

# HOLATRON

## OPERATION & MAINTENANCE GUIDE - InstantFire-12 Random-fire UHF Transmitter



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## **WARNING**

Holatron Systems specializes in the design and manufacture of standard and custom electronic control systems where reliability and error free data communication are critical. The transmitter described in this manual is part of a system intended to remotely actuate pyrotechnic or other hazardous devices, and the components of this system have been carefully designed to minimize the possibility of accidental actuation of such devices. Holatron's design goal is to ensure that data communication errors due to radio interference or to insufficient signal strength due to low battery, exceeding specified range, or conductive objects in the signal path will result in failure of intentional actuation rather than unintended actuation. Techniques used to achieve this design goal are described in section 1.9. Though the probability of unintended actuation is extremely small, it cannot be guaranteed to be zero. It is also possible for an unexpected actuation to occur if another Holatron transmitter set to the same digital channel is operated in the vicinity. Therefore, **it is important that the user not enable the receiver until all persons who might be harmed by accidental actuation are in a safe area.**

As a condition of purchase, the user must acknowledge awareness and agreement that utilization of this product and participation in activities utilizing fireworks, rockets, and explosives is an ultra-hazardous activity carrying implied and explicit risks of injuries and damages to the user and to other participants. The user assumes the risk connected with the utilization of this product and all risks of participation in the activities for which this product is sold. User acknowledges that he/she/it has the necessary and required skill, expertise, training and licensing, as may be applicable or necessary by custom, usage, trade or law, to engage and participate in the ultra-hazardous activities connected with the use, purchase, transportation, or employment of the products sold under this agreement. User acknowledges that Holatron Systems, LLC, has not and will not conduct any investigation into the skill, expertise, training and licensing, as may be applicable or necessary by custom, usage, trade or law, of the user or of user's agents, employees and assigns, to engage and participate in the ultra-hazardous activities connected with the use, purchase, transportation, or employment of this product. User specifically agrees that Holatron Systems, LLC, its officers, employees, and agents shall not be liable for any claim, demand, cause of action of any kind whatsoever for, or on account of death, personal injury, property damage or loss of any kind resulting from or related to user's or user's employees', agents' or assigns' use of this product, and user agrees to indemnify, defend in any action at law, and hold harmless Holatron Systems, LLC, from same, whether brought by the user, user's agent, or assigns, or any third party.

Usage of this transmitter is authorized under FCC Rules and Regulations as listed in CFR 47 Ch.1 (10-1-96 Edition), part 15, subpart C, sections 15.209 and 15.231. This equipment has been tested and assigned **FCC ID number: OI4RFLS1XT.**

**Any changes or modifications to the hardware not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

This manual is divided into four sections. The first is a description of the system hardware. The second describes radio interference suppression methods. The third lists transmitter specifications. The fourth covers the recommended operating and maintenance procedure.

## **1.0 HARDWARE DESCRIPTION.**

The model RFLS-12XT Fixed Channel High Speed UHF Transmitter is a low power hand-held remote control transmitter which can transmit commands over any of six different digital channels. Each transmitter's channel setting is fixed in software at time of manufacture and cannot be changed. A label displaying the channel setting is affixed to the top of the transmitter next to the antenna. Transmitters fixed to separate digital channel numbers can transmit simultaneously without interfering with each other. This permits up to six different receivers or groups of receivers to be controlled by separate transmitters simultaneously. The transmitter will only actuate receivers whose digital channel switches are set to select the same channel as the transmitter. Thus, multiple transmitters may be used to actuate different selected receivers even though all operate on the same frequency. Transmitters fixed to the same digital channel number should not be used simultaneously, as they will interfere with each other and result in failure-to-fire.

When used with RFLS-96HSRC, RFLS-96HSARC, RFLS-496HSRC, RFLS-496HSARC, RFLS-912HSRC, or RFLS-912HSARC receivers, a range of ½ mile can be achieved. All inscriptions on the transmitter panel are luminescent to facilitate use of the transmitter in a dark environment. The panel will continue to glow for two to three hours after being exposed to a bright light source. The transmitter's commands are digitally encoded and amplitude modulated on a single carrier frequency of 418 MHz (or optionally 433.96 MHz). This frequency is controlled by a SAW (surface acoustic wave) device for exceptional stability. No alignment or tuning procedures are ever required to maintain optimum performance. The modulated RF output occurs continuously while a transmit button is depressed. Resulting receiver output is continuous while the button command signal is being transmitted. The command signal is transmitted by amplitude modulating the carrier to indicate to the receiver which of the transmit buttons is depressed.

The user has access to the following components:

## 1.1 THE ANTENNA.

The RF signal is radiated by a quarter-wave flexible whip antenna which screws onto the top end of the transmitter box. **The transmitter should never be operated without this antenna in place, as damage to the RF components could result.** Such operation will void the warranty.

Antennas with red rings are used for 433 MHz, and antennas with blue rings are used for 418 MHz. Be careful not to overtighten the antenna when screwing it on, as this could cause its mating connector to rotate and break its internal connection. Rotation could also occur, with the same result, when subsequent removal of an overtightened antenna is attempted. The recommended way to install the antenna is to grasp it by its small diameter upper part and rotate gently in a clockwise direction until increased resistance is felt. It need not be tight to achieve a good electrical connection. When removing the antenna for storage, observe the base of the mating connector to ensure that it is not rotating. If the antenna is so tight that rotation is occurring, grasp the hex base of the mating connector with long nose pliers, and then unscrew the antenna.

## 1.2 THE POWER SWITCH.

The Power Switch is a miniature toggle switch on the left side of the transmitter with two positions, "On" and "Off". In the "Off" position no RF output occurs even if a button is pressed. In the "On" position modulated RF output occurs continuously while a button is pressed. The battery level indicator next to button 1 flashes whenever the switch is in its "On" position. Approximately 1 milliamp is drained continuously from the battery while the transmitter is enabled and not transmitting. So this switch should always be turned off while the transmitter is not being used.

Firing on all receivers set to the transmitter's digital channel always commences at cue 1 after the transmitter has first been turned on. Thus all receivers on this transmitter's fixed channel can be reset to fire next from cue 1 at any time by turning this switch momentarily off and then back on. Note that pressing a numeric key will override the "next-fire" memory as described in section 1.4.

### **1.3 THE “BATTERY LEVEL” INDICATOR.**

This lamp, located next to the “1” button, indicates that the transmitter is on and that battery drain is occurring. If flashing red, it warns the user that the transmitter is armed and transmission will occur when a button is pressed. If flashing green, it indicates that the transmitter is not armed and that no transmission will occur if a button is pressed.

It also verifies that battery voltage is adequate to transmit a signal over the specified range by flashing periodically in bursts of two, three, or four flashes per cycle. A cycle lasts approximately one second. If fewer than two flashes per cycle are occurring, the battery must be replaced before the transmitter can be used reliably. Four flashes per cycle indicate that the battery has full capacity, three flashes indicate that its capacity is beginning to diminish, and two flashes indicate that it is near the end of its useful lifetime in which case it should be replaced immediately after the current use. Adequate transmitter output to achieve the specified range will occur as long as the battery voltage is above approximately 7.0 volts, but the battery voltage will drop rapidly at this point.

This lamp also serves as a transmit indicator by lighting continuously red while transmission is occurring.

### **1.4 THE FIRE BUTTONS.**

These buttons are snap action dome switches under a sealed overlay. The transmitter is idle while no buttons are pressed. If armed, continuous transmission occurs while “Next Fire” or a numeric button is pressed.

Depression of “Next Fire” (while armed) fires the next receiver output after the one fired last. For example, if output 3 had been fired last, pressing “Next Fire” would cause output 4 to fire, etc. Thus, “Next Fire” can be used to fire a series of sequential shots. Note that after powering up the receiver or transmitter, output 1 will be the first receiver output fired by a depression of the “Next Fire” button.

Pressing a numeric button (while armed) fires the corresponding receiver output immediately.

Output firing pulses are stretched to a minimum duration of 0.6 seconds in the receivers to ensure that all cues fire reliably, even when the fire buttons are pressed for a shorter period of time. Note that it is not necessary to wait for the completion of the 0.6 second firing pulse period before firing subsequent cues. They can be fired as fast as the operator can press the button, provided that each button depression lasts at least 0.1 second, followed by at least 0.1 second with the button released. If many transmitters are transmitting simultaneously, it may be necessary to depress a fire button slightly longer than 0.2 second in order to ensure an output from the receiver.

### **1.5 THE ARM BUTTON.**

Pressing this button alternately arms and disarms the transmitter. This button must be pressed once after power-on to enable transmission of firing commands since the transmitter always powers up in a disarmed state.

## 1.6 THE RESET BUTTON.

Pressing this button resets the firing sequence to receiver output 1 so that the next depression of "Fire Next" will fire receiver output 1. It does not affect the function of the numeric keys or the ARM state of the transmitter.

## 1.7 THE BATTERY.

Power is supplied from an alkaline 9 volt battery, accessible beneath a slide-out door on the back side of the transmitter. This battery should be replaced when required by conditions described in section 1.3 above. In order to prevent the possibility of damage due to battery leakage, the battery should always be removed if the transmitter is to be stored for a prolonged period. Damage due to battery leakage is not covered under the warranty.

## 2.0 RADIO INTERFERENCE REDUCTION.

For obvious safety reasons, Holatron's design goal is to ensure that data communication errors due to radio interference or to insufficient signal strength due to low battery, exceeding specified range, or conductive objects in the signal path will result in failure of intentional actuation rather than unintended actuation. This goal is achieved by transmitting a 64 bit noise-tolerant code repeatedly while a transmitter button is depressed. 60 of these bits must match the pattern expected by the receiver. Thus, there is one chance in (2 to the 60<sup>th</sup> power) of an actuation occurring due to reception of a random signal. Expressed in decimal numbers, this is (1.1529 times 10 to the 18<sup>th</sup> power, or 11529 followed by 14 zeroes). This is a probability of 8.6736 times 10 to the -19<sup>th</sup> power (or a decimal point followed by 18 zeroes followed by 86736). Though this probability of unintended actuation is extremely small, it cannot be guaranteed to be zero. Therefore, **it is important that the user not arm the receiver until all persons who might be harmed by accidental actuation are in a safe area.**

Additional protection is offered by use of 418 MHz as the operating frequency. This frequency is sparsely used only by low power transmitters with a maximum range of approximately 100 yards. It is not commonly used by auto security systems, garage door openers, radio control models, cordless or cellular telephones, wireless microphones, or two way communications equipment. Because this system operates in the UHF region, interference from lamp dimmers, electrical discharges, and other natural sources is also minimal.

No instances of false triggering with this communications technology have been reported to date.

### 3.0 SPECIFICATIONS.

| Parameter  | Minimum  | Typical  | Maximum  |
|--|----------|----------|----------|
| Carrier Frequency, MHz.  | 417.96   | 418.02   | 418.08   |
| Carrier Frequency, MHz. (optional)   | 432.90   | 433.96   | 434.02   |
| Range (line-of-sight with RFLS-96RC-496RC receivers)   |          |          | ½ mile   |
| Delay from start of button depression to receiver output (fewer than 4 transmitters transmitting simultaneously) |          | 50 msec  | 75 msec  |
| Delay from start of button depression to receiver output (more than 3 transmitters transmitting simultaneously)  |          | 100 msec | 400 msec |
| Button depression time per cue (fewer than 4 transmitters transmitting simultaneously)                           | 100 msec |          |          |
| Button depression time per cue (more than 3 transmitters transmitting simultaneously)                            | 400 msec |          |          |
| Battery current, average, (enabled)  |          | 1.0 mA   |          |
| Battery current, average, (xmting)   |          | 4.0 mA   |          |
| Battery life (enabled, not transmitting)   |          | 500 hrs  |          |
| Low Battery Detect Threshold   |          | 7.7 V    |          |
| Transmitter Supply Voltage   | 7.0 V    |          |          |

## 4.0 OPERATION AND MAINTENANCE.

This section describes the recommended operating procedure and maintenance for the transmitter-receiver system.

### 4.1 OPERATION.

**4.1.1** Turn on and arm the transmitter, and **with the receiver's ARM switch in "safe" or "disarmed" position and no devices connected**, perform a range test by observing the green activity light on the receiver while pressing a numeric transmitter button. An assistant may be needed to observe the receiver activity light while you operate the transmitter. There should be no intervening conductive objects for most reliable operation. All receivers must be elevated 12" or more above ground level to achieve specified range. When transmitting over water, range will normally exceed the specified value. Range of the receiver is typically ½ mile.

Verify that the transmitter battery is not depleted by observing the flashing "Battery Level" light while not pressing the FIRE buttons. (See section 1.3) Then turn the transmitter off.

**4.1.2** With the receiver turned off and its arm switch set to "disarm" (RFLS-496HSRC or RFLS-496HSARC) or "safe" (RFLS-96HSRC, RFLS-96HSARC, RFLS-912HSRC, or RFLS-912HSARC), connect devices to the receiver outputs.

**4.1.6** With the arm switch still in the previous position, turn on the receiver. Verify a flashing green battery indicator on the receiver module. This indicator will flash intermittently in bursts of two, three, or four flashes at a time if the battery has enough capacity to power the receiver. If only one flash occurs per burst, the receiver cannot be used reliably. Four flashes per burst indicate that the battery is fully charged, three flashes indicate that its charge is beginning to diminish, and two flashes indicates that it is near the end of its useful charge, in which case it should be replaced immediately after the current use.

**4.1.4** When the area around the devices to be actuated is clear of persons who might be injured by an accidental actuation, and after verifying that the receiver's green activity light is off (no radio signal is being detected), turn the receiver's ARM switch to its "Armed" position. Refer to the receiver manual for the corresponding arming procedure.

**WARNING - If the receiver's green activity light is erratic or on continuously, its output may be actuated immediately upon changing its ARM switch to the "Armed" position.**



- 4.1.6 Verify electrical continuity through the devices connected to the receiver outputs. Continuity is tested on the RFLS-96HSRC, RFLS-96HSARC, RFLS-496HSRC, and RFLS-496HSARC receivers by pressing the test button. On the RFLS-912HSRC and RFLS-912HSARC receivers, it is done by pressing the ARM toggle switch down into its “Test” position. Lighted lamps indicate open circuits. It is recommended this be done with the Arm Switch in the “Safe” or “Disarmed” position, but the test circuit will also function in the “Armed” position.
- 4.1.6 Turn the transmitter on. Press the “Arm” button once to arm the transmitter and verify a flashing red lamp, indicating that the transmitter is armed. Press the appropriate numeric or “Next Fire” button to actuate the desired receiver output channel. A button must be depressed for at least 75 milliseconds to produce a receiver output. **It is never necessary to hold a transmit button down longer than one second**, however. If no actuation has occurred in this period of time, none will occur, no matter how much longer the transmit button is depressed. The receiver may be attempting to actuate a short circuit, and damage could result.

The transmitter should be held with the antenna in a vertical orientation, away from the body and other conductive objects to achieve maximum range and communication reliability. Generally, the higher the transmitter is held, the greater the range. Conductive objects such as chain-link fences, aluminum bleachers, electrical wires, and automobiles in the transmission path will reduce the range.

- 4.1.7 When finished, turn off the receiver and the transmitter to stop further drain of their batteries. You may remove the antenna to make it easier to store the transmitter. Observe the precautions in section 1.1 before removing the antenna. If the transmitter is to be stored for a prolonged period, remove the battery as described in section 1.7 above.

## 4.2 MAINTENANCE.

Since there are no calibration or tuning adjustments in the transmitter, the only maintenance required is periodic replacement of the 9 volt battery. This should be done at least once per year, at the next opportunity if the “Battery Level” light is flashing 2 flashes per cycle, or immediately if 1 flash per cycle.

The face of the transmitter, which is completely sealed, may be safely cleaned by wiping with a damp cloth if care is taken not to get moisture into the lock switch. The battery compartment door and the junction between the front and back panels are NOT water tight, however. The transmitter must never be immersed in water.

If further information or service is required, contact:

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