



## **OPERATION & MAINTENANCE GUIDE -**

### ***InstantFire-12C High-speed 144-shot Controller***



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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 2.0. Though the probability of unintended actuation is extremely small, it cannot be guaranteed to be zero. It is also possible that an **unexpected actuation can occur if another Holatron transmitter set to the same digital channel and system code is being operated in the vicinity**. Therefore, **it is important that the user not enable (arm) the receiver until all persons who might be harmed by accidental actuation are in a safe area**.

Equipment that has been damaged or contaminated internally with water or other substances could be hazardous to operate, and it could generate an unintended actuation. The user must consult with Holatron Systems before continuing use of such equipment.

As a condition of purchase, the user must acknowledge awareness and agreement that utilization of this product and participation in activities utilizing compressed gas, fireworks, rockets, explosives, etc. 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.

## INFORMATION TO USER

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested, assigned FCC ID number **OI4XMTR12C**, and found to comply with the limits for 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 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

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

Les changements ou modifications non approuvés expressément par la partie responsable de la conformité pourrait annuler l'autorité de l'utilisateur à faire fonctionner l'équipement..

This device also complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter **11556A-XMTR12C** has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio **11556A-XMTR12C** a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

This radio transmitter is approved for operation with Linx Technologies ANT-315-CW-HW quarter wave antenna with RP-SMA connector and peak gain of 0 dBi.

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 system specifications. The fourth covers the recommended operating and maintenance procedure.

## 1.0 HARDWARE DESCRIPTION.

The model XMTR12C high-speed 144-shot controller is a low power hand-held remote control transmitter which can transmit commands over any of twelve different digital channels.

The transmitter can be configured to be fixed or multi-channel multi-shot, and any fixed channel setting or multi-channel range can be set from the keypad by pressing a special code on the keys during the LED scan period immediately after power-up. Once set, this configuration is saved in non-volatile memory even when power is off. The configuration is defined by 3 parameters: "Base Channel", "High Channel", and "Low Channel". Each of these can be assigned the value 1 through 12 by pressing the appropriate key.

"Base Channel" is the channel on which the transmitter starts after power-on. "High Channel" is the last channel the transmitter uses before cycling back to "Low Channel" after firing cue 12 of the high channel. So if you want to configure a transmitter to be fixed channel 3, for example, you would key in 3,3,3 after entering the special code. If you wanted it to be a 72-shot unit operating on channels 1 through 6, you would key in 1,6,1. You can do much more elaborate configurations, too, such as making it an 84-shot unit operating on channels 3 through 9 and starting on base channel 5 by keying in 5,9,3. The special code consists of pressing the 5 and 11 keys simultaneously. This cannot occur accidentally, because it is very difficult to press these keys simultaneously with one hand, and because this code is only sensed during the initial LED scan after power-up

Operation can be switched on-the-fly to a different channel (within the configured range) by pressing the Pwr / Rst button, followed by the number of the desired new channel. On-the-fly channel changes are not saved in non-volatile memory. So operation will revert to normal after power cycling the transmitter or after firing past cue 12.

Transmitters operating on separate digital channel numbers can transmit simultaneously without interfering with each other. This permits up to twelve different receivers or groups of receivers to be controlled by separate transmitters simultaneously. A transmitter will only actuate receivers whose digital 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. Transmitters operating on the same digital channel number should not be used simultaneously, as they will interfere with each other and possibly result in failure-to-fire.

This transmitter features an enhanced display mode which provides the following indications:

- Current cue number (to be fired next).
- Current channel number (in single-shot mode).
- Battery "fuel-gauge".
- Current firing mode (Safe, Single-shot, or Auto-fire).
- Automatic firing rate (in Auto-fire mode).
- Base-channel, High-channel, Low-channel configuration (at power-on).

When used with RFLS-491HSRC, RFLS-96HSRC, RFLS-96HSARC, RFLS-496HSRC, RFLS-496HSARC, RFLS-912HSRC, RFLS-912HSARC, or RFLS-91212HSRC receivers, a range of  $\frac{1}{2}$  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 315 MHz (or 433.96 MHz in Europe). This frequency is synthesized via phased-locked-loop from a quartz crystal for exceptional stability and immunity to antenna proximity effects. 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 transmitter turns off its power automatically after 90 minutes of inactivity in order to prevent accidental depletion of its batteries while in storage.

The user has access to the following components:

## 1.1 THE ANTENNA.

The RF signal is radiated by a quarter-wave reduced height helical 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 green rings are used for 315 MHz, with blue rings for 418 MHz, and with red rings for 433 MHz. Be sure to use an antenna that matches the transmitter frequency, or range will be seriously degraded. Be careful not to overtighten the antenna when screwing it on, as this could put excessive stress on the internal connections to the mating connector. 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 very tight to achieve a good electrical connection. The antenna can be removed for storage.

## 1.2 THE PWR / RST BUTTON.

This is a dual function button. It can turn the transmitter power on and off, or it can initiate the transmitter's reset / channel-change function, depending on how and when it is pressed.

If the transmitter is off, pressing this button instantly turns power on, with the transmitter initialized to cue 1 on its base channel. If the transmitter is on, pressing and holding this button for at least 0.75 second turns power off.

The transmitter turns off its power automatically after 90 minutes of inactivity in order to prevent accidental depletion of its batteries while in storage.

Pressing the Pwr / Rst button for less than 0.5 second while the transmitter is on places the transmitter in channel-change mode, as indicated by a continuously illuminated cue indicator. The transmitter will switch to the channel number selected by the next numerical button press, and the cue number for that channel will be reset to 1. If more than 4 seconds elapses without a button press after channel-change mode is entered, the transmitter will revert to its previous flashing mode without affecting channel or cue number. If the Pwr / Rst button is pressed instead of a numeric button within the 4 second timeout period, channel-change mode is canceled, and a RESET command is transmitted to all receivers set to the transmitter's digital channel. Operation of the transmitter is also reset to cue 1. This feature is useful for restarting automatic-fire sequences from cue 1. It does not affect the function of the numeric keys or the ARM state of the transmitter.

## 1.3 THE TRANSMITTER STATUS INDICATORS.

When the transmitter is on, one of the 12 cue indicators will flash to indicate the transmitter mode (armed state), current cue number, current channel number, selected automatic firing rate, and battery level.

### 1.3.1 SAFE MODE INDICATION.

The current cue number (next cue to be fired) is flashed with a green color on the numeric keys when in this mode. The number of green flashes per burst indicates the battery level as described in section 1.3.4 below. A separate orange flash indicates the current channel number. No firing commands can be transmitted in this mode.

### 1.3.2 SINGLE-SHOT MODE INDICATION.

The current cue number (next cue to be fired) is flashed with a red color on the numeric keys when in this mode. The number of red flashes per burst indicates the battery level as described in section 1.3.4 below. A separate orange flash indicates the current channel number. A single cue is fired with each button press in this mode.

### 1.3.3 AUTO-FIRE MODE INDICATION.

In this mode the current cue number (next cue to be fired) is flashed with a red color on the numeric keys continually at the selected firing rate, and no orange channel indication flash or battery level indication occurs. Fire commands will be transmitted in machine-gun fashion while the “Next Fire” button is depressed.

### 1.3.4 BATTERY LEVEL INDICATION.

If not in AUTO-FIRE mode, the current cue number flashes in bursts of red or green, depending on whether the transmitter is in SINGLE-SHOT or SAFE mode, repeating once per second. The bursts indicate whether the battery voltage is adequate by including one, two, three, or four flashes. If fewer than two flashes per burst are occurring, the batteries must be replaced before the transmitter can be used reliably. Four flashes per burst indicate that the batteries have full capacity, three flashes indicate that their capacity is beginning to diminish, and two flashes indicate that they are near the end of their useful lifetime in which case they should be replaced immediately after the current use. Adequate transmitter output to achieve the specified range will occur as long as the total series battery voltage is above approximately 2.0 volts, but the battery voltages will drop rapidly at this point.

### 1.3.5 CHANNEL CHANGE MODE INDICATION.

The current cue number lights continuously while in channel-change mode (after momentarily pressing the Pwr / Rst button). Pressing “Pwr / Rst” again or a numeric button while in this mode will switch the transmitter as described in section 1.2.

### 1.3.6 TRANSMISSION INDICATION.

The current cue number also serves as a transmit indicator in single shot mode by lighting continuously red while transmission is occurring.

## 1.4 THE FIRE BUTTONS.

These buttons are snap action dome switches under a sealed overlay. When the transmitter is off, all indicators are dark, and no signals can be transmitted even if a button is pressed. When it is on, no transmission occurs (after the initial power-on reset transmission) while no buttons are pressed. If armed (not in SAFE mode), continuous transmission occurs while “Next Fire” or a numeric button is pressed.

Pressing a numeric button while in single-shot mode fires the corresponding receiver output on the current channel immediately.

Depression of “Next Fire” while in single-shot mode fires the next receiver output (indicated by the illuminated numeric LED). For example, if output 3 had been fired last, LED 4 would be illuminated, and pressing “Next Fire” would cause output 4 to fire. If output 12 had been fired last, LED 1 would be illuminated, and pressing “Next Fire” would cause output 1 on the next sequential channel to fire. Thus, “Next Fire” can be used to fire a series of sequential shots. Note that after powering up the transmitter, output 1 will be the first receiver output fired by a depression of the “Next Fire” button.

In single-shot mode, the current cue will continue firing until the transmitter button is released. In auto-fire (machine-gun) mode, the transmitter will continue firing cues sequentially at the selected fire rate until the “Next Fire” button is released. After firing cue 12, the transmitter will wrap around to cue 1 on the next sequential channel and continue firing from there.

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.

If in auto-fire mode, pressing a numeric button will change the auto-fire rate as follows:

Button	Auto-fire Rate Selection, Shots / Sec
1	1
2	2
3	3.03
4	4
5	5
6	5.88
7	7.62
8	7.62
9	10
10	10
11	14.3
12	20

The selected auto-fire rate is saved in non-volatile memory even while power is off. So it does not need to be entered again unless the operator wishes to change to a new rate.

## 1.5 THE ARM BUTTON.

Each successive depression of this button advances the transmitter to the next of three firing modes: "Safe", "Single-shot", and "Auto-fire". The next button depression after "Auto-fire" returns the transmitter to "Safe" mode, and the sequence then repeats. This button must be pressed after power-on to enable transmission of firing commands since the transmitter always powers up in Safe mode.

### 1.5.1 SAFE MODE.

The display operates as described in section 1.3.1. No firing commands can be transmitted in this mode.

### 1.5.2 SINGLE-SHOT MODE.

The display operates as described in section 1.3.2. Firing commands in this mode are transmitted as described in section 1.4.

### 1.5.3 AUTO-FIRE MODE.

The display operates as described in section 1.3.3. Firing commands in this mode are transmitted as described in section 1.4.

## 1.6 THE BATTERIES.

Power is supplied from two 1.5 volt type AA batteries, accessible beneath a slide-out door on the back side of the transmitter. These batteries 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 batteries should always be removed when the transmitter is to be stored for a prolonged period. Damage due to battery leakage is not covered under the warranty.

**Be sure to observe proper battery polarity as marked inside the battery compartment**, as it is possible to install the batteries backwards, and this could damage the transmitter, voiding the warranty.

The transmitter turns off its power automatically after 45 minutes of inactivity in order to prevent accidental depletion of its batteries while in storage.

## 2.0 RADIO INTERFERENCE REDUCTION.

For obvious safety reasons, Holatron's top 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 315 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, modern 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 unexpected actuation with this communications technology have been reported to date, but the user must consider that radio is a shared medium. It is very important to know what other wireless devices are operating in the vicinity of this equipment. Interference from non-Holatron equipment can result in diminished range or failure-to-fire, and **interference from other Holatron devices operating on the same channel and with the same system code can result in unexpected actuation.** To be protected from this possibility, the user must purchase a proprietary system code from Holatron when ordering.

### 3.0 SPECIFICATIONS.

Parameter	Minimum	Typical	Maximum
Carrier Frequency, MHz. (US, Canada)	314.95	315.00	315.05
Carrier Frequency, MHz. (Europe)	433.91	433.96	434.01
Range (line-of-sight with RFLS-96RC - 496RC & RFLS-912HSRC 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, standby, (power off)		1 uA	
Battery current, average, (power on)		1.0 mA	
Battery current, average, (xmitting)		4.0 mA	
Battery life (power on, not transmitting)		4 months	
Battery life (power off)		5 years	
Inactivity power-down timeout		90 min.	
Low Battery Detect Threshold		2.0 V	
Transmitter Supply Voltage	1.8 V		3.6V

### 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 full 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, RFLS-912HSARC, or RFLS-91212HSRC), connect devices to the receiver outputs.
- 4.1.3 With the arm switch still in the previous position, turn on the receiver. Verify a flashing green battery indicator on the receiver module. On an RFLS-912HSRC, RFLS-912HSARC, or RFLS-91212HSRC receiver, 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. On the other receiver models, there will be one fewer flash per burst for the same condition.
- 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 not erratic or illuminated continuously (no radio signal is being detected), turn the receiver’s ARM switch to its “Armed” position. Refer to the receiver manual for the detailed arming procedure.

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

**Do not arm a receiver with connected devices if it has been internally contaminated with water or any other substance,** as unexpected actuation could occur due to conductive residues remaining on the circuit board. Contact Holatron Systems first.

- 4.1.5 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, RFLS-912HSARC, and RFLS-91212HSRC 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. 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. If it is desired to switch to a different channel, follow the instructions in the last paragraph of section 1.2.

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, earth mounds, 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. If the transmitter is to be stored for a prolonged period, remove the batteries as described in section 1.6 above.

## **4.2 MAINTENANCE.**

Since there are no calibration or tuning adjustments in the transmitter, the only maintenance required is periodic replacement of the AA batteries. They should be replaced with a pair of new batteries at least once every two years, at the next opportunity if the battery level indication 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. 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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