

**BIG SHOTS® WIRELESS TRANSMITTER
AND RECEIVER**

OPERATION AND MAINTENANCE GUIDE

Artistry In Motion, Inc.

19411 Londelius Street

Northridge, CA 91324

818-994-7388

www.artistryinmotion.com

WARNING

The transmitter and receiver described in this manual is part of a system intended to remotely actuate the launch of confetti, streamers, or other visual special effects devices, and the components of this system have been carefully designed to minimize the possibility of accidental actuation of such devices. The design goal for this system 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 4.0. 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 confetti, streamers, and other visual special effects can be a 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 activities connected with the use, purchase, transportation, or employment of this product. User acknowledges that Artistry In Motion, Inc. 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 activities connected with the use, purchase, transportation, or employment of this product. User specifically agrees that Artistry In Motion, Inc., 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 Artistry In Motion, Inc. from same, whether brought by the user, user's agent, or assigns, or any third party.

This manual is divided into four sections. The first is a description of the Receiver system hardware. The Second is a description of the Transmitter system hardware. The third covers the recommended operating and maintenance procedures for both the Receiver and the Transmitter. Section four provides an overview of the design techniques used to reduce interference and the systems technical specifications.

1.0 RECEIVER HARDWARE DESCRIPTION.

The Big Shots® Wireless Receiver compact single-shot sequential UHF receiver is 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 Big Shots® Wireless Transmitter, a range of ½ mile (line of sight operation) has been demonstrated, provided there are no intervening conductive objects such as automobiles, chain link fences, etc. positioned between the transmitter and the receiver. Range increases, as the receiver is elevated above earth. The practical range for this system when used in a typical theater, arena, or stadium environment is 600 feet.

These devices should be tested at each site prior to use to check for adequate range in the intended installation.



1.0 THE ANTENNA.

A quarter-wave rigid antenna mounted to the top of the Big Shots® Wireless Receiver enclosure by a threaded connector receives the RF signal. The antenna may be removed for shipping, but should be installed prior to using this system. If this Antenna is lost or damaged it must be replaced prior to using the system.

For maximum range and reliability, the antenna must be positioned at least twenty-four (24) inches above the ground plane. Additionally, the antenna should not be surrounded by steel or wire mesh, both of which will reduce the effective range of the system. (The Big Shots® frame has been designed so as to not interfere with the wireless signal.) If the firing position of the Big Shots® cannons

requires that the antenna be positioned on or near the ground plane, or adjacent to metal or wire mesh, then the antenna should be replaced with our 6' antenna extension. (Under those circumstances, please call Artistry In Motion for technical support.) The Big Shots® Frame does not interfere with the function of this system.

1.01 THE POWER, ARM AND CHANNEL SWITCHES.

These toggle switches are located on the topside of the enclosure. The "POWER" switch turns on and off the battery power to the receiver electronics. The "ARM" switch has "Safe" and "Armed" positions. In the "Safe" position, the Big Shots ® Cannon cannot be fired. The "CHANNEL" switch allows the user to select either "CH A" or "CH B" as the operating channel for the receiver. This allows for two queues in the standard system. **It is recommended that the receiver always be powered up in "Safe" mode if a device is already connected to a cannon. The operator can then verify that the green "BATTERY" light does not indicate that any radio reception is occurring before arming the receiver.**

1.02 THE "BATTERY" INDICATOR.

While the power switch is on, this green indicator, located on the topside of the enclosure, will flash intermittently in bursts of one, two, or three flashes at a time if there is sufficient 12V battery voltage input to power the receiver. If no flashing occurs, the battery must be replaced or recharged before the receiver can be used reliably. Three flashes per burst indicate that the battery has full capacity; two flashes indicate that its capacity is beginning to diminish, and one flash indicates that it is near minimum charge, in which case it should be replaced or recharged immediately after the current use.

The green "BATTERY" indicator will light while a signal is being received that matches the selected digital address and system firing code. This feature is useful for warning of reception of firing signals before the arm switch is turned on.

1.03 CONNECTION TO THE BIG SHOTS® SOLENOID VALVE.

Connection to the Big Shots® solenoid valve is achieved through the three-pin connector located at the top of the enclosure. A dust cap protects this connector. The connector is keyed, so there is only one way to insert the plug into the receptacle. After insertion, the locking nut on the plug should be rotated clockwise 180 degrees to lock the plug into the receptacle.

1.04 THE POWER SOURCE.

All power is supplied from an internal 12VDC power source. The power source used is a sealed lead acid battery. This battery should only be recharged using the battery charger sold with this system. Using other battery charges could result in over charging the battery that could result in destruction of the Wireless Big Shots® Receiver.

Lead acid batteries slowly discharge over time. If the Big Shots® Wireless Receiver is not charged every six months, the batteries may fully discharge. If this were to occur, the battery may be damaged and require replacement. During extended periods of non-use, the Big Shots® Wireless Receiver needs to be recharged at least once each six-month period to prevent battery damage from excessive discharge.

The Big Shots® Wireless Receiver is equipped with a battery protection circuit which will disable the receiver any time the battery voltage drops below 10.5 volts. This circuit is designed to prevent the inadvertent total discharge of the battery.

1.05 Battery Charging.

To charge the battery, set the on/off switch to “Off” and the armed/safe switch to “Armed”. Unplug the connector attached to the Big Shots® solenoid, and using the same plug receptacle, plug in the connector from the Big Shots® Wireless Battery Charger. The Battery Charger is equipped with two lights, one is red and the other is green. When the Big Shots® Wireless Receiver battery is charging, the red light on the Battery Charger will be illuminated. When the battery is fully charged, the red light will turn off, and the green light will illuminate. A fully discharged battery will require approximately 8 hours to fully recharge. When using the Big Shots Wireless Battery Charger it is impossible to over charge the battery. The charger has a built in circuit to detect when the battery is fully charged. When attached to a fully charged battery, the charger shifts into a float charge so as not to damage the battery.

2.0 TRANSMITTER HARDWARE DESCRIPTION

The Big Shots® Wireless Transmitter is a low power two channel, safety locking, hand-held remote control transmitter with a range of 600 feet (line of sight operation) when used with the Big Shots® Wireless Receivers. 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 two channels are digitally encoded and amplitude modulated on a single carrier frequency of 418 MHz. No alignment or tuning procedures are ever required to maintain optimum performance. The modulated RF output occurs for one second or continuously while one of the two momentary transmit buttons is depressed, which ever is longer.



2.1 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 the antenna in place, as damage to the RF components could result.** Such operation will void the warranty.

Be careful not to over tighten 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 over tightened 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.

2.2 THE SAFETY LOCKING SWITCH

The Safety Locking Switch is a miniature cylindrical key lock with two positions, "Safe" and "Armed". In the "Safe" position no RF output occurs even if a button is pressed. In the "Armed" position modulated RF output occurs continuously while a button is pressed. Whether transmitting or not, a green warning indicator near the switch flashes whenever the switch is in its "Armed" 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 "Armed" and not transmitting. So this switch should always be turned to the "Safe" position while the transmitter is not being used. The key may only be removed from the switch in "Safe" position. Keys are interchangeable, as all Big Shots® Wireless Transmitters are keyed the same.

2.3 THE "ARMED" INDICATOR

This green lamp, located at the "Armed" position of the lock switch, warns 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.

When the transmitter is turned on (transmitter "Armed") with the key lock switch, the battery status is indicated by the flashing of the green lamp. It is of sufficiently high intensity to be visible in direct sunlight and will flash intermittently in bursts of one, two, or three flashes at a time if the battery has enough capacity to power the transmitter. If no flashing occurs, the battery must be replaced before the transmitter can be used reliably. Three flashes per burst indicate that the battery has full capacity; two flashes indicate that its capacity is beginning to diminish, and one flash indicates that it is near the end of its useful lifetime in which case it should be replaced immediately after the current use.

2.4 THE FIRE BUTTONS

These buttons are snap action dome switches under a sealed overlay, labeled “Fire CH A” and “Fire CH B”, respectively. They have a high spring constant which requires a firm depression for actuation, decreasing the likelihood of accidental depression.

The transmitter is idle while no buttons are pressed. Continuous transmission occurs while “Fire CH A” or “Fire CH B” is pressed

Output firing pulses are stretched to a minimum duration of 1 second to ensure that all cues fire reliably, even when the “Fire CH A” button is pressed for a shorter period of time. Note that it is not necessary to wait for the completion of the 1-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.

2.5 THE TRANSMIT INDICATOR.

This is a high intensity red indicator, visible in direct sunlight, which 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.

2.6 THE BATTERY.

Power is supplied from an alkaline 9-volt battery, accessible beneath a slide-out door on the backside of the transmitter. This battery should be replaced when required by conditions described in section 2.3 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.

3.0 OPERATION AND MAINTENANCE.

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

3.1 OPERATION.

3.1.1 PRE TEST: Before connecting the Big Shots® solenoid valve to the receiver perform a reception test by observing the receiver battery light while pressing the transmitter button. Be sure that the receiver is in the “Safe” mode, and select Channel A on the channel select switch. Turn the key on the Wireless Big Shots® Transmitter to “Armed” and press the “Fire CH A” button. The receiver battery light will illuminate a solid green when the transmit button is depressed. An assistant may be needed for this test. If the receiver location will be fixed, determine the limits of the range in the current environment, and position the transmitter and

receiver so that their separation does not exceed $\frac{3}{4}$ of this maximum range. Verify that the input voltage is adequate by observing the flashing green “BATTERY” and “ARMED” lights on the receiver and transmitter, respectively. Operation of these indicators is as described in section 1.3 above. Turn the transmitter lock switch back to “Safe” position, and turn off the receiver.

- 3.1.2 ARM:** Connect the Wireless Big Shots® Receiver connector to the Big Shots® solenoid valve plug as described in section 1.4 above. With the “ARM” switch turned off, turn on the receiver power switch. The red indicator should remain off. Check that the green “BATTERY” indicator is only flashing in bursts of one, two or three to indicate input voltage status. **If this indicator exhibits continuous or erratic behavior, there is a signal being received, which will cause firing when the “ARM” switch is turned on.** Determine the source of the interference before attempting to use the system.
- 3.1.3 CHECK:** Verify that the Big Shots® accumulator tank has not been pressurized and that the barrels have not been filled with confetti or streamers. Verify that the “Battery” indicator does not show reception of firing signals. Now, move the “ARM/SAFE” toggle from “SAFE” to “ARM”.
- 3.1.4 FIRE:** Turn the transmitter lock switch to its “Armed” position, and press the “FIRE CH A” button to actuate the receiver output. The “FIRE” and the “BATTERY” lights on the receiver should both light up red. You should hear the solenoid valve in the Big Shots® Cannon click as it opens and closes. If the “Fire” and “Battery” lights flash red, but you do not hear the solenoid click, you should verify that the solenoid plug is completely seated in the receiver receptacle, and that the solenoid is fully seated on the valve stem. Repeat this test until you are certain of the continuity of your system. When you are satisfied with the continuity of your system, return the transmitter and the receiver to the “SAFE” positions. You are now ready to fill the Big Shots® accumulator tank and load the confetti or streamers in the barrels.

Please note: The “Fire” buttons must be depressed for at least 100 milliseconds to produce a transmitter output. The transmitter should be held with the antenna in the same orientation as the Receiver Antenna, 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.

- 3.1.5 STORE:** When finished turn off the receiver “ON/OFF” switch to the “OFF” position and “ARM/SAFE” switch to the “SAFE” position. You also should turn the transmitter lock switch back to its “SAFE” position. These actions will stop further drain of the power sources. If the receiver is to be stored for a prolonged period, charge its batteries as described in section 1.5 above.

You may remove the transmitter and receiver antenna(s) to make it easier to store the units..

Be careful not to over tighten the transmitter 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 over tightened 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.

4.0 MAINTENANCE.

Since there are no calibration or tuning adjustments in the units, the only maintenance required is periodic replacement of the transmitter battery and the periodic charging of the receiver battery. The transmitter battery should be replaced at least once per year, or at the next opportunity if the battery indicator fails to flash at least twice per burst while transmitter power is switched on.

5.0 RADIO INTERFERENCE REDUCTION.

For safety reasons, the design goal for this equipment was 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 72-bit code repeatedly while a transmitter button is depressed. 70 of these 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 72-bit patterns must be identical before an actuation can occur. 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 a non-repetitive bit pattern for the internally programmed firing code that cannot produce a match in the receiver if a synchronization error occurs (as can occur with a "0101010101" pattern, for example), and by selection of 418 MHz as the operating frequency. This frequency is sparsely used, and when utilized it is used only by low power transmitters with a maximum range of approximately 100 yards. Auto security systems, garage door openers, radio control models, cordless or cellular telephones, wireless microphones, or two-way communications equipment does not commonly use 418 MHz. Because this system operates in the UHF region, interference from lamp dimmers, electrical discharges, and other natural sources is also minimal.

The technology in this system has been tested and used extensively since its introduction in 1999 in public fireworks displays, commercial blasting, theatrical and movie special effects, and amateur rocket launches, and no instances of false triggering have ever been reported to date.

4.1 SPECIFICATIONS.

| Parameter | Minimum | Typical | Maximum |
|-----------------------------------------------------|---------|----------------|----------|
| Carrier Frequency, MHz. | 417.96 | 418.02 | 418.08 |
| Range | | | 600 feet |
| Delay from start of transmission to receiver output | | | 75 msec |
| Input power drain, (Rcvr switch on) | | 8 mA | 9 mA |
| Input power drain, (Rcvr switch off) | | | 0 mA |
| Receiver Supply Voltage | 10.1 V | | |
| Low Supply Detect Threshold | | 11.3 V | |
| Supply Input Voltage | 10.1 V | 12 V | 13.0 V |
| Output Fire Pulse Duration | 1 sec | | |
| Output Fire Current, (Armed) | | | 5 amp |
| Output Fire Current, (Safe) | | | 200 uamp |
| Height of box | | 2.00 in | |
| Width of box | | 3.00 in | |
| Length of box | | 6.00 in | |
| Weight of receiver + bracket | | 1 lb. 14.4 oz. | |

If further information or service is required, contact:

Artistry In Motion, Inc.
 19411 Londelius Street
 Northridge, CA 91324
 818.994.7388