

**OPERATION & MAINTENANCE GUIDE -
2 Channel Digital UHF Transmitter**

HOLATRON SYSTEMS, LLC
7242 Alliance Court
San Diego, Ca. 92119-1522
Phone or FAX: (619) 464-2137
www.holatron.com

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 signal path, will result in failure of intentional actuation rather than unintended actuation. Techniques used to achieve this design goal are described in section 1.8. Though the probability of unintended actuation is extremely small, it cannot be guaranteed to be zero. 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 other participants. 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 47 CFR Ch.1 (10-1-96 Edition), part 15, subpart C, sections 15.209 and 15.231. **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 two sections. The first is a description of the system hardware. The second covers the recommended operating and maintenance procedure.

1.0 HARDWARE DESCRIPTION.

The model RFLS-1XT Two Channel Digital UHF Transmitter is a low power two channel, safety locking, hand-held remote control transmitter with a guaranteed range of 60 yards (line of sight operation) when used with the Holatron model RFLS-1RC receiver. A range of 100 yards is typical. The two channels are digitally encoded and amplitude modulated on a single carrier frequency of 418MHz. 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 one of the two momentary transmit buttons is depressed. Receiver output is continuous while this signal is being transmitted. A digital code amplitude modulates 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.

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. Overtightening could also cause the connector to rotate, with the same result, when subsequent removal of the 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 SAFETY LOCKING SWITCH.

The Safety Locking Switch is a miniature cylindrical keylock with two positions, "Safe" and "Xmtr Enabled". In the "Safe" position no RF output occurs even if a button is pressed. In the "Xmtr Enabled" position modulated RF output occurs continuously while a button is pressed. Whether transmitting or not, a red warning indicator near the switch flashes whenever the switch is in its "Enabled" position and the battery voltage is above the low battery detect threshold. Approximately 1 milliamp is drained continuously from the battery while the transmitter is enabled and not transmitting. So this switch should always be turned to the "Safe" position while the transmitter is not being used. The key may be removed from the switch in either position. Keys are interchangeable, as all Holotron RFLS-1XT transmitters are keyed the same.

1.3 THE "XMTR ENABLED" INDICATOR.

This red indicator, located at the "Enabled" position of the lockswitch, is of sufficiently high intensity to be visible in direct sunlight. It flashes continuously while the transmitter is enabled and the battery voltage is above the low battery detect threshold, warning the user that transmission will occur when a button is pressed and that battery drain is occurring. It also verifies that battery voltage is adequate to transmit a signal over the specified range. If this indicator does not flash when the lock switch is in the "Enabled" position, the battery should be replaced. The low battery detect threshold is approximately 8.5 volts. Adequate transmitter output to achieve the specified range will occur as long as the battery voltage is above approximately 7.0 volts, allowing some additional operating time after the battery voltage falls below the low battery detect threshold. While this additional time should be adequate to complete the current sequence of transmissions, it is not absolutely predictable, and so the battery should be replaced at the very next opportunity.

1.4 THE FIRE BUTTONS.

These buttons are snap action dome switches under a sealed overlay, labeled "Fire A" and "Fire B", respectively. They have a high spring constant which requires a firm depression for actuation, decreasing the likelihood of accidental depression. The enabled transmitter can be kept in a shirt or jacket pocket without fear of accidental button depression. If the receiver is set to Dual Channel mode, a continuous output from receiver channel A occurs while "Fire A" is pressed, and a continuous output from receiver channel B occurs while "Fire B" is pressed. If the receiver is set to Remote Arm mode, receiver channel A alternately latches on and off each time "Fire A (Enable B)" is pressed, and a continuous output from receiver channel B occurs while "Fire B" is pressed and receiver channel A is latched on. While in this mode and channel A is not latched on, no receiver output can occur from channel B. Remote Arm mode provides added insurance against accidental actuation of devices connected to receiver channel B.

1.5 THE TRANSMIT INDICATOR.

This is a high intensity indicator, visible in direct sunlight, that lights continuously while the transmitter is generating RF output. It is located between the two buttons. It will light even if the battery voltage is below the low battery detect threshold.

1.6 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.

1.7 THE DIGITAL CHANNEL SWITCH.

A 16 position miniature rotary switch is accessible by removing the four screws and the back side of the transmitter. This switch is on the left edge of the internal printed circuit board. It can be set to digital channels 0 – 9 or A – F. The transmitter will only actuate receivers whose corresponding channel switches are set to 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. All transmitters are set to channel 0 at time of manufacture.

1.8 RADIO INTERFERENCE REDUCTION.

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 12 bit, 3 state, code repeatedly while a transmitter button is depressed. Ten of those bits must match the pattern expected by the receiver, and the other two bits select which channel (A or B) is to be actuated. Two successive received 12 bit patterns must be identical before an actuation can occur. Thus there is one chance in 3^{20} (or a probability of .000000000287) of an actuation occurring due to reception of a random signal. Though the probability of unintended actuation is extremely small, it cannot be guaranteed to be zero. 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. Additional protection is offered by use of a bit pattern that cannot produce a match in the receiver if a synchronization error occurs (as is the case with a "0101010101" pattern), and by selection 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 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.

1.9 SPECIFICATIONS.

Parameter	Minimum	Typical	Maximum
Carrier Frequency, MHz.	417.96	418.02	418.08
Range, yards (line-of-sight with RFLS-1RC rcvr)	60	100	
Battery consumption, mA (enabled) (transmitting)		1.5 4.0	
Low Battery Detect Threshold, Volts		8.5	
Transmitter Supply Voltage	7.0		

2.0 OPERATION AND MAINTENANCE.

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

2.1 OPERATION.

- 2.1.1** Connect devices to receiver outputs. With the receiver turned off, set the receiver key switch to its “Enabled” position. Verify continuity through the devices by contacting the tops of the receiver output terminals.
- 2.1.2** Turn the receiver key switch to its “Shunted position, and turn on the receiver. Verify flashing “Battery OK” light. Enable transmitter, and perform range test by observing receiver activity lights while pressing transmitter buttons. (The receiver should be located within 60 yards of the transmitter with no intervening conductive objects for most reliable operation.) Verify that the transmitter battery is good by observing the flashing “Xmtr Enabled” light. Turn the transmitter lock switch back to “Safe” position, and turn off the receiver.
- 2.1.3** When the area around the devices to be actuated is clear of persons who might be injured by an accidental actuation, turn on the receiver. After verifying that the receiver’s two red activity lights are off (no radio signal is being detected, and channel A is not latched on), turn the receiver’s lock switch to its “Enabled” position.

WARNING - If an activity light is on, the corresponding receiver output will be actuated immediately upon turning the lock switch to “Enabled”.

- 2.1.4** Turn the transmitter lock switch to its “Enabled” position, and press the appropriate button to actuate the desired receiver output channel. Once the lockswitch is in its “Enabled” position, the key may be removed to make it easier to press the buttons. A button must be held for at least 100 milliseconds to produce a receiver output. 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.
- 2.1.5** When finished, turn off the receiver, and turn the transmitter lockswitch back to its “Safe” position to stop further drain of the transmitter battery. 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 1.6 above.

2.2 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, or at the next opportunity if the "Xmtr Enabled" light fails to flash when the transmitter is enabled.

If further information or service is required, contact:

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