Blast Control Unit 4G Mode | UTM-00340 | Rev 2

SVN 34404 | 2019

APPROVER: 2019/04/09

Herman van der Walt yyyy/mm/dd

APPROVED

TABLE OF CONTENTS

1 USERS OF THIS MANUAL 4
1.1. End User 4
1.1.1. Requirements 4
1.2. Training 4
1.3. Information 4
2 4G BCU SYSTEM PRODUCT SAFETY 5
2.1. DetNet Safety Philosophy 5
2.2. User Safety 5
2.3. Transportation, Storage and Handling 5
2.4. Maintenance Schedule 5
2.5. Information in case of emergency 5
2.6. Warning, Caution, and Note Statements 6
2.7. RF compliance - FCC (USA) and ICES (Canada) 6
2.7.1. Unauthorised Changes 6
2.7.2. Radio Interference 7
2.7.3. FCC Class A digital device notice 7
2.7.4. Labelling Requirements for the Host device 7
2.7.5. CAN ICES-3 (A) / NMB-3 (A) 7
2.8. DISCLAIMER 7
3 BCU IN 4G MODE 8
3.1. General Description 8
3.2. BCU in 4G Mode System Limits 8
3.3. Components 9
3.3.1. Status LED's 9
3.3.2. Channel Status LEDs 9
3.3.3. Soft Keys 10
3.3.4. Arrow and Enter Keys 10
3.3.5. Numerical Key Pad 10
3.3.6. Abort and Arm Keys 11
3.4. SmartKeys 12
3.4.1. Red SmartKey 12
3.4.2. Orange SmartKey 12
3.4.3. Yellow SmartKey 12
4 OPERATION 13

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4.1. Product Mode Selection 13
4.2. View Main Menu 14
4.2.1. Corrupt System Parameters 14
4.3. View IO Channel 16
4.3.1. Soft keys 16
4.4. View Detonator List 17
4.5. Lock Design and Scan 18
4.5.1. Display Main Menu 18
4.5.2. Confirmation screen 18
4.6. Unlock Design and Scan 20
4.6.1. Display Main Menu 20
5 DEBUG 21
6 FAULT FINDING 22
6.1. Error Soft Key 22
6.2. BCU Error Codes 23
6.3. BCU Error Display Per Channel 24
7 BLASTING 25
7.1. Local blast 25
7.1.1. Using the RED SmartKey: 26
7.1.2. Using the ORANGE SmartKey: 26
7.2. Centralised Blasting 27
7.3. Surface Lock Override 27
8 RISKS 28

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1 USERS OF THIS MANUAL

DetNet endeavours to upgrade BlastWeb software annually to comply with new challenges and needs faced by Centralized Blasting users in the market. As new software becomes available, the DetNet version control policy requires that all control equipment be upgraded to ensure support is provided on the latest software version installed on Surface Blast Controllers as deployed on customer sites.

NOTE	**This manual is only to be used for the BCU System in 4G Mode and the applicable software version as displayed.**

1.1. End User

1.1.1. 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 BlastWeb BCU 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.

1.2. 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 BCU SYSTEM SHALL HAVE SUCCESSFULLY COMPLETED THE SPECIFIC TRAINING BEFORE PERFORMING ANY WORK WITH THE DEVICE(S).**

1.3. Information

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

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2 4G BCU SYSTEM PRODUCT SAFETY

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.**

2.1. DetNet Safety Philosophy

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

- SmartKeys remains 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 our 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. Transportation, Storage and Handling

BlastWeb 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 http://www.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 http://www.detnet.com/ for additional detail and documentation.

2.7. RF compliance - FCC (USA) and ICES (Canada)

2.7.1. Unauthorised Changes

DetNet South Africa has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

DetNet South Africa *n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.*

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2.7.2. Radio Interference

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

2.7.3. FCC Class A digital device notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2.7.4. Labelling Requirements for the Host device

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the FCC ID and IC of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:
Contains FCC ID: 2ARNH-0743337A

L'appareil hôte doit être étiqueté comme il faut pour permettre l'identification des modules qui s'y trouvent. L'étiquette de certification du module donné doit être posée sur l'appareil hôte à un endroit bien en vue en tout temps. En l'absence d'étiquette, l'appareil hôte doit porter une étiquette donnant le FCC ID et le IC du module, précédé des mots « Contient un module d'émission », du mot « Contient » ou d'une formulation similaire exprimant le même sens, comme suit :
Contains IC: 24476-0743337A

2.7.5. CAN ICES-3 (A) / NMB-3 (A)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe A est conforme à la norme canadienne ICES-003.

2.8. DISCLAIMER

This document forms part of the User Manual for the BlastWeb System and is considered to be confidential. This document contains restricted information for company and channel partners' application only.
Should any of the restricted information contained in this document be disclosed to any third party either intentionally or unintentionally, DetNet South Africa will not be held responsible, accountable or liable for any resulting event and or issue.

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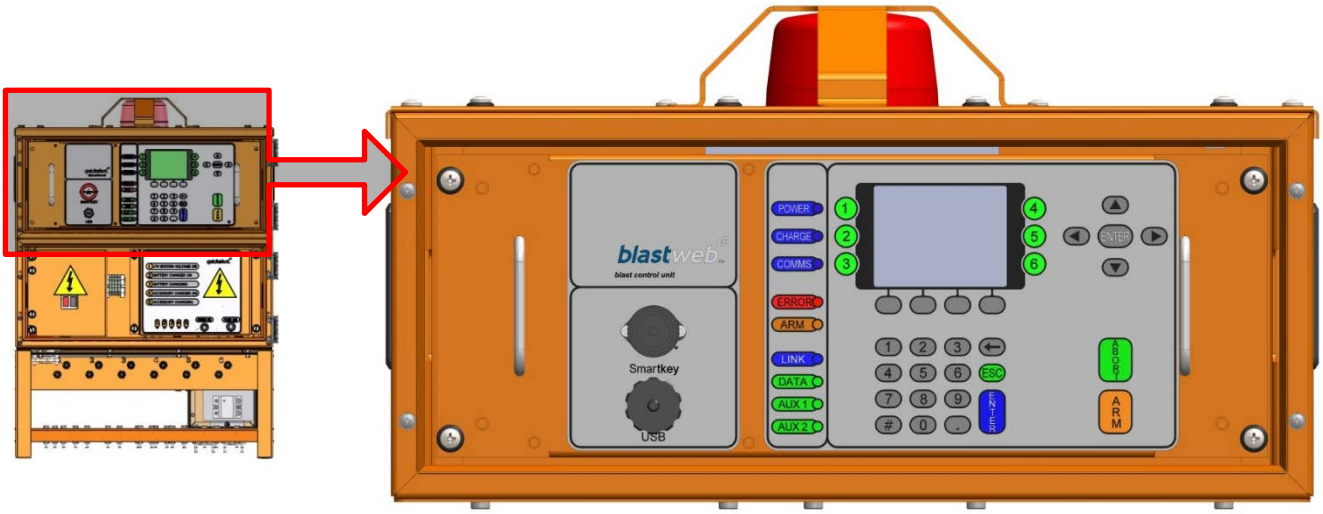
3 BCU IN 4G MODE

3.1. General Description

The Blast Control Unit (BCU) controls a maximum of 6 individual IO channels.
Each IO channel is connected through a Terminator to a maximum of 200 (combined) 4G, 3G and 4G Starter detonators.



The total maximum of 200 detonators per channel could consist of 200 4G detonators, or 150 4G detonators and 50 Starter detonators, or any other combination of 4G and Starter detonators adding up to a total of 200 detonators. 3G Starters, 4G Starters and 4G detonators may be connected on the same channel.

3.2. BCU in 4G Mode System Limits

Channels	6 individual IO channels.
Dets/Channel	• Each IO channel is connected through a Terminator to a maximum of 200 detonators. • 4G detonators and a maximum of 50 NetShock Starters may be connected to a channel simultaneously.
Power	• Powered by 115VAC 60Hz, 230VAC 50Hz or 525 VAC 50/60Hz • Battery backup
Arming	Arming through use of Yellow, Orange or Red blast keys.
Blasting	• Centralised (Remote) blasting from Surface Blast Controller using Yellow Smart Key • Direct (Local) blasting initiated by either a Red or Orange Smart Key

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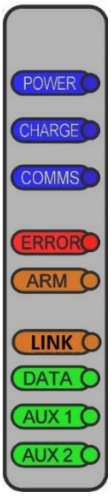
3.3. Components

3.3.1. Status LED's



Power LED - Blue LED indicates that mains power supply is connected and switched ON.

- Charge LED - Blue LED indicates the backup battery is being charged.
- Communication LED - ON/OFF Blue LED indicates communication with Surface Blast Controller (Leased Line Modem / Ethernet).
- Error LED - Red LED indicates whether there are any errors on the system.
- ARM LED – Red LED indicates the presence of blast voltage on the channel connectors as soon as the Upconverter is enabled.
- Link LED - Orange LED indicates that an Ethernet connection is established.
- Data LED - Green LED flashes every time a data pack is received from the Ethernet network
- Aux 1 LED - SmartKey is present. If relays for shutting down air / water supply are installed, AUX_1 relay will be engaged.
- Aux 2 LED – Blast and standby relay is closed. If relays for shutting down air / water supply are installed, AUX_2 relay will be engaged.

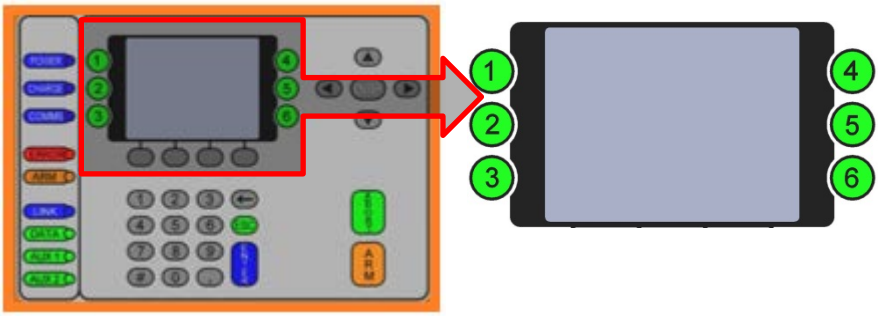
NOTE

The Status LEDs as depicted in the illustration above displays the V3 BCU.

On the V2 BCU, the position of the Link and Data LEDs are reversed.

3.3.2. Channel Status LEDs

The GREEN LED will only illuminate after two identical successful background scans for a particular channel - 1 to 6.
Green LED indicates a good installation on the applicable channel.
No LED indicates bad installation (e.g. a detonator with an error) or blast cable damaged, or nothing connected to the channel.



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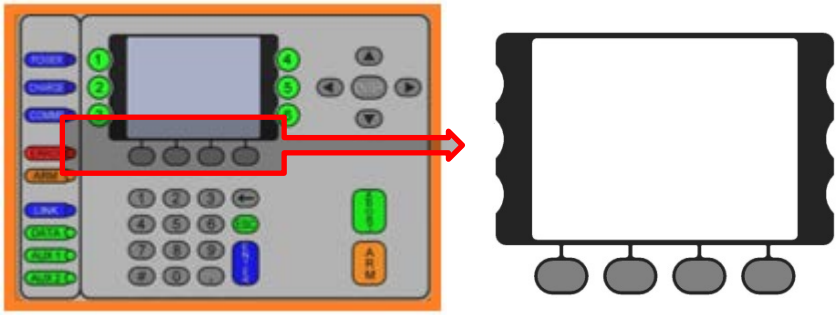
3.3.3. Soft Keys

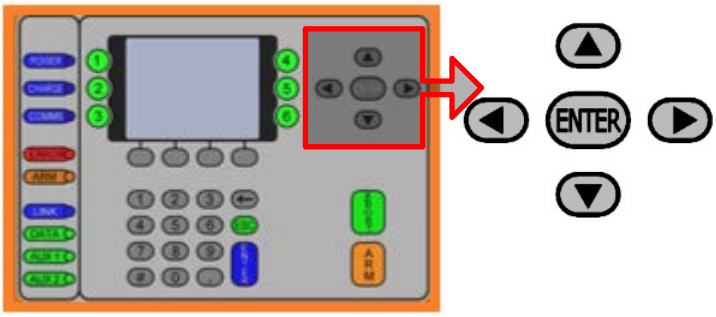
Soft key labels are displayed above the relevant Soft key. Each section will denote the specific Soft key to be pressed for certain functions. Looking at the HOME SCREEN the initial soft keys the user will see are:



- **ERROR soft key (Soft key 1)** - error code and a short description of error will be displayed on screen (if the ERROR light is illuminated at the time).
- **TIMES soft key (Soft key 2)** - depending on user permissions set, this key will only be available after BCU channel has completed two scans. When pressed, the user will be able to select the specific timing template(s) to be used either across all panels, or specify the template to be used for each individual panel.
- **DEBUG soft key (Soft key 3)** - only to be used by authorised personnel.
- **LOCK soft key (Soft key 4)** – press the LOCK soft key to lock in the number of detonators found on the harness. LOCK will ONLY be available after two good scans ON ALL CHANNELS and the user will thus be able to lock only after the GREEN channel LED on all connected channels are illuminated. A confirmation screen will be displayed after LOCK is pressed, to provide user with a summary of the detonator count per channel, and template setup (if applicable). User input for Confirmation Screen will be logged.

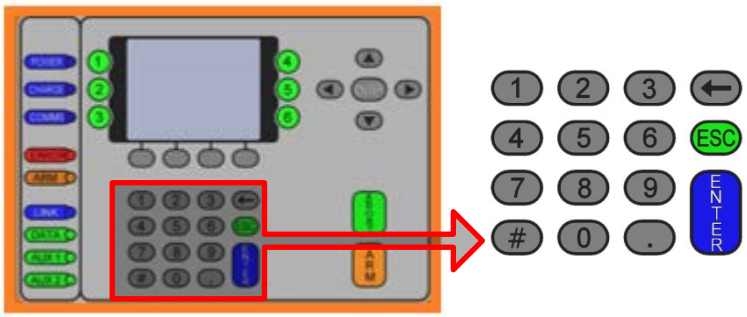
3.3.4. Arrow and Enter Keys

The arrow keys are used to navigate during actions where you may need to move left, right, up or down in an active screen.
The Left and Right arrow keys respectively, adjust the contrast of the LCD in most instances.
When viewing templates, the Left and Right arrow keys are used for paging.
The Up and Down Navigation Keys can scroll one line at a time in certain screens.
The Enter key is used to accept an on-screen activity/option.



3.3.5. Numerical Key Pad

The numerical key pad is used to enter numerical key options and/or numerical values and also to make a selection from a list of commands or menus. Pressing the numerical keys 1 to 6 from the MAIN MENU will display the corresponding IO CHANNEL STATUS screen.



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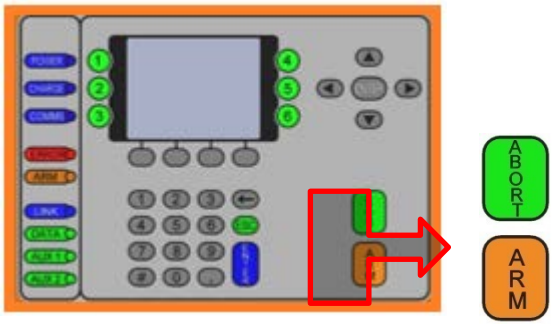
3.3.6. Abort and Arm Keys

When pressed, the abort key will immediately abort all further actions as a safety measure and will need to be re-set by removing and reinserting the SmartKey when safety protocols permit.



NOTE	**The arm key ARM is deactivated and not in use.**

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3.4. SmartKeys

SmartKeys are used to authorise and initiate a blast.

NOTE	**Grace time is standardised to a minimum period of 2 minutes, regardless of whether the key is used on a FIXED or PORTABLE BCU. Users may order certain keys (typically the ORANGE key as it does not have FIRE buttons) with longer grace times, but not less than 2 minutes. Only the Yellow SmartKey will allow re-blasting – Red and Orange SmartKeys will not allow re-blasting. Behaviour after a blast will differ on a portable device as the portable device will turn itself off after a defined duration. A yellow SmartKey blast on a portable device will allow re-arm if detonators are still detected, but will turn itself off if no arm command is received.**

Three types of SmartKeys are available as detailed below.

3.4.1. Red SmartKey

Red SmartKey initiates Local Blasting. This key is password protected and requires a PIN after key is inserted. Once the system has armed the user will need to press both FIRE buttons to send the blast command. The red SmartKey does not allow re-blasting.

3.4.2. Orange SmartKey

WARNING	**DUE TO THE AUTOMATIC INITIATION NATURE OF THE ORANGE KEY, THE USER MUST AT ALL TIMES BE AWARE OF THE CORRECT EVACUATION ROUTE FROM THE BCU TO A POINT OF PERSONNEL SAFETY WHEN HAVING TO MOVE AWAY FROM THE BCU BEFORE BLASTING.**

The Orange SmartKey initiates Local Blasting and requires only a PIN after key is inserted. After a grace period, the Orange SmartKey will cause the BCU to Program, Arm and Fire without any further user input i.e. no Fire buttons appear. The orange SmartKey does not allow re-blasting.

3.4.3. Yellow SmartKey

The Yellow SmartKey is used to initiate Centralised Blasting on a BCU connected to a Centralised Blasting Network. This is the only key that will be allowed to be inserted after a BCU is locked by the Surface Blast Controller. Note that a Surface Blast Controller lock that is issued from the controlling PC on surface is different to a detonator count lock, which is local to a particular BCU. No PIN is required for the Yellow key. A yellow key blast on a portable device will allow re-arm if dets are still detected, but will turn itself off if no arm command is received.

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4 OPERATION

4.1. Product Mode Selection

The mode will be displayed both on the BCU LCD screen as well as on the screen of the Surface Blast-Controller. The product mode deployed must be selected on the BCU from the following list:

1	QuickShot mode	(QS)
2	BCU4G mode	(4G)
3	DigiShot U/G mode	(DSUG/DSUG+)
4	DriftShot mode	(DRIFT)

NOTE	**Should the BCU not be in the BCU4G mode, refer to the DriftShot BCU Debug document (UTM-301) for detailed information on how to select the BCU 4G mode.** **For detailed information on the QuickShot, DriftShot and DigiShot U/G modes, refer to system specific documentation as it is not covered in this manual.**

With the BCU in 4G mode, detonators are allocated a location and delay though tagging in (basic, planned or advanced mode).

CAUTION	**USER MUST VERIFY THAT BCU ID, MAC ADDRESS, IP ADDRESS AND BCU MODE ARE CORRECT AFTER UPDATING BCU FIRMWARE. IN THE EVENT THAT RECOVERY FAILS, THE BCU WILL MOST LIKELY NOT BE ABLE TO COMMUNICATE WITH THE SURFACE CONTROLLER, IN WHICH CASE THE BCU WILL REQUIRE ITS SETTINGS TO BE PHYSICALLY RESET BY A USER AT THE BCU, OR REQUIRE THE USER TO RE-UPGRADE THE BCU FROM THE SBC..**

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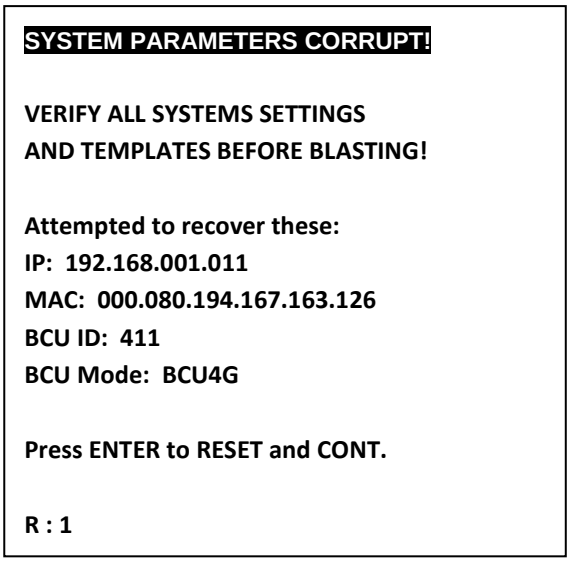
4.2. View Main Menu

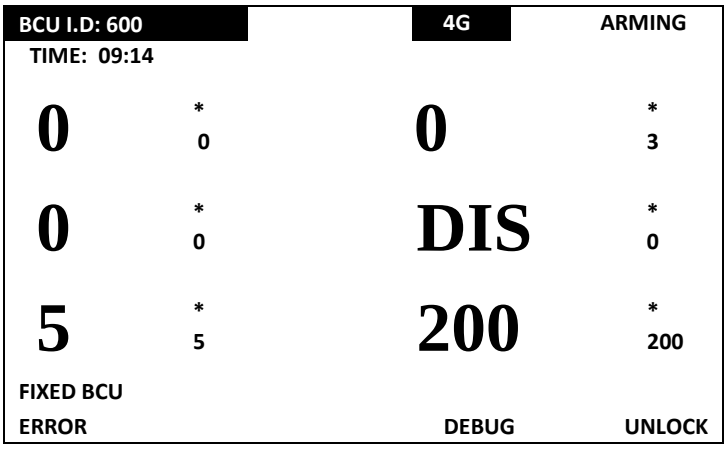
4.2.1. Corrupt System Parameters

- In the event that recovery of IP, MAC and ID fails, the BCU will most likely not be able to communicate with the surface controller, in which case the BCU will require its settings to be physically reset by user at the BCU, or require the user to re-upgrade the BCU from the SBC.



Main Menu will be displayed

- Refer to the table below for a short description of the fields as displayed on the Main Menu



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DISPLAY	DESCRIPTION
BCU ID	BCU Identification number – 600 displayed in example
TIME	Local time - 09:14 displayed in example; updated to Surface Blast Controller time when connection is established
4G	Product Mode - Indicates that BCU is in 4G mode
ARMING	Current BCU State
200 **200**	Large font number 200 indicates 200 current detonators found on Channel 6. The small font number 200 indicates that 200 detonators have been locked in for Channel 6 which is the number of detonators that will be programmed and blasted. Should the large font number not be equal to the small font number, a HARNESS BREAK has occurred or detonators have been removed, and the problem should be fixed before blasting
DIS	Indicating that a particular channel has been disabled and will not be blasted.
*	When the BCU is Locked, an asterisk will be displayed for all channels. The channels with zero detonators will display an asterisk and a 0 to indicate zero detonators locked.
ERROR	Press ERROR soft key to view error messages
DEBUG	DEBUG Soft Key – Password Protected
UNLOCK	Press UNLOCK Soft Key to unlock the locked channels. This will rescan all the channels for connected detonators.
LOCK	Press LOCK Soft key to lock all the channels after a completed scan with all channel LEDs on.

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4.3. View IO Channel

Press the numerical key corresponding with the IO Channel Number to view the required channel.

```
IO – CHANNEL STATUS SCREEN

Channel 1

Number of dets:          5

Current det:             5
Error:                   0    :  0
Leakage / Current:         0.07   /      0.13 mA
Channel Voltage:           8.66   V
T.Voltage / Count:         0.00   V  /   0
Mode:                    TESTING

LIST                                     EXIT
```

DISPLAY	DESCRIPTION
Channel 1	Selected Channel
Number of dets	Indicating the number of detonators the Channel was locked on.
Current Det	Current detonator being tested
Error	Error code number
Leakage/Current	Leakage and Current measurement on channel – Measured in milli-Ampere (mA)
Channel Voltage	Indicates the measured voltage for the particular channel
T.Voltage/Count	Terminator voltage (low voltage only) / Indicating the Terminator blast count.
Mode	Indicating current BCU mode - Idle, Testing, Arming, Blasting.

4.3.1. Soft keys

- **LIST** (Only available after first scan) – Activates a view of the firing time for detonator in the Detonator List.
- **EXIT –** Exit from current screen and returns to Main Menu.

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4.4. View Detonator List

This function enables the user to view the detonator list and times at which the detonators will start firing.

- From Main Menu press numerical key corresponding with required IO Channel Number.
- Press the **LIST** soft key to view the detonator list.
- Detonators are listed in a dual-column format with odd-numbered detonators on the left and even-numbered detonators on the right.
- Refer to the table below for a short description of the fields displayed for each of the detonators listed.

IO – CHANNEL STATUS SCREEN

Channel 1

Number of dets:	**5**
Current det:	**5**
Error:	**0 : 0**
Leakage / Current:	**0.07 / 0.13 mA**
Channel Voltage:	**8.66 V**
T.Voltage / Count:	**0.00 V / 0**
Mode:	**TESTING**

LIST **EXIT**

DISPLAY	DESCRIPTION
DET	The detonator's number in the list.
ID	The detonator's identifier. Note that the detonator's product class is not displayed.
TIME	The time set on the detonator. Note that starter detonators will have a time of zero.

4G DETLIST **[page 1 of 5]**

DET : ID	TIME		DET : ID	TIME
1 : c3dd	4228	/	2 : c3de	3758
3 : c3df	3289	/	4 : c3e0	2819
5 : c3e1	2349	/	6 : c3e2	1879
7 : c3e3	1409	/	8 : c3e4	939
9 : c3e5	469	/	10 : c3e6	0
11 : c3e7	672	/	12 : c3e8	1142
13 : c3e9	1611	/	14 : c3ea	2081
15 : c3eb	2551	/	16 : c3ec	3021

PREV **NEXT**

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4.5. Lock Design and Scan

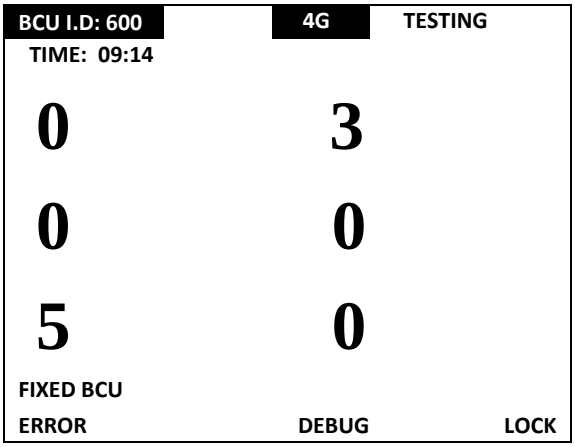
Before a design is locked, the BCU will scan for all possible detonators connected per channel. This includes the scanning of NetShock Starter (3G and 4G) detonators. Once all connected detonators are found, the channel LEDs will illuminate and the LOCK soft key will appear. The design must then be locked by pressing the LOCK softkey.

WARNING

THE DETONATORS, AS FOUND DURING THE SCAN AT THE TIME OF BEING LOCKED, WILL BE RESCANNED. ANY DETONATORS CONNECTED AFTER A DESIGN WAS LOCKED WILL NOT BE DETECTED BUT PROGRAMMED AND INITIATED.

4.5.1. Display Main Menu

Press the LOCK soft key to lock the detonators found during the scan.

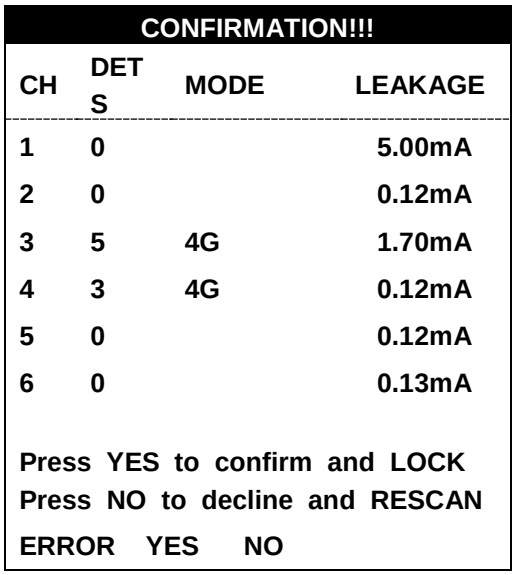


CAUTION

IT IS EXTREMELY IMPORTANT THAT A DESIGN IS LOCKED ONLY WHEN ALL DETONATORS HAVE BEEN SUCCESSFULLY SCANNED.

4.5.2. Confirmation screen

Press the **YES** soft key to lock.
Press the **NO** soft key to rescan.
Press the **ERROR** soft key to view the ERROR SCREEN when ERROR light is on.
An asterisk (*****) is displayed to indicate the locked channels.



CONFIRMATION!!!

CH	DETS	MODE	LEAKAGE
1	0		5.00mA
2	0		0.12mA
3	5	4G	1.70mA
4	3	4G	0.12mA
5	0		0.12mA
6	0		0.13mA

Press YES to confirm and LOCK
Press NO to decline and RESCAN
ERROR YES NO

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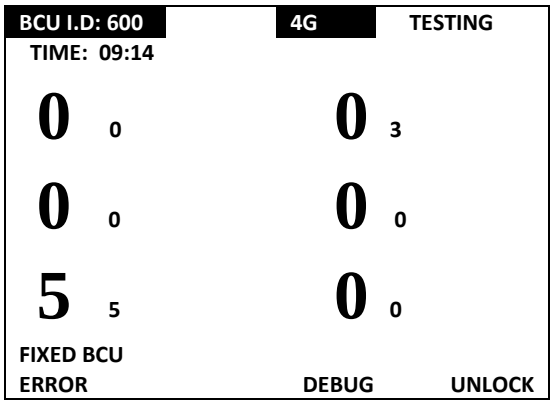
NOTE	**While the Confirmation screen is displayed, the BCU will update the channel status until either YES or NO is selected.** **Should any change occur on the 4G channels, the YES soft key will be hidden and a Channel Status warning screen will be displayed. A new scan yielding the same results will be necessary before YES soft key will be displayed again, indicating permission to LOCK** **If further scans continue to show different detonator counts, with the 'YES' soft-key hidden the user will need to press 'NO' and force the BCU to reset channels and start a new scan, or proceed to the detonator panel to fix the problem.**



NOTE	**Missing detonators and faulty harness connections are quickly detected once a channel is locked. The locked channel will indicate the maximum detonator count it was locked on (Small font number) which may be compared to the actual detonator count (Large font number).**

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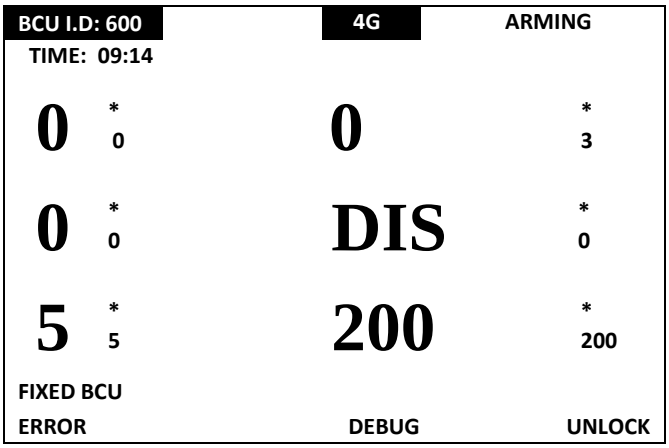
4.6. Unlock Design and Scan

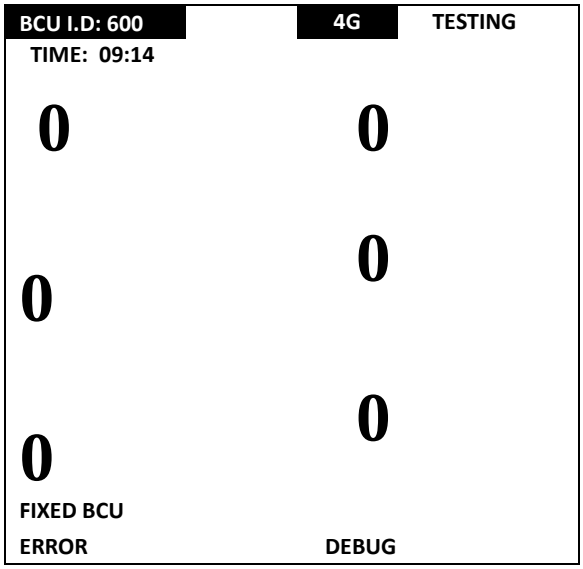
To change a locked design, the user must unlock and rescan all connected detonators.
The user shall use this option when adding or removing detonators from the detonator string.

4.6.1. Display Main Menu

- Press the **UNLOCK** soft key to unlock detonators.
- When the asterisk (*) and the small fonts are not displayed, it indicates that the channel is unlocked.



- Channels have been reset to restart scanning.



CAUTION	**UNLOCKING THE CHANNELS WILL ERASE ALL SCANNED INFORMATION AND RESCAN ALL CHANNELS.**

NOTE	**FIXED BCU: Will automatically unlock channels on power-up after complete power shut down.** **The BCU will also unlock when a SmartKey is removed, either before or after a blast.** **In the event of a bad power-cycle (power dip or bad battery) the channels will also be automatically unlocked on the next good start-up.**

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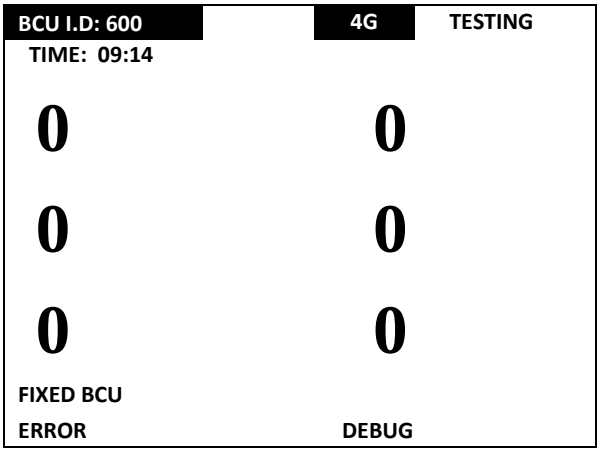
5 DEBUG

From the Main Menu, press the DEBUG soft key to open the DEBUG menu.



NOTE	**Refer to the 4G BCU Debug document – UTM-00301 for detailed debugging information.**

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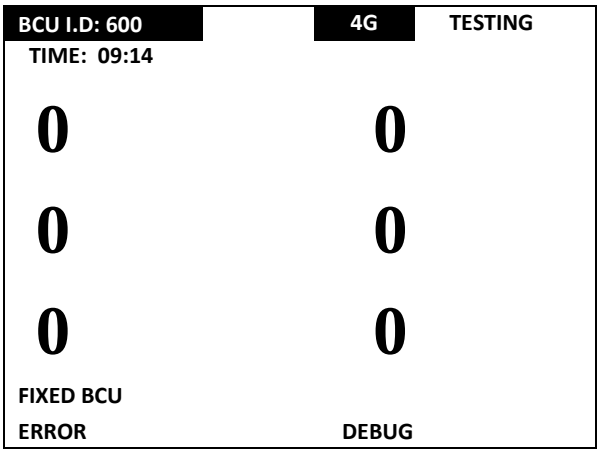
6 FAULT FINDING

6.1. Error Soft Key

This function will display errors that are present on the system.

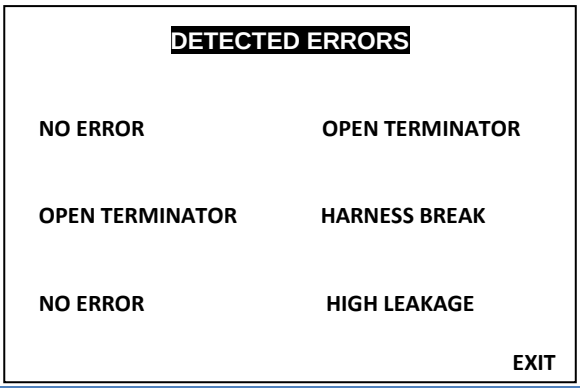
Display Main Menu

- Press **ERROR** soft key to select Error Menu.



Detected Error Display per Channel

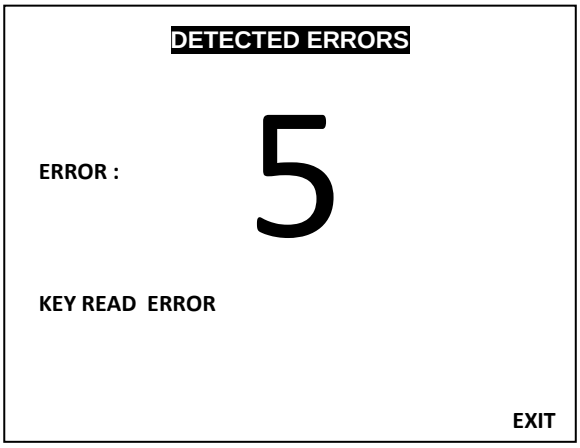
- Errors detected will be visible per channel.
- NO ERROR will be displayed when no errors are found.
- Errors related to specific channels will be displayed.



When an error occurs, the ERROR LED will illuminate with the exception of the Battery Low Error. BCU Error Codes might be displayed depending on the type and priority of the error detected.

Error code and description will be displayed.
The following error messages may be displayed:

- Key Read Error.
- High leakage.
- Short circuit.
- Det internal.
- High current.
- Harness Break.
- Untagged Det.



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6.2. BCU Error Codes

BCU ERROR CODES	CAUSES OF ERRORS	REMEDIAL ACTIONS
ERROR 2	This error is caused when there is a synchronisation error between the Maestro and Powerlock.	This is an internal error within the UI. 1. Reset the UI by switching of main power supply and then pressing the re-set button for 10 seconds. 2. If the error remains, replace the complete UI.
ERROR 3	This error is displayed when Maestro cannot communicate with the on-board flash memory and thus cannot read and/or save logs.	This is an internal error within the UI. 1. Reset the UI by switching of main power supply and then pressing the re-set button for 10 seconds. 2. If the error remains, replace the complete UI.
ERROR 4	This error is caused by a Faulty Relay when either the STANDBY or ARM relay is in the incorrect state at a specific stage of the blast cycle.	This is an internal error within the UI. 1. Reset the UI by switching of main power supply and then pressing the re-set button for 10 seconds. 2. If the error remains, replace the complete UI.
ERROR 5	This error is caused by a faulty SmartKey. It occurs when the key cannot be read or if the data in the key is corrupt or incorrect.	This is caused by a faulty SmartKey. 1. Replace faulty key with a spare key from surface. 2. The faulty key must be returned to DetNet to be repaired or replaced.
ERROR 6	This error is caused by either the UI or UPCONVERTER. This flag is raised when either Maestro cannot communicate to UI (Unable to read key-presses and/or write to the screen), or if the Upconverter has not supplied the required blast voltage at the time of firing a blast.	This is an internal error within the UI. 1. Reset the UI by switching of main power supply and then pressing the re-set button for 10 seconds. 2. A test blast must be performed after replacing the UI to ensure that error is no longer present. 3. If the error remains, replace the complete UI.
ERROR 7	This is an IO error and will be present if any of the IO-channels do not enter a DONE-STATE within a time period of three minutes.	This is an internal error within the UI. 1. Reset the UI by switching of main power supply and then pressing the re-set button for 10 seconds. 2. If the error remains, replace the complete UI.
ERROR 8 (Auto display)	BCU not locked. Automatically displays on the LCD screen once detected.	Error message is displayed when ANY SmartKey is inserted before the BCU is locked.
ERROR 9	Blast window expired.	Error message is displayed when user has not pressed the FIRE buttons within the 60 second blast window.

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6.3. BCU Error Display Per Channel

BCU ERROR DISPLAY	CAUSES OF ERRORS	REMEDIAL ACTIONS
SHORT	This is caused when at least one IO-channel has detected a short circuit on the respective IO-channel (Short in this case is defined as more than 30mA).	Check the blast cable for damage towards the face and also the harness wire and initiator connections.
HIGH CURRENT	This is caused when High Current is consumed and indicates a consumption in excess of 7mA on any IO-channel.	Check the blast cable for damage towards the face and also the harness wire and initiator connections.
HIGH LEAKAGE	This is caused when the blast cable is drawing more than 3mA of current leakage. High leakage may be detected on any IO-channel.	Check the blast cable for damage towards the face and also the harness wire and initiator connections.
DET INTERNAL ERROR	This is caused by a faulty Initiator. This Error occurs when any IO-channel detects that a detonator has an internal fault.	1. Identify the faulty initiator and replace with a functional unit. 2. Program un-programmed initiators. 3. Fix initiator using the Tagger.
UNTAGGED DET(S)	Untagged detonators on specific channel.	Untagged detonator(s) detected on the specific channel. Misfires will occur if the user does not correct the problem.
SPI BUS ERROR	The Serial Peripheral Interface bus is faulty. This means that logs cannot be stored in the non-volatile memory.	Reset the BCU and or return to factory if problem persists.
I2C ERROR	The main processor was not able to communicate with at least one other device on the I2C bus.	Reset the BCU and or return to factory if problem persists.
HARNESS BREAK	4G channel found detonator count after LOCK that is different to detonator count before LOCK.	Check the harness wire and blast cable connections; unlock the BCU to restart scanning and fix broken detonator connections, etc.
OPEN TERMINATOR	When only Terminators are connected with no dets connected to them, the ERROR screen will not display HARNESS BREAK, but will display OPEN TERMINATOR.	NO Detonators connected – User to verify terminator open/Not.
DET NOT TIMED	4G Detonator cannot be calibrated.	4. Identify the faulty initiator and replace with a functional unit. 5. Program un-programmed initiators. 6. Fix initiator using the Tagger.

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7 BLASTING

NOTE

Grace time is standardised to 2 minutes minimum, regardless of the key used on the FIXED or PORTABLE BCUs. Users may order certain keys (typically the ORANGE key as it does not include FIRE buttons) with longer grace times, but not less than 2 minutes.

7.1. Local blast

A Local blast can be initiated by either a Red or Orange SmartKey as detailed below:
The errors below only apply to the red SmartKey and the yellow SmartKey. Such errors will have to be acknowledged on the SBC when using the yellow SmartKey. The BCU will however not require the user to acknowledge errors when using the orange SmartKey. Such errors will have to be acknowledged on the SBC when using the yellow SmartKey.

If all channels are not locked at the time of inserting a SmartKey, the following screen will be displayed. The SmartKey will have to be removed in order to rectify the problem.

BCU LOCKING ISSUE

BCU NOT LOCKED!

REMOVE SMARTKEY, LOCK BCU AND RE-INSERT SMARTKEY TO CONTINUE BLASTING!

In the event of a short-circuit, low blast voltage or high blast current, the BCU will flag an error screen that the user has to acknowledge before continuing the blast, or the key should be removed to rectify the error before attempting to blast again.

- Depending on the Blast Policy (see UTM-301 for setting the blast policy) the user will either be allowed to acknowledge the errors and continue blasting, or be required to remove the Smart Key and fix the problem before being able to blast.
- Portable BCU will turn itself off roughly nine minutes after a blast unless:
    - The key is removed, OR
    - An ARM command is received by the unit.

ERROR!

THE FOLLOWING CHANNELS HAVE BEEN DISABLED DUE TO ERRORS AND WILL NOT BE BLASTED:

2, 4

PRESS ENTER TO CONTINUE

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7.1.1. Using the RED SmartKey:

- When the RED SmartKey is inserted after BCU Channels have been locked, the user is prompted to enter a PIN and on acceptance the countdown starts and activates the SIREN and STROBE.
- LCD displays a status of AWAITING GRACE PERIOD.
- Once the Grace Period is complete, the BCU goes into a Programming window.
- LCD indicates the LOCAL BLAST blasting mode.
- BCU sends ARM command to all channels.
- BCU waits 30 seconds for all detonators to charge after which BCU displays FIRE buttons and requires the user to press both FIRE Soft Keys simultaneously within the 60 second blast window.
- If FIRE buttons are not pressed within the blast window, the BCU will go into an error state and will turn off high voltage.
- After the blast the BCU will return to test mode and create a blast report on the Surface Blast Controller.

7.1.2. Using the ORANGE SmartKey:

- When the ORANGE SmartKey is inserted after BCU Channels have been locked, the user is prompted to enter a PIN.
- The Orange SmartKey will initiate Local Blast sequence on acceptance of PIN.
- LCD indicates the ORANGE KEY TIMED BLAST blasting mode.
- LCD backlight will start flashing and siren tone will sound as blasting tone to draw attention that automatic firing capability has been initiated. (The flashing screen can be stopped by pressing ENTER)
- After the grace period, the Orange SmartKey will cause the BCU to Program, Arm and Fire without any further user input.
- In the event of channels encountering an error that results in particular channels being disabled, the BCU will not halt for user acknowledgement as is the case with RED and YELLOW keys (YELLOW to require acknowledgement on Surface Blast Controller) and will continue blasting channels that were not disabled.
- After the blast, the BCU will return to test mode and create a blast report that is made available on the Surface Blast Controller.

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7.2. Centralised Blasting

- Insert a YELLOW SmartKey on completion of locking channels.
- The BCU will start counting down the specified grace window and activate the SIREN and STROBE.
- During the grace window the user must exit to a safe point; during this period the BCU does not accept commands from surface to blast. Once the grace window has expired the BCU allows remote blasting.
- LCD indicates the CENTRALISED BLAST blasting mode.
- When the grace period expires, the BCU will display READY TO ARM.
- When the ARM command from Surface Blast Controller is received by the BCU, the channels will be programmed and indicate READY TO BLAST.
- The BLAST command will be issued from the Surface Blast Controller.
- BCU status will change to BLASTING.
- After the blast the BCU will return to test mode and create a blast report on the Surface Blast Controller.

7.3. Surface Lock Override

Should the 4G BCU be locked (restricted from arming / blasting) from the Surface Blast Controller, the BCU LOCKED FROM SURFACE screen will be displayed when user inserts a Red or Orange SmartKey. Yellow SmartKeys will be allowed to be inserted – after BCU was locked for Blasting by performing the LOCK routine – either before or after the BCU was locked from Surface.

BCU LOCKED FROM SURFACE

BCU LOCKED FROM SURFACE
CENTRAL BLAST CONTROLLER !

REMOVE KEY, WAIT FOR UNLOCK FROM SURFACE, WAIT FOR BCU TO COMPLETE SCANS AND THEN REINSERT KEY TO CONT. BLAST !

NOTE

Only in the event that communication between BCU and Surface Controller cannot be re-established and the BCU absolutely has to be blasted locally, refer to the BCU Debug document (UTM-00301) for detailed information to override the surface lock.

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8 RISKS

- Ensure that the armoured cables are properly earthed.
- Note that any TAGGED 4G DETONATORS that are connected after the unit has been LOCKED will blast! Enure that no TAGGED 4G DETONATOR is connected after the unit has been LOCKED.
- Connect the supply voltage correctly.
- Ensure all Strobes and Sirens on the BCU are in working condition, as this is part of the blast warning system.
- Ensure all LED's are in working condition.
- Ensure the Backup Battery is kept in good condition and is maintained regularly. Regular testing is performed by switching OFF the mains for 20 minutes and observing whether the battery stores sufficient charge to power the system. Should it fail, replace the battery.
- Ensure all error codes are attended to before leaving the BCU.

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