

COMMANDER SYSTEM QUICK REFERENCE GUIDE

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1. Think through the task
2. Identify the hazards
3. Eliminate or manage the hazards
4. Assess the remaining risk
5. Do the job safely

1 SYSTEM LIMITS

The 4G system limits must be adhered to at all times to ensure that blasts are successfully initiated.

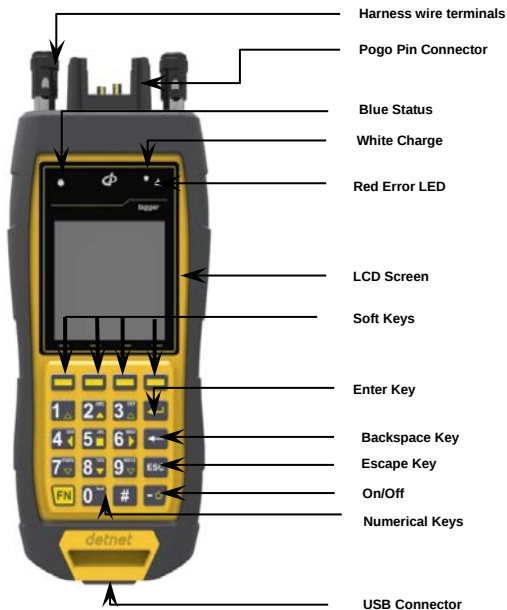
Maximum harness wire per channel	2,500m
Maximum downline per channel	12000m
Maximum Bench Commanders per Base Commander	10
Maximum detonators per Tagger	16000
Maximum detonators per Channel	400
Maximum detonators per Bench Commander	1600
Maximum detonators RF	16000
Maximum detonators standalone	1600
Maximum detonators per hole	6 decks x 3 dets each = 18 dets
Maximum holes per string	400
Maximum strings per blast design	44
Maximum line-of-sight for Remote Firing	3km
Maximum delay for any detonator	20,000ms
Minimum delay per detonator	0ms
Minimum delay increment	1ms
Maximum Wi-Fi connectivity distance	10m

2 PRE-USE CHECKLIST

Prior to arrival on the bench:

1. Ensure Commanders and Taggers are fully charged.	
2. Check for latest software version	
3. Check communications settings on Bench Commander and Base Commander correspond.	
4. Ensure Smart Cards are available and check serial numbers to ensure they are paired.	
5. Ensure dates and times on control equipment are correctly set.	
6. Ensure correct amount of detonators and harness wire are delivered to the bench.	
7. Ensure that blast layout is correctly loaded onto Tagger.	
8. Ensure a copy of Tagging Plan is available.	
9. Ensure pre-planning is performed.	

3 CE4 TAGGER



3.1. Setting up Tagger

Turn Tagger ON

Enter Password (Default password 9949 - If required)

Configure Tagger

From Main Menu press configuration soft key.

Once in the **CONFIGURATION** menu press:

- 1 to enter 4G Setup
- 2 to enter Device Setup
- 3 to enter Advanced Setup
- 4 to enter Factory Setup (Password protected)

The Device **SETUP** menu will allow you to:

-  Adjust the Screen CONTRAST
-  Adjust the Screen Brightness
-  Set the TIME ZONE for your location. (**GMT+2** for SA)
-  To set the Auto Shutdown time for the Tagger
-  Choose one of 3 Languages – ENGLISH, SPANISH and FRENCH
-  Set up the conversion units used i.e. Imperial or Metric

The Advanced **SETUP** menu will allow you to:

-  Assign Tagger ID (using multiple taggers)
-  Link up PC to Tagger through Wi-Fi
-  Link up PC to Tagger through a USB cable
-  Link up Commander to Tagger through Wi-Fi
-  Remote view on your PC (**USB**)
-  Clear Det IDs (incorrectly tagged dets)
-  Change the Device Password

Press “**Home**” soft key to return to “Main Menu”

3.2. Tagging

SET UP TAGGER FOR TAGGING

Tag Option

-  Basic: Delay Option (D)
-  Planned: Tag by Plan Option (P)
-  Advanced: Location and Delay Option (A)
-  Once the option is set, the corresponding symbol will be displayed in the top bar.

Main Menu

-  Press  SoftKey to select Configuration Settings.
-  Press  to select **4G Setup**
-  Press  to select **Tag Option**
-  Use   navigational keys to scroll up/down and display the required selection as follows:



-  Press  SoftKey to save option as required.
-  Press  SoftKey to return to Main Menu

Site Setup

Main Menu

- Press  SoftKey to select Configuration Settings.
- Press  to select 4G Setup
- Press  to select Site Setup
- Site Setup screen for each tagging mode



- Use Markers: When this item is enabled (Black filled rectangle), the tagging screen will contain a soft key to allow marking and tagging a detonator at the same time.
- Autotag: If this option is disabled (White filled rectangle), tagging can only be performed on the pogo pins, and not by connecting a detonator onto the harness wire (It is not practical to connect and then remove the detonator from the harness wires).
- Multi Commander: allows the user to load blast designs for multiple commanders up to 16 000 dets
- Multi-Primed: Enables setting of multiple dets per shot hole.
- Assign Locations: Allows for tagging locations without timing to detonators
- List Hole Config: Setting of decks and dets per deck.
- Det Label: Configures how locations is tagged to detonators i.e. numerical or Alfa-numerical.
- Delete ViewShot: Clears ViewShot Plan in Planned mode.

4 COMMANDER



4.1. Set Up Bench Commander

Power up the Commander

1. Main Menu

 Press  to select **Configuration**

2. Configuration Menu

 Press  to select **Advanced Setup**

3. Advanced Setup

 Press  to select **Bench Box Mode**

 Bench Box Mode will be activated

 User will be prompted to shut the CE4 Commander down and restart for the change to take effect

Connecting CE4 Tagger to CE4 Commander via Wi-Fi

ENSURE THAT THE BENCH IS CLEARED BEFORE THE DETONATORS OR CE4 TAGGER IS CONNECTED TO THE BENCH COMMANDER.

1. Switch both the Commander and the Tagger ON
2. Press and hold  key and then press the  key to connect CE4 Tagger to CE4 Commander via Wi-Fi

Observe the Commander ID

3. Enter the Commander ID
4. Press  key to connect to Commander
5. CE4 Tagger will connect to Commander
6. Enter device password when prompted
7. Press  key to continue

Device password will be required only during first connection to the Commander.

8. CE4 Commander Main Menu will be displayed

Set up RF Channel (Only used when not hard set by DNAP technical department)

NOTE (Using paired Blast Cards will set the RF channel and Key automatically)

NOTE (The Bench Commander and Base Commander must have the same Software version, RF Key and the same RF channel for successful communication to take place)

Main Menu

1.  Press  to select Configuration Menu
2.  Press  to select **Long Range RF** Remote Blast
-  Press  to select **Set RF Channel**
-  Use   navigational keys to navigate selection.
-  Press  to select Region and open RF Channel selection.
-  Use numerical keypad to enter Unique RF Channel range as follows:
 -  Between 16 and 49 for Americas
 -  Between 48 and 55 for Australia.
-  Press  to continue
-  Press  SoftKey to return to Main Menu

Set Encryption Key

1. Main Menu

 Press  to select Configuration

2. Configuration Menu

 Press  to select **Long Range RF**

3. Remote Blast

4. Press  to select Set Encryption Key

Set Encryption Key (Only used when not hard set by DNAP technical department)

 Key will be displayed

 Press  to change

 Use numerical keypad to enter New Key

 Press  to continue

 Press  SoftKey to return to Main Menu

4.2. Set Up Base Commander

1. Main Menu

 Press  to select **Configuration**

2. Configuration Menu

 Press  to select **Advanced Setup**

3. Advanced Setup

 Press  to select **Base Station Mode**

4. Base Station Mode

 Press  to select **Base Station Mode**
 Base Station Mode will be activated

 User will be prompted to shut the CE4 Commander down and restart for the change to take effect

Set up RF Channel

NOTE (Using paired Blast Cards will set the RF channel and Key automatically)

NOTE: The Bench Commander and Base Commander **MUST** have the same Software version, RF Key and the same RF channel for successful communication to take place) Refer to Page 14 above for setup detail.

Base + Repeat Mode

1. Main Menu

 Press  to select **Configuration**

2. Configuration Menu

 Press  to select **Advanced Setup**

3. Advanced Setup

 Press  to select **Base Station Mode**

4. Base Station Mode

 Press  to select **Base + Repeat Mode**

 Base + Repeat Mode will be activated

 User will be prompted to shut the CE4 Commander down and restart for the change to take effect

Repeater Mode

1. Main Menu

 Press  to select **Configuration**

2. Configuration Menu

 Press  to select **Advanced Setup**

3. Advanced Setup

 Press  to select **Repeater Mode**

 Repeater Mode will be activated

 User will be prompted to shut the 4G CE4 Commander down and restart for the change to take effect.

4.3. SYSTEM DEPLOYMENT



NO DETONATOR SHALL BE CONNECTED TO THE TAGGER WHILST THE CE4 TAGGER IS CONNECTED TO A CHARGER

Inherent Safety

- ❏ CE4 Taggers are said to be INHERENTLY SAFE because they cannot produce the necessary minimum required firing voltage to blast the electronic 4G detonator.
- ❏ The CE4 Tagger is also unable to produce the encoded FIRING SIGNAL necessary to initiate a blast.
- ❏ The CE4 Tagger must NEVER be connected to a normal electric detonator or a suspected damaged/shrink wrapped detonator.

Safety Warnings

Batteries may leak or explode if incorrectly handled.

Only use batteries approved for use in the CE4 Tagger.

Do not expose the battery to an open flame or excessive heat.

Replacing external batteries in the battery pack must be done in a safe and dry place so as to prevent ingress of moisture or condensation into the battery pack enclosure.

Do not apply undue pressure to the LCD screen as this could damage the Tagger or cause a malfunction.

Should the LCD screen break, care should be taken to avoid injury from broken glass and to prevent liquid crystal from the screen touching the skin or entering the eyes and mouth.

4.4. Tag Detonators

4.4.1. Basic (B) Tagging Option

1. From the Main Menu

-  Press  to select New Design
-  Type in delay required

2. Tag Detonators Warning

-  Press **OK** SoftKey to acknowledge warning

This detonator warning message will only be displayed when the user opens the tagging screen on the initial start-up of the device.

3. Enter desired delay

-  Use the keypad to enter the delay in milliseconds
-  Connect detonator and press  to continue
-  Detonator number and delay entered will be displayed
-  Tagger will be in ready state to enter next detonator delay

4. Press  to select Tag Detonators to continue tagging after leaving the tag screen

4.4.2. Planned (P) Tagging Option

Upload ViewShot Plan

When a ViewShot plan is not downloaded onto the CE4 Tagger, the user will be prompted to download a plan.

Connect the CE4 Tagger to the PC and download plan

1. From Main Menu

 Press  SoftKey to select **Configuration Settings**.

2. Configuration Settings Menu

 Press  to select Advanced Setup.

3. Advanced Setup Menu

 Press  to select Connections.

4. Connections

 Press  on the keypad to connect CE4 Tagger to PC via USB.

5. USB Link with PC

 Ready for PC – Connect USB cable between PC and CE4 Tagger

 Connected to PC

 Download the Plan (via ViewShot on the PC) onto the CE4 Tagger to enable the use of the Tag by Plan option.

View the downloaded design on the CE4 Tagger

1. From the Main Menu

 Press  to select View Design.

2. View Plan

 The ViewShot plan will be displayed as a list.

3. Users may exercise the functions on the Soft-Keys such as "Plan Summary" to check that all the detonators are captured in the plan.

Start Tag process

1. From the Main Menu

 Press  to select New Design

 Clear det list

When a ViewShot plan is not downloaded onto the CE4 Tagger, the user will be prompted to download a plan.

2. Select Start Position

The user will be prompted to select the starting position from the list. Only the detonator situated at the top position in the list can be selected.

Selection in a list is displayed as white text on black background



The keyboard mapping mode  at the top of the screen indicates navigation by arrows.

 Use   keys to navigate by one up/down.

 Use keys  and  to navigate to previous/next

page (6 locations displayed per page).

 Press  or  key once the selected position is made to return to tagging screen.

3. Press  to select Tag Detonators to continue tagging after leaving the tag screen

When using Autotag ON mode, the detonators may be directly placed on the wire bus and only untagged detonators can be detected.

When Autotag is OFF, connect the detonator to the pogo pins to tag. In Autotag OFF mode, any detonator can be re-tagged (i.e. any detonator can be detected). Retagging is not possible if Autotag is enabled

4.4.3. Advanced (A) Tagging Option

The **Advanced Mode** option is **NOT** recommended if the user **does NOT** have a **paper plan**. The emphasis with this tagging option is on **TIME**, since location is used for tracking purposes

1. Initial Setup:

-  String Number
-  Row Number
-  Hole number
-  Absolute Time / Starting Time
-  Inter-Hole Increment
-  Hole configuration i.e. decked etc.
-  Hole loading per deck or per hole dependent on hole configuration used

2. Manual adjustments:

-  Timing Mode
-  Inter-Hole Increment
-  Absolute Time
-  Row Increment or decrement



Observe the ▼▼▼ display which will indicate keyboard mapping mode.

-  Use   keys to add/subtract time increment from the current time displayed on the screen equal to the inter hole delay set



-  Use  keys to add/subtract hole increment in 1ms

- ☞ Use   keys to adjust the row number.
- ☞ Use  &  keys and  &  keys to adjust the row number

Adjust hole configuration

1. From home screen:
 - ☞ Press  SoftKey to go to Configuration Menu
 - ☞ Press  4G Setup
2. Press  Site Setup
3. Press  to select List Hole Config(uration)
4. Press + SoftKey (SF3) to add to the list of hole templates
5. Press  up/down arrows to select the required List
 - ☞ Press ENTER key to continue
6. Press  up/down arrows to select the number of Decks per Hole (Maximum of 9 allowed)
 - ☞ Press  to save
 - ☞ Press → key to continue
 - ☞ Use Keypad to enter Time per deck



Press  to continue to next Time



Press  to save



7. Press **up/down** arrows to select the number of

Detonators per Hole (Maximum of 6 allowed)



Press **ENTER** key to continue

8. Enter the individual delay offset (Ms) to be applied for each detonator



Press **ENTER** key to continue



Press  SoftKey (SF4) to continue

The detonators should be counted from the bottom of the hole up. I.e. Detonator 1 is located at the bottom of the hole or in the bottom deck

When using Autotag ON mode, the detonators may be directly placed on the wire bus and only untagged detonators can be detected.

When Autotag is OFF, connect the detonator to the pogo pins to tag. In Autotag OFF mode, any detonator can be re-tagged (i.e. any detonator can be detected). Retagging is not possible if Autotag is enabled.

4.5. Test Detonators

4G detonators connected to the harness wire that are not in the detonator list will be ignored.

Test All

1. Main Menu

 Press  SoftKey to select **Test Menu**.

2. Test Menu

 Press  SoftKey to select **Test All**.

3. Test All

 CE4 Tagger will Test All Detonators

 **Done** will be displayed when test all is complete.

4. User may use the following SoftKeys:

 Press  SoftKey to continuously repeat test.

 Press  SoftKey to stop continuously repeating test

  to View Design

 After Testing press the  Key to return to the Test Menu

Test String

1. Main Menu

- Press  SoftKey to select **Test Menu**.

2. Test Menu

- Press  SoftKey to select **Test String**.

3. Test String

- Enter required String number
- Press  to continue
- CE4 Tagger will Test All Detonators on specified string
- Done** will be displayed when test all is complete.

4. User may use the following SoftKeys:

- Press  SoftKey to continuously repeat test.
- Press  SoftKey to stop continuously repeating test
-  to View Design
- After Testing press the  Key to return to the Test Menu

Test Single Detonator

1. Main Menu

 Press  SoftKey to select **Test Menu**.

2. Test Menu

 Press  SoftKey to select **Test Single Det.**

3. Test Single

-  Connect Detonator to CE4 Tagger
-  Detonator will be tested
-  Results will be displayed

Leakage Test

High leakage levels can result in potential misfires of the 4G detonators.

1. Main Menu

 Press  SoftKey to select **Test Menu**.

2. Test Menu

 Press  SoftKey to select **Test Leakage**.

3. Leakage Test

-  CE4 Tagger will Test Leakage on all Channels
-  Press  SoftKey to continuously repeat test.
-  Press  SoftKey to stop continuously repeating test

4. CE4 Tagger will display leakage test results
 - ☛ Note that even when leakage is high the Test OK will be displayed to indicate that the actual test was successful
 - ☛ Press  to continue
5. After Testing press the  Key to return to the Test Menu

Untagged Test

1. Main Menu
 - ☛ Press  SoftKey to select **Test Menu**.
2. Test Menu
 - ☛ Press  SoftKey to select **Untagged Test**
3. Untagged Test
 - ☛ OK message will be displayed when no untagged detonators are found.
 - ☛ Error message will displayed when untagged detonators are found.
4. User may use the following SoftKeys:
 - ☛ Press  SoftKey to continuously repeat test.
 - ☛ Press  SoftKey to stop continuously repeating test

ESC

5. After Testing press the **ESC** Key to return to the Test Menu
[Use a binary search to locate untagged detonator\(s\)](#)

Search Detonators

1. Main Menu

 Press  SoftKey to select **Test Menu**.

2. Test Menu

 Press  SoftKey to select **Search Dets**

3. Search Dets

 Enter required Channel number

 Press  to continue

[Note: If new detonators are to be found they will be assigned \(logically\) to Channel 1 as per the existing example.](#)

 CE4 Tagger will search for detonators and display **Done** when complete

 Press  to return to the Test Menu

 Press  to View Design

4.6. View Design

1. LIST DETONATORS displays a complete list of all detonators the Tagger has tagged
2. LIST MISSING DETS displays a list of missing detonators found during testing compared to the Detlist created during tagging
3. LIST NEW DETS displays a list of all new detonators found during testing compared to the Detlist created during tagging
4. LIST BAD STATUS displays a list of all detonators that are faulty during testing
5. BLAST SUMMARY displays a summary of detonators per row, total detonators connected and number of special detonators connected
6. DUPLICATE LOCATION will display only the detonators that were found having the same location.
7. BLAST SUMMARY displays the blast presenting a summary of detonators per channel.

4.7. Prepare for Blast

Connect tagger to Bench Commander via Wi-Fi

Local Blast

1. Main Menu

 Press  SoftKey to select **Prepare for Blast**.

2. Prepare for Blast

 Press  SoftKey to select Program **Detonators**.

3. Program Detonators

 Detonators will be programmed

 Press  button to return to **Prepare for Blast Menu**

 Press  to continue.

4. Prepare for Blast

 Press  button to select **Arm**.

5. Arm

 Press  button to select **Local Blast**

Arm and fire commands for detonators will not initially be known to the CE4 Commander. These commands are only available from the blasting (red) Blast Card and will be issued to the CE4 Commander when necessary, either directly from the red BlastCard (in case of a local blast) or remotely from the base

commander. Arm and fire blasting commands will be erased from the Commander memory after use.

6. Local Blast

- ☞ User will be prompted to **Scan Key**
- ☞ Scan the **Red Blast Card** at the back of the CE4 Commander
- ☞ Enter the associated PIN
- ☞ Press  to continue.

7. Local Blast

- ☞ Press and hold the NEXT button on the front of the CE4 Commander
- ☞ The CE4 Commander will initiate a Grace period

8. Local Blast

- ☞ The CE4 Commander will initiate a 30-second high-voltage charging period followed by a 90-second blast window.
- ☞ Should there be detonators marked as "last det", the last det test will be performed between the charge and blast window

9. Local Blast

- ☞ Press both FIRE-buttons (SoftKeys) on the CE4 Tagger to fire

10. Local Blast

- ☞ Blast Command sent

Remote Blast

Connect tagger to Bench Commander via Wi-Fi

1. Main Menu

☛ Press  SoftKey to select **Prepare for Blast**.

2. Prepare for Blast

☛ Press  SoftKey to select Program **Detonators**.

3. Program Detonators

☛ Detonators will be programmed

☛ Press  or  button to return to Prepare for Blast Menu.

4. Prepare for Blast

☛ Press  button to select **Arm**.

5. Arm

☛ Press  button to select **Remote Blast**

ARM and FIRE commands for detonators will not initially be known to the CE4 Commander. These commands are only available from the blasting (red) Blast Card and will be issued to the Commander when necessary, either directly from the red BlastCard (in case of a local blast) or remotely from the base CE4 Commander. ARM and FIRE blasting commands will be erased from the Commander memory after use.

6. Remote Blast

- ☐ Press  SoftKey to initialise RF communication

7. Remote Blast

- ☐ User will be prompted to **Scan Key**
- ☐ Scan the **Yellow BlastCard** at the back of the CE4 Commander
- ☐ Enter the associated PIN
- ☐ Press  to continue.

8. Remote Blast

- ☐ Press and hold the NEXT button on the front of the CE4 Commander
- ☐ The CE4 Commander will initiate a Grace period

**Disconnect the CE4 Tagger from the Bench Commander.
Connect the CE4 Tagger via Wi-Fi to the Base Commander.**

9. Remote Blast

- ☐ The Bench Commander will await a command from the Base Commander

10. Remote Blast

- ☐ Select the applicable Bench Commander(s) by pressing corresponding number on the keypad
Applicable Bench Commander will be Indicated by ✓
- ☐ Press  to continue

When a Bench Commander is accessed from the Base Commander, the “remote number” of the Bench Commander is the same as the bench commander number unless the number was greater than 4. If the number is greater than 4, subtract 4.

- Example: A Bench Commander configured as '7' will have to be selected as $7-4 = 3$ on the base. No other bench commander may be allowed to be 3 as all numbers must be unique.

11. Remote Blast

- Wait if message "Not ready yet" is displayed
- User will be prompted to **Scan Key** once all the bench commanders are out of grace period and ready to blast.

12. Scan Key

- Scan the RED BlastCard at the back of the CE4 Commander
- Enter the corresponding PIN
- Press  to continue
- 'Awaiting High Voltage' and 'Press Next' messages will alternate on the screen
- Press and Hold the NEXT button on the front of the CE4 Commander
- The CE4 Commander will initiate a 30-second high-voltage charging period followed by a 90-second blast window
- Press both FIRE-buttons (SoftKeys) on the CE4 Tagger to fire
- Blasting will take place**
- Blast Command sent message will be displayed

5 TROUBLESHOOTING

5.1. CE4 TAGGER

A Binary search is used to find untagged detonators, high leakage and short circuits

1. **Untagged detonator** (detonator does not have a delay or location)
 - a. Apply BINARY SEARCH method in conjunction with UNTAGGED TEST in the TEST MENU (*a binary search is the quickest way to determine the source of a leakage or untagged detonator error; the method consists of dividing the problem area into halves and isolating the problem by repeating this process*)
 - b. Once untagged detonator is identified, tag detonator with correct location
 - c. Conduct TEST/ALL to ensure that the problem has been corrected

2. High Leakage (> 1.0 mA)

- a. Apply BINARY SEARCH method in conjunction with LEAKAGE TEST in the TEST MENU
- b. Once the leakage is identified, determine if leakage can be fixed
- c. If harness wire leakage exists, fix or replace the affected harness wire
- d. If leakage exists on a detonator, attempt to remove leakage by removing excess downline
- e. Conduct a leakage test on all channels to ensure that the problem has been corrected
- f. Once the problem detonator/s have been isolated and removed – note the lead length, ID#, Batch# & DOM on your paperwork

3. Leakage (between 0.3mA and 1.0mA)

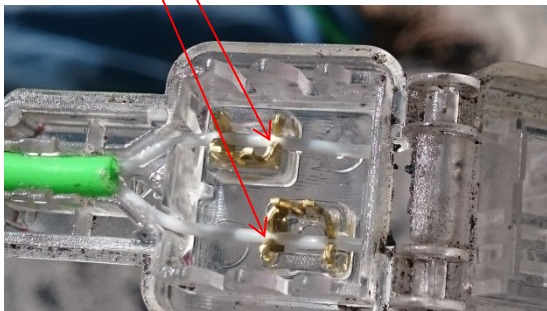
- a. Apply BINARY SEARCH method in conjunction with LEAKAGE TEST in the TEST MENU
- b. Once the leakage is identified, determine if leakage can be fixed
- c. If harness wire leakage exists, fix or replace the affected harness wire
- d. If leakage exists on a detonator, attempt to remove leakage by removing excess downline

- e. If this is not possible and the leakage is lower than 1mA, connect this detonator to a free channel
 - f. Conduct a leakage test on all channels to ensure that the problem has been corrected
 - g. Once the problem detonator/s have been isolated and removed – note the lead length, ID#, Batch# & DOM on your paperwork
4. **FAIL** (Detonator does not reply during tagging or test)
- a. Check the connection between the Tagger/Bench Commander and the detonator – ensure the harness wire isn't broken or damaged
 - b. If Tagging and in "Auto" mode, disconnect the tagger and the detonator from the harness wire
 - c. Connect the CE4 tagger to the DS+ connector via the "Pogo Pins" and test single det via the tagger test menu
 - d. If the detonator tests "Fail" – cut the lead wire as close to the collar of the hole and beyond into the stemming if evidence is noted for possible damage within, as practicable, strip and hardwire to the tagger and test.
 - e. If the detonator tests "Fail" – Proceed with your site misfire procedure, which may involve recovery of the stemming in order to re-prime the hole

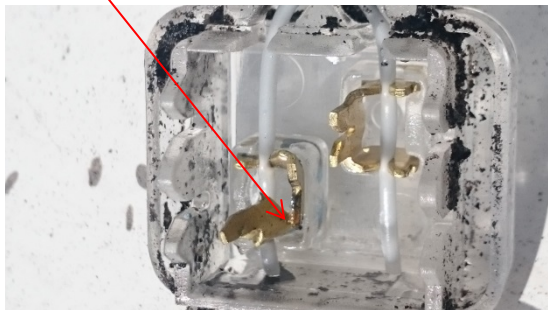
5. **WRONG PRODUCT**

- a. Disconnect the suspected detonator and test using “Test Single Det” on pogo pins
- b. If the Tagger reports “Fail” re-prime hole
- c. If the Tagger reports “Wrong Product” treat as “Low Read”

Example of poor connection –Spade Connector blades not cutting in lead wire



Example of damaged Spade Connector blades within the connector



Damaged connectors are removed and Det leads connected to harness using a "Back to Back Connector"



Back to Back Connector

5.2. Commander

Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Low Battery		When Envelope is displayed, Press # to display Error Screen Ensure that the Commander is fully charged before it is deploying in a blast. Should this error trigger, charge the Commander before using or alternatively use another Commander that has been sufficiently charged.
Charge fault		The Charge Fault will be displayed to indicate that the Commander is not charging from the connected charger. Ensure that the charging cable is connected securely to the Commander. Also ensure that the charger has sufficient output power to charge the Commander. A charger capable of supplying 2A or greater is preferred.

Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Design Changed		This error will occur when the Commander detects that the design has changed. This indicates that, either a new detonator has been found, or a detonator has gone missing. When this error occurs, the user is encouraged to examine the list to ensure that the total detonator count is correct. Once the list has been examined and the detonator count has been confirmed to be correct, the user must reprogram the Commander. Should there be a missing detonator, it must be found and corrected.
Detonator(s) Missing		This warning is triggered when the Commander detects that a previously connected detonator is no longer present on the line. When this error occurs the user is encouraged to examine the list to determine which detonator is missing. The user will then need to return to the bench to identify and correct the fault.

Fault Condition	Error Screen	Trouble-shooting / Remedial Action															
High Leakage	 Leakage Test Failure 10 mA <table border="1"> <thead> <tr> <th>CH</th> <th>CURRENT</th> <th>LEAKAGE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.0</td> <td>0.0 ✓</td> </tr> <tr> <td>2</td> <td>0.0</td> <td>0.0 ✓</td> </tr> <tr> <td>3</td> <td>0.0</td> <td>0.0 ✓</td> </tr> <tr> <td>4</td> <td>4.4</td> <td>3.3 X</td> </tr> </tbody> </table> High leakage 2x	CH	CURRENT	LEAKAGE	1	0.0	0.0 ✓	2	0.0	0.0 ✓	3	0.0	0.0 ✓	4	4.4	3.3 X	Leakage is tested during various stages, including testing and programming. Should a high leakage warning be triggered, the user will need to find the source of the leakage – this is performed most effectively by using a Tagger. The user is encouraged to disconnect the string from the Commander and divide the string into two equal halves, and test each half with a Tagger. The leakage should be present on only one half and this process can be repeated until the source of the leakage is discovered. Some of the reasons for leakage include: damage to the down-line wire of a detonator unit, moisture in the connector of a detonator unit and also damage to the surface harness wire insulation. It is recommended that the user resolve all leakage sources to have a leakage of 0 mA, however, should it not be possible to eradicate all leakage sources, the system may be able to cope with leakage sources up to 1 mA per channel.
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Last detonator not set	 Set if station C3Last det(a) not set Exit	Each channel on the Commander needs to discover at least one detonator that has been marked as the 'last detonator' on the string. To ensure that there is connectivity to the last unit on the harness, this 'last detonator' will be searched for just after charging. The Commander will also check the voltage supplied to the last detonator to ensure that sufficient energy has been transferred to allow for successful blasting. Should the Commander not find a detonator marked as the 'last detonator' on a channel, the 'Last detonator not set' notification will be displayed – note that the channel affected will also be indicated.															

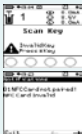
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Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Wire limit exceeded		This warning will trigger when the cumulative detonator wire length for a channel is exceeded. The down-line wire length of each detonator is stored in memory, and the software can thus calculate the total down-wire length per channel. If this total length exceeds 8000m the warning will be triggered. It is recommended that the user decrease the down-wire length on the channel in question by moving detonators to another channel.
Last detonator error		This error occurs when communication to the last detonator is unsuccessful after charging and just prior to firing. If the last detonator is not found it indicates a harness break or the last detonator does not have sufficient voltage to initiate. The user is encouraged to disarm and return to safe voltage. After waiting the minimum of 10 minutes re-entry time as per the manufacturer requirement, proceed to the string in question to identify the source of the fault. A Tagger may be used to aid in this process. The first step would be to check if there is a leakage problem on the string. Once this is resolved the user will need to test the string to check if all the expected detonators are present on the line.

Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Misfires Expected		This warning will be displayed during the firing window if the voltage at the last detonator is too low for successful blasting. In such a case the user is encouraged to disarm and return to safe voltage. After waiting the appropriate amount of time the user may proceed to the channel in question to identify the source of the fault. A Tagger may be used to aid in this process. The first step would be to check if there is a leakage problem on the string. Once this is resolved the user will need to test the string to check if all the expected detonators are present on the line.
Current limiter has activated		This error may trigger at any point during the testing, programming or firing process. The error points to excessively high leakage or a short circuit on the channel. The Tagger may be used to identify the source of leakage using the binary search technique. If this error occurs after programming the user will need to reprogram the channel.

Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Untagged detonator found		When the Commander detects a detonator that still has the internally recorded factory ID, which means that it has not been successfully tagged, it will trigger the untagged warning. The Tagger may be used to find the untagged detonator on a string using the binary search technique. Once the untagged detonator has been found, it must be tagged with a delay or location (or both) as per the blast plan.

Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Wrong / Invalid Card		This error will be displayed either when the user scans a Red BlastCard when a Yellow BlastCard is expected or vice versa. The error will also be displayed if the BlastCard is invalid. The user must scan the correct BlastCard or replace the BlastCard if it is invalid or not working correctly.
Low Battery / Link Down / Check RF Settings		The low battery warning will be displayed when the battery has depleted to a point where blasting may be jeopardised. Recharge the battery before continuing with blasting. When the RF link is down at the Base Commander, the 'link down' error will be displayed. The number (B4 in example) refers to the Bench Commander with which communication has been lost. The RF connection warnings will indicate that either the RF channel or the Encryption key does not match. Adjust settings to ensure that these parameters match on the Base Commander and all the Bench Commanders.

Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Card Not paired		The Invalid Key / Card not paired error will be displayed if the BlastCard used to arm the Base Commander is from a different group (set) of BlastCards to the BlastCard used to arm the Bench Commander/s. Use only the BlastCards from the same set as shipped together

6 Emergency Contact details

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