| D2        | Relay 3 ON      |
| D3        | Relay 3 OFF     |
| D4        | Relay 2 ON      |
| D5        | Relay 2 OFF     |
| D6        | Relay 1 ON      |
| D7        | Relay 1 OFF     |

SWITCHED DEVICE ATTACHMENT

The Relay Function Module features heavy-duty quick-connect block terminals for attaching the devices to be switched. To use the terminals, press and hold the button over the entry channel to release the contact. Insert the wire and then release the button to allow the internal contact to clamp down on the wire.

The terminals accept wire gages from 16 to 26 AWG. Funnel-shaped entry channels help prevent fraying when using untinned wire. The terminal block is arranged as shown in the figure below. There is no polarity on the relay terminals and they may be used in any order (or left unterminated) without internal damage. Do not attempt to switch loads in excess of the limits listed in the Electrical Specifications section. The module does not provide internal protection for shorted loads. Therefore, the designer must provide external protection, such as fusing, if the possibility of shorting exists.

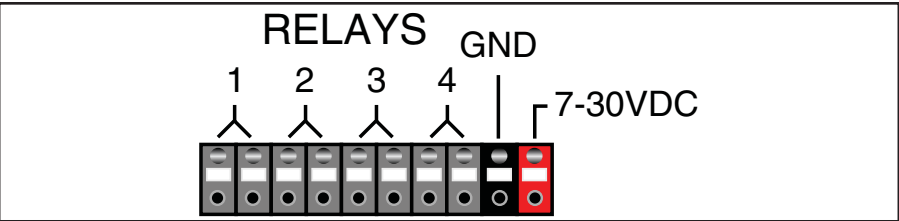


Figure 5: Relay Connection Block

INTERFERENCE CONSIDERATIONS

It is important to remember that the range performance of the modules is heavily dependent on the environment in which they are operated. The effects of interference, multipath, and physical attenuation will vary significantly from location to location.

The Relay Function Module is based on the Linx LR Series RF receiver. These are simple low-cost receivers intended for short-range transmissions. They utilize OOK AM-based modulation. AM devices can be affected by external noise, such as that from motors or other sources of broadband RF emissions. Interference can also come from sources such as paging towers or amateur radio activity. The designer should carefully test the Relay Function Module in the environment in which it will be used to ensure that its performance is appropriate for the chosen application.

ANTENNA ORIENTATION

Since the control signals for the Relay Function Module are sent through the air, the physical orientation of the transmitter and receiver plays a critical role in determining the overall range of the system. The antenna may be tilted and swiveled to adjust for maximum range in your environment. In most cases, orienting the antenna in a vertical position will result in optimum system performance and the greatest range.

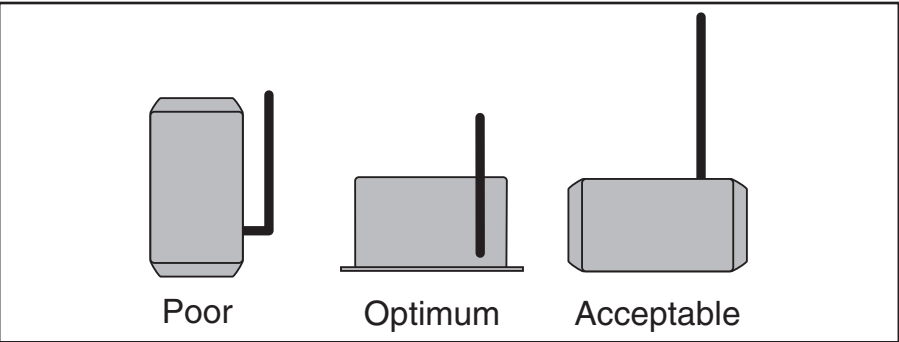


Figure 6: FCTN-RLY4-\*\*\*-2 Antenna Orientation

The placement of the module in the final product will also affect the range and performance of the system. If the module is to be placed inside an enclosure, then the enclosure must be plastic or another non-conductive material. Otherwise, a hole must be cut into the enclosure to allow the antenna to stick out as the metal or conductive enclosure will shield the module and it will not be able to receive a valid transmission. In this case, the antenna should stick straight out of the enclosure and should not be bent to rest parallel to the metal. This will detune the antenna and significantly reduce its performance.

The module should be placed in a position to have the widest line-of-sight field so that the range may be maximized. Typically, the module will be placed on top of the product to accommodate this, especially when used with machinery. Remote location of the module’s antenna is not possible as it will invalidate the FCC testing, so the positioning of the module and its antenna is an important consideration in the design of the system.

CONTENTION CONSIDERATIONS

An unlimited number of Relay Function Modules may be operated in proximity without interference, but 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, the signals will interfere with each other, so the Relay Module will not see a valid transmission and will not take any action.

## LABELING REQUIREMENTS

In cases where the FCTN-RLY4-\*\*\*-2 module is incorporated inside a product and its standard labeling is not visible, the end product must be labeled as shown below.

- The following label shall be affixed in a conspicuous location to any device self-certified under the FCC's Declaration of Conformity process:



- When the device is constructed in two or more sections connected by wires and marketed together, the label is required to be affixed only to the main control unit.
- The label shall not be a stick-on paper label. The label shall be “permanently affixed” to the device (meaning the label is etched, engraved, stamped, silk-screened, indelibly printed on a permanently attached part of the device, or on a nameplate fastened to the equipment by welding, riveting, or a permanent adhesive). The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and may not be readily detachable.

## COMPLIANCE REQUIREMENTS

The FCTN-RLY4-\*\*\*-2 has been tested by an FCC-approved facility and been found to comply with all applicable FCC and Industry Canada requirements as of the date of this document. A Declaration of Conformity (DoC) is on file. It is the user's responsibility to consult the FCC or other testing body to determine if any additional testing may be required on the user's completed product. In products where no additional testing is required, further labeling of the unit is not needed unless the module will be placed inside another housing. It is, however, necessary to include the following statement in the end product's instruction manual or insert card.

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.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. 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.

*Place the above statement in the instruction manual or insert card.*

## TRANSMITTERS

The Relay Function Module incorporates a Linx LR Series receiver paired with a Holtek-based decoder IC. This means that there are several options available for controlling the module.

The first option is to use one of the pre-certified OEM transmitters offered by Linx. These transmitters come in several packages and can be customized to bear the logo or other artwork required by the customer. The only setup required by the customer is to set the address of the transmitter and the Relay Module.

There are four OEM transmitters that can be used with the Relay Function Module: the Full Size Handheld, the Compact Handheld, the Long-Range Handheld, and the Keyfob. The Full Size Handheld uses the same eight address lines used by the Relay Function Module, so they only need to be set the same for proper function.

The other three transmitters use all ten address lines offered by the Holtek ICs while the Relay Function Module uses eight. This means that the last two address lines on the transmitters (A8 and A9) must be left floating (turn off the DIP switches on the handhelds, cut traces 8 and 9 on the Keyfob). The other address lines can be set to whatever the user desires, as long as the transmitter and the Relay Function Module match.

A custom transmitter can also be created with a KH2 Series transmitter or an LC or LR Series transmitter paired with a Holtek HT640 encoder or microprocessor. Because the Holtek ICs have 10 address lines, the last two lines (A8 and A9) must be left open. The Holtek address lines are tri-state, meaning that they have three valid input conditions: high, low, or floating. The Relay Function Module uses only the low and floating states, so the custom transmitter can only use these states as well. The lines that are floating should be left open and have no electrical connection.

It should be noted that the Keyfob transmitter does not allow full functionality of the Relay Function Module. Each of the four relays in the module uses two data lines for a total of eight. The Keyfob transmitter offers a maximum of five buttons, so at most, it can control two relays in latched operation and three in momentary operation.

Application Note AN-00300 describes in detail how to set the Relay Function Module address to match any of the Holtek-based transmitters offered by Linx. This note can be found in the Support section of the Linx web site, [www.linxtechnologies.com](http://www.linxtechnologies.com).



Figure 7: Pre-Certified Transmitters

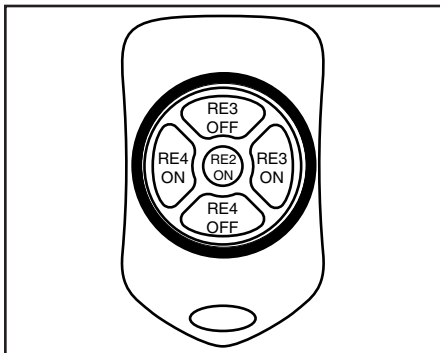


Figure 8: Keyfob Button / Relay Relationships

## ONLINE RESOURCES



[www.linxtechnologies.com](http://www.linxtechnologies.com)

- Latest News
- Data Guides
- Application Notes
- Knowledgebase
- Software Updates



If you have questions regarding any Linx product and have Internet access, make [www.linxtechnologies.com](http://www.linxtechnologies.com) your first stop. Our website is organized in an intuitive format to immediately give you the answers you need. Day or night, the Linx website gives you instant access to the latest information regarding the products and services of Linx. It's all here: manual and software updates, application notes, a comprehensive knowledgebase, FCC information, and much more. Be sure to visit often!



[www.antennafactor.com](http://www.antennafactor.com)

The Antenna Factor division of Linx offers a diverse array of antenna styles, many of which are optimized for use with our RF modules. From innovative embeddable antennas to low-cost whips, domes to Yagis, and even GPS, Antenna Factor likely has an antenna for you, or can design one to meet your requirements.



[www.connectorcity.com](http://www.connectorcity.com)

Through its Connector City division, Linx offers a wide selection of high-quality RF connectors, including FCC-compliant types such as RP-SMAs that are an ideal match for our modules and antennas. Connector City focuses on high-volume OEM requirements, which allows standard and custom RF connectors to be offered at a remarkably low cost.







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