BLAST TECH

A GENUINE TJPE PRODUCT

8 Channel Remote Control Sequential Electric Detonator and STI(optional) Capacitive Blasting System

V1.0

Operational Reference Guide

DESIGNED AND MANUFACTURED IN AUSTRALIA

by TJPE QLD, Australia. A.B.N. 37 503 040 550

IMPORTANT WARNING NOTICE!

PLEASE READ THIS ENTIRE REFERENCE GUIDE PRIOR TO OPERATION OF THIS DEVICE.

THE SECURE KEY FOR THE REMOTE INITIATOR WHEN NOT IS USE IS TO BE IN THE POSSESSION OF THE PERSON IMMEDIATELY RESPONSIBLE FOR BLASTING OPERATIONS.

ANY DAMAGE OR OPERATIONAL MALFUNCTION MUST BE IMMEDIATELY REPORTED TO THE MOST SENIOR AUTHORITY OF BLASTING OPERATIONS ALONG WITH A DETAILED INCIDENT REPORT AND THE ENTIRE SYSTEM TO BE RETURNED TO BLAST TECH ACCOMPANIED BY A COPY OF THE INCIDENT REPORT FOR SERVICE AND A COMPREHENSIVE INSPECTION.

THE COMPLETE RANGE OF BLAST TECH FIRING SYSTEMS HAVE BEEN DESIGNED TO COMPLY WITH AND EXCEED SPECIFICATIONS OF AUSTRALIAN STANDARDS AS2187.2 – APPENDIX B.

IT IS STRICTLY PROHIBITED TO DISASSEMBLE ANY COMPONENT OF A BLAST TECH FIRING SYSTEM UNDER ANY CIRCUMSTANCE.

THERE ARE NO USER SERVICABLE COMPONENTS INSIDE.

ALL REMOTE INITIATORS AND BLASTERS ARE FACTORY FITTED WITH ELECTRONIC TAMPER SEALS. DISASSEMBLY OF ANY KIND WILL VOID ALL WARRANTY AND MAY POSE A SAFETY ISSUE.

DO NOT OPEN!

THE INFORMATION CONTAINED IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

IMPORTANT WARNING NOTICE!

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1 INTRODUCTION

1.1 System Overview

Blast Tech firing systems are a unique, Australian designed and manufactured, radio-controlled firing system. For use in open cut mines, quarries, construction and general blasting activities with all operations being safely controlled only via the remote initiator. Blast Tech firing systems have NOT been designed nor intended for use in underground mining activities.

Designed around operational safety, reliability and ease of use for the initiation of standard two (2) ohm electric detonators. Systems may also be optionally ordered with a single, factory fitted Blast Tech proprietary direct *SHOCK TUBE INITIATOR* (STI) output module thus allowing shock tube to be directly connected and electronically fired from the blaster unit.

The Blast Tech 8 channel sequential firing system is comprised of eight (8) individual output channels and live onboard continuity function of 0.01 ohm resolution with a maximum test current of 5mA. The system channels may be fired either simultaneously (equal sequential, 0mS), sequentially from 1mS up to 250mS apart also offering equally spaced sequential delays or alternatively fired individually (single shot). Longer sequential delays are achievable, see 4.4 Sequential Delay Initiation section on page 11. Each channel is capable of firing up to one hundred (100) series wired two (2) ohm electric detonators.

Blast Tech firing systems operate in the 915-920MHz ISM band and therefore eliminates any requirement for licencing worldwide.

1.2 Authorised Use

All Blast Tech firing systems may only be used STRICTLY by qualified shotfirers. The usage of this product by non-qualified personnel is expressly forbidden.

It is important that users of Blast Tech firing systems familiarise themselves with all operational aspects of the system by reading this entire operational reference guide prior to any blasting activities.

1.3 Safety Notice

Blast Tech remotes and blasters are uniquely paired rendering them non-responsive unless specifically used in conjunction with one another. Radio communications employ strict data encryption/decryption algorithms and on-the-fly absolute data integrity verification techniques making data interception meaningless and data corruption simply not possible.

Proprietary Blast Tech *Secure Key* technology also employs strict data encryption/decryption algorithms with a hardware generated truly random 196bit rolling code that is verified and superseded each time the *Secure Key* is applied to the remote. By design, all Blast Tech firing systems are rendered inoperable and completely unusable without constant application of the *Secure Key*.

All high voltage circuitry capable of blast initiation is physically disconnected from the output terminals at all times except for the brief period of initiation. Additionally, unless ARMED, all high voltage stages are electronically disabled and held at zero potential system wide, inclusive of the STI module. Furthermore, if the radio link between blaster and remote is lost, the system will automatically return to a disarmed state.

Only channels with a detected in-range continuity between 0.01 ohms and 220 ohms will be actively charged upon arming and can only be initiated according to user input once the system becomes ‘charge ready’.

The blaster unit will automatically enter a total shutdown state after 30 minutes has elapsed without an active radio link to the remote.

Upon firing, each active channel delivers a capacitive stored charge to the associated terminal pair for a period of not more than 25mS.

The blaster unit may be powered on or off via the power button located on the top panel and must be initially powered on with this button, however all operational functions are performed via the remote including the total system shutdown procedure.

While ARMED, the only operational functions available are ARM/DISARM, SHUT DOWN, Single Shot SELECT and FIRE. If in sequencer mode and the Single Shot SELECT button is pressed, the system can enter Single Shot mode and the first detected active channel will be immediately selected.

If no active channels are detected, any arming attempts shall be denied by the blaster and the system will automatically return to a disarmed state.

Before ANY initiation can be executed, the system must first be ARMED, in a CHARGE READY state and both FIRE buttons simultaneously pressed by the user.

NOTE: In general, a notable brief delay of operations will be recognised during use due to radio communications of absolute command verification between the blaster and remote initiator.

*** EXPRESS WARNING ***

NEVER under any circumstances touch any channel terminals whilst a blast is initiated as the output potential delivers an electrical shock capable of causing serious harm or injury and could be fatal.

NEVER under any circumstances mix, link or electrically combine two separate channel terminal pairs into the same detonator circuit. Only ever use the + and – terminals of one channel for any one detonator circuit.

NEVER apply any external electrical potential to the output terminals.

Non-compliance of this warning has the potential to cause internal damage to the system and will NOT be covered under warranty.

Further to this warning, improper detonator connectivity of this nature has the potential to produce unintended initiations upon firing and may be harmful or fatal.

1.4 Package Contents

1 x Blast Tech remote initiator

1 x Blast Tech *Secure Key*

1 x Blast Tech 8 channel blaster

1 x 240VAC charger (blaster)

2 x 12/24VDC automotive adapters (remote & blaster)

2 x 3.0dBi flexible R/A SMA-J antennas

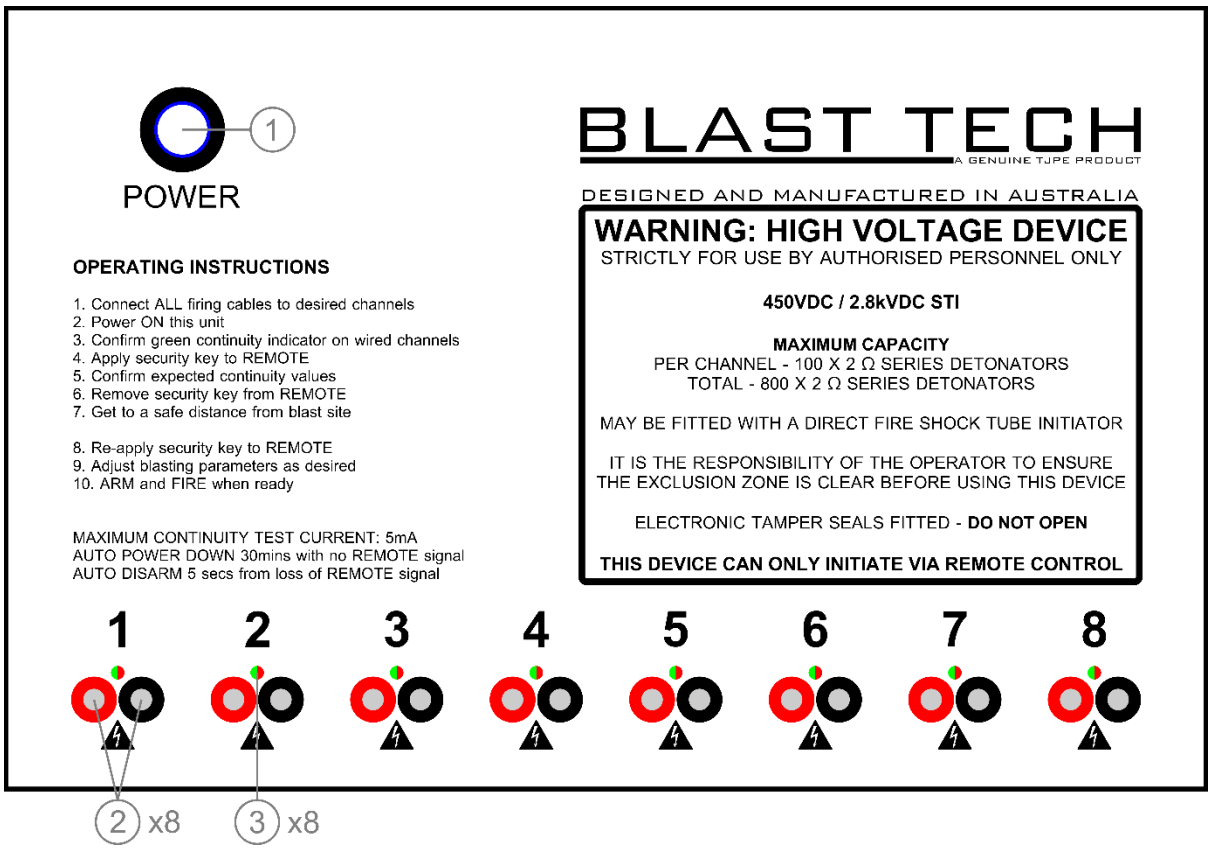
6 x 1.5V AA alkaline batteries

1 x Operational reference guide

1 x Registration/Warranty certificate

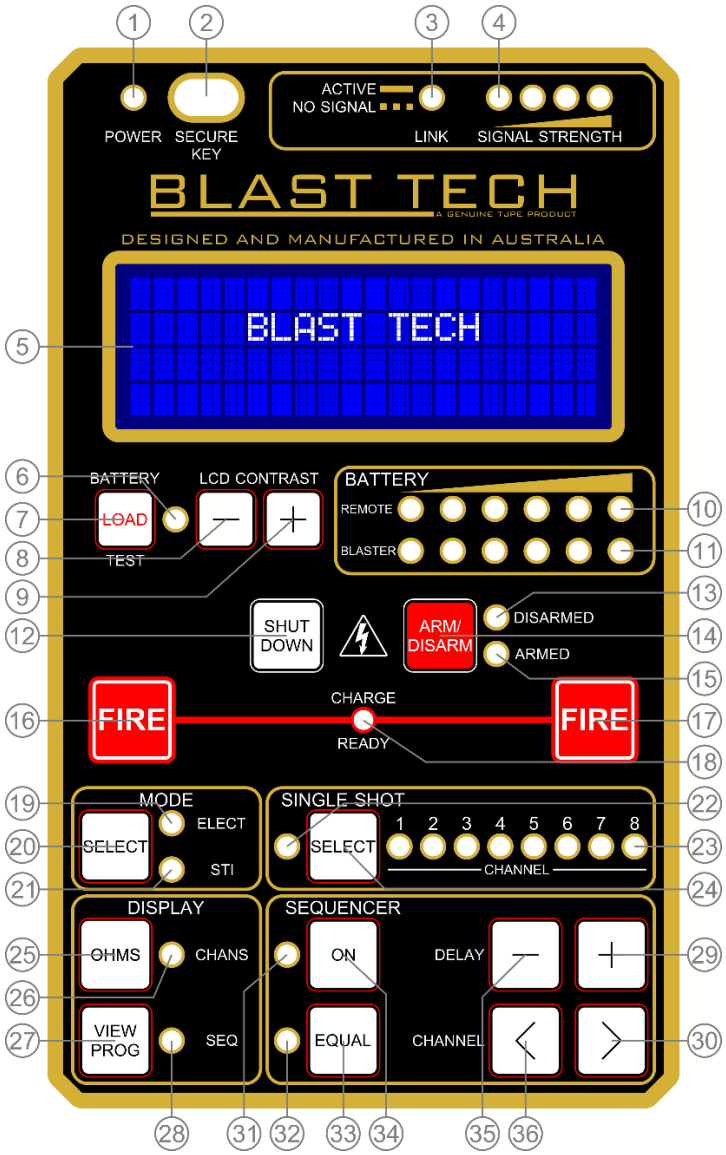
2 PANEL OVERVIEWS

2.1 Blaster Panel



1. Blaster power button and status indicator LED ring
2. +/- Electric detonator connection terminals
3. Continuity indicator LEDs – RED=Open circuit, GREEN=Continuity in range

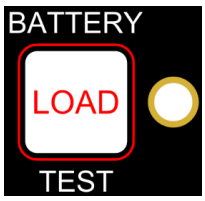
2.2 Remote Initiator Panel



1. Power/Key verification indicator
2. *Secure Key* magnetic coupling
3. Link active/inactive indicator
4. Signal strength indicator
5. Liquid crystal display (LCD)
6. Battery load test indicator
7. Battery load test
8. Decrease LCD contrast
9. Increase LCD contrast
10. Remote battery level indicator
11. Blaster battery level indicator
12. Total shutdown
13. Disarmed indicator
14. Arm/Disarm
15. Armed indicator
16. Fire button 1 of 2
17. Fire button 2 of 2
18. Charge ready indicator
19. Electric detonator mode indicator
20. Firing mode selector
21. Shock Tube initiator mode indicator
22. Single shot mode indicator
23. Selected active channel indicator
24. Single shot channel selector
25. Channels continuity display
26. Channels continuity display indicator
27. View sequencer delays
28. View sequencer delays indicator
29. Increase sequencer delay
30. Increment selected delay channels
31. Sequencer ON indicator
32. Sequencer times equal indicator
33. Sequencer times equal
34. Sequencer ON
35. Decrease sequencer delay
36. Decrement selected delay channels

3 GETTING STARTED

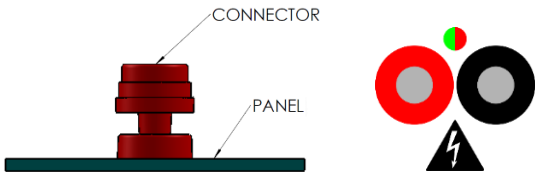
3.1 System Batteries Load Test



Before connecting any detonators to the output terminals or inserting shock tube to the STI port, power ON the blaster unit, allow the self-test function to complete which is recognised when the continuity indicator LEDs become static. Next, press the 'Battery Load Test' button on the remote without applying the *Secure Key*. BATTERY TEST will be displayed on the remote LCD and a brief load test will be performed on both the remote and blaster batteries simultaneously. The results shall then be momentarily displayed on the Battery Level indicators on the remote after which the remote and blaster units will automatically return to a total shutdown state.

NOTE: If the blaster is not first powered ON when performing this test, only the remote battery indicator will return a test result.

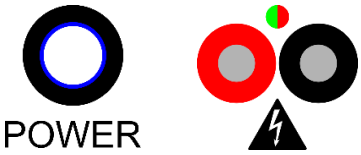
3.2 Connecting Detonators to the blaster terminals



Pushing down on the spring-loaded plastic terminal surround will expose the connection post. Wrap each bare detonator wire end around each of the + and – terminal posts ensuring at least two complete loops around the posts.

NOTE: For additional safety, whilst the blaster is in a total shutdown state, ALL terminal posts are electronically held permanently short circuited.

3.3 Blaster - Initial Continuity Confirmation



Power ON the blaster unit. Initially a self-test and system wide safe operating verification will be performed which is indicated by a scanning sequence of the continuity test LEDs. Once completed and ready for operation, a RED indicator LED at any terminal pair indicates an out of range (>220 ohms) detonator circuit is detected, while GREEN indicates an in range (0-220 ohms) detonator circuit capable of initiation.

3.4 Secure Key

The proprietary Blast Tech *Secure Key* has a 196bit encrypted rolling code and is fitted with a magnetic coupling. Application of the key only authenticates and maintains radio communications between the remote and blaster and cannot trigger the system to initiate only by application to the remote. The key's code is hardware random generated and is superseded each time the key is applied with a successful verification.

Successful verification:

A beep and a constant power LED indicator on the remote and a green LED on the *Secure Key*.

Unsuccessful verification:

A beep, a flashing power LED indicator on the remote and a red LED on the *Secure Key*.

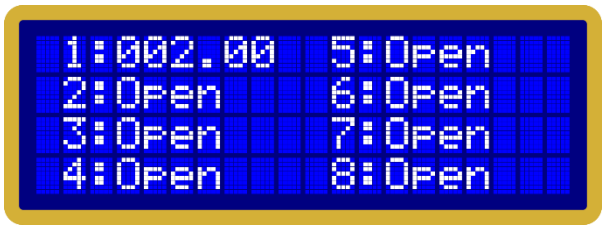
Without the *Secure Key* your blasting system cannot function.

***** DO NOT MISPLACE YOUR KEY! *****

NOTE: To apply the key, recognise the orientation of the five (5) connecting pins and allow the magnetic coupling to take the key from your hand as this will seat the key correctly.

3.5 Verify Continuity Values on the Remote LCD

Apply the *Secure Key* to the remote. Once the radio link has been established, the remote LCD will display the ohmic value detected on each output channel.



Any channel with a detected in-range value will display a measurement in ohms, while any channels displaying ‘Open’ have been detected with a line resistance that is too high for initiation is considered as open circuit and therefore will not be charged and cannot be fired.

Once the expected ohmic values of each channel have been confirmed, remove the *Secure Key* from the remote, leave the blaster unit powered ON and exit the exclusion zone.

NOTE: The blaster unit can remain idle and powered ON for a period of not more than 30 minutes without an active radio link to the remote initiator after which the blaster unit will automatically enter a total shutdown state requiring the power button to be pressed in order to be powered up again. Anytime a radio link to the remote initiator becomes active, the 30-minute total shutdown timer is reset.

3.6 Exit Exclusion Zone

It is the responsibility of the shotfirer in command of the blasting system to ensure all personnel are outside the designated exclusion zone and all required signage as per site policies have been erected before proceeding.

4 CONFIGURATION PARAMETERS

4.1 Radio Link and Signal Strength Confirmation

The LINK and SIGNAL STRENGTH indicators provide a visual representation of the radio communications quality between remote and blaster.

LINK:

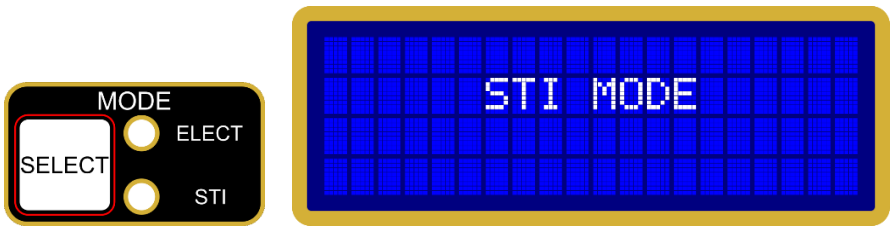
- Constant - Radio link active
- Flashing - Radio link inactive/link lost

SIGNAL STRENGTH:

- Red - Signal is weak, reliable communication can be maintained
- Yellow – Signal is fair
- Green1 – Signal is good
- Green2 – Signal is excellent

NOTE: A constant LINK indicator in the absence of any SIGNAL STRENGTH indication does denote an active link, however communication may not be reliably maintained. Proprietary algorithms ensure data integrity is maintained between remote and blaster at all times.

4.2 Electric or STI Mode Selection

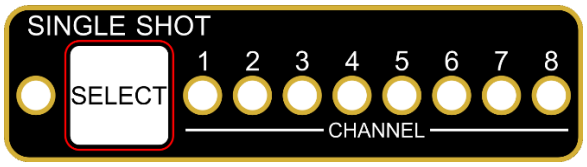


Systems fitted with the optional Blast Tech proprietary direct SHOCK TUBE INITIATOR module have a MODE select feature. This provides the choice of initiating via electric detonators (ELECT) using the output channel terminals or by direct connection of shock tube (STI). The shock tube port is located on the

front of the blaster unit. Pressing the MODE – SELECT button will toggle between these two options.

NOTE: By design, the combination of these two output options is not possible.

4.3 Single Shot Initiation

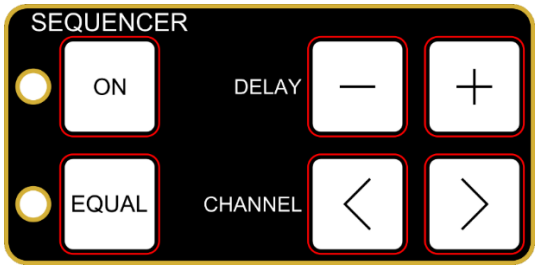


The default power up parameter of the remote initiator is disarmed single shot initiation with the first detected active/in range channel automatically selected. This is indicated by the LED to the left of the SELECT button with a specific channel LED illuminated.

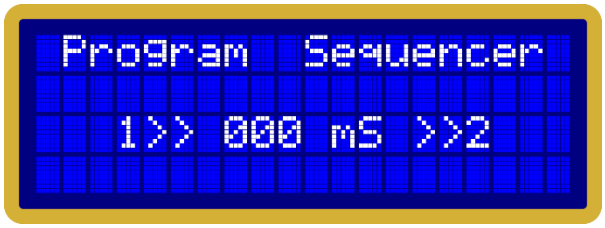
Single shot initiations require no specific setup procedure other than to ensure the user has the desired output channel selected prior to initiation. Once an initiation has been executed and the detonator becomes open circuit, the system will automatically advance to the next active channel until no active channels are detected at which time the system will automatically return to a disarmed state. With the system armed or disarmed, the selected channel may also be manually advanced by pressing the SELECT button.

NOTE: Each channel can only be initiated once. If all active channels have been initiated, the system will return to a permanently disarmed state until a total shutdown is executed and the blaster is re-powered. Any further attempts to arm the system at this time will be denied.

4.4 Sequential Delay Initiations



To enter sequential initiation programming mode, press the SEQUENCER-ON button, this will display ‘Program Sequencer’ on the LCD with a channel number either side of a millisecond delay time value in the middle.



To program the sequencer or to alter the current programmed delay times, press the SEQUENCER-ON button at any time. By default, the channel delay displayed is between channels 1 and 2.

The delay time between consecutive channels can be varied from 0mS up to a maximum of 250mS using the DELAY + and - buttons. Programming delays between other channel pairs can be selected by pressing CHANNEL < or >. Only delays between consecutive channel pairs may be programmed. For example, delay times can be set between channels 1-2, 4-5 or perhaps 7-8.

Although all channels may not have detonators connected, all channel delay times are actively available for use in this mode thereby making longer delays possible.

Programming examples:

Connecting detonator circuits to channels 1 and 3 while leaving channel 2 unconnected, can achieve a delay up to 500mS.

1-2 programmed delay = 250mS

2-3 programmed delay = 250mS

therefore 1-3 programmed delay = 500mS

Connecting detonator circuits only to channels 1 and 8 while leaving all other channels disconnected can achieve a maximum initiation delay of 1750mS.

1-2 programmed delay = 250mS

2-3 programmed delay = 250mS

3-4 programmed delay = 250mS

4-5 programmed delay = 250mS

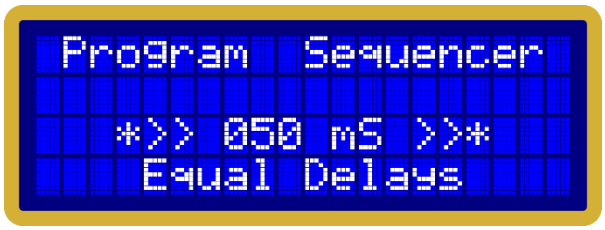
5-6 programmed delay = 250mS

6-7 programmed delay = 250mS

7-8 programmed delay = 250mS

therefore 1-8 programmed delay = 1750mS or 1.75 seconds

4.5 Equal Sequential Delay Initiations



With the same operational functionality as previously explained in section 4.4, programming equal time delays between all consecutive channel pairs simultaneously may be achieved by pressing the EQUAL button within the Sequencer Panel.

An equal programmed delay of 50mS will result in the following:

1-2 programmed delay = 50mS

2-3 programmed delay = 50mS

3-4 programmed delay = 50mS

4-5 programmed delay = 50mS

5-6 programmed delay = 50mS

6-7 programmed delay = 50mS

7-8 programmed delay = 50mS

From the above example, a delay of 350mS would be achieved by making use of only channels 1 and 8 leaving all other channels disconnected.

4.6 Simultaneous Channel Initiations

The simultaneous initiation of channels may also be achieved by using the sequencer.

By activating the initiation sequencer and leaving all delays at 0mS, will result in all channels with a detected in range continuity to initiate simultaneously.

4.7 Mixed Delay Initiations

Both delayed and simultaneous initiations can also be mixed when appropriately programming the initiation sequencer.

Mixed initiation example:

Say we want one channel to initiate, then 12mS later two other channels initiate simultaneously, after which another channel initiates upon a further delay of 8mS. Then finally after a further 60mS delay another three channels initiate simultaneously.

START

First channel initiation

|

12mS DELAY

|

Second and third channels initiate simultaneously

|

8mS DELAY

|

Fourth channel initiation

|

60mS DELAY

|

Fifth, sixth and seventh channels initiate simultaneously

FINISH

To achieve this, the sequencer would be programmed as follows:

1-2 programmed delay = 12mS

2-3 programmed delay = 0mS

3-4 programmed delay = 8mS

4-5 programmed delay = 60mS

5-6 programmed delay = 0mS

6-7 programmed delay = 0mS

Circuit connections for this example:

First detonator circuit connected to channel 1

Second and third detonator circuits connected to channels 2 and 3

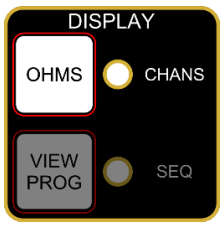
Fourth detonator circuit connected to channel 4

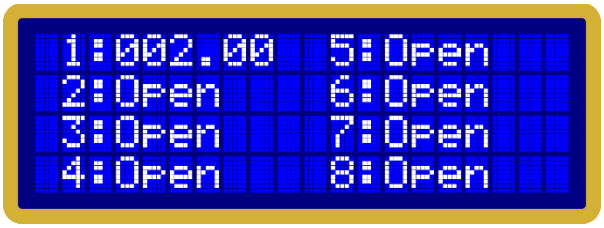
Fifth, sixth and seventh detonator circuits connected to channels 5, 6 and 7

Remember, NEVER under any circumstances mix, link or electrically combine two separate channel terminal pairs into the same detonator circuit. Only ever use the + and – terminals of one channel for any one detonator circuit.

NOTE: If the system is returned to Single Shot mode, Equal Sequencer mode is activated or deactivated, the firing mode is switched between Electric and STI or the *SECURE KEY* is removed from the remote, ALL programmed delay values are immediately lost and will be returned to the default state of 0mS. However if the radio link was momentarily lost for any reason, the programmed sequencer delay values will be retained.

4.8 Display – Ohms



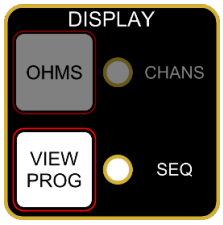


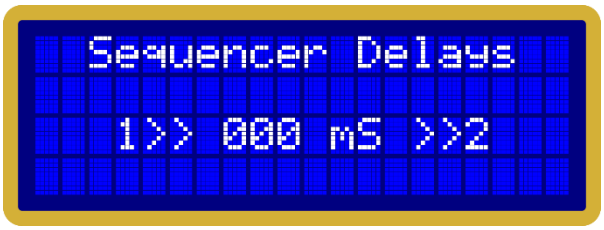
Display - Ohms button will return the LCD to display the live continuity measured against all channels.

1: 002.00 = 2.00 ohms continuity detected on channel 1

2 to 8: Open = Open circuit (> 220 ohms) detected on channels 2 to 8

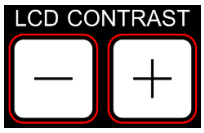
4.9 Display – View Program





Display – View Prog button will consecutively display the currently programmed Sequencer delays from 1-2 through to 7-8 and then return the LCD to Display – Ohms.

4.10 LCD Contrast



Adjustment of the liquid crystal display (LCD) contrast can be made via the LCD CONTRAST + and – buttons. This setting is always retained.

5 INITIATING A BLAST

5.1 Arming

Once all parameters have been set and the exclusion zone is confirmed clear of all personnel, the system may be armed by pressing the ARM/DISARM button.

Upon arming in electric initiation mode (ELECT), the LCD will display the live detected continuity of all channels. In direct shock tube initiation mode (STI), the LCD will continue displaying STI MODE.

The high voltage supply will become active and all wired channels with a detected in-range continuity or the STI module will be actively charged.

NOTE: In single shot mode, the user must ensure the desired channel is selected prior to initiation.

5.2 Charge Ready and Blast Initiation

For blast initiation to commence, the CHARGE READY indicator must be illuminated and both FIRE buttons must be pressed simultaneously.

NOTE: The system will ignore any initiation attempt without first being ARMED and in a CHARGE READY state.

5.3 Disarming

Automatic disarming will occur once all active channels have been initiated.

When the system is armed, disarming may also be achieved at any time by either pressing ARM/DISARM or by removing the secure key.

Any attempt to re-arm the system once all active channels have been fired will be automatically denied and the system will return to a disarmed state.

6. POST BLAST PROCEDURE

6.1 Total Shutdown

A total system shut down may be executed at any time.

When a total shut down request is received by the blaster, a disarm command is immediately executed, system wide electronic high voltage lock out mechanisms are activated and detection of all high voltage circuitry is confirmed to be at ZERO potential. This confirmation is then returned to the remote prior to the blaster's total shut down state at which time all LED indicators and the LCD on the remote will extinguish and the power LED indicator will flash rapidly indicating a successful total shut down of the blaster has occurred.

The *Secure Key* should now be removed and stored securely. Failure to remove the *Secure Key* at this time will drain the remote batteries until they are completely flat.

In the event that the radio link was lost even momentarily and the shutdown button was pressed, the command will remain present in the remote (unless the *Secure Key* is removed) and will instantly send the shutdown request to the blaster once the radio link has been re-established.

Once a total shutdown has been successfully executed, it is impossible to operate the blaster unit without first physically pressing the blaster POWER button.

NOTE: If in the event that a system wide ZERO high voltage potential is NOT confirmed for any reason during a total shutdown, the blaster unit records this event into non-volatile memory and will cease to function. It will then emit a high rate beep and flash the blue power button LED ring, for a duration of 4-5 seconds and will return to a total shut down state. This will permanently re-occur every time there is an attempt to operate the blaster. At this time the system can only be returned to Blast Tech TJPE for service and inspection to remedy any potentially hazardous issue.

7 TECHNICAL SPECIFICATIONS

7.1 Blaster

t -5°C to +55°C

PARAMETER	MIN	TYP.	MAX	UNIT
Detonators (per channel)	1	-	100	2Ω dets
Continuity Test Function				
Voltage	4.999	5.000	5.001	VDC
Current	-	-	5	mA
Resolution (0.1 Displayed on LCD)	-	10	-	mΩ
		16		bit
Accuracy		+/-0.02		%
Electric output initiation (per channel)				
Capacitance	84.6	94	103.4	µF
Voltage	447	450	453	VDC
Initial current			944	ADC
Stored energy	8.68	9.64	10.6	J
Initiation duration	24.94	25.0	25.05	mS
STI voltage	2.78	2.9	3.12	kVDC
Battery – Li-Ion 4S1P				
Voltage	12.9	14.8	16.8	VDC
Capacity		3400		mAh
Run time (single charge)		7		h
External power/charge voltage	9	-	30	VAC/VDC
Charge time (from 0%)		5.5		h
Transceiver				
Operating frequency	915.125	-	920.000	MHz
Transmission power EIRP			30	dBm
Receiver sensitivity		-129		dBm

7.2 Remote Initiator

t -5° to +55°C

PARAMETER	MIN	TYP.	MAX	UNIT
Battery – 6x AA (LR6) type Alkaline				
Voltage		9		VDC
Run time		2.1		h
External input voltage	9	-	30	VDC
Transceiver				
Operating Frequency	915.125	-	920.000	MHz
Transmission power EIRP			30	dBm
Receiver sensitivity		-129		dBm

*Total system package dimensions and weight 520x425x210mm, 10.8kg

7.3 AS2187.2 – Standards Australia

APPENDIX B

EQUIPMENT FOR ELECTRICAL FIRING

(Normative)

B1 GENERAL

Clause 2.5 requires that equipment used for testing and firing electric detonators shall comply with the requirements of this Appendix and that, where appropriate, compliance be verified by testing in accordance with the test methods specified herein.

The specification for circuit testers, exploders and firing cables set out in Paragraphs B4, B5, B6 and B7 apply only to equipment used to fire detonators that have no-fire currents in the range of 180mA to 250mA.

NOTES:

1 Group 1 detonators have a bridge resistance of 0.9Ω to 1.6 Ω.
2 The requirements for other types of equipment would normally be set by the regulatory authority.
3 For detonators other than Group 1, the specification for circuit testers, exploders and firing cables should be determined accordingly.

B2 APPROVAL OF EQUIPMENT

In general, exploders and circuit testers will require approval. Equipment shall comply with the following requirements:

(a) The equipment shall pass such tests as the regulatory authority considers necessary to establish their qualities and, in particular, their safety (see Note 1).
(b) The equipment shall comply with any construction and performance specified by the regulatory authority.

(c) The equipment shall be durable, robust, functionally reliable and suitable for use in ambient temperatures normally found in Australia (-5°C to 45°C).

(d) Any enclosing case shall be constructed to prevent ingress of dust or splashed liquids, as far as reasonably practicable.

(e) For exploders and circuit testers, the insulation resistance between the circuit and the case shall be greater than 50 MΩ at 500 V when measured after conditioning for 24h in an ambient temperature of maximum 20°C and relative humidity of at least 90%.

NOTES:

1 Certification to other national or international Codes or Standards may be acceptable.

2 Exploders and circuit testers are electrical instruments and should be accorded the care in handling and use appropriate to such instruments.

B3 CARE OF EQUIPMENT

All equipment shall be maintained in good and efficient condition.

B4 CIRCUIT TESTER

The circuit tester shall be a special type of ohmmeter, manufactured so that under any operating conditions it will deliver less than 50mA when short-circuited.

NOTE: The use of a battery with an output limited to 50mA is recommended. The scale of the instrument should be graduated to give clear readings from 0.5 Ω upward and for convenience the scale may be divided into two or more ranges.

Any adjustment or replacement of batteries in circuit testers shall be done either by the manufacturer or strictly in accordance with instructions issued by the manufacturer.

The circuit tester shall be reliable in performance and be accurate to within 0.5 Ω or within 7% of true resistance value, whichever is the greatest.

B5 EXPLODER

B5.1 Maintenance

The maintenance of exploders shall be carried out by a competent person. For mechanically operated exploders, the moving parts shall be lightly lubricated, care being taken to prevent excess oil spreading to the commutator and brushes.

NOTE: The interior of the exploders should be kept free from dust and the exterior should be clean and dry. The terminals should be kept clean.

B5.2 Routine testing

The exploder shall be tested by means of the rheostat described in Paragraph B6 or by an alternative means provided by the exploder manufacturer.

Where the rheostat method is used, the rheostat shall be constructed to the specifications of Paragraph B6, together with two detonators, and connected in series across the exploder firing terminals. Both detonators shall be shielded separately, so that one will not initiate the other, and no injury can result to any person in the vicinity. The rheostat shall be set for a rated capacity one unit less than the rated capacity of the exploder. The exploder shall be operated according to prescribed instructions. Both detonators shall fire.

B5.3 Construction

In addition to the general requirements set out in Paragraph B2, the construction of the exploder shall comply with the following:

(a) The exploder shall be provided with a protective case incorporating carrying straps or handles.

(b) The output terminals or connecting arrangements shall be designed and sized so as to allow convenient and secure attachment of firing cables of the size specified in Paragraph B7.

(c) The exploder shall be so constructed that it can be made operable by a removable handle or key, and it shall only be possible to remove this handle or key in the 'off' or 'safe' position.

The following types of exploders are available:

(i) *Generator type* Generator type exploders have a dynamo, the armature of which is manually rotated through gearing from either a plunger rack-bar or a twisting handle. They are normally used for series firing.

(ii) *Capacitor type* Capacitor-type exploders have one or more capacitors that are charged from either a battery or dynamo having a manually rotated armature. Capacitor-type exploders are suitable for series firing, and most may be used to a limited extent for firing series-in-parallel circuits.

Capacitor exploders are fitted with a device to indicate when sufficient electrical energy is available to fire the circuit of detonators.

A special variant of capacitor type exploders embodies several capacitors, each of which is used to fire one circuit of detonators. Internal timing controls allow the capacitors to discharge into their detonator circuits at predetermined time intervals thus providing sequential firing.

(iii) *Sequential or sequence switch type* The sequential or sequence-

switch-type exploders provide delay firing intervals of predetermined duration. A manually or mechanically rotated sequence switch directs electrical energy to fire each detonator/circuit in turn as the rotating arm passes over the appropriate contact.

B5.4 Maintenance

The exploder shall be labelled as follows:

(a) *Instructions for use* A permanent label of instructions shall be secured to the exploder by screws, rivets or other permanent means.
NOTE: The instructions should be visible during use.

(b) *Removal of key* A prominent label shall be fixed to the front face of the exploder, readily seen when inserting the key with the exploder in or out of its protective case, bearing the words 'REMOVE KEY AFTER FIRING' or 'REMOVE HANDLE AFTER FIRING', as appropriate.

(c) *Capacity* The capacity expressed in terms of the maximum number of defined detonators or the maximum series circuit resistance that can be fired by the exploder, shall be marked on the exploder.

(d) *Battery* The type of battery required.
NOTE: Leak-proof batteries are recommended.

B5.5 Electrical design features

B5.5.1 *Firing output*

The exploder shall be capable of producing an output current only with the firing mechanism in one definite firing position. With a connected resistance of $2.1(n + 1)\ \Omega$, where n is the rated capacity of the exploder for any single operation of the firing, the output current shall be as follows:

(a) For a constant output exploder …… 1.4 A for 3.5 ms.

(b) For a capacitance exploder ……..…….. not less than 8mJ/ Ω.

Once a firing output has been produced, the firing controls shall be returned to the 'off' or 'safe' position or otherwise cancelled before another firing output can be produced.

B5.5.2 *Abortion of firing*

The sequence for obtaining a firing output shall be able to be abandoned at any point up to the final firing position without producing an output current.

B5.5.3 *Component malfunction*

The design of the exploder shall be such that a firing output shall not be produced through component malfunction. For the purpose of this Paragraph, 'malfunction' shall include mechanical and electrical failure of a switch, an earth fault on any part of the equipment, and an open-circuit or short circuit occurring on any component or any part of the electrical circuit.

NOTE: It is recommended that at least two components would need to malfunction before an unintentional firing output is produced.

B5.5.4 *Generator-driven exploders*

For exploders whose output is directly provided from a generator, suitable means shall be provided to ensure that current is not put to line until the firing output required by Paragraph B5.5.1 is available.

B5.5.5 *Exploders of the capacitor-discharge type*

For exploders of the capacitor-discharge type, the following requirements apply:

(a) Where the firing circuit is made automatically, no current shall be put to line until the capacitor is adequately charged and the firing output required by Paragraph B5.5.1 is available.

(b) Where the firing circuit is made by a manually operated switch, an indication shall be given when, and only when, the capacitor is adequately charged.

(c) When the removable handle or key is removed (see Paragraph B5.3(c))-

(i) the capacitor shall automatically be discharged over a period of not more than 3 s (see Note); and

(ii) the firing terminals shall be short-circuited.

NOTE: A resistor is normally used, as discharging a capacitor by means of a direct short-circuit can damage the capacitor and result in a reduction in capacity of the exploder.

(d) When there is no external circuit connected, adequate provision shall be made to discharge the exploder over a period of not more than 3 s.

(e) In the 'off' or 'safe' position, any battery used in the exploder shall be electrically disconnected from the capacitor.

B6 RHEOSTAT

Where a rheostat is used for testing exploders (see Paragraph B5.2), it shall consist of a suitable variable resistance fitted with stepped contacts or a number of resistances connected to terminals. This may be calibrated in terms of a convenient number of detonators, each contact being clearly marked with the proper number of detonators represented by the contact.

For the purpose of calculating the resistance required between steps, and allowing a factor of safety, 3.2 Ω shall be considered as the resistance for each detonator in the circuit.

B7 FIRING CABLE

Firing cable for use with portable-type exploders, except sequential exploders, shall comply with AS/NZS 3191 and shall be of two-core flexible cord, thermoplastic insulated and sheathed. The cores shall be multi-stranded copper conductors having a minimum cross-sectional area and maximum resistance as follows:

(a) Heavy duty …….. 2.0mm², not more than 2 Ω/100 m of cable.
(b) General duty ……. 1.0mm², not more than 5 Ω/100 m of cable.

The cable shall be maintained in a sound condition, care being taken to avoid kinks, cuts and abrasions.

NOTE: A suitable type of heavy-duty cable is 50/0.25mm, preferably yellow in colour.

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~END~

8. BATTERIES AND CHARGING

8.1 Blaster Unit Batteries

The blaster unit has an internal onboard Li-Ion 4S1P cell configuration with over-charge/discharge/overload protection and precision balance charging circuits designed to maximise battery life providing years of uncompromised service. This battery is inaccessible and is not serviceable by the end user. If the blaster battery becomes depleted during use wherein reliable operation cannot be maintained, both remote and blaster will enter a total shutdown state.

When the charger is plugged in, the blue LED ring indicator of the power button will flash. As the state of charge alters, the LED indicator will alter accordingly. A very short ON period followed by a very long OFF period indicates the blaster battery is almost depleted. A very long ON period followed by a very short OFF period indicates the blaster battery is almost full. If both on and off periods appear equal to the eye, the battery can be considered to be approximately 50% charged.

Once the battery reaches 100% capacity, the blue LED ring indicator will extinguish and remain off.

The charger may remain plugged into the blaster indefinitely without causing any damage to the unit and/or charger.

If the blaster is not in constant use, the charger should be plugged into the unit at least once every three (3) months until the blue LED ring indicator extinguishes and remains off.

8.2 Remote Initiator Batteries

The remote initiator is powered by 6x AA (LR6) disposable, non-rechargeable alkaline batteries capable of providing approximately 2.1 hours of continuous operation. If the remote batteries become depleted during use wherein reliable operation cannot be maintained, both remote and blaster will enter a total shutdown state.

8.3 External Power and Charging

9-30VDC may be used to externally power the blaster unit and remote initiator.

To ensure no electrical damage to any component of the blasting system occurs, use only the supplied external power adapters.

TEST AND COMPLIANCE

Annual Test and Compliance Prerequisite

It is a condition of sale that all Blast Tech systems MUST be presented to the manufacturer for test and compliance checking on an annual and ongoing basis which will include any and all calibrations and applicable firmware updates.

NOTE: When presenting your system for test and compliance please ensure your *SECURE KEY* is accompanied with the system. Test and compliance checks take 2-3 days at our facilities.

Please communicate with us at least 30 days prior to your annual test date to confirm the most appropriate Blast Tech TJPe service office.

On the condition you have completed your warranty/registration as required, we will contact you via the details you provided us 30 days prior to your annual test date.

Please contact us at: customerservice@tjpe.com.au

IMPORTANT!

Upon completing the registration of this product (within 14 days of purchase), your first annual test and compliance check will be performed free of charge, however all shipping and handling fees are the sole responsibility of the customer.

All future annual test and compliance checks will incur a flat fee which may be subject to change without notice. See our website for the current fee schedule.

If required, you may request a loan system at no extra charge during this time to ensure there is no down time of blasting operations. Shipping and handling charges for this service are the sole responsibility of the customer.

In the event TJPe finds no evidence of misuse or damage of any kind and for any reason during the annual test and compliance check, TJPe deems it necessary to replace your registered system, it will do so without any prior notice at its sole discretion and at no extra charge to the customer.

WARRANTY

What does this warranty cover?

Subject to the exclusions contained herein, TJPE (the manufacturer) warrants that this Blast Tech branded product (“product”) or certified accessory (“accessory”) sold for use with this product that it manufactured to be free from defects in materials and workmanship under normal consumer usage for a period of twelve (12) months from the original purchase date the item was sold new directly by TJPE or one of its sales agents.

Who is covered?

This Warranty extends to any customer for a period of twelve (12) from the original purchase date the item was sold new directly by TJPE or one of its sales agents.

What will BLAST TECH do?

Blast Tech or its authorized distributor at its option and within a commercially reasonable time, will at no charge repair or replace any products or accessories that do not conform to this warranty. We may use functionally equivalent genuine TJPE reconditioned/refurbished/pre-owned or new products, accessories or parts.

What Other Limitations Are There?

ANY IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL BE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY, OTHERWISE REPAIR OR REPLACEMENT PROVIDED UNDER THIS EXPRESS LIMITED WARRANTY IS THE EXCLUSIVE REMEDY OF THE CONSUMER, AND IS PROVIDED IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. IN NO EVENT SHALL TJPE BE LIABLE, WHETHER IN CONTRACT OR TORT (INCLUDING NEGLIGENCE) FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT OR ACCESSORY, OR FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR LOSS OF REVENUE OR PROFITS, LOSS OF BUSINESS, LOSS OF INFORMATION OR OTHER FINANCIAL LOSS ARISING OUT OF OR IN CONNECTION WITH THE ABILITY OR INABILITY TO USE THE PRODUCTS OR ACCESSORIES TO THE FULL EXTENT THESE DAMAGES MAY BE DISCLAIMED BY LAW.

Exclusions

Normal Wear and Tear. Periodic maintenance, repair and replacement of parts due to normal wear and tear are excluded from coverage.

Batteries. Only blaster Li-Ion batteries with a fully charged capacity falling below 80% of their rated capacity are covered by this Warranty.

Abuse & Misuse. Defects or damage that result from: (a) improper operation, storage, misuse or abuse, accident or neglect, such as physical damage (cracks, scratches, etc.) to the surface of the product resulting from misuse; (b) contact with liquid, water, rain, extreme humidity, sand, dirt or the like, extreme heat; (c) subjecting the Product or Accessory to abnormal usage or conditions; or (d) other acts which are not the fault of TJPe, are excluded from coverage.

Use of Non-Blast Tech Branded Products and Accessories. Defects or damage that result from the use of non-Blast Tech branded or certified Products or Accessories or other peripheral equipment are excluded from coverage.

Unauthorized Service or Modification. Defects or damages resulting from service, testing, adjustment, installation, maintenance, alteration or modification in any way by someone other than TJPE is excluded from coverage.

Altered Products. Products or Accessories with (a) serial numbers or date tags that have been removed, altered or obliterated; (b) broken seals including electronic seals or that show evidence of tampering; (c) mismatched board serial numbers; or (d) non-conforming or non-Blast Tech branded housings or parts are excluded from coverage.

Warranty Registration

To be included in our valuable incentive offers program, the Registration/Warranty certificate accompanied with this blasting system MUST be completed and a copy returned to TJPE via email within fourteen (14) days of the original purchase date. Upon us receiving your Registration information, we will send you a non-transferable Unique Customer Number incentives offer certificate by post.

How to Obtain Warranty Service or Other Information?

To obtain service information, warranty registration, submit any relevant feedback or complaints, please contact us via email:

customerservice@tjpe.com.au

DISCLAIMER

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