HOLATRON

OPERATION & MAINTENANCE GUIDE - *RFLS-CD2* Double Detonator

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WARNING

Holatron Systems specializes in the design and manufacture of standard and custom electronic control systems where reliability and safety are critical. The device described in this manual is intended to remotely detonate pyrotechnic or other hazardous items connected by electrical cable to its output terminals by application of hazardous high voltage pulses to those terminals. Be aware that there is danger of personal injury or death not only from the detonation of the connected devices, but also from electrical shock if this device's output is in contact with a person at the moment of actuation. Therefore, **it is important that the user not turn on and charge the detonator until all persons who might be harmed by accidental detonation are in a safe area and no one is in contact with the output terminals or cable**.

As a condition of purchase, the user must acknowledge awareness and agreement that utilization of this product and participation in activities utilizing pyrotechnics, 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 three sections. The first is a description of the system hardware. The second is a list of specifications, and the third describes the recommended operating and maintenance procedures.

1.0 HARDWARE DESCRIPTION.

The model RFLS-CD2 Double Detonator is a dual output capacitor discharge hand-held firing module which is triggered by three buttons on its top panel. Before the outputs can be triggered (fired), their corresponding capacitors must be charged. Charging is initiated by a separate pair of buttons in the middle of the top panel. Before charging can be initiated, the module must be turned on by momentarily pressing its Pwr / Test button, also on the top panel. Power is turned off by pressing the Pwr / Test button and holding it down for at least 1.5 seconds. The capacitors automatically discharge while power is off. **NOTE that discharge will not occur if the 9V battery is removed.** A power-off period of at least 45 seconds is required to discharge the capacitors from a maximum 5 joule level to a safe level that poses no danger of accidental detonation or electric shock. Lower energy levels require proportionally less discharge time.

An internal timer automatically turns off the module if 45 minutes elapses without a button press. This prevents excessive battery discharge and possible leakage if the module is mistakenly stored without turning it off.

A pair of red indicators immediately below the Fire buttons light dimly if their respective capacitors are charged but not yet at the full charge level. The indicators light brightly when full charge is attained or maintained. Once charging is initiated on an output, its capacitor charge is maintained until its output is fired or until power is turned off.

A 16 position digital switch inside the bottom of the module is used to select one of sixteen optional output energy levels. Switch position assignments are shown in the table in section 1.6. This switch is accessible through a hole in the bottom of the module, and it has been initially set to position “F” at the factory for selection of maximum energy level (5 joules per output) generated by 316V DC pulses. The charge time to maximum energy level is only 4 seconds. Note that charging is even faster when lower energy levels are selected.

This module also has built-in output continuity checking (galvanometer function) which is activated by a momentary (less than one second) press of the Pwr / Test button. This function tests both output circuits by attempting to momentarily drive a small current (less than one milliamp) through the devices connected to their terminals. Green indicators immediately underneath the Chg buttons light for two seconds if successful connections are detected. This function can be safely activated regardless of the charge level of the capacitors.

A yellow indicator immediately under the Pwr / Test button will flash to indicate the charge level of the battery. See section 1.1 for a description of the meaning of its flashing pattern.

Detailed hardware description (refer to photos):

1.1 THE “BATTERY” INDICATOR.

While power is on, this yellow indicator, located just underneath the Pwr / Test button, flashes intermittently in bursts of one, two, or three flashes at a time if the battery has enough capacity to power the module. If no flashing occurs, the battery will need to be replaced before the module 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. Adequate detonator power is available as long as the battery voltage is above approximately 7.5 volts, but the battery voltage will drop rapidly at this point. While this additional time should be adequate to complete the current operation, it is not absolutely predictable, and so the battery should be replaced at the very next opportunity.

This indicator will also light while the Pwr / Test button is being pressed, and it will go out when the 1.5 second minimum power-down period has elapsed to indicate that module power will turn off when the button is released.

1.2 THE “TEST” INDICATORS.

These indicators, located just underneath the Chg buttons, light green for 2 seconds when continuity is detected on their respective output terminals. This test uses one milliampere currents to perform galvanometer functions that verify continuity through the devices connected to their outputs, ensuring that a successful firing will occur when the module is fired. The test currents are well below the minimum fire current of electrically actuated devices, and they are only applied during the 2 second test period which is initiated by momentary depression (less than one second) of the Pwr / Test button. The test can be performed safely in both the charged and discharged capacitor states.

1.3 THE “CHARGE” INDICATORS.

These indicators, located just underneath the Fire buttons, light bright red for the outputs that have reached and are maintained at full charge for the energy level selected by the digital switch. They are dim for outputs that are charged to a level lower than full charge. They are dark for outputs with zero charge.

1.4 THE OUTPUT CONNECTORS.

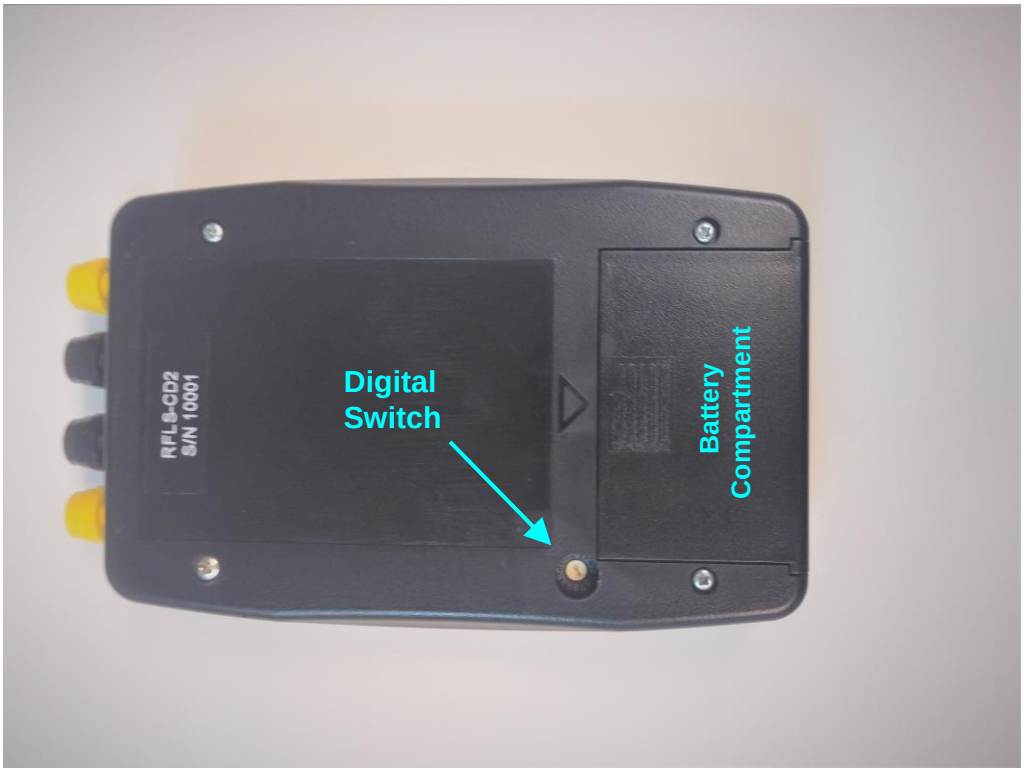
The devices to be fired are connected between the yellow (+) and black (-) “PyroClip” spring terminals located at the end of the module. There are two pairs of terminals, one labeled “1” and the other labeled “2” for outputs 1 and 2, respectively. The outputs are internally shunted when testing or firing is not occurring.

CAUTION: The pulses applied to these terminals may be as high as 316 volts when the output is fired. This will result in a painful, and possibly lethal, electric shock to a person touching these terminals or the connected cables at the moment they are fired. BE CAREFUL! Do not touch them unless the module power has been off for at least 45 seconds.

NOTE that discharge will not occur if the 9V battery is removed.

1.5 THE BATTERY.

Power is supplied from a 9V alkaline (not lithium) battery contained in a compartment in the bottom of the module as shown below:



The battery should be replaced when required by conditions described in section 1.1 above. Be careful to observe the positive and negative polarity markings in the battery compartment when installing the battery. In order to prevent damage to the module from battery leakage, the battery should be removed before storing the module for long periods of time. To prevent battery depletion and resulting leakage, be sure the power is turned off when the module is not being used.

An internal timer automatically turns off the module if 45 minutes elapses without a button press. This prevents excessive battery discharge and possible leakage if the module is mistakenly stored without turning it off.

1.6 THE DIGITAL SWITCH.

A 16 position digital switch inside the bottom of the module is used to select one of sixteen optional output energy levels. Switch position assignments are shown in the following table. This switch is accessible through a hole in the bottom of the module as shown in section 1.5 above, and it has been initially set to position "F" at the factory for selection of maximum energy level (4.99 joules per output) generated by 316 VDC pulses.

Switch Position	Output Energy / Max Voltage
0	0.17 joules / 58 volts
1	0.31 joules / 79 volts
2	0.51 joules / 101 volts
3	0.97 joules / 139 volts
4	1.28 joules / 160 volts
5	1.62 joules / 180 volts
6	2.25 joules / 212 volts
7	2.55 joules / 226 volts
8	2.88 joules / 240 volts
9	3.20 joules / 253 volts
A	3.51 joules / 265 volts
B	3.84 joules / 277 volts
C	4.15 joules / 288 volts
D	4.47 joules / 299 volts
E	4.81 joules / 310 volts
F	4.99 joules / 316 volts

(Factory setting shown in yellow)

1.7 THE "Pwr / Test" BUTTON.

Power is turned on by momentarily pressing this button, located in the center of the top panel. Power is turned off by pressing this button and holding it down for at least 1.5 seconds. The capacitors automatically discharge while power is turned off. A power-off period of at least 45 seconds is required to discharge the capacitors from a maximum 5 joule level to a safe level that poses no danger of accidental detonation or electric shock. **NOTE that discharge will not occur if the 9V battery is removed.**

An internal timer automatically turns off the module if 45 minutes elapses without a button press. This prevents excessive battery discharge and possible leakage if the module is mistakenly stored without turning it off.

A momentary (less than one second) press of this button button also activates built-in output continuity checking (galvanometer function) which tests both output circuits by attempting to momentarily drive small currents (less than one milliamp) through the devices connected to their terminals. Green indicators immediately underneath the Chg buttons light for two seconds if successful connections are detected. This function can be safely activated regardless of the charge level of the capacitors.

1.8 THE “Chg” BUTTONS.

These buttons, located on the left and right sides of the middle button row, initiate capacitor charging for their respective outputs. The left button charges output 1, and the right button charges output 2. Charging from zero to maximum (5 joule) energy level is complete in 4 seconds. Lower energy levels require less time. Pressing both buttons together will initiate simultaneous charging of the two outputs.

1.9 THE “Fire” BUTTONS.

These buttons, located in the top button row, cause the capacitors to dump their charges to the outputs corresponding to the pressed button. The left button fires output 1, and the right button fires output 2. The center button, labeled “Fire 1&2”, fires both outputs simultaneously. Charge maintenance of an output capacitor ceases when it is fired, and its capacitor will not resume charging until its Chg button is again pressed. If some small residual charge remains on a capacitor after firing, its red charge indicator will glow dimly.

2.0 SPECIFICATIONS.

Parameter	Minimum	Typical	Maximum
Delay from fire button to fire output		15 msec	
Charge-up time from zero to max energy level			4 sec
Power-off discharge time from max energy to safe level			45 seconds
Battery drain, not charging Battery drain per output, maintaining 0.17 joules Battery drain per output, maintaining 4.99 joules Battery drain per output, while charging		5 mA 20 mA 40 mA 300 mA	
Continuous battery life, not charging Battery life, maintaining 0.17 joules on 1 output Battery life, maintaining 4.99 joules on 1 output Battery life, maintaining 0.17 joules on 2 outputs Battery life, maintaining 4.99 joules on 2 outputs		7 days 5 days 3 days 3 days 2 days	
Button inactivity automatic power-down period		45 minutes	
Low Battery Detect Threshold		7.6 V	
Battery Input Voltage	7.5 V	9 V	10 V
Output Fire Voltage (selected)	58 V		316 V
Output Fire Energy (selected)	0.17 joules		4.99 joules
Output Test Current (for 2 seconds)			1 mA

3.0 OPERATION AND MAINTENANCE.

This section describes the recommended operating procedure and maintenance for the Double Detonator module.

3.1 OPERATION.

3.1.1 With the 9V battery installed and the module turned off for at least 45 seconds to ensure complete capacitor discharge, connect the devices to be fired to the module's output terminals.

3.1.2 Turn the module on by pressing the Pwr / Test button momentarily (less than one second).

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3.1.3 Verify that the flashing yellow light indicates that the 9V battery has sufficient energy to run the module..

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3.1.4 Verify that the devices to be fired are successfully connected to the output terminals by momentarily pressing the Pwr / Test button to initiate output continuity checking. Outputs that are connected will be indicated by green lights for two seconds.

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3.1.5 Initiate the charge function by momentarily pressing the Chg buttons for the outputs to be fired. Full charge is achieved within 4 seconds for 5 joules energy level or less for lower energy levels. Full charge is indicated by a bright red light.

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3.1.6 Once full charge is indicated, fire the desired output by pressing its Fire button. Both outputs may be fired simultaneously by pressing the BTH button in the center of the top row..

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3.1.7 If an output needs to be refired, it must be charged again before firing.

3.1.8 Turn off the module by pressing the Pwr / Test button for at least 1.5 seconds or until the yellow indicator goes out. Power will go off when the button is released, and capacitor discharging will begin. It will take 45 seconds to discharge the capacitors to a safe level. It is best to wait until discharging is complete before handling the connected cables or output connectors, although the output terminals are internally shunted and no voltage is present on them when not firing or testing. **NOTE that discharge will not occur if the 9V battery is removed.**

3.1.9 Disconnect the cables from the output terminals.

3.2 MAINTENANCE.

The case should never be opened, as no user serviceable parts are inside, and reassembly is a very difficult process that is likely to result in damage to the electronics, voiding the warranty.

The only maintanance required is periodic replacement of the 9V alkaline battery. It should be replaced at least once a year, or at the next opportunity if the battery level indication is flashing 1 flash per burst, or immediately if there are no flashes. The battery should be removed during long-term storage. Use only an alkaline battery. Never use a lithium 9V battery as that cannot deliver sufficient instaneous current.

The face of the Double Detonator, which is sealed, may be safely cleaned by wiping with a damp cloth. The battery compartment door, digital switch access hole, and the junction between the front and back panels are not water tight. So the Double Detonator must never be immersed in water. Protection from dust and moisture is enhanced if a piece of transparent tape is kept over the digital switch access hole.

If further information or service is required, contact:

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