

HOLATRON

OPERATION & MAINTENANCE GUIDE - *SureFire-1* High Energy Trigger



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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 receiver 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 1.8. Though the probability of unintended actuation is extremely small, it cannot be guaranteed to be zero. Therefore, **it is important that the user not arm 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.

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-CD1 High Energy Trigger is a single output capacitor discharge firing module which can be triggered by an onboard manual switch, wire command input, or radio command input. The wire command input is applied to the red and black REMOTE INPUT PyroClip terminals. The standard module accepts 9 VDC pulses, but the module can be optionally configured at time of manufacture for contact closure inputs instead of 9 VDC. Wire inputs are optically isolated from the internal high voltage firing circuitry.

NOTE:

Due to safety concerns over the possibility of accidental manual firing, unless requested otherwise, the MANUAL FIRE position of the ARM switch is disabled in all remote fired high energy triggers. This function is now only available in optional “manual-fire only” triggers that cannot be fired remotely.

Radio commands are received by a highly sensitive narrow band (superhetrodyne) radio receiver designed to be used for remote control applications where high reliability is critical. When used with the Holatron model RFLS-6HSXT, XMTR12B, and similar high speed remote control transmitters, a range of ½ mile (line of sight operation) is typical, provided there are no intervening conductive objects such as automobiles, chainlink fences, etc. Range increases as the receiver is elevated above earth or other conductive objects (such as aluminum bleachers). Range will be even greater when transmitting over water. The reception carrier frequency is fixed at 418 MHz by a PLL frequency synthesized oscillator for exceptional stability. No alignment or tuning procedures are ever required to maintain optimum performance.

The radio firing signals are digitally decoded from the transmitted digital code which is amplitude modulated on a single carrier frequency of 418 MHz. The transmitted digital code indicates to the trigger which of the transmit buttons is being pressed as well as the current transmitter cue and channel number.

A 16 position digital switch inside the receiver is used to select one of six available radio cues, 4 of the 16 available output energy levels, and “radio-fire / fire-by-wire” or “fire-by-wire only” modes. Switch position assignments are shown in the table in section 1.8. Other custom switch assignments can be incorporated in software at time of manufacture.

The digital channel switch has been initially set to position “5” at the factory for operation on channel 1, cue 1, and energy level of 1.49 joules (110V output pulse). Output pulse energies of 1.49, 4.09 (182V), 8.35 (260V), or 11.9 joules (310V) in “fire-by-wire only” mode, and energies of 1.49 or 11.9 joules in channel 1 “radio-fire / fire-by-wire” modes, can be selected by rotating the digital switch. Note that charging takes longer when high output energy level is selected.

The user has access to the following components (refer to figures 1 & 2):

1.1 THE ANTENNA.

The RF signal is received by a reduced height loaded quarter wave antenna which screws onto the top of the receiver. The antenna should be removed for storage.

The antenna need not be tight to achieve a good electrical connection. It should be hand-tightened only to the point where resistance to further rotation is felt. It should never be tightened with pliers or other tools.

Note that reception is better when the receiver antenna is elevated at least 12" above ground or nearest conductive surface. This is necessary to achieve specified range.

1.2 THE POWER, ARM, & TEST SWITCHES.

These miniature toggle switches are located on the top panel.

The "POWER" switch turns on power to the module, at which time output capacitor bank charging begins. Full energy level is reached within 3 to 20 seconds, depending upon the level selected and whether the trigger contains the enhanced energy option. The capacitor bank is slowly discharged while the power switch is off. This process takes approximately one minute for complete discharge from maximum energy to zero.

Operation of the "TEST" switch is described in section 1.4.

The "ARM" switch has "Safe", "Remote Enbl", and "Manual Fire" positions. In the "Safe" position, the output cannot be fired, even if fire commands are received from the radio or wire terminals. **It is recommended that the receiver always be powered up in "Safe" mode if devices are connected to the output. The operator can then verify that the "BATTERY / ACTIVITY" light does not indicate that any wire or radio signal reception is occurring before switching to Remote Enbl. A prolonged or erratic illumination of this light may indicate the presence of an active fire-by-wire or radio input which could cause the output to fire as soon as the ARM switch is placed in the "Remote Enbl" position).**

The "Manual Fire" position is a momentary spring return position which, if enabled, immediately causes the output to fire. As stated in section 1.0, **this function has been disabled to prevent the possibility of accidental manual fire when switching out of "Safe" mode.**

1.3 THE “BATTERY / ACTIVITY” INDICATOR.

While the power switch is on, this indicator, located just above the switch, will flash intermittently in bursts of one, two, or three flashes at a time if the battery has enough capacity to power the module. If the capacitor bank is discharged, it will flash green, if charging, it will flash orange, and if charged fully to the selected energy level, it will flash red.

If no flashing occurs, the batteries will need to be replaced before the module can be used reliably. Three flashes per burst indicate that the batteries have full capacity, two flashes indicate that their capacity is beginning to diminish, and one flash indicates that they are near the end of their useful lifetime in which case they should be replaced immediately after the current use. Adequate receiver power is available as long as the battery voltage is above approximately 5 volts, but the battery voltage will drop rapidly after this point. While this additional time should be adequate to complete the current operation, it is not absolutely predictable, and so all batteries should be replaced at the very next opportunity.

This indicator will also light while a wire input signal, or a radio signal that matches the expected preamble and sync code of the system communication protocol, is being received, even if it is from a transmitter set to a different digital channel or firing a different cue than the one selected by the digital switch. It will light green if the reception does not match the selected cue or channel and is not capable of firing the output. **It will light red if the received command is capable of firing the output**, including the wire terminal and manual fire commands. This feature is useful for warning of the presence of firing of signals before the arm switch is turned on and for indication of activity on other digital channels.

1.4 THE “TEST” INDICATOR.

This indicator, located just above the TEST switch, lights green when the switch is momentarily pressed upward if there is a device connected between the yellow output terminals. This test uses a one milliamper current to perform a galvanometer function that verifies continuity through the device connected to the output, ensuring that a successful firing will occur when the module is actuated. The test current is well below the minimum fire current of electrically actuated devices, and it is only applied when the TEST switch is actuated. The test can be performed safely in both the “Safe” and “Remote Enbl” positions of the ARM switch.

1.5 THE REMOTE INPUT CONNECTORS.

When the ARM switch is in the “Remote Enbl” position, a 9 VDC pulse applied to these terminals will cause the output to fire. The pulse’s positive wire should be connected to the red terminal, and the pulse’s negative wire should be connected to the black terminal. The input is protected from accidental reverse polarity connection, but the output will not fire in this case. If desired, this input can be configured optionally by the factory to respond to a contact closure instead of a 9VDC pulse.

1.6 THE OUTPUT CONNECTORS.

The device to be fired is connected between the yellow “PyroClip” spring terminals located at the end of the top panel.

CAUTION: The pulse applied to these terminals may be as high as 330 volts when the output is fired. This will result in a painful, and possibly lethal, electric shock to a person touching these terminals at the moment they are fired. BE CAREFUL! Do not touch them unless the ARM switch is in “Safe” position and the power switch has been off for at least one minute.

1.7 THE BATTERIES.

All power is supplied from four AA alkaline batteries, contained in a compartment in the bottom of the plastic box as shown below:

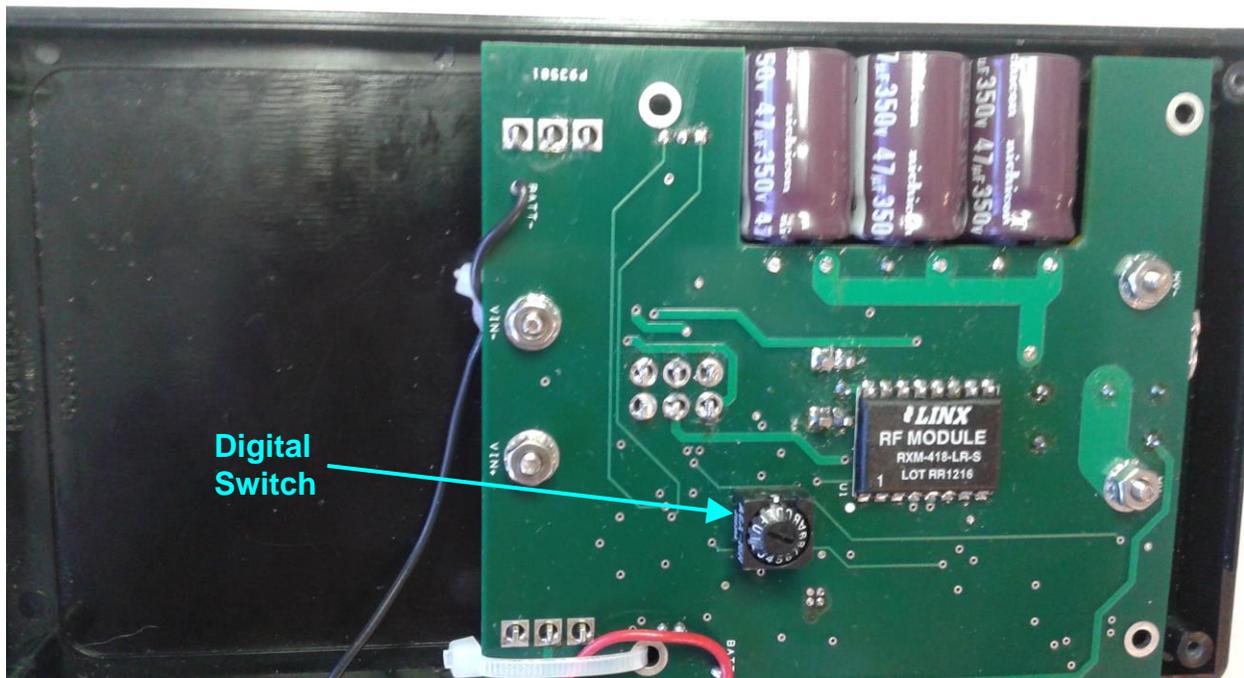


The batteries should be replaced when required by conditions described in section 1.3 above. Be careful to observe the positive and negative polarity

markings in the battery compartment when installing batteries. In order to prevent irreversible damage to the module, the batteries should be removed before storing the receiver for long periods of time. To prevent battery depletion and resulting leakage, be sure the power switch is turned off when the module is **not being used**.

1.8 THE DIGITAL SWITCH.

A 16 position rotary digital switch inside the receiver, as shown below, is used to select the digital radio channel, six of the 12 available channel cues, and 4 of the 16 available output energy levels:



Positions 1 – 4 disable radio firing but not fire-by-wire. The digital channel switch has been initially set to position “5” at the factory for operation on channel 1, cue 1, and energy level of 1.49 joules (110 VDC output pulse). Access to this switch is gained by removing the four screws securing the bottom cover and turning it with a miniature flat blade screwdriver. The possible selections are shown in the following table:

Switch Position	Output Energy / Max Voltage	Cue #	Channel
1	1.49 joules / 110 volts	None	None
2	4.09 joules / 182 volts	None	None
3	8.35 joules / 260 volts	None	None
4	11.9 joules / 310 volts	None	None
5	1.49 joules / 110 volts	1	1
6	1.49 joules / 110 volts	2	1
7	1.49 joules / 110 volts	3	1
8	1.49 joules / 110 volts	4	1
9	1.49 joules / 110 volts	5	1
A	1.49 joules / 110 volts	6	1
B	11.9 joules / 310 volts	1	1
C	11.9 joules / 310 volts	2	1
D	11.9 joules / 310 volts	3	1
E	11.9 joules / 310 volts	4	1
F	11.9 joules / 310 volts	5	1
0	11.9 joules / 310 volts	6	1

(Factory setting shown in yellow)

Other combinations of output energy level, cue number, and radio channel can optionally be provided by the factory.

If wire-fire only (no radio) has been selected by setting the switch to positions 1 – 4, output capacitor charging will begin immediately upon power-up. Charge will then be maintained until a wire-fire command input, at which time charging will cease in order to conserve battery life. Power must be turned off and then back on to restart charging in this mode.

All other switch positions (modes) allow firing by wire and radio command, but charging can only be initiated by radio command in these modes. **Charging does not start when power is turned on.** Instead reception of a Holatron “Reset” command starts charging. Holatron transmitters output a “Reset” command automatically when they are turned on. So the High Energy Trigger can be left on but its power will be conserved until the transmitter is turned on and charging commences. Charging ceases upon input or reception of a fire command in order to further conserve battery life. Charging can be restarted by turning the transmitter off and then back on, sending a Holatron “reset” command.

If configured for optional reduced energy levels (with faster charging), the switch selections and selected energies are:

Switch Position	Output Energy / Max Voltage	Cue #	Channel
1	0.853 joules / 110 volts	None	None
2	2.34 joules / 182 volts	None	None
3	4.77 joules / 260 volts	None	None
4	6.78 joules / 310 volts	None	None
5	0.853 joules / 110 volts	1	1
6	0.853 joules / 110 volts	2	1
7	0.853 joules / 110 volts	3	1
8	0.853 joules / 110 volts	4	1
9	0.853 joules / 110 volts	5	1
A	0.853 joules / 110 volts	6	1
B	6.78 joules / 310 volts	1	1
C	6.78 joules / 310 volts	2	1
D	6.78 joules / 310 volts	3	1
E	6.78 joules / 310 volts	4	1
F	6.78 joules / 310 volts	5	1
0	6.78 joules / 310 volts	6	1

(Factory setting shown in yellow)

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-rejecting 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 60th power) of an actuation occurring due to reception of a random signal. Expressed in decimal numbers, this is (1.1529 times 10 to the 18st power, or 11529 followed by 14 zeroes). This is a probability of 8.6736 times 10 to the -19th 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 power up and arm the trigger with device(s) connected 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 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 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 request a proprietary system code from Holatron when ordering

3.0 SPECIFICATIONS.

Parameter	Minimum	Typical	Maximum
Carrier Frequency, MHz.	417.96	418.02	418.08
Range (line-of-sight with XMTR12B or RFLS-1XT xmtr)			½ mile
Delay from start of transmission to fire output			100 msec
Charge-up time from pwr-on to max energy level			20 sec
Average battery drain, (1.49 joules)		30 mA	
Average battery drain, (11.9 joules)		45 mA	
Instantaneous battery drain, (charging)		500 mA	
Continuous battery life, (not charging)		4 months	
Continuous battery life, (1.49 joules, charging)		4 days	
Continuous battery life, (11.9 joules, charging)		2.5 days	
Receiver Supply Voltage	5.0 V	6.0 V	
Low Battery Detect Threshold		5.0 V	
Battery Input Voltage	4.5 V	6.0 V	6.5 V
Output Fire Voltage	110 V		310 V
Output Fire Energy (standard trigger)	1.49 joules		11.9 joules
Output Fire Energy (reduced energy trigger)	0.853 joules		6.78 joules
Output Test Current			1 mA
Height of box		1.0 in	
Width of box		4.0 in	
Length of box		7.5 in	
Weight of receiver, including batteries		13 oz	

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 position and no devices connected**, perform a range test by observing the "BATTERY / ACTIVITY" light on the receiver while pressing a transmitter fire 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. Receiver antenna must be elevated 12" or more above ground level or nearest conductive surface to achieve full specified range. When transmitting over water, range will normally exceed the specified value.

4.1.2 With the transmitter off and in the possession of the operator, the receiver power off, and its ARM switch in SAFE position, connect the device to be fired to the yellow output terminals.

- 4.1.3 Turn on the receiver power switch, and verify that the batteries are not depleted and that no radio or wire-fire signals are being received by observing the “BATTERY / ACTIVITY” indicator as described in section 1.3. If the receiver digital switch is in a “Wire-fire only” position, charging will begin immediately. Otherwise, it will wait for a transmitter signal.
- 4.1.4 Momentarily press the TEST switch upward and verify continuity through the output device by observing that the TEST indicator lights green.
- 4.1.5 When the area around the device to be actuated is clear of persons who might be harmed by an accidental actuation, and after verifying that the receiver’s activity light is not erratic or illuminated continuously (radio or wire-fire signal being detected), move the ARM switch downward into its REMOTE ENBL position.

WARNING:

If the receiver’s activity light is not green and is erratic or on continuously, its output may be actuated immediately upon switching to REMOTE ENBL.

Never arm (or power up) the receiver with a connected device 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.

- 4.1.6 Move to a safe distance and wait until you are ready to fire before turning on (enable / arm) the transmitter. This causes the transmitter to automatically signal the receiver to begin charging. In order to conserve receiver battery life, the receiver will not charge up until signaled that the transmitter has been turned on.
- 4.1.7 If possible, verify that the receiver output capacitors are fully charged by observing that the flashing activity light has changed from green to red. (Orange flashes indicate partial but not full charge.) If unable to view the flashing receiver charge indicator, wait at least 25 seconds before firing.
- 4.1.8 The receiver charge will be maintained until it is fired or powered off. Since battery consumption is relatively high during the charge / maintenance period, you should fire the receiver soon after charge-up is complete in order to maximize battery life.
- 4.1.9 Fire the receiver by transmitting the cue number corresponding to the receiver’s digital switch selection (as described in the table in section 1.8). Reception of the correct switch selected firing cue, whether the receiver is armed or not, immediately stops the receiver charging period in order to conserve battery life. Charging can be restarted by turning the transmitter off and back on.
- 4.1.10 Alternatively, you can fire by wire by applying a 9 VDC signal to the remote input terminals. Red is positive, and black is negative. The remote

input terminals are optically isolated from the high voltage output for safety.

In “Wire-fire only” mode, charging can only be restarted by turning the receiver off and back on. In all other modes, it can only be restarted by turning the transmitter off and back on.

- 4.1.11** When finished firing, power down the transmitter and then the receiver(s). If the receiver was flashing green, it is OK to disconnect its output wires immediately. If it was not green, wait at least one minute before disconnecting the output wires.

4.2 MAINTENANCE.

Since there are no calibration or tuning adjustments in the receiver, 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 1 flash per burst, or immediately if there are no flashes.

The face of the High Energy Trigger, which is 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 High Energy Trigger must never be immersed in water.

For prolonged storage or shipping, the batteries should be removed. The antenna can also be removed by unscrewing it.

If further information or service is required, contact:

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