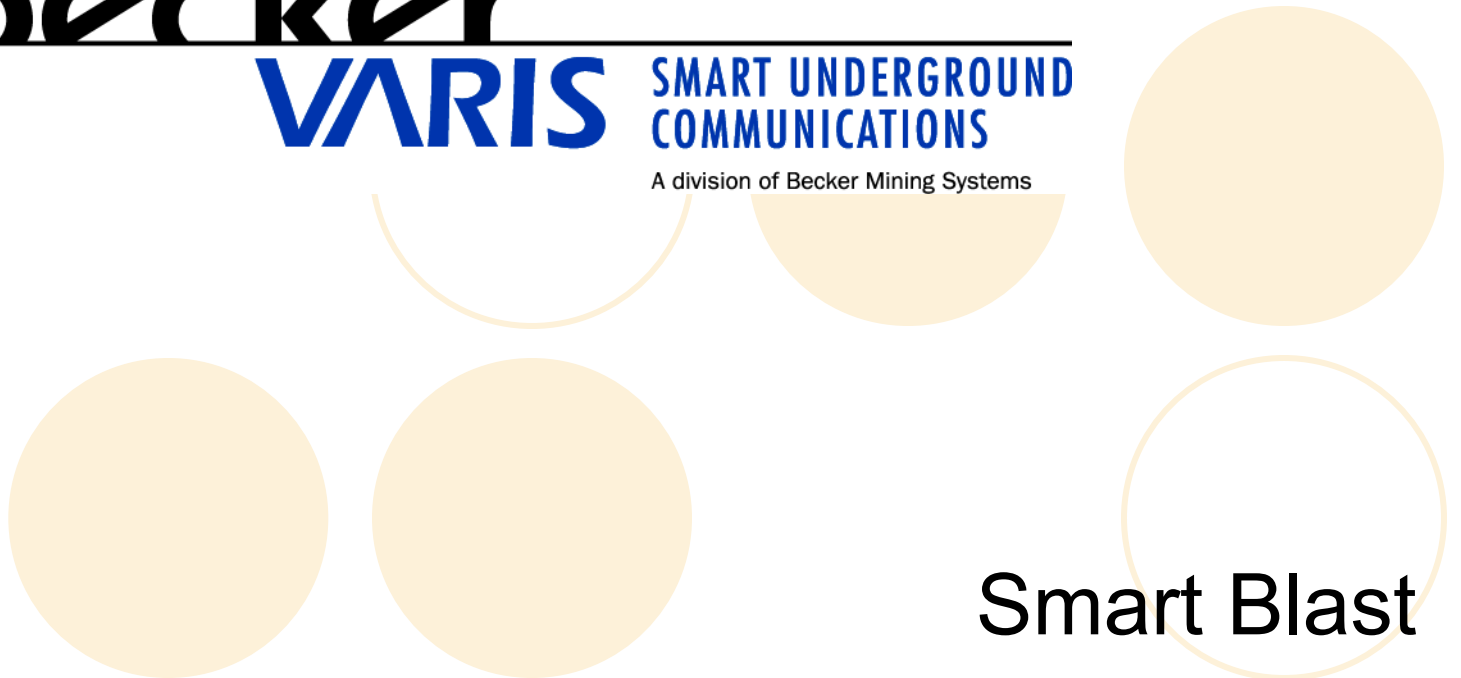


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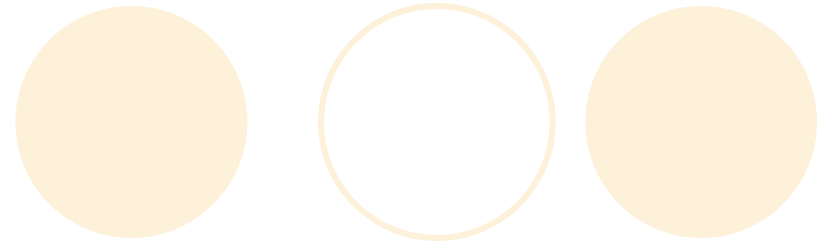
**SMART UNDERGROUND
COMMUNICATIONS**

A division of Becker Mining Systems



**Smart Blast
Training Manual V1.4**

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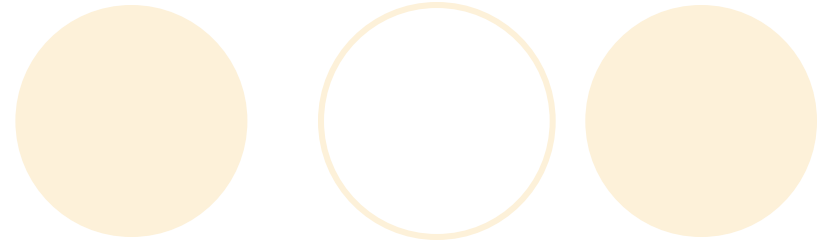
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1.0 Introduction



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1.1 Why Smart Blast?

Improved processes:

- Safety
- Productivity
- Cost Savings



1.2 Safety

- Remove people out of mine during arming and firing.
- Individual firing control provides flexibility, enabling a reduction in ground shock and stress.
- Two-way confirmation of arming and firing (accelerometer forthcoming).
- No transient voltages induced as with ULF signaling.
- Bringing Leaky Feeder network to working faces brings increased safety through improved communication.
- Smart Blast enables use of shock-tube initiation.



1.3 Productivity

- Shift Boss no longer needs to visit each face at blasting time.
- Compared to Central Blasting there is less lead line/shock tube to run and clean up.
- Safety Poll™ mechanism ensures system is communicating before blaster leaves working face.
- During shaft sinking the Leaky Feeder cable can provide communications as well as blast initiation.



1.4 Cost Savings

- Central Blasting cable network extension and maintenance eliminated.
- Shorter lengths needed for shock-tube.
- Compared to ULF blasting no additional infrastructure is required.



1.5 Smart Blast Highlights

- Up to 8 Remotes
- Electric and Shock Tube Outputs
- Surface Mines OR Underground via Leaky Feeder
- Two-Way Status Communication
- Up to 5 Mile Range
- Unique System ID Codes
- Safety Poll[®] Communications Check
- Electronic Keys
- External Programming and Option Port
- Remote Battery Status Check
- 4 Hour Battery Charge
- Emergency shutdown
- Tag Board Check Compatible
- Vibration and Shock Mounted Electronics
- Weather Proof Cases



2.0 Smart Blast Operation

[2.1 Remote Unit Setup Procedure](#)

[2.2 Controller Setup Procedure](#)

[2.3 Operation Summary](#)

[2.4 Typical U/G Blasting Procedure](#)



2.1 Remote Unit Setup Procedure

Step 1: Install Remote Antenna

Step 2: Turn on the Remote Unit

Step 3: Select fire circuit

Step 4: Connect firing line

Step 5: Insert Electronic Key

Step 1: Install Remote Antenna



Step 2: Turn on the Remote Unit



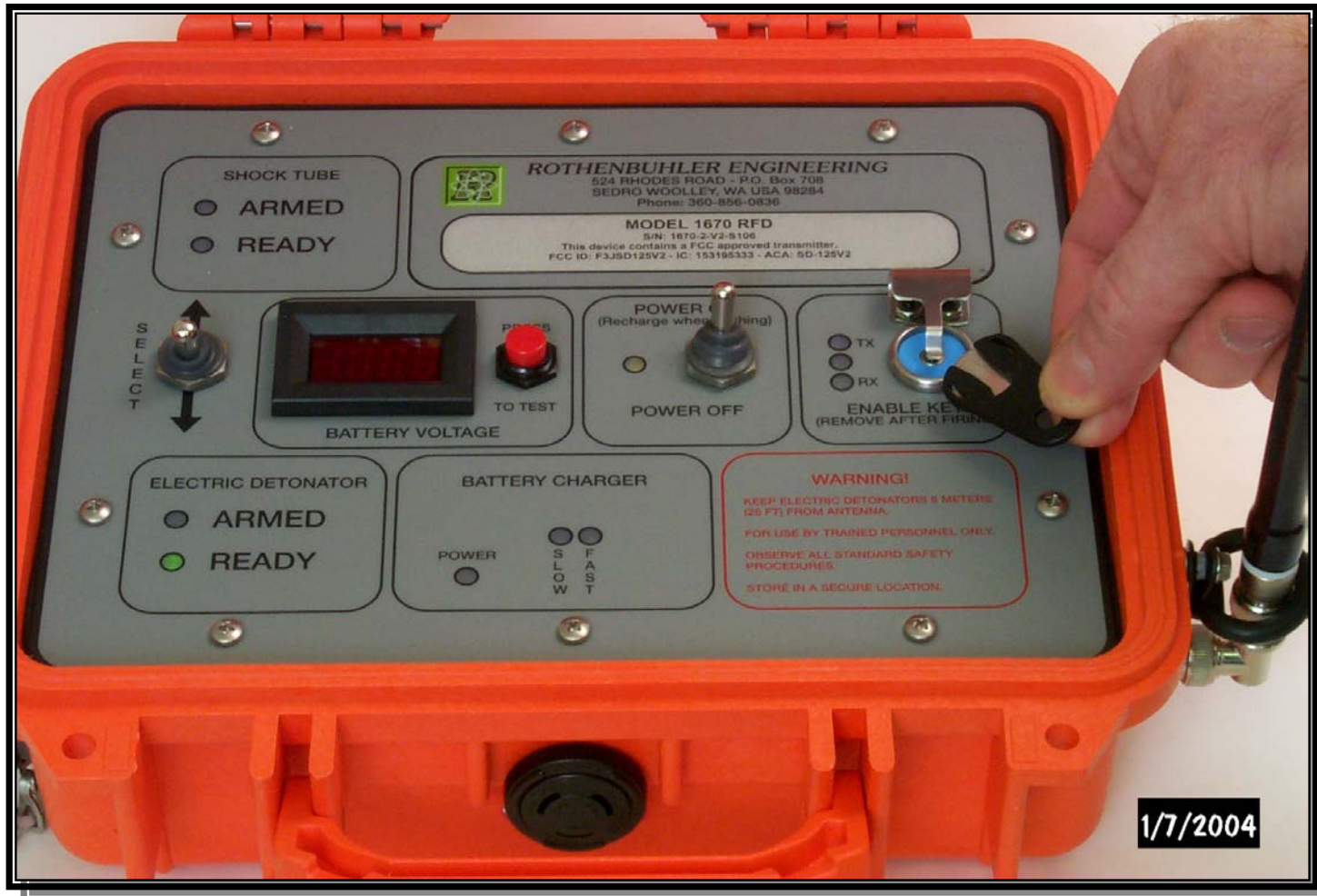
Step 3: Select ELECTRIC DETONATOR or SHOCK TUBE fire circuit



Step 4: When green **READY** Light is on, connect the firing line.



Step 5: Insert the Electronic Key. The yellow light next to the Key begins flashing.



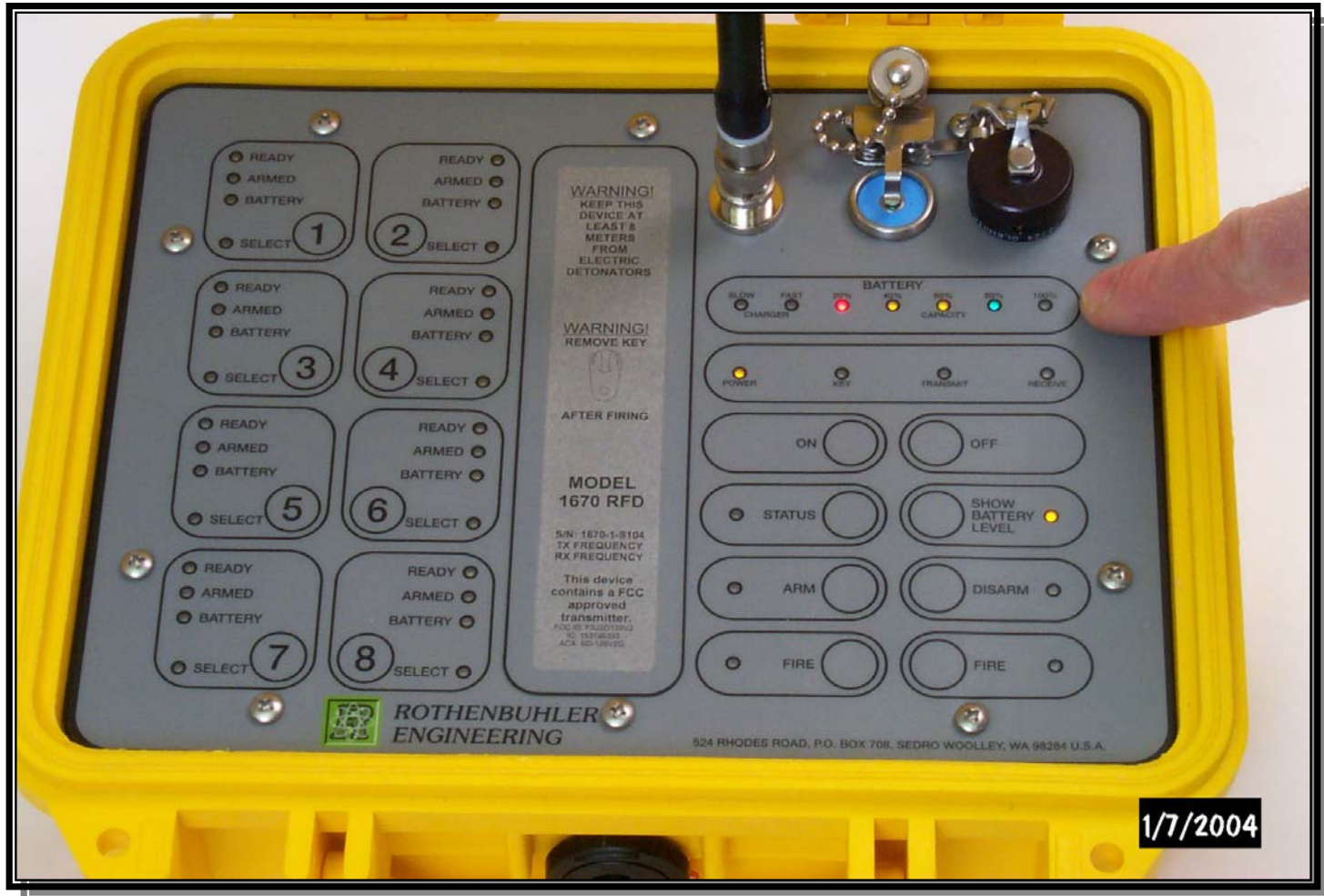
2.2 Controller Setup Procedure

- Step 1: Install Controller Antenna
- Step 2: Turn on Controller Unit
- Step 3: Insert Key/Select Remote Units
- Step 4: Comms Status Check
- Step 5: Arm Selected Remotes
- Step 6: Fire at the Appropriate Time
- Step 7: Disarm the Controller
- Step 8: Turn Controller OFF
- Step 9: Remove Key

Step 1: Install the Controller's Antenna.



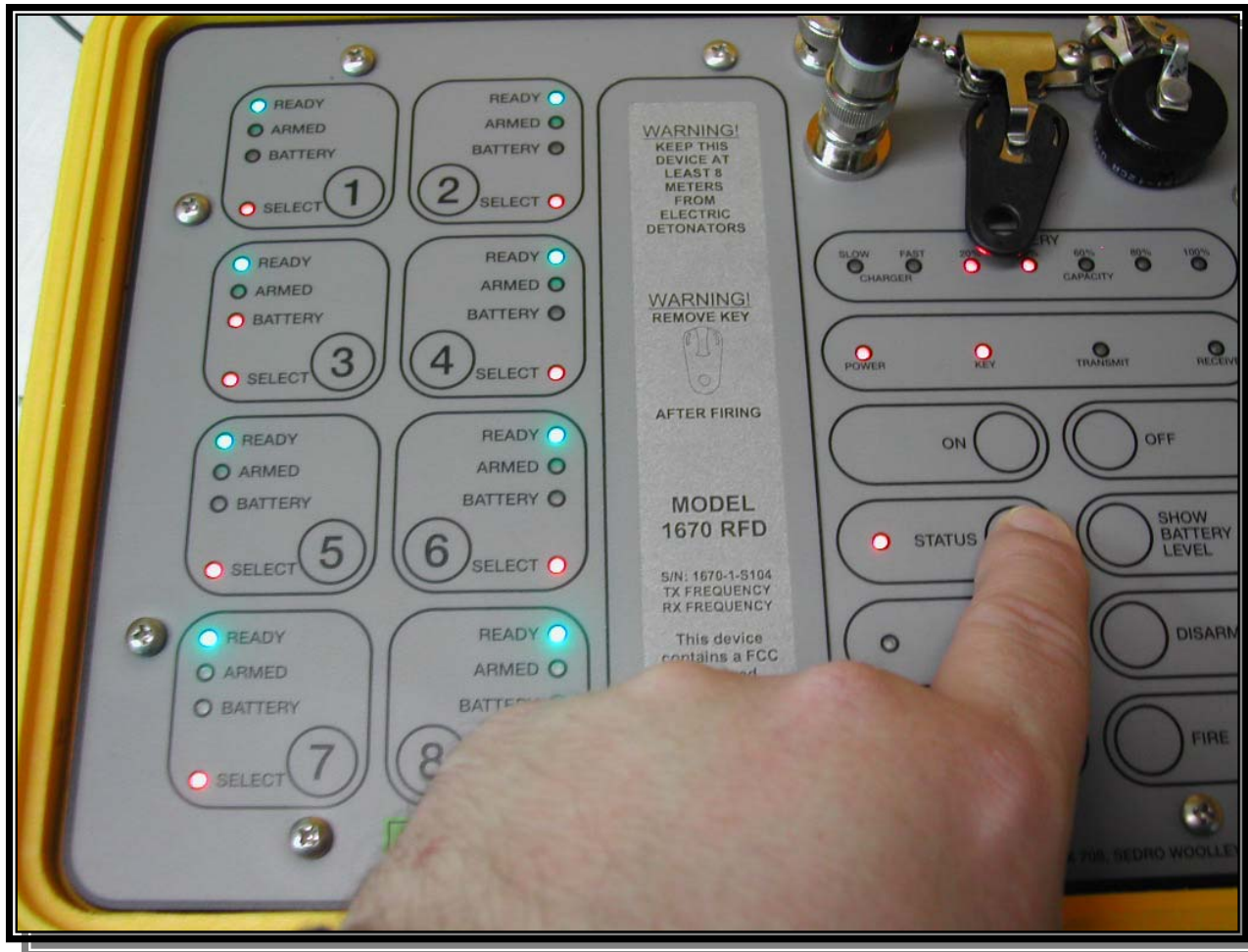
Step 2: Turn on the Controller Unit. The BATTERY should be at least 40%.



Step 3: Insert the Electronic Key and Select the Remote Units to be fired.



Step 4: Perform a STATUS check to verify your communication links.



Green **READY** on steady. Battery light on and not flashing.



Step 5: Arm the SELECTED Remotes.
Allow 15 seconds for units to arm.



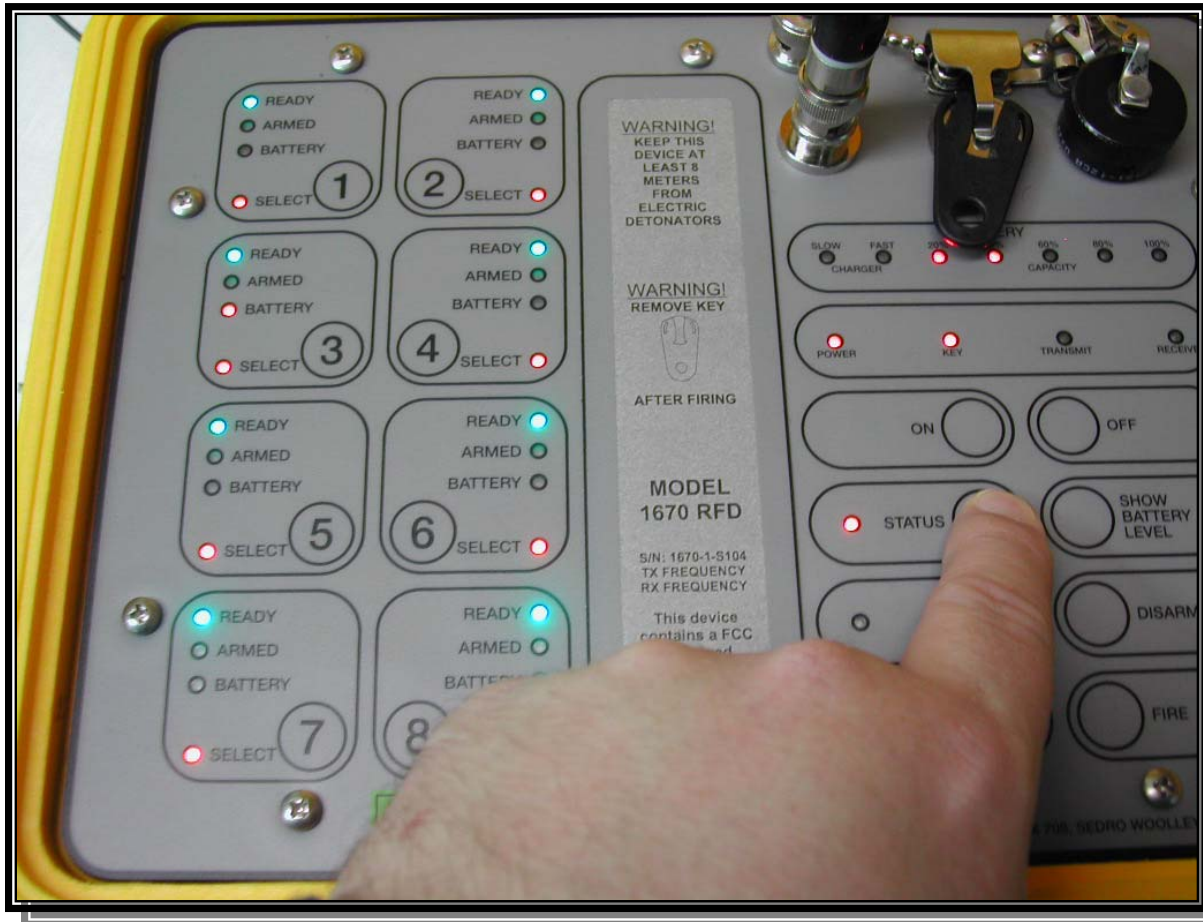
Step 6: FIRE at the appropriate time



The green **READY** light should come on steady for each Remote Unit.



To manually check status, press the STATUS button at any time.



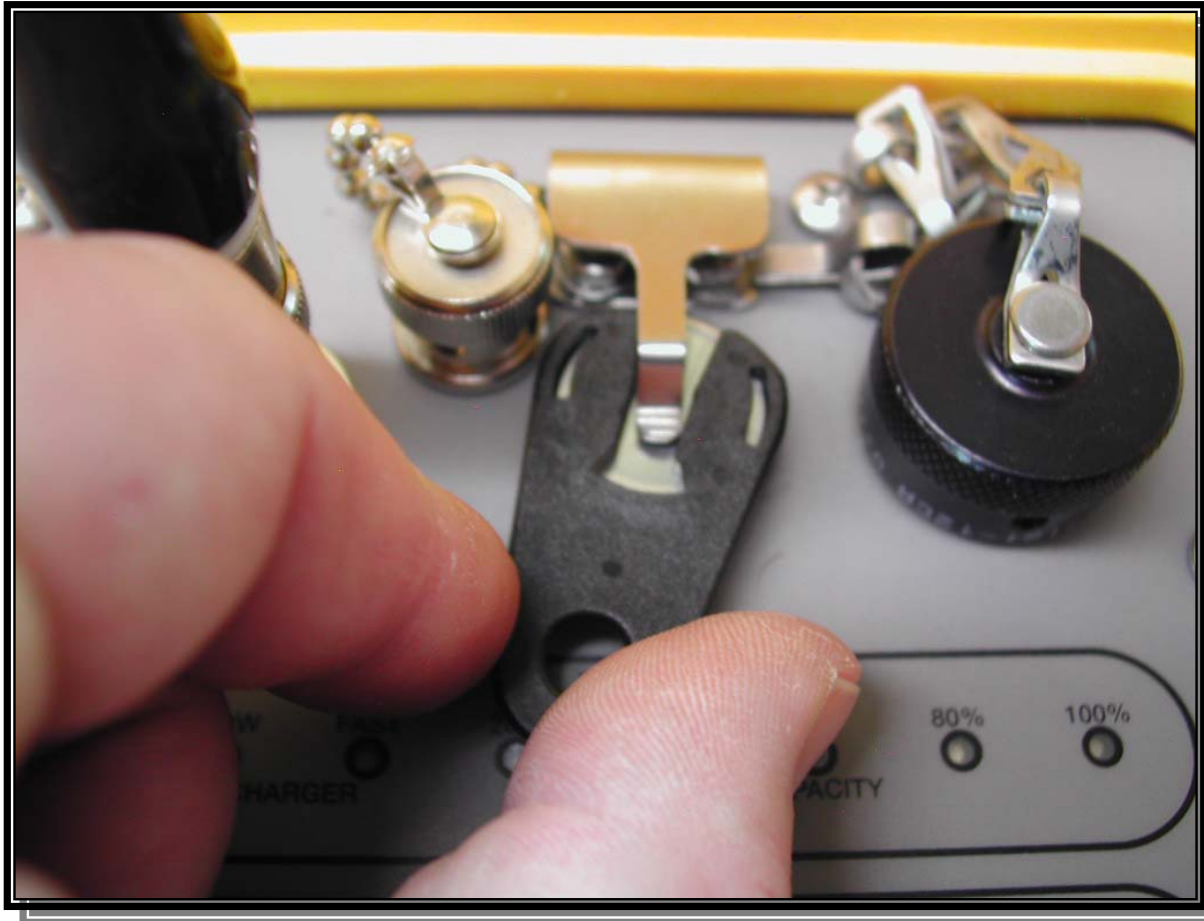
Surface Blasting – GCS Promo



Step 7: To manually disarm, press the DISARM switch at any time.



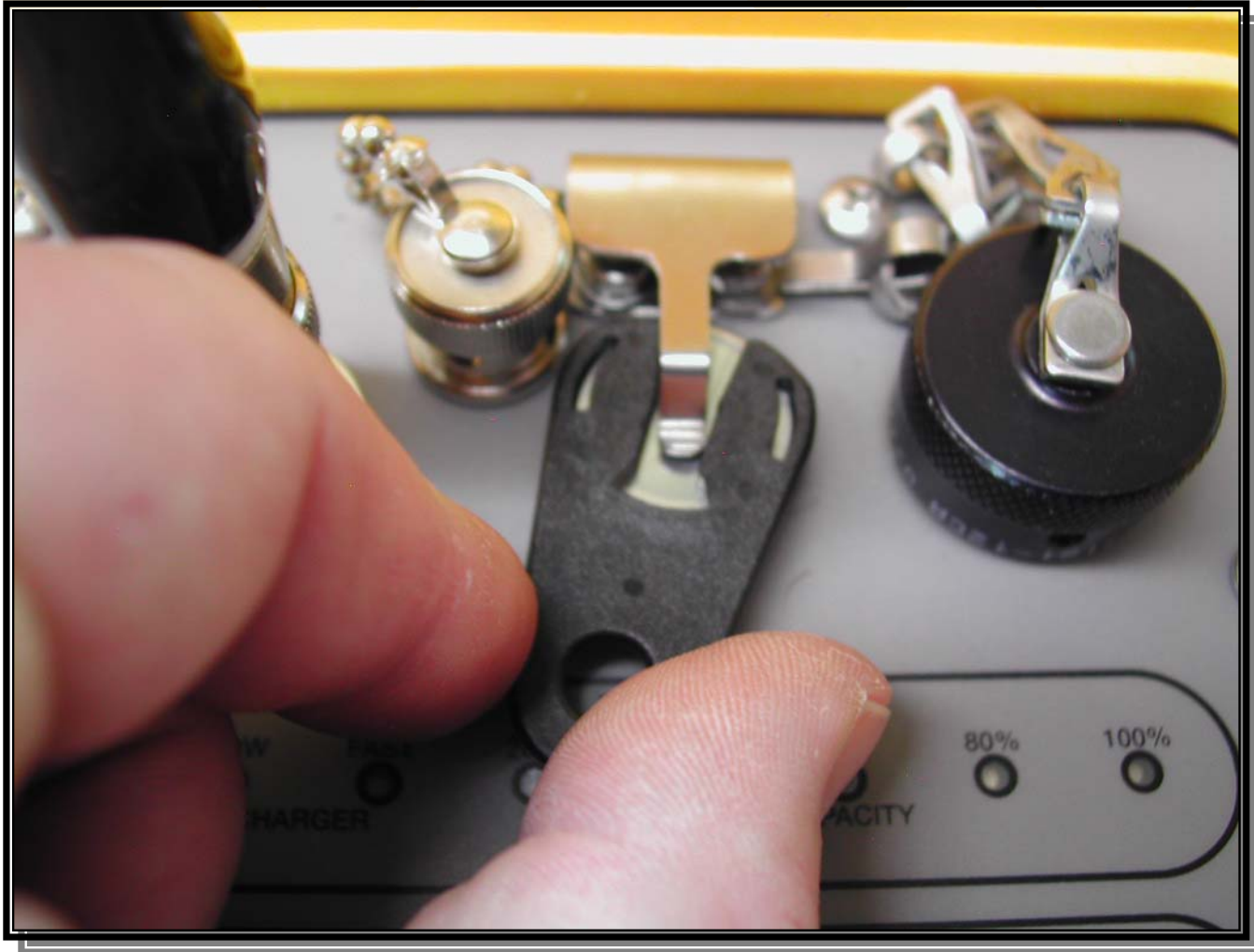
In a *PANIC* situation, remove the Controller Key to disarm all Remotes.



Step 8: Turn Controller OFF.



Step 9: Remove Controller Key.



2.3 Operation Summary

REMOTE:

- 1) **Attach Antenna to Remote.**
- 2) **Turn on Power.**
- 3) **Check for Green Ready Light on Remote.**
- 4) **Check Battery Level - above 12.00 Volts.**
- 5) **Connect the firing cable or shock tube.**
- 6) **Insert the electronic Key.**
- 7) **Close the lid. Repeat for remaining Remotes.**

CONTROLLER:

- 1) **Attach the Antenna to Controller.**
- 2) **Turn on the Controller.**
- 3) **Ensure the Battery is at least 40% charged.**
- 4) **Insert the Electronic Key and select the units for firing with the SELECT switches.**
- 5) **Push Status, Check for Solid Green Ready Lights**
Ready?

Operation Summary (Con't)

6) Give Alarms or Warnings

At 30 second mark:

- 7) Check Status – Solid Green READY?
- 8) ARM selected Remotes
- 9) Wait for Solid Red ARMED lights
- 10) Give final warning
- 11) Check Status – Solid Red ARMED?
- 12) FIRE
- 13) Wait for Solid Green READY, Turn off power.

Remove the electronic keys.

2.4 Typical U/G Blasting Procedure

The Shifter is to proceed to the Mine Captain Office to inspect the Controller Unit at the start of the shift.

The shifter will ensure that the power is turned on by pressing the “STATUS” button and the “ON” button at the same time which will set the Controller Unit on Safety Poll Mode. The Shifter will then be able to see which Remote Units the Controller Unit is in communications with and double check it against the information passed on to him from his cross-shift.

Typical U/G Blasting Procedure (Con't)

The shifter will obtain Controller Key from the Captains lock-up. He will keep the Controller Key on his person for the duration of the shift.

1. Shifter is to communicate to the leaders the location of the Remote Units as well as any discrepancies between the safety poll and the cross-shift information, if any. For example, if the cross-shift reported using Remote Units #1, 3 and 5 but the Safety Poll is only communicating with #3 and #5, the shifter will inform the leader that there is no communication with #1 and that could be a dead battery, leaky feeder damage or damage to the Remote Unit.

Typical U/G Blasting Procedure (Con't)

2. Leaders are to proceed to the Remote Unit locations, turn the power off, ensure lead wire ends are disconnected and shorted out, inspect the blast as per procedure and return the Remote Unit to the designated refuge station and put it on charge.
3. Follow standard loading procedures during shift.



Typical U/G Blasting Procedure (Con't)

4. As close to blasting time as possible, blaster is to go pick up the Remote Unit from the charging station in the Refuge and test the battery by pushing on the button for 8 seconds, ensure a minimum of 12V. If there is less than 12V, they must use another Remote Unit.
5. Proceed to the blasting area and hang the remote unit to wall securely within a maximum of 300' from the blast (preferably inside a cut-out or safety bay) in an area with Leaky Feeder communication (check communication by ensuring the safety Poll mode amber light is solid) and at a safe location from the blast.

Typical U/G Blasting Procedure (Con't)

6. As close to the end of shift as possible, proceed to face and place electric detonator on the ground, away from b-line/det. Cord, remove shunts from electric cap and connect cap to the lead wire. Tape the cap to the detonating cord.
7. Secure or anchor lead wire (anchor must be non-metallic such as plastic stand-offs), extend lead wire back to Remote Unit ensuring no contact is made with any conductive material.

Typical U/G Blasting Procedure (Con't)

8. Cut, strip and test lead wire with an approved circuit tester (light indicates a closed circuit).

9. Turn on the Remote Unit, ensure:

- i. Power Light goes on.
- ii. Test for a minimum of 12V for 8 seconds.
- iii. Solid amber light for Safety Poll.

If condition I, or ii. Fails, you must get another Remote Unit. If condition iii. fails, move to another location and repeat step #9. Connect lead wire.

10. Turn on the water sprays, install proper

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Appendices



[Appendix A: Safety Poll Mode](#)

[Appendix B: Programming](#)

[Appendix C: Hardware](#)

[Appendix D: Maintenance](#)

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[Appendix F: Safety Warnings](#)

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Appendix A: Safety Poll Mode

[A.1 Safety Poll Mode Overview](#)

[A.2 Activating Safety Poll Mode](#)



A.1 Safety Poll Mode Overview

Safety Poll® mode was designed to simplify the verification of the communication link between the Controller and Remote Units in underground mines.

With Safety Poll®, the person positioning a Remote Unit deep in a mine can easily and safely determine if the Remote Unit is communicating bi-directionally with the Controller.

A.2 Activating Safety Poll Mode

When Safety Poll® is activated, the Controller Unit automatically requests STATUS from all Remote Units approximately every 15 seconds. The status of all reporting Remote Units are updated automatically on the Controller's Display Panel showing steady green READY lights for all Remotes that are working.

Following a successful Safety Poll®, the Controller sends an acknowledge signal to the Remote Units to show the communication links are working bidirectionally. As each Remote Unit receives this acknowledge signal, the yellow lights next to the ENABLE KEYS will transition from flashing to solid. The communication link is now confirmed and displayed on each Remote Unit Panel.

Activating Safety Poll Mode (Con't)

Activation:

While the Controller is turned off, press and hold the STATUS switch while pressing the ON switch. All other functions are disabled while in the Safety Poll® mode. The Remotes being setup must have their electronic keys in place to operate while the Controller is in the Safety Poll® mode. The Controller does not need to have its electronic key in place in the Safety Poll® mode. Exit the Safety Poll® mode by pressing the OFF switch.

Appendix B: Programming

[B.1 Address/Unit Identification](#)

[B.2 Programming Procedure](#)



B.1 Address/Unit Identification

The electronic key contains the system address and unit identification for the Remotes.

The Controller electronic key also contains repeater timing requirements and whether the Controller is configured to operate with a tag board or not.

The Remotes read the system address and unit identification from the electronic key that is placed in their electronic key port.

Address/Unit Identification (Con't)

The Controller reads the system address and unit identification from its electronic key and verifies that system address of the electronic key matches the factory programmed system address. The Controller also verifies that the unique identification number of the electronic key matches the unique identification number the Controller is programmed to operate with. The Controller will transmit status requests and disarm commands with or without its electronic key in place. It will only transmit arm and fire commands when the correct electronic key is in place.



Address/Unit Identification (Con't)

The Controller will program electronic keys with its factory programmed system address and the desired unit identification. The Controller will also program a time that the Controller and Remotes should transmit for before sending data to operate with a repeater system. The repeater time is programmable from 0 seconds to 1 second in 1/8th second increments. Whether or not the Controller is to operate with a tag board is also programmed with the Controller.

B.2 Programming Procedure

1. With the Controller turned off, enter the electronic key programming mode by pressing and holding the DISARM switch while pressing the ON switch.
2. Place an electronic key in the Controller's electronic key port. The Controller will read the electronic key and illuminate the SELECT light for the unit identification it is currently programmed with. If it is a Controller electronic key, none of the SELECT lights will be illuminated. If the system address of the electronic key matches the system address of the Controller the KEY light will illuminate steady. If the system address does not match the system address of the Controller, the KEY light will flash.

Programming Procedure (Con't)

3. To change the unit identification of the electronic key and program it with the system address of the Controller, press the SHOW BATTERY LEVEL switch. The SELECT light for the existing unit identification will begin to flash.
4. Press the switch for the desired unit identification. That SELECT light will begin to flash. Pressing the same switch again turns off all SELECT lights indicating it will become a Controller electronic key.

Programming Procedure (Con't)

5. After selecting the desired unit identification, press the STATUS switch and the information will be written to the electronic key. The SELECT light for the programmed unit identification will then return to steady illumination.

If all of the SELECT lights were turned off when the STATUS switch was pressed, the Controller is programmed with the electronic key's unique identification number.

Programming Procedure (Con't)

The Controller will only arm and fire Remotes when that exact electronic key is in place. The Controller's unique identification number is changed to match the unique identification number of the last electronic key programmed as a Controller electronic key.



Appendix C: Hardware

[C.1 Keys](#)

[C.2 Tag Board](#)

[C.3 Repeater Time](#)

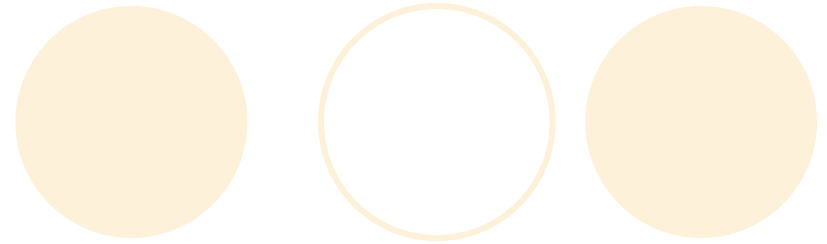
[C.4 Programming Repeater Time](#)



C.1 Keys

Only one key will work in the Controller at a time. A new Controller key may be created using a procedure at which time the old key automatically becomes obsolete. The Remotes are the same. You have to program the whole set in one session. For example, if someone created a new Controller key, they would also have to also reprogram or create new Remote key(s) at the same time or nothing would work. Duplicates are simply not allowed.

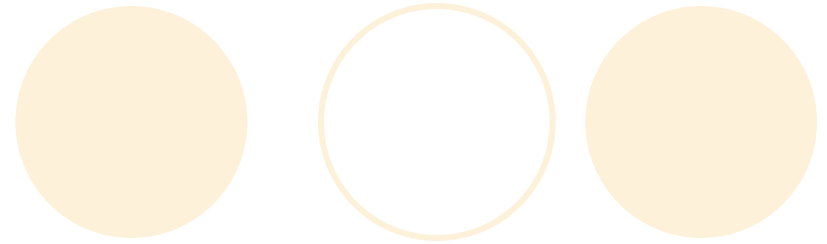
C.2 Tag Board



A tag board interface cable is required to program the Controller to operate with a tag board system.

The tag board system must output 12 volts DC when all tags are in place and arming or firing is allowed. If this feature is to be enabled, the Controller electronic key must be programmed while the tag board interface cable is in place and 12 volts DC are supplied to the interface cable at the time of programming.

Tag Board (Con't)



To disable this feature, program the Controller electronic key without the interface cable connected. If the tag board feature is enabled, the Controller will only arm and fire when 12 volts DC is applied to the tag board interface cable.

C.3 Repeater Time

The Controller and Remotes will operate with a repeater system. The amount of time the Controllers and Remotes should transmit before sending data is programmed into the Controller Unit. The repeater time is programmable from 0 seconds to 1 second in 1/8th second increments. Only the Controller is programmed with this time. The Controller includes the repeater time data in messages sent to the Remotes.

C.4 Programming Repeater Time

1. With the Controller turned off, enter the repeater time programming mode by pressing and holding the '8' switch while pressing the ON switch. The Controller will read the electronic key and illuminate the SELECT light for the 1/8th second increment of repeater time the Controller electronic key is currently programmed with.

Programming Repeater Time (Con't)

- SELECT light '1' equals .125 seconds.
- SELECT light '2' equals .25 seconds.
- SELECT light '3' equals .375 seconds.
- SELECT light '4' equals .5 seconds.
- SELECT light '5' equals .625 seconds.
- SELECT light '6' equals .75 seconds.
- SELECT light '7' equals .875 seconds.
- SELECT light '8' equals 1 second.
- All SELECT lights off equals 0 seconds.

Programming Repeater Time (Con't)

2. To change the programmed repeater time, press the **SHOW BATTERY LEVEL** switch. The **SELECT** light for the currently programmed time will begin to flash.
3. Select the desired repeater time by pressing the corresponding switch. The **SELECT** light for that time will begin to flash. Pressing the same switch again turns off all of the **SELECT** lights indicating a repeater time of 0 seconds.

Programming Repeater Time (Con't)

4. When the desired time is selected, press the STATUS switch to program the new time into the Controller Unit. The SELECT light for that time will switch to steady illumination.
5. Press the OFF switch to exit the repeater time programming mode.



Appendix D: Maintenance

[D.1 Normal Maintenance](#)

[D.2 Scheduled Maintenance](#)

[D.3 Corrective Maintenance](#)

[D.4 Battery Indicator Calibration](#)

[D.5 Battery Maintenance](#)

[D.6 Tip Care](#)

[D.7 Tip Replacement](#)



D.1 Normal Maintenance

Normal maintenance is limited to periodic battery charging and cleaning the outer surfaces and panels with a damp cloth removing dirt and debris.

1. Ensure the Antenna Jacks, Charge Connectors, and Key Receptacles are clean and dry with a cotton swab.
2. Check for signs of corrosion around and on connector pins.

D.2 Scheduled Maintenance

It is recommended that the 1670 RFD be returned to the manufacturer or an authorized service shop every two years for periodic maintenance.

At this time the latest improvements are added, fresh battery packs are installed, the radio transceivers are tuned and verified, and the overall performance of the RFD is thoroughly tested.

D.3 Corrective Maintenance

Corrective maintenance should be performed at the manufacturer or an authorized service shop only.

Replacement of parts or repair at the user level and field disassembly is strongly discouraged and may result in death, injury, or unsafe equipment operation. The Remote Unit contains dangerously high voltage levels when armed.

D.4 Battery Indicator Calibration

The following procedure will recalibrate the Controller Unit's Battery Indicator. Calibration time is approximately 10 hours.

1. Begin by discharging the Controller. With the Controller OFF, hold the SHOW BATTERY LEVEL switch while pressing the ON switch. Observe that all display lights come on except TRANSMIT and KEY. The Battery is now discharging.
2. After approximately 10 hours, the Controller will have finished the calibration process and will be fully charged.

D.5 Battery Maintenance

Your RFD contains heavy-duty 12V NiMH battery packs that should be replaced after 500 charge/discharge cycles or every two years, whichever comes first. If a decrease in run time has developed, there may be a memory problem caused by repeated shallow discharges or interrupted charge cycles.

Battery Maintenance (Con't)

To restore the battery packs, allow the units to fully discharge (until the low battery light flashes) before recharging. Repeat this procedure twice. NiMH batteries are less likely to develop memory problems than NiCads. If performance is not restored, your system may need fresh battery packs installed.

D.6 Tip Care

The two Shock Tube Igniter Tips provided with the RFD are rugged, and will last for 200 or more shots if properly cared for.

Take care to keep mud and debris from getting on the Igniter Needle. In some cases, the tip's life can be extended by washing in soapy water and gently rubbing the Igniter Needle with a non-metallic device such as a cotton swab.

D.7 Tip Replacement

As the tips are used, the electrodes will wear and eventually become unreliable. Therefore, it is highly recommended that your Company adopt a strict tip replacement/tracking plan.

Tip usage can be tracked using the serial number engraved on the tip. Discard the tip when usage reaches 200 shots.

Always hold a replacement tip handy. You may also dry fire the old tip and compare it to the sound and spark intensity of a new tip. If the old tip's spark is noticeably weaker, replace it.

Appendix E: Troubleshooting

[E.1 Remote Troubleshooting](#)

[E.2 Controller Troubleshooting](#)



E.1 Remote Troubleshooting

Will not Initiate Shock Tube

- a) Igniter Tip may be worn or damaged. Try a new tip.
- b) There may be water on tip. Blow out tip and test fire the tip without any tube installed.
- c) Shock Tube may be damaged. Cut a fresh section.
- d) Unit needs recharging.

Battery Meter does not work.

- a) The power switch is not placed in the POWER ON position.
- b) The Unit is totally discharged and needs to be recharged.

Charger does not work

- a) Ensure the power switch is in the POWER OFF position.
- b) Ensure the outside air temperature is between 32 and 86 °F (0 to 30 °C)

E.2 Controller Troubleshooting

Battery Indicator does not accurately reflect the state of charge

- a) Ensure the SHOW BATTERY LEVEL function is on.
- b) Recalibrate the Battery Level Indicator.

Charger does not work

- a) Ensure the Controller is turned off.
- b) Ensure the outside air temperature is between 32 and 86 °F (0 to 30 °C).

Controller Troubleshooting (Con't)

Commands are not confirmed (Blinking ARMED or READY lights).

- a) The Remote Unit is out of 2-way range of Controller Unit.
- b) The Remote Unit is within 2-way range of the Controller Unit.

Check the Leaky Feeder system or surface repeater for failure.

Check for damage to Controller Unit Antenna or Antenna Jack

Check for damage to Remote Unit Antenna or Antenna Jack.

Move at least 10 meters in any direction and try again.

Reposition any Units if:

- The antenna is not positioned vertically.
- The Unit is isolated by large dirt walls, rocks, or metal objects.
- The antenna is next to another radio antenna.

Appendix F: Safety Warnings

F.1 Safety Warnings



F.1 Safety Warnings

1. Always follow your local safety regulations. This manual and its procedures are secondary to governmental regulations, local regulations or company safety regulations and procedures. The operation procedures in this manual are only suggestions and should be checked against the above safety regulations and procedures. Company training should include the proper use of this machine and only trained personnel should use it.

Safety Warnings (Con't)

2. Never rely on this equipment or any equipment totally for your safety. All mechanical and electronic equipment can fail. Always have a safety procedure that will protect you and minimize hazards of such failure.



Safety Warnings (Con't)

3. High power radio transmissions can cause electric blasting caps to detonate. When the transmitters are configured for low power operation (standard), keep electric blasting caps at least 15 feet (5 meters) from RFD. When the transmitters are configured for 5-watt operation, keep electric blasting caps 25 feet (8 meters) or more from the RFD.

Safety Warnings (Con't)

4. The Shock Tube Initiator on the Remote Unit can develop up to 3,000 Volts. Do not touch this tip or tip jacks while arming or firing the unit.
5. Do not connect electric detonator wires or shock tube to the Remote Unit unless the green READY light is on, the red ARMED light is off, and the Battery Light is on steady.



Safety Warnings (Con't)

6. Do not use the System if any of the Units show damage to the point that failure is suspected. Thoroughly test the system prior to use.
7. Never approach the Remote Unit if it is attached to live explosives unless you have a confirmed READY status back to the Controller AND you have waited at least 2 minutes for the automatic disarm AND you have followed proper safety wait times



Appendix G: Warranty

[G.1 Warranty](#)



G.1 Warranty

The Smart Blast Remote Firing Device is guaranteed for 2 years (batteries - 1 year, spark tips excluded) against defects in workmanship and materials. If the equipment should fail during this period, we will repair it at our factory or at the nearest authorized service facility. Warranty service on this equipment must be performed only by an authorized dealer. Unauthorized service procedures or parts will void and cancel your warranty, and may cause radio equipment to fail, resulting in accidents and/or personal injury. This is a limited warranty and is given in place of legally implied warranties of merchantability and fitness for a particular purpose. Our liability is expressly limited to the cost of repair or replacement of the RFD under this guarantee, and does not extend to additional or consequential damages resulting from the operation of equipment.

