LR900 Node™

Wireless Long Range Remote Controller

Hardware Manual

Genave / NRC, Inc.

> ⚠️ **<u>Warning</u>** ⚠️
>
> **If incorrectly used, this equipment can cause severe injury. Those who use and maintain the equipment should be trained in its proper use, warned of its dangers, and should read the manuals before attempting to set up, operate, adjust or service the equipment. Keep this manual for future reference.**

Important Safety Information

<u>Installation & Service Precautions</u>

• Electrocution, severe personal injury and damage to equipment can occur during installation or servicing this equipment. All electrical work should be performed by, or under the supervision of an experienced electrician and in accordance with all applicable electrical, fire, building and safety codes.

•This equipment can start at any time from local controls, automatic timers, radio remote, commands from a computer and many other sources. Attached equipment can cause personal injury when they engage. Whenever working in or around the equipment you must assume it could activate at any moment, and take appropriate precautions to protect yourself and others. You should completely disable the equipment before working on or in close proximity to any part of it.

•You must test the system and equipment to insure it is operating correctly after the installation, as well as after any work has been performed.

<u>System Operation</u>

•Training is necessary to ensure those responsible can correctly control the system. It is also necessary that everyone understand the purpose of the equipment and the protective actions they need to take when the system is activated.

•You must carefully read and completely understand all the information about the system including its abilities and its limitations.

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LR900 Node™ Hardware

Phone 952-236-6540

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2) Critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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LR900 Node

Table of Contents

Specifications
General Specifications

Enclosure
Width:	36mm (1.417 inches)
Length:	100mm (3.937 inches)
Height:	80mm (3.149 inches)
Weight:	114.6 grams (5.10oz)

Input Connector
Header:	9 pos., 2.5mm
Mating Connector:	9 pos. cage clamp
	28-16 AWG
	0.25" Strip length
	P/N 6000-0101-124
Max Input Voltage:	$30V_{DC}$ (Pull to GND for active)

Output Connector
Header:	9 pos., 3.5mm
Mating Connector:	9 pos. screw clamp
	26-16 AWG
	0.25" Strip length
	P/N 6000-0049-009
Max Control Voltage:	30 V_{DC}
Max Control Current:	70mA

Power Connector
Header:	2 pos., 3.81mm
Mating Connector:	2 pos. screw clamp
	26-16 AWG
	0.25" Strip length
	P/N 6000-0048-003
Input Voltage:	7.5 to 28 V_{DC}

Antenna Connector (if equipped)
Connector:	50 Ohm
	Reverse Polarity SMA
	(RPSMA)

External Antenna (if equipped)
Antenna:	Dipole
	Reverse Polarity SMA
	(RPSMA)
	½ Wave
	50 Ohm
	3dBi Gain
	P/N 8035-0000-008

Internal Antenna (if equipped)
Antenna:	Whip
	u.fl
	¼ Wave
	50 Ohm

Radio Transceiver Module
ISM:	902-928MHz
Max Power:	250mW

Battery
General:	LiFePO4
	3.2V
	400mAH
	UN38.8 Passed
	<20Wh Single Cell
Shippable under:	UN3481 PI967 Section 2

Display
Type:	OLED
Size:	128 x 64
Colors:	Blue & Yellow

MicroSD Card Slot
Accepts:	Transflash MicroSD
	SDHC, Class 10, FAT32,
	4GB to 32GB

Transmit / Receive Distance*
Included Antennas:	Up to 1000' Indoor/Urban
	Up to 2 Miles Outdoor*
Optional Antennas:	Up to 2000' Indoor/Urban
	Up to 6 Miles Outdoor*
	*Line of Sight (LOS)
	unobstructed

*The range of all radio products is not guaranteed and is dependent on local and environmental conditions, structures, antenna selection and location.
Additional LR900 modules may be used as repeaters to enhance coverage and extend range.
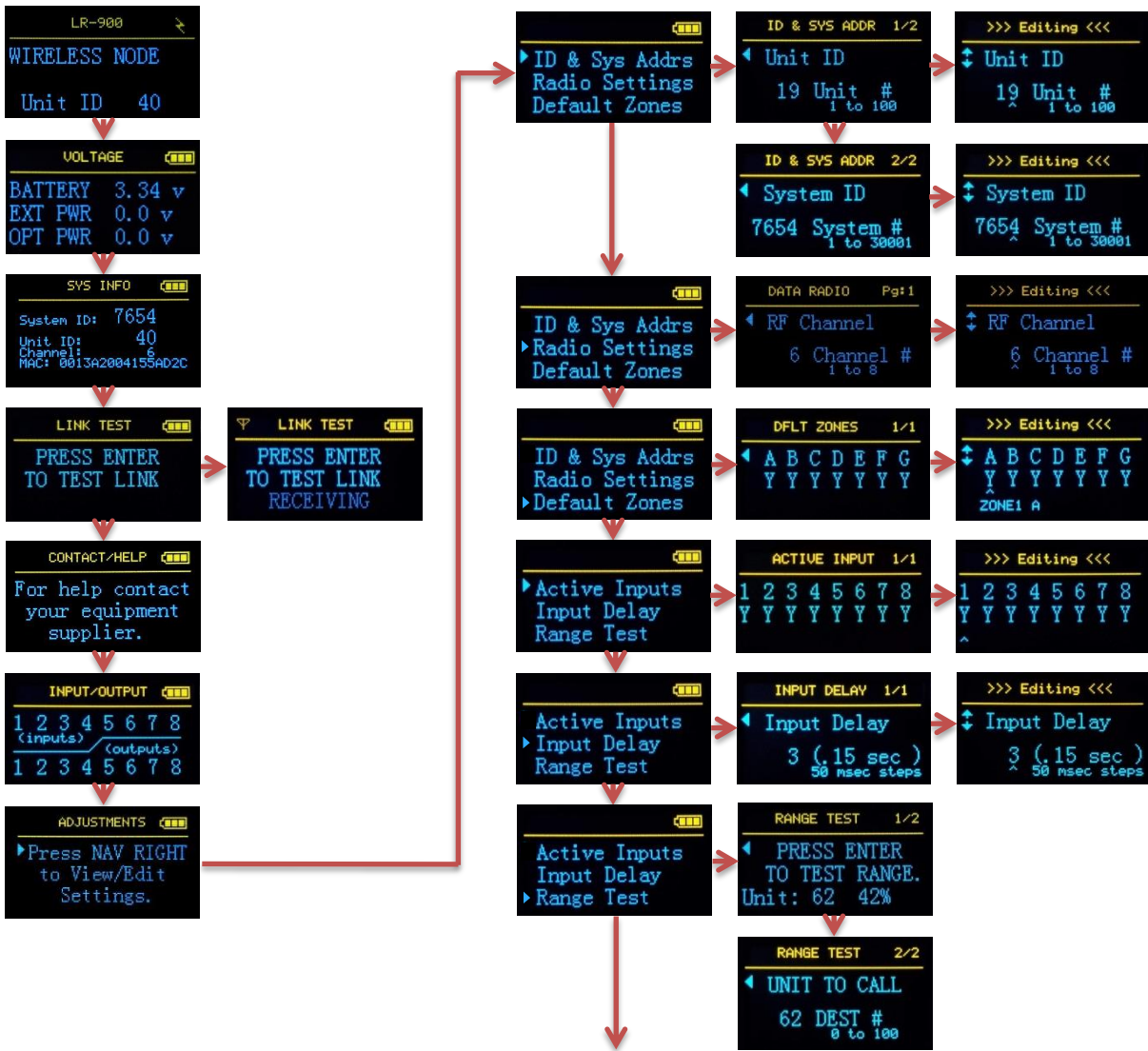
Overview
How it Works

The LR900 Node is a stand-alone transceiver/controller that utilizes FHSS (Frequency Hopping Spread Spectrum) to communicate and synchronize actions with other LR900 nodes or LR900 Keypads.

Keypads are normally the origination point for commands. When a button is pressed on the LR900 wireless keypad, a signal is transmitted to all Nodes within range. Any LR900 Node which hears this signal does two things; First it activates its own corresponding output and then it retransmits the signal to reach additional LR900 Nodes who may not have heard the original signal. If an LR900 has already heard the signal, it ignores all future receipts of that particular signal to keep the signal from repeating forever.

Each node has 8 inputs and 8 outputs. If one of the inputs is activated (shorted to common), The LR900 activates the corresponding output for 2 seconds (Ex: Input 1 activates Output 1). Optionally, the LR900 can transmit to all of the other LR900 Nodes that its input has been activated (See Advanced Info).

Communications between LR900s is performed peer-peer. By using this method it's unnecessary to have a master controller and LR900's can be installed, relocated or removed without needing to register them into or out of a system.
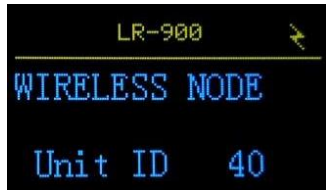
Menu Map


(See next page for more menus)

```
ADJUSTMENTS  [===]
▶Press NAV RIGHT
  to View/Edit
   Settings.
```

```
              [===]
▶Roll Call
 RF Beacon
 Menu Lock
```

```
ROLL CALL    1/1
◀ PRESS ENTER
  TO START RCALL
```

```
ROLL CALL    1/1
  WAITING *
```

```
ROLL CALL    1/1
UID:062 RF:33%
```

```
              [===]
 Roll Call
▶RF Beacon
 Menu Lock
```

```
ALIVE BEACON 1/2
◀ Ext. Pwr Rpt.
  60 Minutes
        0 to 9999
```

```
>>> Editing <<<
⬍ Ext. Pwr Rpt.
  60 Minutes
   ^    0 to 9999
```

```
ALIVE BEACON 2/2
◀ Network Rpt.
  60 Minutes
        0 to 9999
```

```
>>> Editing <<<
⬍ Network Rpt.
  60 Minutes
   ^    0 to 9999
```

```
              [===]
 Roll Call
 RF Beacon
▶Menu Lock
```

```
MENU LOCK    1/1
◀ Edit Password.
 00000 Password
   (00000 to disable)
```

```
>>> Editing <<<
⬍ Edit Password.
 00000 Password
       ^
```

```
              [===]
▶Encryption
 Install PGM
 Copy PGM To SD
```

```
ENCRYPTION   1/1
◀ Encrypt Key
 00000 Key
```

```
>>> Editing <<<
⬍ Encrypt Key
 00000 Key
       ^
```

```
              [===]
 Encryption
▶Install PGM
 Copy PGM To SD
```

```
SD-> PGM UNIT 1/1
◀ INST. NEW PGM
 Code 531 to begin.
   0 <- CODE
```

```
>>> Editing <<<
⬍ INST. NEW PGM
 Code 531 to begin.
   0 <- CODE
     ^
```

```
              [===]
 Encryption
 Install PGM
▶Copy PGM To SD
```

```
COPY PGM-> SD 1/1
◀ PRESS ENTER
 to Send Pgm out
   to SD Card.
```

```
COPY PGM-> SD 1/1
 PGM -> -> SD
 W O R K I N G
 * * * * * * * *
```

```
COPY PGM-> SD 1/1
   FINISHED
```

```
              [===]
▶Restart Unit
 Pgm Name / SD
 Firmware Info
```

```
RESTART UNIT 1/1
◀ PRESS ENTER
 KEY TO RESTART
   THE UNIT.
```

```
              [===]
 Restart Unit
▶Pgm Name / SD
 Firmware Info
```

```
NAME/VIEW SD 1/2
Program Name:
LR900-PGM.900
```

```
NAME/VIEW SD 2/2
◀ PRESS ENTER TO
 VIEW FILES ON
 SD MEMORY CARD
```

```
              [===]
 Restart Unit
 Pgm Name / SD
▶Firmware Info
```

```
FIRMWARE     1/1
◀
GenOS LR900-NA
 7.1807.1101
 (c) 2018 Genave/NRC
```

```
              [===]
▶Factory Reset
 NAV LEFT -Exit
```

```
FACTORY DFLTS 1/1
◀ FACTORY RESET
 Code 987 to reset.
   0 <- CODE
```

Screens and What They Mean

1) LR900 (Opening Screen)
    a. Displays the Unit ID.
    b. When the battery is being charged, a lightning symbol replaces the battery symbol.
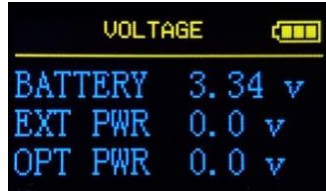
2) Voltage Status
    a. Internal battery voltage.
    b. External voltage supplying the node.
    c. Optional voltage input (unused in this model).
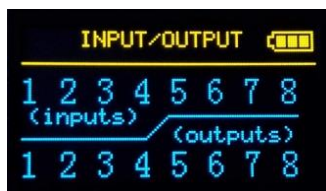
3) System Info Reference
    a. System ID of the group.
    b. Unit ID.
   c. Radio channel.
    d. MAC address for the radio networking.

4) Link Test (Testing with other LR900s)
    a. Pressing the enter button sends a request to all units asking them to respond. The word "RECEIVING" and the antenna icon will flash when responses from other LR900's are received.
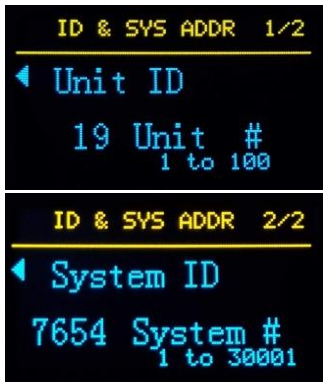
5) Contact Information

6) Input & Output
    a. Status of the eight inputs and outputs.
    b. Number is highlighted when the associated input or output is active.
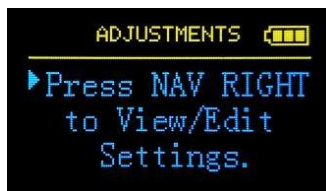
7) Adjustments
    a.   Leads to sub-menus to view and change the LR900 operational settings.
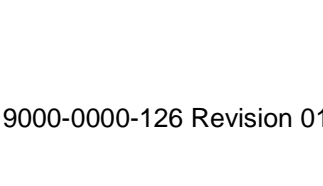
8) ID & Sys Addrs
   a. Unit ID (screen 1): 1 to 999. Unique ID for each node.

   b. System ID (screen 2): 1 to 30001. All nodes in a group must have the same System ID.

9) Radio Settings
   a. Adjust the radio channel from 1 to 8.

10) Default Zones – Advanced feature.
   a. Zones are identified by the letters A to G.
   b. Receiving. The receiving units can be switched in and out of zones with the LR900 menu. When an LR900 receives a signal that is intended for only specific zones, it checks which Active Zones it has been set to accept. The signal is acted upon if the zone has been enabled (set to 'Y'), or ignored if the specific zone is disabled (set to 'N').
   c. Transmitting. Node inputs can be set to send commands to one or more particular zones (sub-groups) rather than the standard all-call to all the nodes. Due to the extensive configurability of this feature, the transmitting zone groups cannot be adjusted using the LR900 menu. The sending node must be programmed externally, by either directly editing the configuration on the SD card and re-loading, or by using the LR900 editing program.

11) Active Inputs
   a. Individual external inputs can be enabled or disabled using this menu. "Y" indicates that the input is enabled.

12) Input Delay
   a. Adjusts the input debounce for all the external inputs. Step size is 50ms.
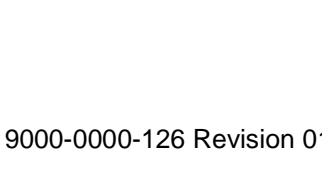
13) Range Test
   a. (pg. 1) Pressing "Enter" will send a transmission to the unit identified in screen 2. When the remote LR900 replies, the word "RECEIVING" and the antenna icon will flash on the screen.
   b. (screen 2) Enter the Unit ID of the remote unit to contact during the range test.
   c. Note on range test. Due to the self-repairing nature of the LR900 radio network, the range test signals may pass through other nodes to reach the intended destinations.

14) Roll Call
   a. Pressing the "Enter" button sends a signal to all units asking them to respond. Each response will appear on the screen with its Unit ID and the strength of the signal when it was received at the remote.

15) RF Beacon
   a. (screen 1) RF beacon interval the LR900 transmits it's status when on external power.

   b. (screen 2) RF beacon interval the LR900 transmits it's status on the network port.

16) Menu Lock
   a. A five digit alpha-numeric code to limit access to the adjustment menus. Note the password for future reference.

17) Encryption
   a. A five digit alpha-numeric, security key used to encrypt the radio communications.
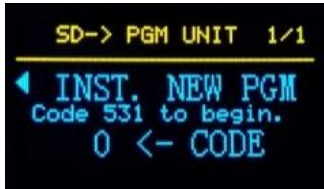
18) Install Program
    a. Programs the LR900 from the configuration file on the micro SD card.
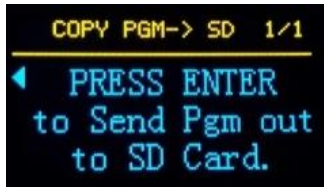
19) Copy PGM to SD
    a. Copies the LR900 configuration settings to the micro SD card.

20) Restart Unit
    a. Reboots the LR900.

21) Pgm Name / SD
    a. (screen 1) Shows the program name that was last uploaded to the LR900.

   b. (screen 2) Scrolls and shows the filenames on the micro SD memory card.

22) Firmware Info
    a. Shows the firmware information of the LR900.

23) Factory Reset
    a. Restores all the settings and configurations back to the original factory settings. As a safety to prevent unintended resets, the code 987 must be entered via the keypad before the Factory Reset is performed.

Installing
Mounting the LR900
To remove the node from a Din rail, use a screw driver to pull and hold down on the red latch on the enclosure while pulling the bottom of the case forward.
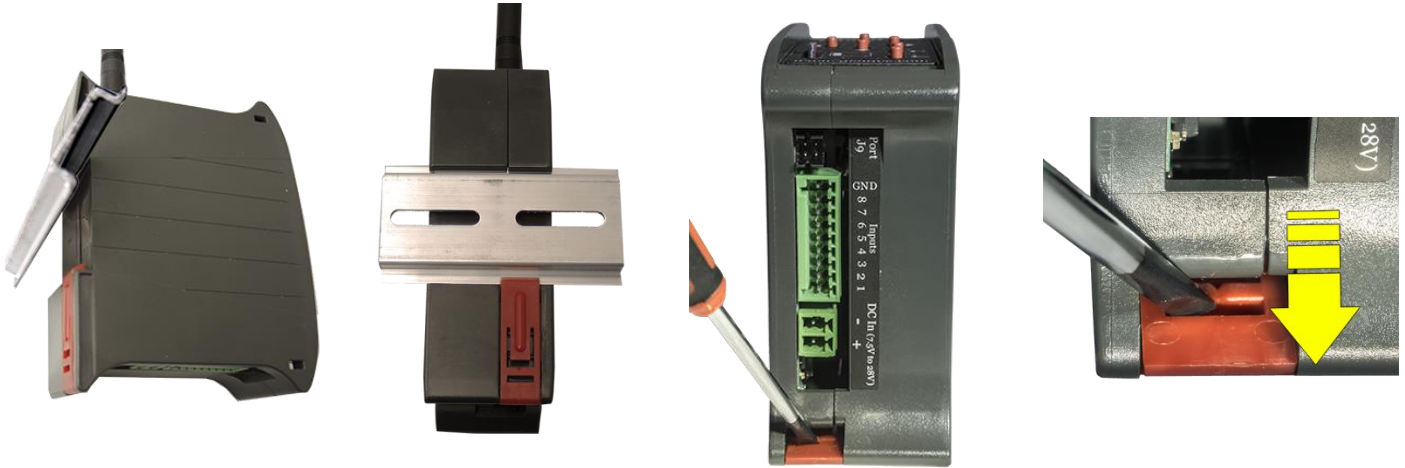
Power Connection
The LR900 operates from 7.5VDC to 28 VDC. The power input is also reverse voltage protected. The polarity of the connections is displayed on the label.

Internal Battery Backup
The LR900 devices include a high capacity, rechargeable battery so the unit remains operational during temporary power interruption. Battery life is affected by traffic load and other system variables, but the battery power will generally last 4 – 6 hours. **When power is first applied, the LR900 must charge the battery to a minimum voltage before coming alive. If you observe the screen blinking on and off, it is due to the battery being charged. Turn the Power switch off and wait 2 to 3 minutes before reapplying power.**

Power Switch On/Off
The power switch is used to disable the LR900 when testing, modifying, or shipping the system. Even when the switch is Off, the LR900 will continue to charge the internal battery. The power switch is recessed to prevent accidental operation.

Power Switch

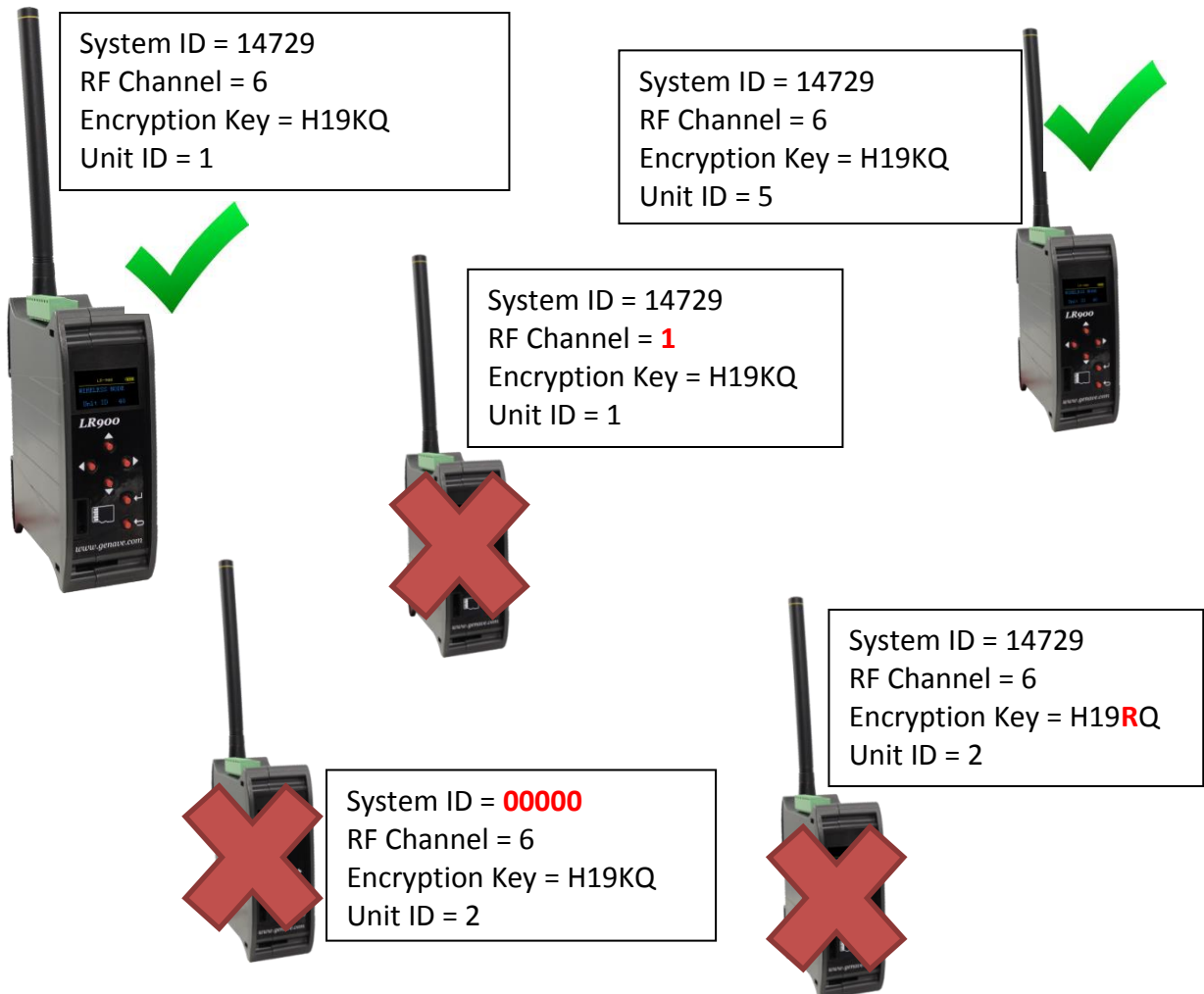## *Pairing the First Units with a Keypad*

Three unique settings must match between LR900 units before they will communicate and retransmit signals from a keypad or other LR900 that have the identical settings.

- **System ID:**   A number from 1 to 30001.
- **RF Channel:** Specify radio channel 1 to 8.
- **Encryption Key:** Alpha-numeric code from five to sixteen digits. (0-9, A-Z, a-z, with the exception of the letters I, i, O, o, L, l which are too easily confused with other letters).

The system ID and RF channel can be viewed and changed using the menu screen.

The Encryption Key can be changed using the menu screen, but for security purposes it cannot be viewed on the screen nor copied to the SD card. Thus, **it's very important to record any new encryption keys for future changes.**

Unit ID numbers are employed for some advanced features as well as quickly identifying unit locations by simply viewing the main screen. They should be unique, but it is not required.

System ID = 14729
RF Channel = 6
Encryption Key = H19KQ
Unit ID = 1

System ID = 14729
RF Channel = 6
Encryption Key = H19KQ
Unit ID = 5

System ID = 14729
RF Channel = **1**
Encryption Key = H19KQ
Unit ID = 1

System ID = 14729
RF Channel = 6
Encryption Key = H19**RQ**
Unit ID = 2

System ID = **00000**
RF Channel = 6
Encryption Key = H19KQ
Unit ID = 2

Antenna Requirements
There are a few items to remember about the antenna.
1) Keep the antenna away from metal surfaces for the best RF signal range.
2) For long antenna cable runs, use LMR-400 coaxial cable with adapters.
3) Never exceed 11dbi of antenna gain without some sort of cable loss (FCC requirement).

Note: If an LR900 is out of range of its group, any LR900 can be used as a repeater to extend the range of the signals and reach the lone LR900.

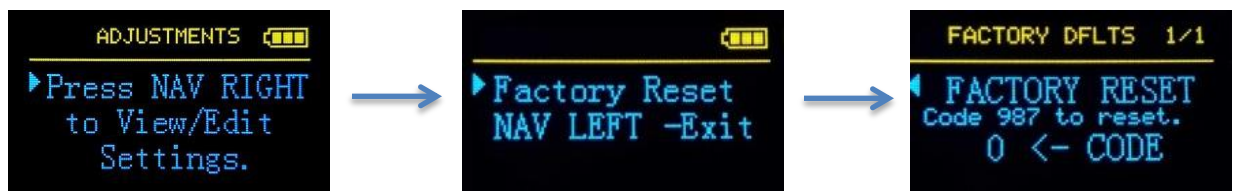### Returning to Factory Defaults Using Menu Screen
The LR900's can be restored to their factory default programming at any time by using the menu screen. Returning to the factory default is the recommend method to recover from programming errors or other events such as when a unit is not communicating within the group.

After defaults have been restored, basic communications can be verified and custom changes can continue from that basic, known state.

| System ID = 7654 |
| --- |
| RF Channel = 6 |
| Encryption Key = 13579 |
| Unit ID = 1 |

The Factory Defaults

To restore the defaults, Press the **DOWN** arrow until the **Adjustments** screen appears, then press the **RIGHT** arrow once and then press the **DOWN** arrow to select **Reset Memory**. Press **ENTER** key and use the **LEFT, RIGHT, UP** and **DOWN** keys to enter 987. Press **ENTER** key to restore LR900 to factory default settings.

Returning to Factory Defaults Using Buttons

Another method to restore the default settings is to use the arrow buttons. Press and hold the **BACK** button and the **UP** button at the same time while applying power to the unit. Release the buttons once the unit indicates that it's working on restoring the defaults.

Press and hold simultaneously as power is applied.
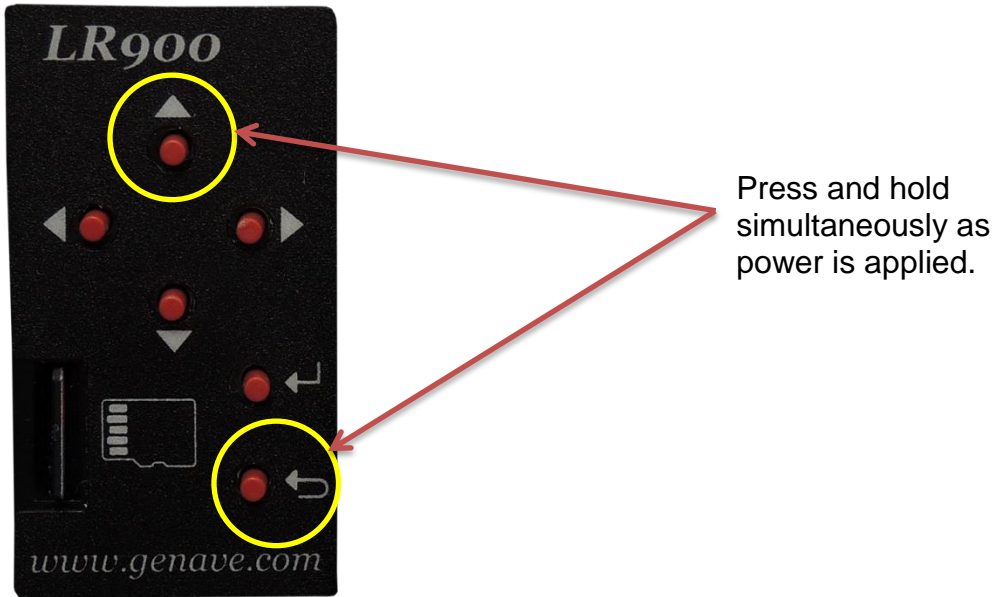
Adding More Units to a System / Cloning Units

In most instances, the LR900's will operate as required using the factory defaults with a new encryption code as the only recommended change. Adding another Node to the system is as simple as matching the unit's **System ID, RF Channel, Encryption Key** to the existing system nodes and assigning the new Node a unique **Unit ID**.

In applications where many changes have been made to the LR900's operation, it's easy to clone a new LR900 by using a Transflash memory card to transfer the configuration from the operating unit to the fresh LR900.

- Insert a fresh SD memory card into the operating unit (source unit).
- Menu View/Edit Settings->Clone to SD.
- Remove SD card after the configuration has finished and plug into the fresh LR900 (destination unit).
- Menu View/Edit Settings->Load New Pgm.
- Restart the destination unit and manually change the Encryption Key and give it a unique ID number.

Inputs
Input Header Characteristics
The inputs for the LR900 are used to trigger actions and transmissions. When an input is pulled low (shorted to pin 9 of J9) the LR900 turns on the associated output for 2 seconds (Input 1 turns on Output 1).

Some features of the inputs:
1) DO NOT apply any voltage to the inputs. Only connect an input to pin 9 of J1. Although the inputs have diodes to protect them from incoming voltages, they should only be pulled low.
2) The inputs are protected from moderate voltage spike. Large voltage spikes will overwhelm the input protection and damage the processor. Therefore keep wires leading to the inputs as short as possible and twist the wires to reduce voltage spikes.
3) Node Inputs are normally not transmitted to other Nodes (See Advanced Information).
4) If an input is retriggered within 2 seconds, the associated output will not be turned off.
5) Each input has a pull up resistor of 470 Ohms.

Input Header Pinout
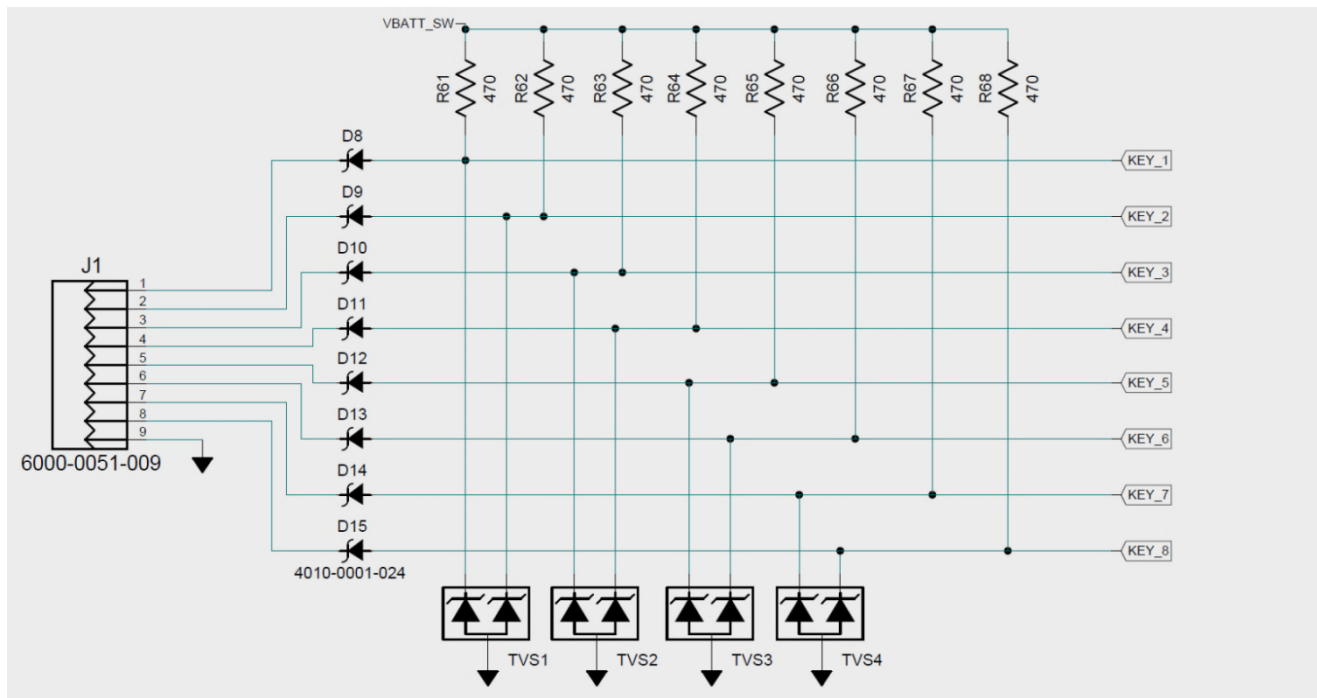
Outputs
Output Characteristics

The LR900 has 8 individual output Mosfet transistors. Each of the transistors pulls its output to common ground (Pin 9 of J2) when activated.

Some features of the outputs:
1) Never apply more than 30 Volts DC to an output
2) Never control more than 70 milliamps of current through an output.
3) Each output is on for 2 seconds with each triggering of an input.
4) The transistor resistance when On, it is typically 7 Ohms.

Output Header Pinout
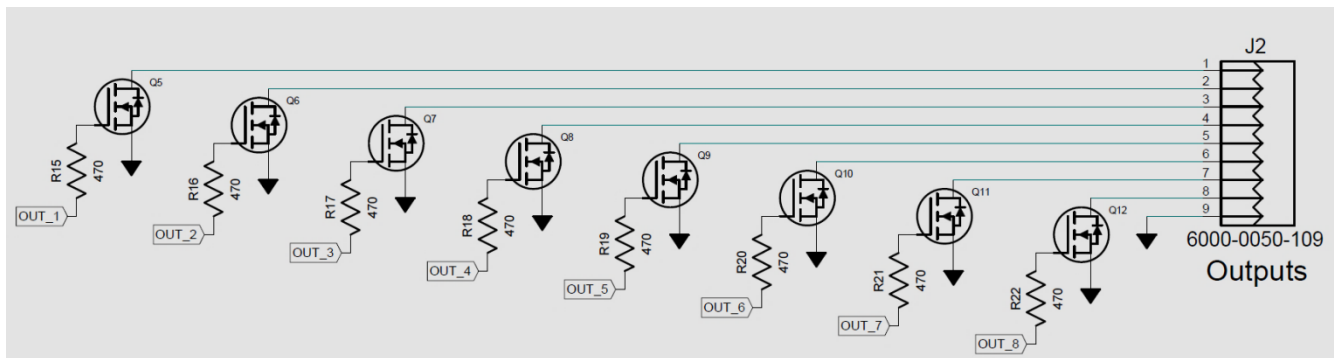
Radio
Radio Module

The LR900 internal radio has the following features:
1) Maximum power output is 250 milliWatts
2) 50 Hop/channel FHSS transmission
3) 902MHz to 928MHz frequency range (ISM Band)
4) RPSMA output connector
5) 128 Bit AES Encryption

Changing Channel
The LR900 uses a group of 50 frequencies within 902 MHz to 928MHz. When you change the channel, you are only changing WHICH of the 50 frequencies are used and in which order they are hopped. From the **ADJUSTMENTS** menu, select **Radio Settings.** Press the **ENTER** button and then use the **DOWN** and **UP** buttons to change the channel. Press the **ENTER** button to make the change.

Testing Signal Strength Between Units
There are three methods to test if there is sufficient signal strength between units.

1) Link Test (All Nodes)

   Go to the **LINK TEST** screen and press Enter. If there is another Node within range of the unit, the word *RECEIVING* will flash on the bottom of the display each time the LR900 transmits.

   Note: The LR900 does not display which Node has responded, nor the signal strength, only that another Node can hear it.

2) Range Test (Specific Node)

   Go to the **RANGE TEST** screen within the **ADJUSTMENTS** menu. With each press of the Enter button, the LR900 will send a request to a single node in the system. If the Node show on the screen receives the signal, it responds with the strength of the signal IT received. The results are displayed on the screen as a percentage (ie. 100% is good, 40% marginal). Perform the test 10 times and average the results. Individual results vary depending on local interference.

   To change which Node will receive the request, press the **DOWN** button when in the **RANGE TEST** screen. The screen will change to **"Editing"**. Use the keypad buttons to change the destination address to the new desired Node number and then press the **ENTER** button to make the change.

Advanced Features and Information
Zones
LR900 units can be sub-grouped to only accept a command if they are within this subgroup. All other nodes will repeat the signal, but they will ignore the command because they are not in the subgroup.
(This feature requires the use of the LR900 computer program)

Roll Call
Roll Call is used to find other Nodes on the system with the same System ID, Channel number and Encryption Code. Press the ENTER button to begin a Roll Call. The first units to respond within 10 seconds are displayed on the screen. The information displayed for each Node is the Unit ID followed by the signal strength for that unit.

RF Beacon
RF beaconing is used in systems with Master Internet Nodes. When selected, a Node will transmit at a selected interval that it is alive, its battery voltage, external power voltage, input and output status.

Firmware
The FIRMWARE screen displays the firmware level loaded in the device. Firmware cannot be modified or upgraded by the customer.

Active Inputs
Inputs can be disabled during testing. When disabled, an input is completely ignored by the LR900.

MAC
The MAC address is displayed in the SYS INFO screen. This number is the MAC address assigned to the radio and is used only in systems with Master Internet Nodes. The number cannot be changed.