IntelliShot® Commander System
UTM-00338 | Rev 5 | 2018

IntelliShot® Commander SVN 36230C
CE4 Tagger SVN 36230B
IntelliShot® Detonator

APPROVER: 2018/08/27

Vinesh Naidoo yyyy/mm/dd APPROVED

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1 USERS OF THIS MANUAL

1.1. Purpose of this manual

This manual details the operation of the IntelliShot® Commander System.

NOTE	**This manual is only to be used for the IntelliShot® Commander System and the applicable software version as displayed.**

1.2. End User

1.2.1. Requirements

- Only trained personnel, and personnel found competent, are allowed to operate the system.
- Users of the system shall be aware of the recommended procedures for using the IntelliShot® Commander System as per manufacturer's recommendations.
- These recommendations do not supersede the method as required by local mine, explosives or statutory regulations/procedures/codes of practise regarding the use of detonators. In such cases, the MOST STRINGENT set of rules between the mine, explosives or local regulations/procedures/codes of practise and the manufacturer must be followed.

1.3. Training

Training and software upgrades shall only be performed by a DetNet SA subject matter expert.
Contact the DetNet head office for additional information.

WARNING	**ALL USERS OPERATING THE INTELLISHOT® COMMANDER SYSTEM SHALL HAVE SUCCESSFULLY COMPLETED THE SPECIFIC TRAINING BEFORE PERFORMING ANY WORK WITH THE DEVICE(S).**

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2 INTELLISHOT® COMMANDER SYSTEM PRODUCT SAFETY

2.1. DetNet Safety Philosophy

DetNet safety philosophy is to design, manufacturer and provide control equipment, detonators and accessories to the highest safety standards.

- Energy management in control equipment will be regulated by providing two separate circuits managing test voltage and blast voltage, through software and hardware safety interlocks.
- BlastCards remain in possession of the accountable person, and should only be used to authorize the blast process at such a time as stipulated by the Mine after completion of the required Risk Assessment.
- All products must conform to local and international standards before it is sold for use.
- DetNet complies to ISO 9001, SANS 551:2009, CEN/TS 13763-27 which is acceptable to countries we operate in; in countries not subscribing to the above marks, we advise users to engage with DetNet to ensure that all equipment comply to local regulations.

2.2. User Safety

Safety is ensured when the user supplements the product's in-built safety systems through adequate training in the safe use of the product:

- Induction training
- Refresher training

DetNet continuously upgrades software to make the products more user friendly and to ensure that users stay abreast on latest developments, it is important that users get trained on the relevant changes before their equipment is updated.

2.3. Product Safety

Inherent Safety

- CE4 Taggers are "Inherently Safe" because they cannot produce the necessary minimum required firing voltage or encoded "Fire" command to initiate the electronic IntelliShot® Detonator.
- In addition, the CE4 Tagger firmware does not contain the procedures or commands necessary to calibrate, arm or fire the detonator.

Transportation, Storage and Handling

IntelliShot® Commander System equipment must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations. Control equipment and accessories should be handled with due care and not dropped, mishandled, subjected to excessive vibration or exposed to any chemical agents. Connectors should be kept clean and the equipment must be kept in a safe environment to avoid misappropriation or misuse.

2.4. Maintenance Schedule

All equipment in the field will need to be returned to DetNet, or its repair centres, for service at the following intervals:

- Handheld Equipment (Tagger, etc.) – 18 Months.
- Other equipment (Excluding accessories) – 24 Months.

2.5. Information in case of emergency

Refer to https://portal.detnet.com/ http://www.portal.detnet.com/ for additional detail and documentation.

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2.6. *Warning*, *Caution*, and *Note* Statements

WARNING, ***CAUTION***, and ***NOTE*** statements are used throughout this manual to emphasise important and critical information. Observe these statements to ensure safety and to prevent product damage. The statements are *defined as follows:*

WARNING	**A WARNING MEANS THAT INJURY OR DEATH IS POSSIBLE IF THE INSTRUCTIONS ARE NOT OBEYED.**

Warnings draw special attention to anything that could injure or kill the reader/user. *Warnings* are generally placed before the step in the procedure they relate to. Warning messages are repeated wherever they apply.

CAUTION	**A CAUTION MEANS THAT DAMAGE TO EQUIPMENT IS POSSIBLE.**

Cautions draw special attention to anything that could damage equipment or cause the loss of data and will normally describe what could happen if the caution is ignored. *Cautions* are generally placed before the step in the procedure they relate to.

NOTE	**Notes are added to provide additional information.**

Notes are used to emphasise important information by visually distinguishing this from the rest of the text. Notes can contain any type of information except safety information, which is always placed in cautions or warnings.

Refer to https://portal.detnet.com/ http://www.portal.detnet.com/ for additional detail and documentation.

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3 INTELLISHOT® COMMANDER SYSTEM INTRODUCTION

3.1. IntelliShot® Commander Basic System Description

The system description details a full system lay-out and also the individual component name, function and interaction between the components.

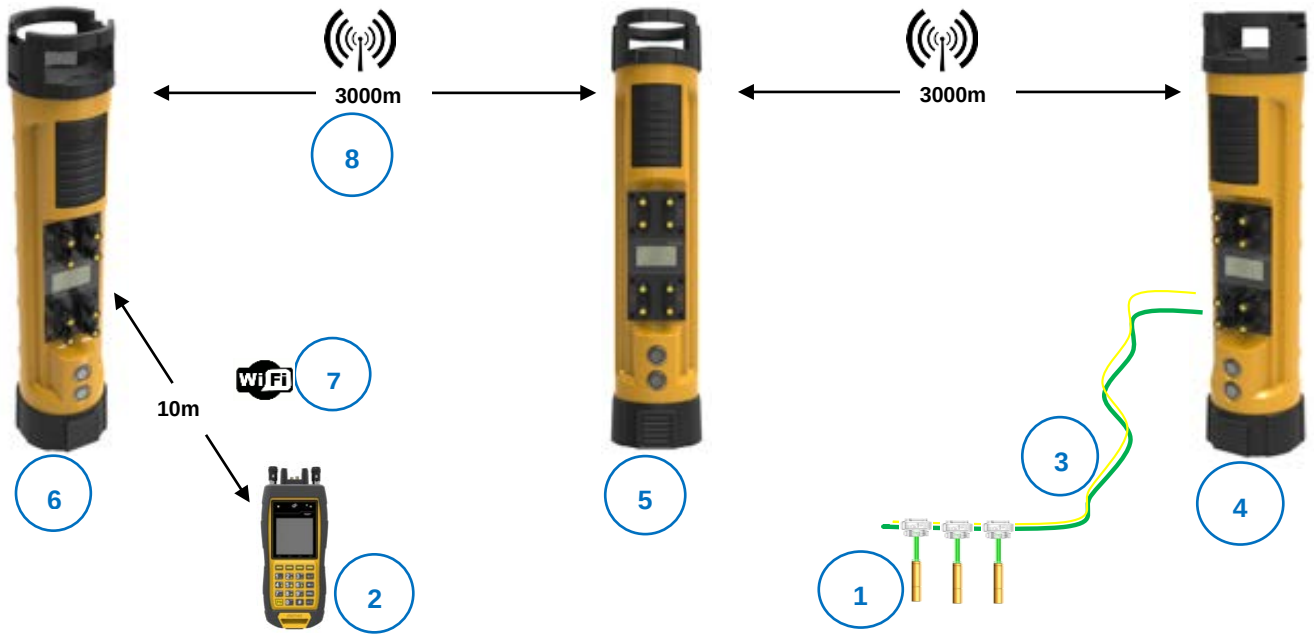
This 4th generation Control Equipment (CE4) that is designed and developed by DetNet South Africa consists of two main devices, namely the IntelliShot® Commander and CE4 Tagger. The IntelliShot® Commander unit may be set-up either as a Bench Commander (for connection to detonators) or as a Base Commander that is used to remotely communicate with a Bench Commander to initiate the blast (see illustration below). The Commander may also be used as a RF Repeater to increase remote blasting range and maintain line of sight.

The CE4 Tagger is an inherently safe device that is used on the bench to test detonators and assign delays to them. The CE4 Tagger has a dual role and may also be used to wirelessly connect to an IntelliShot® Commander thereby acting as an interface unit for the IntelliShot® Commander.

This unique design simplifies the design of the IntelliShot® Commander – which comprises of a screen and two buttons allowing the user to control the IntelliShot® Commander remotely from the comfort of a CE4 Tagger.

Peripheral devices such as a Laptop or Tablet will be COTS (Commercial Off-The-Shelf) equipment loaded with DetNet software to interact with the system.

Figure 1 (below) depicts a scaled system as would be required to perform a 1600 detonator blast (Using 10 Commanders each connected to 1600 detonators the blast size can be increased to capacity of 16 000 detonators)



1	Detonator (Max 400 Dets per Channel)	5	Repeater
2	CE4 Tagger	6	Base Commander
3	Harness Wire	7	Short Range RF
4	Bench Commander	8	Long range RF

Figure 1: IntelliShot® Commander System Composition

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Table 1: Component Description

#	Component	Function
1	Detonator	Detonator will initiate the blast on command from the Bench Commander
2	CE4 Tagger	Test, Write Location and/or Delay to detonator and remote control Commander
3	Harness Wire	Connects the detonator to the Bench Commander
4	Bench Commander	Test Detonators / Communicates with Base Commander directly, or via the Repeater to allow remote blasting. Can also enable a local blast
5	Repeater	Enables 2-way RF communication between a Base and Bench Commander where line of sight is not possible, effectively doubling the RF range
6	Base Commander	Establish communication via all Bench Commanders and enables remote blasting
7	Wi-Fi	Enable Wi-Fi communication
8	Long range RF	Enable RF communication

The following illustrations depict some of the lesser configurations possible with the system.

3.1.1. Direct Blasting Configuration

Direct blasting of up to 1600 detonators. The CE4 Tagger can be replaced with a Tablet or PDA.

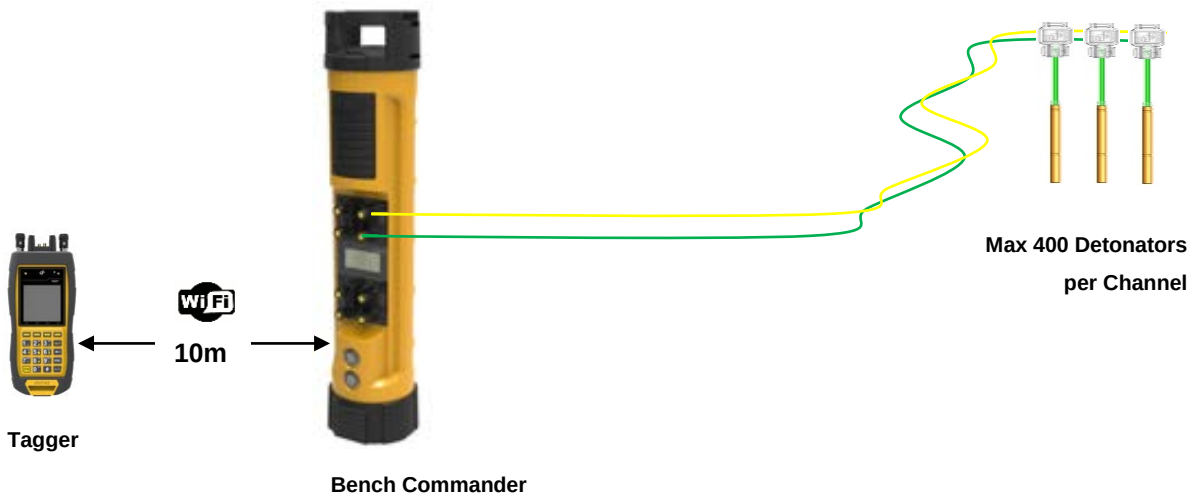

Figure 2: Direct Blasting

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3.1.2. Remote Blasting Configuration

Remote blasting of up to 16000 detonators (Total of 10 Bench Commanders with 1600 detonators per Bench Commander) using a CE4 Tagger as user-interface at the blasting point.

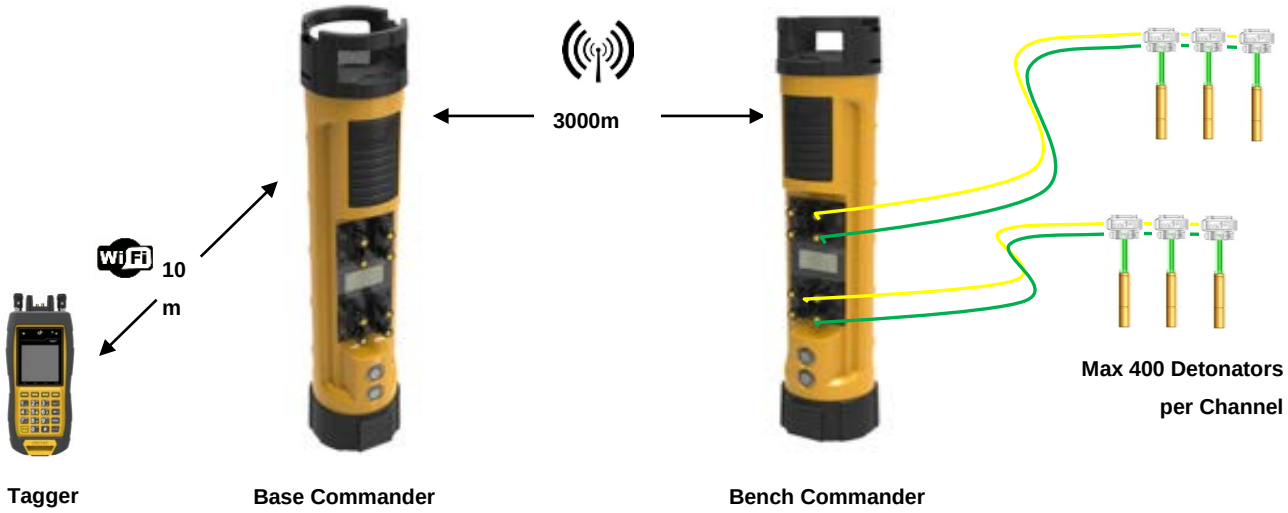

Figure 3: Remote Blasting of up to 16000 detonators

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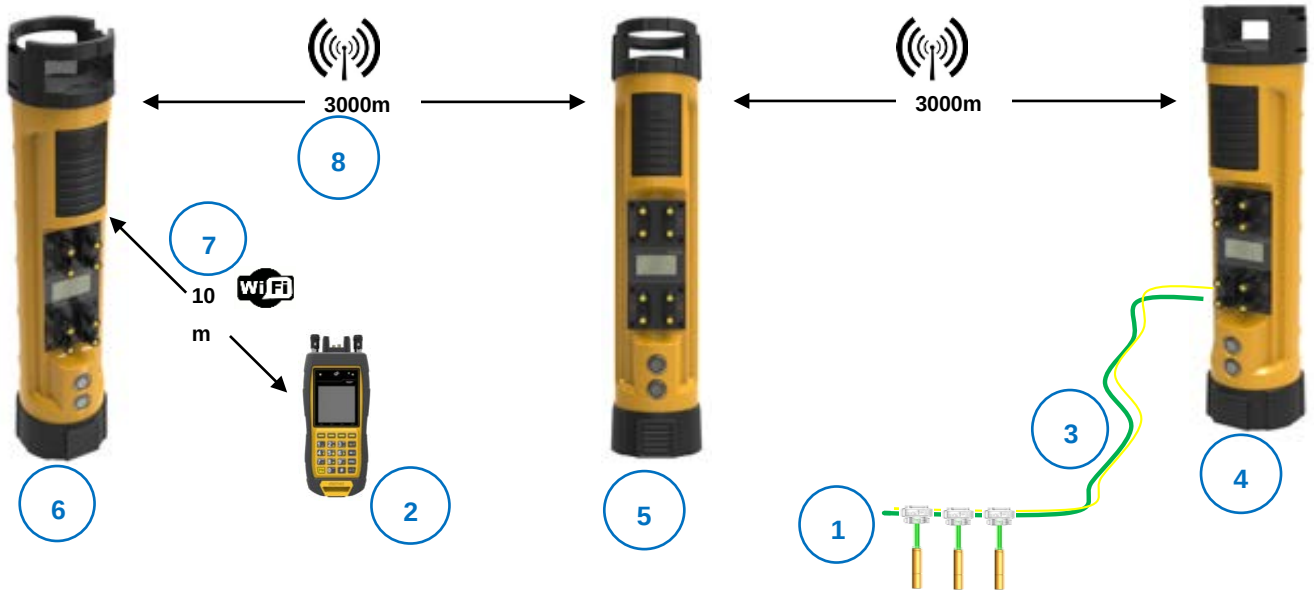
3.1.3. Remote Blasting via a Repeater Configuration

Multiple Bench Commanders can be used if they are within the 3000m range of the Repeater (5). Every Bench Commander (4) adds a 1600 detonator capability. A maximum of 10 Bench Commanders may be used for the current iteration of the IntelliShot® Commander System.



1	Detonator (Max 400 Dets per Channel)	5	Repeater
2	CE4 Tagger	6	Base Commander
3	Harness Wire	7	Short Range RF
4	Bench Commander	8	Long range RF

Figure 4: Remote Blasting via a Repeater

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3.2. IntelliShot® Commander General Description

The IntelliShot® Commander is a 4-channel multi-functional device intended for use across all surface blasting applications in the DetNet portfolio. DetNet has designed the IntelliShot® Commander to incorporate an internal antenna that may be shipped to function in either the 900 MHz, 868MHz or 2.4 GHz RF frequency range. Corresponding with the system's ease-of-use the IntelliShot® Commander has a simple user interface, which comprises a screen and two buttons. Allowing for easy inventory control, especially in the way of storing spare equipment, the IntelliShot® Commander unit may be configured to function either as:

- Base Commander,
- Bench Commander, or
- Repeater.

3.3. CE4 Tagger General Description

The CE4 Tagger is an inherently safe device that is used on the bench to test detonators and assign delays to them. The CE4 Tagger has a dual role and may also be used to wirelessly connect to an IntelliShot® Commander thereby acting as an interface unit for the IntelliShot® Commander.

3.4. IntelliShot® Detonator General Description

The IntelliShot® Detonator is a programmable detonator that is suitable for all types of blasting operations, especially those requiring precise timing.
The IntelliShot® Detonator is housed in a copper tube, which protects the circuit board and the base charge.
The IntelliShot® Detonator is attached to a robust black and green two wire down-line cable that is capped with a gel-filled connector that clips on a surface harness wire.

WARNING	**ELECTRONIC DETONATORS ARE TOTALLY DIFFERENT TO CONVENTIONAL ELECTRIC DETONATORS AND ABSOLUTELY NO CONNECTION WITH CONVENTIONAL ELECTRIC DETONATORS OR ANY OTHER ELECTRONIC DETONATORS IS POSSIBLE AS IT CAN LEAD TO UNINTENDED INITIATION. ALL USERS OPERATING THE ELECTRONIC INITIATION SYSTEM SHALL HAVE SUCCESSFULLY COMPLETED THE SPECIFIC TRAINING BEFORE PERFORMING ANY WORK WITH THE DEVICE(S). DO NOT USE ANY DEVICES OTHER THAN THOSE SPECIALLY DESIGNED FOR THIS TYPE OF ELECTRONIC DETONATOR. NEVER CONNECT ANY THIRD PARTY OR OTHER UNAPPROVED DETONATORS TO THE INTELLISHOT® COMMANDER SYSTEM**

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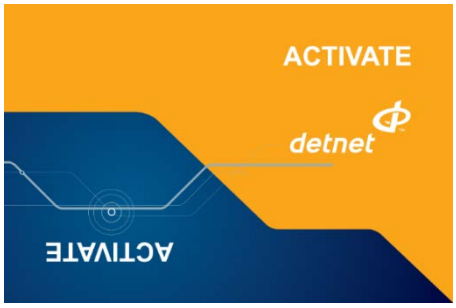
3.5. BlastCards General Description

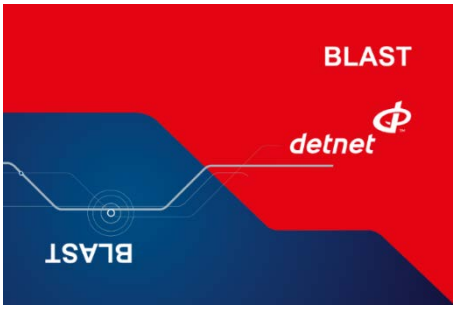
For safety purposes, the system is activated through a pre-programmed and unique Password (PIN code) protected Blast card System. The system deploys two types of near field communication (NFC) BlastCards that are identified by a Yellow or Red colour.

3.5.1. The Yellow BlastCard



The User will scan the Yellow BlastCard on the CE4 Bench Commander after completion of the connecting and testing of the blast installation. This should only be performed after the bench has been cleared of all personnel. Scanning the BlastCard will place the Bench Commander in a 'waiting to arm' state and this should be undertaken in accordance with local legislation and prescribed blasting procedures on site.
A quick activation setting on the Commander is also available. If turned ON and the unit has had a good scan and testing cycle with no errors, the user will be allowed to scan the yellow Activation Card and the Bench Commander will proceed to the 'waiting for arm' state without being prompted by the user; connecting the Tagger. This function is known as AutoArm.

3.5.2. The Red BlastCard



The Red BlastCard, when scanned at the Base Commander during an RF Multi-bench Commander blast, or at the Bench Commander during a local blast, will issue the Arm and Fire Commands.

The ARM and FIRE commands for detonators will not initially be known to the IntelliShot® Commander. These commands are only available from the Red BlastCard and will be issued to the IntelliShot® Commander when the BlastCard is scanned. The ARM and FIRE blasting commands are erased from the IntelliShot® Commander memory after use.

NOTE	**Always keep the BlastCards and PIN locked away in a secure place when not in use.** **Always place the BlastCards in direct control of the certified user during the blast.** **Always inform the supervisor and supplier immediately if a BlastCard is lost or damaged.** **BlastCards are classified as blast keys and must be handled in accordance with local legislation requirements.**

CAUTION	**NEVER SWIPE THE RED BLASTCARD ONTO THE INTELLISHOT® COMMANDER WHEN IN IDLE MODE, UNLESS IT IS INTENDED TO INITIATE A BLAST AND THE SOFTWARE PROMPTS THE USER TO DO SO. (THE YELLOW BLASTCARD CAN BE SWIPED TO OBTAIN THE RF SETUP INFORMATION AND ALSO TO AUTOARM)** **NEVER USE A FAULTY OR DAMAGED BLASTCARD. IF BLASTCARD IS FAULTY OR DAMAGED IT MUST BE RETURNED TO THE ORIGINAL SUPPLIER FOR DESTRUCTION.** **NEVER STORE THE BLASTCARDS AND BLASTING PIN TOGETHER.** **NEVER DIVULGE THE BLASTING PASSWORD/S TO ANOTHER PERSON. ONLY THE CERTIFIED USER TO WHOM THE BLASTCARDS WAS ALLOCATED SHOULD KNOW THE PASSWORD.** **A BLAST CANNOT BE INITIATED WITHOUT THE BLASTCARDS.**

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3.6. Harness Wire

The Surface harness wire consists of a pair of yellow and green individually sheathed copper wire, 0.63mm in diameter.

Detonators are connected to the surface harness wire to enable communication with control equipment.
The maximum length of 2-wire surface harness per channel, including the lead-in wire used to connect shall not exceed 2500m measured from the Commander to the furthest connected detonator.

3.7. IntelliShot® Commander System Blast Application

NOTE	**The IntelliShot® Commander System Blast Application is detailed in UTM-00346 DetNet Blast Application Tablet User Manual.**

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3.8. IntelliShot® Commander System User Application

There are three methods of operation for the IntelliShot® Commander System, as detailed below:

3.8.1. Users that deploy simple blast patterns. Basic (B) Tagging Option

With the Basic tagging option, the user will only need to concentrate on the Time value, string number and the sequence number assigned to the detonator and it is best suited for small, single-primed hole blasts.

NOTE	**It is advised to use only one Tagger per Commander when the Basic Tagging Option is used. If more than one Tagger need to be used then both Taggers can start at a different String number.**

3.8.2. Users that follow a paper plan. Advanced (A) Tagging Option

The Advanced Tagging option is used when there is emphasis on both Time and Location but no ViewShot plan is available for download

- The Advanced Mode includes more functionality than the BASIC mode as it allows for multi-primed holes and time incremental settings.
- The user will need to define a hole configuration from the “Site Setup” screen in 4G Setup menu.

3.8.3. Users that follow a plan. Planned (P) Tagging Option

With the **Planned** (**P**) option, a location and/or the delay is written into the detonator.
The source for the data is received from a plan which is downloaded into the CE4 Tagger via the ViewShot 3D® blast design software.

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3.9. IntelliShot® Commander System Limits and Specifications

System Limits define the design parameters that users must adhere to when designing their blast to be used with IntelliShot® Commander System.

Maximum harness wire per channel	2,500m
Maximum accumulated down-line wire per channel	12 000m
Maximum Bench Commanders per Base Commander	10
Maximum detonators per Tagger	Full Design
Maximum detonators per Channel	400
Maximum detonators per Bench Commander	1600
Maximum detonators RF	16000
Maximum detonators standalone	1600
Maximum detonators per hole	18
Maximum holes per String	400
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
Maximum Distance using Repeater	6km
Maximum Tagger ID's	10
Maximum Commander ID's	10

3.9.1. CE4 Tagger System Limits

3.9.1.1. Strings

- User selectable 1 – 40 Strings. (Only 1 string can be connected to the Tagger at a time)

3.9.1.2. Maximum Dets tagged per Channel

- 400 Detonators using down-hole wire of 30m or lower.
- For longer lengths, see "Wire calculation table under Product Documents on DetNet Portal of down-hole length versus amount of IntelliShot® Detonators.

3.9.1.3. Maximum Dets tagged per CE4 Tagger (1 Channel)

- 16000 Detonators in storage/memory. Only 400 dets (one String) could physically be tested at a time on a Tagger.

3.9.1.4. Maximum Decking per Hole

- 18 Detonators per hole with 6 decks and 3 detonators per deck.

3.9.1.5. Maximum Distance in Wi-Fi communicating to IntelliShot® Commander

- 10 meters

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3.9.1.6. CE4 Tagger Specifications

- -30°C to +60°C / -22°F to +140°F.
- Cold Temperature Battery Pack can be used to extend battery operating life in sub-zero conditions.
- The CE4 Tagger may be used for approximately 10 hours at 25°C / 77°F. At temperatures below -15°C / -5°F battery life may be reduced significantly.
- When the battery level of the CE4 Tagger reaches 9%, a warning symbol will appear on the top bar. Should the user choose to continue, the CE4 Tagger will automatically switch off when the battery level reaches 3%.
- IP 57 Ingress protection: Protected against water and dust ingress and protected against immersion between 15cm and 1m for 30 minutes.

3.9.1.7. CE4 Tagger Storage

- It is recommended that the CE4 Tagger be charged to 50% when placed into long-term storage, and thereafter the unit should be charged at least every six months to 50%, to maintain the expected lifetime of the battery.
- The CE4 Tagger may be kept on charge for extended periods as the CE4 Tagger will manage the battery.

3.9.1.8. Electrostatic Discharge, Over Voltage, Over Current and EMP Immunity

The system is also designed to be immune (within limits) to Radio Frequency interference (RF) but it is advised that cell phones and two-way radios be kept at least 5m away from control equipment (Blasters) during Programming, Arming and Firing as communication between the blaster and 4G detonators may be corrupted.

3.9.1.9. Inherent Safety

- CE4 Taggers are “Inherently Safe” because they cannot produce the necessary minimum required firing voltage or coded “Fire” command to initiate the electronic IntelliShot® Detonator.
- In addition, the CE4 Tagger firmware does not contain the procedures or commands necessary to calibrate, arm or fire the detonator.

3.9.1.10. GPS

- The GPS location, and also the altitude and number of satellites found, will be displayed on the System Information screen.

3.9.2. IntelliShot® Commander System Limits

3.9.2.1. Channels

- Maximum of 4 Channels.

3.9.2.2. Maximum Dets per Channel

- 400 Detonators.

NOTE	**A notification warning will be displayed when channel limits are exceeded. The system will still allow blasting to continue.**

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3.9.2.3. Maximum Dets per Bench IntelliShot® Commander (4 Channels)

- 1600 Detonators.

3.9.2.4. Maximum Distance in Wi-Fi communicating to IntelliShot® Commander

- 10m

3.9.2.5. Maximum Distance in RF mode between Base IntelliShot® Commander and Bench IntelliShot® Commander

- 3000m.

3.9.2.6. Maximum Harness wire between furthest IntelliShot® Detonator and IntelliShot® Bench Commander

- 2500m.

3.9.2.7. Maximum Distance in RF mode between IntelliShot® Base Commander and Repeater/ Bench Commander and Repeater

- 6000m between the Base and Bench Commanders via Repeater placed between Commanders.

3.9.2.8. IntelliShot® Commander Specifications

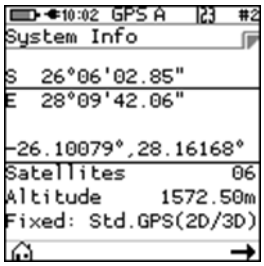
- IntelliShot® Commander is operated by 3.7V 7.2Ah single cell Lithium Polymer battery.
- -30°C to +60°C / -22°F to +140°F.
- The IntelliShot® Commander can be used for approximately 8 hours at 25°C. At temperatures below -15°C / -5°F battery life may be reduced significantly. Operating time is influenced by detonator load, backlight settings and operational temperature.
- When the battery level of the IntelliShot® Commander reaches 15%, a warning symbol will appear. Should the user choose to continue, the IntelliShot® Commander will automatically switch off when the battery level reaches 3%.

3.9.2.9. IntelliShot® Commander Storage

- It is recommended that the IntelliShot® Commander be charged to 50% when placed into long-term storage, and thereafter the unit should be charged at least every six months to 50%, to maintain the expected lifetime of the battery.
- The IntelliShot® Commander may be kept on charge for extended periods of time - the IntelliShot® Commander will manage battery charging accordingly.
- The IntelliShot® Commander may draw current up to 2 Amperes during charging, and an appropriately specified charger is therefore required – it is recommended that the charger supplied with the IntelliShot® Commander be used for charging the unit.

3.9.2.10. GPS

GPS information displayed on System Information screen.



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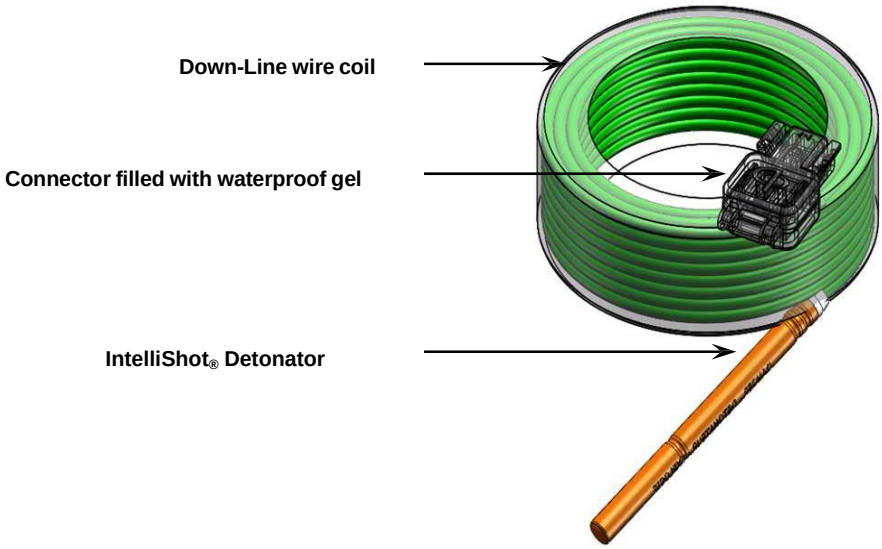
4 INTELLISHOT® DETONATOR

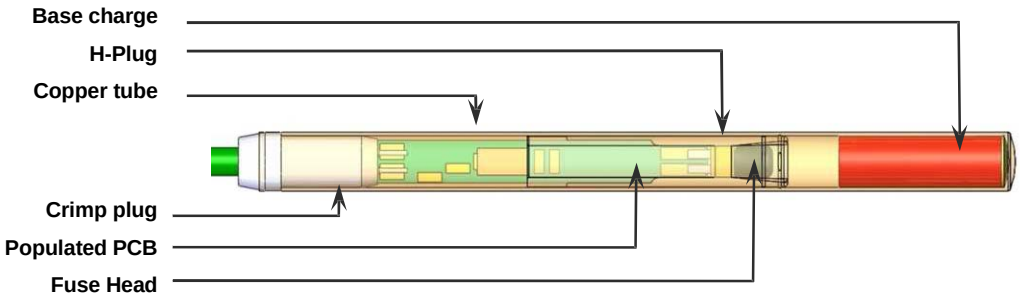
The IntelliShot® Detonator is a programmable detonator that is suitable for all types of blasting operations, especially those requiring precise and flexible timing and is programmable in 1ms increments from 0 to 20 000ms

The IntelliShot® Detonator is housed in a copper tube, which protects the circuit board and base charge.

The IntelliShot® Detonator is attached to a robust black and green two wire down-line cable which ends in a gel filled connector that clips on a surface harness wire.



4.1. Components



4.1.1. Crimp Plug

The crimp plug is a seal that is moulded onto the down-line wire preventing ingress of moisture and contaminantsinto the detonator tube between the down-line wire and crimp plug.

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4.1.2. Printed Circuit Board (PCB)

The PCB is an electronic module that houses components such as ASIC, resistors and a capacitor.

ASIC:

The ASIC (Aplication Specific Integrated Circuitry) controls the functions of the detonator:

Resistors:

The resistors protect the detonator circuitry against external influences such as:

- Over voltage,
- Over current,
- Electrostatic Discharge,
- Electromagnetic Pulse.

Capacitor:

The capacitor is an energy storage device that stores the required energy for the detonator to function independently after the blast signal has been sent and the connection between the control equipment and detonator has been destroyed.

4.1.3. Fusehead

The Fusehead is an incendiary explosive device that acts as the interface between the electronics and the explosives base charge of the detonator.

4.1.4. Protective H-Plug

An anti-static H-plug that is used to centralise the PCB separates the base charge from the circuitry and prevent powder migration into the circuitry. It also protects the PCB from dynamic shock and static discharge.

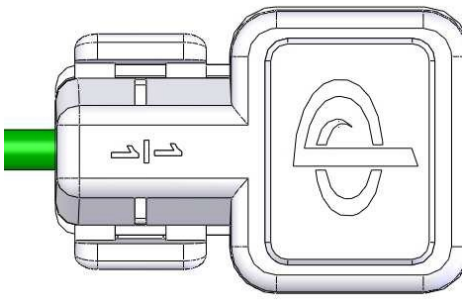
The second crimp is situated around the H-Plug and provides the seal which separates the explosive powders from the circuit board.

4.1.5. Connector

The Connector is used to connect the detonator down-line onto the surface harness-wire bus of the installation.

The Connector has two spade connectors that ensures a secure connection on each harness-wire and has two grooves enabling the user to align each wire with these connectors and also facilitates ease of use. These connections are not polarity sensitive and can be connected in any configuration.

The transparent polycarbonate connectors allow for improved visual inspection of the wires inside the connector to ensure correct connection.



The connector is filled with a transparent gel to facilitate water resistance during use. It is advisable not to submerge connectors in water.

4.1.6. Down-line wire

The down-line wire is a cable comprising 2 steel, copper or Bi-metal wire conductors which are individually sheathed and an outer black and green insulation.

The down-line wire is manufactured in various lengths and can be supplied to the user's requirements.

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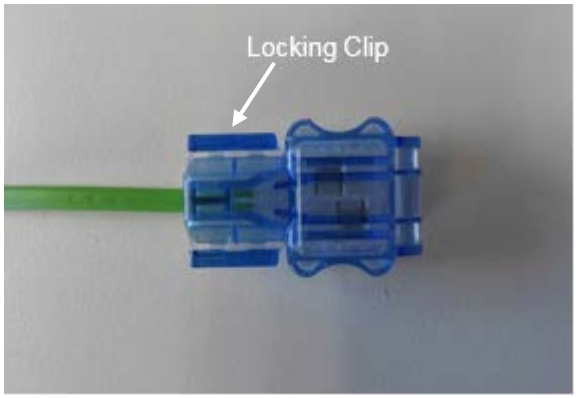
4.2. Connecting Up

4.2.1. Connector

1. Using one hand, hold the down-line wire with the connector facing away from your body.
2. With the other hand, pinch the locking clips together to release the connector and release the top lid.
3. Flip the connector lid open.
4. Ensure that there are no small stones and grit inside the connector.



5. Align the harness wire with the spade connectors inside the connector and pull the wires down. Guiding grooves on either side of the connector housing will facilitate the ease of this operation.
6. When closing the connector, ensure the connector clicks home to ensure a secure and proper connection and prevent the connector from opening

NOTE	**Place connectors away from normal operational movement of vehicles and users. Walking or driving over these connectors will result in damaged connectors, requiring the replacement of detonators.** **Avoid contamination inside the connector by keeping the connector closed at all times before final connection to the harness-wire.** **Do not remove the gel because it assists with preventing moisture accumulating inside the connector that will lead to corrosion of the connectors and leakage. In addition, small stones and grit can cause damage to contacts causing loss of communication to the detonator.** **A connector that is not closed correctly could result in a poor connection which may cause communication problems with the detonator and ultimate misfire.** **Avoid contamination inside the connector by keeping the connector closed at all times.** **A connector that is not closed correctly could result in a poor connection which may cause communication problems with the detonator.**

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4.3. Application of Detonator

Refer to Application document OPI-00390 for guidelines. The guideline does not supersede those required by the local mine, explosives or statutory regulations/procedures/codes of practise regarding the use of IntelliShot® Detonators. In such cases, the MOST STRINGENT set of rules between the mine, explosives or local regulations/procedures/codes of practise and the manufacturer must be followed.

4.4. Handling Precautions

NOTE	**Refer to the Electronic Detonator Material Data Sheet for detailed information on Precautions for safe handling, Conditions for safe storage, Disposal methods and Regulatory information.**

4.4.1. Storage

- Store IntelliShot® Detonators in accordance with relevant regulatory/legal requirements. .
- Ensure no smoking or open flames near IntelliShot® Detonators.
- Always keep storage facilities clean and dry.
- Ensure rotation of stock to use product with the specified shelf life.

4.4.2. IntelliShot® Detonator Care

- Avoid dropping or applying any physical shock to IntelliShot® Detonators because all detonators are impact sensitive.
- The connector is splash proof; water inside the connector could cause leakage that could result in IntelliShot® Detonators malfunctioning.
- Keep detonators a minimum of 0.1m from cellular phones and 2m away from handheld radios while priming and loading blastholes
- Keep detonators a minimum of 2m from cellular phones and 2 way radios when preparing for blasting as interference could cause the 4G Detonator to malfunction.
- Never attempt to open the IntelliShot® Detonator as it could initiate.
- Keep the connectors closed when not in use to prevent corrosion of the connector's pins.
- Grit and dirt inside the connector could damage the connector pins and result in poor connection
- Explosives inside the connector may cause corrosion on the connector pins that could result in poor connection and leakage.

CAUTION	**4G DETONATORS MAY ONLY BE CONNECTED TO THE THE INTELLISHOT® COMMANDER IN ACCORDANCE WITH LOCAL LEGISLATION AND PRESCRIBED BLASTING PRACTICES ON SITE WHICH MAY REQUIRE THE BENCH TO BE CLEARED FOR BLASTING BEFORE CONNECTION TO A BLAST DEVICE IS ALLOWED.**

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4.5. Specifications

4.5.1. Number of IntelliShot® Detonators

A maximum of 400 IntelliShot® Detonators (dependent on down-hole wire length) can be accommodated per channel.

4.5.2. Automated detonator capacity check

Due to the expanded non-volatile memory capacity of the new IntelliShot® Detonator, the cable length is now stored in the detonator during assembly. With this information stored in the detonator, the software on the Control Equipment will automatically verify the cumulative detonator down-hole length and warn the user should the installation limits be exceeded.

4.5.3. Decking

The system can accommodate decking applications with up to six decks and three 4G detonators per deck while using the Advanced and Planned Tagging Options.

4.5.4. Maximum delay times and increments

IntelliShot® detonators can be programmed from 0ms to a maximum delay of 20 000ms in 1ms increments.

4.5.5. Temperature Limitations

The following temperature limitations apply to the IntelliShot® Detonator:

- -40°C to +80°C
- -40°F to +176°F

4.5.6. Storage Life and Equipment Life

Store in a well-ventilated magazine suitably licensed for IMCO Class 1.1B or 1.4S (specified on packaging) and in accordance to specifications of the relevant Acts on the storage of explosives. The product has a 5 year shelf life from date of manufacture when stored in accordance with relevant regulatory requirements.

4.5.7. Electrostatic Discharge, Over Voltage, Over Current and EMP Immunity

LIKE ALL OTHER DETONATORS, INTELLISHOT® DETONATORS ARE SENSITIVE TO SHOCK AND TEMPERATURE AND USERS MUST REFRAIN FROM EXPOSING THEM TO EXCESSIVE SHOCK AND HEAT.

The IntelliShot® Detonators have resistors which provide the following safety features:

- Over voltage protection - Over current protection,
- Static - Electrostatic discharge (ESD) Electromagnetic Pulse (EMP),
- As per SANS 1717-1 and CEN 13763-27 requirements.

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4.6. Safety

The IntelliShot® Detonator cannot be initiated by the CE4 Tagger. The CE4 Tagger is incapable of producing the required firing voltage and cannot produce the required 'Fire' command to initiate an IntelliShot® Detonator.

WARNING	**NEVER CONNECT ANY THIRD PARTY OR OTHER UNAPPROVED DETONATORS TO THE INTELLISHOT® COMMANDER SYSTEM.**

4.7. Safety Warnings

4.7.1. User and Safety Tips

NOTE	**Always keep connectors closed when not in use to avoid damage and/or contamination. Always ensure all the IntelliShot® Detonators are connected to the system via the harness wire before leaving the bench.** **IntelliShot® Detonators are impact sensitive and should always be handled with care.**

4.7.2. Risks

WARNING	**HANDLE MECHANICALLY DAMAGED 4G DETONATOR AS PER APPROVED PROCEDURES. NEVER CONNECT THE 4G DETONATOR TO ANY UNAPPROVED VOLTAGE SOURCE. NEVER CONNECT THE 4G DETONATOR TO ANY EQUIPMENT OTHER THAN A CE4 TAGGER WHILE ON THE BENCH. THE 4G DETONATOR MAY BE CONNECTED TO THE COMMANDER AS PER LOCAL LEGISLATIVE REQUIREMENTS AND PRESCRIBED BLASTING PRACTICES ON SITE WHICH MAY REQUIRE THE BENCH TO BE CLEARED FOR BLASTING BEFORE CONNECTION TO A BLAST DEVICE IS ALLOWED**

4.7.3. Destruction of 4G Detonators

Refer to Destruction of Shot Detonators document OPI-202 for guidelines. The guideline does not supersede those required by local mine, explosives or statutory regulations/procedures/codes of practise regarding the use of 4G detonators In such cases, the MOST STRINGENT set of rules between the mine, explosives or local regulations/procedures/codes of practise and the manufacturer must be followed.

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5 CE4 TAGGER

5.1. CE4 Tagger General Information

The CE4 Tagger is a lightweight device that is powered by an internal rechargeable 3.7V Lithium Polymer cell and equipped with a backlit screen and a keypad.

The CE4 Tagger is used on the bench to test and configure the detonators by tagging the location of the detonators and assigning appropriate delays.

The device is also used to establish a Wi-Fi link with an appropriate IntelliShot® Commander in order to interface with the IntelliShot® Commander.

The CE4 Tagger features various user-interface elements including separate LEDs located above the LCD screen, a buzzer and a vibration motor to draw the user's attention to the system's current state.

The CE4 Tagger is incapable of producing sufficient voltage and the coded signal required to fire any detonators, thus rendering the CE4 Tagger inherently safe.

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5.2. CE4 Tagger Components

Figure 5: CE4 Tagger Component Identification

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5.2.1. Harness wire terminals

The harness wire terminals are used to connect to detonator / surface harness wires.

5.2.2. Pogo pins

The Pogo pins are used to connect a single detonator, while testing and tagging holes.

5.2.3. LEDs

- STATUS LED – A Blue circular LED (●) which indicates the status of the CE4 Tagger.
- CHARGE LED – A White DetNet Swirl shaped LED ( ) which indicates that the CE4 Tagger is charging.
- ERROR LED – A Red triangular LED (▲) which indicates when an error is present.
-

5.2.4. LCD Screen

The LCD screen displays 128x128 pixels. If the device is used in environments where the temperature drops below -15°C, heating of the LCD will be necessary and the internal heater pad will automatically switch on to heat the display.

5.2.5. SoftKeys

The SoftKeys will activate functions that appear at the bottom of the LCD screen, above the corresponding SoftKey, as an option in a menu.

5.2.6. Navigation and Numerical keys

The Yellow arrows (↑ ↓ ← →) on the keypad are the Navigation keys.
The Up and Down Navigation Keys are also used to increase and decrease values in certain screens.
The Numerical keys are used to enter numerical values and to select a function from the list of commands or menus.
The top bar displayed on each screen will indicate the keyboard mapping mode designed for that screen.

5.2.7. Enter key

The Enter key is used to accept an on-screen activity/option.

5.2.8. Backspace Key

The Backspace key is used to delete the character to the left of the cursor.

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5.2.9. On/Off key

Press key to switch ON the CE4 Tagger.
Press key while holding the FN key to switch the CE4 Tagger OFF.
To save battery power, the CE4 Tagger turns off automatically after a set period of idle operation. The auto power-off time may be adjusted, within limits, by the user.

5.2.10. Esc key

The **Esc** key ESC is used to cancel and escape out of selected options.

5.2.11. Function key

The FN key is a function key that is used in conjunction with other keys to perform specific functions.

5.2.12. USB connector port

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

The USB connector port will allow for charging of the battery and also for software upgrades and communication with a PC.

NOTE	**To perform a software upgrade, plug a flash drive containing the new software version into the USB connector while the CE4 Tagger is switched off. Hold down "any key" (Except the FN key) and then press the power ON button This will place the CE4 Tagger in bootloader mode and start the download of the new software. Follow the on-screen instructions to complete the software upgrade.**

5.2.13. Battery

The CE4 Tagger uses a rechargeable 3.7V Lithium Polymer battery. Consult Section 5.7 for more details on the CE4 Tagger battery, charging and maintenance procedure.

5.2.14. Audio Tones

Audible feedback operates as follows:

- A specific audio sample is played during the boot-up process
- A positive acknowledgement sound accompanies successful tasks
- An error acknowledgement sound accompanies errors or automatic power-off after a software timeout
- An informational sound accompanies other noteworthy events to draw the user's attention to the screen

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5.2.15. Vibration Signals

Error events are accompanied by a CE4 Tagger vibration sequence.

5.2.16. Visual Signals

LEDs will illuminate to visually signal a change to the user.
A round blue LED (●) and a triangular red LED (▲) will illuminate under the following conditions:

- Successful tests or operations result in the blue led illuminating until a new operation is performed or until the screen is exited.
- Unsuccessful tests or operations result in the red LED flashing until a new operation is performed or until the screen is exited.
- When an error is accepted by the User, the red LED will switch off, and only if a test fails will the red LED flash.
- The red and blue LEDs will illuminate simultaneously only if the operation has completed but some error conditions (acknowledged by the user) have been encountered (example: tagging a det with a bad fuse).
- The DetNet Swirl shaped white LED will illuminate to indicate that the CE4 Tagger is charging.

5.2.17. Real Time Clock (RTC) Function

The CE4 Tagger contains an internal Real Time Clock (RTC), which is required for its operation and log keeping.
The user should manually confirm/set the time-zone on the CE4 Tagger.
The time is automatically updated via the internal GPS.

5.2.18. NFC

The CE4 Tagger (version 4 and later) is equipped with a Near Field Communication (NFC) reader located on the rear of the Tagger. NFC functionality will be activated in a future software release.

5.2.19. Wireless Charging

Wireless charging has been incorporated into the CE4 Tagger (version 4 and later) to allow the unit to be charged using a commercially available off-the-shelf Qi wireless charging pad. This will allow the user to charge the Tagger without the need for USB cables, and also ensures that the protective cover on the USB connector remains closed and sealed in harsh environments.
The wireless charging receiver is situated on the rear of the Tagger. The receiver supports a power transfer of 5W and can charge the Tagger with a current of 500mA. Note that at the supported power transfer rate the Tagger will take longer to charge wirelessly than when connected to a USB cable / charger, where a charging current of up to 1A is supported

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5.3. Power CE4 Tagger ON and OFF

5.3.1. CE4 Tagger Power-ON

1. Press the ON key.
2. The splash screen will display for approximately 1.5 seconds during the CE4 Tagger boot sequence.
3. The system name will be displayed.
4. The software release and hardware version number will be displayed similar to example shown.

WARNING

ONLY TRAINED USERS SHALL BE ALLOWED TO USE THIS EQUIPMENT.

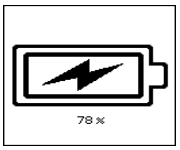
5. Warning will be displayed to indicate that the Tagger is due for service (If applicable)
6. Press the Ok SoftKey to acknowledge and continue.

7. Warning will be displayed indicating that Tagger must have a unique number which the user must acknowledge before proceeding
8. Press the Ok SoftKey to acknowledge and continue.

9. Disclaimer will be displayed which the user must acknowledge before proceeding.
10. Press the Ok SoftKey to acknowledge the Disclaimer.

NOTE

The charging screen will only be displayed when the CE4 Tagger is plugged into a USB, or external battery pack charging source. Pressing ESCAPE returns the user to the original screen and prevents this screen being shown again until the next power-on sequence.



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Device password

11. Enter the Device password using the numerical keypad.
12. Press ↵ to continue.

NOTE	**To prevent unauthorised use, the CE4 Tagger is assigned a default password by the manufacturer. The default password may be changed by the user and can be configured from the "Settings" menu. The user may reset the password with a ticket retrieved from DetNet Portal, should the password be previously set and the user does not recall the password.** **Entering value 0 as a password will remove the password-required step when starting the device.**

13. Main Menu screen will be displayed.
    The main menu screen will vary dependant on the mode of operation.

5.3.2. CE4 Tagger Power-OFF

14. Press and hold FN key and then press the ⏻ key to power OFF CE4 Tagger.

CAUTION	**IN THE EVENT OF THE SOFTWARE NOT RESPONDING TO THE FN KEY IN COMBINATION WITH THE ⏻ KEY, IT IS POSSIBLE TO FORCE THE CE4 TAGGER TO POWER OFF BY PRESSING AND HOLDING THE ⏻ KEY FOR AT LEAST 10 SECONDS TO FORCIBLY POWER OFF THE CE4 TAGGER. NOTE THAT THIS ACTION MAY RESULT IN SETTINGS OR BLAST INFORMATION BEING LOST AND SHOULD NOT BE USED IN NORMAL PRACTICE AS HARD POWER DOWNS CAN LEAD TO DATA CORRUPTION OR LOSS.**

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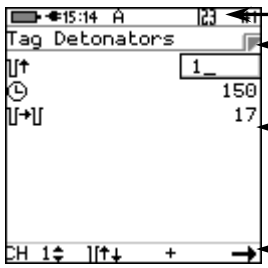
5.4. CE4 Tagger Menu Navigation

Menu navigation is performed by directly pressing the associated menu item number key. This is indicated to the user by the '**123**' keyboard mode displayed in the top bar. Pressing escape will normally navigate to the previous menu. In some screens, such as Tagging, other keyboard modes may be appropriate e.g. an arrow notation may be displayed to indicate that options on the screen may be incremented or decremented using up and down arrow keys.

NOTE	**The charging Icon will only be displayed while the CE4 Tagger is plugged into a power.**



Keyboard Mapping Mode
Menu Title / List Heading
Instructions and Information Interactive window
SoftKey Menus

- Press the Numerical keys to enter numerical values or to select a function from the list of menus.
- The Yellow arrows are Navigation keys and are used to navigate during actions where it is required to move left, right, up or down in an active screen.
- The Up and Down Navigation Keys are also used to increase and decrease values in certain screens.
-
- Use the SoftKeys to select soft menu options. Soft menu options will appear as icons at the bottom of the LCD screen directly above the corresponding SoftKey, as an option in a menu.
- Press the corresponding SoftKey to perform the indicated function.
- Press the ↵ key to confirm an instruction.
- Press the ESC key to cancel an instruction.
-

5.4.1. CE4 Tagger Common User Interface Conventions

The CE4 Tagger screens support standard conventions of interaction as detailed below:

5.4.1.1. 'Box' Numeric input

- When a default number is displayed on the screen, any numeric keyboard input will replace the existing number entirely.
- Pressing Enter will move to the next field, if any
- Pressing Escape will exit the numeric field and consequently also the active screen if it cannot continue without the required input.
- The Backspace key will delete the rightmost character, including that of a default number if present.
- Escape will not return a changed numeric input field to the original value. Pressing escape will exit the menu.

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5.4.1.2. 'Scrolled' Numeric input

Fixed range numeric input may be scrolled if indicated by up/down arrows associated with the field:

- Pressing the Up key (2) increments the number, if possible.
- Pressing the Down key (8) decrements the number, if possible.

5.4.1.3. Navigation

Navigation follows the conventions of DigiShot® to ease migration as detailed below:

- Menus are selected by pressing the appropriate numeric key directly.
- Soft-keys perform the indicated function.
- Escape exits the current field or screen, as appropriate.
- Arrow keys may be used to move in selected lists or scroll selected lists e.g. the detonator list.
- Arrow keys may also jump between selected fields in specific screens, typically those involving configuration settings.

Table 2: CE4 Tagger Icon Shortcut Keys and Commander Icons

ICON / KEYSTROKES	DESCRIPTION
FN & ESC	Press both the Function & Escape keys to disconnect the Tagger from the Commander
FN & ↵	Press both Function and Enter keys while in the main menu to connect Tagger to the Commander
#	Press Hash to display errors / View Notifications screen
	Number of commanders connected
	Amount of detonators (Per Commander)
&	Errors exist. Press hash (#) key.
	Wait – Not ready yet
	Info
	Return to SAFE (Abort)
	Fire Button(s)
	Force fire buttons (Should the last det check fail, the User can force the blast with blast override password)
	Fire keys Disabled
	Busy with background tasks

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5.5. CE4 Tagger Menu Quick Reference

Table 3: CE4 Tagger Menu Reference

Info Screen	Main Menu	Configuration
Battery/Current/Temp/Humidity	1. New design	1. 4G Setup
HW serial no/SW release	2. Tag detonators	2. Device Setup
GPS data/Satellites/Altitude	3. Test menu	3. Advanced Setup
User ID	4. View design	4. Factory Setup
	5. Mark detonators	
	6. Assign ViewShot - *Available in Planned (P) tagging option only*	
	7. Verify Plan - *Available in Planned (P) tagging option only*	

Table 4: CE4 Tagger Main Menu Reference

1-New Design	
	Warning Displayed: Do you want to clear the list? Y/N
	Main Menu is presented. This will clear the tagged detonator list and not the ViewShot design
2 -Tag detonators	
	Warning Displayed: • Connect one det at a time • If No plan available. Use ViewShot 3D to download a plan!
	Tagging detail settings
3-Test Menu	
	3.1. Test All
	3.2. Test String
	3.3. Test Single Det
	3.4. Leakage Test
	3.5. Untagged Test
	3.6. Search Dets
4-View Design/Plan	
	4.1. List Detonators
	4.2. List Missing Dets
	4.3. List New Dets
	4.4. List Bad Status
	4.5. Duplicate Location
	4.6- Blast Summary
5-Mark Detonators	
	5.1. End of Line
	5.2. Start of Row
	5.3. End of Row
	5.4. Inflection Pt.
	5.5. Remove Mark

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6- Assign ViewShot - Available in Planned (P) tagging option only	
	No detonators message is displayed if the detonator list (tagged) is empty
	6.1. List Detonators
7- Verify Plan - Available in Planned (P) tagging option only	Message displayed: Verification Complete
	7.1. Verify Plan
	7.2. Verify Delays
	7.3. Show Results
	7.4. Merge Plan

Table 5: CE4 Tagger Configuration Menu Reference

⚙.1: 4G Setup	
	⚙.1.1. Tag Option
	Select: • Basic (B) • Advanced (A) • Planned (P)
	⚙.1.2. Site Setup
	• Use Markers (B/A/P)
	• Multi-Commander (A/B/P)
	• Autotag (A/P)
	• Multi Primed (A)
	• Assign Locations (A)
	• List Hole Config (A/ P)
	• Det Label (A/ P)
	• Delete ViewShot (P)
	⚙.1.3. Leakage Trigger
	Select leakage warning trigger (Between 0.1 and 1mA)
⚙.2: Device Setup	
	2.1. Contrast
	2.2. Brightness
	2.3. Time Zone
	2.4. Timeouts
	2.5. Language
	2.6. Units
⚙.3: Advanced Setup	
	3.1. Tagger ID
	3.2. Connections
	3.3. Remote View
	3.4. Clear Tags
	3.5. Device Password
	3.6. Read All Det Data
	3.7. Max Wire length

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.4: Factory Setup	
	1. Clear Tags
	2. Clear Logs
	3. Leakage Calibrate
	4. Start Self-Test
	5. Experimental Menu
	6. Storage Mode
	7. Connector Type
	8. Reset Service Date
	9. SD Card Dump

NOTE	**The Factory Setup Menu is password protected and not for normal use. It is required to access the Factory Setup only.**

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5.6. CE4 Tagger Accessories

5.6.1. External Battery Pack

The External Battery Pack is an optional accessory used to increase the capacity of the internal battery when operating in sub-zero temperatures or other environments that demand extended operating times.
The Internal Heater Pad can operate with the internal polymer battery, independently of the external battery pack, and will switch ON when the temperature drops below -15°C.

External Battery Pack enclosure is attached to the back of the CE4 Tagger by four retaining screws.

Six batteries are fitted in the bottom of the External Battery Pack.
A cover closes the battery bay.

NOTE	**Replace using 6 x 1.5V AA Alkaline or 6 x 1.2V Ni-MH / Ni-Cd batteries only.**

Closed External Battery Pack fitted to the CE4 Tagger.

Figure 6: CE4 Tagger External Battery Pack

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5.6.2. Replaceable Top Connectors

The Top Connector contains the pogo pins, used for tagging the detonators (one detonator at a time)
It also consists of the Harness wire terminals, used to connect to the detonator harness wire (multiple detonators on the same wire bus).

CAUTION	**THIS PART SHOULD BE REPLACED IN A CLEAN ENVIRONMENT.**

Figure 7: CE4 Tagger Top Connector

NOTE	**Always keep the contacts clean and free of contamination.**

The Top Connector may be ordered separately and is easily replaceable should the contacts become worn and/or damaged, through prolonged use.

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5.6.3. Surface Harness Wire

The Surface harness wire consists of a pair of yellow and green individually sheathed copper wire, 0.63mm in diameter.

Figure 8: Surface Harness Wire

IntelliShot® Detonators are connected to the surface harness wire to enable communication with control equipment.
The maximum length of 2-wire surface harness per channel, including the lead-in wire used to connect shall not exceed 2500m.

CAUTION	**BY EXCEEDING THIS LIMIT THE INHERENT RESISTANCE ON THE HARNESS WIRE WILL INCREASE RESULTING IN POTENTIAL MISFIRES.** **ALL JOINTS SHALL BE SECURELY TWISTED AND INSULATED TO PREVENT INTERMITTENT CONNECTIONS, SHORT CIRCUITS AND EXCESSIVE LEAKAGE. THESE CAN BE A MAJOR SOURCE OF TROUBLE CAUSING POTENTIAL MISFIRES.**

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5.7. CE4 Tagger Battery

The CE4 Tagger uses a rechargeable 3.7V Lithium Polymer cell battery.
The CE4 Tagger battery compartment is sealed to prevent moisture ingression and condensation which could cause corrosion and or short circuits within the CE4 Tagger resulting in a possible malfunction or an unreliable CE4 Tagger. The CE4 Tagger is tested to an IP 57 rating.

CAUTION	**NO DETONATOR SHALL BE CONNECTED TO THE CE4 TAGGER WHILST CONNECTED TO A CHARGER.**

NOTE	**The battery is not replaceable in the field and should only be replaced by a DetNet qualified technician.**

5.7.1. Charging the CE4 Tagger

- Connect the USB cable between the mini USB port on the CE4 Tagger and a Personal Computer or use a DetNet Universal charger to charge the CE4 Tagger.
- The CE4 Tagger will automatically start charging as soon as the USB connector port is plugged into a USB socket.
- A battery level indication will be displayed during charging.

The CE4 Tagger may not charge sufficiently if the CE4 Tagger is connected to a weak charger or damaged USB port.
The charging circuit of the CE4 Tagger may require as much as 1A for charging.

NOTE	**It is recommended that the CE4 Tagger be charged to 100% before use, to allow for maximum operating time .**

CAUTION	**IT IS RECOMMENDED THAT THE CE4 TAGGER BE CHARGED TO 50% WHEN PLACED INTO STORAGE, AND THEREAFTER THE UNIT SHOULD BE CHARGED AT LEAST EVERY SIX MONTHS TO 50%, TO MAINTAIN THE EXPECTED LIFETIME OF THE BATTERY. REFER TO CE4 TAGGER STORAGE MODE UNDER ADVANCED SETUP FOR MORE DETAIL.**

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5.7.2. Low Battery

Once the battery has discharged to 9%, the CE4 Tagger will display the message ✉ icon in the top bar indicating a possible low battery condition. (The message Icon is active for any fault condition).

NOTE	**The CE4 Tagger will automatically switch off when the battery capacity drops below 3%.**

- Press # button to view Notifications screen.
- Screen will display **Low Battery!**
- Press Exit SoftKey to return to previous screen.

5.7.3. Battery Information

The user may navigate to the System information screen (detailed in paragraph 6.1.1) to check that the CE4 Tagger is being charged and to verify the state of health of the battery.

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5.8. CE4 Tagger Storage Mode

The CE4 Tagger storage process is to be followed when the CE4 Tagger will be stored for an extended period of time.

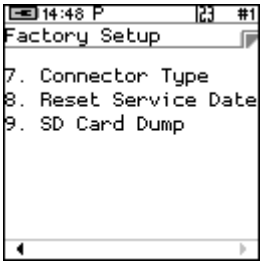
NOTE	**It is recommend that the CE4 Tagger be charged to 50% when put into storage and thereafter the unit should be charged at least every six months to 50%, to maintain the expected lifetime of the battery. Store the CE4 Tagger in a cool, dry place when not in use.**

1. Main Menu
   - Press SoftKey below to select **Configuration** Settings Menu.

2. From Configuration Settings Menu
   - Press 4 to select **Factory Setup.**

3. Factory Password
   - Enter Factory Password
   - Press to select Factory Setup Menu

4. Factory Setup Menu
   - Press key 6 to select Storage Mode



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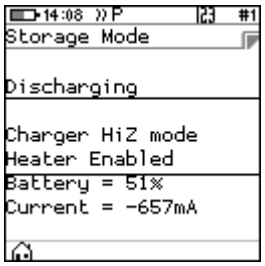
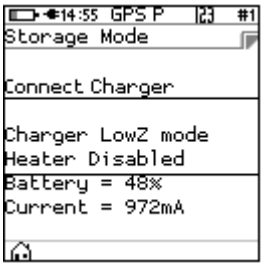
5. Storage Mode





- When the battery capacity is more than 50%, the CE4 Tagger will discharge the battery by activating various battery consuming functions such as the heating pad, to accelerate the discharge level to the required 50% charge level.
- When the battery capacity is less than 50%, the CE4 Tagger will prompt the user to connect a charger to attain the required 50% charge level.
- When the CE4 Tagger reaches the 50% battery storage capacity as required, it will switch off automatically allowing for safe storage.

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6 CE4 TAGGER SYSTEM INFORMATION

This function enables the user to view battery charge information, current consumption, state-of-health of the battery, temperature information, hardware and software serial numbers, GPS detail and User ID.

6.1. System Info

From the Main Menu, press SoftKey to view the CE4 Tagger System Information

6.1.1. System Info - Battery

- **95%:** Battery charge information (USB = the charging source). Should the charger not be able to supply enough power to charge the CE4 Tagger, 'Weak Charger' will be indicated as the charging status, instead of 'Charging (USB)'.
- **Current Consumption:** By convention a negative value indicates that current is being drawn from the battery.
- **Cell Status:** (Good) indicates the state of health of the battery. Should the status indicate 'Low' the unit should be serviced to have the battery replaced.

NOTE	**The CE4 Tagger will switch OFF automatically when the battery capacity drops below 3%.** **(The CE4 Tagger will display a warning at 9% and switch OFF at 3%).**

6.1.2. System Info - Temperature and the Relative Humidity

The Temperature and the Relative Humidity as measured inside the CE4 Tagger are displayed as follows:

- **Temperature:** The Temperature is displayed in degrees Celsius or Fahrenheit (Dependant on Units Setting under Device Setup).
- **Humidity:** The Relative Humidity is displayed as a percentage.

6.1.3. System Info - Hardware Serial Number and SW Release Number

- Hardware Serial Number will be displayed, and
- Software Release Number will be displayed.
- Press to select next page.

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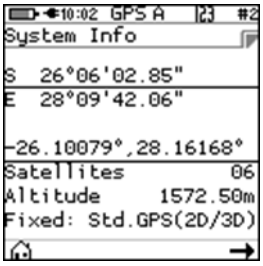
Hardware Serial number is required when Challenge Response tickets are required from the DetNet Portal.

6.1.4. System Info - GPS Detail

- The GPS location will be displayed.
- Altitude and the number of satellites found will also be displayed.
- Press ▶ to select next page.



6.1.5. System Info –User ID

- Press SoftKey to enter or edit User ID.
- Use alphanumeric characters to enter a User ID.
- Press ▶ to select next page.

The User ID may be used to identify ownership of the CE4 Tagger such as the User name or Site name/code where used.

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7 CE4 TAGGER CONFIGURATION SETTINGS

7.1. CE4 Tagger 4G Setup Configuration

7.1.1. Tag Option

The Tag Option will allow the User to select one of the following three tagging options:

- Basic (B)
- Advanced (A)
- Planned (P)
- A corresponding symbol (B, A or P) will be displayed in the top bar once the tag option is set.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 1 to select **4G Setup**

3. 4G Setup
   - Press 1 to select **Tag Option**

4. Tag Option
   - Use 2 8 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.

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7.1.2. Site Setup

1. Main Menu

- Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu

- Press 1 to select **4G Setup**

3. 4G Setup

- Press 2 to select **Site Setup**

NOTE	**The Site Setup is dependent on the Tagging Option and in this menu, the user may allow certain functions to be active when tagging.** **Advanced mode has more advanced features and can be used with multi-primed or decked holes. Detail about decking and hole configuration can be found further in this document where Advanced mode is detailed**

4. Site Setup

Site Setup screen for each (Basic, Advanced and Planned) tagging mode are depicted below.

- **Use Markers:** When the Use Markers option is enabled (Black filled rectangle) the tagging screen will contain a SoftKey to allow the simultaneous marking and tagging of a detonator. “Mark detonators” menu includes more types of markers besides “End of Line” which typically is assigned to the detonator connected last on a wire harness.
- **Multi-Commander:** When this option is selected, the user may tag more than 4 channels and up to 16000 detonators on a single Tagger. If not selected it will stop and provide a warning when more than 4 channels are allocated and more than 1600 detonators are being tagged.

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- **Autotag:** If the Autotag 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-Primed**: When this item is enabled one can load more than one detonator per hole and tagging can also be restricted to a deck only if necessary. .
- **Assign Locations**: With large blast designs, the plan may not be complete at the time of tagging and to speed up the process, tagging can be conducted in parallel with drilling. If this item is checked, the "Tag Detonators" menu will only write the locations in the detonator.

NOTE	**When the plan is available later, the tagging must be completed using the tagger to "Assign Delays" (as the commander does not have the option to time dets) in order to prepare the detonators for the blast.**

- **List Hole Configuration**: Allows users to define a hole configuration.
  A hole configuration consists of the number of decks in a hole, the number of detonators in each deck and the time offset of each deck.
  The system allows more than one hole configuration to be defined but only one can be employed at the time of tagging.
- **Det Label**: The label defines how the hole (det) is referred to throughout the system.
  The following choices are available:
  1. Row number, hole number, det number
  2. Literal row, hole number, det number
  3. Hole Number, det number
  4. Numeric sequence (used internally in basic mode)*
- **Delete ViewShot:** This option allows for the previously saved ViewShot plan to be deleted from the Tagger memory.

NOTE	**Refer to individual Tag Options in the Tagging Operation section (Chapter 10) of this manual where detail is provided regarding the Site Setup. This will differ according to the type of Tagging Option selected.**

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7.1.3. Leakage Trigger

The user could set the maximum limit where the leakage warning is triggered. This limit could be set from 0.1 mA to 1mA in increments of 0.1mA. Note that the default leakage limit is 0.5 mA

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 1 to select **4G Setup**

3. 4G Setup
   - Press 3 to select **Leakage Trigger**

   - Use 2 8 navigational keys to scroll up/down and display the required selection
   - Set warning trigger between 0.1 and 1mA
   - Press SoftKey to save.

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7.2. Device Setup

This menu will allow the user to adjust device specific settings. The following options are available:

1. Contrast
2. Brightness
3. Time Zone
4. Time Outs
5. Language
6. Units

7.2.1. Contrast

This function enables the user to adjust the LCD screen contrast.

NOTE	**The contrast adjusts as the value changes but the setting will only be saved permanently when the SoftKey is pressed.**

1. Main Menu

- Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu

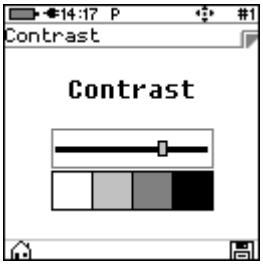
- Press 2 to select **Device Setup**.

3. Device Setup

- Press 1 to select **Contrast**.

4. Contrast

- Use the arrow key 4 6 to adjust contrast.
- Adjust to ensure the displayed contrast 'blocks' are distinguishable to allow viewing 'greyed out' versus 'bold' items. If the contrast is either too high or too low, these font differences will not be notable.
- Press SoftKey to save.
- Press SoftKey to return to Main Menu.



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7.2.2. Brightness

The Brightness menu allows the LCD screen display brightness to be adjusted using the 4 6 arrow keys.

NOTE	**The Brightness adjusts as the value changes but the setting will only be saved permanently when the SoftKey is pressed.**

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 2 to select **Device Setup**.

3. Device Setup
   - Press 2 to select **Brightness**.

4. Adjusting the Brightness
   - Use the arrow 4 6 keys to adjust brightness.
   - Press SoftKey to save.
   - Press SoftKey to return to Main Menu.

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7.2.3. Time Zone

This function enables the user to define the time zone. Date/time settings are controlled by GPS GMT data but, since the time **zone** is not configured automatically, it should always be set by the user in order to ensure the correct time display. The time zones may be adjusted in 0.5 hour increments.

1. Main Menu

- Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu

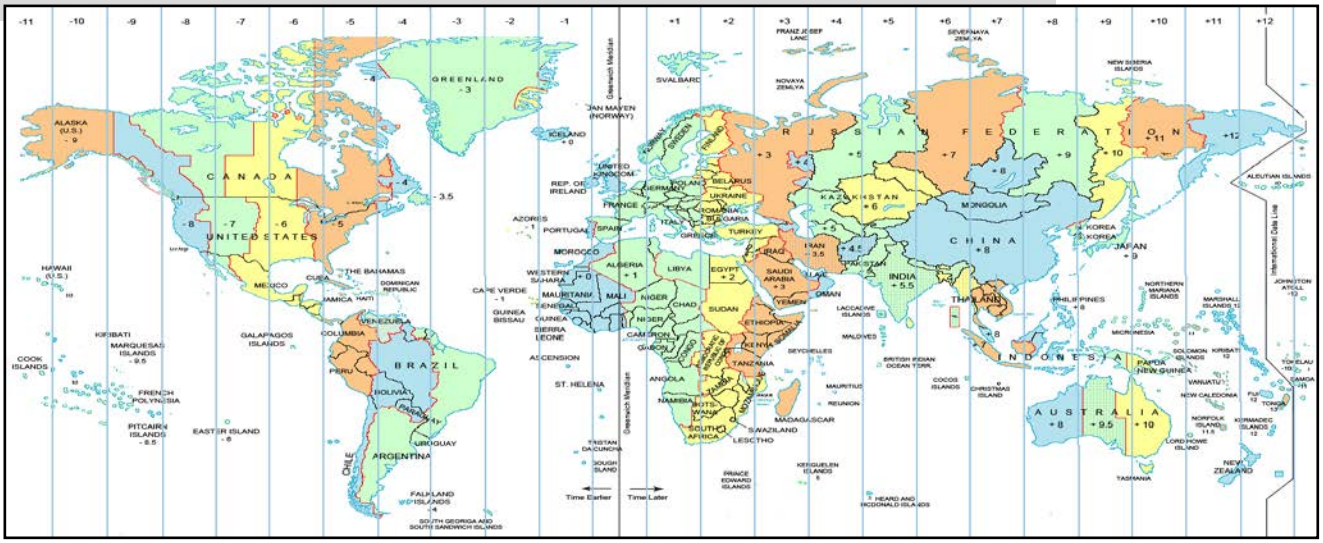
- Press 2 to select **Device Setup**.

3. Device Setup

- Press 3 to select **Time Zone**.

4. Set Time Zone

- Use the arrow key 2 8 to navigate the **Time Zone** options (Time zone can be adjusted in 0.5h increments).
- Press SoftKey to save.
- Press SoftKey to return to Main Menu.



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7.2.4. Timeouts

This function enables the user to set a time period of inactivity before the CE4 Tagger will automatically power off to conserve battery power. The user can set the idle time between 2 to 120 minutes.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 2 to select **Device Setup**.

3. Device Setup
   - Press 4 to select **Timeouts.**

4. Auto Shutdown
   - Use 2 8 navigational keys to navigate selection.
     - Minimum of 2 minutes.
     - Maximum of 120 minutes.
   - Press SoftKey to save.
   - Press SoftKey to return to Main Menu.

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7.2.5. Language

This function enables the user to select a language preference for the CE4 Tagger menus.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 2 to select **Device Setup**.

3. Device Setup
   - Press 5 to select **Language.**

4. Language
   - Press 1 on the keypad to select English.
   - Press 2 on the keypad to select Español.
   - Press 3 on the keypad to select Français.
   - Press SoftKey to return to Main Menu.

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7.2.6. Units

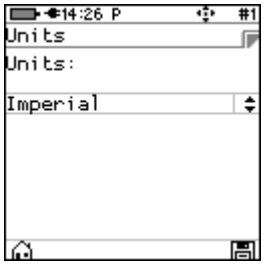
This function enables the user to select either the Imperial or Metric Units of Measure as preferred.

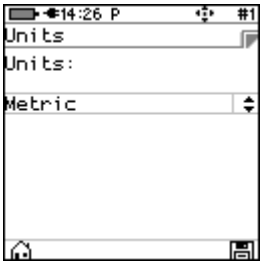
1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 2 to select **Device Setup**.

3. Device Setup
   - Press 6 to select **Units.**

4. Units
   - Use 2 8 navigational keys to toggle selection.
   - Press to select either Imperial or Metric.
   - Press SoftKey to save.





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8 CE4 TAGGER ADVANCED SETUP

The Advanced Setup Menu displays the following options:

1. Tagger ID
2. Connections
3. Remote View
4. Clear Tags
5. Device Password
6. Read all det data (trouble shooting option)
7. Max Wire Length

8.1. Tagger ID

This function enables the user to set a unique Tagger ID that is used for device identification and RF communication. The Tagger ID should be unique amongst all Taggers at a site. IDs from 1 to 10 are supported.

NOTE	**The current CE4 Tagger ID is displayed on the right side of the top bar on the screen (#1 in the screen depicted below).**

CAUTION	**WHEN USING MULTIPLE TAGGERS ON THE SAME BLAST, ENSURE THAT TAGGER IDS ARE UNIQUE AS TAGGERS USING THE SAME ID WILL CAUSE ERRORS ON THE BLAST.**

1. Main Menu

   Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu

   Press 3 to select Advanced Setup.

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3. Advanced Setup

- Press 1 to select **Tagger ID**

4. Tagger ID

- Use numerical keypad to enter Unique Tagger ID between 1 and 10.
- Press SoftKey to **save**.
- Press SoftKey to return to Main Menu.

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8.2. Connections

This function enables the user to activate the Wi-Fi and/or USB module allowing the Tagger to communicate with other equipment.

NOTE	**Additional software for a PC may be required from the manufacturer to support this feature. USB cable or Wi-Fi must be connected, and the PC software must be configured and activated before this function can be used.**

1. Main Menu
   - Press SoftKey to select **Configuration Settings.**

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 2 to select Connections.

4. Connections
   - Press 1 on the keypad to connect Tagger to PC via Wi-Fi.
   - Press 2 on the keypad to connect Tagger to Commander via Wi-Fi
   - Press 3 on the keypad to connect Tagger to PC via USB

NOTE	**During initial connection with a PC, the device will be displayed on the PC Wi-Fi List and will require a Password to connect. Use Generic Password: 145634235. Subsequent connections will connect automatically.**

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8.2.1. Connect Tagger to PC via Wi-Fi

NOTE

To establish Wi-Fi connectivity between the CE4 Tagger and a PC, the PC must be equipped with the required Wi-Fi functionality and corresponding software.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 2 to select Connections.

4. Connections
   - Press 1 on the keypad to connect CE4 Tagger to PC via Wi-Fi.

5. PC via Wi-Fi
   - CE4 Tagger will search for access point on PC
   - CE4 Tagger will connect to the PC
   - Follow on-screen prompts to connect to CE4 Tagger Access point Wi-Fi

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8.2.2. Connect CE4 Tagger to IntelliShot® Commander via Wi-Fi

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 2 to select Connections.

4. Connect to
   - Press 2 on the keypad to connect CE4 Tagger to IntelliShot® Commander via Wi-Fi.

5. Commander via Wi-Fi
   - Enter the Commander's ID using the keypad to connect
   - Press ↵ to continue
   - **Enter Commander's ID** will also be displayed if Commander is not found while attempting to connect.

NOTE	**Only one Commander with selected ID must be active when connected.** **When connectivity is established between the CE4 Tagger and the Commander an audible "Bling" and subsequent "Tock" sound should be heard for every button press.**

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- CE4 Tagger will connect to the selected IntelliShot® Commander

NOTE	**Shortcut key combination is available from the Tagger main menu to connect the CE4 Tagger to IntelliShot® Commander via Wi-Fi menu as follows:** - **Press and hold FN key and then press the ↵ key to connect.** - **Press and hold FN key and then press the ESC key to disconnect.**

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8.2.3. Connect CE4 Tagger to PC via USB

1. Main Menu
   - Press SoftKey to select **Configuration Settings.**

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 2 to select Connections.

4. Connections
   - Press 3 on the keypad to connect CE4 Tagger to PC via USB.

5. USB Link with PC
   - The CE4 Tagger will wait for the connection to be established and the following messages will appear:
     - Ready for PC – Connect USB cable between PC and CE4 Tagger
     - Connected to PC

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8.3. Remote View

This function enables the user to demonstrate the CE4 Tagger in action by replicating the screen on a PC. It may be used by trainers, product presenters and document writers.

NOTE	**Additional PC software may be required from the manufacturer to support this feature. USB cable or Wi-Fi must be connected, and the PC software must be configured and activated before the Remote View function can be used.**

8.3.1. Select Remote View on CE4 Tagger

1. Main Menu
   - Press SoftKey to select **Configuration Settings.**

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 3 to select Remote View.

4. Screen Capture
   - Press 1 to Enable on USB when prompted
   - CE4 Tagger actions will be replicated on the PC screen
   - Press 1 to disable remote view.

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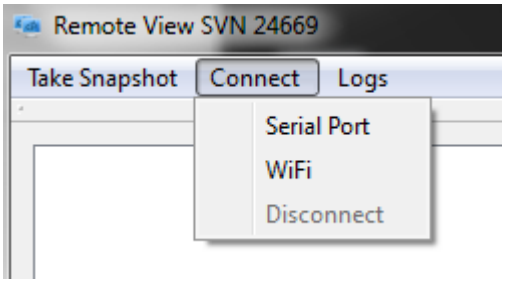
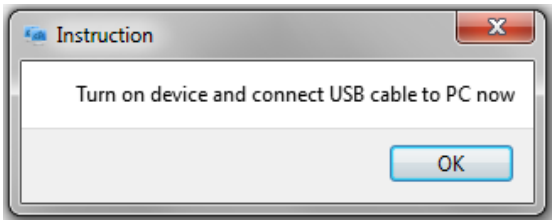
8.3.2. Initiate Remote View on PC

1. Open the Remote View software application on the PC

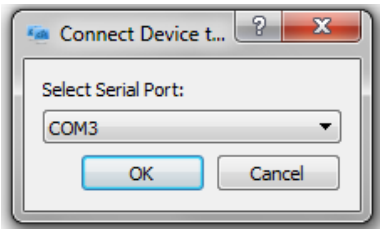
2. Click on **Connect** tab
3. Select either **Serial Port** or **Wi-Fi** as required from option



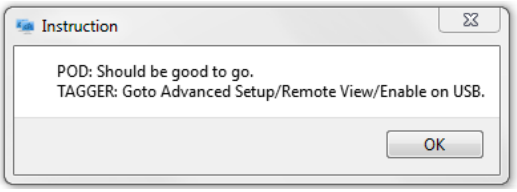
4. Ensure CE4 Tagger is switched ON
   - Connect USB cable between CE4 Tagger and PC
   - Click OK to continue



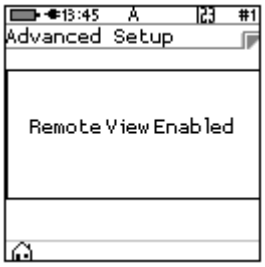
Connect Device
- Select Serial (COM) Port from dropdown list
- Click OK to continue



5. Navigate to Advanced Setup/ Remote View on CE4 Tagger
6. Press 3 to select **Remote View**



7. Press 1 to enable Remote View on PC via USB
8. Remote View will be displayed on PC



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8.4. Clear Tags

This function enables the user to clear the detonator memory and remove the tag that was assigned. After the process completes the detonators will contain the factory ID that they were shipped with.

Connect the harness wire to the Harness wire terminals of the CE4 Tagger. The detonators should remain connected to the Harness wire during the process.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 4 to select Clear Tags

4. Clear Tags
   - An information screen will be displayed.
   - Press Yes SoftKey to erase all detonators tags for connected detonators.
   - Press No SoftKey to exit without clearing detonators.

5. When Yes SoftKey was selected, **Det tags cleared** message will be displayed to indicate that Tags have been cleared.
6. Press Ok SoftKey to return to Advanced Setup Menu.

NOTE

Use this feature with caution. Once all det tags are cleared, the detonators will need to be re-tagged from the start, which will be time consuming.

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8.5. Device Password

The CE4 Tagger is protected from unauthorised use by assigning a password.
This function enables the user to change the default password by assigning a new unique password that is known only to the user.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 3 to select **Advanced Setup**.

3. Advanced Setup Menu
   - Press 5 to select **Device Password**

4. Passwords
   - Use the numerical keypad to enter **Current Password.**
   - Press to confirm.
   - Use the numerical keypad to enter **New Password.**
     Leave blank and press for NO password requirement during start-up of the Tagger
   - Press to confirm.

5. Passwords
   - Information message confirming password changed will be displayed briefly.
   - CE4 Tagger will display Passwords Screen.
   - Press ESC to return to Advanced Menu.
   - Press SoftKey to return to Main Menu.

NOTE	**The Password should be changed regularly to maintain security.** **Unlike conventional password entry, the chosen password is visible to the user (rather than ****) to enable the user to see if any typing errors are being made.**

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8.6. Read All Detonator Data

This function was designed for debug purposes and it captures the data from a single detonator in the Tagger logs.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 3 to select **Advanced Setup**.

3. Advanced Setup Menu
   - Press 6 to select **Read All Det Data**

4. Read All Det Data
   - Connect a single detonator to the pogo pins or spring terminals
   - Tagger will indicate the test progress**.**
   - Detonator information will be recorded in the Tagger logs
   - Press SoftKey to return to Main Menu.

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8.7. Maximum Wire Length

This function enables the user to set the maximum detonator wire length on a particular string. When the total detonator wire length on a particular string exceeds the set maximum wire limit, a system notification warning will be triggered.

1. Main Menu

   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu

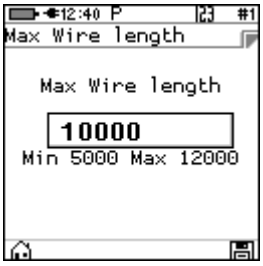
   - Press 3 to select **Advanced Setup**.

3. Advanced Setup Menu

   - Press 7 to select **Max Wire length**

4. Max Wire length

   - Use numerical keypad to enter maximum wire length. Default is 10000m



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9 CE4 TAGGER FACTORY SETUP

NOTE

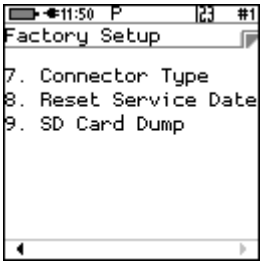
The Factory Setup is password protected and may only be accessed by designated maintenance teams.

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 4 to select **Factory Setup**.

3. Use numerical keypad to enter Unique Tagger Password.
   - Press **ENTER** to continue.

4. Factory Setup Menu
   - Factory Setup will be displayed.
   - Press ▶ to go to next page.
   - Press ◀ to return to previous page.



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5. Web Ticket
   - Press required Menu option.
   - Obtain Ticket to continue.

NOTE	**With the exception of the storage mode function, each option is protected by its own web-based ticket system. If no active ticket is available for the chosen option (as stored on the tagger), the user is prompted for a ticket issued by portal.detnet.com. The ticket is comprised of two 10-digit numbers that need to be entered before continuing. If the ticket is valid, access will be granted to the given function. Tickets can be issued for a selected number of repeated uses before a given expiry date. Tickets issued are specific to a given CE4 Tagger as determined by the hardware serial number, thus allowing flexible control over protected features.**

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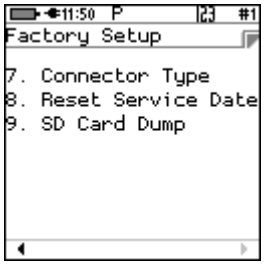
9.1. Factory Setup Menu Options

1. Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 4 to select **Factory Setup**.

3. Use numerical keypad to enter Unique Tagger Password.
   - Press **ENTER** to continue.

4. Factory Setup Menu
   - Factory Setup will be displayed.
   - Press to go to next page.
   - Press to return to previous page.



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5. Each Factory menu option is described below:
   - **Clear Tags (Factory)** The factory clear tags option allows any connected detonators to be rewritten to the factory untagged ID.
   - **Clear Logs (Factory)** The clear logs option erases the internal log and will display a confirmation dialog briefly.
   - **Leakage Calibrate (Factory)** The Leakage Calibration option recalculates the leakage and current offsets by measuring the current and leakage with no detonators connected. It functions in the same fashion as the leakage test screen, except that it initially shows a leakage calibrate dialog briefly and then proceeds to the leakage screen.
   - **Start Self-Test (Factory)** The self-test function starts a factory self-test of the device.
   - **Experimental Menu (Factory)** The Experimental Menu option will contain any experimental functions that are required by the engineering team only.
   - **Storage Mode** This item is not web-ticket protected. Please refer to Chapter 5.8 for detail.
   - **Connector Type (Factory)** This option will allow the user to select the replaceable Top Connector Type as fitted to the CE4 Tagger.
   - **Reset Service Date (Factory)** The option will reset the maintenance schedule warning.
   - **SD Card Dump (Factory)** This option will dump all content on the SD card via the USB.

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10 TAGGING OPERATIONS

NOTE

Always clear the tagged detonator list whenever a new tagging process is started. From the Main Menu, select NEW DESIGN and confirm that the list needs to be cleared.

From the Main Menu, select NEW DESIGN and confirm that the list needs to be cleared

NOTE

Tagging allows the User to tag detonators in various configurations. To cater for specific user requirements, refer to Chapter 7.1.1 - CE4 Tagger Setup Configuration to configure the required Tag Option as some features displayed on-screen may not be applicable to a particular tagging option.

10.1. COMMANDER SYSTEM TAGGING PRINCIPLE

The main principle of tagging in the IntelliShot® Commander System is to assign a delay for each detonator tagged. To make the detonator uniquely identifiable in the blast, the CE4 Tagger writes an ID in the detonator.
A part of the ID written in the detonator reveals the CE4 Tagger ID involved in the assignment. The tagging process for the entire blast may be shared by multiple CE4 Taggers.
Each CE4 Tagger MUST be uniquely identified, i.e. no two CE4 Taggers may have the same Device ID.
Each CE4 Tagger can contain a maximum of 16000 Detonators in storage/memory. Only 400 dets (one String) could physically be tested at a time on a Tagger.
For tracking and troubleshooting purposes, the CE4 Tagger can also write a location in the detonator memory. This location can be a number only (referred to as “sequence”) or may be a fully descriptive position of a detonator in the blast as Row (number), Hole (number) and Det (number) in a hole.
When tagging a detonator, the record is automatically appended to an internal list and saved on the persistent data storage card.

10.1.1. Basic.

The BASIC tagging option (**B**) is offered to make the tagging simpler and also suitable for smaller applications.

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10.1.2. Advanced

The Advanced Mode option is more complex than the Basic Mode as it allows for multi-primed holes and the user will need to control several parameters within this mode. To define a hole configuration the “Site Setup” screen will need to be accessed. The Advanced (**A**) Tagging option also allows the user to tag detonators using Detonator Label methods as follows:

- Method 1: {NNNNN} {N}, a hole number and det number is assigned
- Method 2: {NNN} {NNN} {N} a group number depicted as Row number, hole number and det number is used.
- Method 3: {AA} {NNN} {N}, a user configurable 2 letter group number, hole number and det number is assigned.
- Method 4: {A} {NNNNN} {N}, a user configurable single letter group number, hole number and det number is assigned.

10.1.3. Tag by Plan.

With the Planned (P) tagging option, both the location and a delay must be written into the detonator.
The data written into the detonator is taken from a plan downloaded into the CE4 Tagger via ViewShot 3D.
When exporting the design from ViewShot 3D as “Send Plan Locations Only (4G Only)”, only the connection sequence and blasthole numbers will be exported to the tagger.
Manual locations can also be deployed separately from delays by using Advanced mode with “Assign Location” setting checked. This feature can be used when the delays are not yet known.
Delays can be deployed to the tagged detonators later in Planned mode, using the available plan based on location matching.

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10.2. BASIC (B) TAGGING OPTION

With the BASIC tagging option, the user needs to only concentrate on the Delay value assigned to the detonator. The BASIC option is best suited for single primed hole blasts.

NOTE	**It is advised to use only one Tagger per Commander when the Basic Tagging Option is used.**

1. From the Main Menu
   - Press 2 to select Tag Detonators

   - Tag Detonators Warning
   - Press OK SoftKey to acknowledge warning

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

2. From the Tag Detonators Option

The user will be prompted to configure the Tagger with the desired String ID and new starting Sequence Number when tagging

- Observe String ID (**1** depicted on screen)
- Enter new String ID (**2** depicted on next screen)
- Press ↵ to save new String ID
- Enter new starting Sequence # as required
- Press ↵ to save new starting Sequence #

NOTE	**The User may bypass the above procedure if required and Press the → SoftKey to display the following Enter Delay screen.**

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3. Enter desired delay
   - Use the keypad to enter the delay in ms

   - Connect detonator and press ↵ to continue
   - **ST2** String Number 2
   - **#1** Total Count of detonators tagged
   - **100m** Total down wire length
   - Detonator number and delay entered will be displayed
   - Tagger will be ready state to enter next detonator delay

4. Enter desired delay for following detonators
   - Use the keypad to enter the delay in ms
   - Connect next detonator and press ↵ to continue
   - Detonator number and delay entered will be displayed
   - Tagger will be ready state to enter next detonator delay

5. Enter the required delay values for all detonators to be tagged and press ↵ after each entry to save and move to next field.

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10.2.1. Mark Detonators

With the IntelliShot® Commander System it is recommended that the user mark the detonator that will be placed at the end of the harness wire, as the Bench Commander will verify the voltage level of this detonator just before presenting firing buttons.
Each String should have 1 detonator marked as End of Line.

NOTE	**The other types of marking are not explicitly used in this version of the system although it is planned to use it in a future release of the software. They would typically indicate that specific points of the blast have been captured and also indicate if a change of plan (delays and increments) is required.**

1. From the Main Menu
   - Press 5 to select Mark Detonators

2. **From Mark Detonators Menu**
   - Press 1 to select/deselect End of Line
   - Press 2 to select/deselect Start of Row
   - Press 3 to select/deselect End of Row
   - Press 4 to select/deselect Inflection Point
   - Press 5 to Remove Mark from previously marked Detonator
   - Press Cancel SoftKey to return to Main Menu
   - Press Apply SoftKey to apply the setting.

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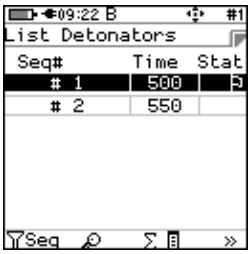
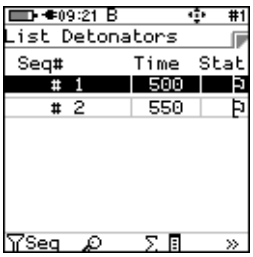
10.2.1.1. Multiple Last-Det assignment

From List Detonators Menu

- Select detonators to be assigned as Last Det
- Press Enter



- Press Set as Last Det SoftKey
- Multiple last detonator will be set and displayed



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10.3. PLANNED (P) TAGGING OPTION

With the **Planned** (**P**) tagging option, both the location and a delay must be written into the detonator.
The data written into the detonator is taken from a plan downloaded into the CE4 Tagger via ViewShot 3D.
If the delay plan is not yet known, but the holes are drilled at known locations one can tag the blast in 2 steps.
The first step is to deploy the known locations by exporting the pattern from ViewShot 3D as Plan Location Only
Delays can be deployed or updated to the tagged dets later using an updated ViewShot plan.
To assign/update the delays, one must enter “Assign ViewShot” menu which is on the main menu.

NOTE	**The user needs to ensure that he/she is at the correct location before tagging the detonator.**

1. From the Main Menu
   - Press 2 to select Tag Detonators

   - If the CE4 Tagger does not detect a downloaded ViewShot plan, the user will be prompted to download a plan.

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10.3.1. Connect the CE4 Tagger to the PC

1. From Main Menu
   - Press SoftKey to select Configuration Settings.

2. Configuration Settings Menu
   - Press 3 to select Advanced Setup.

3. Advanced Setup Menu
   - Press 2 to select Connections.

4. Connections
   - Press 3 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

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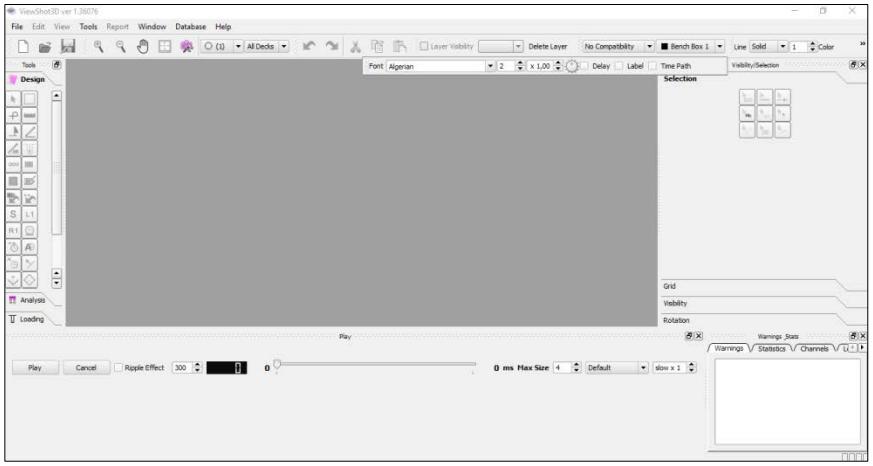
10.3.2. Download the Plan (via ViewShot 3D)

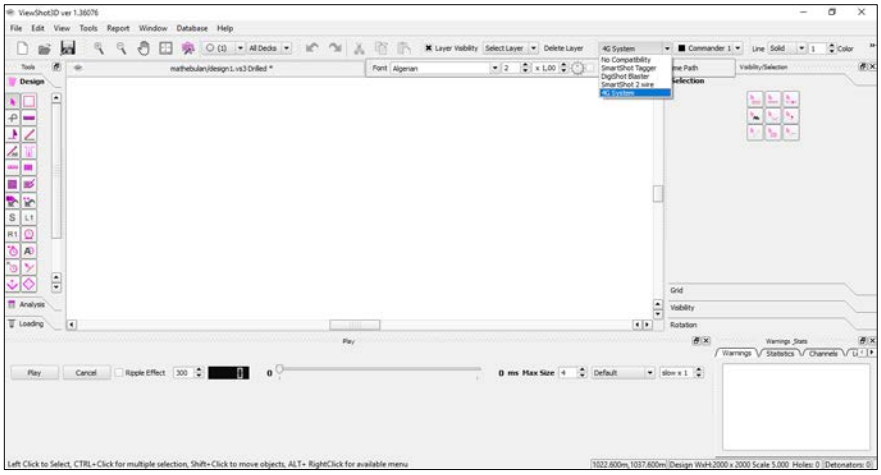
Download the Plan (via ViewShot 3D on the PC) onto the CE4 Tagger to enable the use of the Tag by Plan option.

NOTE	**Refer to the ViewShot 3D User Manual for detail**

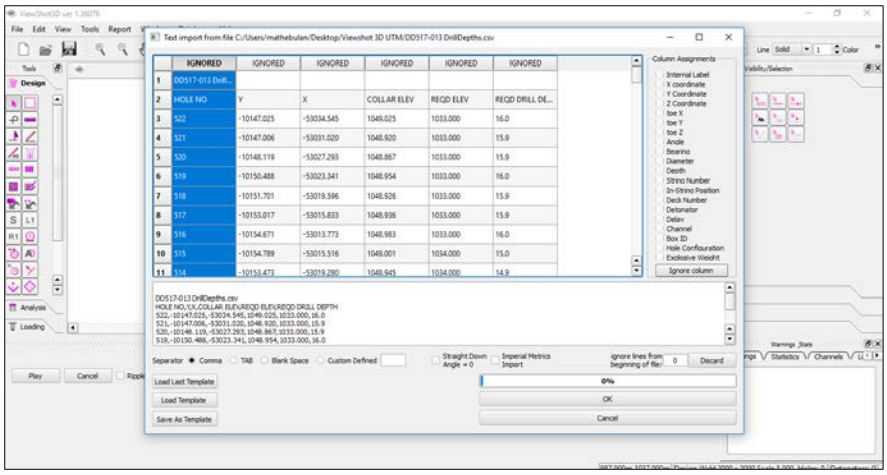
1. Open ViewShot 3D on the PC



2. Press NEW DESIGN to start the application
   - Select 4G System



3. Design Plan
   - Import the .CSV file



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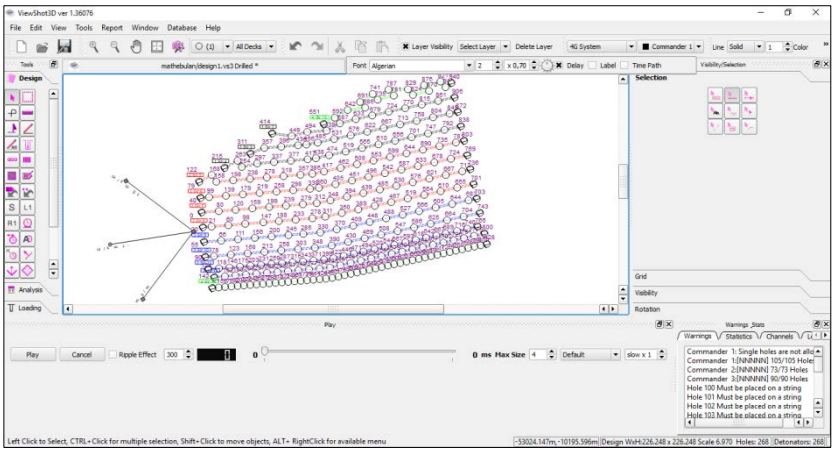
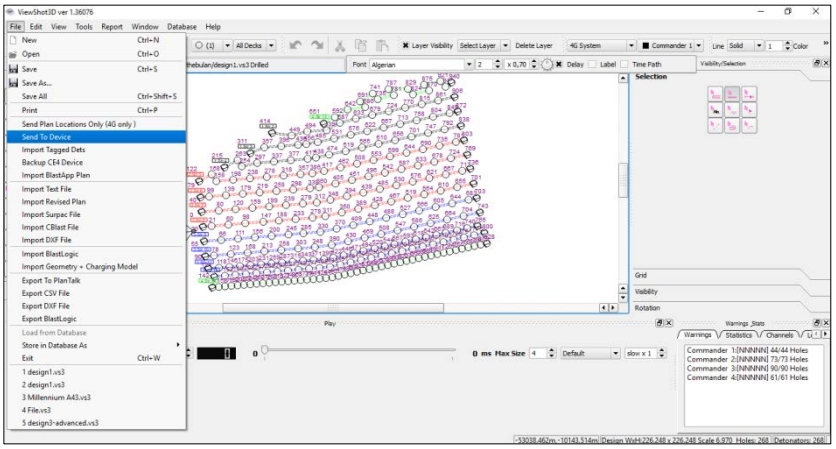
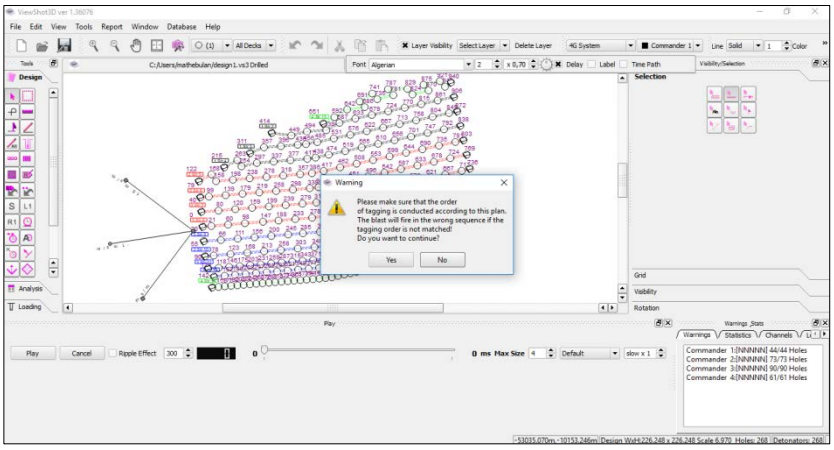
- Create the timing design
- Create the tag path for each string



4. Send design to the (Tagger)
   - Click on FILE
   - Click “Device Communication
   - Select either “Send Plan Locations Only” or “Send to Device”



- Enter YES to continue



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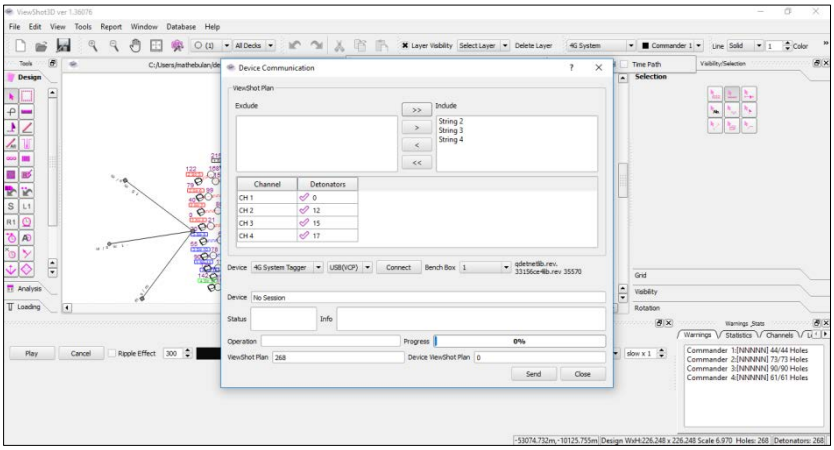
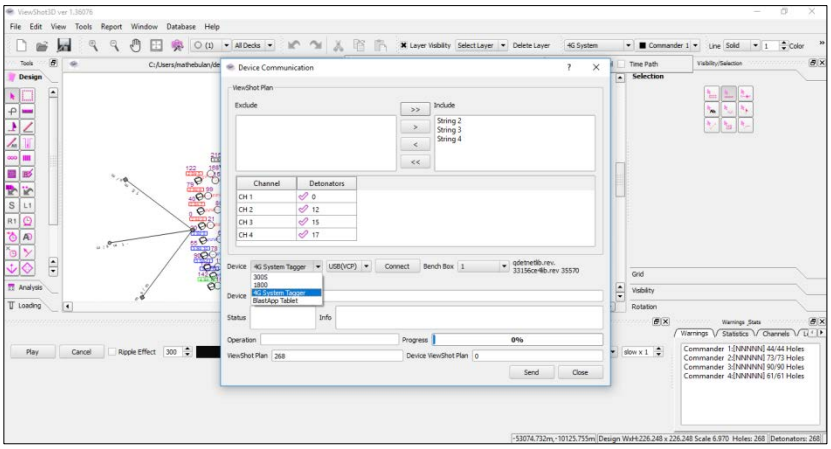
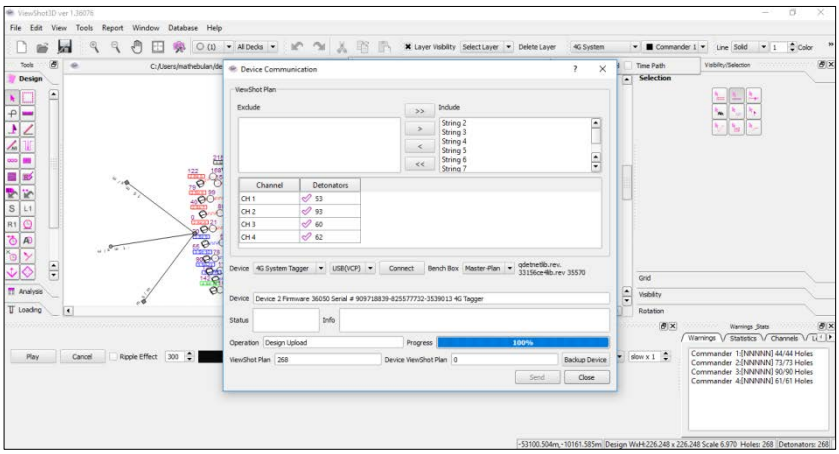
5. Select the required rows (For individual taggers) or rows
   - Include all rows by clicking on the **>>** button when a single Tagger is used



6. Select 4G System Tagger and press CONNECT



7. Press the SEND Button
8. The CE4 Tagger will receive the Plan via ViewShot 3D and the user will be able to tag by plan.



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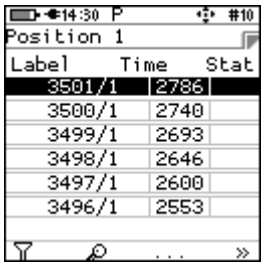
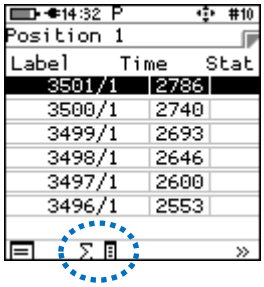
10.3.3. View the downloaded design on the CE4 Tagger

1. From the Main Menu
   - Press 4 to select View Design.

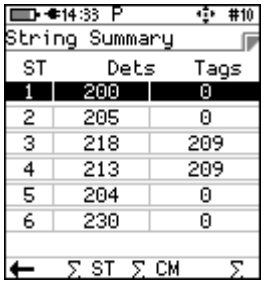
2. View Plan
   - The ViewShot 3D plan will be displayed as a list.



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.



4. Plan Summery screen will be displayed



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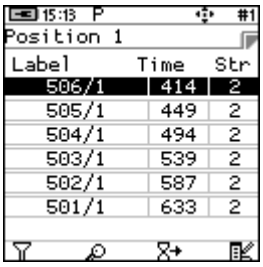
10.3.4. Select Start Position



When tagging by following a plan, the user is expected to follow the path determined by a row or a tagging path (ViewShot 3D).
To allow the user to select a starting position / Row, Hole and Det number, the planned list is displayed.
Only the remaining (untagged) positions will be displayed in this list.
The screen presented here can also be recalled in the Tagging screen / configuration SoftKey.
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 2 8 keys to navigate by one up/down.
- Use keys 4 and 6 to navigate to previous/next page (6 locations displayed per page).
- Press ↵ or ESC key once the selected position is made to return to tagging screen.

Table 6: CE4 Tagger SoftKey Icons – Select Position

Filter the list: The list may be filtered by Row, String, Channel or Hole	
Search the list: Search for the number within the parameter as set by the Filter #	
Sort in Tag order: Unsorted (according to Tag path), Reversed order (starting at the end of the string), Acending (starting at the highest hole number and tagging backwards in sequencial hole numbers) or Decending (starting at the lowest hole number and tagging forward in sequencial hole numbers).	
Amend the plan. If required to adjust the time for a particular hole/detonator or delete a detonator from the list. The deleted detonators will be skipped when tagging.	

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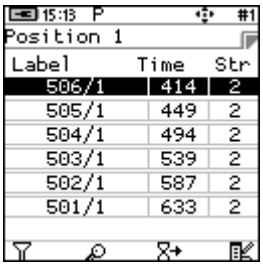
10.3.5. Tag by Plan Screen

1. Connect the detonator and press the key to tag
2. The screen will confirm the tagged detonator and display details as tagged.
   - Observe Autotag status
   - Screen Instruction : Enter to tag next “detonator”
   - From this screen, the user will have two options:
     - Return to the list, or
     - Stay in the current screen (Waiting for user to connect the next detonator).

NOTE	**Observe that the current implementation remains in the tagging screen and adjusts the parameters according to the next position in the list which can be verified by pressing on “tag configuration” SoftKey.**

3. Press “tag configuration” SoftKey from the tagging screen to return to the list.



4. To skip a position (mark as deleted) while tagging, the user must navigate to the panel of SoftKeys that contains the Add/Delete **+** and **-** Icons.
5. Press the indicated SoftKey to mark the current location as deleted in the tagging list, the tagging screen will be updated with the next location as illustrated in this example
6. To skip over the current location without deleting it, scroll up or down the lagging list by using the buttons

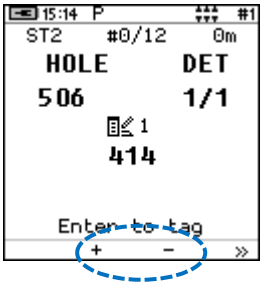


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Table 7: CE4 Tagger SoftKey Icons – Tag By Plan" Option

Tag Configuration	
Toggle Autotag *	AutoX
Tagging Screen Information	?
Test Single Det with harness connected	
Display the current tagged list	
Undo the last detonator tagged	**Undo**
Skip or add det and or shothole	**+ -**
Next Page	**>>**
String Statistics	Σ

10.3.6. Assigning ViewShot

1. From the Main Menu
   - Press 6 to select Assign ViewShot.

When the locations have been tagged separately, the detonators will not be ready to be connected to the Commander.

To deploy the delays, the Tagger needs a plan (with updated delays) that matches the actual locations already deployed.

By executing "Assign ViewShot" from the main menu, the Tagger will check every detonator recorded in the "tagged list" against the ViewShot plan (loaded on the Tagger). If the delay in the detonator does not match the plan, the new delay will be tagged in the detonator and the ViewShot plan will be updated with a checked mark against the matching record.

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10.3.7. Verify Plan

This menu option is only available for the “Planned” mode context.

2. From the Main Menu
   - Press 7 to select Verify Plan.

The list of tagged detonators is compared with the actual plan. The user can view the updates in the “View Plan “ menu. All detonators that do not match the plan are flagged in the list (Listed as new and indicated by asterisk). Matching positions are also marked off as completed, (a checked sign) if location and delay are matched and just a tag symbol if only location is matched but not the delay.

10.3.8. Verify Delays

Times as in the Plan correspond to detlist

10.3.9. Show results

Actioned Delay results are displayed

10.3.10. Merge Plan

The Merge Plan option will merge all deleted/added detonators to the plan.

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10.4. ADVANCED (A) TAGGING OPTION

The Advanced Tagging option is used in situations where there is only a paper plan available and when holes are decked or multi-primed.

NOTE	**Always clear the list when starting a new tagging process. From the Main Menu, select New Design and confirm that list needs to be cleared.**

10.4.1. Advanced Mode

The Advanced Mode option, as the name suggests, includes more features than the Basic Mode as it allows for multi-primed holes and the user will need to control several parameters within this mode. To define a hole configuration the "Site Setup" screen needs to be accessed.

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

1. From Main Menu
   - Press SoftKey to go to Configuration Menu

2. From Configuration Menu
   - Press 1 4G Setup

3. From 4G Setup Menu
   - Press 2 Site Setup

4. From Site Setup Menu
   - Press 6 to select List Hole Config (Configuration)

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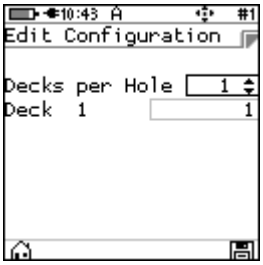
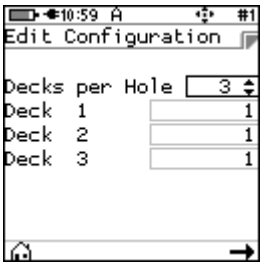
5. Press **+** SoftKey to add to the list of hole templates
   - Note that the Default hole type cannot be edited

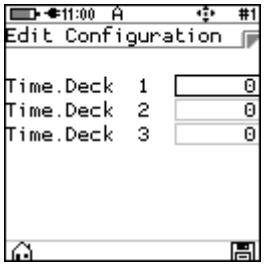
6. Press 2 8 **up/down** arrows to select the required List
   - Press **ENTER** key to continue

7. Press 2 8 **up/down** arrows to select the number of **Decks per Hole** (Maximum of 6 allowed)
   - Press to save
   - Press ➔ key to continue





   - Use Keypad to enter Time per deck
   - Press to continue to next Time
   - Press to save



NOTE	**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 by convention.**

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10.4.2. Edit the Hole configuration

1. From Main Menu
   - Press SoftKey to go to Configuration Menu

2. From Configuration Menu
   - Press 1 4G Setup

3. From 4G Setup Menu
   - Press 2 Site Setup

4. From Site Setup Menu
   - Press 6 to select List Hole Config (Configuration)

5. List Hole Config screen will be displayed (after creation)
   - Use 2 8 up/down arrow keys to select the required option
   - Press Enter to select.

NOTE	**Selection in a list will be displayed as white text on black background**

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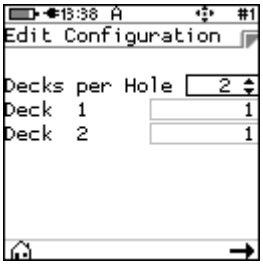
6. Edit Configuration screen will be displayed
   - Edit as required.
   - Press SoftKey to save



10.4.3. Delete the Hole Configuration

1. From Main Menu
   - Press SoftKey to go to Configuration Menu

2. From Configuration Menu
   - Press 1 4G Setup

3. From 4G Setup Menu
   - Press 2 Site Setup

4. From Site Setup Menu
   - Press 6 to select List Hole Config (Configuration)

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5. From List Hole Config screen
   - Use 2 8 up/down keys to select the required option.
   - Delete the Hole configuration by selecting the required option
   - Press the dustbin SoftKey to delete

NOTE	**Default hole type can NOT be edited and a message will be displayed if attempted**

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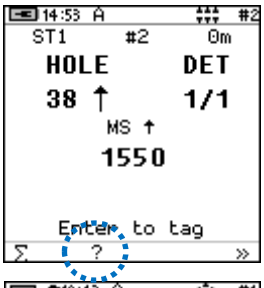
10.5. Advanced (A) Tagging Screen Info

1. From the Main Menu
   - Press 2 to select Tag Detonators

2. From Advanced Tagging Screen, press » until the screen alongside is displayed
   - Press ? to select Tagging Screen Info

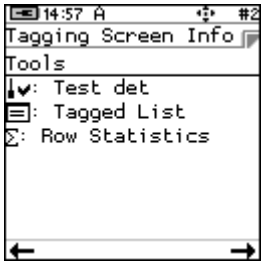


3. Press ← or → SoftKeys to navigate to Next / Previous Screens to display the following Information screens:
   - Location

   - Timing

   - Settings

   - Tools



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10.5.1. Advanced Tagging Screen SoftKey Icons

The following table contains a detailed list of SoftKey icons that are used in the Advanced Tagging Screens.

Table 8: CE4 Tagger SoftKey Icons – Advanced Tagging

Advanced Screen	Icon	Description
		Toggle Increment Direction
		Inter-hole increment
		Absolute Time
	>>	Next Page
		Tag Configuration
		Test Single Det
		Tagged List
	>>	Next Page
		Change Tagging order
	AutoX	Toggle Autotag
		* Tagged List
	>>	Next Page
	Σ	Statistics
	?	Tagging Screen Information
	>>	Next Page

*Items marked with an asterisk * are subject to "Site Setup" selected options.*

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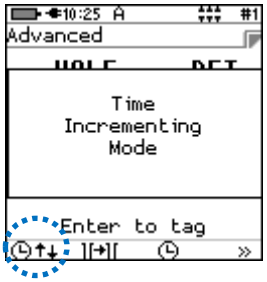
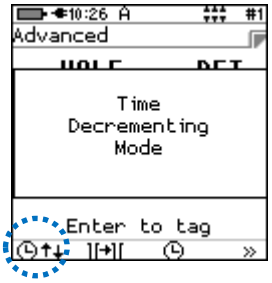
10.5.2. Toggle Increment Direction

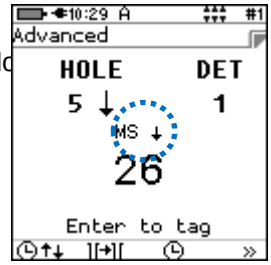
1. Press SoftKey to toggle between Time Increment, Decrement and Manual modes.

2. Auto Incrementing Mode displayed
   - Increasing time - arrow displayed next to time value points upwards

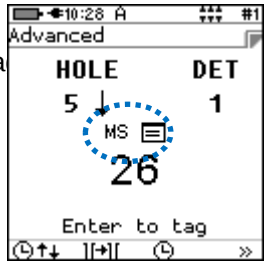


3. Auto-Decrementing Mode displayed
   - Decreasing arrow displayed next to time value points





4. User (Manual) Input Mode displayed
   - User is prompted to enter the absolute time with each



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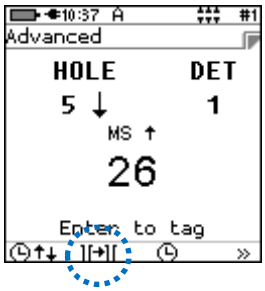
10.5.3. Inter Hole Delay

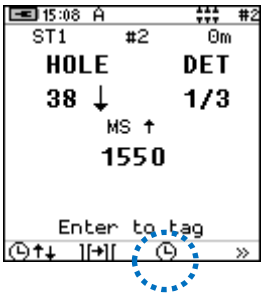
1. From Advanced Tagging Screen
   - Press][→][to select Inter Hole delay



2. From Time Increment Screen
   - Use numeric keypad to enter Inter-Hole delay
   - Press Enter to return

10.5.4. Absolute Detonator Time

1. From Advanced Tagging Screen
   - Press 🕒 to select Inter Hole delay



2. From Detonator Time Screen
   - Use numeric keypad to enter value
   - Press Enter to return

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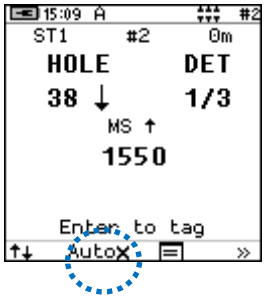
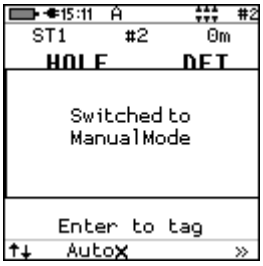
10.5.5. Autotag / Manual Mode

1. From Advanced Tagging Screen
   - Press either the **AutoX** (Auto OFF) or **Auto✓** (Auto ON) SoftKey as displayed to toggle the Autotag Mode



   - Press AutoX SoftKey to toggle between Autotag and Manual Mode
     - **Auto✓** indicates Autotag ON
     - **AutoX** indicates Manual Mode (Autotag OFF)



NOTE	**When using Autotag ON mode, the detonators may be directly connected to the wire bus and only untagged detonators will be searched for.** **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 turned ON.**

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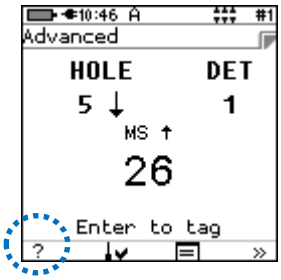
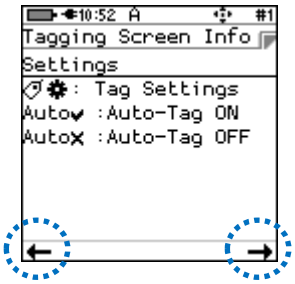
10.5.6. Tagging Screen Info

The User may check the “Tagging Screen Info” to browse through a brief description of the active keys in the tagging screen.

1. From the Main Menu
   - Press 2 to select Tag Detonators

2. From Advanced Tagging Screen
   - Press ? SoftKey to select Tagging Screen Info
   - Press ← or → SoftKeys to navigate to Previous/Next screens to display the following Information:





Location

The sequence tracked as location may be adjusted in real time by using the first set of up/down 1 7 arrow keys.

Timing

The time can be adjusted with the increment value in real time by using the last set of up/down 3 9 arrow keys.

The row increment may be applied to the absolute time using the second set of up/down arrow keys 2 8.

Settings

The user can navigate to the configuration from the tagging screen.

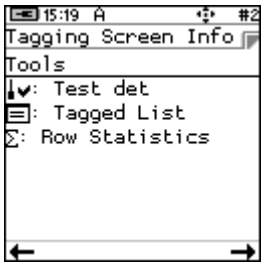
Should Autotag be allowed, this function may be switched off when a detonator has to be re-tagged

Tools

Users can test any detonator without leaving the tagging screen

The “tagged detonators” list may be checked from the tagging screen

Statistical data is accumulated as tagging is performed.



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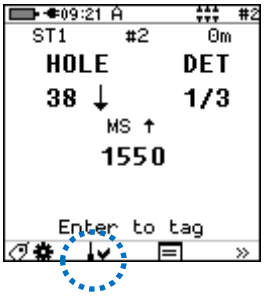
10.5.7. Test Single Detonator

At times it is useful to allow testing of detonators from the tagging screen, and to check if a detonator has previously been tagged or if it is untagged, without disturbing the setup of the current tagging context.
The information displayed with this test contains the location, the time the detonator was tagged to, the length of the detonator and also the mark allocated to the detonator.

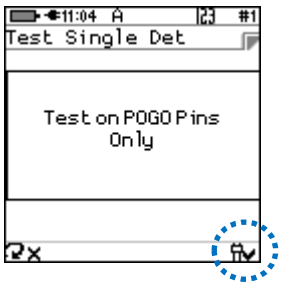
1. From the Main Menu
   - Press 2 to select Tag Detonators

2. From Advanced Tagging Screen
   - Connect a detonator to the Tagger
   - Press SoftKey to select Test Single Det



3. ***From Test Single Det screen***
   - Press or to toggle between options
     - indicates single test
     - indicates continuous test

   - Press or SoftKey to toggle between testing a single detonator as follows:
     - indicates testing on POGO Pins or Wire Connectors
     - indicates testing on POGO Pins Only



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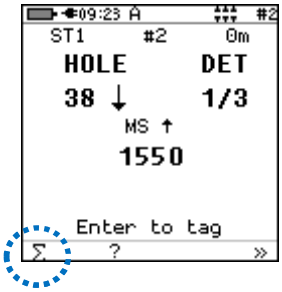
10.5.8. Tagged Detonators

1. From the Main Menu
   - Press 2 to select Tag Detonators

2. From Advanced Tagging Screen
   - Press Σ SoftKey to select Row Statistics



3. Row Statistics screen will display:
   - Row
   - Detonators (Total)
   - Holes
   - Start hole/det
   - Wire Length (Metric or Imperial as set)

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10.5.9. Mark Detonators

With the IntelliShot® Commander System it is recommended that the user mark the detonator that will be placed at the end of the harness wire, as the Bench Commander will verify the voltage level of this detonator just before firing.
Each String should have 1 detonator marked as End of Line.

NOTE	**The other types of marking are not explicitly used in this version of the system although it is planned to use it in a future release of the software. They would typically indicate that specific points of the blast have been captured and also indicate if a change of plan (delays and increments) is required.**

1. From the Main Menu
   - Press 5 to select Mark Detonators

6. **From Mark Detonators Menu**
   - Press 1 to select/deselect End of Line
   - Press 2 to select/deselect Start of Row
   - Press 3 to select/deselect End of Row
   - Press 4 to select/deselect Inflection Point
   - Press 5 to Remove Mark from previously marked Detonator
   - Press Cancel SoftKey to return to Main Menu
   - Press Apply SoftKey to apply the setting.

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10.5.10. Review Tag Detonator Screen Parameters

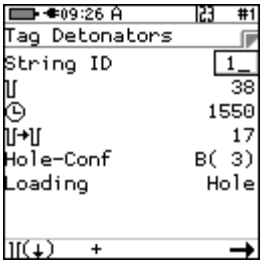
The user may review the parameters at any time in the tagging screen.

1. From Advanced Tagging Screen

   Press Tag Configuration SoftKey to select Tag Detonators Screen

2. From **Tag Detonators Screen**, check the following:

Should the value be correct, press key to move to the next field.



a) String

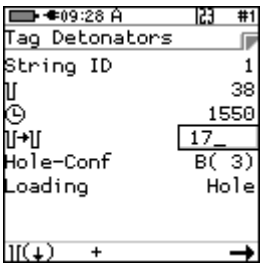
Check that the correct Row is being tagged; if not, adjust it as follows:

- Use numeric keypad to enter new Row number, and
- Press to continue

b) Initial Time

Ability to modify the Initial time

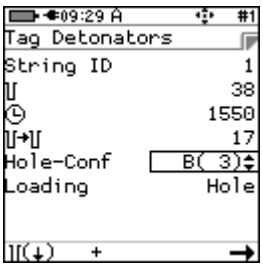
- Use numeric keypad to set the initial time
- Press to continue



c) Inter-hole Increment

Ability to modify the Dealy time from one hole to the next.

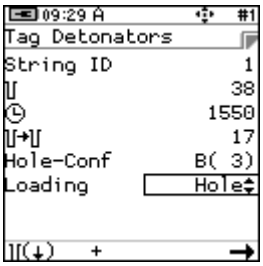
- Use numeric keypad to set the inter-hole increment
- Press to continue

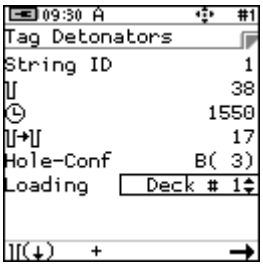


d) Hole –Conf(iguration)

Ability to switch to a user defined hole configuration

- Use to toggle (Available options as configured during the initial setup)
- Press to continue





e) Loading mode

- Set the Loading mode.
- Use to toggle between available options.
- Press to continue

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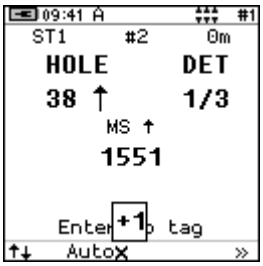
10.5.11. Advanced Screen Manual Adjustments

1. The user may set:

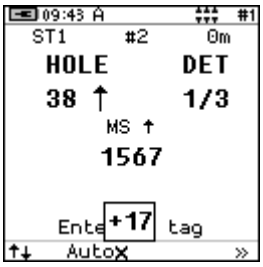
- Absolute time (at any time)
- Hole number but not counting direction
- Det number (if multiple primed and not loading per deck)
- Increment values and if increments are to be factored in for the next hole (Incrementing /Decrementing / Manual)

2. The Up/Down arrow keys may be used as follows:

- Middle **UP/DOWN** arrow 2 8 functions:
- Used to increment/decrement the delay with 1ms offset value.



- Right **UP/DOWN** arrow 3 9 functions:
- Used to increment/decrement the delay with inter-hole offset value.



- Side Arrow keys
- Only available when tagging group/row hole and det. This key will change the det number.

- FN & 8 or FN & 2
  - Adjust the hole number and corresponding delay of that hole.

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11 TEST MENU

The Test Menu will allow the user to perform the following tests:

1. Test All,
2. Test String
3. Test Single Det
4. Leakage Test,
5. Untagged Test
6. Search Dets

11.1. Test All

From the test menu, the user will have the option to test all the tagged detonators.

Although the tagger detonator list capacity is equal to a Full Blast Design which can be a maximum of 16000 detonators, the Tagger will only test one string at a time with large blast designs.

1. Main Menu
   - Press 3 Key to select **Test Menu**.

2. Test Menu
   - Press 1 Key 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

   - After Testing press the SoftKey to View the design or,
   - Press the ESC Key to return to the Test Menu
   - Press the Key to return to the Main Menu.

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11.2. Test String

From the test menu, the user will have the option to test all the detonators connected to a String

1. Main Menu
   - Press 3 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 2 SoftKey to select **Test String**.

3. Test String
   - Enter required String number
   - Press ← to clear and re-enter required string number
   - Press ↵ to continue

   - CE4 Tagger will Test All Detonators in the selected 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 ESC Key to return to the Test Menu

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11.3. Test Single Detonator

From the test menu, the user will have the option to test a single detonators connected either to the POGO Pins Only or to the POGO Pins and Harness wire.

1. Main Menu
   - Press 3 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 3 SoftKey to select **Test Single Det**.

3. Test Single Det
   - Connect Detonator to CE4 Tagger
   - Press or to toggle selection
   - Connect the required single detonator to be tested
   - Press to test

   - Detonator will be tested
   - Results will be displayed
   - Press SoftKey to continuously repeat test.
   - Press SoftKey to stop continuously repeating test
   - Press Untag SoftKey to untag the detonator

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11.4. Leakage Test

This function enables the user to perform a current measurement and a leakage measurement test.
Leakage is measured in milli-amps (mA) and low leakage is considered to be below 0.5mA.
Leakage higher than 1mA is considered high leakage and may result in blasting problems (potential misfires) and should therefore be addressed and resolved prior to arming. The user can set the maximum limit where the leakage warning is triggered from 0.1mA to 1mA in increments of 0.1mA. Note that the default leakage limit is 0.5 mA. A warning will be displayed when the leakage level exceeds the leakage warning trigger level as set by the user.

WARNING	**HIGH LEAKAGE LEVELS CAN RESULT IN POTENTIAL MISFIRES OF THE INTELLISHOT® DETONATORS.**

1. Main Menu
   - Press 3 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 4 SoftKey to select **Leakage Test**.

3. LeakageTest
   - 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
   - Press to test for leakage again.
   - After Testing, press the ESC Key to return to the Test Menu

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11.5. Untagged Test

This function enables the user to test for Untagged Detonators connected to the harness wire.

1. Main Menu
   - Press 3 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 5 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 and the number of untagged detonators found will be displayed at the bottom right of the screen.

4. User may use the following SoftKeys:
   - Press ✓ SoftKey to continuously repeat test.
   - Press ✗ SoftKey to stop continuously repeating test
5. After Testing press the ESC Key to return to the Test Menu

NOTE	**Use a binary search to locate untagged detonator(s)**

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11.6. Search Detonators (Binary Search)

This function enables the user to search for detonators connected to the harness wire. It can be conducted with any CE4 Tagger and no prior tagged list is necessary. This same function will be performed by the Bench Commander to discover detonators. The detonators found will be compared with the detonators in the tagged list and the tagged list will be amended with new detonators if any are found.

1. Main Menu
   - Press 3 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 6 SoftKey to select **Search Dets**

3. Search Dets
   - Enter required String ID
   - Press ↵ to continue

   - CE4 Tagger will search for detonators and display **Done** when complete
   - Press ESC to return to the Test Menu
   - Press to View Design

11.6.1. Search Function Results

Press the SoftKey to check the “Search” results

- The View Design Menu will be displayed
- Refer to Chaper 12 - VIEW in this manual for more information.

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12 VIEW PLAN

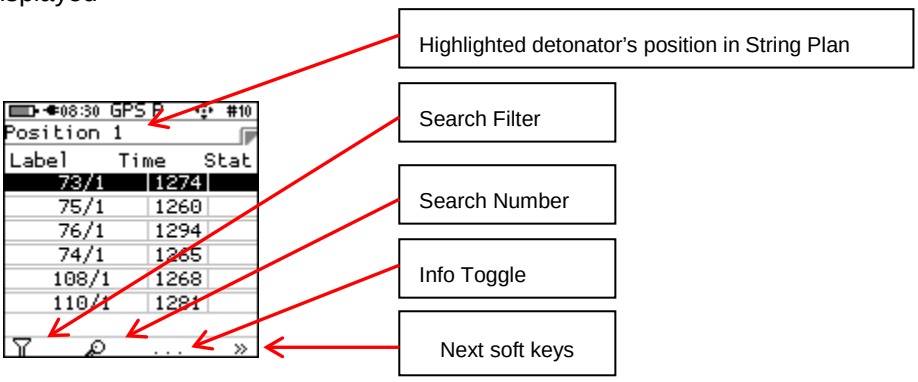
The View Plan Menu will display the planned ViewShot List when the tag option is set to “Tag by Plan”.
The Basic and Advanced options will allow the user to view the list of tagged detonators filtered by various important characteristics.

12.1. List Detonators

1. From Main Menu

- Press 4 to select **View Plan**

2. View design screen will be displayed



- Detonator position in String Plan will be displayed in the page header.
- A tick mark ✓ will be displayed under **Stat** when the plan contains tagged detonators

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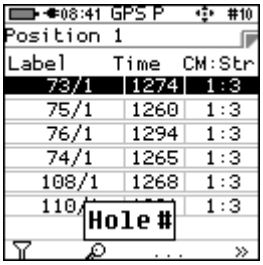
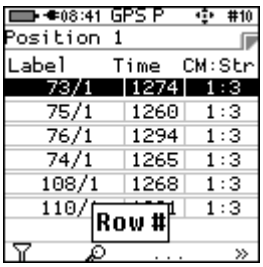
12.1.1. Search Filter

Press the Search Filter SoftKey to toggle between options as detailed below:

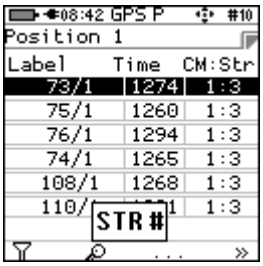
- Hole Number,



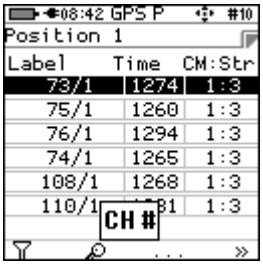
- Row number,



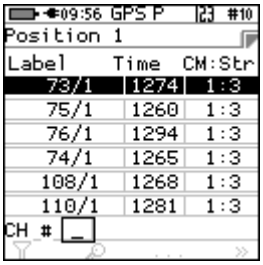
- String Number,

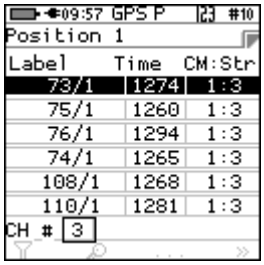


- Channel number.



Press Search SoftKey and insert the Channel, String, Row or Hole number to be searched (Channel number shown in example)
Press Enter to search





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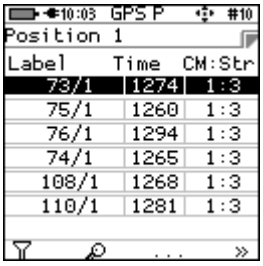
12.1.2. Info SoftKey

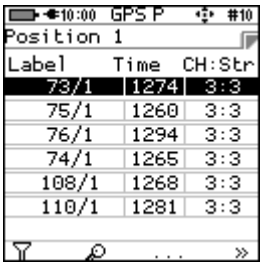
Press the Information . . . SoftKey to display **o**ptions as detailed below.

- Detonator Timing and Status

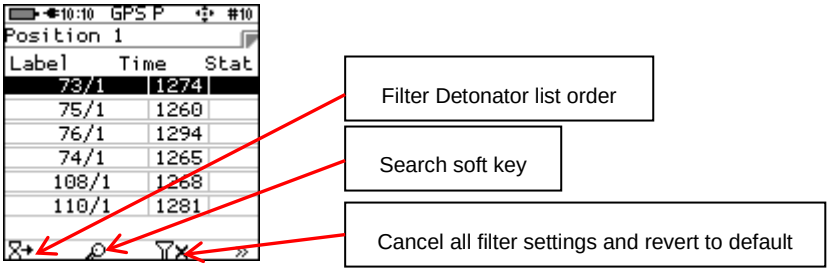
- Allocation to Commander and String



- Channel and String



Press the Next page » SoftKey and observe the follow set of SoftKeys displayed



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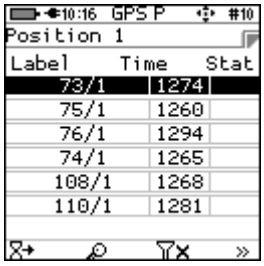
12.1.3. Sort Detonator list

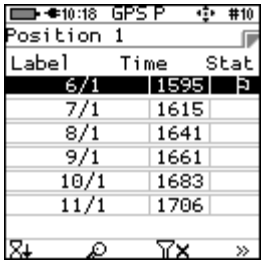
Press Sort Detonator List SoftKey to display the detonator list in the order as required:

- Unsorted Order
- Ascending Order
- Descending Order
- Reversed Order

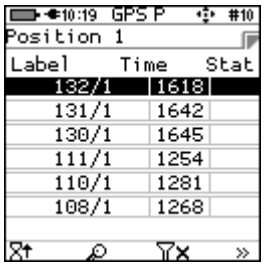
1. Unsorted Order (Tag Path)



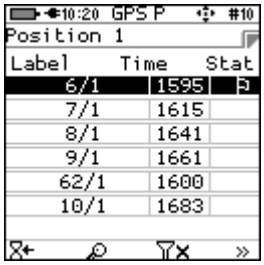
2. Ascending Order



3. Descending order



4. Reversed order (Tag Path)



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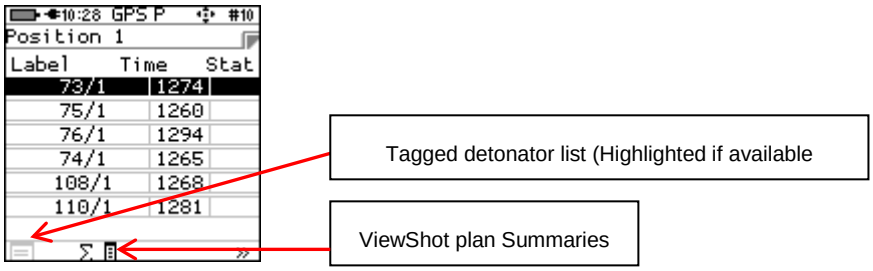
5. Press Search SoftKey (criteria based on previous filter settings will be selected)

6. Press the Cancel Search Criteria filters SoftKey to cancel previous search
   Filter reset message will be displayed

Press the Next page SoftKey and observe the follow set of SoftKeys displayed.



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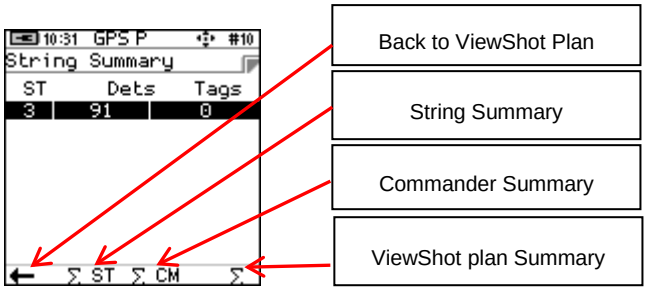
12.1.4. ViewShot Plan Summary (Heading)

Press the Next page » SoftKey to page to the following set of SoftKeys.



Press the String Summary Σ ST SoftKey to display the string statistics as follows:

- String number,
- Number of Detonators per string
- Number of Detonators tagged on that string.
- Press ← SoftKey to return to ViewShot Plan

Press the Commander Summary Σ CM SoftKey to display the Commander statistics as follows:

- Commander number,
- Channel number per Commander,
- Number of detonators in plan per channel,
- Number of detonators tagged per channel.
- Press ← SoftKey to return to ViewShot Plan

Press the ViewShot plan summary Σ SoftKey to display the summary

- Press ← SoftKey to return to ViewShot Plan

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12.2. List Missing detonators

This screen lists the detonators that were not found during testing.

1. Main Menu

- Press 4 to select **View Design**

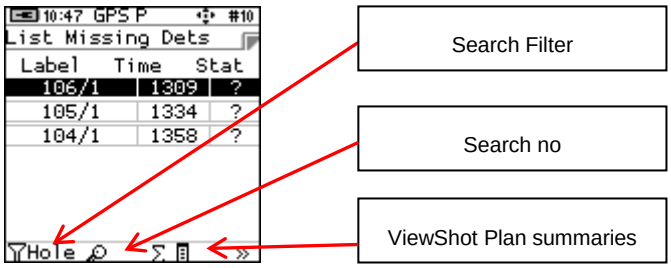
2. View Design Menu

- Press 2 to select List Missing Detonators

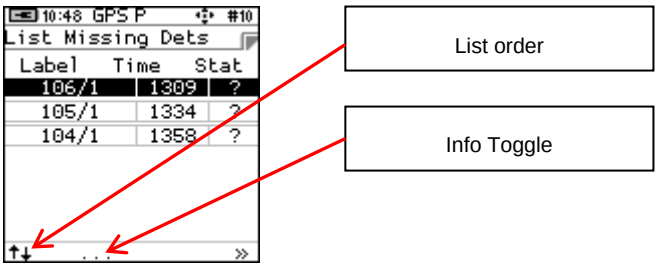
3. List Missing Dets

The List Missing Detonators screen will be displayed.

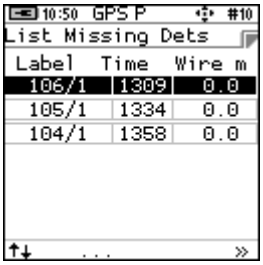
- Soft keys will be available as displayed
  - Search Filter,
  - Search Number,
  - ViewShot Plan Summaries
  - Next Page



- Press Next Page » SoftKey to display
  - List order,
  - Information Toggle



- Toggle Information to view
  - **Wire m** - Wire length information



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- String number,
- Channel number,
- Commander number

- Det position in ViewShot Plan Info

- Detonator ID
- GPS information of highlighted detonator (if available)

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12.3. List New detonators

This screen will list the new detonators found during testing.

1. Main Menu
   - Press 4 to select **View Design**

2. View Design Menu
   - Press 3 to select List New Detonators

3. List New Dets
   - The List New Detonators screen will be displayed
   - Press SoftKey to un-mark the detonators as new (*).

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12.4. List Bad Status

This screen will list the detonators that were found to have an error status during the test. (A bad status indicates the detonator may have a bad fuse or another internal problem).

NOTE	**This List does NOT include untagged detonators.**

1. Main Menu
   - Press 4 to select **View Design**

2. View Design Menu
   - Press 4 SoftKey to select List Bad Status Detonators

3. List Bad Status
   - The List Bad Status screen will be displayed
   - Use SoftKeys to sort/filter or display other information as required.

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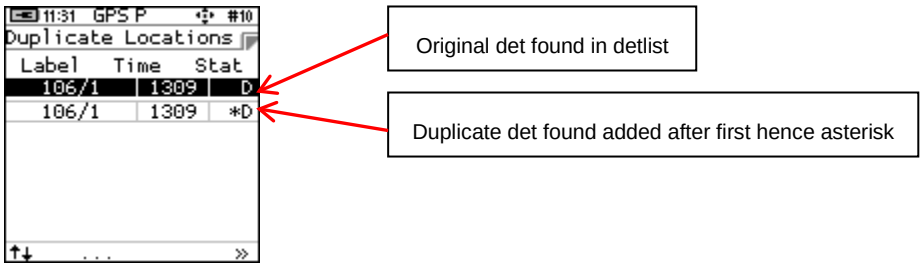
12.5. Duplicate Location

This screen will list the detonators that were found to be tagged with the same location.
The system does not rely on the location data to communicate with the dets and provided that the detonator has been tagged with a delay, all detonators can be fired.
However, a duplicate location means that either the user has assigned the same location when tagging, or another user with another CE4 Tagger has assigned this same location to a detonator. Note that this error is flagged when the user attempts to assign the same location on the same Tagger.

1. Main Menu
   - Press 4 to select **View Design**

2. View Design Menu
   - Press 5 Key to select Duplicate Location
   - The duplicated location will be displayed

3. List Duplicate Location
   - The Duplicate Location screen will be displayed



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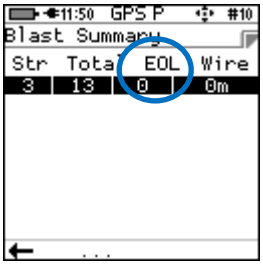
12.6. Blast Summary

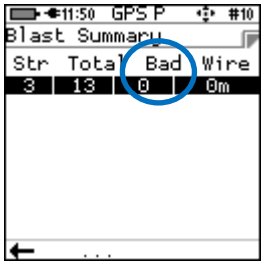
The Blast Summary function enables the user to view a blast summary per channel.

1. Main Menu
   - Press 4 to select **View Design**

2. View Design Menu
   - Press 6 SoftKey to select Blast Summary

3. The Blast Summary screen will be displayed
4. Press the Back SoftKey ← to page back to previous screen
5. Press the Info SoftKey **. . .** to toggle display a summary as indicated as follows:
   - **New** - New Detonators
   - **Mis** - Missing Detonators
   - **EOL** - End of Line Detonators
   - **Bad** - Bad Detonators





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12.7. Tracking Detonators

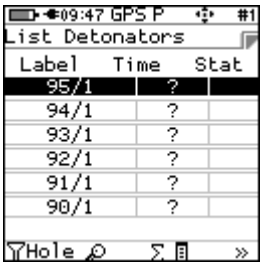
This option will allow the user to track detonators that have been tagged, the user will be directed to the location of the tagged detonator.

NOTE	**The detonators can only be tracked using the same Tagger that it was tagged with and a GPS signal was available during the initial tagging, and is available to track the detonator.**

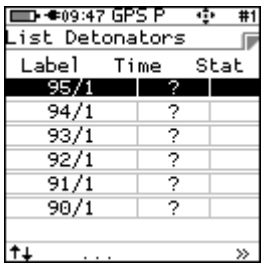
1. From Main Menu
   - Press 4 to select **View Design**

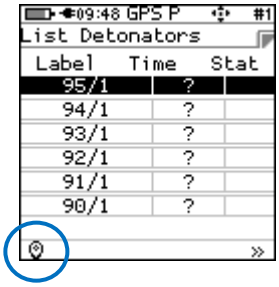
2. From View Design Menu
   - Press 1 to select List Detonators

3. Detonator list will be displayed
   - Hold the tagger in upright position
   - Highlight the Detonator to be tracked from the list. (Selected detonator will be displayed as highlighted in the top position of the screen).



   - Press SoftKey 4 » to scroll to next page
   - Scroll until the location SoftKey is displayed.
   - Press the location SoftKey to select





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- Start walking towards the bench
- Tagger will detect the direction and distance to the selected detonator.

- The distance and direction to the detonator will be displayed
- Proceed in the direction as indicated.

- When the Tagger is within 3 meters of the selected detonator, "**Near Location**" will be displayed
- The user will now have tracked the selected detonator to be within 3 meters of the current vicinity.

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13 COMMANDER

13.1. General Information

The IntelliShot® Commander is a 4-channel blasting device intended for use across all surface blasting platforms in the DetNet portfolio. These devices are controlled from a CE4 Tagger or an optional tablet device / PC loaded with the DetNet Android Application.

The IntelliShot® Commander can be configured to operate in different modes as follows:

- The Base Commander,
- Bench Commander, or
- Repeater.

13.2. IntelliShot® Commander Components

The following illustration depicts a front and rear view of the IntelliShot® Commander indicating the major components.

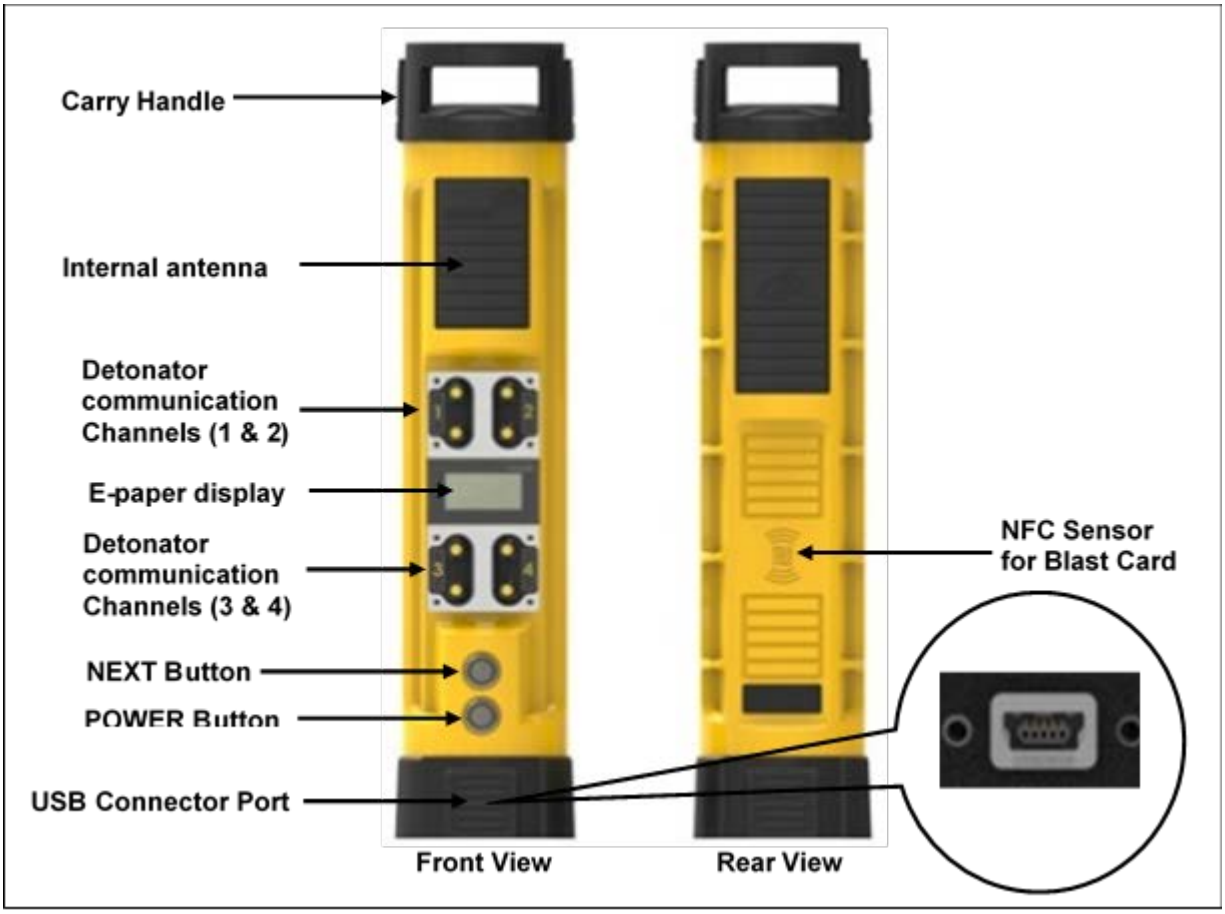

Figure 9: IntelliShot® Commander Part Identification

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13.2.1. IntelliShot® Commander Body

The IntelliShot® Commander housing body contains all the electronic components in a durable environment equipped with a carry handle.

13.2.2. Internal antenna

- RF – long range: 3000m (900MHz data radio, internal antenna)
- RF – short range: 10m (Wi-Fi, internal antenna)

NOTE	**The IntelliShot® Commander must be placed on a tripod or otherwise elevated during use; elevating it to approximately 1.5m above ground level ensures that the internal antenna will operate at optimum levels. Future versions of the IntelliShot® Commander will also include a connection to accommodate external antennae which should also be at least 1.5m above ground level.**

13.2.3. Detonator Communication Channels (1 - 4)

The four detonator communication channels on the front panel are clearly marked 1 – 4.
Harness wire terminals on each channel are used to connect to detonator / surface harness lead-in wires.

13.2.4. E-paper display

The e-paper display reflects light unlike conventional backlit flat panel displays that emit light. This makes it more comfortable to read, and provide a wider viewing angle than most light-emitting displays

NOTE	**The display remains visible even if the device is off – thus the last screen that was visible before shut-down will be displayed while in off mode until the commander is booted-up again.The e-paper display should never be exposed to direct sunlight for long periods.**

13.2.5. NEXT (FUNCTION) button

The NEXT (*FUNCTION)* button is used in conjunction with other keys to perform specific functions.

13.2.6. POWER button

The POWER button is used to switch the IntelliShot® Commander ON and OFF.
It is also used, in conjunction with the NEXT (FUNCTION) button, to enter the bootloading mode from where software updates can be performed.
While the Commander is plugged in and charging the Power button can be used to toggle between low and high charge rates. This function is useful when charging from a less powerful charger.
Turn Off by disconnecting the charge cable, waiting a few seconds and then pressing the Power button.

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13.2.7. USB connector port

The USB connector port allows charging of the rechargeable battery and is also used to upgrade software and downloading logs. Plug in a flash drive containing the new version and then hold in the NEXT button and press the power ON button. This will place the IntelliShot® Commander in bootloader-mode and start the download of the software.

13.2.8. BlastCard (NFC) Sensor

A Near Field Communication (NFC) Sensor located inside the back of the IntelliShot® Commander makes use of technology that enables the NFC BlastCard to establish communication with the IntelliShot® Commander by touching the devices together or bringing them into proximity to a distance of typically 5cm (2in) or less.

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13.3. Power IntelliShot® Commander ON and OFF

13.3.1. Power IntelliShot® Commander ON

1. While the IntelliShot® Commander is in an OFF state, it will display the following information:
   - IntelliShot® Commander ID (4)
   - Mode (BASE)
   - Hardware version (HW Ver. 4)
   - Software version (SW Ver.36230C)

2. Press the POWER **ON** Button.

   - A two-part splash screen will be displayed. The first part will request the user to WAIT during power-on.
   - Battery Percentage will be displayed
   - Power On Self-Test (P.O.S.T.) will be displayed

   - Shortly after the previous screen, the second-part splash screen will be displayed requesting user to press the NEXT button.
   - Battery Percentage will be displayed

3. Press the **NEXT** Button to continue.

13.3.2. Power IntelliShot® Commander OFF

4. Press the POWER Button to power **OFF** the IntelliShot® Commander. The IntelliShot® Commander will power off after a second or two.

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13.4. IntelliShot® Commander Accessories

13.4.1. Battery

The IntelliShot® Commander uses a rechargeable 3.7V Lithium Polymer battery.
Battery life is influenced by the conditions in which the IntelliShot® Commander operates.
When the battery capacity drops below 15%, a warning will be displayed.
The low battery error will clear once Commander is charged to 35%.
When the battery capacity drops below 3%, the IntelliShot® Commander will shut down.

NOTE	**The battery should only be replaced by a DetNet qualified technician and is not field replaceable.**

CAUTION	**THE INTELLISHOT ® COMMANDER MUST NOT BE CONNECTED TO THE INTELLISHOT® DETONATORS OR THE LEAD-IN HARNESS WIRE WHILST THE INTELLISHOT® COMMANDER IS CONNECTED TO A CHARGER.**

13.4.2. Charging the IntelliShot® Commander

- Connect charger to IntelliShot® Commander.
- Connect charger to correct power supply.
- Detonators should never be connected while charging.
- The IntelliShot® Commander should be charged for at least six hours prior to a blast.

NOTE	**While the Commander is plugged in and charging, the Power button can be used to toggle between low (500mA) and high (2A) charge rates. The low option (500mA)is the default charging rate.** **Turn Off by disconnecting the charge cable, wait a few seconds and then press the Power button.**

13.4.3. Storage

Store the IntelliShot® Commander in a cool, dry place, with an ambient temperature of approximately 21 °C.
It is recommend that the IntelliShot® Commander be charged to 50% when placed into long-term storage, and thereafter the unit should be charged to 50%, at least every six months to maintain the expected lifetime of the battery.
The IntelliShot® Commander may be kept on charge for extended periods as the IntelliShot® Commander will manage the battery.
The IntelliShot® Commander can draw current of up to 2 Amperes during charging.

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13.5. IntelliShot® Commander Process Description

The following paragraphs contain a detailed description of User-interaction and safety features designed into the IntelliShot® Commander.

13.5.1. Start-up

Press the POWER button briefly to switch ON the device.

13.5.2. Shutdown

Press-and-hold the POWER button for 2 seconds to switch the device OFF.
In case of malfunction, press-and-hold the POWER button for 10 seconds to force the device OFF.
While the Commander is plugged in and charging, the Power button can also be used to toggle between low (500mA) Lo and high (2A) Hi charge rates.
Turn Off by disconnecting the charge cable, waiting a few seconds and then pressing the Power button.

13.5.3. Bootloading

Ensure that the device is switched OFF.
Press-and-hold the NEXT button, then press the POWER button to switch ON. The device will now enter bootloading mode.

NOTE	**To load new software, connect a flash drive containing the new software version into the IntelliShot® Commander. Place the IntelliShot® Commander in boot loader-mode to start the download of the software.**

13.5.4. Pairing

After the start-up sequence the identification number (1-10) will be displayed.
Remote control of the IntelliShot® Commander is now possible from a CE4 Tagger within range (or a tablet loaded with the required software).
Press and hold the FN button and press ↵ from the Main Menu on the CE4 Tagger to start the pairing function.
Select the appropriate IntelliShot® Commander ID (1-10). The CE4 Tagger will establish a communication link with one IntelliShot® Commander at a time.
Commanders will clearly indicate their pairing status on the E-paper display.

NOTE	**All IntelliShot® Commanders have a default ID of 1. Users will have to change these IDs if intending to use multiple Commanders in a single setup.**

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13.5.5. Aborting

Choosing the ABORT option will return all devices in the setup to a safe state. No further activities can be initiated remotely before cycling the power ON, on all said devices. Aborting is typically accomplished by pressing escape and confirming the abort action when in an active blasting screen.

- Pressing the ESC button after arming will display a warning with three options:
  - Yes – this will return to the main menu
  - Abort – the blast will be aborted and the user is then forced to turn off Commander
  - No – this will return to the blast menu

13.5.6. Blasting

Refer to the **B**lasting Overview contained in Chapter 18 of this document.

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13.6. Connecting CE4 Tagger to IntelliShot® Commander via Wi-Fi

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

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

NOTE	**Observe the Commander ID**

3. Enter the IntelliShot® Commander ID
4. Press ↵ key to connect to IntelliShot® Commander

5. CE4 Tagger will connect to Commander

6. Enter device password when prompted
7. Press ↵ key to continue

NOTE	**Device password will be required only during first connection to the IntelliShot® Commander. The default password may be changed by the user and can be configured from the "Settings" menu. The user may reset the password with a ticket retrieved from DetNet Portal, should the password be previously set and the user does not recall the password.**

8. IntelliShot® Commander Main Menu will be displayed for the Bench Commanders and the Select Bench's

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Menu will be displayed for Base Commander.

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13.7. IntelliShot® Commander System Information

This function enables the user to view the IntelliShot® Commander's: battery charge information, current consumption, state-of-health of the battery, temperature information, hardware and software serial numbers, GPS detail and User ID.

1. Main Menu

   - Press SoftKey to view **System Info**

2. System Info - Battery

   - **54%**: Battery charge Information
   - **Current Consumption**: By convention a negative value indicates that current is being drawn from the battery.
   - **Cell Status**: (Good) indicates the state of health of the battery. Should the status indicate 'Low' the unit should be serviced to have the battery replaced.

NOTE	**The IntelliShot® Commander will display a warning at 15% and switch OFF at 3%.**

3. Temperature and the Relative Humidity as measured inside the IntelliShot® Commander are displayed as follows:

   - Temp: The Temperature is displayed in degrees Celsius and Fahrenheit.
   - Humidity: The Relative Humidity is displayed as a percentage.

4. System Info – Hardware Serial Number and SW Release Number

   - Press to select page right.
   - Hardware Serial Number will be displayed.
   - Software Release Number will be displayed
   - Hardware Serial number is required when tickets are required from the DetNet Portal.

NOTE	**Hardware Serial number is required when Web tickets are required from the DetNet Portal. Web tickets are not needed in normal use.**

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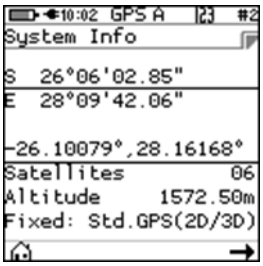
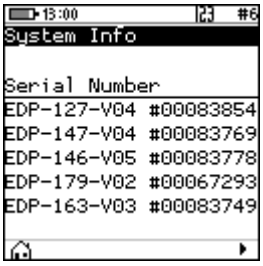
5. System Info –GPS Detail
   - Press ▶ to select page right.
   - The GPS location will be displayed.
   - The number of satellites found and Altitude and will also be displayed.



6. User ID
   - Press SoftKey to enter or edit User ID.
   - Use alphanumeric characters to enter a User ID.
   - Press ▶ to select next page.

7. System Info –Serial Number
   - Serial numbers of the internal circuit boards will be displayed.



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13.8. IntelliShot® Commander LCD Screen Icons

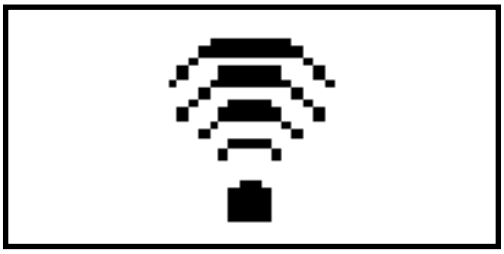
The Icons as displayed on the IntelliShot® Commander will differ according to the selected mode. Each of the following modes will display icons that are applicable to the selected mode:

- Base Mode,
- Base with Repeater Mode
- Bench Mode, and
- Repeater Mode.

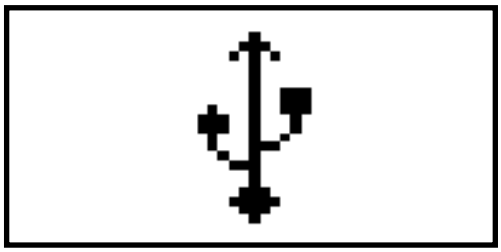
Press the NEXT button to display a detail screen that will be displayed for 30 seconds before reverting back to the main screen.

13.8.1. IntelliShot® Base Commander Mode Icons

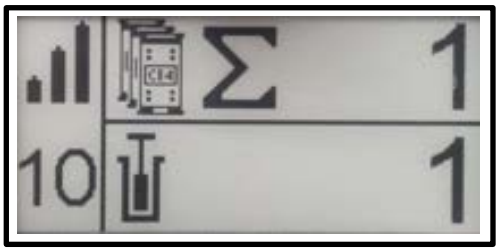
When the IntelliShot® Commander is connected to a CE4 Tagger / Laptop / Tablet via Wi-Fi, it will display only the Wi-Fi symbol on the screen. This icon will replace all other screens.



When the IntelliShot® Commander is connected via USB rather than Wi-Fi, the USB symbol will be displayed



When the Base Commander is connected via RF, it will display the RF symbol in the main screen



Press the NEXT button to display a detail screen that will be displayed for 30 seconds before reverting back to the main screen.

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NOTE

The Detail screen is displayed as a black layout on a white background. The illustration below has a black background only to improve the visibility of the icons in this manual.

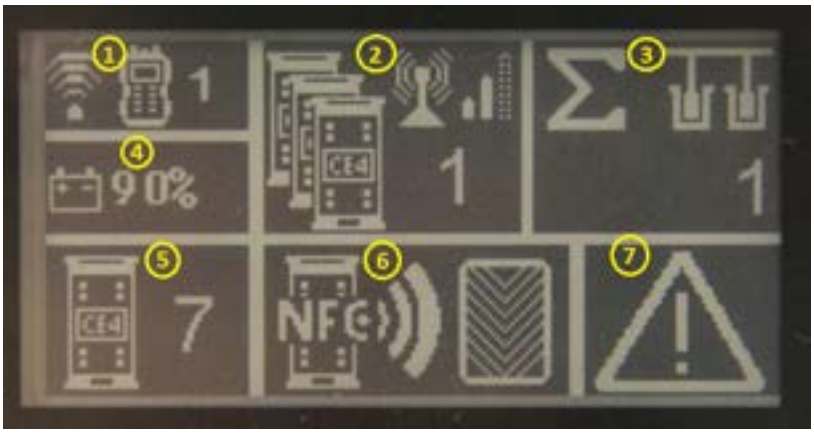
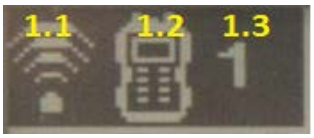


Figure 10: IntelliShot® Base Commander Mode Detail Screen

Table 9: IntelliShot® Commander Base Station Screen Icons

Item #	Description	Detail	Indication	Icon	Options / Variants / Description
1	Wi-Fi/USB connectivity indication area (CE4 Tagger or PC)	Indicates whether DigiShot® Plus 4G Commander is connected via Wi-Fi or USB Indicates whether DigiShot® Plus 4G Commander is connected to CE4 Tagger or PC	Connected to something		As simultaneous Wi-Fi and USB connections are allowed (one of each), this section can indicate a combination of connections. Refer to 1.4 below for possible combinations.
1.1	Connection type	Indicates the connection type and will also show the last active connection type when disconnected	Connected via Wi-Fi		
			Connected via USB		

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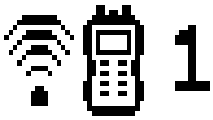
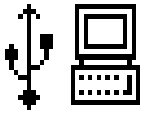
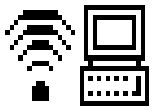
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
1.2	Type of device connected to	Indicates the type of device / driving unit that DigiShot® Plus 4G Commander is connected to.	Connected to CE4 Tagger		
			Connected to PC		
1.3	CE4 Tagger ID to which the DigiShot® Plus 4G Commander is connected to	Indicates the CE4 Tagger ID to which the DigiShot® Plus 4G Commander is connected. CE4 Tagger connections to DigiShot® Plus 4G Commander is always via Wi-Fi. Whenever a non-zero value is indicated, that value represents an active Wi-Fi connection to the relevant CE4 Tagger.	CE4 Tagger ID connected to	1…10	
1.4	Possible connection combinations	Wi-Fi and USB connections, and combinations thereof.	CE4 Tagger ID 1 connected via Wi-Fi		
			PC connected via USB		
			PC connected via Wi-Fi		
			PC connected via USB AND CE4 Tagger ID 1 connected via Wi-Fi		

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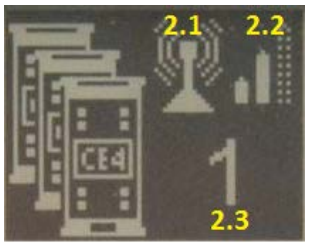
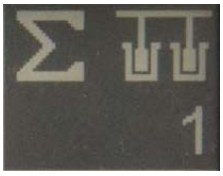
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
2	RF connectivity indication area	Indicates whether the RF module on this Base is active Indicates whether Base Commander is connected to one or more Benches via RF Indicates the signal quality of the RF connection	Connected to Bench (In this case depicted, connected to 1 Bench – Refer to section 2.3 below)		
2.1	RF active and waiting for Base connection		RF active		
2.2	RF signal quality		Signal low		
			Signal medium		
			Signal high		
2.3	Number of Bench Commanders connected to this Base		RF-connected Bench Commander count	1…10	
3	Total detonator count	Indicates the total number of detonators that this Base can detect. It includes all the detonators found on all the Bench Commanders connected to this Base.			
4	Battery percentage indicator	Indicates the remaining battery life as a percentage			
5	DigiShot® Plus 4G Commander ID	DigiShot® Plus 4G Commander ID used to connect to over Wi-Fi.	DigiShot® Plus 4G Commander ID	1…10	

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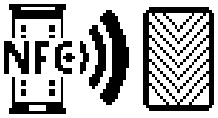
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
		Base directly connects to Benches	Only Base		
		Base set up to use Repeater	Base + Repeater		
6	DigiShot® Plus 4G Commander system state	Indicates the current system state the DigiShot® Plus 4G Commander is in. Will also indicate some of the lagging Bench Commander states, where applicable. This means that it will show the Bench state with the lowest system state. This first section of states are states that will be indicated as a result of the Base Commander system. 6.1 indicates states relevant to the connected Bench Commanders. This description is terrible. The state shown on the base is simply the 'least advanced' of all the benches that are involved in the blast.	State = UNKNOWN	?	Undefined DigiShot® Plus 4G Commander state
			State = IDLE		Idle state, DigiShot® Plus 4G Commander waiting for processes to commence, start-up to finish
			State = SCAN BLASTCARD		Waiting for user to scan NFC BlastCard at the back (NFC area) of the CE4 Commander.

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Item #	Description	Detail	Indication	Icon	Options / Variants / Description
			State = ENTER BLASTCARD PIN		Waiting for user to enter the scanned BlastCard's PIN on the connected CE4 Tagger / PC.
			State = PRESS NEXT WITHIN 2sec		Waiting for user to depress the Commander's NEXT button for at least 2 sec.
6.1	Indicating last (lagging) connected Bench Commander state	Indicates the system state of the lagging Bench Commander. If all other connected Benches are in e.g. state "Ready to Charge" and the lagging Bench is still in state "Awaiting Grace", then that state will be indicated along with the icon identifying Bench state. See previous comments re clarity of description.	Lagging Bench state = Grace		
			Lagging Bench state = Charging		
			Bench-state-on-base icon		
7	Error notification area	DigiShot® Plus 4G Commander will indicate any error condition it has by printing the exclamation triangle. Holds for errors reported on the connected Bench Commanders as well.			

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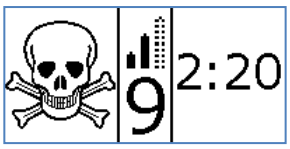
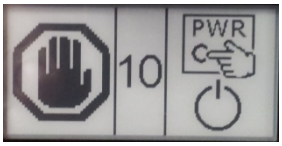
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
		If Base is in **?** state after Function button was pressed to ARM and the Wi-Fi/USB connection is severed/lost/discon-nected, then drop to this display that indicates the Bench with the first occurring shutdown time. If we have already mentioned that the Wi-Fi signal takes precedence over the other images then repeating stuff about Wi-Fi elsewhere is just overly verbose.			
		If Base is ready to blast and Wi-Fi/USB connection is severed/lost/discon-nected, then drop to this display that indicates the Base is in READY_TO_BLAST state. See comment above.			
		When blasted, to request user to turn off power, when Wi-Fi/USB connection lost Ditto			
		when in ABORTED state, to also turn off power, when Wi-Fi/USB connection lost			

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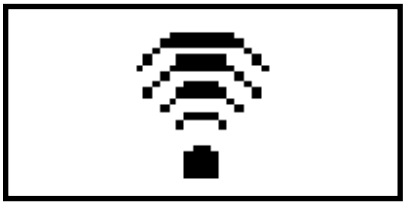
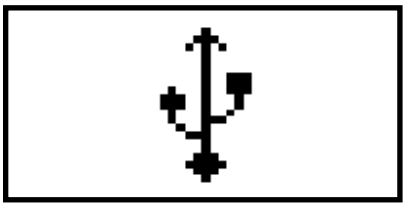
13.8.2. IntelliShot® Commander Bench Mode Icons

When the IntelliShot® Commander, in Bench Mode, is connected to a CE4 Tagger / Laptop / Tablet via Wi-Fi, it will display only the Wi-Fi symbol on the screen. This icon will replace all other screens.

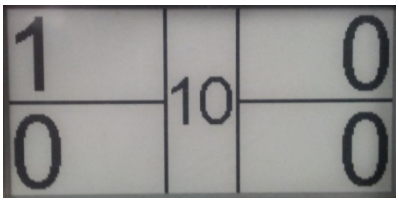


When the Bench Commander is connected via USB rather than Wi-Fi, the USB symbol will be displayed

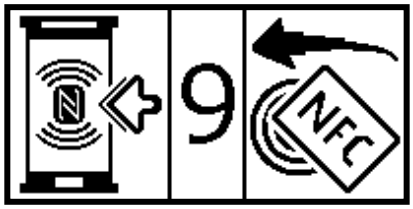


When the Bench Commander is connected via RF, it will display the RF symbol in the main screen

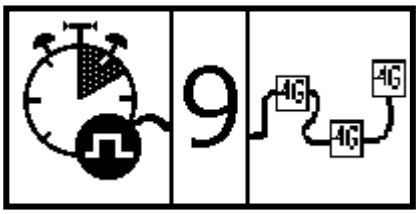
When the Bench Commander NOT is connected via RF, it will display the following main screen



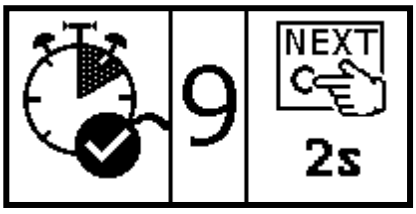
Swipe SmartKey for AutoArm
Bench Commander will perform programming and then go to the waiting for next key press state.



Programming screen



Waiting for next button press screen
Press the NEXT button to display a detail screen that will be displayed for 30 seconds before reverting back to the main screen.



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NOTE

The Detail screen below is displayed as a black layout on a white background. The illustration below has a black background only to improve the visibility of the icons in this manual.

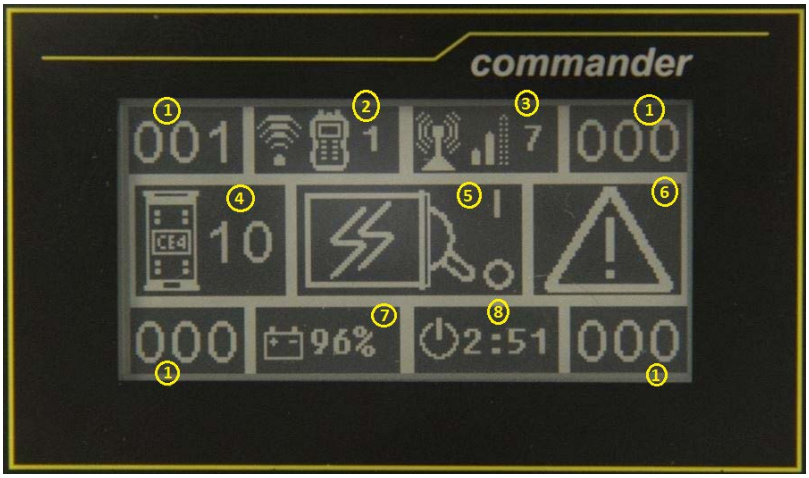

Figure 11: IntelliShot® Commander Bench Mode Screen

Table 10: IntelliShot® Commander Bench Mode Screen Icons

Item #	Description	Detail	Indication	Icon	Options / Variants / Description
1	Detonator count of each of the Bench Commander's channels	Indicates the total det count of dets found per channel. Will be reset every time a new scan is demanded. It is of an upwards-counting nature, incrementing as dets are detected, but not decremented / decreased if dets are missing. These descriptions are just terrible, The number shown is the total number of dets known to the commander for this channel. Not all of the dets are necessarily good.	Detcount		Det count; Min = 000, Max = 400

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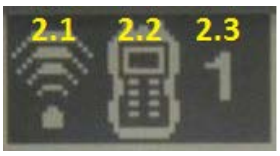
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
2	Wi-Fi / USB connectivity indication area (CE4 Tagger or PC)	Indicates whether DigiShot® Plus 4G Commander is connected via Wi-Fi or USB Indicates whether DigiShot® Plus 4G Commander is connected to CE4 Tagger or PC	Connected to something		As simultaneous Wi-Fi and USB connections are allowed (one of each), this section can indicate a combination of connections. As this is all the screen space available to us for the connections, connections will be printed over one-another. See point 2.4 for possible combinations.
2.1	Connection type	Indicates the connection type and will also show the last active connection type when disconnected	Connected via Wi-Fi		
			Connected via USB		
2.2	Type of device connected to	Indicates the type of device / driving unit the DigiShot® Plus 4G Commander is connected to.	Connected to CE4 Tagger		
			Connected to PC		
2.3	CE4 Tagger ID to which the DigiShot® Plus 4G Commander is connected to	Indicates the CE4 Tagger ID to which the DigiShot® Plus 4G Commander is connected to. CE4 Tagger connections to DigiShot® Plus 4G Commander is always via Wi-Fi. Whenever a non-zero value is indicated here, that value represents an active Wi-Fi connection to the relevant CE4 Tagger.	CE4 Tagger ID connected to	1…10	
2.4	Possible connection combinations	Wi-Fi and USB connections, and combinations thereof.	CE4 Tagger ID 1 connected via Wi-Fi		

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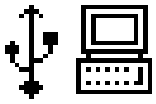
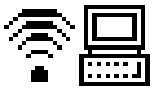
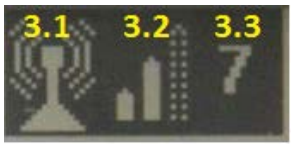
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
			PC connected via USB		
			PC connected via Wi-Fi		
			PC connected via USB AND CE4 Tagger ID 1 connected via Wi-Fi		
3	RF connectivity indication area	Indicates whether the RF module on this Bench is active Indicates whether Bench Commander is connected to Base via RF Indicates the signal quality of the RF connection	Connected to Base		
3.1	RF active and waiting for Base connection		RF active		
3.2	RF signal quality		Signal low		
			Signal medium		
			Signal high		
3.3	ID of the RF-connected Base Commander		Base Commander ID	1…10	
4	DigiShot® Plus 4G Commander ID	DigiShot® Plus 4G Commander ID used to connect to over Wi-Fi.	DigiShot® Plus 4G Commander ID	1…10	
5	DigiShot® Plus 4G Commander system state	Indicates the current system state the DigiShot® Plus 4G Commander is in	State = UNKNOWN	?	Undefined DigiShot® Plus 4G Commander state
			State = IDLE		Idle state, DigiShot® Plus 4G Commander waiting for processes to commence, start-up to finish

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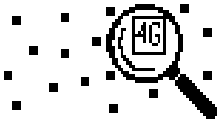
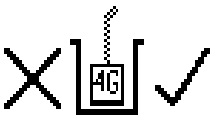
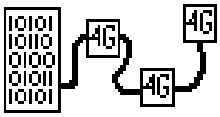
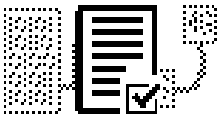
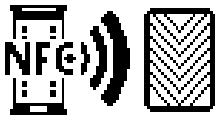
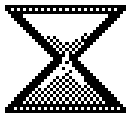
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
			State = ABORTED		Aborted state. User issued blast abort command. STATE IS LATCHED and requires DigiShot® Plus 4G Commander Power Cycle. Communication channels and testing functions still active, but blasting cannot be performed anymore.
			State = SEARCHING		Searching for new detonators
			State = TESTING		Testing detonators found during previous search. Testing detonators as a user request.
			State = PROGRAMMING		Programming detonators
			State = PROGRAMMED		Detonator programming finished
			State = SCAN BLASTCARD		Waiting for user to scan NFC BLAST / ACTIVATE card at the back (NFC area) of the CE4 Commander.
			State = ENTER BLASTCARD PIN		Waiting for user to enter scanned BlastCard's PIN on the connected CE4 Tagger/PC. Not applicable to BlastCard with no PIN
			State = PRESS NEXT WITHIN 2sec		Waiting for user to depress the NEXT button for at least 2 sec.
			State = AWAITING GRACE TIMEOUT		DigiShot® Plus 4G Commander waiting for GRACE timer to expire

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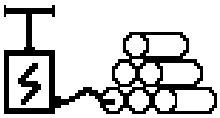
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
			State = READY TO CHARGE		DigiShot® Plus 4G Commander waiting for the CHARGING command to be received
			State = CHARGING		DigiShot® Plus 4G Commander blast voltage charging
			State = LAST DET TEST		Testing the detonators specified as end-of-line / end-of-row in the blast layout
			State = READY TO BLAST		DigiShot® Plus 4G Commander ready to receive blast instruction and transmit blast command to detonators.
			State = BLASTED		Blasted state. Blast command sent. STATE IS LATCHED and requires DigiShot® Plus 4G Commander Power Cycle. Communication channels still active.
6	Error notification area	DigiShot® Plus 4G Commander will indicate any error condition it has by printing the exclamation triangle			
7	Battery percentage indicator	Indicates the remaining battery life as a percentage			
8	Blast shutdown timer indicator	As soon as DigiShot® Plus 4G Commander has been past state "PRESS NEXT" the shutdown timer is started. As soon as timer expires, DigiShot® Plus 4G Commander will be turned off. Timer indicated in terms of hours and minutes	Timer inactive		Blast shutdown timer inactive. DigiShot® Plus 4G Commander will be turned off if Auto Shutdown timer (inactivity timer) expires.

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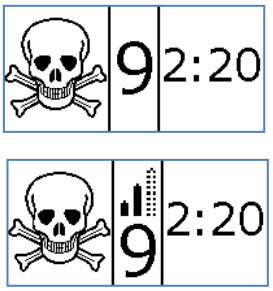
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
			Timer active		Blast shutdown timer active. Auto Shutdown timer deactivated as soon as Blast shutdown timer is started, and DigiShot® Plus 4G Commander will turn off after Blast shutdown timer expires - in this instance after 2hrs 51 minutes.
		If Bench is in GRACE after Function button was pressed to ARM and the Wi-Fi/USB connection is severed / lost / disconnected, this display indicates the Bench grace time counting down See earlier comments about the Wi-Fi/usb verbiage. As a further example of how terrible this is, nothing has properly explained what grace is. The same thing applies to all the stuff below.			It's totally inappropriate to put this information here …. This is the MAIN SCREEN AND THE MAIN SCREENS NEED TO BE DEALT WITH FIRST AND SEPARATELY FROM THE DETAIL SCREEN. Same issue applies below … cover the main screens first. They're big, beautiful and tons less confusing than the detail screens which can be covered later.
		If Bench is in state after GRACE is timed out and the Wi-Fi/USB connection is severed / lost / disconnected, then drop to this display that indicates the Bench is in a potentially dangerous state, awaiting ARM command either from CE4 Tagger or from Base			The top figure indicates a local blast, where RF is not used or for remote, when RF is not connected. Bottom figure indicates RF signal

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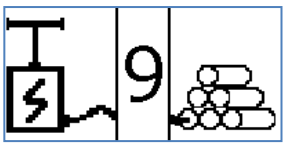
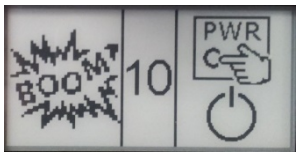
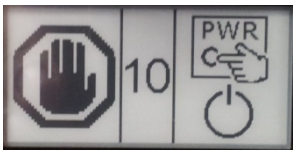
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
		If Base is ready to blast and Wi-Fi/USB connection is severed / lost / disconnected, then drop to this display that indicates the Base is in READY_TO_BLAST state			The top figure indicates a local blast, where RF is not used or for remote, when RF is not connected. Bottom figure indicates RF signal
		When blasted, to request user to turn off power, when Wi-Fi/USB connection lost			
		when in ABORTED state, to also turn off power, when Wi-Fi/USB connection lost			

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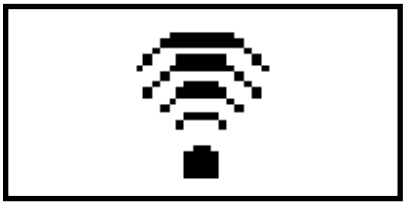
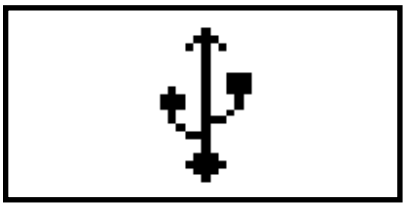
13.8.3. IntelliShot® Commander Repeater Mode Icons

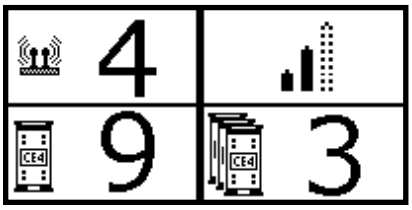
When the Repeater is connected via Wi-Fi, it will display only the Wi-Fi symbol on the screen. This icon will replace all other screens.



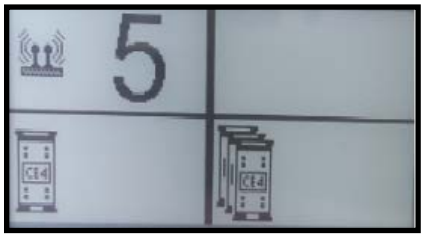
When the Repeater is connected via USB rather than Wi-Fi, the USB symbol will be displayed



When the Bench Commander is connected via RF, it will display the RF symbol in the main screen



Repeater will display the following main screen



Press the NEXT button to display a detail screen that will be displayed for 30 seconds before reverting back to the main screen.

NOTE	**The Detail screen is displayed as a black layout on a white background. The illustration below has a black background only to improve the visibility of the icons in this manual.**

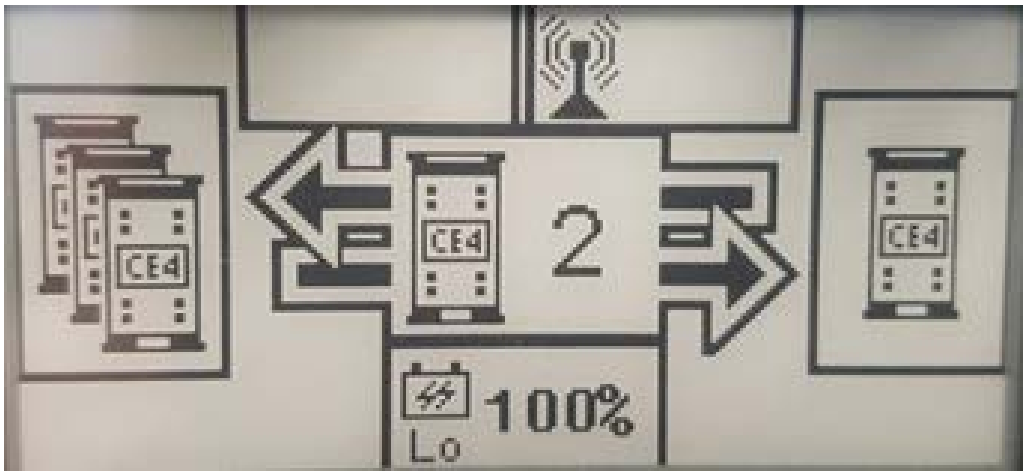


Figure 12: Repeater Detail Screen

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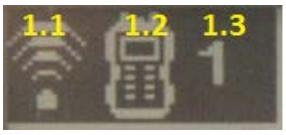
Table 11: Repeater Screen Icons

Item #	Description	Detail	Indication	Icon	Options / Variants / Description
1	Wi-Fi / USB connectivity indication area (CE4 Tagger or PC)	Indicates whether DigiShot® Plus 4G Commander is connected via Wi-Fi or USB Indicates whether DigiShot® Plus 4G Commander is connected to CE4 Tagger or PC	Connected to something		As simultaneous Wi-Fi and USB connections are allowed (one of each), this section can indicate a combination of connections. As this is all the screen space available to us for the connections, connections will be printed over one-another. See point 1.4 for possible combinations.
1.1	Connection type	Indicates the connection type and will also show the last active connection type when disconnected	Connected via Wi-Fi		
			Connected via USB		
1.2	Type of device connected to	Indicates the type of device / driving unit the DigiShot® Plus 4G Commander is connected to.	Connected to CE4 Tagger		
			Connected to PC		
1.3	CE4 Tagger ID to which the DigiShot® Plus 4G Commander is connected to	Indicates the CE4 Tagger ID to which the DigiShot® Plus 4G Commander is connected to. CE4 Tagger connections to DigiShot® Plus 4G Commander is always via Wi-Fi. Whenever a non-zero value is indicated here, that value represents an active Wi-Fi connection to the relevant CE4 Tagger.	CE4 Tagger ID connected to	**1…10**	

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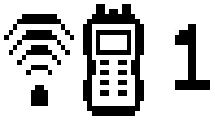
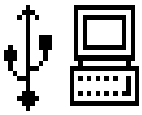
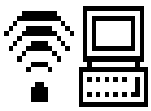
Item #	Description	Detail	Indication	Icon	Options / Variants / Description
1.4	Possible connection combinations	Wi-Fi and USB connections, and combinations thereof.	CE4 Tagger ID 1 connected via Wi-Fi		
			PC connected via USB		
			PC connected via Wi-Fi		
			PC connected via USB AND CE4 Tagger ID 1 connected via Wi-Fi		
2	RF connectivity indication area	Indicates whether the RF module on this Repeater is active. On Repeater the RF module is permanently engaged. Indicates whether Base Commander is connected to one or more Benches via RF Indicates the signal quality of the RF connection as reported by the Base.	Connected to Bench (In this case connected to 1 Bench - section 2.3)		
2.1	RF active		RF active		
2.2	RF signal quality		Signal low		
			Signal medium		
			Signal high		
			No connection to Benches	**Blank space**	

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Item #	Description	Detail	Indication	Icon	Options / Variants / Description
2.3	ID of the RF-connected Base Commander		Base Commander ID	**1…10**	Repeater indicates the Base Commander ID that is in charge of the remote setup.
3	DigiShot® Plus 4G Commander ID	DigiShot® Plus 4G Commander ID used to connect to over Wi-Fi.	DigiShot® Plus 4G Commander ID	**1…10**	
4	Battery percentage indicator	Indicates the remaining battery life as a percentage			

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13.9. NEW DESIGN

NOTE	**It is a good practice to clear the list when starting a new blasting process as the Commander retains original detonator details from the previous blast. From the Main Menu, select new design and confirm that list needs to be cleared.**

1. Main Menu
   - Press 4 SoftKey to select **New Design**.

2. Clear Memory Menu
   - Press Yes SoftKey to Clear Memory.
   - Det List Cleared will be displayed briefly

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13.10. TEST MENU

The Test Menu will allow the user to perform the following tests:

1. Test All,
2. Leakage Test,
3. Untagged Test.

13.10.1. Test All

From the test menu, the user will have the option to test all the detonators known to the IntelliShot® Commander to check if they are still connected to the Harness wire

1. Main Menu
   - Press 1 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 1 SoftKey to select **Test All**.

3. Test All
   - IntelliShot® Commander will test all known 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

NOTE	**Failures are detonators that are known to the Commander but have not responded to the test command. These detonators might not be connected to the harness for example.**

- After Testing press the ESC Key to return to the Test Menu.

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13.10.2. Leakage Test

This function enables the user to perform a current measurement and a leakage measurement test.
Leakage is measured in milli-amps (mA) and low leakage is considered to be below 0.5mA.
Leakage higher than 1mA is considered high leakage and may result in blasting problems (potential misfires) and should therefore be addressed and resolved prior to arming. The user can set the maximum limit where the leakage warning is triggered from 0.1mA to 1mA in increments of 0.1mA. Note that the default leakage limit is 0.5 mA. A warning will be displayed when the leakage level exceeds the leakage warning trigger level as set by the user.

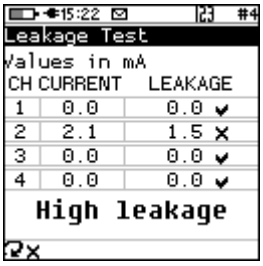
WARNING	**HIGH LEAKAGE LEVELS CAN RESULT IN POTENTIAL MISFIRES OF THE INTELLISHOT® DETONATORS.**

1. Main Menu
   - Press 1 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 2 SoftKey to select **Leakage Test**.

3. Leakage Test
   - IntelliShot® Commander 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
5. After Testing press the ESC Key to return to the Test Menu
   - Refer to basic causes of leakage as detailed in the CE4 Tagger section



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13.10.3. Untagged Test

This function enables the user to test for Untagged Detonators connected to the harness wire.

1. Main Menu
   - Press 1 SoftKey to select **Test Menu**.

2. Test Menu
   - Press 3 SoftKey to select Untagged Test.

3. Untagged Test
   - The Channel and Result will be displayed
   - 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
5. After Testing press the ESC Key to return to the Test Menu

NOTE	**Use a binary search to locate untagged detonator(s).** **Refer to Appendix A for details to perform binary search.**

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13.11. VIEW DESIGN

The View Design Menu will allow the user to view detonator lists sorted or filtered as desired. The following menu options are available:

1. List Detonators,
2. List Missing Detonators,
3. List New Detonators,
4. List Bad Status Detonators,
5. Channel Summary.

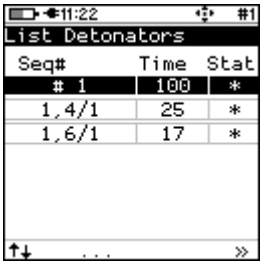
13.11.1. List Detonators

The Lists do NOT include untagged detonators.

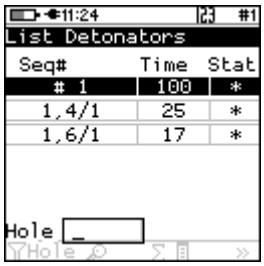
1. Main Menu
   - Press 2 Key to select **View Design**.

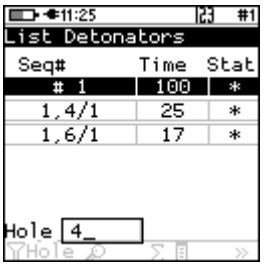
2. View Design
   - Press 1 Key to select List Detonators.

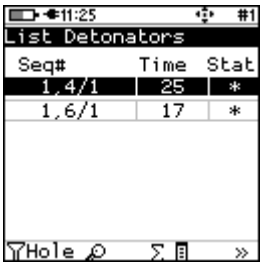
3. Detonator list will be displayed
   - Press **>>** SoftKey to cycle between various views as required
   - Press SoftKey to filter



   - Press SoftKey to search Sequence
     - Enter Sequence number
     - Press ENTER to filter the list and place the required detonator at the top of the list







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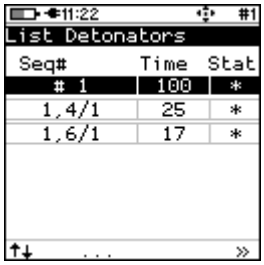
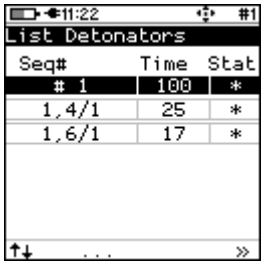
- Press Σ SoftKey to view Plan Summary





- Press ↑↓ SoftKey to select:
  - Sort By Channel
  - Sort by Location

  - Sort by Time view.
  - Sort in Tag order.

NOTE

In the List Detonator screens, make use of the 2 8 keys to navigate up or down, and press ↵ to view the selected detonator's details. The following icons may be displayed under the Status column:

*** indicates a "New Det"**

indicates a "Last Det"

? indicates a "Missing Det"

X Bad Status det

D Duplicate dets

Start row marker

End row marker

Inflection point

4. Press the ESC Key to return to the View Design Menu

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13.11.2. List Missing Detonators

This screen will list the detonators that were not found during testing.

1. Main Menu
   - Press 2 Key to select **View Design**.

2. View Design
   - Press 2 Key to select **List Missing Detonators**.

3. List Missing Dets
   - The List Missing Detonators screen will be displayed
   - Press the applicable SoftKey as required.
4. Press the ESC Key to return to the View Design Menu

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13.11.3. List New Detonators

New detonators are detonators that were not found when the Commander completed the original search but were found when it repeated the search later (i.e. the detonators are “new”). Once programming is done, the detonators are considered to be accepted as part of the design and will not be shown as new anymore.

1. Main Menu
   - Press 2 Key to select **View Design**.

2. View Design
   - Press 3 Key to select **List New Detonators**.

3. List New Detonators
   - New detonator(s) found will be displayed

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13.11.4. List Bad Status Detonators

This screen lists the detonators that were found to be bad during the test. (A bad status indicates the detonator may have a bad fuse or other internal problem).

NOTE	**This List does NOT include untagged detonators.**

1. Main Menu
   - Press 2 Key to select **View Design**.

2. View Design
   - Press 4 Key to select List Bad Status Detonators.

3. List Bad Status
   - The List Bad Status screen will be displayed
   - Use SoftKeys to navigate pages and sort/filter the view as required.

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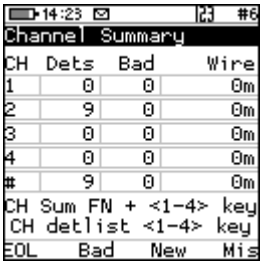
13.11.5. Channel Summary

The Channel Summary menu allows the user to view summaries of the number of detonators on each Channel.

1. Main Menu
   - Press 2 Key to select **View Design**.

2. View Design
   - Press 5 Key to select Channel Summary.

3. Channel Summary screen
   - Press the following SoftKeys to toggle display as follows:
     - **EOL** = End of Line
     - **Bad** = Bad Detonators
     - **New** = New Detonators
     - **Mis** = Bad Detonators



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13.12. Prepare for Blast

This function prepares for either a Local Blast or a Remote Blast

13.12.1. Local Blast

1. Main Menu
   - Press 3 SoftKey to select **Prepare for Blast**.

2. Warning for **last det not set**
   User is enforced to select last dets on all channels. A warning will appear where the user may:
   - Press Auto to automatically select last det, which is the last det on the list for each channel
   - Press to have the list of detonators displayed and select the last dets manually
   - Press to return to main menu
   - If the user selects the last det automatically, a warning will appear to ensure that all dets are connected before proceeding to programming.

3. Prepare for Blast
   - Press 1 Key to select **Program Detonators**.

4. Program Detonators
   - Detonators will be programmed
   - Press ESC button to return to **Prepare for Blast Menu**
   - Press to continue.

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5. Check Blast Design
   - Press 4 from main Menu to view Design to view

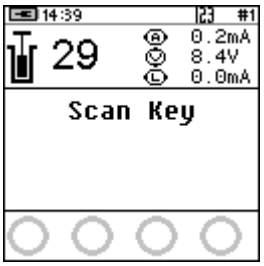
6. Prepare for Blast
   - Press 2 button to select **Arm**.

7. Arm
   - Press 1 button to select **Local Blast**

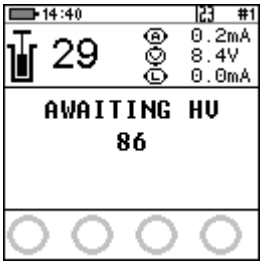
CAUTION	**ARM AND FIRE COMMANDS FOR DETONATORS WILL NOT INITIALLY BE KNOWN TO THE INTELLISHOT® COMMANDER AT POWER ON. THESE COMMANDS ARE ONLY AVAILABLE FROM THE BLASTING (RED) BLASTCARD AND WILL BE ISSUED TO THE INTELLISHOT® COMMANDER WHEN NECESSARY, EITHER DIRECTLY FROM THE RED BLASTCARD (IN CASE OF A LOCAL BLAST) OR REMOTELY FROM THE BASE COMMANDER. ARM AND FIRE BLASTING COMMANDS WILL BE ERASED FROM THE COMMANDER MEMORY AFTER USE.**

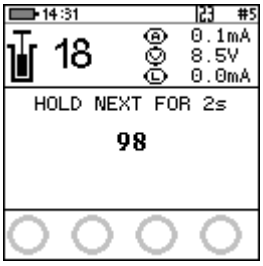
8. Local Blast
   - User will be prompted to **Scan Key**
   - Scan the **Red BlastCard** at the back of the IntelliShot® Commander
   - Enter the associated PIN
   - Press ↵ to continue.

BLAST CARD NFC SENSOR



   - The screen will alternate between displaying awaiting high voltage and prompting the User to press next.
   - The time displayed indicates the time remaining to press next before it 'disarms'.





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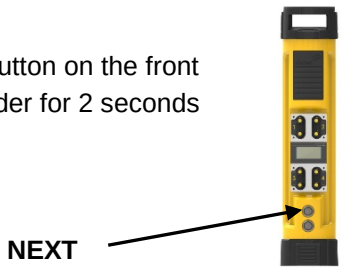
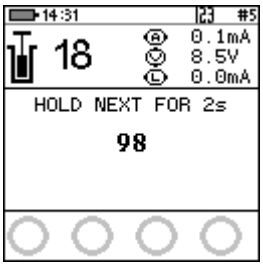
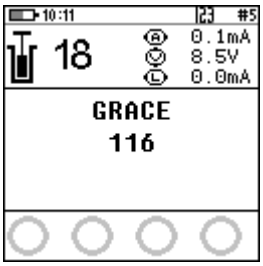
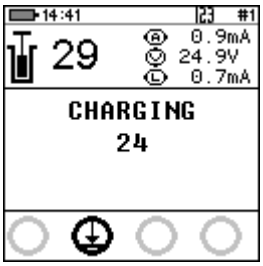
9. Local Blast
   - Press and hold the NEXT button on the front of the IntelliShot® Commander for 2 seconds

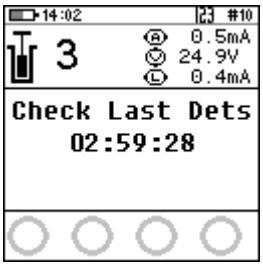






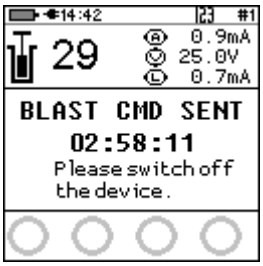
10. Local Blast
    - The IntelliShot® Commander will initiate a 30-second high-voltage charging period followed by a 90-second blast window.
    - Should there be detonators marked as “last det”, the last det test will be performed between the charge and blast window





11. Local Blast
    - Press both FIRE-buttons (SoftKeys) on the CE4 Tagger simultaneously to fire

12. Local Blast
    - Blast Command sent
    - Switch Off Commander and Tagger



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13.12.2. Remote Blast

NOTE	**The following Remote Blast description details the manual process to arm the system. The user is also provided with an option to Arm the Commander without the need to connect the Tagger via an AutoArm function. The AutoArm function will allow the user to scan a no-PIN yellow BlastCard and if there are no errors present; program and move to the waiting for next press state. The user will then have to press next for 2 seconds and the unit will then be ready to arm.**

1. Main Menu
   - Press 3 SoftKey to select **Prepare for Blast**.

2. Prepare for Blast
   - Press 1 SoftKey to select **Program Detonators**.

3. Program Detonators
   - Detonators will be programmed
   - Press ESC or ↵ button to return to Prepare for Blast Menu.

4. Prepare for Blast

Press 2 button to select **Arm**.

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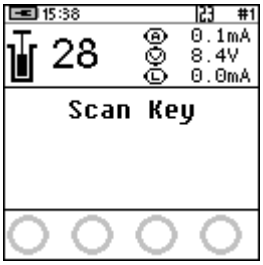
5. Arm
   - Press 2 button to select **Remote Blast**

CAUTION	**ARM AND FIRE COMMANDS FOR DETONATORS WILL NOT INITIALLY BE KNOWN TO THE INTELLISHOT® COMMANDER AT POWER ON. THESE COMMANDS ARE ONLY AVAILABLE FROM THE BLASTING (RED) BLASTCARD 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 INTELLISHOT® 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 IntelliShot® Commander

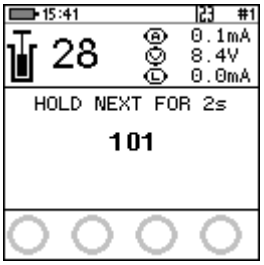
BLAST CARD NFC SENSOR

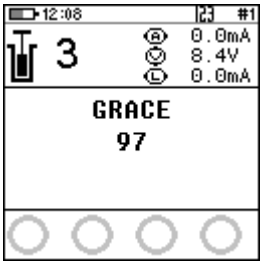


NOTE	**Yellow NFC card must be from the same group as Red NFC card for RF communication to take place.**

8. Remote Blast
   - Press and hold the NEXT button on the front of the IntelliShot® Commander for 2 seconds
   - The IntelliShot® Commander will initiate a Grace p d of 2 minutes.

NEXT





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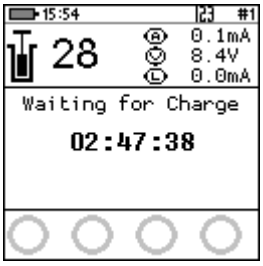
Disconnect the CE4 Tagger from the Bench Commander. CE4 Tagger will automatically disconnect from the Bench Commander during charging.

9. Remote Blast
   - The Bench Commander will await a command from the Base Commander



Connect the CE4 Tagger via Wi-Fi to the Base Commander.

- Select the applicable Bench Commander by pressing corresponding number on the keypad. Select Bench 10 by pressing **0** on the keypad. (Bench 1 is selected as indicated by the tick mark ✓ in example shown).
- Applicable Bench Commander will be Indicated by ✓
- Press ↵ to continue

10. To remove a Commander from the blast:
    - Press ⓘ button
    - Highlight Commander to be removed
    - Press ↵
    - Then press 🗑 Soft button to remove

11. To add a removed Commander
    - Press + Button

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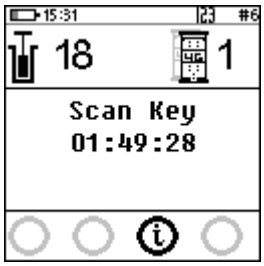
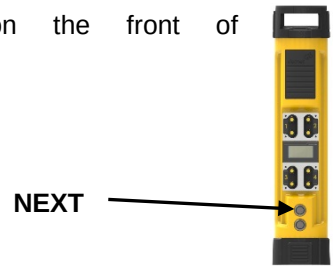
12. Remote Blast
    - Wait if message “Not ready yet” is displayed
    - User will be prompted to **Scan Key** once all the bench commanders are out of grace period and ready to blast.

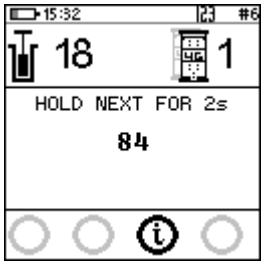


NOTE	**The user is also provided with an option to Arm the commander without the need to connect the tagger via an AutoArm function. The AutoArm function will allow the user to scan a no PIN yellow BlastCard and if there are no errors present; program and move to the waiting for next press state. The user will then have to press next for 2 seconds and the unit will then be ready to arm.**

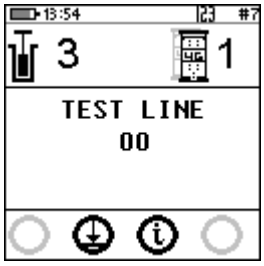
13. Scan Key
    - Scan the RED BlastCard at the back of the IntelliShot® Commander
    - Enter the corresponding PIN
    - Press ↵ to continue

- Press and Hold the NEXT button on the front of the IntelliShot® Commander for 2 seconds

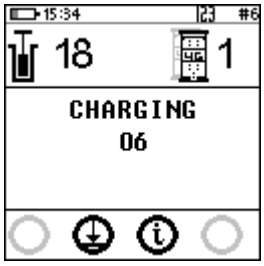




- The IntelliShot® Commander will initiate arming and a 30-second high-voltage charging period followed by Testing Line and the 90-second blast window.



14. To end the blast process or abort the blast
    - From the Base Commander press the button
    - If you select **No** it will continue with blast process



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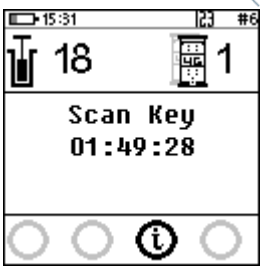
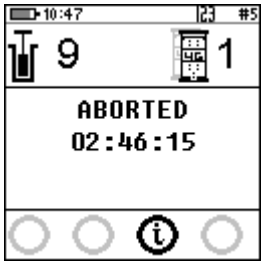
- If you select **Yes** the Base will return to “Scan Key”



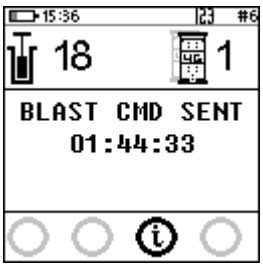
- If **ABORT** is selected, the Base will abort the Benches connected to it



- The Bench Commander will display “Aborted” and Request to be reset

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

- **BLASTING WILL TAKE PLACE**
- Blast Command sent message will be displayed



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14 INTELLISHOT® COMMANDER CONFIGURATION SETTINGS

The configuration menu presents a variety of informational screens and configurable options for the following:

1. 4G Setup
2. Device Setup
3. Long Range RF
4. Advanced Setup
5. Factory Setup.

14.1. 4G Setup

The 4G Setup menu will allow the user to set the det labelling that was used when tagging to ensure that the Commander is able to interpret the locations tagged on the detonators.

1. Main Menu
   - Press ⚙ to select Configuration

2. Configuration Menu
   - Press to select **4G Setup**

3. 4G Setup
   - Press 1 to select Det Label
   - Select correct Det label used when tagging
   - Press 2 to select Leakage Trigger
   - Select leakage warning trigger level using numerical keys 2 and 8 to move up or down

14.2. Device Setup

The Device Setup menu will allow the user to adjust device specific settings.
The following options are available:

1. Time Zone
2. Language
3. Time Outs
4. Units

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14.2.1. Time Zone

This function enables the user to define the time zone. Date/time settings are controlled by GPS GMT time data but since the time zone cannot be configured automatically, it should always be set by the user in order to ensure the correct local time display. The time zones may be adjusted in 0.5 hour increments.

1. Main Menu
   - Press to select Configuration

2. Configuration Menu
   - Press 1 to select **Device Setup**

3. Device Setup
   - Press 1 to select **Time Zone**

4. Set Time Zone
   - Use the arrow key 2 8 to navigate the TIME ZONE options.
   - Press SoftKey to save.
   - Press SoftKey to return to Main Menu.

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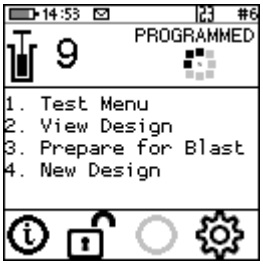
14.2.2. Language

This function enables the user to select a language preference for the IntelliShot® Commander menus.

NOTE	**This version of software does not have complete translations of all languages other than English. The addtional languages will be included in a later software release.**

1. Main Menu
   - Press to select Configuration



2. Configuration Menu
   - Press 1 to select **Device Setup**

3. Device Setup
   - Press 2 to select **Language**

1. Language
   - Press 1 on the keypad to select English.
   - Press 2 on the keypad to select Español (Spanish).
   - Press 3 on the keypad to select Français (French).
   - A confirmation screen will be displayed when the language is changed.
   - Press SoftKey to return to Main Menu.

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14.2.3. Timeouts

This function enables the user to set a time-period of inactivity before the Commander will automatically power off to conserve battery power. The user can set the idle time between 2 and 120 minutes.

1. Main Menu
   - Press to select Configuration

2. Configuration Menu
   - Press 1 to select **Device Setup**

3. Device Setup
   - Press 3 to select **Timeouts**

4. Auto Shutdown
   - Use 2 8 navigational keys to navigate selection.
   - Minimum of 2 minutes.
   - Maximum of 120 minutes.
   - Press SoftKey to save.
   - Press SoftKey to return to Main Menu

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14.2.4. Units

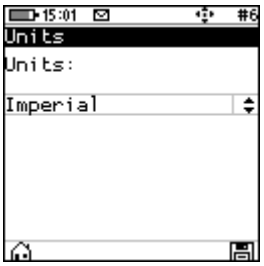
This function enables the user to select either the Imperial or Metric Units of Measure as preferred.

1. Main Menu
   - Press to select Configuration

2. Configuration Menu
   - Press 1 to select **Device Setup**

3. Device Setup
   - Press 4 to select **Unit**

4. Units
   - Use 2 8 navigational keys to toggle selection.
   - Press to select either Imperial or Metric.
   - Press SoftKey to save.



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14.3. Long Range RF

This function enables the user to manually select the region where the IntelliShot® Commander will be deployed, set the region specific RF Channel and set the Encryption Key.

NOTE	**Communication will NOT be possible unless the channel, encryption key settings and firmware version are the same on Base and Bench commanders. This will be automated when the RF settings from NFC card is enabled, and the onus will thus not be on the user to ensure matching settings, unless it needs to be altered. When the option to obtain RF settings from card is enabled, simply swipe a yellow blast card in idle state and the system will obtain the RF settings**

14.3.1. Set RF Channel

1. Main Menu

   - Press to select Configuration

2. Configuration Menu

   - Press 2 to select **Long Range RF**

3. RF Setup Menu

Press 3 to toggle SET RF CHANNEL

Press 4 to toggle Set Encryption Key

   - Press 1 to select **Set RF Channel**

   - Use 2 8 navigational keys to navigate selection.
   - Press ↵ to select Region and open RF Channel selection.

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- Use numerical keypad to enter Unique RF Channel within the range as follows:
- Between 16 and 47 for Americas
- Between 48 and 55 for Australia.
- Press ↵ to continue
- Press SoftKey to return to Main Menu

NOTE	**Communication will NOT be possible unless the channel and encryption key settings are the same on Base and Bench commanders. The channel range will also change to reflect the available allocated RF channels for each specific region**

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14.3.2. Set Encryption Key

1. Main Menu
   - Press to select Configuration

2. Configuration Menu
   - Press 2 to select **Long Range RF**

3. RF Setup
   - Press 2 to select Set Encryption Key

4. Set Encryption Key
   - Key will be displayed
   - Press to edit
   - Use numerical keypad to enter desired 6 digit encryption key
   - Press to continue

   - Press SoftKey to save the change

NOTE	**Communication will NOT be possible unless the channel and encryption key settings are the same on Base and Bench commanders. Note that this function is automated, and the onus is not on the user to ensure matching settings, unless they need to alter them. We should emphasize in this section and the previous that this is now automated, so the onus is not on the user to ensure matching settings, unless they need to alter them.**

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15 ADVANCED SETUP

The Advanced Setup menu presents configurable options for the following:

1. Device ID
2. Base Station Mode
3. Bench Box Mode
4. Repeater Mode
5. Device Password.
6. Last Det
7. Toggle Auto Arm
8. Max Wire Length

15.1. Device ID

1. Main Menu
   - Press to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 1 to select **Device ID**

4. Device ID
   - Use numerical keypad to enter desired Device ID
   - Press to continue
   - Press SoftKey to save.
   - Press SoftKey to return to Main Menu
   - Power cycle the Commander for the change to take effect.

NOTE	**All devices must have unique IDs. The Commanders may be set to IDs ranging from 1 to 10.**

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15.2. Base Station Mode

The Base Station Mode menu allows the User to configure the Commander to be utilised in either Base Station or Base Station + Repeater Mode.

NOTE	**The Commander unit will turn off automatically when the mode change is selected.**

1. Main Menu
   - Press ⚙ to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 2 to select **Base Station Mode**

4. Base Station Mode
   - Press 1 to select **Base Station Mode**
   - Base Station Mode will be activated and Commander will switch off automatically
   - Power **On** the Commander for the change to take effect.

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15.3. Base + Repeat Mode

The Base and Repeat mode will allow the Base Commander to communicate through a repeater. The User should use this mode of operation when a repeater is used in the blast.

NOTE	**The Commander unit will turn off automatically when the mode change is selected.**

1. Main Menu
   - Press to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 2 to select **Base Station Mode**

4. Base Station Mode
   - Press 2 to select **Base + Repeat Mode**
   - Base + Repeat Mode will be activated and Commander will switch off automatically
   - Power On the Commander for the change to take effect

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15.4. Bench Box Mode

The Bench Box Mode menu allows the User to configure the IntelliShot® Commander to be utilised as a Bench Box.

NOTE	**The Commander unit will turn off automatically when the mode change is selected.**

1. Main Menu
   - Press ⚙ to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 3 to select **Bench Box Mode**
   - Bench Box Mode will be activated and Commander will switch off automatically
   - Power On the Commander for the change to take effect

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15.5. Repeater Mode

The Repeater Mode menu allows the User to configure the IntelliShot® Commander to be utilised as a Repeater.

NOTE	**The Commander unit will turn off automatically when the mode change is selected.**

1. Main Menu
   - Press to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 4 to select **Repeater Mode**
   - Repeater Mode will be activated and Commander will switch off automatically
   - Power On the Commander for the change to take effect

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15.6. Device Password

This function enables the user to change the device password by assigning a new unique password that is known only to the user.

1. Main Menu
   - Press ⚙ to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 5 to select **Device Password**

4. Passwords
   - Use the numerical keypad to enter Current Password.
   - Press ↵ to confirm.

NOTE	**Unlike conventional password entry, the chosen password is visible to the user (rather than ****) to enable the user to see if any typing errors are being made.** **Leaving the new password 'blank' disables the password request when the Commander is switched on.**

- Use the numerical keypad to enter New Password.
- Press ↵ to confirm.
- Information message confirming password changed will be displayed briefly.
- Advanced Menu will be displayed.

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15.7. Last Det

This function enables the user to enable or disable the last det test.

1. Main Menu
   - Press to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 6 to select **Last Det**

4. Last Det
   - Press 2 8 key to toggle between Last Det Enabled and select Last Det Preferred

   - Last det preferred indicates that the last det test will be used in preference to the normal current measurement checks in blasting
   - Press to select and save the setting.

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15.8. Toggle Auto Arm

This function enables the user to enable arming automatically or manually.

1. Main Menu
   - Press to select **Configuration**

2. Configuration Menu
   - Press 3 to select **Advanced Setup**

3. Advanced Setup
   - Press 7 to select **Toggle Auto Arm**

4. Toggle Auto Arm

   User may select to:
   - Enable – this will allow user to read the information (RF encryption key and RF channel) stored on the NFC cards when in idle mode and arming the Bench Commander when it is ready to blast.
   - Disable – this will only allow the user to arm the Bench Commander manually.

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15.9. Max Wire Length

1. Main Menu

   Press to select **Configuration**

2. Configuration Menu

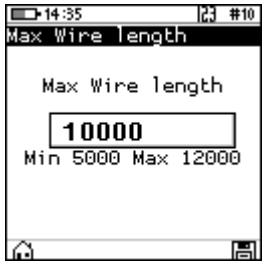
   Press 3 to select **Advanced Setup**

3. Press right soft key to display next screen

4. Advanced Setup

   Press 8 to select **Max Wire Length**

5. Insert the max wire length between 5000 and 12000m.



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16 FACTORY SETUP

NOTE

The Factory Setup is password protected and may only be accessed by designated maintenance teams.

1. Main Menu
   - Press to select **Configuration**

2. Configuration Menu
   - Press 4 to select **Factory Setup**

3. Factory Password
   - The factory setup menu will prompt for a password, after which the factory options will be displayed.
   - Use numerical keypad to enter Unique CE4 Tagger Password.
   - Press to continue.

4. Factory Setup
   - Factory Setup will be displayed.

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NOTE	**Each option is further protected by its own web-based ticket system. If no active ticket is available for the chosen option (as stored on the CE4 Tagger), the user is prompted for a ticket issued by portal.detnet.com. The ticket is comprised of two 10-digit numbers that need to be entered before continuing. If the ticket is valid, access will be granted to the given function. Tickets can be issued for a selected number of repeated uses before a given expiry date. Tickets issued are specific to a given CE4 Tagger or Commander as determined by the hardware serial number, thus allowing flexible control over protected features.**

5. Web Ticket
   - Press required Menu option.
   - Obtain Ticket to continue

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16.1. Factory Setup Menu Options

Each Factory menu option is described below. Many of the screens are common to several CE4 products and are shared between them.

NOTE	**Only Storage Mode will be accessible without a Web Ticket. All other Menu items will need a Web Ticket to be accessed.**

1. Clear Logs (Factory)

The clear logs function erases the internal log and will displays a confirmation dialog briefly.

2. Leakage Calibration (Factory)

The Leakage Calibration menu recalculates the leakage and current offsets by measuring the current and leakage with no detonators connected. It functions in the same fashion as the leakage test screen except that it initially shows a leakage calibrate dialog briefly and then proceeds to the leakage screen.

3. Start Self-Test (Factory)

The self-test function starts a factory self-test of the device.

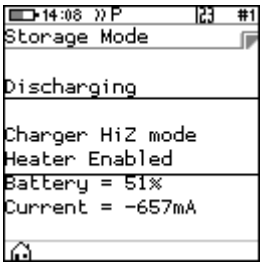
4. IO Setup (Factory)

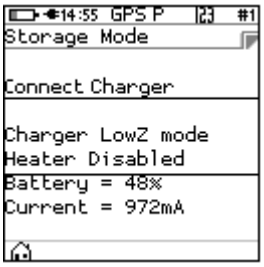
The IO Setup function is used to setup experimental IO parameters.

5. Experimental Menu

This menu option will contain any experimental functions that are required in engineering only.

6. Storage Mode





- Press 6 Key to select **Storage Mode**
- When the battery capacity is more than 50%, the CE4 Tagger will discharge the battery by activating additional battery draining functions such as the heating pad, to accelerate the discharge level to the required 50% charge level, and
- When the battery capacity is less than 50%, it will prompt the user to connect a charger to attain the required 50% charge level.
- When the CE4 Tagger reaches the required 50% battery storage capacity it will switch off automatically allowing for safe storage

7. Reset Service Date

- This function will allow the user to reset the service schedule.

8. Migrate NFC Key

- The Migrate NFC Key function is used to migrate an outdated key to the new structures.

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17 TABLET BLAST APPLICATION GENERAL DESCRIPTION

NOTE	**Please refer to UTM-00346 for the Commander System Tablet Blast Application details**

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18 COMMANDER SYSTEM ON-BENCH DEPLOYMENT OVERVIEW

- Configure all equipment
- Prepare for tagging
- Tag detonators
- Test detonators
- View Design

WARNING	**LOCAL MINE, EXPLOSIVES OR STATUTORY REGULATIONS, PROCEDURES, OR CODES OF PRACTISE REGARDING SAFETY TAKE PRECEDENCE OVER ANY OF THE TIPS AND HINTS DESCRIBED IN THIS DOCUMENT. THE MINE, EXPLOSIVES OR LOCAL REGULATIONS, PROCEDURES OR CODES OF PRACTISE MUST BE FOLLOWED AT ALL TIMES.**

18.1. Blasting Overview

The IntelliShot® Commander can be used for Local Blasting, Remote Blasting and Synchronized blasting. The description below provides a high-level overview of the steps required to operate the IntelliShot® Commander during each of the blasting processes.

18.1.1. Local blasting

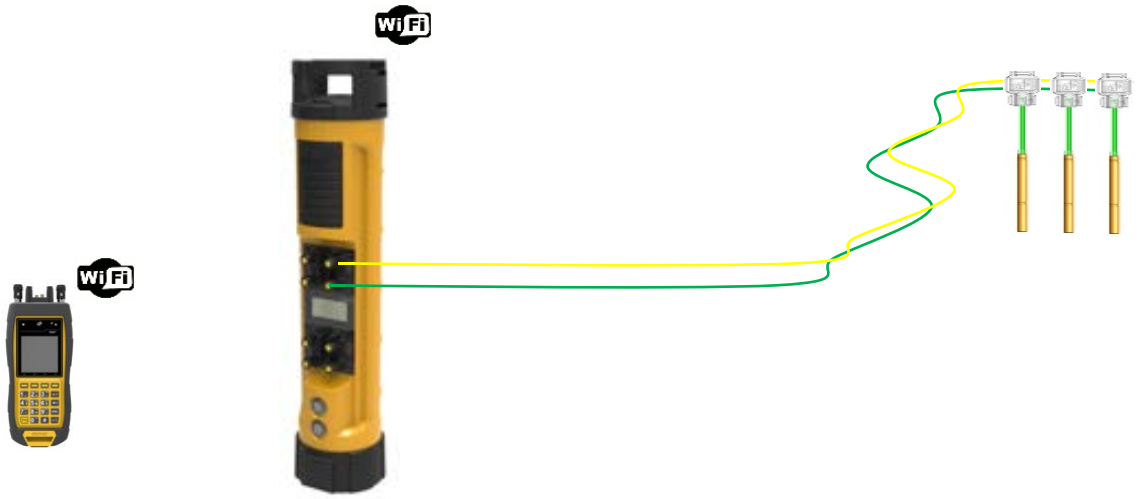

Figure 13: Local Blasting

a. Connect detonator lead-in wires to the detonator channel(s) on the front panel of the IntelliShot® Commander. Channels are clearly marked 1 – 4.
b. Switch ON both the CE4 Tagger and IntelliShot® Commander.
c. Establish a Wi-Fi link between the CE4 Tagger and appropriate IntelliShot® Commander. Both devices will confirm connected status on the respective displays.
d. Initiate the necessary tests using the CE4 Tagger as a 'remote control'. All associated results will be displayed in detail on the CE4 Tagger screen while a summarized result will be displayed on the IntelliShot® Commander.
e. Initiate the program functions to ensure all detonators are timed appropriately.
f. Select ARM and scan the RED BlastCard to the designated NFC Sensor area on the back of the IntelliShot® Commander.
g. ARM/Activate the IntelliShot® Commander from the CE4 Tagger.

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h. Enter the associated PIN on the CE4 Tagger.
i. Press and hold the next button for 2 seconds
j. The IntelliShot® Commander will initiate a 30-second high-voltage charging period followed by a 90-second blast window.
k. Press both FIRE-keys (soft buttons) on the CE4 Tagger to fire.

18.1.2. Remote blasting

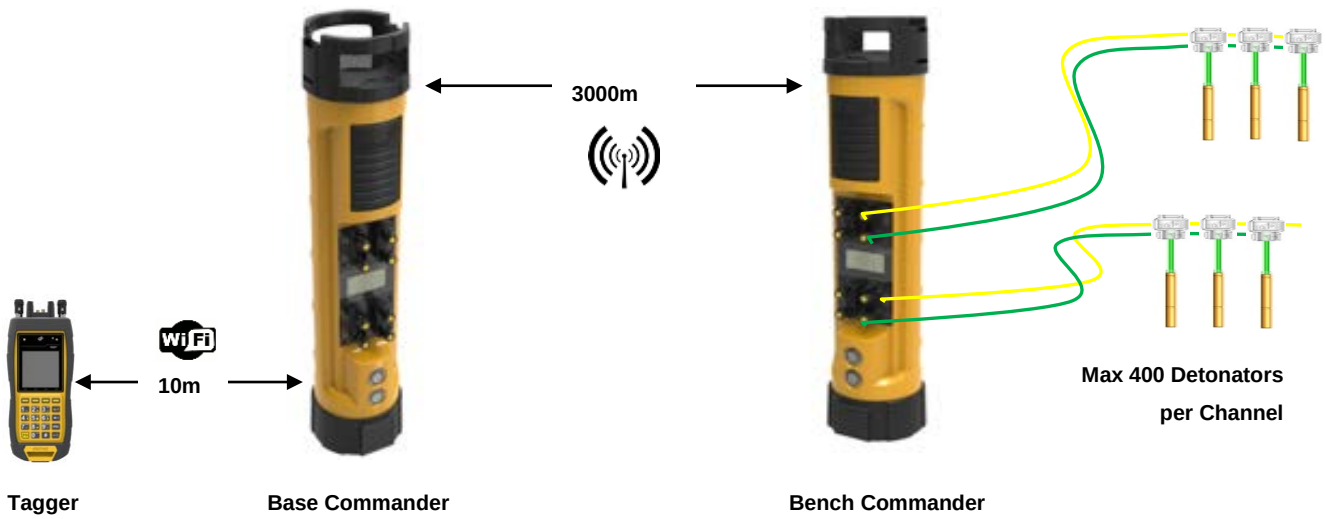

Figure 14: Remote Blasting

a. Repeat steps a – f as specified for local blasting.
- Connect detonator lead-in wires to any / each available detonator channel on the front panel. Channels are clearly marked 1 – 4.
- Switch both CE4 Tagger and IntelliShot® Commander ON.
- Establish a Wi-Fi link between the CE4 Tagger and appropriate Bench Commander. Both devices will confirm connected status on the respective displays.
- Initiate the necessary tests using the CE4 Tagger as an interface unit. All associated results will be displayed in detail on the CE4 Tagger screen while a summarized result will be displayed on the Bench Commander.
- Initiate the program functions to ensure all detonators are timed appropriately.
- ARM/Activate the Bench Commander from the CE4 Tagger.

b. Scan the Yellow BlastCard to the designated NFC Sensor area on the Bench Commander and to Arm the Bench Commander.
c. Press next for 2 seconds.
d. The Bench Commander will initiate the grace period as specified in the BlastCard. Evacuate the bench.
e. Set up a Base Commander at a safe location within RF range from the Bench Commander.
f. Establish a Wi-Fi link between CE4 Tagger and Base Commander. Both devices will confirm connected status on displays.
g. Confirm which Bench Commanders to proceed with.
h. Apply the RED BlastCard to the designated area on the Base Commander.

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i. Enter the associated PIN on the CE4 Tagger and press next.
j. The Base Commander will instruct the selected Bench Commander(s) to apply high voltage for 30 seconds before allowing a 90-second firing window. In Synchronise mode the firing window will be 60 seconds).
k. Press both FIRE-keys (SoftKeys) on the CE4 Tagger to fire.

18.1.3. Synchronized blasting (Multiple Commanders)

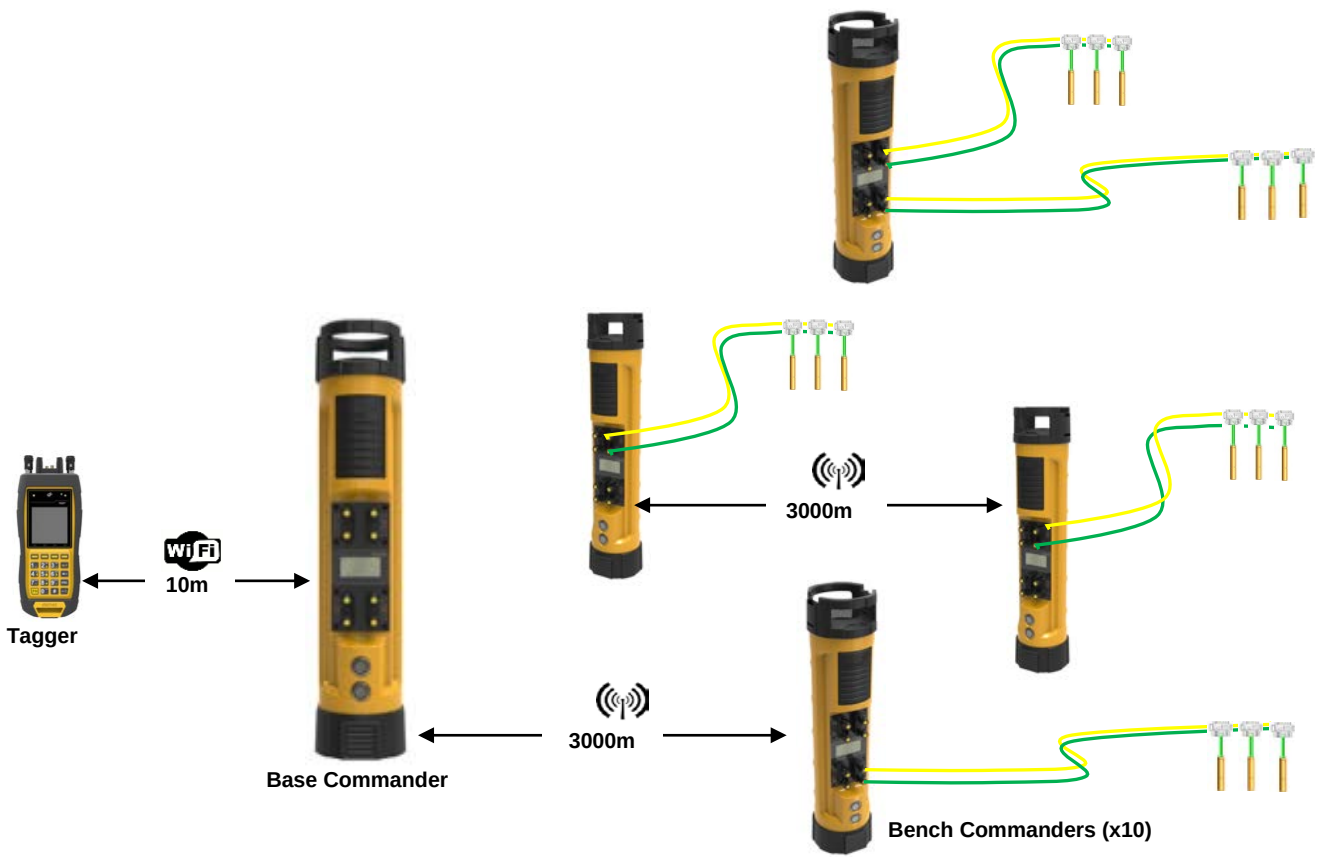

Figure 15: Synchronized Blasting via Multiple Commanders

a. Repeat steps a – d as specified for remote blasting.
b. When configuring the base and selecting the bench commanders to be blasted, select the sync option
c. A sync-management period will automatically be applied at step l to ensure 1ms synchronization between Commanders.

CAUTION	**ARM AND FIRE COMMANDS FOR DETONATORS WILL NOT INITIALLY BE KNOWN TO THE INTELLISHOT® COMMANDER. THESE COMMANDS ARE ONLY AVAILABLE FROM THE BLASTCARD (RED) AND WILL BE ISSUED TO THE COMMANDER WHEN NECESSARY, EITHER DIRECTLY FROM THE 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.**

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19 INTELLISHOT® COMMANDER SYSTEM TROUBLESHOOTING

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.
Design Changed	 or 	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

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Fault Condition	Error Screen	Trouble-shooting / Remedial Action
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.
High Leakage		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.
Last detonator not set		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.
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.

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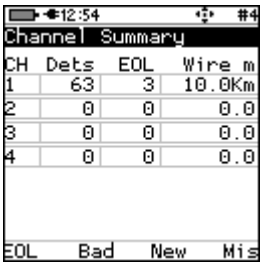
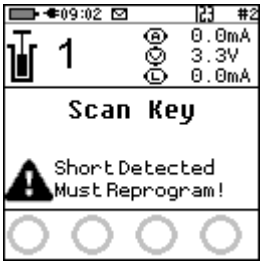
Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Wire limit exceeded	 	This warning will trigger when the cumulative detonator wire length for a channel is exceeded. The down-line wire length of each detonator is stored in memory, and the software can thus calculate the total down-wire length per channel. If this total length exceeds the set max wire limit setting 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.
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

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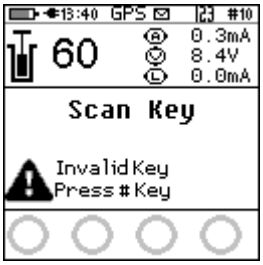
Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Untagged detonator found	Test All Untagged test Test Single det 	When the Commander detects a detonator that still has the internally recorded factory ID, which means that it has not been successfully tagged, it will trigger the untagged 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.
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

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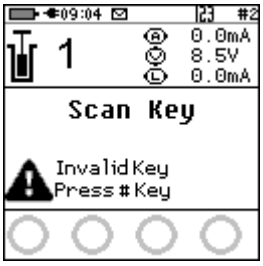
Fault Condition	Error Screen	Trouble-shooting / Remedial Action
Low Battery / Link Down / Check RF Settings		The low battery warning will be displayed when the battery has depleted to a point where blasting may be jeopardised. Recharge the battery before continuing with blasting. When the RF link is 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.
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
Last det not set		The last det not set error will occur when arming if the last dets were not set on the connected channels. The user may select to select last dets automatically where the system will assume that the last detonator in the last is the last det or the user may manually select the last det.
Missing dets after programming and reconnected		The system will display a reprogram error should dets be disconnected after programming and reconnected afterwards. The user can view the errors on the Bench Commander by pressing the # button. The system will allow the user to continue with arming on the Base Commander but the Commander will display the error message in grace, charging but the fire buttons will be greyed out in the fire menu.

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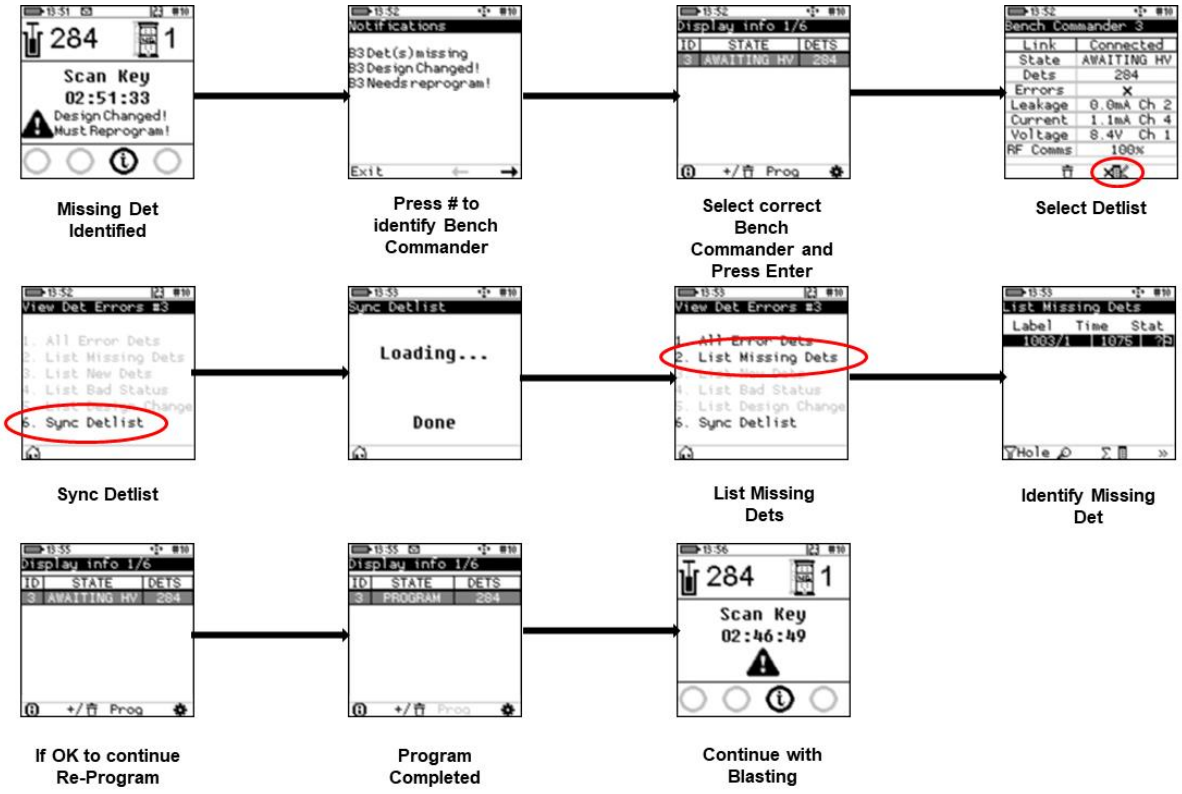
Fault Condition	Error Screen	Trouble-shooting / Remedial Action

NOTE

All detonator errors encountered after programming on the Bench Commander will be synced and displayed on the Base Commander with the relevant Bench Commander ID.

19.1. DigiShot® Plus 4G Commander System Troubleshooting: Reprogram required



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20 APPENDIX A – INTELLISHOT® COMMANDER SYSTEM PRACTICAL TIPS AND HINTS

This section provides some practical tips and hints based on previous on-bench experience to assist new users with their learning and ensure a successful deployment of the system on the bench. This document must not be regarded as a replacement for Training manuals or Quick Guides but rather as supplementary to other documentation. To ensure that this document remains useful, receiving feedback and suggestions from DetNet Channel partners and end users is important

WARNING	**LOCAL MINE, EXPLOSIVES OR STATUTORY REGULATIONS, PROCEDURES, OR CODES OF PRACTISE REGARDING SAFETY TAKE PRECEDENCE OVER ANY OF THE TIPS AND HINTS DESCRIBED IN THIS DOCUMENT. THE MOST STRINGENT SET OF RULES BETWEEN THE MINE, EXPLOSIVES OR LOCAL REGULATIONS/PROCEDURES/CODES OF PRACTISE AND THE MANUFACTURER MUST BE FOLLOWED.**

Refer to https://portal.detnet.com/http://www.portal.detnet.com/ for additional detail on Quick Guides, Channel Leakage and other documents of interest.

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20.1. On Bench Delivery of Detonators

When boxes of IntelliShot® Detonators are delivered, ensure to place boxes at a point of safety to prevent on-bench vehicles from driving over the boxes and damaging detonators.

WARNING	**IT IS IMPORTANT TO NOTE THAT ALL DETONATORS ARE IMPACT SENSITIVE AND CAN INITIATE IF EXPOSED TO EXCESSIVE MECHANICAL IMPACT.**

20.2. Distributing Detonators on the Bench

When distributing detonators on the bench the following points are important:

- Before placing detonators at holes to be primed, ensure that all connectors are properly closed to prevent ingress of moisture and/or dirt.
- Place detonators in line with the direction of drilled holes to minimise people treading or vehicles driving over detonator coils. Place coiled detonators far enough from the hole collar to prevent detonators rolling down drilled holes.
- If different lengths are used for decking purposes then place coils in the sequence of charging to reduce time and minimise confusion for the charging crew.

20.3. Priming with IntelliShot® Detonators

During priming (inserting the detonator into a booster) the following points are important:

- When removing the detonator from the coil ensure that it is removed from the opposite end of the connector to prevent tangling of the down-hole wire.
- Pull out sufficient length to thread the detonator through the booster and to be left with approximately 300mm of down-hole wire between booster and coil.
- Remove helix by gently pulling the cable between thumb and forefinger to prevent inner-cores from taking on different orientations. This could exert unnecessary tension on the crimp area.
- Thread the detonator through the booster and ensure it is properly seated.
- Pull on the incoming cable to ensure that the down-hole wire is tightly placed and properly seated in the booster saddle. Check to ensure that it is not kinked or damaged when the booster is lowered down the hole.
- Place primed detonator in a safe place to minimise the chance of treading on the primer and ensure that the connector is still in the closed position.

20.4. Lowering Detonators into Drilled Holes

When lowering booster down the drilled hole it is important to note the following:

- Pillow loading is advisable to prevent the down-hole wire being exposed to unnecessary tension when augering explosives down the hole. It also helps to prevent the down-hole wire being damaged when the booster strikes the bottom of the hole.
- When lowering the booster down the drilled hole, hold coil in one hand and use the thumb and forefinger of the other hand to guide the booster down the hole. At the same time uncoil the helix that is formed in the cable during coiling.
- When the booster hits the bottom of the hole, raise it off the bottom and tighten the cable to ensure that no kinking or coiling of the down-hole wires has occurred in the hole. Kinking/coiling could cause damage during loading or slumping.
- There are two schools of thought on how to tie the down-hole wire to the stake that must always be placed in line with the row of holes as follows:

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- The first one is to take the down-hole wire protruding from the hole and coil it three or four times around the stake, leaving sufficient slack on the fourth coil to pull the coil through the loop and then carefully tighten the down-hole wire without causing any sharp kinks in the cable.
- The second one is advisable in areas that are known for slumping of holes. Treat same as above with the exception that instead of using the down-hole wire protruding from the hole, place the remaining coil next to the stake and then coil a sufficient length from the connector side and tie in same manner as above, ensuring that tension is exerted on the down-hole wire and not on the connector interface by allowing sufficient slack between knot and connectors. It is believed that if slumping appears, the down-line wire will have sufficient slack in the coil to compensate for the slumping without the wire pulling directly on the stake. Both methods as described above have been successfully deployed globally.

WARNING	**ENSURE THAT CONNECTOR IS PROPERLY CLOSED TO PREVENT INGRESS OF MOISTURE AND DIRT.**

20.5. Charging of Drilled Holes

When charging drilled holes it is important to keep the following in mind:

- Ensure that the connector is properly closed to prevent ingress of explosives which could result in the corrosion of tines inside the connector. Corrosion of the tines will cause increased resistance during blasting.
- If Pillow loading was not done during auguring, lift the booster an appropriate distance from the drilled hole bottom and keep the down-hole wire tight to prevent it from kinking. Kinks in the wire can lead to pocket loading of the explosives; these pockets will, through time, slide down the hole and cause insufficient explosive charge per hole. Kinks may also lead to damage of the inner cores in the downline if tension is exerted on the downline wire. On completion of charging, ensure that connectors are properly closed and ensure that the down hole lead is still tied to the stake
- If Pillow loading was done, keep down-line wire tight to prevent kinks from forming inside the hole and keep down-line wire towards middle of the hole to prevent the charging hose from pushing the down-line wire against rock surface of the hole which might result in down-line wire damage. Ensure that the stake is still in place and connector still closed.

20.6. Stemming of Charged Holes

When stemming holes with aggregate it is important to do the following:

- Position the down-hole wire to mitigate damage as much as possible.
- Pull down-hole wire away from the side from which stemming material is being poured down the hole.

Ensure that all slack is taken-up to prevent kinking inside the stemming column. Kinking will result in the cable snapping if slumping is experienced.

20.7. Tagging of Charged Holes with IntelliShot® Detonators

Tagging according to a plan and ensuring all Users adhere to this plan is important to reduce errors during blasting:

- Always ensure that a proper blast and tagging plan is available and that all personnel partaking have a clear understanding of the tagging method and channel allocation. Duplicate, missing or extra detonators and/or detonators on the wrong channel will have a negative impact at blasting time if discovered on the Bench Commander.
- Ensure that CE4 Tagger head is clean and free of water droplets or emulsion especially between the two Pogo-pin connectors. This helps to prevent a conductive path between the connectors that will add

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leakage during tagging and testing.

- When tagging using the “through holes” ensure that the CE4 Tagger head is regularly cleaned and connectors closed and placed properly on the stake.
- When tagging directly on the tines, inspect the tines for alignment with harness wire guiding groves, that the spade gap is in good repair and ensure that connector is properly closed and placed on the stake
- Ensure that Tagging is performed according to tagging plan and that all detonators are tagged to prevent the system discovering extra or missing detonators during blasting
- When the connector is damaged or does not make proper contact and needs to be removed, cut the down-line wires and strip the insulation sufficient in length to fit into the Back-to Back Connector without protruding on either side of the connector as this can result in a short circuit.

WARNING	**ALWAYS USE BACK-TO-BACK CONNECTORS AS A CONNECTOR REPLACEMENT KIT.**

20.8. Harnessing of the Blast

Harnessing according to the blast design will reduce fault diagnostics. Also take note of the following:

- Always use the correct harness wire as specified in the UTM’s.
- Test roll of harness wire with CE4 Tagger to ensure it is in good repair and that no short circuits are present inside coil.
- When uncoiling the harness wire, ensure that it is uncoiled from the inside out to prevent tangling of wire.
- Where possible, connect harness wire in the same sequence as tagging, keep to the system limits and to the tagging plan.
- Open detonator connector and ensure it is free of dirt or moisture as well as being in a good condition, separate twisted pair with thumb, place harness wire onto connector aligning it with the guiding grooves and corresponding tines. Next, tighten wire over connector ensuring that harness wires are properly aligned and close connector until it clicks shut. If both wires are pushed into the same tine it will result in a short circuit. If the harness wire is not properly positioned it can become trapped between the closing lid of the connector and the top of the tine which will result in a harness break or intermittent connection, which will be time consuming when doing fault diagnostics
- When joining of the harness wire is required, always use a Back-to Back Connector to ensure a proper joint. Strip the harness wire insulation a sufficient length to fit into the connector of the Back-to Back Connector without protruding on either side of the connector as this can result in a short circuit
- Always trim harness wire ends at the end of each channel leaving no bare conductors that could touch or lie in a conducting solution as this will create a leak path and have a negative impact on the leakage measurement.

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20.9. Testing of Blast Installation

Testing the blast installation with the CE4 Tagger is the last on bench verification that the system deployment is within the required parameters:

- When a channel is completely harnessed connect the CE4 Tagger to detonator string and perform a "test all" comparing the number of detonators with the blast plan to ensure all detonators are accounted for. Check that holes not connected are treated as misfires and marked on the plan. A good rule of thumb is if leakage exceeds 0.2mA, locate the source and fix before proceeding.
- If the leakage is isolated to a single detonator, remove this detonator from the string and connect this detonator to a separate harness wire and to its own channel. During programming assign the absolute time to detonator.
- Ensure that all channels are properly tested and within system limits before connecting to lead-in harness wire.
- Ensure that all detonators are connected to the correct channels.

20.10. Testing lead-in wire and rolling out harness wire to Bench Commander position

Key points to note in testing of the Lead-in wire before rolling it out to the Bench Commander:

- Test total length of lead-in harness wire for short circuits and leakage before connecting to strings of detonators.
- Make use of Back-to-Back Connectors when joining harness wires.
- When rolling out to the Bench Commander position ensure that wires do not cross blasts or harness wires that are connected to detonators deployed to the blast, pre-split or near big rocks that might cut harness wire before the blast signal is sent.
- Keep away from high wall to prevent rolling rocks severing harness wire during deployment or rocks that may become dislodged by vibration or air blast from other blasts in vicinity.
- If lead-in harness wire requires extension, always use Back-to-Back Connectors ensuring that ends do not touch, as this could result in leakage or short circuits.

20.11. Connecting Harness wires to Bench Commander

Based on errors that have been observed during the connecting of the harness wire to the Bench Commander, the following is important to note:

- Ensure that connection points on the Bench Commander are clean and in good condition to ensure a proper connection.
- Trim Harness wire ends to prevent it from touching the connector face plate to avoid short circuits.
- Fold copper portion double to have a bigger connection area.
- Wrap harness wire around large rocks to provide slack on the harness wire connections to prevent these from being pulled out by accidental bumping or people traveling.

20.12. Setting Up RF Communication

When deciding on a suitable blast point and setting up multiple Base stations for blasting, the following must be noted:

- Ensure that all spare Commanders and CE4 Taggers in the transporting vehicles are switched OFF to prevent RF interference with Commanders used in the blast.
- If more than one Base Commander is in use, ensure that they are further than 10 metres apart to eliminate RF communication interference.

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20.13. Basic causes of leakage

- Poorly made joints when joining Harness Wire.
- Re-using Harness Wire.
- Leakage occurs when a damaged Harness Wire lies in water or emulsion. The water and emulsion are both conductive substances that can result in leakage. The same can occur if a connector is left submerged in water or emulsion indefinitely. It is advisable to raise the connectors off the ground, or at least away from standing water, if the ground conditions are very wet.
- Detonator down hole wire – holes not correctly de-sludged, rubbing of down hole line against hole wall, bent cable when lowering booster into a hole
- Detonator cable damaged around the insulation exposing the steel wire
- Ingress of water or moisture into connector
- Harness wire not properly secured inside connectors
- Short circuits occur when the harness wires are exposed and touch each other.
- SHORTS are typically identified by very high leakage errors - >19mA

CAUTION	**It is advised that once the system is tagged, tested and found to be ready for blasting that the connected control equipment is switched off until blasting time to reduce the likelihood of leakage caused by corrosion.**

NOTE	**These errors can be located and rectified using the Leakage Test in conjunction with a Binary Search.**

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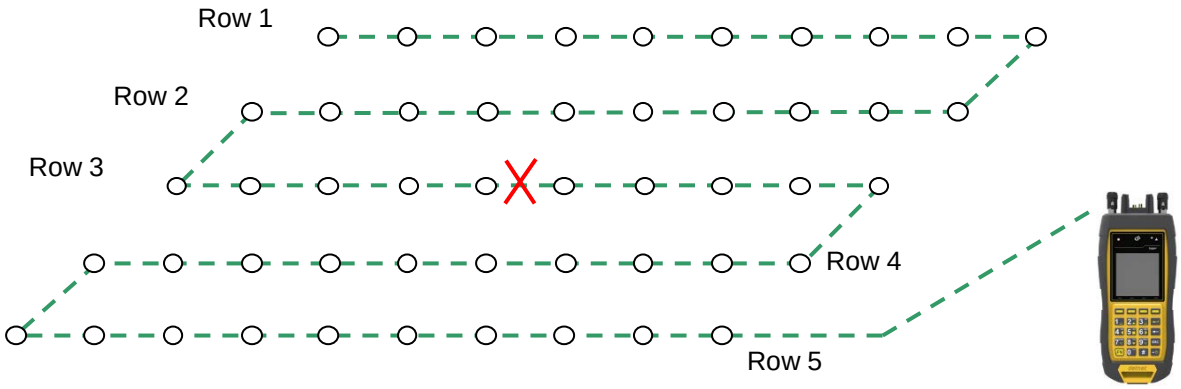
20.14. Binary Search

Untagged Detonators

Conduct a binary search by breaking down the blast into manageable sections, to locate untagged detonators.



The Binary Search is conducted as follows:

1. Assume Row 1 above has an untagged detonator connected but its location is unknown and it needs to be found.
2. Divide the blast in half and cut the surface harness at mid-point.
3. Connect the Tagger and check the back half for untagged detonators. Should the Tagger display NO UNTAGGGED DETONATORS, proceed with following step.
4. Connect the Tagger and check front half for untagged detonators. Should the Tagger now display UNTAGGGED DETONATORS it can be deduced that the problem is located in the front half of the blast. Repeat the partitioning process there.
5. Divide the front half and test backward and forward from the centre to narrow down the search area.
6. By repeating this process, the fault is narrowed down to a small and manageable area. At this point detonators may be disconnected from the surface harness and tested one at a time using the **TEST SINGLE DETONATOR** facility to locate the untagged detonator.
7. Once the untagged detonator is found, tag the detonator according to blast plan and ensure all broken wires are correctly reconnected and insulated with tape to prevent leakage problems.
8. Test Harness Wire to ensure all detonators have been identified and detected.

<u>Alternative method:</u>

If an existing blast plan is available, use the search function and check the blast summary against the blast plan to determine which row has a problem. The detonator count on that row will be incorrect.

Examine the detonator list for that row to determine which detonator in that row is missing.

There is a strong possibility that this is the untagged detonator thus checking for the untagged detonator as detailed in this alternative method may be easier than performing the binary search.

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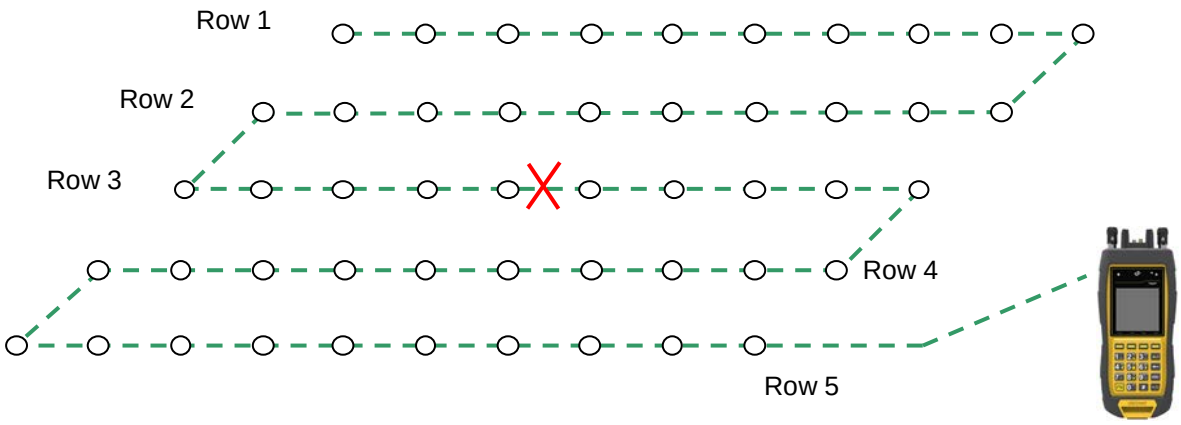
20.15. High Leakage

Conduct a binary search by breaking down the blast into manageable sections to locate high leakage.



The Binary Search is conducted as follows:

Assume Row 5 has an exposed wire in surface harness in water causing a high leakage reading on the Tagger.

1. Divide the blast in half and cut the surface harness at mid-point.
2. Connect the Tagger and check back half for leakage. Should the Tagger display high leakage it indicates a fault present.
3. Connect Tagger and check front half for leakage. Should the Tagger display satisfactory leakage it indicates no fault present.
4. Divide the front half and test backward and forward from the centre to narrow down the search area.
5. By repeating this process, the fault is narrowed down to a small and manageable area.
6. Conduct a visual inspection of the surface harness to locate the fault.
7. Fix the problem ensuring all wires are correctly sealed with insulation tape to prevent further leakage problems.
8. Test the surface harness to ensure all faults have been fixed

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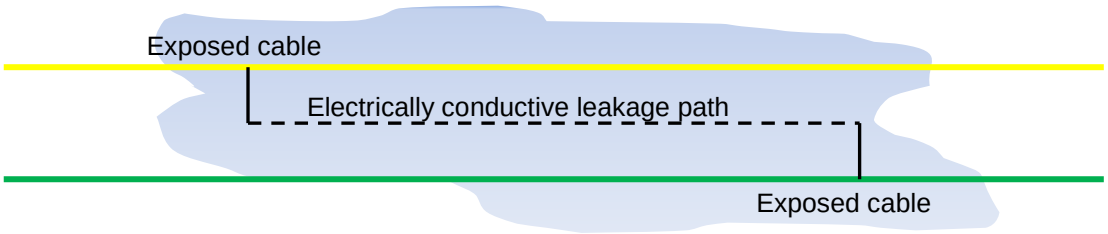
20.16. Leakage through conductive materials

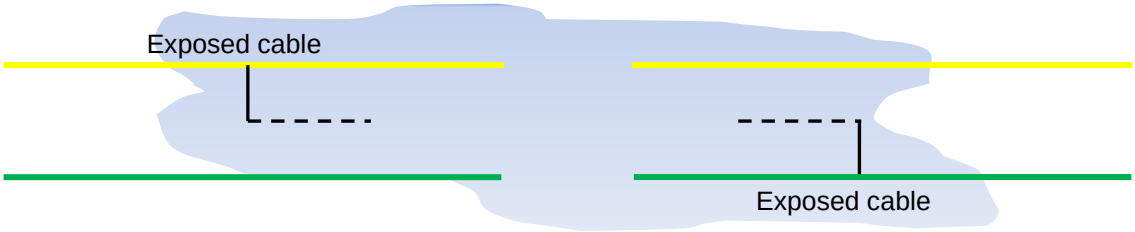
When an individual string of detonators is tested with a Tagger, the leakage reading is within specification, however, when all strings are connect together, the leakage value is outside the acceptable limit indicating that the accumulative leakage value is now outside acceptable parameters. The sum of the leakage on all the strings is greater than the acceptable level.

Damaged surface harness wire insulation and/or detonators cables cause resistance between the surface harness wires when lying in an electrically conductive material which results in high leakage.



The best way of resolving this problem is by conducting a binary search as follows.

Divide the blast in half, cut the surface harness at mid-point.

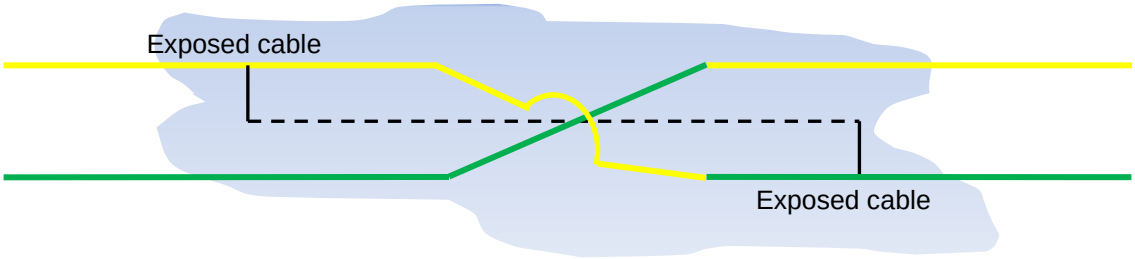


Connect DigiShot® Plus Tagger and check the rear half of the installation for leakage, Tagger displays satisfactory leakage.

Connect DigiShot® Plus Tagger and check front half of the installation for leakage, Tagger displays satisfactory leakage.

Reconnect the break in the surface wire / bus and retest surface harness, DigiShot® Plus Tagger displays high leakage indicating fault present.

Return to mid-point break, remove joint in surface harness.



Re-join the surface harness wire by crossing over the wires, **yellow wire** to **green** and **green wire** to **yellow**.

High leakage is reduced because the exposed wires A and B are now on the same line.

Ensure all wires are correctly insulated with tape to prevent further leakage problems.

Test surface harness wire to ensure leakage is within acceptable limits.

If high leakage is still present, split the blast onto separate channels in the middle of the blast.

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21 APPENDIX B – ABBREVIATIONS AND DEFINITIONS

21.1. Abbreviations

Ah	Amp-hours
CE4	4th Generation Control Equipment
DC	Direct Current
Det(s)	Detonator(s)
GMT	Greenwich Mean Time
in	Inch
IP	Ingress Protection (IP-67 = totally protected against ingress of dust; and protected against the effects of immersion between 15cm and 1m for 30 minutes)
LCD	Liquid Crystal Display
LED	Light Emitting Diode
Long-range	Maximum distance: 3km (<3km)
Med-range	Maximum distance: 1km (<1km)
mm	millimetre
ms	millisecond
NFC	Near Field Communication
OTS	Off The Shelf
PC	Personal Computer
PCB	Printed circuit board
PVC	Polyvinyl chloride
RF	Radio Frequency
RH	Relative Humidity
RTC	Real time clock
Short-range	Maximum distance: 10m (<10m)
UI	User Interface
USB	Universal Serial Bus
W	Watt

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21.2. Definitions

IntelliShot® Detonator	An electronic detonator that has been designed and developed by DetNet South Africa
Initiation point	This is the location where the blast is initiated. The initiation point is always at a place-of-safety (see below).
Initiation time	Time delays that are programmed into detonators.
Detonator harness	The cable that attaches to the detonator that allows detonators to be connected one after another. The harness has two parameters: an inter-hole length and a down-hole length.
Place-of-safety	A location specified by the main blasting authority that guarantees human safety with respect to fly rock, fumes, concussion and fall of ground.
Equipment safe	This is an area close to the bench, where equipment can be located with reasonable assurance that it will not be damaged during or immediately after blast.
Blast voltage	The principal requirements for firing an IntelliShot® Detonator are a minimum supply voltage and the fire command. The minimum voltage required to fire an IntelliShot® Detonator is known as 'blast voltage'.
Inherently safe	Equipment that is unable to transfer sufficient energy to the detonator to cause it to initiate, even in the event of failure of certain safety interlocks in the detonator and test equipment.

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