LASERBLAST

FUNBLAST

Installation and Users Guide

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Warranty and Warnings

T he standard LaserBlast warranty includes all parts and labor for a period of one year from the date of delivery. Shipment to Advanced Avionics, Inc. is the responsibility of the customer. Advanced Avionics will pay for return shipment in the same manner as the item was shipped to Advanced Avionics. Damage due to excessive abuse is not covered. Examples of such abuse include but are not limited to:

- Pinched wires, cut wires, or broken speakers that result from unauthorized opening of the phaser covers.
- Coiled cords damaged from the vest strap being disconnected or cut from the phaser.
- Battery cables being ripped apart due to not pushing on the release knob on the battery cable on the back of the vest and on the chargers.
- Batteries being dropped on the floor
- Batteries being carried by the connector or wires and not by the body of the battery.

DANGER

LASER RADIATION--AVOID DIRECT EYE EXPOSURE

CLASS IIIa LASER PRODUCT

Laser Safety
LaserBlast products comply with CDRH 1040.10 and CDRH 1040.11 regulations governing laser product safety. Do not allow anyone to purposely stare into the laser beam.

FCC Compliance
Contains FCC ID: OUR-XBEEPRO.   The FunBlast system complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(i.) this device may not cause harmful interference and

(ii.) this device must accept any interference received, including interference that may cause undesired operation.

⚠WARNING

RF Exposure
To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended.

Battery Safety
Please read and follow the following handling instructions. Improper use of the batteries may cause heat, fire, explosion, damage, or capacity deterioration of the battery.

⚠DANGER

1. Do not let leaked electrolyte come into contact with the eyes or skin.
   In such a case, immediately wash the area of contact with clean water and seek help from a doctor. If not treated quickly, prolonged contact may cause serious injury.

2. Do not put the battery into a fire. Do not use it or leave it in a place near fire, heaters, or high temperature sources.
   In such a case, the insulator in the battery may be melted, the safety vent and structure may be damaged, or the electrolyte may catch fire, all of which may cause heat generation, explosion, or fire.

3. Do not use, charge, or leave the battery near fire or in a car under the blazing sun.
   Such a high temperature may cause damage of the protecting device in the battery, which may result in an abnormal chemical reaction, and then heat generation, explosion, or fire.

4. Do not charge the batteries with any charger other than the Advanced Avionics, Inc. LaserBlast charger. Use of any other charger may cause heat generation, explosion, or fire.

5. Do not throw or drop the battery.
   Strong impact may damage the protecting device, which may cause an abnormal chemical reaction and result in heat generation, explosion, or fire.

6. Do not disassemble or alter the battery.
   The battery employs a safety mechanism and a protecting device in order to avoid any danger. If these are damaged, heat, explosion or fire may be caused.

WARNING

1. Do not use the battery in other than the following conditions; otherwise, the battery might cause heat generation, damage, or deterioration of its performance.

Operating environment;
When the battery is charged: 0ºC +40ºC (32°F - 102°F)
When the battery is discharged: -10ºC +60ºC (14°F- 40°F)

When stored less than a month: -20ºC +50ºC (-4°F - 122°F)
     When charged 50%
When stored more than a month: -20ºC — +35ºC (-4°F - 95°F)
     When charged 50%

⚠NOTICE

1. Read the instructions of your equipment regarding the battery installation and removal from the equipment so as not to mishandle and waste the battery.

2. Despite being rechargeable, the battery has a limited life span. Replace when usage time between charges becomes short.

3. Nicad, NiMH and Li-Ion batteries should be recycled. Be environmentally conscious - do NOT throw these batteries in the trash.
   If you don't know where your local recycling facility is, call the Portable Rechargeable Battery Association at 1-800-822-8837. They will provide you with the address of the recycling center nearest to you

WARNING! DO NOT DROP BATTERY!
May Cause Damage

DO NOT hold the battery by the connector.
DO push the release button to remove battery.
DO NOT pull the battery off the vest or charger.

Battery Charger Safety

Safe operation of the battery charger requires following these instructions:

- Do not put anything on top of a battery charger.

- Allow a 2" space at the rear of the charger for airflow to release heat..

- Only connect Advanced Avionics Inc. Laser Blast batteries – NEVER anything else.

- Always push release button to remove batteries from charger.

- If charger or battery wires are damaged or frayed, discontinue use immediately and call Advanced Avionics for service.

Caring for the FunBlast System

The FunBlast system was designed to require an absolute minimum of care and maintenance. The following is recommended:

✛ Clean the outside of the plastics once every 6 months with Windex for the best IR info exchange. A light spray and wipe down keeps the range up on the vests.

✛ Check the chest, back, and shoulder plastics for loose screws every 2 weeks. The equipment is used in a very rough environment and the screws become loose, even with lock washers installed. Tightening or replacing a missing screw prevents equipment failure.

✛ Clean off the dust and dirt once every 3 months where you keep the battery chargers. Blow off any dust on the cooling fan of the battery charger.

✛ When not in use clip, the phaser to the vest drop strap clip.

Chapter

2

Installation of the FunBlast Hardware

The FunBlast system was designed to require no specialized installation.

Unpacking

UNPACKING

Unpack the LaserBlast System.

The following items should be included:

1. The correct number of vests
2. The correct number of batteries
3. The FunBlast controller
4. Battery Charger
5. Referee Phaser
6. Thermal Receipt Printer
7. Parallel printer cable
8. DC wall mounted power supply
9. 1 extra roll of Thermal Receipt Paper
10. BetaBrite Scrolling LED sign
11. Telephone cable to connect to the BetaBrite sign.

Connection Diagram

The following block diagram shows the names of the pieces and the types of cables that connect them.

BetaBrite Power Supply

Epson Thermal Printer Power Supply

BetaBrite Scrolling LED Sign

Epson Thermal Printer

6 conductor telephone wire RS232 Cable

IBM 25 pin to 36 pin Centronics Printer Cable

Wall Mounted Controller Power Supply

LCD

ON/OFF SWITCH

4 PUSH BUTTONS
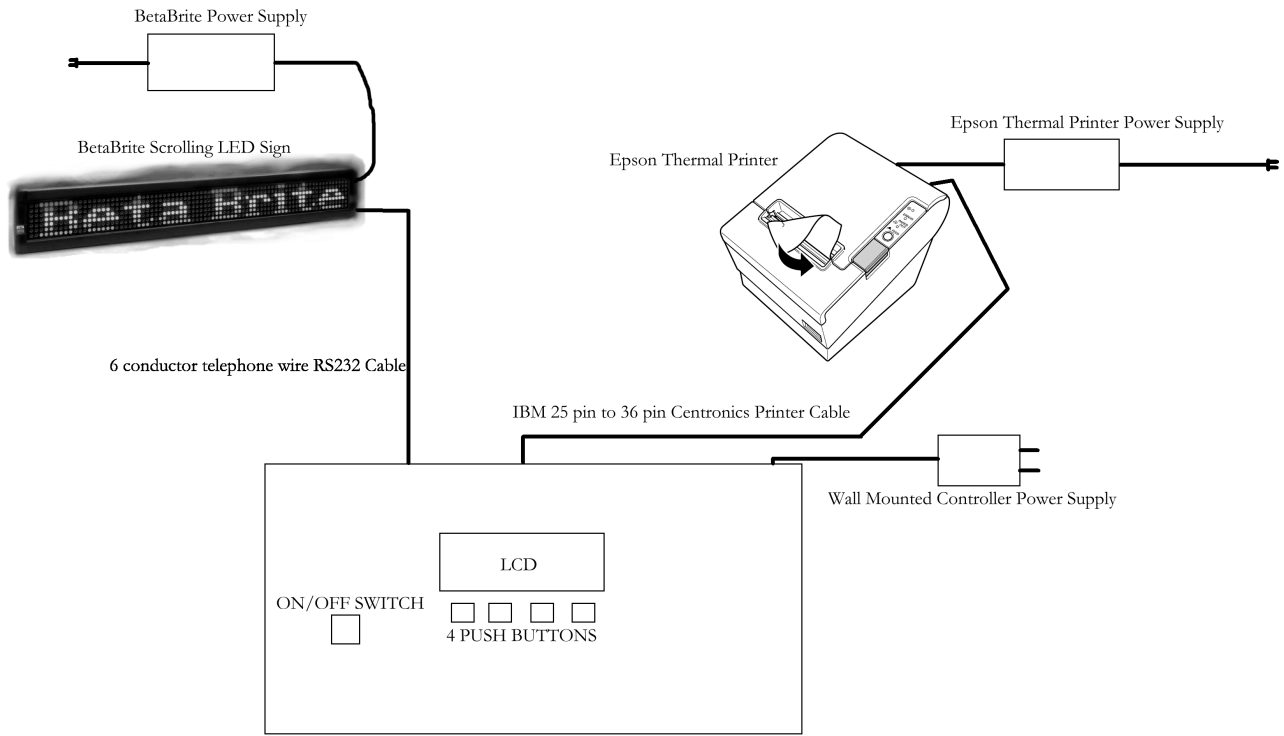
BASICBLAST CONTROLLER AND RADIO BASE STATION

Simply plug the cables into the locations shown above, turn the printer and controller on, and you are good to go.

Game Play using the FunBlast System

This section of the manual describes the basic operation of the FunBlast system and everything you need to know to start and stop games, and print score sheets.

The Terminators

T E R M I N A T O R S

The FunBlast System is provided with referee terminator devices. These devices serve 2 functions when the system is in **IDLE Mode**, and 2 different functions when the system is in **Playing Game Mode**. The functions are selected by either placing your hand under the reflective sensor in the front of the phaser, or not.

Functions of "The Terminator"

	Hand on Sensor	**No Hand on Sensor**
IDLE Mode	Aim directly at shoulders and hold for 3 seconds to start a default 15 minute game. This is useful if you have a power failure .	No Action
Playing Game Mode	Aim at any sensor, and the player will get a 40 second penalty. If you want to terminate the player, aim the terminator at their PHASER sensors during the 40-second penalty and pull the trigger without your hand on the sensor.	This causes a vest to be "Stunned". It is a warning shot that causes the player to be out for the "Stun Time". (Set by the computer).

7 EASY STEPS TO PLAYING A GAME

To play a game with the FunBlast System following these steps:

1. Plug a battery into each vest and place it into the pouch.

2. Provide instructions to the players, and push the "START" button on the controller.

3. Monitor the game play for rules violations.

4. When the game is over, assist players with hanging up their vests.

5. The score sheets will print automatically (if enabled), or click on "PRINT" if automatic printing is not enabled.

That's all you have to do to play games with the FunBlast System.

Low Battery Indicators

There are two ways to tell that the batteries are running low and need to be charged. The first way is by observing a bright yellow and red non-blinking LED on each shoulder. This means that the battery is low and will probably go dead within about 20 minutes.

The second way to tell is by looking at the back of the LCD on the phaser. It will display the battery voltage during operation. If a battery is less than about 7.1 volts, it will need to be recharged very soon.

In order to get the best life out of your batteries, please remove the battery from the vest when either of these low battery indicators show that the battery needs to be recharged.

The Points

The FunBlast system has a fixed point system, depending on where you tag your opponent.

Chest – 200 Points

Back – 100 Points

Shoulder – 50 Points

Phaser – 50 Points

If you tag someone on your own team during a Team game, you will lose 20% of the points listed above.

The Software Bells and Whistles

MAIN MENU

Press any button to reach the Main Menu. From here:

Start – Starts the game using the stored settings

Options – Allows you to go to other menus and set options

Print – Prints all of the scoresheets if a game has been finished.

- This will display the number of vests that are turned on and are communicating with the controller. If you press this button, the controller will display the vest # if the vest is communicating with the base station. This allows you to make sure that you have batteries installed in the vests you think you do.

GAME IN PROGRESS MENU

This menu lets you select from the following:

- Restart – The vests will turn themselves off after 3 minutes if nobody pulls the trigger to join a game. If you want to add a new player or restart a players vest after the 3 minute shutdown, simply push this button. The purpose of the 3 minute shutdown is so that you can get the next group of players all vested and ready to play as soon as the previous group is finished. It also keeps people from goofing around with the vests while another game is in progress.

- Abort – Aborts a game.

OPTIONS MENU

This menu lets you select from the following:

- Game Settings – Adjusts everything about the type of game

- Print Settings – Adjusts everything about the printer

- Radio Channel – Tells the controller to pick a new radio channel

Use the "Down", "Up", "Select" or "Back" buttons to make your selection.

GAME SETTINGS MENU

From this menu you can adjust the following:

- ❑ Game Time. This is the length of the game (in minutes). Valid game times are 1 to 60 minutes. You cannot change the game time once you have started the vests, unless you abort the game.

- ❑ Deacivate Time. This is the number of seconds that the vest will be unable to fire when you have been deactivated by being tagged by another player.

- ❑ Photons/Shields. The phaser is equipped with a wide angle IR emitter in the front that is capable of tagging anything within 20 feet and within a 45-degree angle. This is called a "Photon" and is activated by tapping the option button on the chest. You can control how many photons are allowed per game using this setting. Recommended: 2 to 5. The same button will activate a shield if you hold the button for 1 second. many shields you are allowed. When the shields are activated, the chest and back LED's spin very fast and the player can fire, but can't be tagged. Shields last 8 seconds. Recommended: 3 shields.

- ❑ Rapid Fire. This feature allows you to fire continuously without having to release and pull the trigger every shot.

- ❑ Heat Sensor. If this feature is enabled, the player must hold the phaser with 2 hands, or it will not fire and will honk at them. It will also say "USE TWO HANDS" on the back of the LCD. This feature reduces the likelihood of injury by discouraging people from swinging their phaser. Recommended: Always leave this on.

- ❑ Solo or Team. The only difference between these basic game types is whether or not your score is penalized for hitting other people with the same color. Some players manage to get negative scores by hitting their own team's color. If you don't want negative scores, you can either always run Solo Play. If you are playing a Team game and tag someone on your own team, the system will deduct 20% of the points that you normally get if you tagged the other team's player.

PRINT SETTINGS MENU

- ❑ AutoPrint. If this feature is checked, the score sheets will be printed automatically when the game time is over. If this feature is not checked, then you have to manually select "Print" after each game.

- ❑ Print Totalizer. This button will print a games receipt to help you manage your cash. The system keeps track of how many plays were played since the last time this "Print Totalizer" button was pushed. Each time the button is pushed, the system goes to the next receipt number so that an owner can tell if somebody printed a receipt and threw it away and pocketed the money. An owner should make sure

that there are no missing receipts. The Totalizer receipt prints the number of plays since the last receipt, as well as the total number of plays since the system was manufacytured.

RADIO CHANNEL MENU

If you select this item, you will be prompted to confirm that you want the FunBlast controller to check all 12 possible radio channels, looking for the one with the least interference. This takes about 15 seconds to complete.

When you first turn on a vest, it will try to connect to the base station using the same channel it did last time. If it cannot connect to the base station, it will try all 12 channels, one channel every 2.5 seconds.

If you are changing the radio channel, you may have to turn the FunBlast controller off, and then unplug all the vests and plug them back in. This will make sure the vests are searching through their list of channels looking for the controller. Once all the vests are searching. you can turn the controller back on and the vests will stop searching at the correct new channel.

The FunBlast system uses a radio modem in the 2.4 Ghz band. This same band is also used for Wifi, and some wireless cameras, baby monitors, and other devices. Most of these devices only use some of the 12 available channels, leaving the FunBlast controller able to find an empty channel automatically.

Trouble Shooting and System Repair

HARDWARE TROUBLESHOOTING

There are several diagnostic features built into the FunBlast system to assist with inevitable repairs. Most of the problems that come up with LaserBlast vests and phasers are actually caused by one of the following:

1) A connector has been jarred loose.

2) A cable has a broken wire.

3) A wire has been pinched in the phaser or chest.

4) The LCD glass is cracked or broken.

These 4 problems account for the majority of the required repairs. Many problems can be corrected by doing a very careful visual inspection of all of the connectors to make sure they are fully seated. Also, carefully examine the wires to see if they have been pinched between the phaser plastic halves.

To test the 3 ribbon cables in the vest, you should keep a spare ribbon cable that you know is good so that you can replace a suspicious cable. To temporarily verify whether a vest ribbon cable is good or bad, remove the chest cover, and either the back, or shoulder cover. Disconnect the suspicious ribbon cable, but leave it in the vest. Connect the known good ribbon cable on the outside of the vest, making sure to pay attention to the red stripe (pin 1) orientation. If the problem goes away, you can tape the new ribbon cable to the old one, and pull it through the vest fabric.

This section of the manual contains a list of symptoms and their suggested repairs.

NO LCD SCREEN

OR DIM LCD

1. Check that the LCD cable is plugged in correctly and completely.
2. Check that the cable has no damage or pinched areas on the cable.
3. Check that the Coiled Cord is plugged in on the chest and the phaser.
4. Check that the LCD is not cracked.
5. Check that the Speaker and LCD are in their plastic cradles and not moving around causing shorting to each other.
6. Check that the solder joints on the LCD connector board are good (excessive vibrations can crack them).

7. If none of these work, replace the LCD assembly.

1. Unplug and plug the battery to the vest. If the battery connector is bounced just right, the LCD powers up with all squares.
2. Check that the LCD cable is not damaged.
3. Check that the solder joints on LCD connector board are good.
4. The main IC on the phaser may have been damaged. Unsolder and replace the main phaser processor. A LaserBlast technician needs to do this repair because the chip needs to be reprogrammed.

The LCD will say "VEST RESET" every time when it loses battery power while a game is being played. This can occur because the battery is fully discharged, or it can also happen if a wire is broken somewhere along the path between the battery and the phaser. It can also happen if there is some metal-to-metal short somewhere in the vest, such as a speaker bouncing around (not in its cradle), or an LCD bouncing around (not in its cradle). In order to get the vest ready to play a new game (without keeping the previous game scores), you need to start the vest using the referee unit, and then terminate the game.

If you have determined that the "VEST RESET" message is not the result of simply a discharged battery during a game, follow these steps to isolate the cause.

1. Check that the Coiled Cord is completely plugged in on both sides of the cable. The white part of the connector should be fully plugged in. It is not too uncommon for the connector to get pulled loose a little bit. You can tighten the strain relief nut as tight as you can with your bare hands. Do not torque strain relief nut with a wrench, because it will dent the curly cord and cause premature failure. We glue the connectors to the chest circuit board to make it more difficult to tug the connector loose.
2. Wiggle all the cables that carry the battery power to the phaser. This includes the battery cable itself, the power cable leading to the back circuit board, the 10 pin ribbon cable going from the back circuit board to the chest circuit board, and lastly, the curly cord going to the phaser. Gently flex each cable about every 1 inch, looking to see if the phaser power gets interrupted. Make sure that both sides of the ribbon cable are firmly seated.
3. Check to see if any of the crimp pins on the curly cords have become loose. You can do this by wiggling each wire near the connector.
4. Check that the shoulder lights on both shoulders are blinking. If one of the shoulders lights are not blinking the chest to shoulder cable could be broken.
5. Check that all sensors on the boards have good solder joints and that no sensor is broken or has a broken leg. If a solder joint is broken or leg broken you can bridge it with solder, or replace the sensor.

1. Check that the crimp connecting the laser wire to the connector is not broken. You can wiggle the wire, while firing the laser, and see if the laser begins working. The crimp pin may need to be recrimped or soldered.
2. Check that the wire on the laser is not broken or pinched. May need to cut out and resolder wire.
3. If the above does not fix the problem, the laser is probably blown. Replace the IR/Laser assembly.

Laser Diodes have delicate mirrored surfaces that make up their optical cavity. If the laser diode receives a static discharge, or a power spike, the mirror surfaces can be cracked. This causes the laser to put out about 10% of the light that it normally would. Replace the IR/Laser assembly.

NO LEDS ON BACK

1. Check that the chest chip is in the socket firmly.
2. Check that the chest to back cable is plugged in properly and completely.
3. Unplug the phaser and the 2 shoulders from the chest. If there is a short or other failed component on these 3 boards, the resettable fuse in the back will be tripped and prevent any LEDS from coming on.
4. If the chest LEDs are working properly, replace the chest to back cable.

ONLY 1 LED LIT ON CHEST

1. Check to see if the trigger switch has popped out over the trigger actuator.
2. If it has, remove the 2 screws holding the trigger and reinstall the trigger so that the trigger actuator holds the trigger switch down when not pulled. The proper orientation is shown in the photo below.
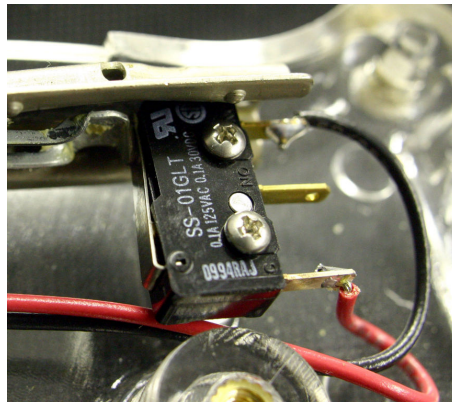
PHASER ONLY SHOOTS 1 SHOT PER SECOND

The phaser updates the LCD display every time a shot is taken. If the LCD is broken, or not working properly, the phaser has to wait for a timeout when it tries to write data to the LCD. This causes the phaser to fire a little slower than usual.

1. Check that LCD is plugged in completely.
2. Trigger may be sticking due to dirt or debris that a customer stuffed in the phaser.

NO YELLOW LIGHT ON CHEST

1. Micro on chest may have taken a static hit; you can try a micro from another vest to see if the vest works with the other micro. If so, then replace the chest micro.

NO LEDS COME ON AT ALL

1. Check that all cables on vest are plugged in completely and correctly.
2. If you are in a game, check that the game setting is not on Stealth.

LEDS ON CHEST BLINK BRIEFLY THEN GO OUT

1. Check that all cables on vest are plugged in completely and correctly.
2. If you are in a game, check that the game setting is not on Stealth.

PHASER LEDS ARE NOT LIT

1. Use a voltmeter and make sure that pin 1 of the main micro reads between 4.5 and 5.2 volts. If not, find out if the 7805 regulator has battery input on one leg and 5 volts on the other leg, with ground in the middle.
2. There could be a short somewhere else in the vest or phaser causing the resettable fuse in the back to not let any current through. You can unplug the shoulder cables in the chest to eliminate the shoulders and shoulder cables.

LEDS ON CHEST SHOULDER, AND BACK NEVER BLINK

1. Check the chest to shoulder cable(s).
2. Check the socketed chest chip, swap with another vest.
3. The crystal on the chest could have failed. Unsolder and replace the crystal.

SHOULDER LOW BATTERY INDICATOR STUCK ON

1. Try another battery you know is charged-- you may have a low battery.
2. Check the chest to shoulder cable for damaged wires.
3. Check the shoulder board for an open or a short on the board.
4. The low battery IC or the Low battery LED may be broken, unsolder and replace the low battery IC.

GAME WON'T START ON THIS VEST ONLY

1. Inspect the chest to shoulder cable for damage and make sure they are plugged in completely and correctly.
2. Check the shoulder boards for shorts or open solder joints.
3. Check that the Coiled cord wires are not broken and are plugged in completely.
4. Check the solder joints on the Shoulder boards on the sensors, and or voltage across the sensor- it should be 4.85-5 volts.
5. The U4 chip may be blown. Unsolder and replace, or replace the entire shoulder circuit board.

GAME STARTS SLOW

1. Make sure that the shoulders are not covered by long hair (this will slow down communication by blocking the sensors on the shoulders)
2. Check the chest /shoulder cable for any damage. Make sure the ribbon cables are secured.
3. Check the voltage on the shoulder sensors 4.85-5V. May need to replaced sensor.

GAME ENDS TOO EARLY

1. Up to 10 seconds early is a normal variation in crystal tolerances between vests.
2. The most likely cause of a vest ending early by more than 10 seconds is that the vest was started early, or was not in "Waiting for Game" mode when the game was started. It is very easy to get confused and let the vests get "out of sync" with the computer and the scanner.

VEST WON'T SCAN IN

1. Make sure that shoulders aren't being blocked by a very dirty plastic cover or by long hair covering sensors.
2. Inspect the Chest to shoulder cable for kinks, and unplugged connectors.
3. Check the voltage and the solder joints on the shoulder sensors as in "No start game."
4. Check that the IR tube opening at the end of the phaser is not blocked or partially blocked.
5. Check that the crimp pin and wire on the Wide beam IR is a good crimp and the wire is not damaged.
6. If during a game you can shoot a photon and tag vests with the photon the Wide beam IR is OK.
7. The transistor at the Phaser diode may be damaged. Replace the transistor.

NO SOUND EFFECTS

1. Check that the Speaker wires are not damaged.
2. Check that the speaker is plugged in.

3. Check the crimp pin is in the connector and that the crimp looks good.
4. Check the speaker for puncture and or damage. May need to replace speaker.

NO PHOTONS OR SHIELDS

1. Check that you do not have shields and photons on the computer set to 0.
2. Check that the option switch is plugged in.
3. Check that the options switch wires are not damaged, and the crimp pins are in the connector and the crimp looks good.
4. If none these fixes the problem you have a broken option switch.

SAFETY SENSOR NOT WORKING

1. Check that there is no tape or gum or residue on the sensor.
2. Check that Use Heat Sensor is checked on Game Setup Screen

SHOOTS BUT NOT TAGGING OTHER VESTS

1. Check that the IR Tube is not blocked with debris at the front of the phaser.
2. Check that the IR Tube is plugged in all the way, the wires are not damaged.
3. The IR DIODE may have failed.
4. The Friendly Fire checkbox is unchecked in the game setup screen.

NOT SHOOTING (NO SOUND, LASER OR SHOTS ON THE LCD)

1. Check that the Trigger is setting on top of the switch lever in phaser handle.
2. Check that the Trigger spring is not broken. Trigger will not bounce back after being pulled.
3. Check that the Switch wire is not broken and the switch is plugged in to board completely and that the crimp is good and the crimp is completely seating in the connector housing.

HARDWARE PIN_OUTS

Some of our customers prefer to do their own component level troubleshooting. In order to do this, you need to know some key information, including the functions of some of the pins of the IC's on the circuit boards, and the functions of the various pins on the connectors. These are listed below:

The 13 IR Sensors
Each sensor has 3 pins.
Ground - Pin 1 – The pin on the outside of the 2 pins grouped together
+5V- Pin 2 – The center pin
Output – Pin 3. This is the pin all by itself.

Each IR sensor is connected to a NAND buffer. The pin # is listed below.

IR Sensor	NAND buffer IC, Pin #
Phaser – U2	U10, Pin 1
Phaser – U3	U10, Pin 2
Phaser – U4	U10, Pin 10
Chest – U1	U4, Pin 1
Chest – U5	U4, Pin 2
Chest – U3	U4, Pin 13
Left Shoulder – U1	U6, Pin 5
Left Shoulder – U2	U6, Pin 4
Left Shoulder – U3	U6, Pin 3
Right Shoulder – U1	U6, Pin 5
Right Shoulder – U2	U6, Pin 4
Right Shoulder – U3	U6, Pin 3
Back-U2	U6, Pin 1,2,& 13

Each sensor can be tested by looking at the voltage on the pin listed in the chart above. A good sensor will have a voltage of between 4.7 and 5.15 volts. When a terminator is aimed at the sensor, the voltage should drop noticeably (about 0.1 to 1.0 volts). This means that the sensor is working. Keep in mind that some types of bright fluorescent lights can cause a sensor to respond as if it were being hit with IR.

The Chest Microprocessor pinout is listed below:

Pin #	Function	Comments
1	Reset	Tied directly to +5V
2	Left Shoulder	Normally high with no IR present
3	Right Shoulder	Normally high with no IR present
4	Vibrator	Feeds a 2N3904 Transistor switch. A high means vibrator on.
5	No Connect	
6	No Connect	
7	No Connect	
8	Ground	
9	4 Mhz Resonator	
10	4 Mhz Resonator	
11	No Connect	
12	No Connect	
13	No Connect	
14	Option Button	Pulled high through a resistor. This pin should go low when the option switch button is pushed.
15	Jumbo Yellow LED	Feeds a 2N3904 transistor switch that turns the yellow LED on or off. This pin should be high when the Yellow LED is turned on, and low when turned off.
16	Member Button Input	Pulled high through a resistor. The chest micro sends very short low pulses to this pin looking for a member button before the game begins.
17	TX to Phaser	This pin should be high unless there is some activity between the chest and phaser.
18	RX from Phaser	This pin should be high unless there is some activity between the chest and phaser.
19	Ground	
20	VCC	Should be +5 volts
21	Blue LED Clear	This signal is used to turn off all of the blue LED's on the chest, back, and shoulders.
22	Red LED Clear	This signal is used to turn off all of the red LED's on the chest, back, and shoulders.
23	LED Clock	There should be pulses on this signal every time the LED's change position.
24	Green LED Clear	This signal is used to turn off all of the green LED's on the chest, back, and shoulders.
25	LED Data	This signal should be alternating between high and low as the LED's blink.

26	Back Sensor Input	Normally high when no IR present
27	Shoulder Sensors Input	Normally low when no IR present
28	Chest Sensors Input	Normally high when no IR present

The Phaser MicroProcessor Pinout is listed below:

Pin #	Name/Function	Comments
1	A18	Sound Address 18
2	Safety_In	Reads the amount of light coming back from the safety sensor. A strong reflection (hand present) should put low voltage on this pin. No hand present should put a +5 signal on this pin. The Safety Sensor Power pin, (24) must be high in order for this sensor to function properly.
3	AD9	Sound Address 9
4	AD8	Sound Address 8
5	Main IR Output	Feeds a 10 Amp HEXFET switch to turn the narrow beam main IR LED on or off at 40 Khz. A high on this pin turns the LED on, a low turns it off.
6	TX2	This is the serial output pin to the RF module. It operates at 57600 baud.
7	RX2	This is the serial input from the RF module.
8	VOLUME	This is a PWM output that sets the audio volume. It is under software control.
9	RESET_	This active low reset line is pulled high with a 10K resistor. A low on this pin during power up resets the processor.
10	RF_SLEEP	A high on this pin puts the RF module to sleep to save battery draw.
11	GND	Battery Ground
12	VSS	+5 volts
13	Laser	Feeds a 2N3904 transistor switch that turns the laser on or off. A low on this pin means laser off. A high means laser on.
14	LCD Data0	These are outputs from the main micro to the LCD module.
15	LCD Data1	These are outputs from the main micro to the LCD module.
16	LCD Enable	This pin is pulsed when the main micro is reading or writing data to the LCD.
17	LCD Data2	These are outputs from the main micro to the LCD module.

18	LCD Data3	These are outputs from the main micro to the LCD module.
19	Phaser IR input2	This pin should be high when there is no IR present on the phaser.
20	Phaser IR input1	This pin should be high when there is no IR present on the phaser.
21	Photon Output	Feeds a 2N3904 transistor switch that turns the photon LED on or off. This pin should switch between high and low when firing a photon.
22	Safety Sensor Power	This output is normally low, but goes high when the micro is actively taking a light reflection measurement on the safety sensor
23	LCD Data4	These are outputs from the main micro to the LCD module.
24	LCD Data5	These are outputs from the main micro to the LCD module.
25	AVDD	Analog 5 volts. Used to scale the battery voltage measurement.
26	AVSS	Analog Ground
27	Red LED2	A high on this pin turns on red LED#2
28	Red LED1	A high on this pin turns on red LED#1
29	Red LED0	A high on this pin turns on red LED#0
30	Battery Input	This pin reads a scaled down version of the battery voltage. This voltage is scaled properly in the software.
31	VSS	Ground
32	VDD	+5 volts
33	Blue LED2	A high on this pin turns on Blue LED#2
34	RF_CTS (Clear to Send)	This input pin reads the RF Module CTS line to determine if it can accept new data for transmission.
35	DA_FS (Frame Sync)	Digital to Analog Converter Frame Sync Signal. This signal toggles with every byte sent to the D/A chip.
36	DA_CS (Chip Select)	This pin goes low every time the main micro sends data to the D/A chip.
37	TX1	This pin transmits serial data to the chest at 62500 bps.
38	RX1	This pin receives serial data from the chest at 62500 bps.
39	NC	No Connect
40	CE#	This active low signal enables the Sound Flash Memory Chip
41	NC	No Connect
42	NC	No Connect

43	AMP SHUTDOWN#	This pin, when low, turns the amplifier off to save power.
44	SCK	This is the clock line for a SPI connection to the D/A chip for playing sounds.
45	Blue LED#1	A high on the pin turns on Blue LED#1
46	SDO	This is the data line for a SPI connection to the D/A chip for playing sounds
47	PGD	This is the program Data line used by the emulator and chip programmer during manufacturing.
48	VDD	+5 volts
49	OSC1	One side of a 16 Mhz resonator
50	OSC2	The other side of a 16 Mhz resonator
51	VSS	Ground
52	PGC	This is the program clock line used by the emulator and chip programmer during manufacturing.
53	Blue LED#0	A high on the pin turns on Blue LED#0
54	Green LED#2	A high on the pin turns on Green LED#2
55	Green LED#1	A high on the pin turns on Green LED#1
56	Green LED#0	A high on the pin turns on Green LED#0
57	Trigger	This pin is pulled high when there is no trigger switch attached or when the trigger is not pulled. Pulling the trigger switch should make this pin go low.
58	IR_IN	This is the gated sum of all three IR sensors. If any of the IR sensor outputs are low, this pin should be low.
59	WE#	Write Enable (Low) to the Flash Memory chip.
60	NC	No Connect
61	OE#	Output Enable (Low) to the Flash Memory chip.
62	NC	No Connect
63	AD7	Sound Address 7
64	AD6	Sound Address 6
65	AD5	Sound Address 5
66	AD4	Sound Address 4
67	AD3	Sound Address 3
68	AD2	Sound Address 2
69	AD1	Sound Address 1
70	VSS	+ 5 Volts
71	VDD	Ground
72	AD0	Sound Address 0
73	AD15	Sound Address 15
74	AD14	Sound Address 14

75	AD13	Sound Address 13
76	AD12	Sound Address 12
77	AD11	Sound Address 11
78	AD10	Sound Address 10
79	A16	Sound Address 16
80	A17	Sound Address 17

The Phaser Chest Connector (JP2 on Phaser)

Pin #	Description
1 - Red	RX from Chest
2 - Black	TX to Chest
3 - White	Battery
4 - Green	Ground

The Phaser Chest Connector (JP1 on Chest)

Pin #	Description
1 - Red	TX to Phaser
2 - Black	RX from Phaser
3 - White	Battery
4 - Green	Ground

The Chest/Back Connector (JP4 on Chest)

Pin #	Description
1 – Red Stripe	Battery
2	Battery
3	Ground
4	Ground
5	Back IR Sensor
6	LED data
7	Green Clear
8	LED clock
9	Red Clear
10	Blue Clear

The Chest/Left Shoulder Connector (JP2 on Chest)

Pin #	Description
1 – Red Stripe	Battery
2	Battery
3	Ground
4	Ground
5	Shoulder IR Sensor
6	Red LED
7	Ground
8	Green LED
9	Ground
10	Blue LED

The Chest/Right Shoulder Connector (JP3 on Chest)

Pin #	Description
1 – Red Stripe	Battery
2	Battery
3	Ground
4	Ground
5	Shoulder IR Sensor
6	Red LED
7	Ground
8	Green LED
9	Ground
10	Blue LED

VEST/PHASER FIRMWARE POWER ON SELF TESTS (POST)

If you know the proper power up sequence of the vests, you can isolate a lot of problems. By observing which power up activities were completed, you know where the failure is. The following sequence represents a properly functioning vest. If the vest does not execute this sequence, then the step before is the likely cause.

The power on self test only helps if there is 5 volts making it to the phaser and chest microprocessors. If the LED's on the phaser and chest blink when you put the battery in, then power is OK and you may skip the power debugging steps. Here are the easiest steps to verify the power is getting where it belongs:

POWER VERIFICATION:

1. Put the black lead of a voltmeter on the green wire (Pin 4) of the chest/phaser connector (JP1) on the chest.

2. Verify that there is between 7.5 and 10.3 volts on the white pin (Pin 3) of JP1. If this voltage is OK, then you have verified the battery connections inside the battery, the fuse inside the battery, the fuse in the vest, and the chest to back cable. If there is a short from +5 to ground anywhere on any of the circuit boards, the fuses in the battery and on the vest will automatically melt and you will get only about 0.1 volts on this pin. Disconnect the phaser and shoulder circuit boards by unplugging them, 1 at a time, from the chest until the battery voltage is seen on Pin 3. The fuse will reset immediately and automatically when a short is removed. If the proper voltage shows up on Pin 3, then the fault is isolated to the last circuit board or cable you just unplugged. If you see between 2 and 7 volts on Pin 3, then your problem is inside of the battery. Either charge the battery, or try another one.

3. Verify that there is +5 volts on the chest circuit board. Leave the black lead of the voltmeter on Pin 4 of JP1 and measure the voltage on pin 1 of the chest micro. This should be between 4.8 and 5.2 volts. If there is the proper battery voltage on pin3 of JP1, but the 5 volts is not correct, it is probably caused by a solder ball getting dislodged under a cap, or an IC that has failed. A failed IC will usually feel much warmer than the other IC's on the board. This is a very rare problem.

4. Verify that the battery voltage has reached the phaser. The easiest place to verify the battery voltage is across the large blue 680 uf cap on the phaser board.

5. Verify the +5 supply on the phaser board. Measure the voltage between ground (Pin 4 of JP5 on the phaser) and pin 1 of the main micro. Since this pin is tied to +5 through a diode, it should read about 4.3 volts. This is just a handy spot to measure the 5 volt supply. If the battery voltage is present, but there is no +5 supply, there is probably a failed IC. The +5 volt regulator has a thermal shutdown protection circuit in it, but whatever IC has failed, is often warmer than the others.

CHEST POWER UP SEQUENCE

Step #	Description	Comments
1	Turn Vibrator on	1. Loose connector on vibrator 2. Chest Micro not fully seated 3. Vibrator Motor damaged
2	Flash Red LED's	1. Power supply or battery problem. See paragraphs above to verify proper power supply on chest and phaser boards. 2. Isolate the cause by disconnecting cables from the chest, 1 at a time. Start with the phaser cable, then the shoulders. 3. Try replacing the chest to back ribbon cable. Use a spare cable to try it first on the outside of the vest before pulling the new cable through the vest.
3	Flash Green LED's	1. Isolate the cause by disconnecting cables from the chest, 1 at a time. Start with the phaser cable, then the shoulders. 2. Try replacing the chest to back ribbon cable. Use a spare cable to try it first on the outside of the vest before pulling the new cable through the vest.
4	Flash Blue LED's	1. Isolate the cause by disconnecting cables from the chest, 1 at a time. Start with the phaser cable, then the shoulders. 2. 2. Try replacing the chest to back ribbon cable. Use a spare cable to try it first on the outside of the vest before pulling the new cable through the vest.
5	Turn off all vest LED's	
6	Turn off Vibrator	The chest turns off all vest LED's and the vibrator and does nothing else while waiting for the phaser to tell it which phaser ID# it is connected to. If there is a problem with the phaser or the curly cable, the vest never receives the ID# and hangs in an infinite loop.
7	Receive Vest ID#	You can tell if the vest ID# is received because the vest will flash the yellow jumbo LED twice as an indicator.
8	Wait for Shoulder IR to stay high	Once a vest ID is received from the phaser, the chest waits to make sure that the shoulder signal is low (pin 27 of the chest micro). If this pin never goes

		low, the chest micro will hang in an infinite loop.
9	Check option button switch	The chest micro looks to see if the option button on the chest is pushed (pin 14 of the chest micro). If this pin is stuck low, the chest micro will hang in an infinite loop.
10	Check for member button	The chest micro puts out some pulses on the member button port and looks for a proper response. If a member button is found, the member information is sent to the phaser and the jumbo LED flashes 6 times.
11	Look for valid start data coming in from the shoulders	If all the LED's are blinking normally on the chest, then it is monitoring the shoulder pin (pin 27 of the chest micro) for valid start data. Valid start data consists of 16 bytes with 2 CRC's for data integrity. These 16 bytes have to be received twice and be identical for the vest to recognize it as valid data. Strobe lights or bright fluorescents can interfere with valid start data.
12	Send start data to the phaser.	If valid start data was received by the chest (through the shoulders) it forwards the good start data to the phaser and continously blinks the yellow LED. If the yellow LED never quits blinking, then the phaser probably never received the start of game data.
13	Wait for an activate command from the phaser	
14	Check for option button pushed	If the option button is stuck low, the chest micro will be stuck in an infinite loop.
15	Check for Chest sensor hit	If one of the chest sensors (pin 28 of the chest micro) has a broken lead and is stuck low, the chest micro will be stuck in an infinite loop.
16	Check for Back sensor hit	If the back sensor signal (pin 26 of the chest micro) is stuck low, the chest micro will be stuck in an infinite loop.
17	Check for Shoulder sensor hit	If any of the 6 shoulder sensors or should cables are failed, and the shoulder input pin (Pin 27 of the chest micro) is stuck high, the chest micro will be stuck in an infinite loop.

PHASER POWER UP SEQUENCE

Step #	Description	Comments

1	Clear LCD	If the LCD has one line of squares on it, then this step was not successful.
2	Put the Phaser Name on the LCD	This writes the phaser name to the second line of the LCD.
3	Say Phaser Name on the speaker	
4	Scan the game memory	Look to see whether this power up is from a battery failure. To determine this, the phaser looks to see whether the previous game ended correctly.
5	If the trigger switch is activated, run a non-stop cable test	This test sends high speed data back and forth through the curly cord to the chest micro. As long as the trigger is activated, you can massage the cable, yank it gently, etc., to look for intermittent cable problems. If a problem is found, you will get a "CABLE ERR" message on the LCD.
6	If not VEST RESET, put the version # on the 1st line of the LCD	If the VEST is RESET, then the 1st line says "VEST RESET"
7	Turn the laser on	The laser is turned on during a power up.
8	Flash the red LEDs	
9	Flash the green LEDs	
10	Flash the blue LEDs	
11	Test the game memory U4	The phaser writes a test byte to the game memory. If this fails, then the phaser lights a single green LED (D4) and stays in an infinite loop (with the laser on)
12	Turn the laser off	
13	Say "Vest Active"	
14	Tell the vest, what ID# it is.	This should cause the vest to blink the yellow LED twice.
15	Check the phaser IR sensors for a change of color command	If pin 9 of the phaser micro is stuck low, the phaser will be stuck in an infinite loop. If a change of color command is received by the phaser, it changes the color of the vest and phaser.
16	Say "Enabled HIDE" on LCD	LCD is written when a start command is received from the chest.
17	Say Game Start message on the speaker	
18	Erase the previous game data from the Game memory U4	

19	Put the countdown message on the LCD	If the game memory U4 won't erase properly, this step will never be executed and the phaser could hang in an infinite loop. This problem should be caught at step #11, but step #11 only checks one memory location.
20	Make backtolife noise	
21	Say "GO" and number of hits on the LCD	This should happen after 15 seconds
22	Monitor the trigger, phaser IR sensor, safety sensor, and chest micro.	During the game, these items are monitored. If the phaser IR line is stuck low, the phaser will get stuck in an infinite loop. This should get caught in step #15.
23	Say "END OF GAME" on LCD	
24	Make "End of Game" noise on speaker	
25	Say "Scanning memory" on LCD	During this time, the phaser is sorting through the game memory (U4) and condensing all of the player information to make it faster to transmit to the computer.
26	Say vest name and number of hits on the LCD	
27	Notify the chest of the end of the game	The yellow LED on the chest should go on at this point.
28	Wait for the scanner commands on the phaser IR sensor	The phaser uses the wide angle photon IR LED and the 3 IR sensors on the phaser to communicate with either the holsters or the scanner. The easiest way to test the photon LED is to actually fire a photon during a game, and make sure you can hit other vests.
29	Go back to Step 1	