DRB & DBD
User manual

DaveyTronic® SP / UG

Davey Bickford

Enaex

System	DaveyTronic® SP/UG - DaveyTronic Swift®	
Language	ENG	
Pack	64	
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Revision	3	
Equipment	DRB2	DBD
User Interface	02.02.04	02.02.00
Driver	02.00.16 03.00.16	02.00.16 03.00.16
RTOS	1.60	1.60

Read this manual

Davey Bickford

Contents

GLOSSARY OF TERMS

DT – DaveyTronic®

DTSP – DaveyTronic® Super Pit

DTUG – DaveyTronic® Underground

DRB2 – DaveyTronic® Remote Blaster 2

DBD – DaveyTronic® Blast Driver

PU – Programming Unit

DEDD – DaveyTronic® Electronic Delay Detonator

RFID – Radio Frequency Identification

UTM – Unversal Transverse Mercator

GNSS – Glabal Navigation Satelite System

System overview

DAVEYTRONIC® SP/UG system

The Daveytronic® SP/UG system is a digital blasting system where one sets comprises of the following devices and accessories:

DaveyTronic® SP system

DaveyTronic® UG system with Swift

- One or more Programming Units (PU – SP/UG/Swift)
- One Daveytronic® Remote Blaster (DRB2 – SP/UG)
- One or more Daveytronic® Blast Drivers (DBD – SP/UG)
- Bus lines
- Wire connectors
- Daveytronic® electronic detonators

Note: All information depicted in this manual applies to the functionality of the DT system. The functionality for all devices and accessories of SP and UG remain the same, where the area of application would differ from Opencast to Underground and methods used to communicate to the Network.

Note: DEDDs are completely different from conventional electric detonators. They can only be used with dedicated equipment, and cannot be initiated with a standard electric exploder.

The Daveytronic® system sets up a coded bi-directional communication between the detonators and the blasting and programming equipment.

This mode of communication between the detonators and the equipment:

- Allows programming of a delay for each detonator.
- Ensures testability at the shot and from the firing location.
- Controls the energy for each detonator up to firing time.
- Reports any anomaly to the operator.
- Prevents firing unless using the dedicated DRB2.

This technology allows for optimal control of the firing sequence precision. Additionally, the DRB2 and DBD control and supervise the entire firing procedure and ensure the correct implementation of safety procedures to guarantee the correct operation of the system.

WARNING: DaveyTronic Swift® detonators are only compatible with DaveyTronic® UG.

Safety

Radio interference

The functionality of DEDDs is not affected by electric fields with an intensity of up to 30 Volts per meter. Fields at this level are rarely encountered, as they are considerably higher than the fields emitted by standard transmission devices (telephones, cellular phones, CB, radio, etc.), or even by HV power lines.

Higher intensity electromagnetic fields may affect communication between detonators and the PUs, DRB2 or DBD, and may even damage the electronic circuit, but in no way can electromagnetic fields initiate the detonators.

Electrostatic discharges

DEDDs can resist a potential of 30 kV / 3500 pF pin to pin and pin to case charge. A discharge of this strength may destroy the electronic circuit, but it will not initiate the detonators. Discharges of this type are very unlikely in the conditions in which the detonators are used.

Lightning

Even though the DEDDs has high resistance to initiation from extraneous currents, all types of explosives and detonators are susceptible to detonate when hit by lightning. Follow all applicable regional and mine specific laws and regulations regarding the approach and progress of electrical storms.

WARNING: As a precaution, it is recommended that all loading operations should be suspended if a thunderstorm is approaching, in accordance with local laws, regulations, acts and procedures

Impact

The DEDD has the same impact resistance as conventional detonators, both electric and non-electric. The same precautions must be taken when handling DEDDs.

Misfires

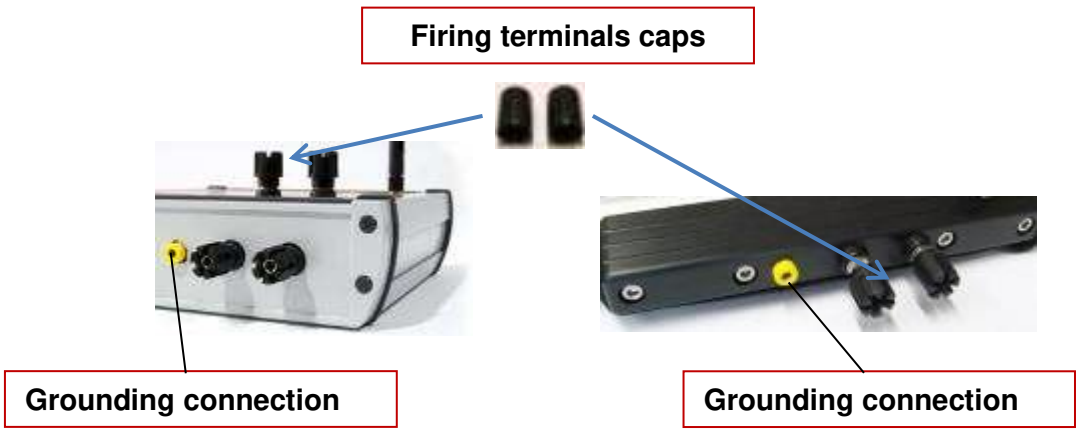
The DEDDs normally discharges its firing energy in less than one second. However, in the event of any malfunction in the circuit, a safety circuit discharges the energy in 5 minutes. This means that the maximum time after which the energy will be completely discharged is 5 minutes.

WARNING If a misfire is suspected, it should be handled always adhering and following all applicable local laws, regulations, acts and procedures.

Grounding of the equipment

The DBD in WIRELESS mode or the DRB2 in WIRED mode, may be earthed by the grounding connections (yellow plug) if conditions require.

Contact your Davey Bickford representative for suitable grounding equipment.



How to use the Firing caps

While operating with DBD and DRB firing caps are available for use if required.

NEVER touch the exposed wires of the firing line while connected to a DRB during firing

The use of firing caps is shown in the following pictures:

General precautions

WARNING:

ALWAYS use approved devices and hardware when using DEDDs.

NEVER connect DEDDs to any energy supply other than the DRB2, DBD or PU: batteries and 110/220V circuits are strictly FORBIDDEN.

NEVER connect conventional electric detonators and DEDDs to the same circuit.

NEVER connect conventional electric detonators to the DRB2, DBD or PU.

NEVER connect electronic detonators from different manufacturers to the the DRB2, DBD or PU .

NEVER use the DTSP/UG unless you have been properly trained, certificated and approved for its use as per the required regional laws and regulations.

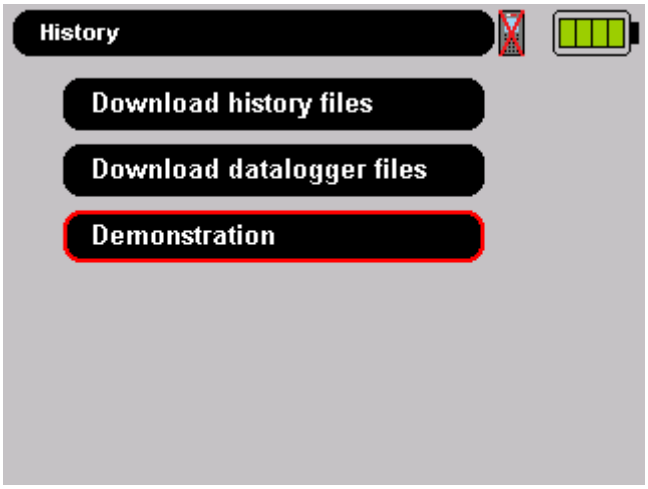
Implementation modes

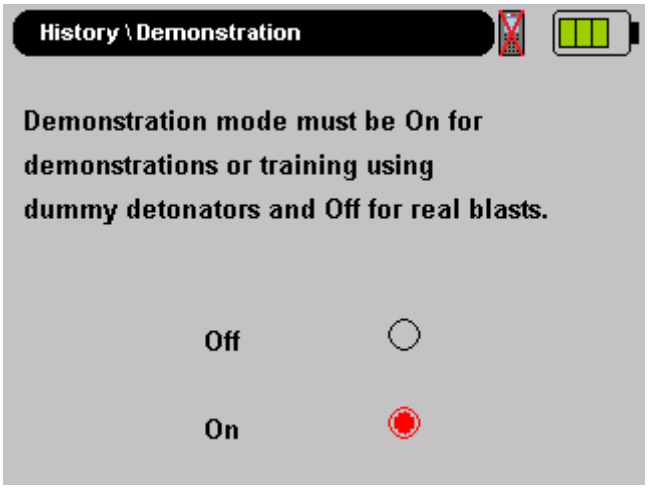
The DT SP/UG system comprises of 3 different devices: the PU, the DRB2 and the DBD. The combination of the 3 different devices allows the system to be used in various configurations suitable for various different operational needs.

Demonstration / Training mode

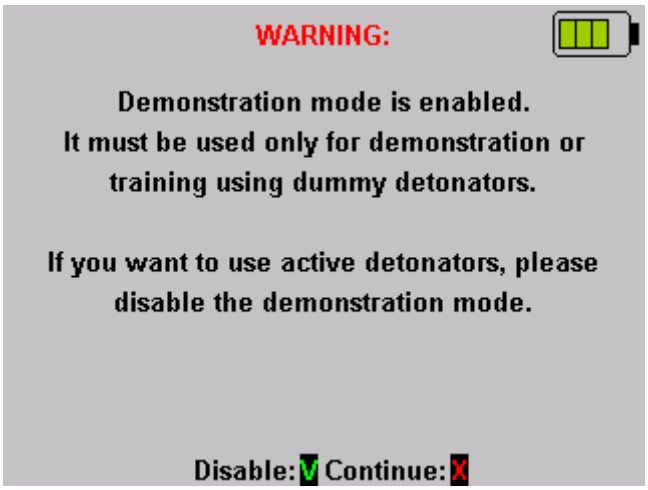
Demonstration mode is for use during training and is indicated in the system History files as such. It assists with identifying when training has been conducted with the use of Inert / Dummy detonators, and must NEVER be activated when actual blasts are to be conducted.

This mode can be activated in the ***History*** Menu





Once activated, when the DRB2 is switched ON, the following message is displayed and it is possible to disable the demonstration mode immediately by pressing the √ button.



WIRED Mode

Operating the DT SP/UG blasting system in WIRED mode requires the use of 1 up to 6 PUs, and a DRB2. The DEDDs are programmed using the PUs. The firing circuit is connected directly to the DRB2 firing terminals.

The Programming Unit (PU)

Up to 6 SP/UG PUs can be associated with a DRB2 and each PU is capable of programming and testing up to 1,000 detonators. Up to 6 Swift PUs can be associated with a DRB2 and each PU is capable of programming and testing up to 1,600 detonators.

The Remote Blaster (DRB2)

WARNING: The DRB2 provides the menu driven instructions and the energy necessary to fire the DEDDs. Operation of the DRB2 must only be carried out from a safe firing location, always adhering and following all applicable local laws, regulations, acts and procedures.

In WIRED mode the DRB2 manages its proper network, carries out checks of the functionality of each DEDD on the firing circuit and then transmits the secure commands to fire each DEDD.

The DRB2 can manage a maximum of 1500 DEDD on its proper network (contact your local Enaex representative for more information).

WIRELESS mode

The DT SP/UG system can also be operated in WIRELESS mode. The WIRELESS configuration requires a DRB2, 1 DBD in Monoblast, up to 8 DBDs in Multibast, 3 DBD in Synchroblast and up to a maximum of 6 PUs per DBD.

The DBDs are connected to the firing circuits and are placed close to the shot, in an area protected from fly rock. The DRB2 is used from the firing location in a safe area for the operator.

The location and distance from a blast, of the DBDs are specified as per the local Enaex representative and should be adhered to at all times.

The Programming Unit (PU)

Up to 6 PUs can be associated with a DBD and each PU is capable of programming and testing up to 1,000 detonators.

The Remote Blaster (DRB2)

WARNING: The DRB2 transmits the menu driven instructions necessary to fire the detonators. Operation of the DRB2 must only be carried out from a safe firing location, always adhering and following all applicable local laws, regulations, acts and procedures.

In WIRELESS mode, the DRB2 sends orders and receives information from the DBD by means of bidirectional wireless communication. At all times, the DRB2 screen displays the status of the DBD.

Blast Driver (DBD)

WARNING: The DBD executes the received instructions and provides the energy necessary to fire the detonators. Remotely controlled operation of the DBD by the DRB2, must only be carried out from a safe firing location, always adhering and following all applicable local laws, regulations, acts and procedures.

The DBD is remotely controlled by a DRB2. The DBD manages its network, carries out checks of the functionality of each detonator on the firing circuit and then transmits the secure commands to fire each detonator when ordered to do so by the DRB2

Monoblast / Multiblast / Synchroblast®

The blast can be operated in three different ways, Monoblast Multiblast and Synchroblast®.

Monoblast is used to operate a single DBD connected to a single or multiple shots in WIRELESS mode.

Multiblast is used to operate multiple DBDs connected to multiple shots in WIRELESS mode.

WARNING: The operation of the DRB2 and DBD must only be performed when safe and authorized to do so and when the mine has been evacuated. Remotely controlled operation of the DBD by the DRB2, must only be carried out from a safe firing location, always adhering and following all applicable local laws, regulations, acts and procedures.

In Multiblast, each DBD is independent from the others.

Synchroblast® is used to manage more than 1500 detonators in a single blast.

In Synchroblast® all the DBDs are connected together with a wire through the SYNCHRO terminals and one DBD is the master of the others to synchronize the fire command.

For safety reasons, the Synchroblast® feature can be disabled for a customer where no training has been done. Advantage: Without Synchroblast®, the firing mode detection is not done, while with Synchroblast® activated it can take from 10 to 45 seconds.

Synchroblast® can be disabled by your local Enaex representative. When not available the following screen is displayed when the DRB2 is switched ON.

WARNING: Synchroblast® cannot be used if the blast includes DaveyTronic Swift® detonators.

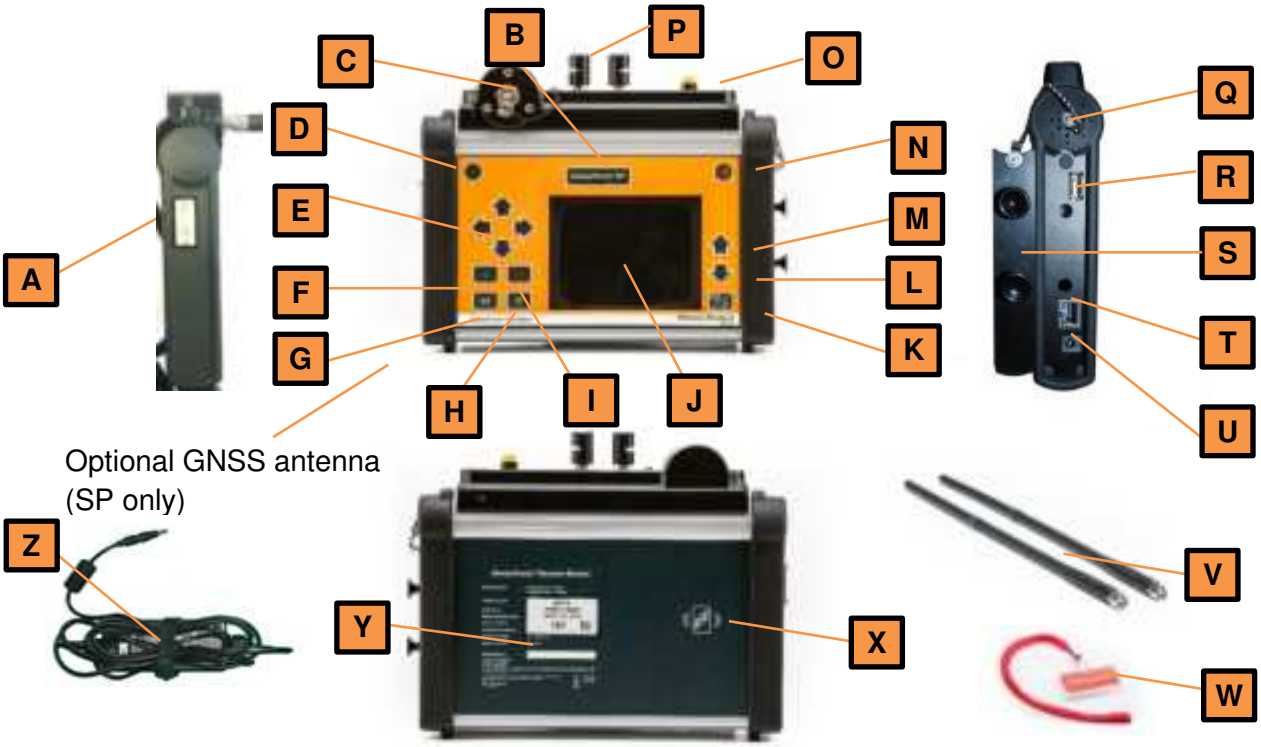
Firing in WIRED mode

Presentation of the Remote Blaster (DRB2)

In **WIRED** mode, the DRB2 manages its network, carries out checks of the functionality of each detonator on the firing circuit and then transmits the secure commands to fire each detonator.

The DRB2 can manage a maximum of 1500 Daveytronic® detonators on its network (contact your local Enaex representative for more information).

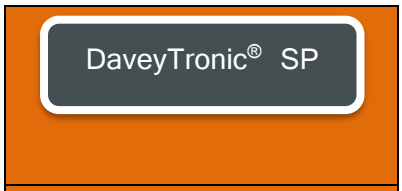
WARNING: The DRB2 provides the menu driven instructions and the energy necessary to fire the detonators. Operation of the DRB2 must only be carried out from a safe firing location, with full regard of applicable safety regulations.



A	RS232 serial port	J	Screen 5”7 ¼ VGA	S	Dustproof plate
B	ON/OFF button	K	MODE button	T	Ethernet port
C	Antenna RP-TNC connector (only SP)	L	Arrow button down	U	Charger socket
D	CHARGE button	M	Arrow button up	V	Antenna
E	Arrow buttons	N	FIRE button	W	RFID card
F	ENTER button	O	Earthing connection	X	RFID reader
G	LIST button	P	Firing line connection terminals	Y	Label
H	Backlight button	Q	Speaker	Z	Charger
I	CANCEL button	R	USB port		

Buttons

The DRB2 operating controls include 14 buttons described below:



DAVEYTRONIC ON/OFF button :
- Switch ON (hold for 1 sec)
- Switch OFF (hold for 1 sec)

ENTER button:
- Choose selected menu
- Confirm

CANCEL button:
- Exit to previous menu
- Cancel previous selection

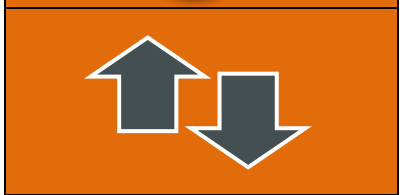
LIST button:
- List all programmed delays

BACKLIGHT button:
- Switch on the screen and buttons backlight

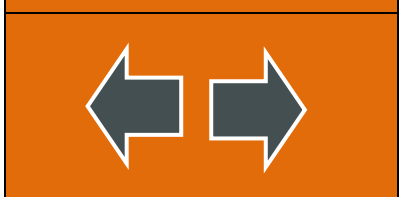
MODE button:
- Switch from configuration to operational mode and vice versa

CHARGE button:
- Must be held to charge the detonators

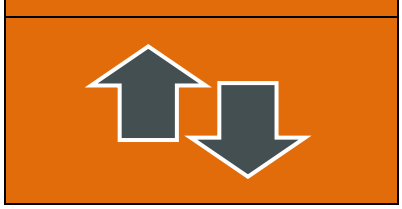
FIRE button:
- Press while CHARGE button is still held to fire the detonators



UP and DOWN ARROW buttons (on left side of screen):
- Scroll characters in blast plan name
- Change field



LEFT and RIGHT ARROW buttons (on left side of screen):
- Access to configured menu (in operating mode)
- Change value or settings within field
- Change field in blast plan name



UP and DOWN ARROW buttons (on right side of screen):
- Change network in operating mode

RFID Card

The RFID card is the security tag of the system. Without an RFID card, the DRB2 cannot enter into operational mode and consequently cannot manage blasts.

The DRB2 is able to manage 2 different RFID cards:

- First one for Testing (should always remain in the shot firer's possession)
- Second one for Firing (should always remain in the blast controller's possession)

The RFID cards can only be associated to a DBR2 by means of the specific DRB2 Administrator menu.

Use the RFID card for identification: slide the card on the rear side of the DRB2 where the “RFID” symbol is located.

WARNING: Upon arrival at the shot location, the RFID security tag must be held by the shot firer at all time.

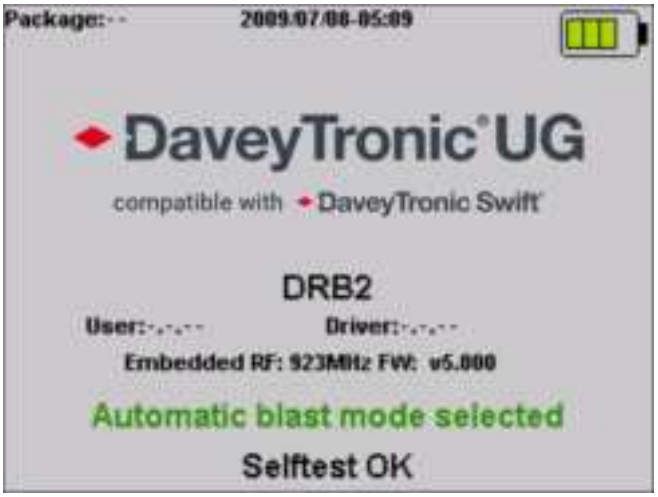
Refer to the « Safety lockout » paragraph for more information regarding the RFID Tag feature.

Basic functions of the DRB2

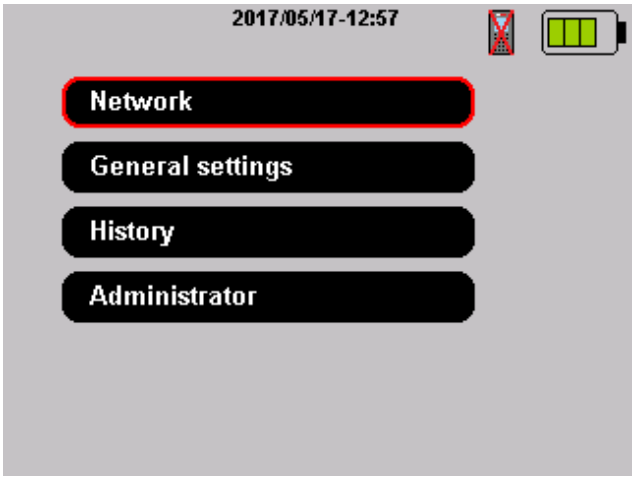
Switch ON/OFF

Switch ON

Switch on the DRB2 by pressing the  button: the charge and fire buttons light up, and the DRB2 carries out a self-test. The DRB2 displays the User, the Driver software version, the Package version the blast mode and the integrated modem type and firmware. The date and time is also displayed.



A few seconds after the self-test is successfully completed, a short beep is generated. The following screen then appears displaying the **MAIN** menu



NETWORK gives the users access to **Read PUs**, recover PU data with **Copy PU to PU**, performing a **Wireless test** and if activated **Read exclusion zone** and setting the **Time windows**

GENERAL SETTINGS give the users access to the **Language**, **Display**, **DRB2 Modem**, **Time - Date**, **DBD modem** and the **About** page.

HISTORY allows users to download the events recorded during a firing procedure

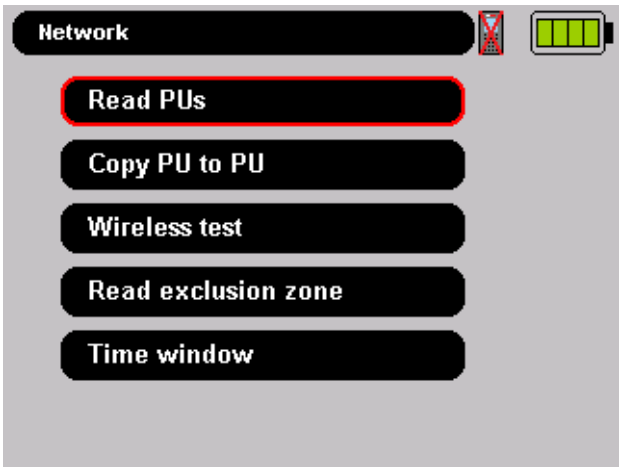
ADMINISTRATOR allows users to reconfigure an RFID card or updating the software version

Switch OFF

Switch off the DRB2 by pressing and holding the  button for 1 sec.

NETWORK menu in SP

On the **MAIN** menu, when the DRB2 is first switched on, the icon is displayed on the top right of the screen and means that no data has been transferred yet. Press to confirm the selection of **NETWORK**. Screen below is then displayed, offering the following menus

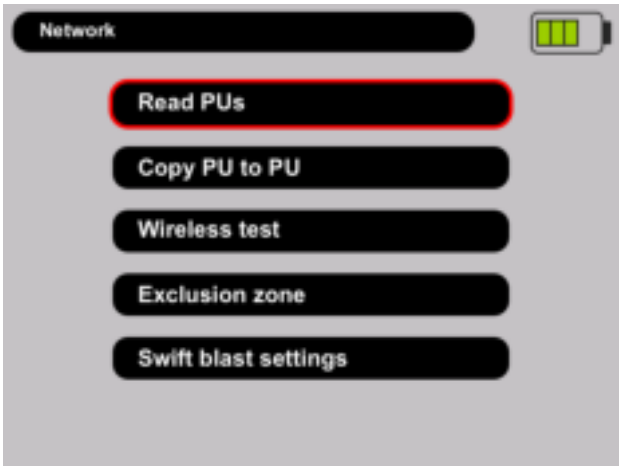


- **Read PUs** to transfer blasting plan data from a PU to the DRB2
- **Copy PU to PU** which allows recovering of data from a PU that is out of order
- **Wireless test** to perform wireless communication tests and is available in SP only
- **Read exclusion zone** used to upload the exclusion zone for the safety lockout feature from a USB key
- **Time Window** to configure the time slots when blasting is allowed by the system

NOTE : Some MENU options, such as Time Window, will only be visisble if activated by Enaex personnel.

NETWORK menu in UG

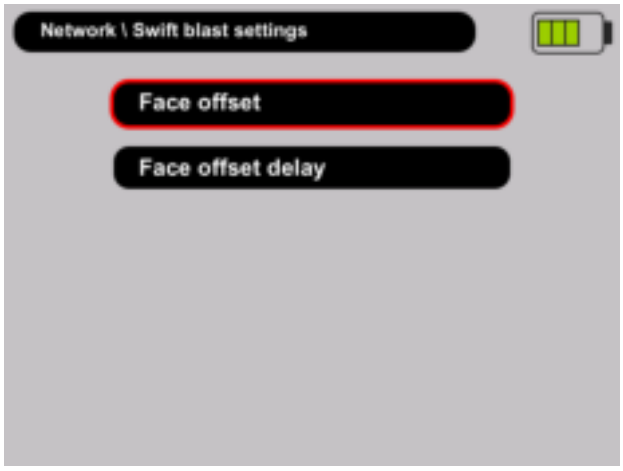
In UG the **SWIFT BLAST SETTINGS** are added to the **NETWORK** menu.



- **Swift blast settings** allows to set the face offset and face offset delay settings.

SWIFT BLAST SETTINGS menu in UG

In UG the **SWIFT BLAST SETTINGS** which contains the **FACE OFFSET** and **FACE OFFSET DELAY** are added to the **NETWORK** menu.



The face offset is a simple delay parameter that the user can add to avoid having too many dets firing at the same time when blasting several headings. It allows the site to reduce vibration in sensitive areas.

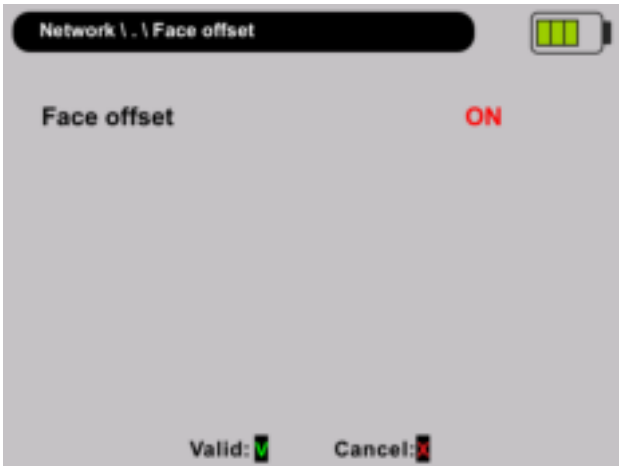
This delay will be applied to the first delay category of each face accordingly to the firing order set during the face selection.

By default, this feature is set on OFF.

The following example displays the firing of 3 faces ranked in a define order with a face offset of 1 025 ms. By adding this delay, the total blast duration is 10 050 ms.

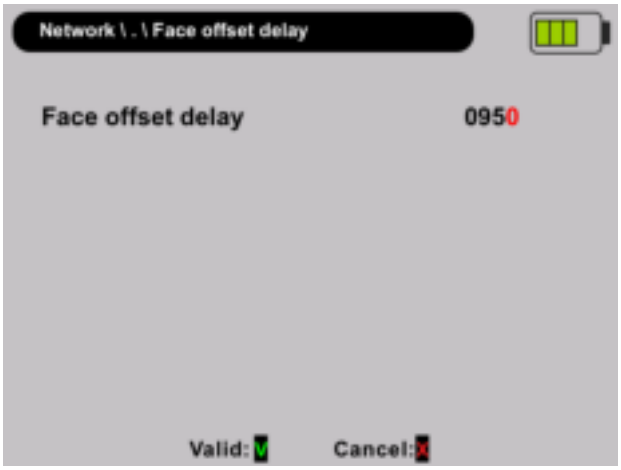
Face offset

This setting allows to turn **ON** or **OFF** the face offset using the ◄/► of the DRB2.



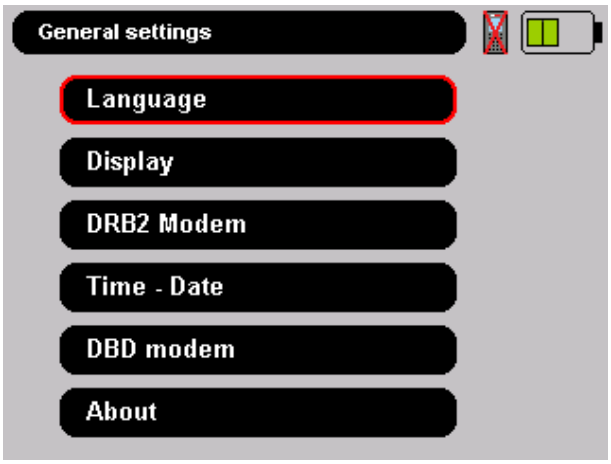
Face offset delay

This setting allows to set the face offset delay from 1 to 1500 ms. Use the ◄/► of the DRB2 to switch between numbers and use ▼/▲ on the left hand side of the device to change each number.



GENERAL SETTINGS menu

On the **MAIN** menu, use ▼/▲ on the left hand side of the DRB2 to select **GENERAL SETTINGS** and press √ to confirm. Six menus are then available: **Language**, **Display**, **Modem**, **Time – date**, **DBD modem** and **About**.

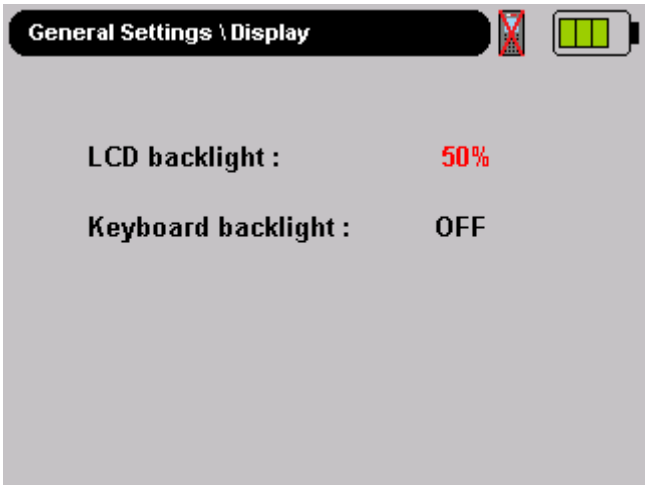


Language

Select the appropriate language with ▲/▼ on the left hand side of the DRB2 and confirm with √. Use X to exit to the **GENERAL SETTINGS** without changing the language.

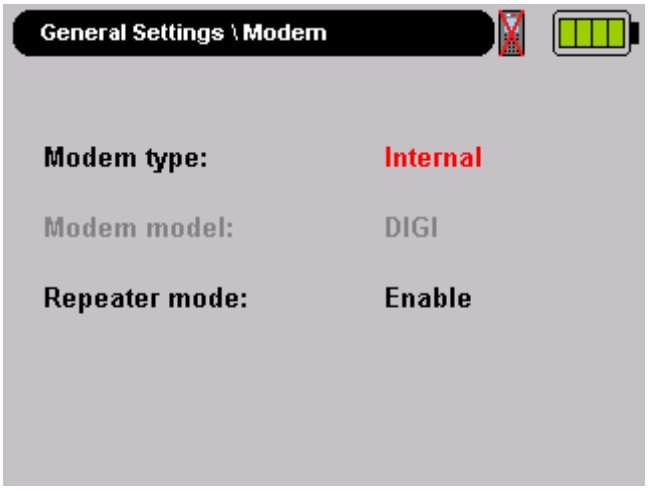
Display

The display properties can be configured as indicated in the screen below. Increase/Decrease the backlight level by using the left ▲/▼ of the DRB2. Change the selection between **LCD backlight** and **Keyboard backlight** using the ◀/▶ of the DRB2. Select ON/OFF using the left ▲/▼ of the DRB2. Confirm new parameters with √ or use X to exit to the **GENERAL SETTINGS** without taking the modification into account.



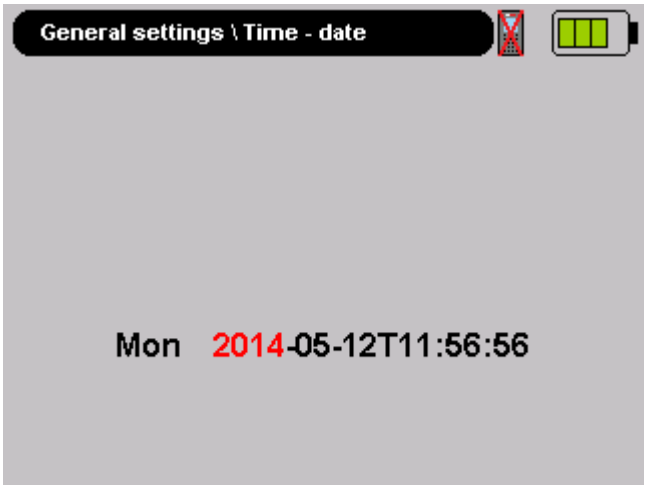
DRB2 Modem

As indicated in the screen below, the operator can select between Internal/External modems and configure repeater setup. Refer to the chapter "Setup blasting system for wireless mode".

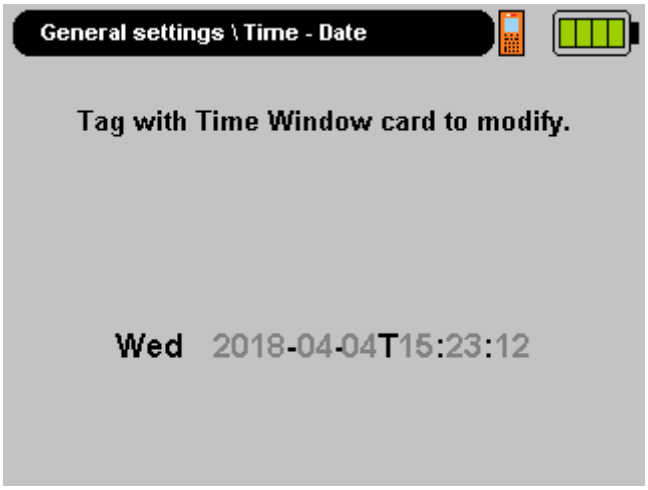


Time – date

As indicated in the screen below, the user can modify the time and date. The highlighted parameter can be changed using the left ◆/◆ of the DRB2. To change the selected parameter value, use the left ◆/◆ of the DRB2. Press √ or X to return to the **MAIN** operating screen



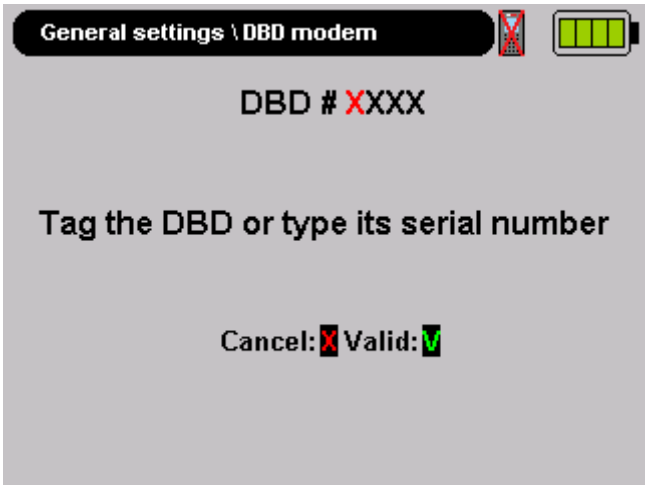
WARNING: If the Time windows feature is activated, the date / time of the DRB2 can only be changed after tagging the "Time Window" RFID card. Refer to the below:



NOTE: Pressing X will not undo the modifications as in the other setting menus.

DBD modem

This menu enables the user to configure the wireless communication mode of the DBD, refer to the related chapter "Setup blasting system for wireless mode".



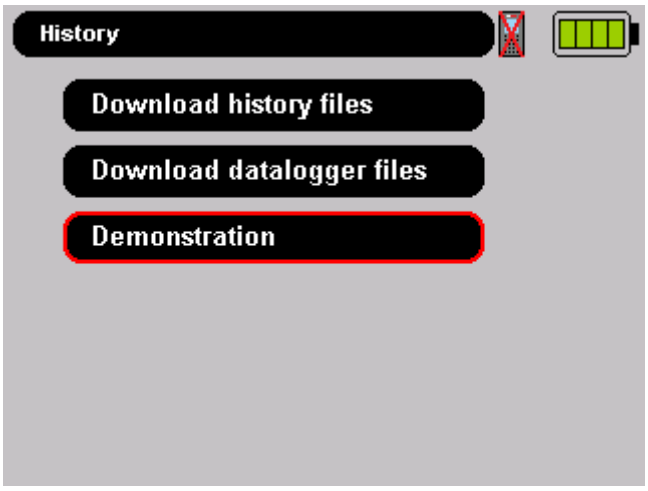
About

This screen display technical details of the DRB2 incl. battery capacity.

HISTORY menu

On the **MAIN** menu, use the left ▲/▼ of the DRB2 to select **HISTORY FILE**, press √ to confirm. The screen below is then displayed giving users access to 3 menus:

- **DOWLOAD HISTORY FILES**: to download the history of the events recorded by the DRB2
- **DOWNLOAD DATALOGGER FILES**: to download the saved data logged during firing procedures
- **DEMONSTRATION**: to activate or deactivate the demonstration mode



A USB key has to be connected to the DRB2's USB port to proceed to download of the history or datalogger files. Refer to the related chapter "

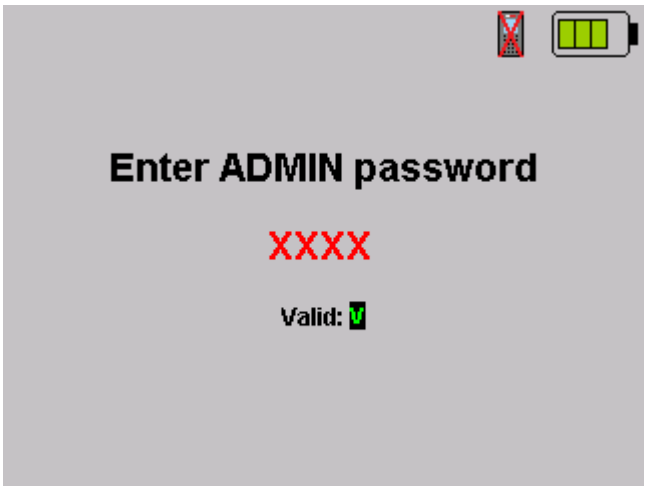
History and Datalogger File Transfer".

Note: Plug in the charger during the data transfer, as it will avoid a complete battery discharge. The downloading process may take several hours to be completed if large blast have been fired with these units

ADMINISTRATOR menu

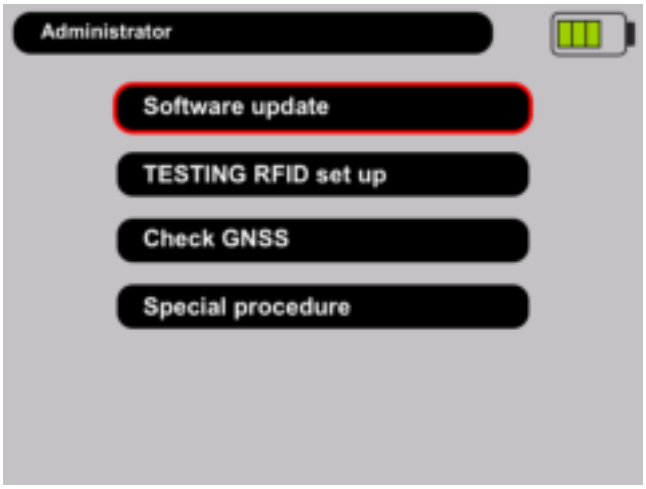
The **ADMINISTRATOR** menu gives access to:

- **USER INTERFACE SOFT UPDATE**: Update the user interface software
- **TESTING RFID setup**: Allows to associate the TESTING RFID safety tag to the blasting equipment
- **FIRING RFID setup** : Allows to associate the FIRING RFID safety tag (equivalent of the charge button) to the blasting equipment
- **Time Window RFID setup** : Allows to associate the Time Window RFID tag to the blasting equipment

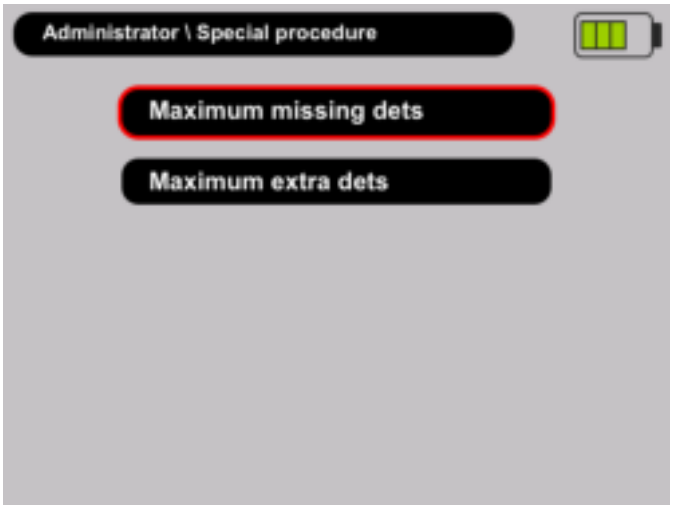


The **ADMINISTRATOR** menu can only be accessed by means of various administrator passwords for various administration functions. Contact your Enaex representative for access. The FIRING RFID setup is only accessible through a specific administrator password.

If a GNSS accessory is installed on the DRB2, a Check GNSS menu is available. This feature is described in the Safety lockout section of this document.



Special procedure



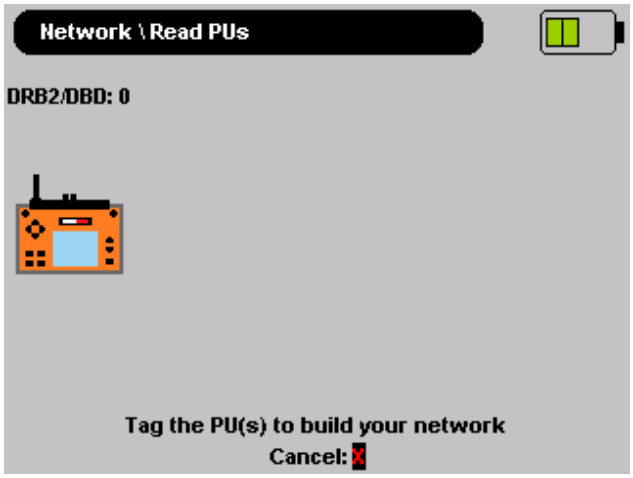
This additional setting allows to set a maximum amount of extra or missing detonators that can be fired with a Special Procedure.

The default value is 0 for both errors.

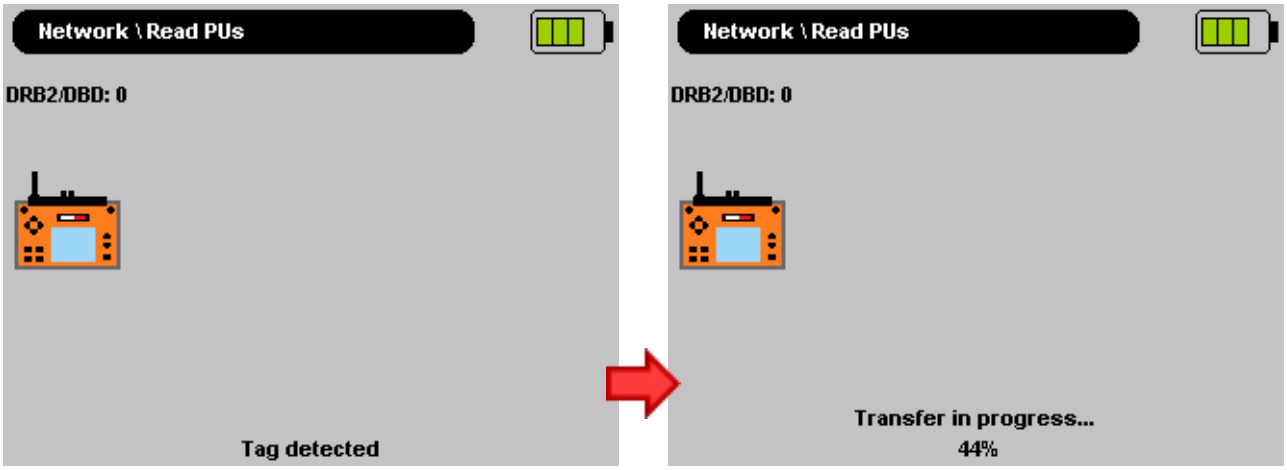
PU to DRB2 data transfer

The PU contains all the programming data (network name, associated DRB2 / DBD, detonator's unique ID number, sequence number and delay) in its RFID tag. After programming and circuit testing with the PU is finished, and before starting the firing procedure, the stored data must be transferred from the PU to the DRB2. The blasting plan data transfer is done through RF communication between the RFID tags of the PU and the DRB2.

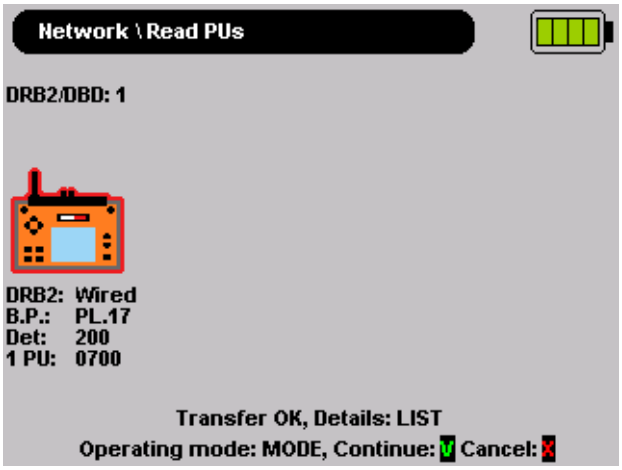
On the **MAIN** menu, when the DRB2 is first switched on, an icon is displayed indicating that no network has been defined. Use the left / of the DRB2 to select **NETWORK** and press. Press again to enter the menu **Read PUs**.



The DRB2 must read the PU's RFID tag in order to transfer the data. Switch off the PU, and tag the PU lining up the RFID logo of the PU with the logo on the DRB2. It will display "**TAG DETECTED**" and start the data transfer.

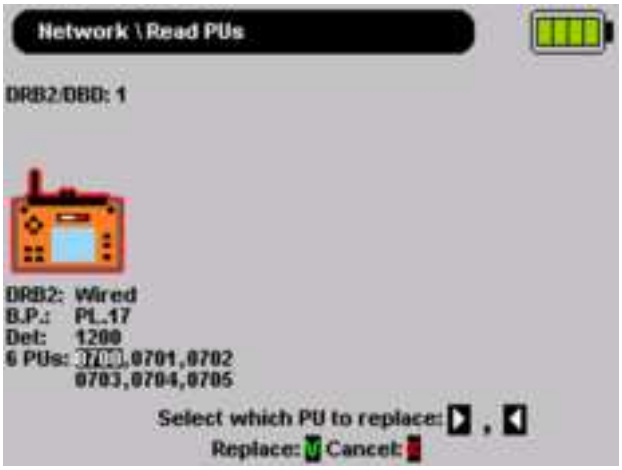


When the transfer is completed a summary of the transferred data is displayed showing ***"Wired"*** (Wired mode), the total number of detonators and the blast name. Number of DRB2/DBD is incremented to 1.

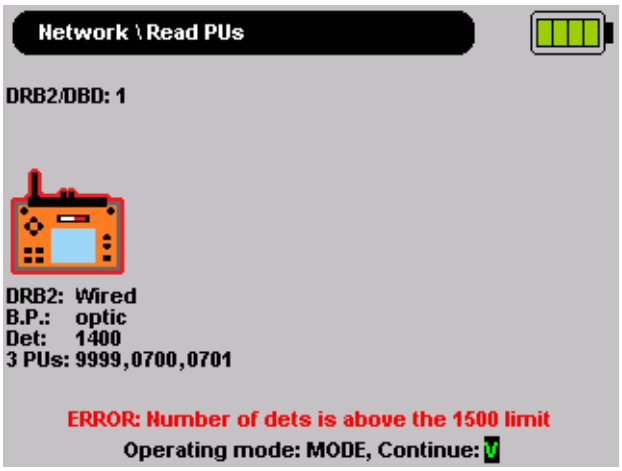


Press √ to continue and tag another PU or press X to exit and to return to the **NETWORK** menu.

Note: Up to 6 PUs can be downloaded to the DRB2 per associated equipment, if the operator tags a 7th PU, the screen below is displayed. It will prompt the user to select a PU to be replaced to allow for the download of the current tagged PU. Select the desire PU with ◄/► and press √ to validate replacement or press X to cancel replacement.



Note: No more than 1500 detonator can be fired per DRB2 in WIRED and DBD in WIRELESS, if the detonators downloaded exceeds 1500, the screen below is displayed.



Note: If the message "PU NOT COMPATIBLE" is displayed, it means that the tagged PU is not compatible with the SP/UG system software.

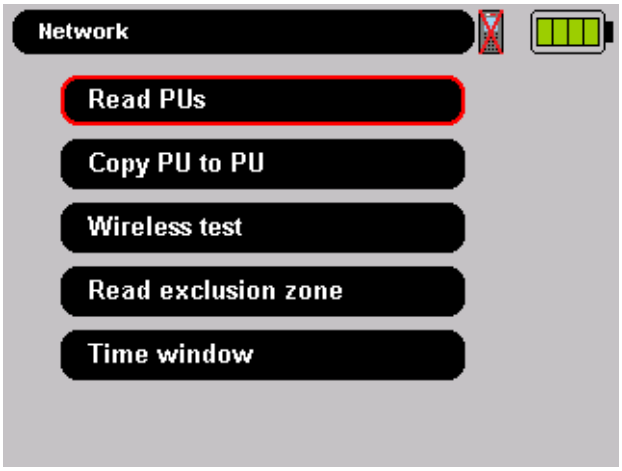
Note: If message "No data to transfer!" is displayed, it means that the blast plan of the tagged PU is empty.

Note: If message "TAG CORRUPTED OR NOT COMPATIBLE" is displayed, contact your Enaex representative.

Firing window

The firing assists with additional safety, where it is possible to only allow the firing procedure to be conducted during only predetermined time windows.

Time Window can be set up in the Network Menu.



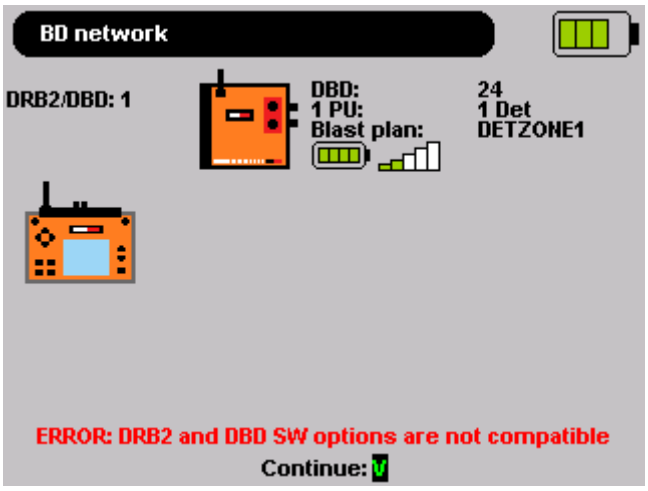
A maximum of 3 Time windows can be set. The window duration is fixed and depends on the number of windows:

- 1 window of 4 hours / day
- 2 window of 3 hours / day
- 3 window of 2 hours / day

These time windows allows firing every days without any limitation.

This feature is optional and can be activated by your Enaex representative.

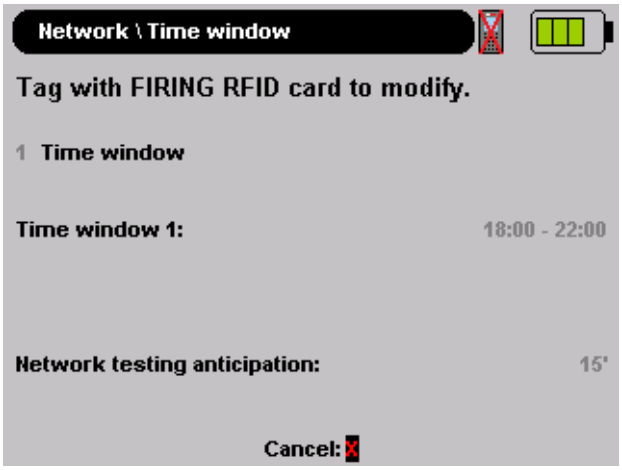
Note: All the equipment must be configured with this feature (DRB2 and DBDs). If one device is not configured, the system will not allow the firing procedure to start and the following error will be encountered by the user:

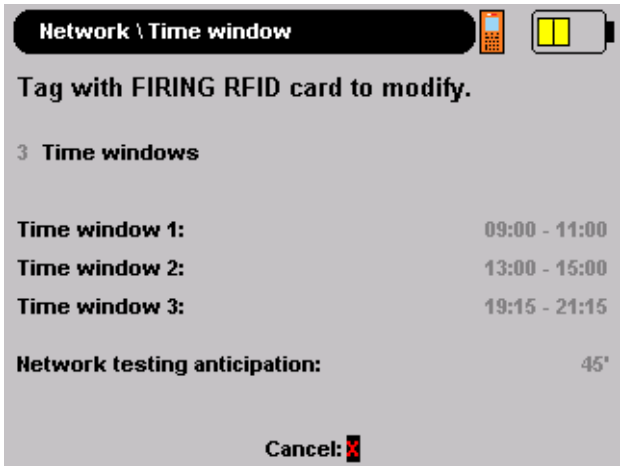


Firing window configuration

In order to set the time windows the following information is vital:

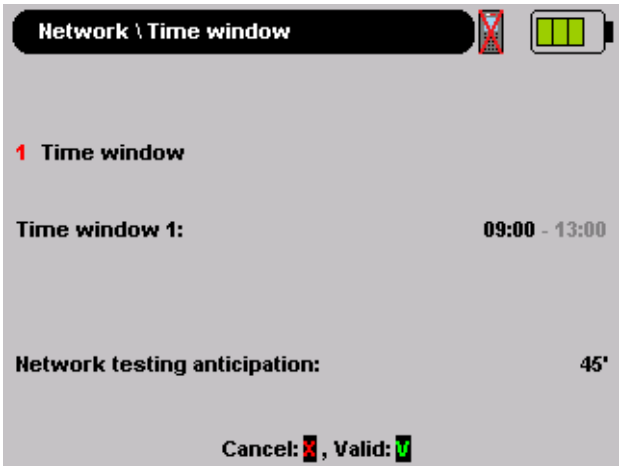
- Number of time windows required: from 1 to 3
- Starting time of each time window
- Allowed period in minutes for network testing (Initial steps on the DRB2 when starting the firing procedure)

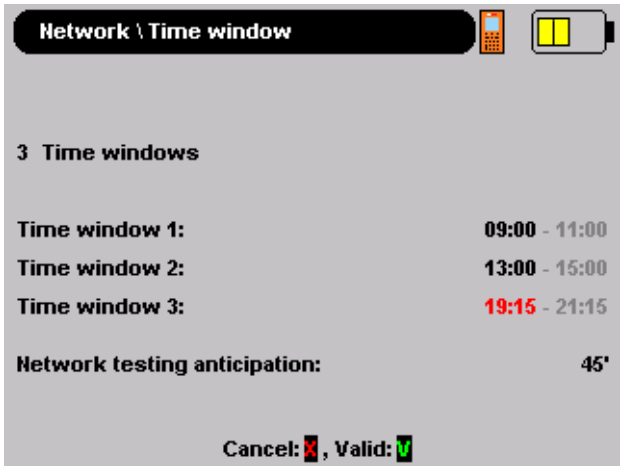




To change the configuration of the Firing Window, or to change the date/time of the DRB2, it is necessary to tag the “Safety Lockout” RFID card (Refer to the “Safety lockout” chapter for RFID card configuration).

When tagged, the number of windows and starting times can be edited.





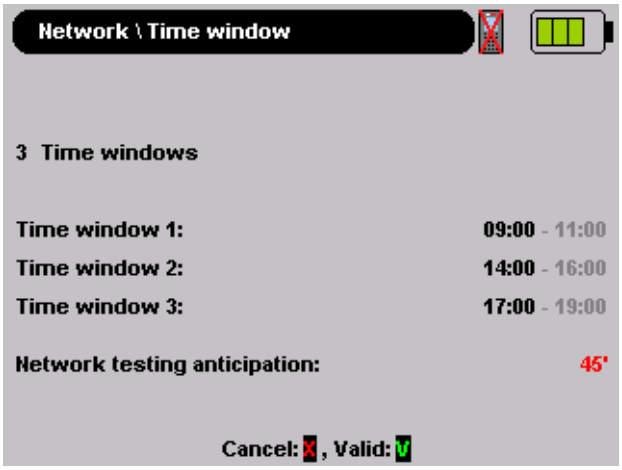
Use the ▲ / ▼ buttons to select the field to modify and press ◀ / ▶ to change the value of the field.

The configuration is saved with √. Use the X button to abort the configuration change.

The starting times is adjusted in increments of 15 minutes..

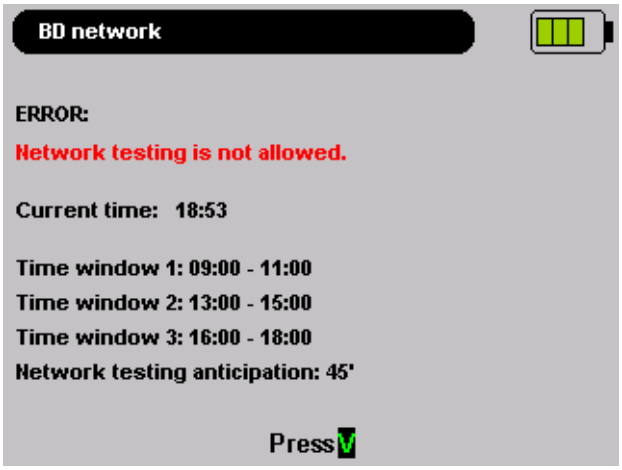
As charging and firing has been disabled, network testing is safe and the procedure can begin before the time window opens. But once testing is complete, charging (and then firing) is not allowed until the Time Window allows.

The network testing window called “Network testing anticipation” can be set at 4 different values: 0, 15, 30 and 45 minutes



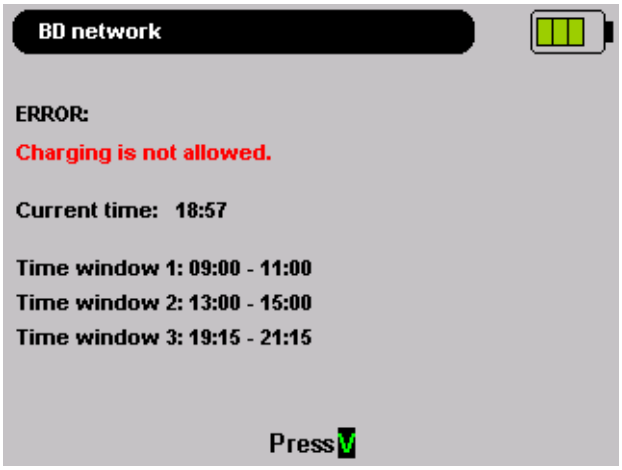
Testing the equipment network

If the user wants to initiate the test procedure outside the time window and set Network testing anticipation, the following error is displayed



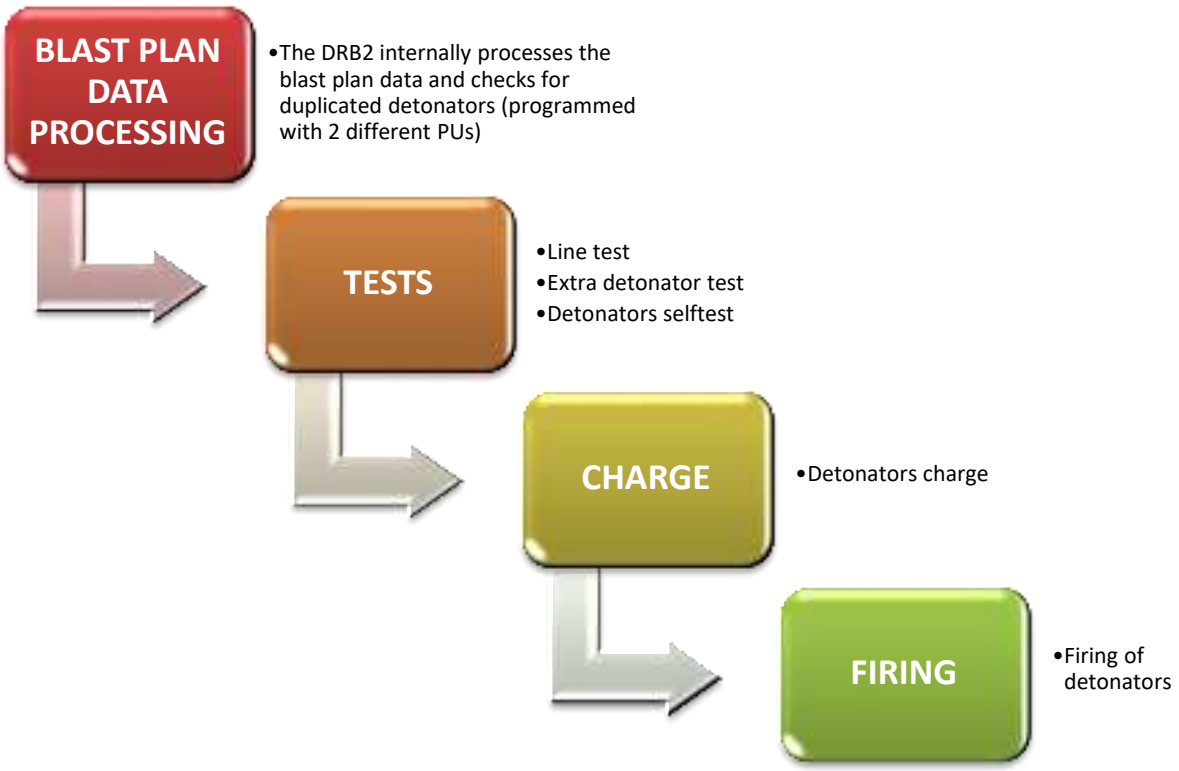
Initiate a firing procedure out of the Firing windows

If the shotfirer wants to initiate the firing procedure outside of the set time windows, the following error is displayed



Firing Procedure

After all tests have been completed with the PU(s), the blast plan data has to be transferred from the PU(s) to the DRB2. Once the site is secured, the firing lines can be connected to the DRB2. The DRB2 executes the firing procedure and associated tests. The progress of the procedure and the results of the tests are displayed on the DRB2's screen. Once authorisation has been given, the firing procedure can then be started. The firing procedure includes 4 successive steps:

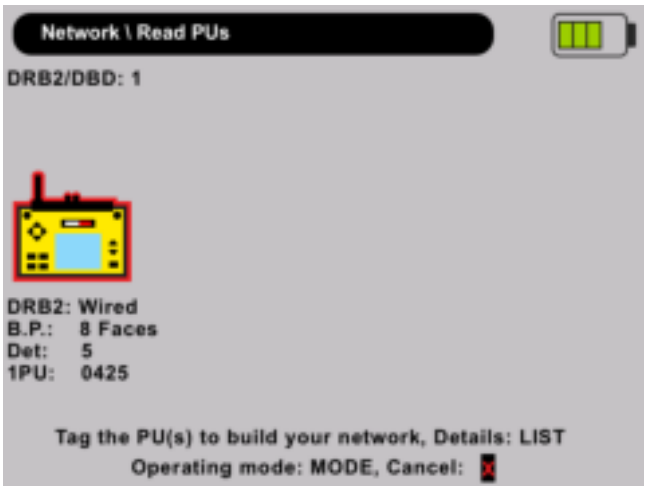


WARNING: Before starting the firing procedure, visually inspect the DRB2 to ensure there is no excessive dirt or damage to the equipment. If damage is detected, do not use the DRB2.

WARNING: Only connect a firing line to the firing line terminals. Never connect any other equipment to these terminals.

Multiface selection in Swift

Standard multiface selection



After importing the content of a PU, press the button all the imported faces and their related information (PU serial number, face name, number of programmed detonators, and name of the applied template) are displayed.

Per default, all the faces are selected. To unselect faces use the / of the DRB2.

The indicator above the list of faces always displays the status of the selection and the authorized limits.

The example below displays 7 ranked faces (Faces 1 to 7) and an already fired face (Face 8).

Press to validate the face selection and go back to the main **READ PUs** screen.

Once fired, the blasted faces will be displayed in grey.

NOTE : With a standard multi-face firing all faces will blast simultaneously

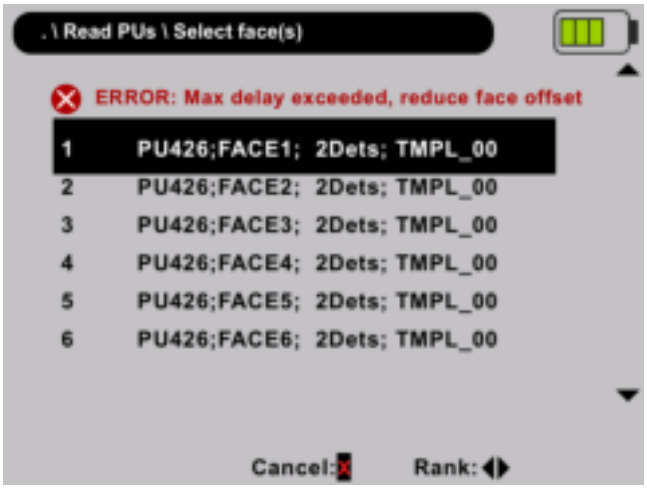
Multiface selection with a face offset

To change the rank (firing order) or unselect faces use the ◄/► of the DRB2, the faces will go higher or lower in the list.

The example below displays 6 ranked faces (Faces 1 to 6), an unselected face (Face 7) and an already fired face (Face 8).

Press √ to validate the face selection and go back to the main **READ PUs** screen.

NOTE : If the indicator turns red and displays "max delay exceeded: reduce face offset" the selected faces and the face offset the total blast duration exceeds 14 000 ms.



To correct this error:

- **Deselect and physically disconnect one or several faces from the Firing Line**
- **Reduce the face offset value in the settings**

NOTE : The face offset can be set in the SWIFT BLAST SETTINGS menu.

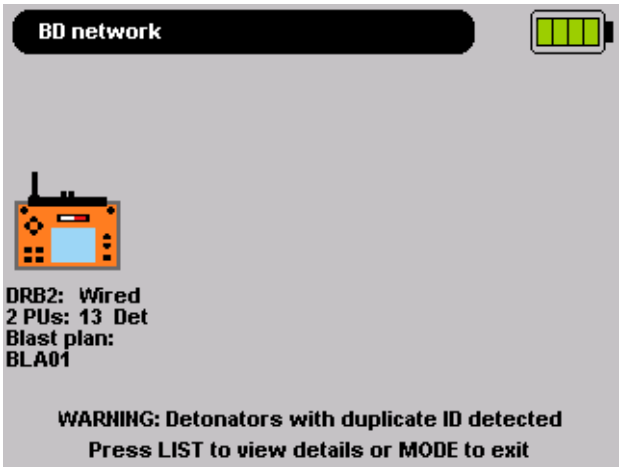
Starting a firing procedure

Once the detonator information has been transferred from the PUs to the DRB2, and a network has been defined, press on the  button to switch from configuration to operational mode.

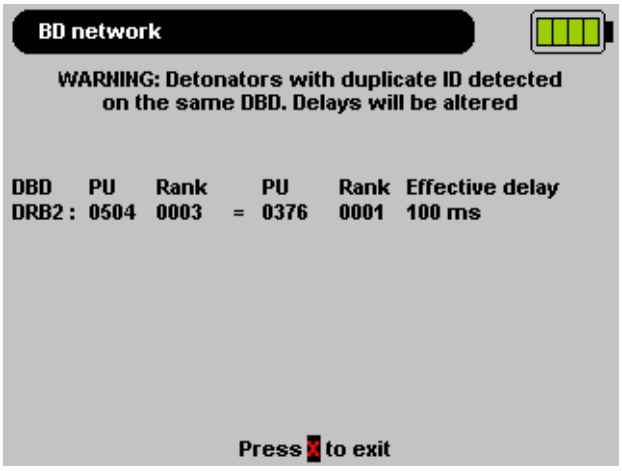
The DRB2 initially verifies that the shot does not contain duplicated detonators (1 detonator programmed on 2 different PUs).

When using more than one PU to program a shot, programming the same detonator on different PUs is possible.

The DRB2 will indicate the below screen if duplicate detonators has been detected:



If duplicated IDs are detected during the duplicated check function, press the  button and the list of duplicates with their delays are displayed on the screen.



DBD PU Rank PU Rank Effective delay

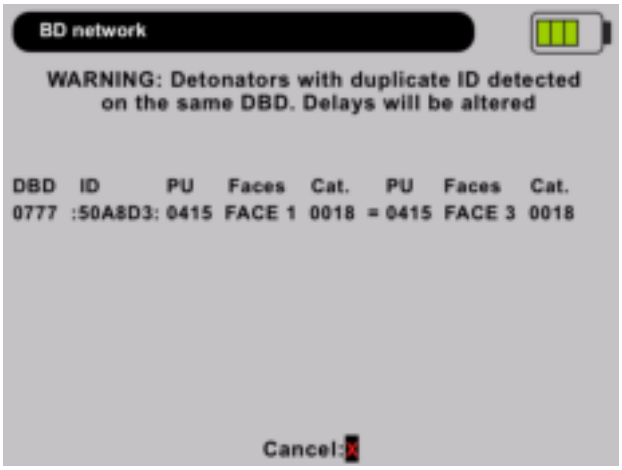
DRB2 : 0504 0003 = 0376 0001 100ms

The onscreen message indicates that the same ID has been programmed by two different Pus (SN: 504 and 376).
The rank indicates the detonator sequence number of the ID:

- 3 in PU 0504
- 1 in PU 0376

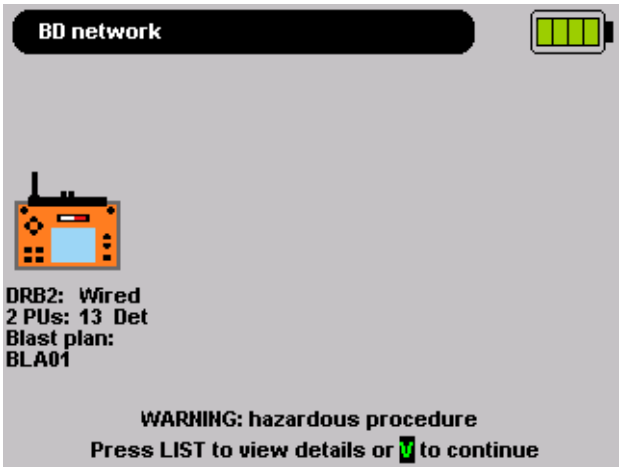
The effective delay that will be assigned to this ID is 100ms which has been assigned with PU_376.

For Swift, the text is formatted as the example below:

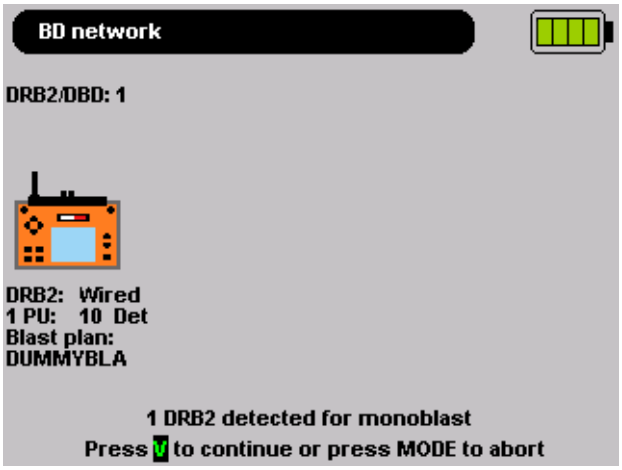


DBD ID PU Faces Cat PU. Faces Cat
0777 50A8D3 0415 FACE 1. 0018 = 0415 FACE 3 0018

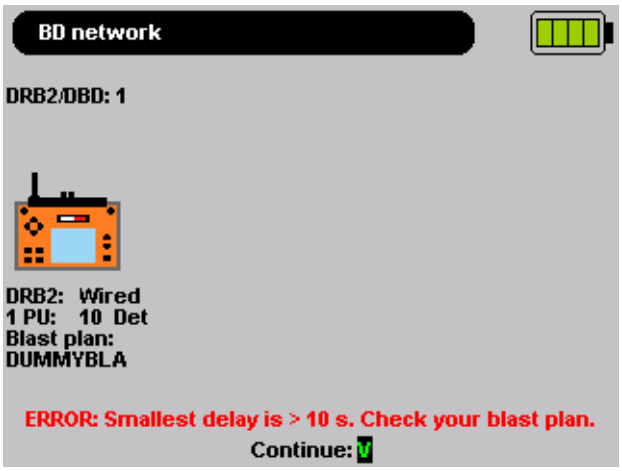
The user is then able to proceed with the firing procedure on the DRB2 by pressing the √ button and accepting the “hazardous procedure”.



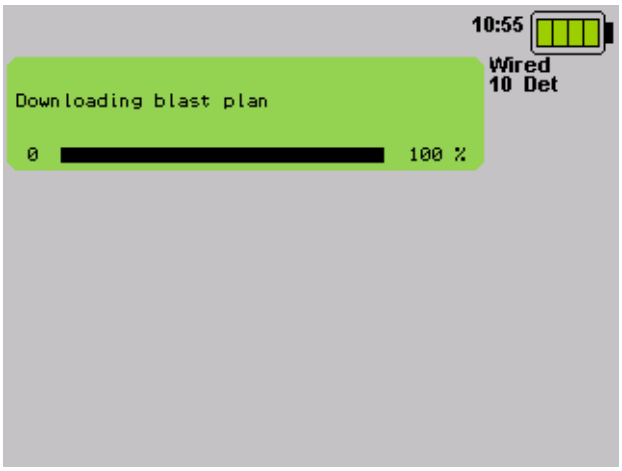
If no duplicated ID is present the following screen is displayed:



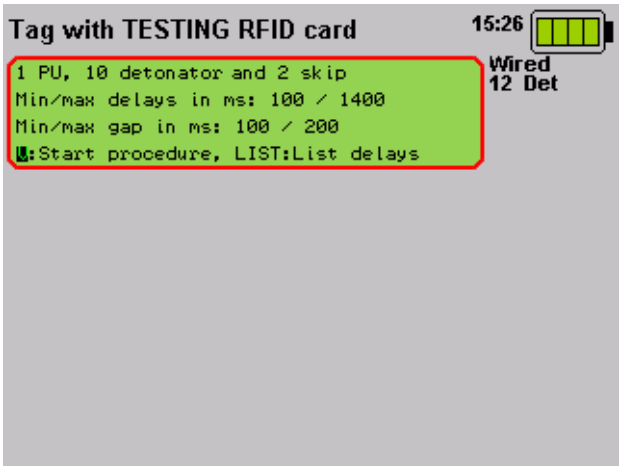
Warning: The smallest delay of the blast must be below or equal to 10s. In case one delay is higher than 10s, the related message is displayed for 5s then the main screen is displayed.



After pressing the √ button, the screen below is displayed while the DRB2 is processing the blast plan data. Depending on the size of the blast plan and thus the processing time, this screen may only be visible for a short time.



NOTE: Switching to the operational mode is only possible after tagging the DRB2 with the TESTING RFID tag. The TESTING RFID safety tag should always remain in the shot firer's possession.

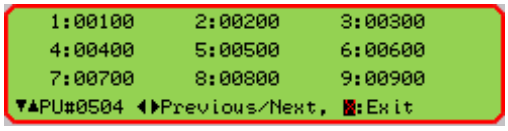


When the TESTING RFID tag has been used, the operational mode is available for 15 minutes. If no button is pressed within 15 minutes , it will be necessary to tag the TESTING RFID tag again to restart a procedure.

The blast summary screen indicates the following information:

- **x PU:** the number of PUs
- **xxxxx detonator and xx skip :** the number of detonators and the number of skipped detonators
- **DELAYS:** the min and max delays
- **GAP:** the min and max interval between delays

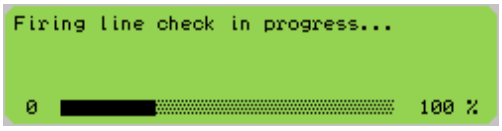
Press to view a list of all detonators and delays (see below). Use the / to scroll through the PUs if more than one was uploaded and use the the left / on the DRB2 to scroll through the list of detonators. Press to return to the blast summary screen.



On the summary screen, press to start the tests on the DRB2 or press to exit to the **MAIN** configuration menu.

Firing Line Test

The firing procedure tests starts by initiailly testing the lines connected to the DRB2 firing terminals

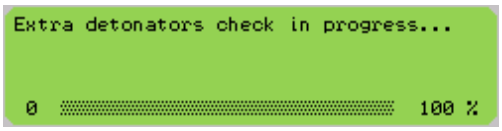


Any errors will be displayed on the DRB2 screen and a voice message will inform the user of the error. If an error occurs at this stage of the procedure, the fault must be rectified and the system will not allow the procedure to continue. The user can use the check again function to verify the faults reported.

Error messages during the line test If no error is detected, the procedure continues automatically to the Extra Det Check.

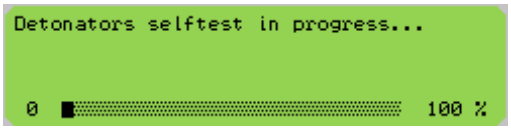
Extra Det Check

The Extra Det Check searches for detonators connected to the circuit, not corresponding to the data transferred from the PU(s). These extra detonators are not programmed but are connected to the line. Refer to the related chapter "Error messages during detection of extra dets". If no problem is detected, the procedure continues automatically with the Detonator Self-test.



Detonator Self-test

During the Detonator Self-test each programmed detonator is ordered to carry out a self-test. At this stage, the firing circuit of each detonator is tested.



A general self-test command is sent to the detonators, after which each detonator individually carries out a self-test and reports its status. Refer to the related chapter "Error messages during detonator ".

Warning: If more than 30 missing and 10 extra detonators are reported on the DRB2, the procedure is stopped and firing the blast is not possible.

If an error is reported by the DRB2 and the screen is green, the user can proceed with the procedure. When the screen is grey the procedure is automatically aborted by the DRB2.

Unique count down timer

The unique count down timer always starts with an initial value of 12 minutes. The 12 minutes will only start counting down if an error is detected by the DRB2 and user intervention is required.

If no errors are detected:

The DRB2 authorizes the charging of the detonators' firing capacitors, the DRB2 screen will indicate "Charging authorized" along with a voice message ***"READY TO CHARGE".***

An additional 1 minute is added to the timer and the timer will start counting down from a total of 13 minutes. Once the user presses the button, the count down timer will stop and charging of the detonators will commence.

Once charging has been completed, the DRB2 will authorizes the firing of the detonators' firing capacitors, the DRB2 screen will indicate "Firing authorized" along with a voice message ***"READY TO FIRE".***

An additional 1 minute is added to the timer and the timer will start counting down from the remainder of the 13 minutes. Once the user presses the button, the count down timer will stop and firing of the detonators will commence.

Note: If no errors are encountered during the tesing phase on the DRB2, the user has a total of 14 minutes at their disposal.

If errors are detected:

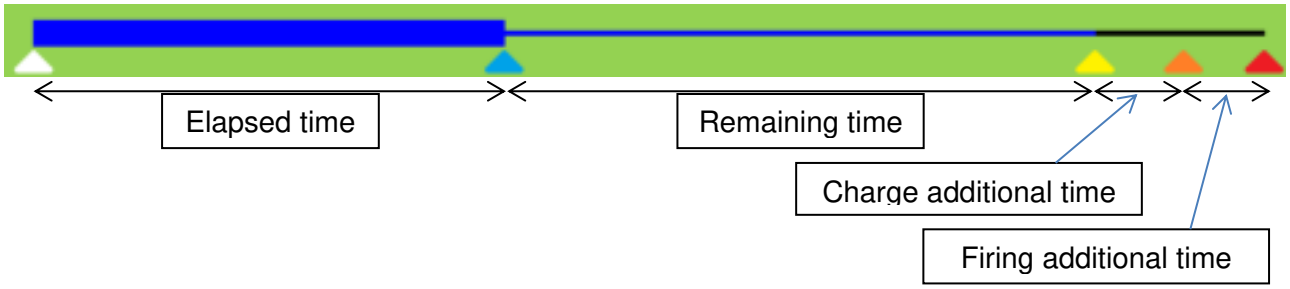
If the DRB2 encounters any error that would still allow the firing procedure to continue, the count down timer will start with every error. Once the user acknowledges the error and continues the procedure, the timer will pause up until the next error is encountered or until charging is authorized.

The timer will be allocated an additional 1 minute above the remainder of the 12 minutes, when charging is authorized then pause again when the button is pressed and charging is started.

The timer will be allocate an additional 1 minute above the remainder of the 13 minutes when firing is authorized and pause when firing is authorized and the pause when the button is presses and firing is started.

The countdown is indicated on the DRB2 screen with a specific bar graph and can be divided in 4 pieces as below:

- Elapsed time - from to
- Remaining time - to
- Charge additional time - to
- Firing additional time from to

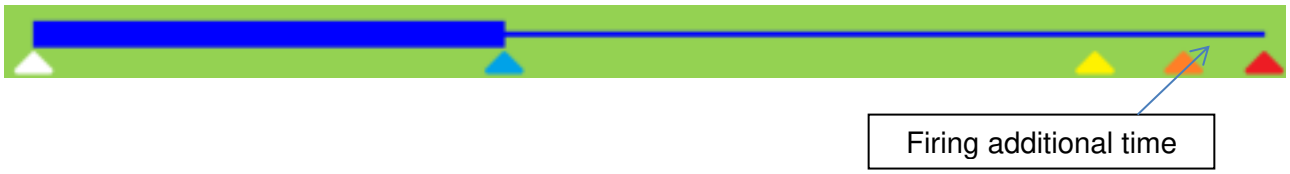


The additional time is indicated as black and changes to blue when activated

When the timer is paused, the bar changes from blue to grey

When charging is authorized, the charging additional time is added (and the additional time bar changes from black to blue)

When firing is authorized, the firing additional time is added (and the additional time bar changes from black to blue)



CHARGING

To charge the detonators, the shot firer initially needs to enable the charge button by tagging the FIRING RFID card: once activated it is enabled for 10 seconds.

NOTE: Charging and Firing is only possible after tagging the DRB2 with the FIRING RFID safety tag. The FIRING RFID safety tag should always remain in the blast controller's possession.

Then press and hold the button to charge the detonators.

The detonators' charging time is approximately 20 to 30 seconds.The progress of charging is indicated by the status bar and shown in %.

If the the button is not pressed within the allowed time of the unique countdown timer and before the time expires, the DRB2 informs the operator that the time has expired and the procedure has to be restarted whereby it will start again from the line test phase.

IMPORTANT: If the operator presses the button before the DRB2 displays the "FIRING AUTHORISED" message, the system will display "Release the FIRING button".

When charging is complete, a charge test is performed and firing authorised. The button is illuminated and the vocal message "***READY TO FIRE***" is announced.

IMPORTANT: If the operator releases the button, the system will go into safety mode, the capacitors are discharged and the firing procedure has to be restarted from the Firing Line test phase on the DRB2. The only consequence of this action is the extra time taken to run the procedure again.

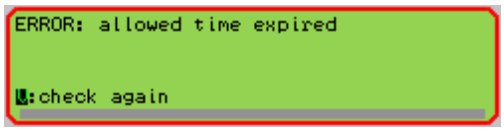
Firing

Firing must take place within the allowed time of the unique countdown timer and before the time expires, but after firing has been authorised on the DRB2.

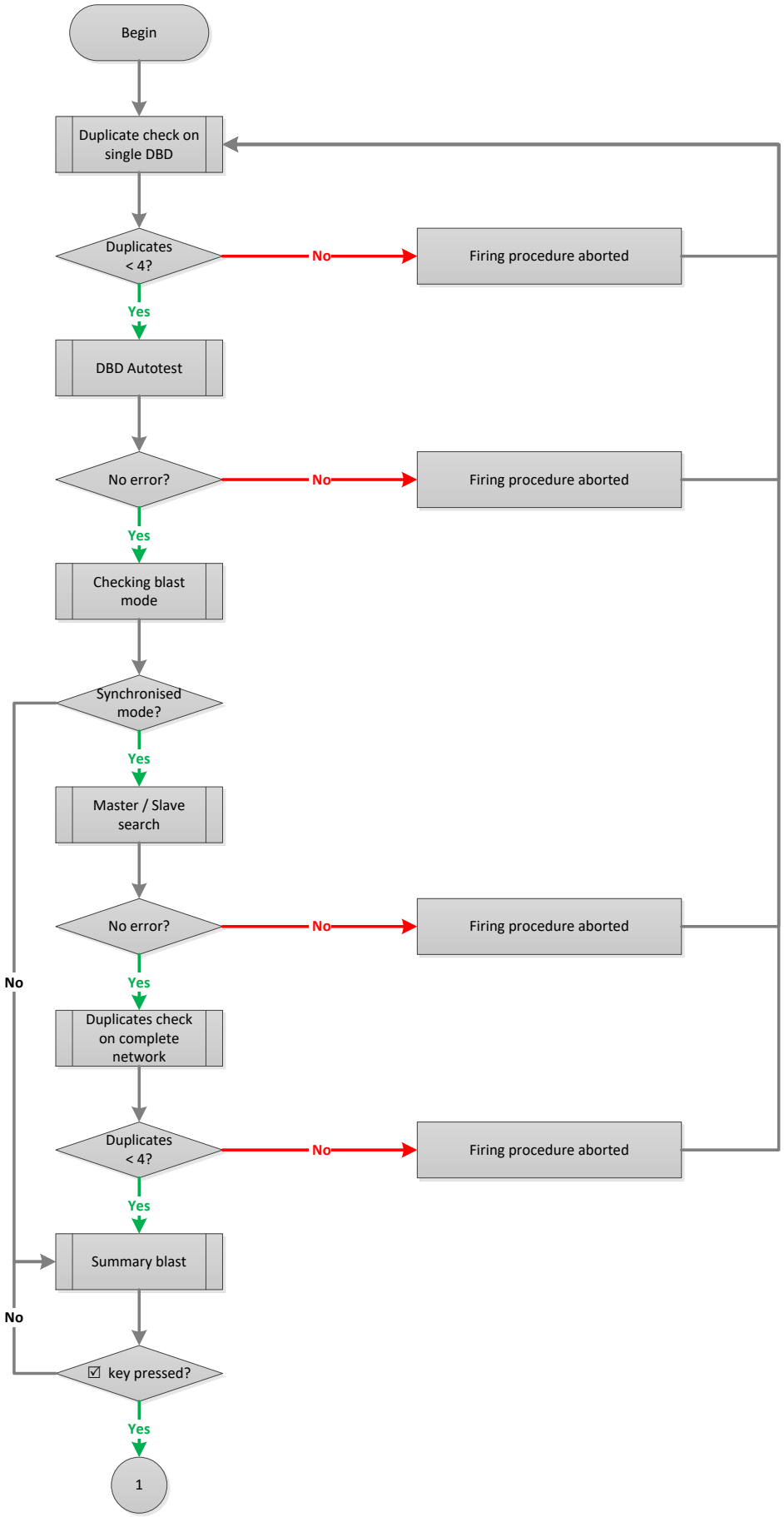
To fire, the operator must press the button while still holding down the button.
A line at the bottom of the green window indicates the blast progress. (This can be too fast to be seen for smaller shots).

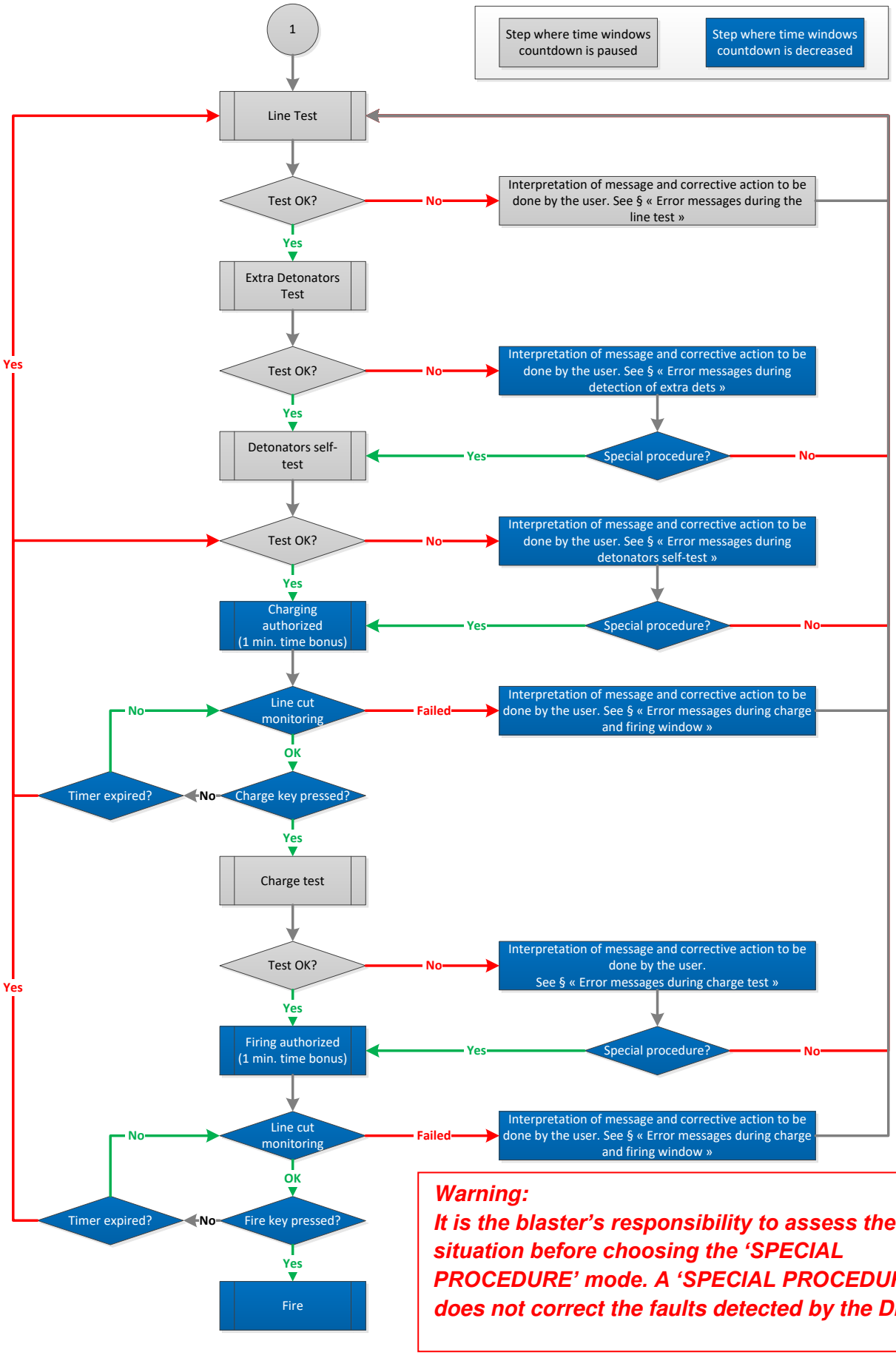
After firing is completed, the “Firing completed” window below is displayed.

If the button is not pressed prior to the expiry of unique countdown timer, the detonator capacitors are discharged and the system returns to safe mode. The firing procedure has to be restarted from the line test phase by pressing √.



Firing procedure flowchart





Warning:
It is the blaster's responsibility to assess the situation before choosing the 'SPECIAL PROCEDURE' mode. A 'SPECIAL PROCEDURE' does not correct the faults detected by the DRB.

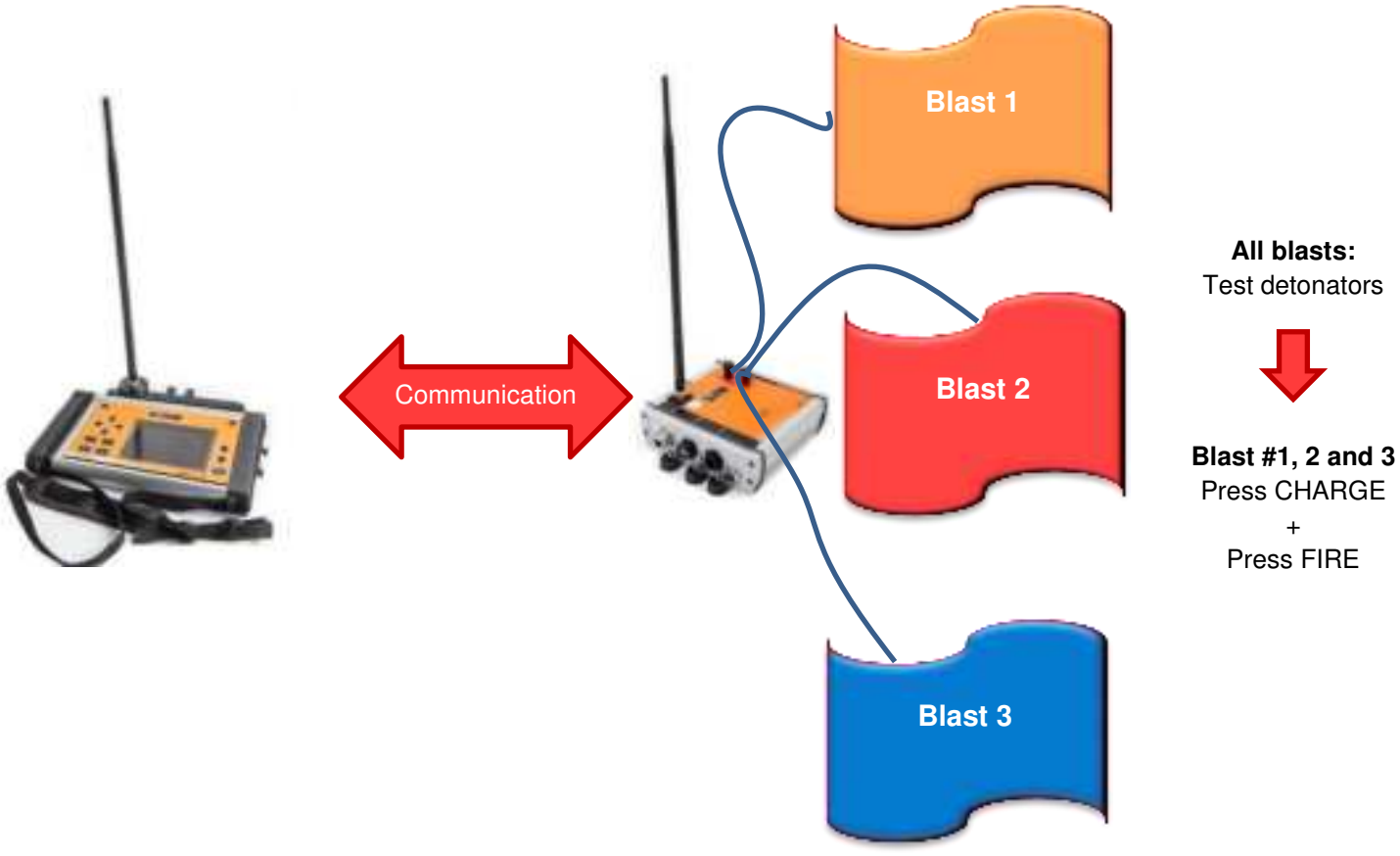
Firing in WIRELESS mode

General information

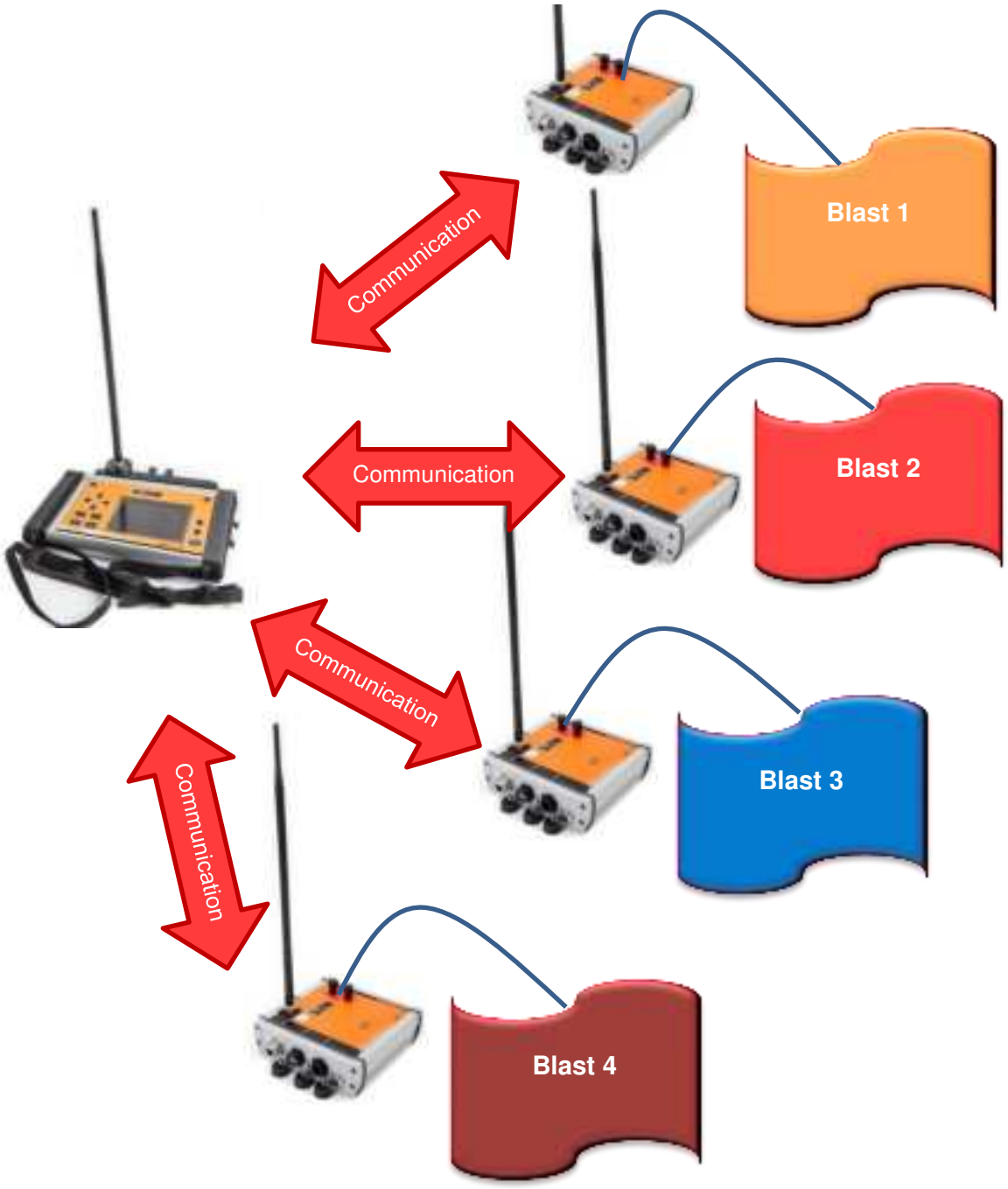
The DT SP/UG Digital Blasting System can be operated in WIRELESS mode in three different configurations:

- Mono
- Multiblast
- Synchroblast

In **Mono** 1 DBD is operated with 1 DRB2, with the use of either internal or external modems. The mono mode allows users to fire one or more than one blast from the same location with the DRB2 and in the same time window as long as the amount of detonators is less than 1500.



In **Multiblast** up to 8 DBDs can be operated using the same DRB2 with the use of either internal or external modems. The multiblast mode allows users to fire more than one blast from the same location with the DRB2 and in the same time window.



All Blasts:
Test detonators

BLAST#1
Press CHARGE
+
Press FIRE

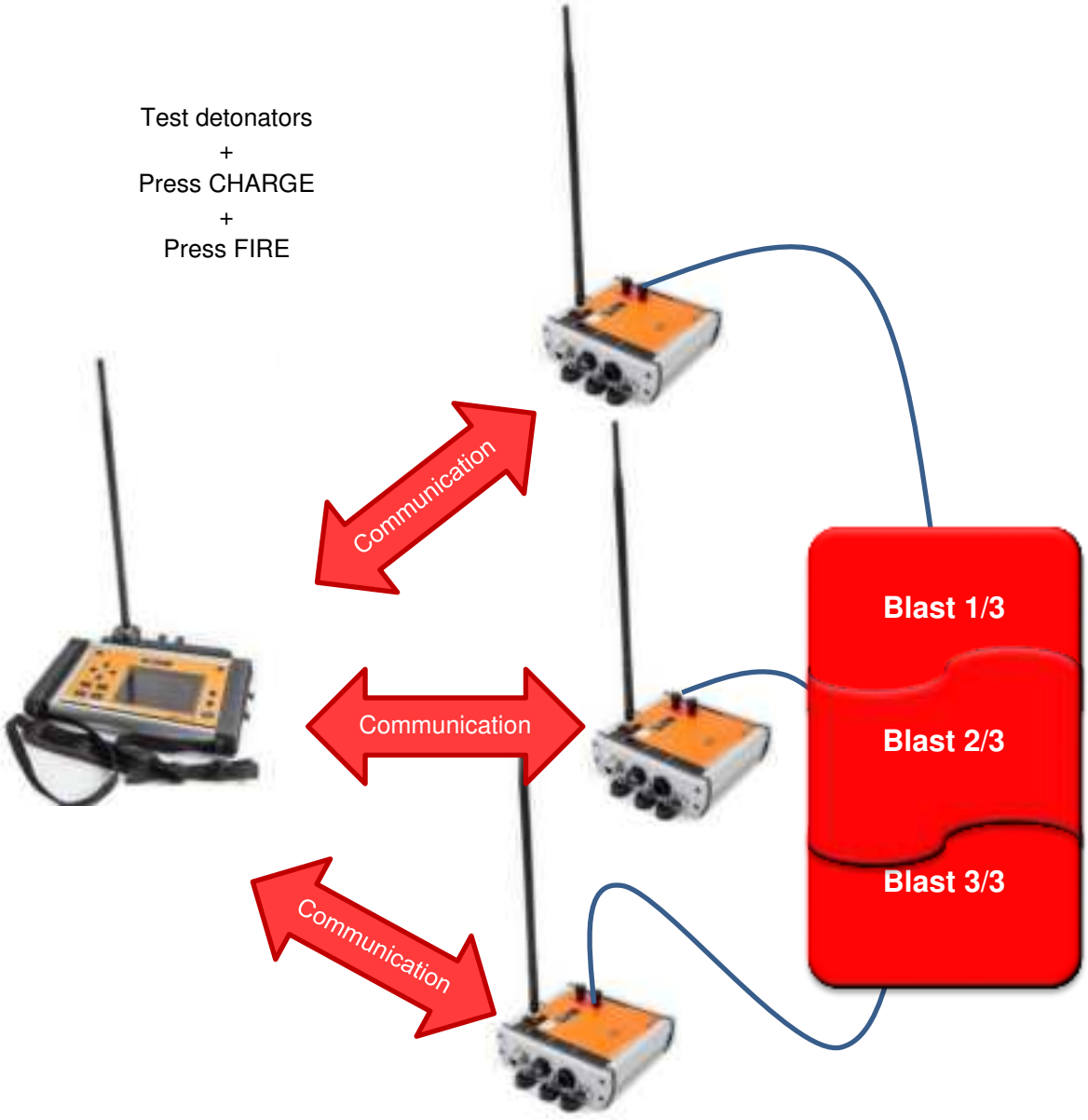
BLAST #2
Press CHARGE
+
Press FIRE

BLAST #3
Press CHARGE
+
Press FIRE

BLAST #4
Press CHARGE
+
Press FIRE

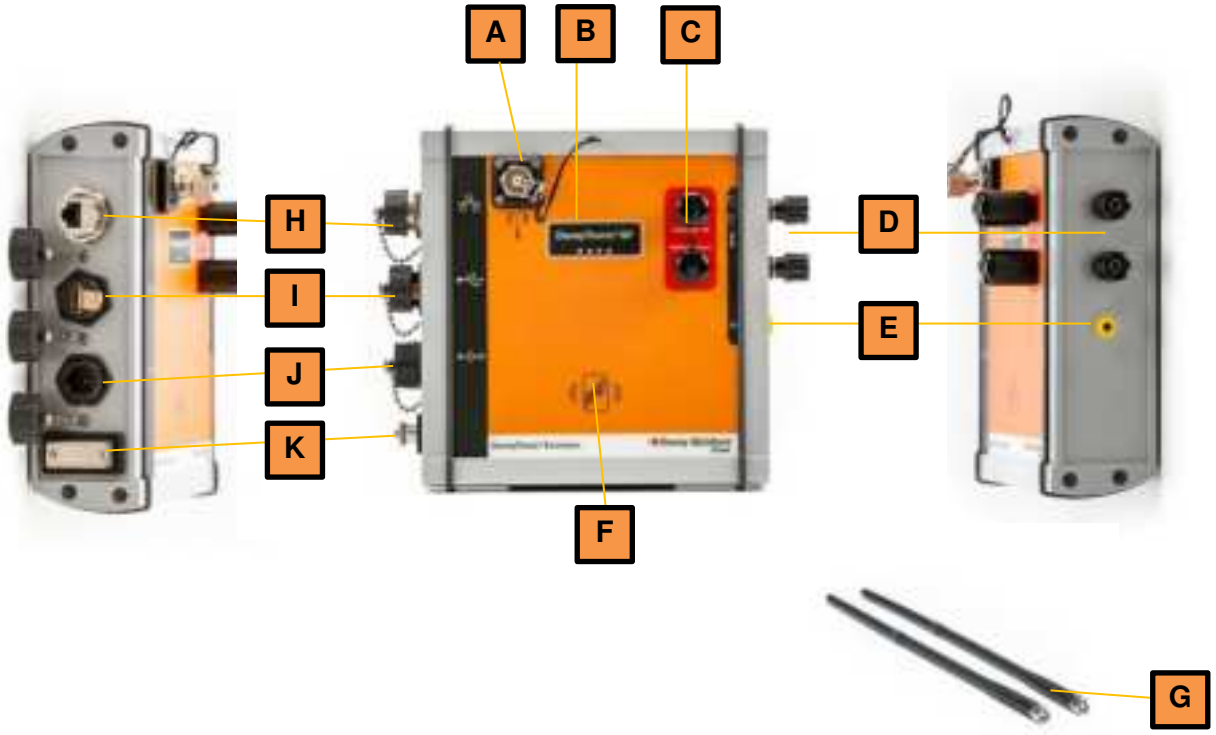
In **SYNCHRONISED** mode or **synchroblast** up to 3 DBDs can be controlled remotely with the DRB2 through the use of either internal or external modems. Synchronised mode allows users to divide a large shot into two or three sections and synchronise the firing of the two or three sections.

The radio communication between DRB2 and DBDs is sequential: the DRB2 questions each DBD one after the other. The DRB2 is to be used at the firing location in a safe area for operators. The DBD is located close to the blast area, in an area protected from fly rock.



Presentation of the DBD

The DBD is the part of the DT SP/UG, connected to the firing line when firing using WIRELESS mode. It will communicate with the detonators, perform tests, charge the detonators and send the command to fire. The DBD is remotely controlled by the DRB2. The DRB2 displays the DBD's status at all times.



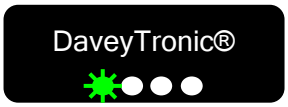
A	Antenna plug
B	ON/OFF button
C	Firing line terminals
D	Synchro terminals
E	Earthing connection
F	RFID reader
G	Antennae
H	Ethernet port
I	USB port
J	Charging port
K	RS232 / 485 port

The DBD supply voltage is 10-12 V DC and the rated current is 4A max.

WARNING: The self-test of the DBD checks the capabilities of the line driver and during this test current consumption can reach 300 mA, always check the battery capabilities of the DBD, as the self-test can switch OFF the equipment.

Basic indicators

No lit LED: the DBD is OFF.



Green LED is flashing: the DBD is ON and operational.

Green and yellow LEDs are flashing: the DBD is ON and receiving/sending radio transmission.

Red LED is flashing after switching on the DBD (alone or not): the DBD didn't pass the self-test, an error occurred while starting up. The three other LED help to define the error code. Contact your local Enaex representative for more information.

Switch ON / OFF

The DBD is fitted with an ON/OFF button:  . Press and hold the button for 1 sec to switch ON. The 4 LEDs light up for 10 sec, then flash quickly for 10 sec during the selftest of the equipment and light up again for 3 sec, indicating the battery status of the DBD. When the DBD is ON and operational, the green LED is flashing.

To power OFF, press and hold  for 1 second: the 4 LEDs flash quickly from left to right.

Communication quality

When firing in WIRELESS mode, once the user has switched to operational mode an RF communication is established between the DRB2 and the DBDs. The quality of the communication is continuously monitored and displayed on the DRB2's screen.

General recommendations

Range reducing elements are commonly introduced into wireless communication systems in the form of walls, wind, vegetation, machinery, dust, buildings, etc. resulting in temporary (or continuous) signal interruptions.

To obtain good communications, the following recommendations need to be taken into account:

- ALWAYS keep cell phones, two-way radios or any other radio devices at least 15 m (50 ft) from the DRB2 and DBDs.
- ALWAYS make sure the firing location and DRB2 location has been qualified by a Enaex technician (range test on site is mandatory to guarantee a proper remote wireless configuration).
- ALWAYS place a DBD at a minimum of 1 to 1.5m (3 to 5 ft) off the ground (i.e. on a tripod).
- ALWAYS clear the line of sight from any obstacles such as light vehicles, low walls, trees, etc …
- ALWAYS keep away (>15 m / 50 ft) from any surf, wall or face that could reflect radio waves and cause interference.
- ALWAYS keep away from any metallic mass such as vehicles, tool box, etc….
- ALWAYS use the aerial in the vertical position.

Strength indicator

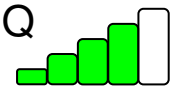
Indicators showing signal strength (S) are displayed as a percentage in the **MAIN** operating window of the DRB2, next to the blast summary screen.

Note that any transmission in the frequency range of the receiving modem will influence this indicator. Thus this indicator may thus not always be a true indication of the signal sent by a DBD. This value is not relevant when estimating the communication signal quality.

Quality indicators

Indicators showing signal quality (Q) are displayed in the **MAIN** operating window of the DRB2, next to the blast summary screen.

This graph, containing 5 bars, gives an indication of the quality of the signal by showing the number of correct data frames received out of the last 5 data frames transmitted.

Q 	4 bars indicate that 4 data frames out of the last 5 have been received correctly.

It is recommended to have at least 2 bars out of 5 in order to proceed through the firing procedure.

Note that empty bars indicate that a data frame has not been correctly received and may slow down the firing procedure due to the same data frame having to be sent twice.

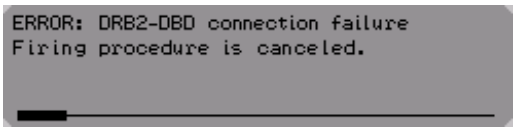
Poor communication

WARNING: Only start the procedure if the Q indicators indicate good blasting conditions. In case of poor communication, move the DRB2 to an elevated location. If the communication does not improve, move the DBD to another location with better communication.

If the signal is lost for;

- less than 45 sec: no effect on the procedure (other than time taken)
- more than 45 sec: procedure/blast aborted

In case of communication loss with a DBD, the DRB2 displays the message "***CONNECTION FAILURE, FIRING PROCEDURE HAS BEEN CANCELED***" in the corresponding grey window.



The corresponding DBD automatically returns to a safe position, and the firing procedure is stopped. To restart the procedure, the operator needs to press  to return to main menu then press  again to switch to operating mode in order to restart the blast plan data transfer processing.

General Precautions

IMPORTANT: To use the DT SP/UG blasting system in WIRELESS mode, it is necessary to attend specific training courses approved by Enaex and its subsidiaries, as well as holding all necessary regulatory certifications in force in the country where the system is being used.

SAFETY: The inherent safety of the DT SP/UG is not affected when remotely controlled. The Firing line and detonators remain physically connected to and managed by a DBD. The safety level of the DBD in WIRELESS mode is the same as the DRB2 in WIRED mode. Radio communication is protected against corruption and hacking.

WARNING: If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Any changes or modifications by the operator not expressly approved by the party responsible for compliance could void the operator's authority to operate the equipment.

NOTE: The DT SP/UG 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 environment. This equipment generates, uses, and can radiate radio energy and, if not installed and used in accordance with the instruction manual, 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.

The use of the system is only allowed under the following conditions: (1) the system must not produce interference and (2) the operator of the system should accept all received radio electric interference, even if this interference might compromise the functionality of the system

This device must be professionally installed

This portable equipment with its antenna complies with FCC's radiation exposure limits set forth for an uncontrolled environment. To maintain compliance, follow the instructions below:

1. **This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.**
2. **This equipment should be installed and operated such that a minimum separation distance of 6 cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.**

Authorized antennas:

Part Number	Type	Connector	Gain	Application	Cable Loss or Power Reduction for S3B Radio
Omni-directional antennas					
A09-FSTM	Fiberglass Base	RPTNC	5.1 dBi	Fixed	0dB

CANADA:

The installer of the system has to assure that the antenna is located or directed in a way that it does not emit radio electric fields superior to the limits specified by Health Canada for the public; consult Security Code 6 available on the web site of Health Canada with the following address www.hc-sc.gc.ca/.

According to the integrated modem type, the equipment has to be used only with the approved antenna. (Contact your local Enaex representative for more information) This antenna should not be changed or replaced by any other antenna type.

***The* communication protocol is protected against corruption by a Cyclic Redundancy Check (CRC) system.**

Detonators and DBD communicate with a specific protocol. This protocol provides all the requirements in order to fire the detonators with a very high level of safety.

This device complies with Industry Canada's licence-exempt RSS'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.**

This portable equipment with its antenna complies with RSS102's radiation exposure limits set forth for uncontrolled environment. To maintain compliance, follow the instructions below:

1. **This ransmitter must not be co-located or operating in conjunction with any other antenna or transmitter**
2. **This equipment should be installed and operated such that minimum separation distance of 6cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.**

Cet équipement portable avec ses antennes est conforme aux limites d'expositions de la CNR102 applicables pour un environnement non contrôlé. Pour maintenir la conformité, suivez les instructions ci-dessous:

1. **Cet émetteur ne doit pas être co-localisé ou opérer en conjonction avec toute autre antenne ou émetteur.**
2. **Cet équipement doit être installé et fonctionner de telle manière qu'une distance minimale de séparation de 6cm soit maintenue entre la partie rayonnante (l'antenne) et l'utilisateur/les personnes à proximité à tout moment.**

This radio transmitter (IC: 25586-XB900HP) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 25586-XB900HP) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Authorized antennas / Antennes souhaitées :

Part Number	Type	Connector	Gain	Application	Cable Loss or Power Reduction for S3B Radio
Omni-directional antennas					
A09-F5TM	Fiberglass Base	RPTNC	5.1 dBi	Fixed	0dB

Preparing a blast in Wireless mode

Note: It is assumed that "Firing in WIRED mode" has been read before reading this chapter

Overview

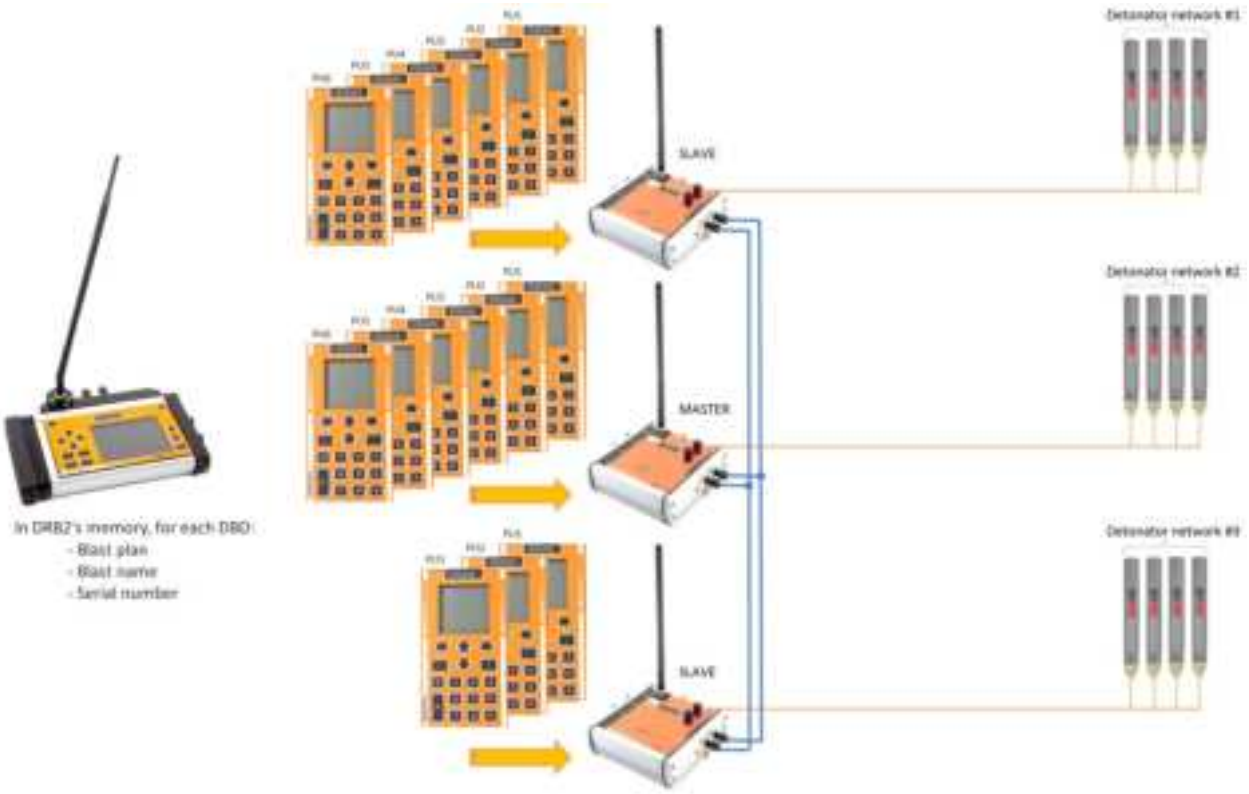
Chapters below describe how to setup the system to fire a blast in wireless mode.

NOTE: A synchroblast can only be fired in WIRELESS mode.

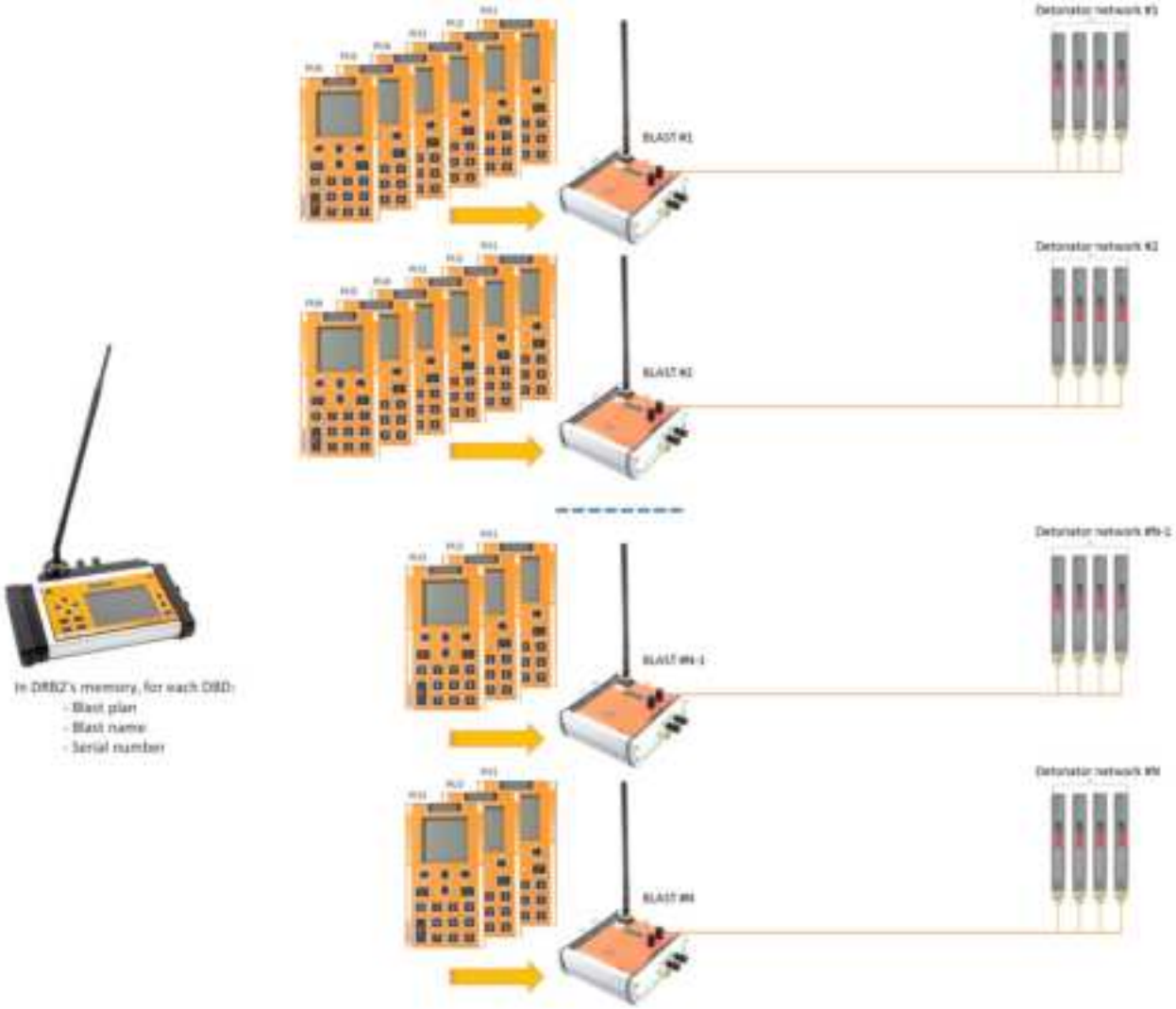
Operators have to:

- Associate the PU's with the corresponding DBD
- Setup the DBD's and DRB2 for the wireless communication
- Wire up the network
- For a Synchroblast, wire up synchro-line

See below an overview of a **synchronised** blasting system (up to 3 DBDs)



Hereunder an overview of a **Multiblast** system (up to 8 DBD).



Data transfer from PU to DBD

The PU has all the programming data (network name, detonator's unique ID number, sequence number and delay) stored in its RFID tag. After programming and circuit testing with the PU is finished and before starting the firing procedure, the stored data has to be transferred through RF communication between the RFID tags of the PU to the DRB2 and then by RF communication from the DRB2 to the DBD. In order to transfer blast plan data to the corresponding DBD, the PUs used for programming the shot must be associated with the DBD.

Tagging to a DBD

The PU used to program the detonators of the shot has to be associated to the DBD which will be used to fire the shot in WIRELESS mode. The association is done by tagging the DBD with the PU as in the picture below.

This association can be done by at 2 separate instances:

- Prior to programming - Resetting the PU used for programming, refer to the previous chapter "**Erreur ! Source du renvoi introuvable.**"
- Programming completed - Preparing to fire in WIRELESS mode using the **MODIFY** function, refer to the previous chapter "**Erreur ! Source du renvoi introuvable.**"

Setup blasting system for wireless mode

DRB2 and DBDs used for the blast need to be setup to enable wireless communication with or without a repeater.

- **Point to point configuration**

The DRB2 and the DBDs must be configured as follows:

1. Disable Repeater Mode on DRB2
2. Configure DBD's on the shot as "Wireless point to point"

- **Repeater configuration**

A DBD can be used as a Repeater in order to improve wireless communications. DBDs connected to the firing line can be used close to the shot as usual and another DBD (not connected to the firing line) can be placed between DRB2 and the other DBD's on the shot to act as a repeater. The DRB2 and the DBD's must be configured as follows:

1. Enable Repeater Mode on DRB2
2. Configure DBDs on the shot as "Wireless Through Repeater"
3. Configure DBD between shot DBDs and DRB2 as "Operating as Repeater"

Hereunder the recommended configuration of the equipment with internal wireless modems

	Without any repeater		With repeater (Trailer or DBD as repeater)	
DBD wireless setting	**DRB2 in point to point**	**DRB2 in Through repeater**	**DRB2 in point to point**	**DRB2 in Through repeater**
DBD in point to point	Yes	No	No	No
DBD in Through Repeater	No	Yes	No	Yes

- **External modem configuration**

A DBD and DRB2 can communicate through the use of external modems and must be configured as follows:

1. Enable external Modem on DRB2
2. Configure DBDs on the shot to communicate through external modem

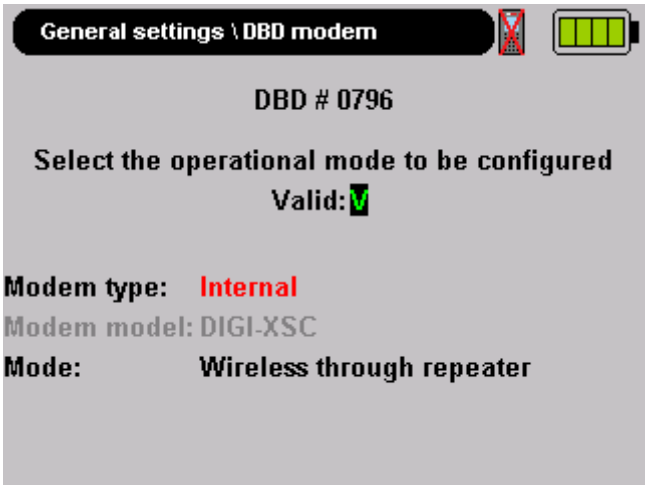
Warning: If the DRB2 and the DBDs are not set using the same wireless communication configuration, they will not be able to communicate.

Note: The DBD wireless communication configuration can only be done by using a DRB2

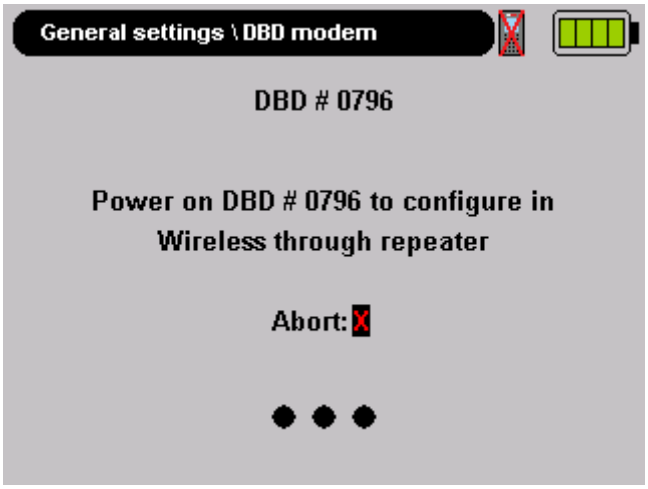
DBD modem configuration

1. Switch off the DBD
2. Install antennae on the DRB2 and DBDs (configuration will be done by means of wireless communication of the equipment; the equipment should be located in close proximity to each other.)
3. Power on the DRB2
4. On the DRB2, select the **General Setting** menu then **DBD modem** menu and press the √ button
5. Tag the DBD to be configured or enter its number with the arrow buttons and press the √ button

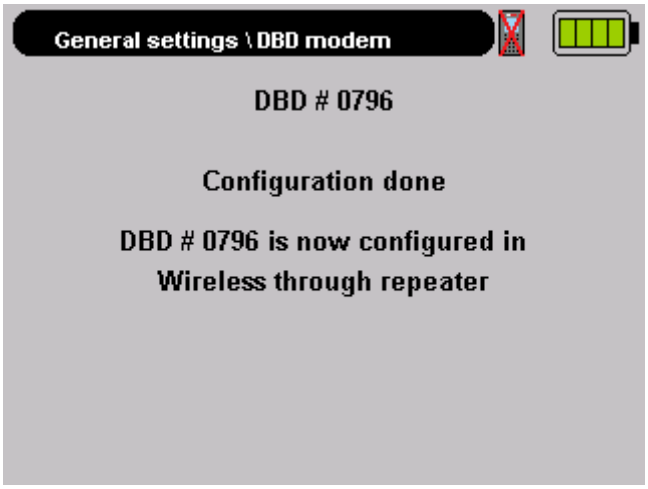
6. On the DRB2 select the operational mode to be configured and press the √ button
   Mode type:
   - **Modem type:** Internal/External ("external": an external modem can be connected to the DRB2, contact your local Enaex supplier for additional information)
   - **Modem model** (available if external modem is set) :
     - DIGI
     - RS485
     - RS232
   - **Mode:** define the repeater mode (available only if internal or digi external modem is selected)



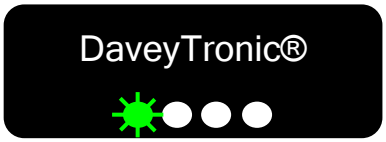
7. Power on the DBD to be configured



8. The DBD configuration will be set automatically after communication between the DRB2 and DBD is established and should take no longer than a few seconds.



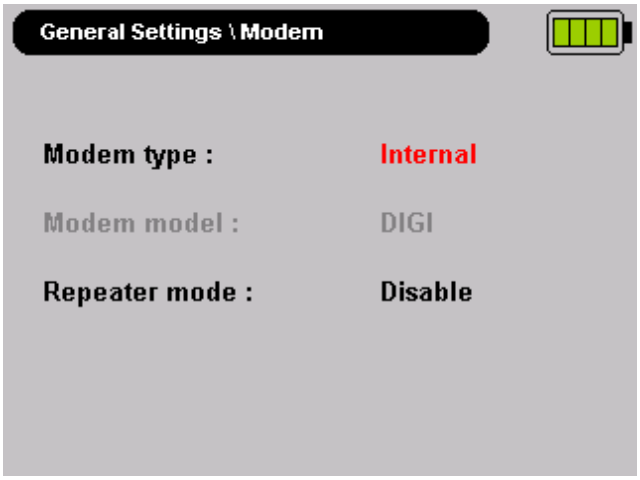
9. Once configuration is completed, the DBD green led will be flashing in sequence, indicating the set configuration



- 1 time for "Wireless point to point" (internal modem)
- 2 times for "Wireless through Repeater" (internal modem)
- 3 times for "Operating as a repeater" (internal modem)
- 4 times for " RFI"
- 5 times for "Wi-Fi
- 6 times for " Wireless point to point" (external DIGI modem)
- 7 times for ""Wireless through Repeater" (external DIGI modem)
- 8 times for ""Operating as a repeater" (external DIGI modem)
- 9 times for RS485 configuration

DRB2 modem configuration

1. Power-on the DRB2
2. Select the **General settings** menu then **DRB2 Modem** menu and press the √



3. Select
   a. **Modem type** => **External** or **Internal**
   b. **Modem model** (only available if external modem is selected) :
      1. DIGI
      2. RS485
      3. RS232
   c. **Repeater mode** => **Enable** or **disable** (only available if internal modem or DIGI external modem selected)

4. Press the √ button, DRB2 configuration is now done

DRB2 and DBDs association

For safety reasons, while a DRB2 is associated to a single or to a group of DBDs, so it is not possible to change the DRB2 while communications is established between DRB2 and DBD(s) unless the user switches of the currently used DRB2 and waits 5 minutes before starting the new DRB2.

Specific underground application

For specific underground application, the DTUG system can be operated in wireless mode with specific communication modems.

The DRB2 is to be used at the firing location on surface in a safe area for operators and the DBD is located close to the shot underground.

Parameters of serial configuration can only be modified by means of the external modem configuration and is not possible to configure through the DRB2 menus.

The available configurations available for underground wireless communications is:

- LeakyFeeder
- WiFi
- Fibre Optics
- RS232
- RS485

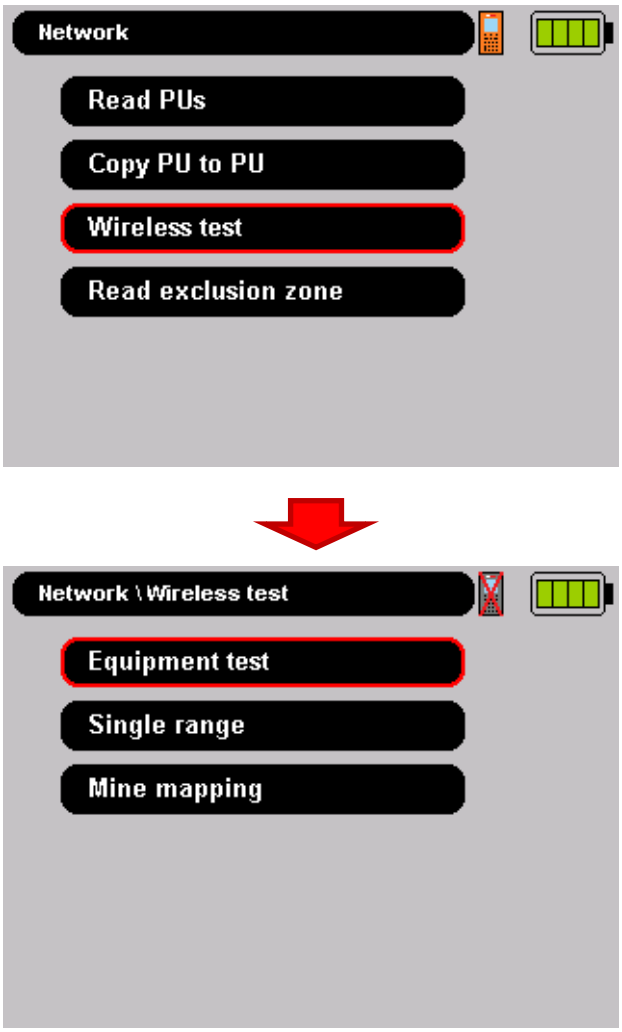
Please contact your local Enaex technical representative and modem manufacturer for such a configuration.

Wireless test

This menu enables the operator to test the wireless communication of the DT SP/UG system:

- **Equipment test:** Enables a test and validates the RF chain between two units.
- **Single range:** Enables a test of the wireless communication of the system installed in the field (now available for SP and UG).
- **Mine mapping:** Enables users to define the best location of the equipment in the mine in order to have the best communication quality.

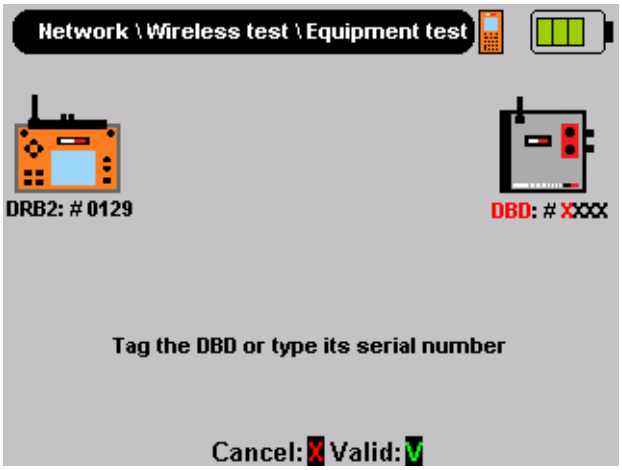
From the main menu, select **NETWORK**, using ▲/▼ then press √.



Equipment test

The objective of this test is to check the chain of radio communication between a DRB2 and a DBD in an office (warehouse, laboratory, technical center …) environment. This test can be performed using internal modems, external modems, in repeater mode and in non-repeater mode.
Note: The equipment under test should have the same modem configuration.
The test time is approximately 3 minutes in non-repeater mode configuration and 4 minutes in repeater mode configuration.

Select **Equipment** using ▲/▼ from the **Wireless test** menu then press √. The screen below is displayed prompting the operator to tag the DBD to be tested:



Equipment setup

The result of the test is relevant only if the equipment is installed following one of the two setups listed below

- Setup n°1

  The 2 units must be installed at the same level (e.g. table) and located at a distance of 2 meters. Connect the antennae on the antenna connectors of the DBD and DRB2

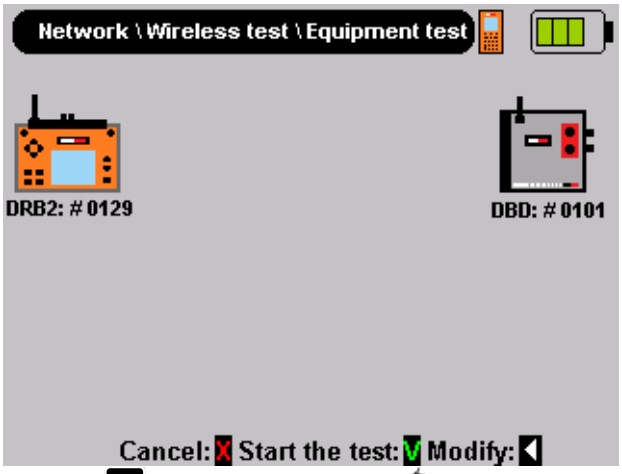
- Setup n°2

  The 2 units must be installed on a table and linked with a coaxial cable and three “-20 dB attenuators” through the DRB2 and DBD antenna connectors.

  Contact your Enaex representative for the connection kit (“DT4 – Maint check attenuator kit” ref: 54116).

Associate the DBD to the DRB2

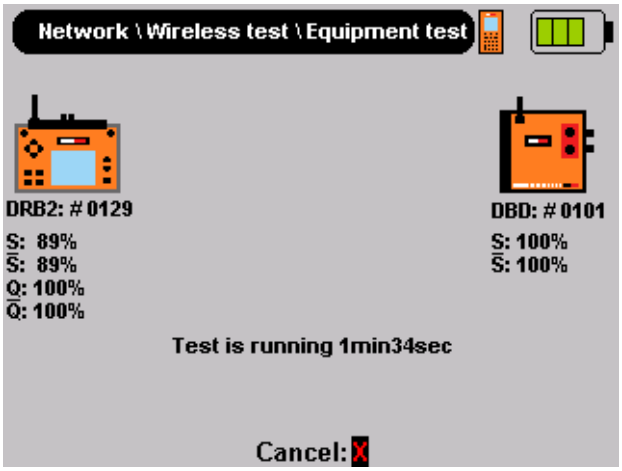
The DBD to be tested must be associated with the DRB2 intended to be used. The operator needs to tag the DBD with the DRB2 or type its number by scrolling through the characters with ▲/▼ and moving the cursor with ◄ / ► .Then press √ to validate and continue.



Press √ to start the test, X to exit or press the ◄ button to modify the tagged DBD.

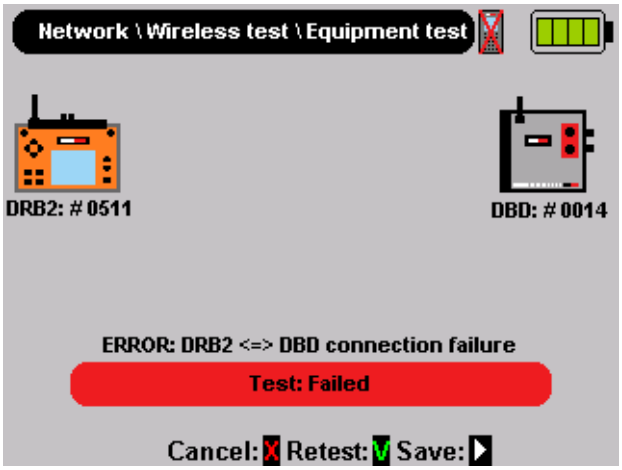
Test processing

When the test is processing, the screen below is displayed indicating the measurement values and time running:



Press X to abort the test.

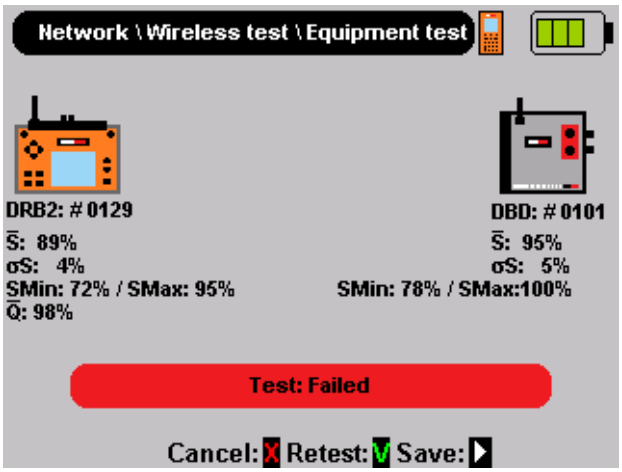
Note: if DRB2 failed to establish wireless communication with the DBD, the following screen is displayed



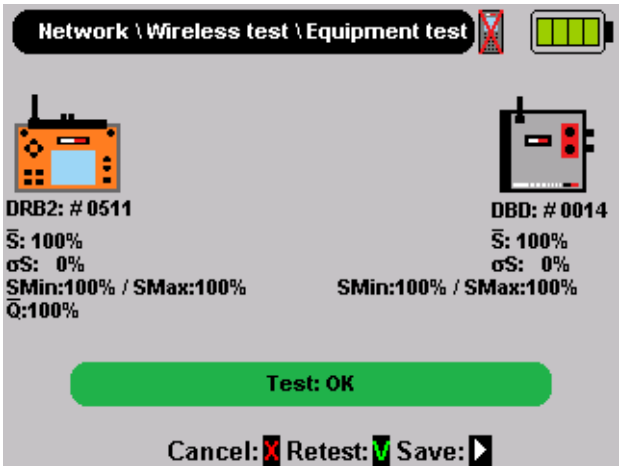
Test result

Depending on the test results one of the two following screens is displayed:

- Test failed



- Test OK



Both screens display the test result for each equipment used in the test:

- $\bar{S}$: Received Signal Strength Indication (Rssi) average
- σS : deviation
- SMin/SMax : min and max value of the Rssi

It also display $\bar{Q}$: Quality average of the whole chain of communication

Save test result

At the end of the test the user has the option to export the test result to a USB key. This report logs the results of the test in a file named ***TE-DRBxxx_yyyymmdd.txt*** where xxx is the serial number of the DRB2 and yyyymmdd is the date of the test.

While in the test result screen, connect a USB key to the DRB2 and press the button so save the report.

```
*******************************
*       DAVEY BICKFORD        *
*       EQUIPMENT TEST        *
*         DRB n° 0511         *
*         DBD  n° 0014        *
*     2018/06/27 11:17:26     *
*******************************

RSSI :
  DRB2 n° 0511 :
    Average     : 100%( -40dB)
    Deviation   :   0%(-105dB)
    MIN         : 100%( -40dB)
    MAX         : 100%( -40dB)
  DBD  n°  14  :
    Average     : 100%( -40dB)
    Deviation   :   0%(-105dB
    MIN         : 100%( -40dB)
    MAX         : 100%( -40dB)
Q               : 100%

Test: OK
```

Press X to exit or √ to restart the test

Single range

The objective of this test is to check that the communication chain between the DRB2 and up to 4 DBDs is correct before tagging the PUs and start a firing procedure.

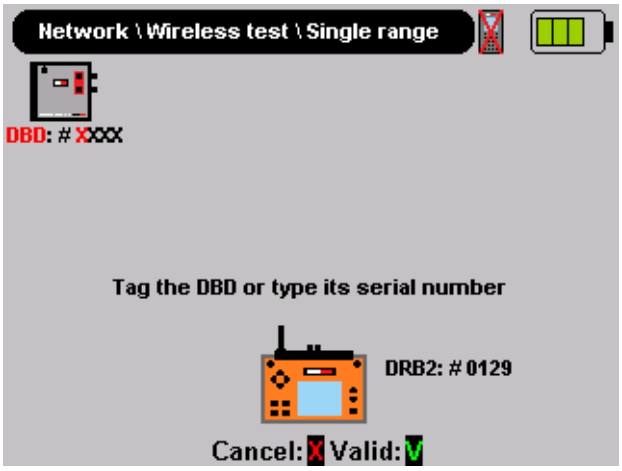
The test result is done in the same sequence as in operational mode, where each DBD one after the other is tested and indicates the following:

- Average Q: Calculated ratio of the last 5 samples received /sent
- For each communication direction: from the DRB2 to the DBD (R←B) and from the DBD to the DRB2 (B←R):
  - Average RSSI level ($\bar{S}$)
  - Maximum RSSI level (M):
  - Minimum RSSI level (m)

The test can be performed using internal modems, external modems, in repeater mode and in non repeater mode.

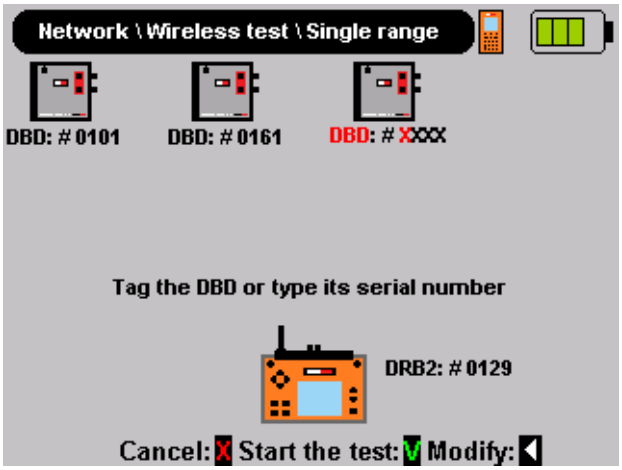
Note: The equipment under test must have the same modem configuration.

Select **Single range** using ▲/▼ from the **Wireless test** menu then press √. The screen below is displayed prompting the operator to tag the DBDs to be tested.



Associate the DBDs to the DRB2

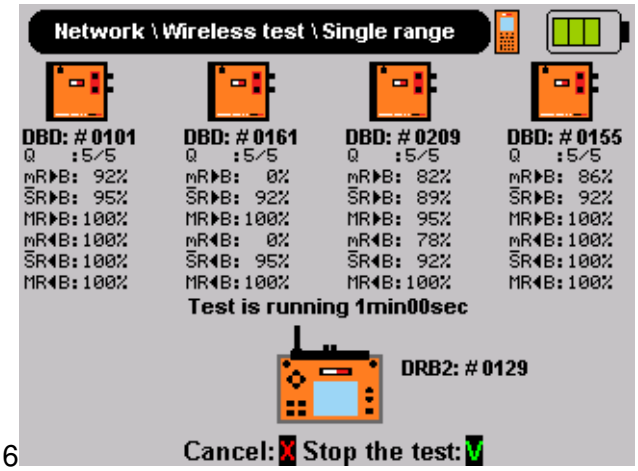
The wireless communication can be test with 1 and up to 4 DBDs. The operator must either tag the DBDs with the DRB2 or type the DBDs number by scrolling through the characters with ▲/▼ and moving the cursor with ◄ / ►. Then press √ to validate association.



Press √ to start the test, X to exit or press the ▲ button to modify the tagged DBDs.

Test processing

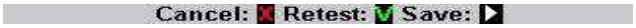
When the test is processing, the screen below is displayed indicating the measurement values and time running:



6

Press X to abort the test or √ to stop the test.

When test is completed, press X to cancel, √ to restart the test or ◄ to save the data.



Save test result

At the end of the test the user has the option to export a report to a USB key.
This report logs the results of the test in a file named ***SR-DRBxxx_yyyymmdd.txt*** where xxx is the serial number of the DRB2 and yyyymmdd is the date of the test.

While in the test result screen on the DRB2, connect a USB key to the DRB2 and press the 🡅 button so save the report.

```
******************************
*       DAVEY BICKFORD       *
*   SINGLE RANGE DRB2 n° 037 *
*     2018/06/27 16:08:06    *
******************************

Duration: 1min02sec

-------------------------------------------------------------
|                |   Q   | RSSI Min | RSSI Mean | RSSI Max |
-------------------------------------------------------------
| DRB2 -> DBD001 |       |    75%   |    89%    |    95%   |
|----------------|  5/5  |----------|-----------|----------|
| DRB2 <- DBD001 |       |    89%   |    95%    |   100%   |
-------------------------------------------------------------
| DRB2 -> DBD025 |       |    75%   |    82%    |    95%   |
|----------------|  5/5  |----------|-----------|----------|
| DRB2 <- DBD025 |       |    82%   |    82%    |    95%   |
-------------------------------------------------------------
| DRB2 -> DBD086 |       |    48%   |    78%    |    95%   |
|----------------|  5/5  |----------|-----------|----------|
| DRB2 <- DBD086 |       |    25%   |    51%    |    78%   |
-------------------------------------------------------------
| DRB2 -> DBD104 |       |    86%   |    89%    |   100%   |
|----------------|  5/5  |----------|-----------|----------|
| DRB2 <- DBD104 |       |    86%   |    86%    |   100%   |
-------------------------------------------------------------
```

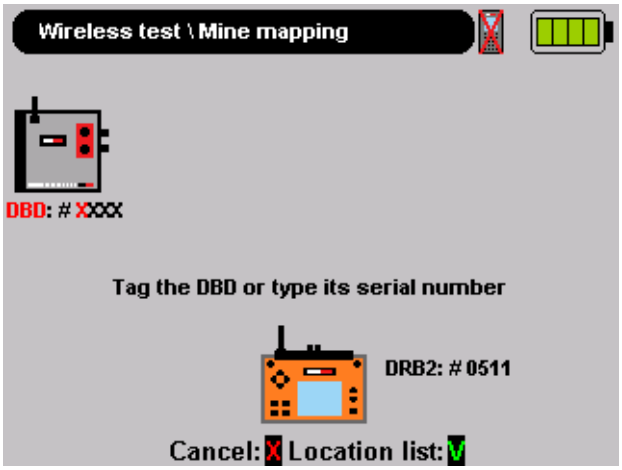
Mine mapping

The objectives of this functionality is to do a mapping of signal quality in the mine when the wireless DTSP system is introduced in order to determine suitable geographical positions for the DRB2 and the DBDs with good communication.

Note: The equipment under test must have the same modem configuration.

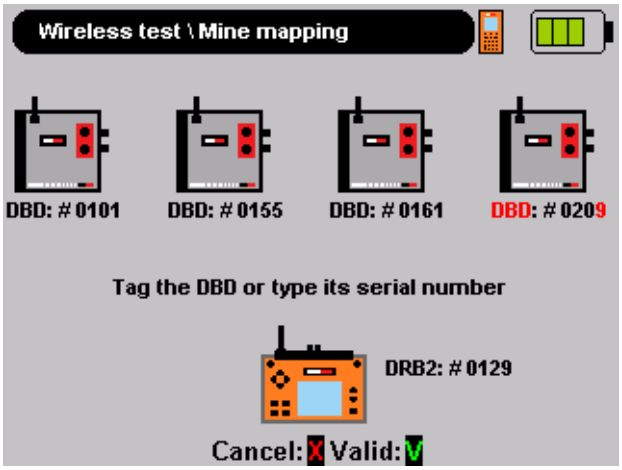
The test time for 1 DBD (not repeater) is approximately 1min30s, and for 4 DBD 6 minutes.

Select **Mine mapping** using the ▲/▼ buttons from the **Wireless test** menu then press √. The screen below is then displayed prompting the operator to tag the DBDs to be tested:



Associate the DBDs to the DRB2

The wireless communication can be tested with 1 and up to 4 DBDs. The operator must either tag the DBDs to the DRB2 or type the DBD numbers by scrolling the characters with ▲/▼ and moving the cursor with ◄ / ► .Then press √ to validate association.

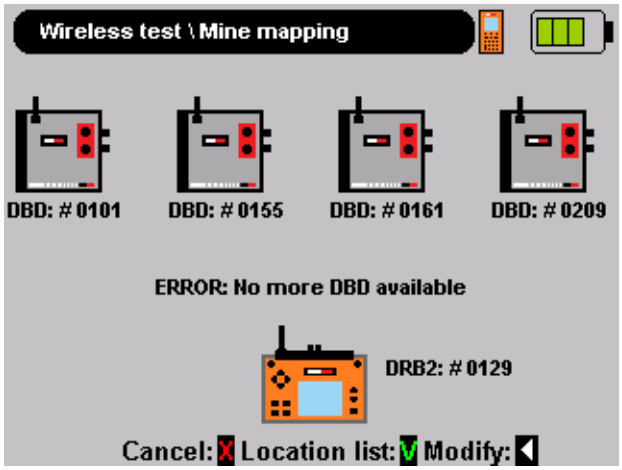


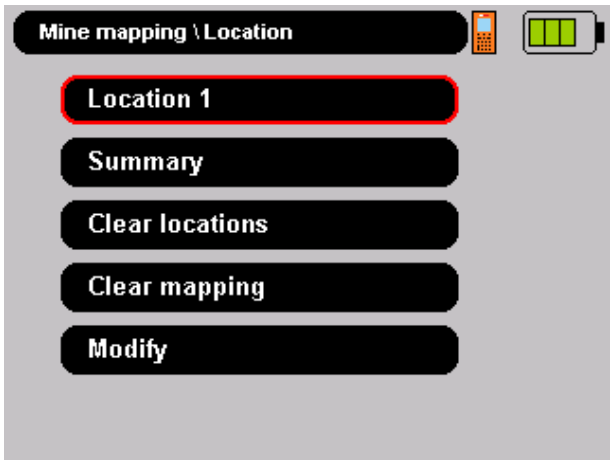
Note: It is recommended to complete the DBD test at the usual blast location.

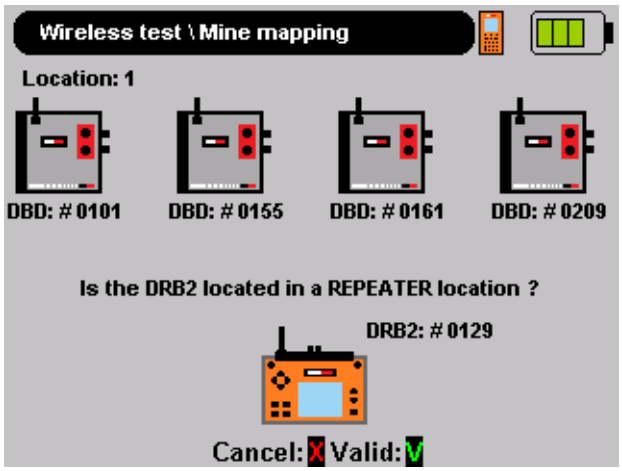
Note: To modify an associated DBD, press ◄ / ► to select it and press √ to modify

Location Menu

When association with the DBDs is done, choose the first potential firing location and press enter in order to start the test ("Location list V")


Wireless test \ Mine mapping
DBD: # 0101
DBD: # 0155
DBD: # 0161
DBD: # 0209
ERROR: No more DBD available
DRB2: # 0129
Cancel: X Location list: V Modify:

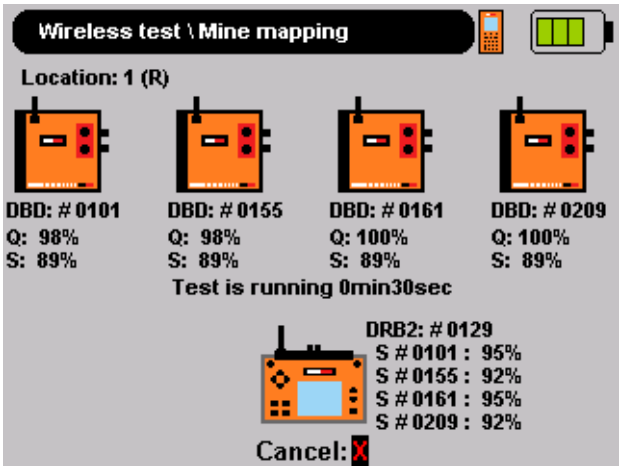

Mine mapping \ Location
Location 1
Summary
Clear locations
Clear mapping
Modify


Wireless test \ Mine mapping
Location: 1
DBD: # 0101
DBD: # 0155
DBD: # 0161
DBD: # 0209
Is the DRB2 located in a REPEATER location ?
DRB2: # 0129
Cancel: X Valid: V

I. Location x:

The "x" is the location number, it defines the location of the unit and is reported in the summary table (refer to the "Summary" to access to the summary table)

Press ◄ / ► to select the location and press √ to start the test from this location.



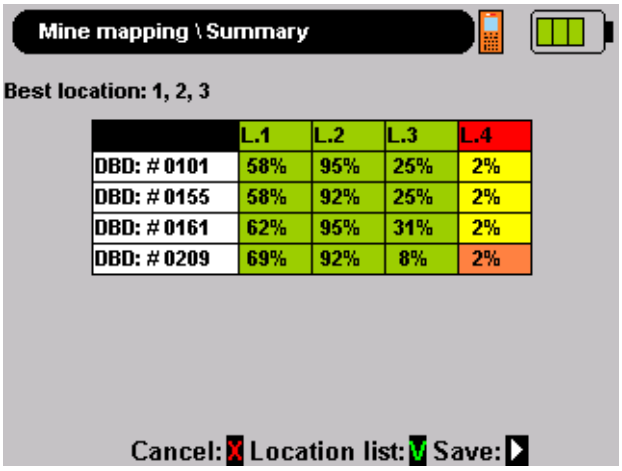
II. Summary :

Based on the test completed at different locations, the summary screen displays the summary test result in a table.

This screen indicates the following information:

- A summary of the test results previously done.
- An indication of the potential best location(s).
- The option to export a report on a USB key.

The values in the table represents the quality averages.



The result of the tests should be interpreted as following:

- Location (first line of each column) : **L.x** where x is the location number and can be **Green** or **Red**,
  - ▬ => Q indicates the DBD's communication quality in this location is equal or less 50%
  - ▬ => Q indicates the DBD's communication quality in this location is higher than 50%

- DBD (per cell) : xx% is the average RSSI (Received Signal Strength Indicator) level and the color of the cell (refer to table below) depends on the average Q calculated during communication between the relevant DBD and DRB2.

	Q between DRB2 and related DBD is higher than 75%
	Q between DRB2 and related DBD is between 51% and 75%
	Q between DRB2 and related DBD is between 26% and 50%
	Q between DRB2 and related DBD is equal to or less than 25%

This menu allows the report to be exported on to a USB key. Insert the USB key in the USB port and press . This report logs the results of the test in a file named MM-DRBxxx_yyyymmdd.txt where xxx is the serial number of the DRB2 and yyyymmdd is the date of the test.

Press x to exit or √ to return to the Location menu.

III. **Clearing location:**

Select **Clear location** using ▲/▼ from the **location** menu then press √ to erase all the measurements made at the locations.

IV. **Clearing mapping:**

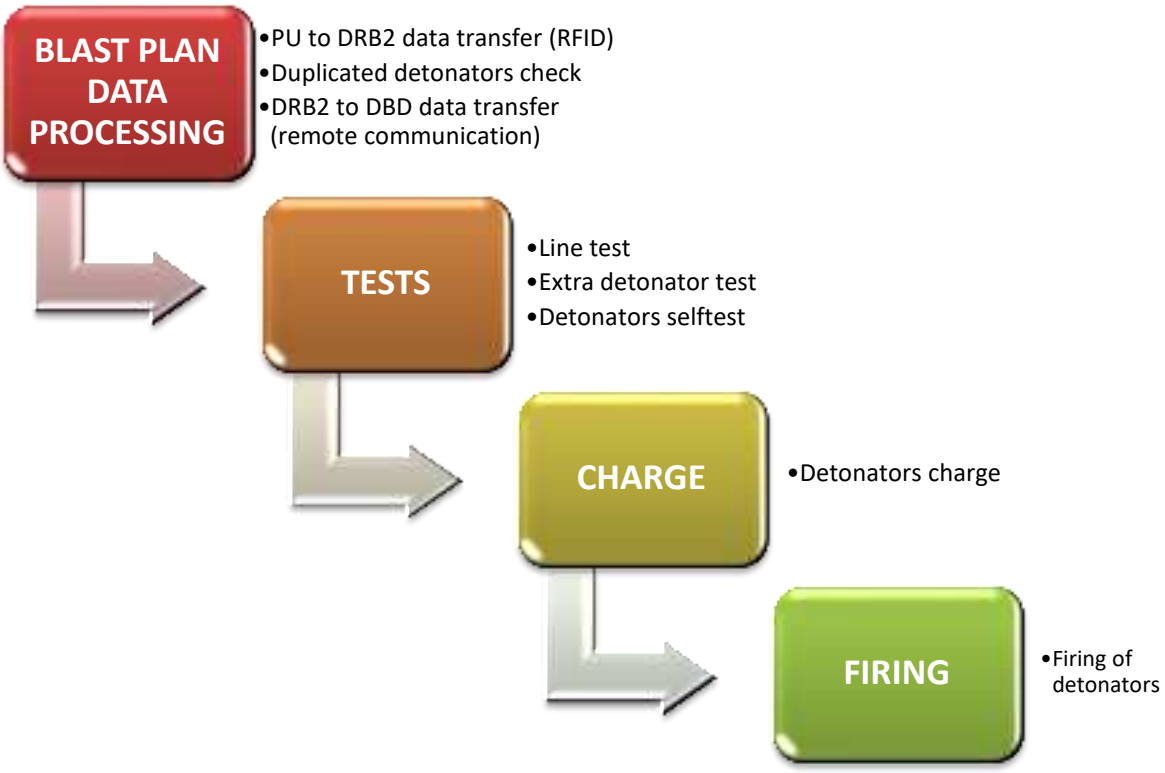
Select **Clear mapping** using ▲/▼ from the **location** menu then press √ to erase all the measurements made at the locations and to erase the associated DBDs.

V. **Modify:**

Select **Modify** using ▲/▼ from the **location** menu then press √ to return to the **Mine mapping** menu and to modify the DBD details.

Firing procedure

After all tests have been completed with the PU(s) and the site is secured the shot firer can connect the firing line to the DBD and retreat to a safe firing location. At the firing location the blast plan data can be transferred from the PU(s) to the DRB2, and the DRB2 switched into operational mode. The DBD then executes the firing procedure and associated tests. The progress of the procedure and the results of the tests are displayed on the screen of the DRB2. The firing procedure includes 4 successive steps:



WARNING: Before starting the firing procedure, visually check the DRB2 and DBDs to ensure there is no excessive dirt or damage to the equipment. If damage is detected, do not use the device.

When the equipment is switched on and successfully passes the self-test, connect the firing line to the firing line terminals of the DBDs.

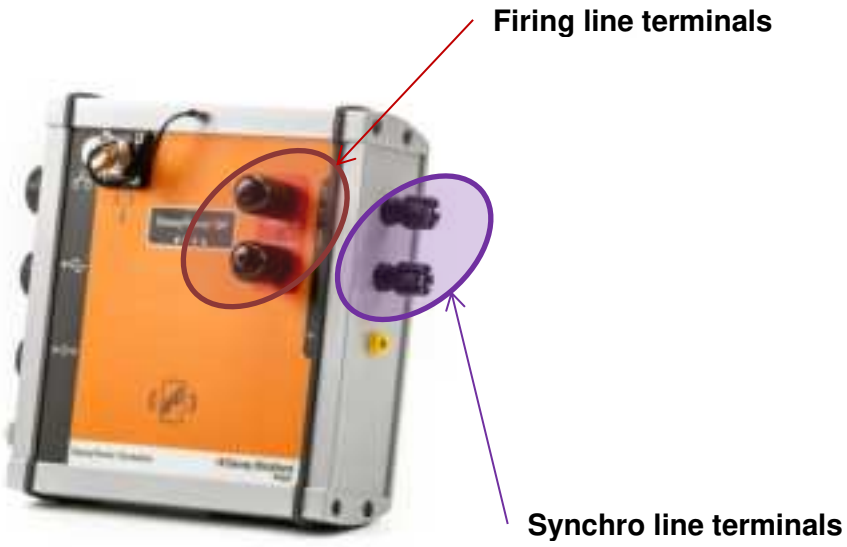
The two terminals on the side of the unit are used to connect several DBDs when the synchronised mode is used.

In Synchroblast:

Connect the firing line to the firing line terminals of the DBD and connect all the DBDs together by means of the Synchro line terminals

In Multiblast or Monoblast:

Connect the firing line to the firing line terminals of the DBD.



WARNING: Only connect a firing line to the firing line terminals of the DBD, encircled in red on the picture above. Never connect any other equipment to these terminals.

WARNING: In Monoblast and Multiblast never connect anything to the Synchro line terminals of the DBD.

While operating with DBD it is reccomended use the firing caps as shown in the following pictures:

Note: To avoid duplicating information, it's assumed that "Firing in WIRED mode" has been read before reading this chapter.

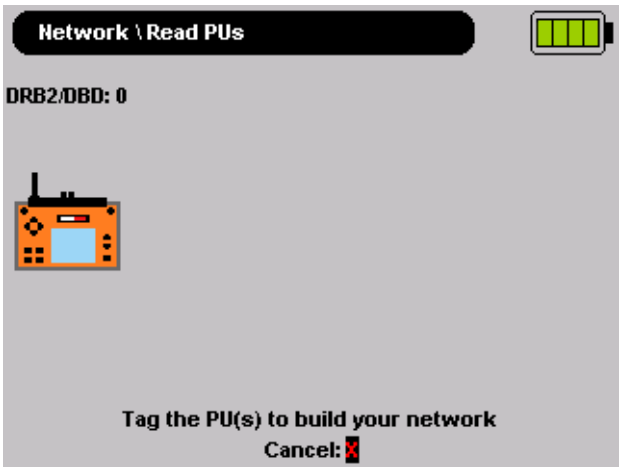
After associating the DBD to the PU, the blast plan data has to be transferred from the PUs to the DRB2

Monoblast

Read PU

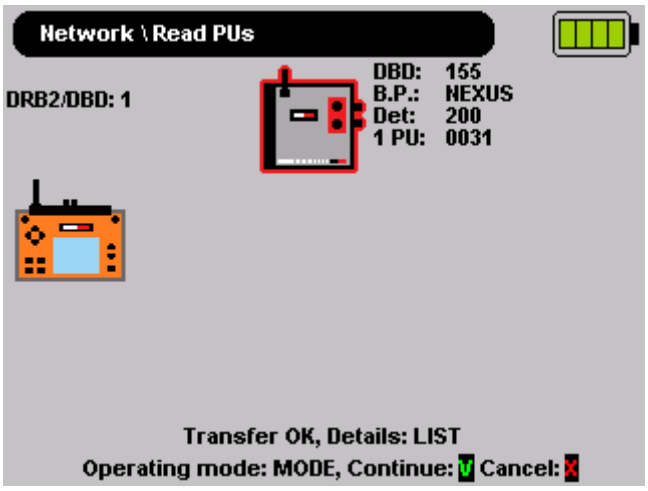
On the **MAIN** menu, when the DRB2 is first switched on, the icon is displayed on the top right of the screen which means that no data has been transferred yet.

Use the ▲/▼ arrow button on the left hand side of the DRB2 to select **Network** \ **Read PUs** and press √.

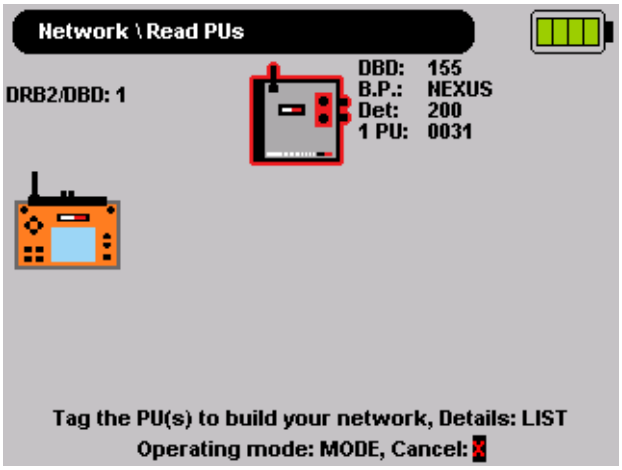


The DRB2 must read the PUs RFID tag in order to transfer the data. Switch off the PU, and tag the PU lining up the PU with the DRB2's left bottom corner. The DRB2 will display "**TAG DETECTED**" and start the data transfer by showing the progress in percent (%).

When the transfer is completed a summary of the transferred data is displayed showing ***"DBD #XXXX"*** blast , Status, plan name, the total number of detonators per PU with its serial number.



Press X to cancel and return to main menu.
Press √ to continue to transfer data from other PU's associated to DBD's.
Press to proceed with blast procedure.

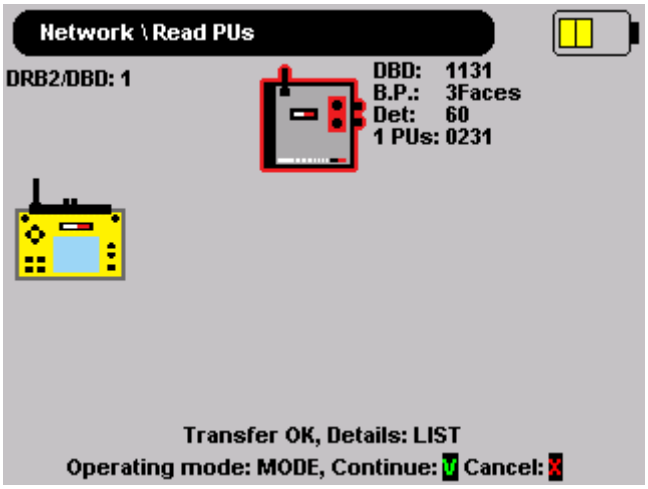


Tag another PU to add detonators in the blast plan.
Press to exit and return to **MAIN** menu.
Press to proceed with blast procedure.

Read Pus (Swift)

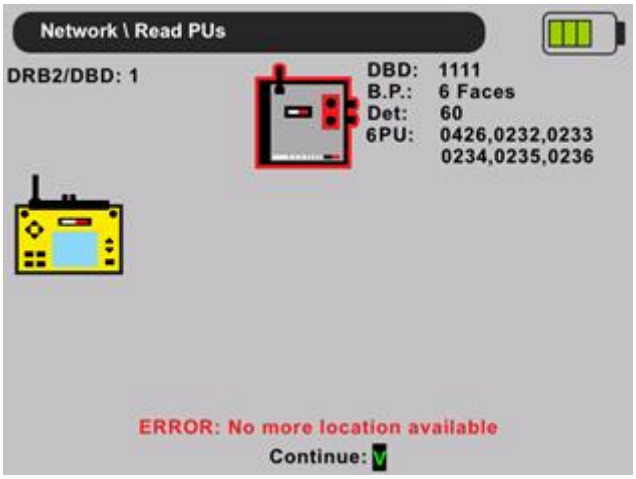
Refer to the Read PU chapter.

When the transfer of a Swift PU is completed a summary of the transferred data is displayed showing ***"DBD #XXXX"*** blast , number of faces, the total number of detonators and PU with its serial number.

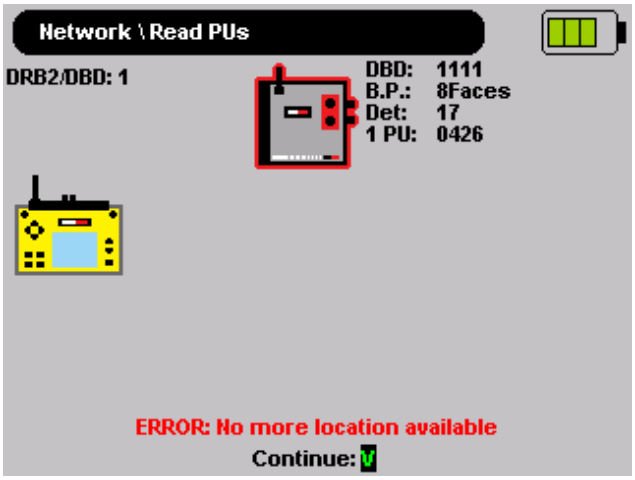


To select the faces to be fired, press LIST button (see "Multiface selection in Swift" chapter)

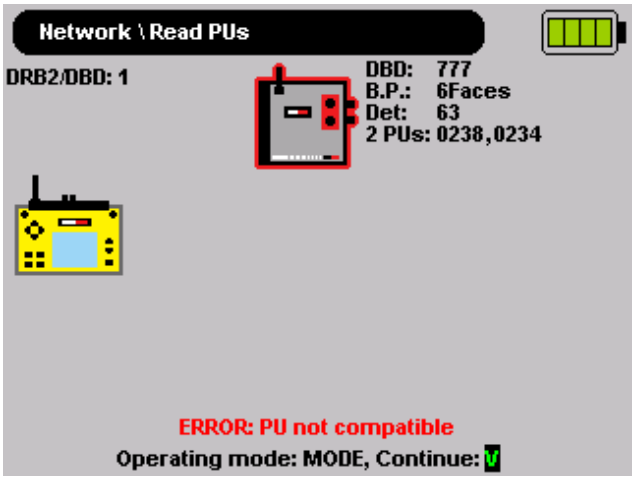
The maximum number of Swift PU per DBD is 6:



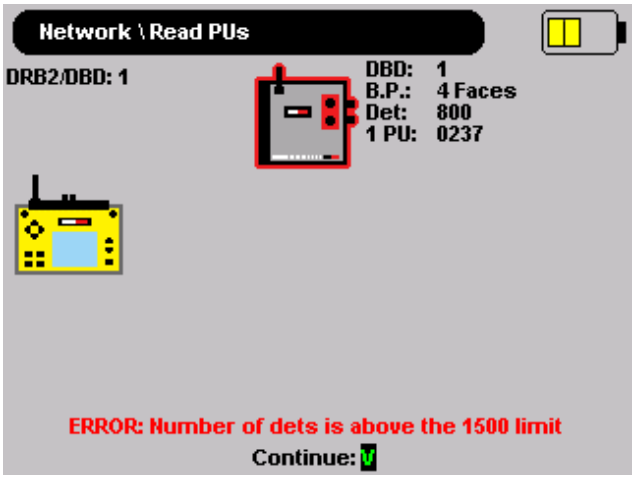
The maximum number of faces is 8:



If Swift detonators are already assigned to a DBD, impossible to tag another PU that contains non Swift detonators



Impossible to have more than 1500 detonators per DBD:



Self-test and blast mode detection

Once blast plan has been transferred from the PUs to the DRB2, press  to start the blast procedure. The DRB2 will conduct the following steps:

- Checking system compatibility
- Perform an equipment Self-test
- Perform a blast mode detection

The status of the steps is displayed in the last line of the screen

The system compatibility check verifies all components of the unit are compatible from an Hardware and Software point of view. If an error occurs during this check, the procedure stops and the relevant error is displayed.

If no system compatibility issue was detected, the self- test of each DBD is launched

If an error occurs during equipment self-test, the procedure stops and the related error is displayed.

The blast mode detection step checks if the equipment is configured in:

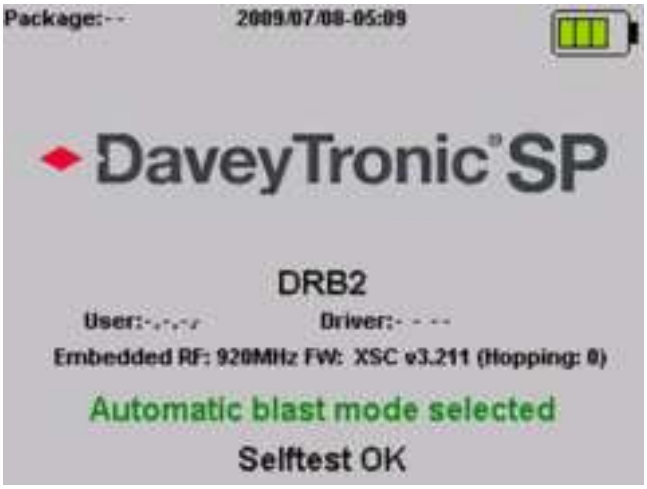
- Monoblast / Multiblast
- Synchroblast®

It is possible to configure the DRB2 in order to reduce the “detecting mode” time:

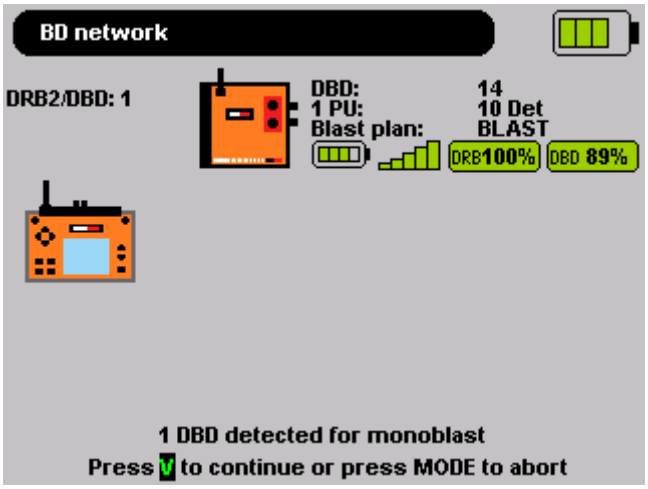
- Automatic blast mode:
  The DRB2 will check the DBD synchro line wiring and automatically detects the blast mode accordingly (in this mode the detection time can take between 10 to 45 seconds)
- Mono/Multiblast mode only:
  The Blast mode is forced for only Monoblast, Multiblast. There is no additional delay for mode detection as Synchroblast® is not possible.
- Synchroblast® mode only:
  The Blast mode is forced for only Synchroblast®. There is no additional delay for mode detection as Monoblast or Multiblast is not possible.

Note: The blast mode detection can only be configured by your local Enaex technical representative.

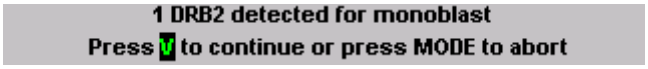
At the DRB2 startup, the configured blast mode option is displayed in green or red characters:



Once the right mode has been detected successfully, the following screen is displayed:



Or

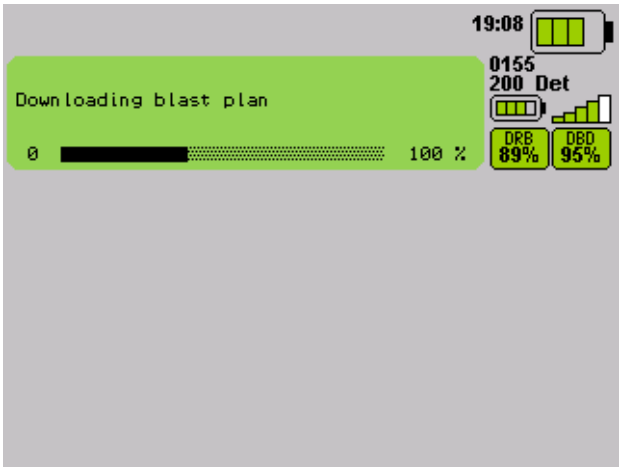


If an error occurs during the test, the relevant message is displayed in the status line on the screen of the relevant DBD.

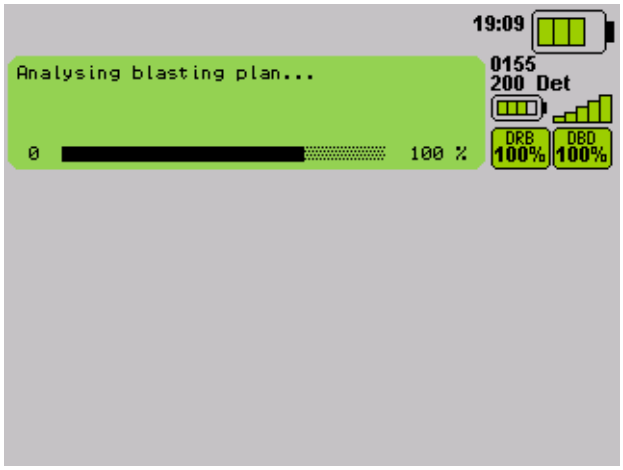
Once blast mode has been detected successfully, the operator is prompted to press √ to continue the firing procedure.

Préliminary checks

The screen below is displayed while the DRB2 transfers the blast plan data to the DBD. The time to process the blast plan, depends on the size of the blast plan and this screen may be visible for a very short time.



When the download is successfully completed, the DRB2 analyses the blast plans

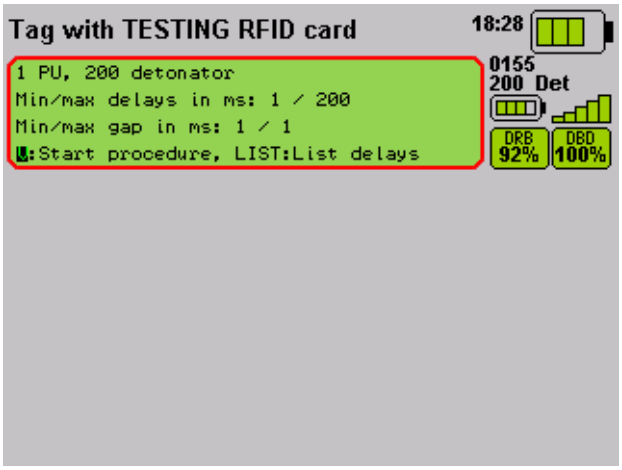


NOTE: Switching to the operational mode is only possible after tagging the DRB2 with the TESTING RFID safety tag. The TESTING RFID safety tag should always remain in the shot firer's possession.

If the blast plans are OK, the DRB2 summarizes the transferred data for each DBD:

- the number of PUs
- the number of detonators and skip detonators
- the min and max delays
- the min and max interval

Each network (DBD) is displayed on its own green screen. The serial number of the DBD, communication signal quality of the communication and the battery indicators of the DBD is displayed on the right hand side of the DRB2 screen. The screen also displays the RSSI (signal strength in %) for the DRB2 and the DBD.



Press  to list all detonators and delays

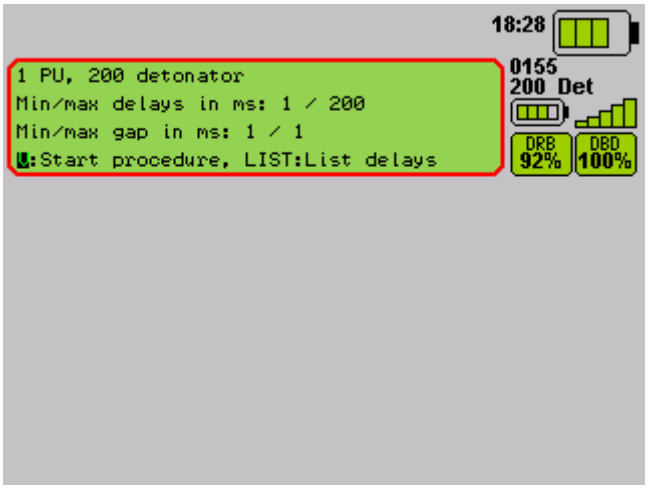
When in the list of detonators and delays, press ◄/► to scroll through the detonators, ▲/▼ to scroll through the PUs or  to return the summary display.

OR

Press  to exit to the **MAIN** configuration menu.

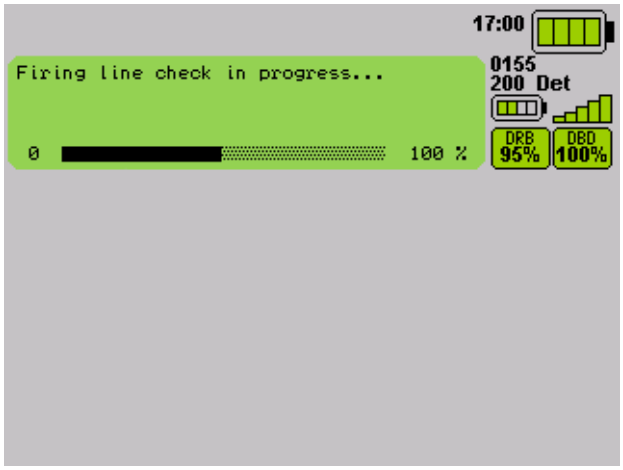
OR

To start detonator test, swipe TESTING RFID card on the back of the DRB2 and press  .

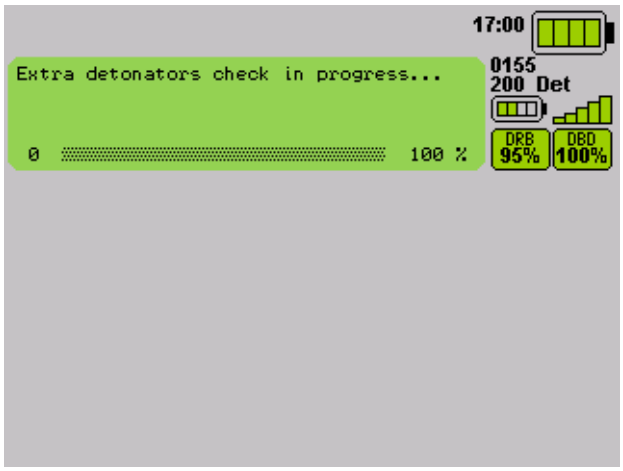


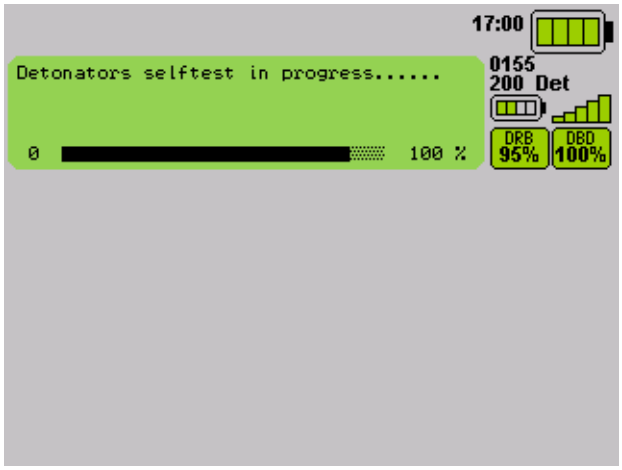
Detonator test

As soon as TESTING RFID card has been swiped on the back and √ button has been pressed (refer to the Préliminary checks chapter), the detonator tests start:



Afterwards, the test procedure will proceed to the "extra det check" test and the "detonator self-test".

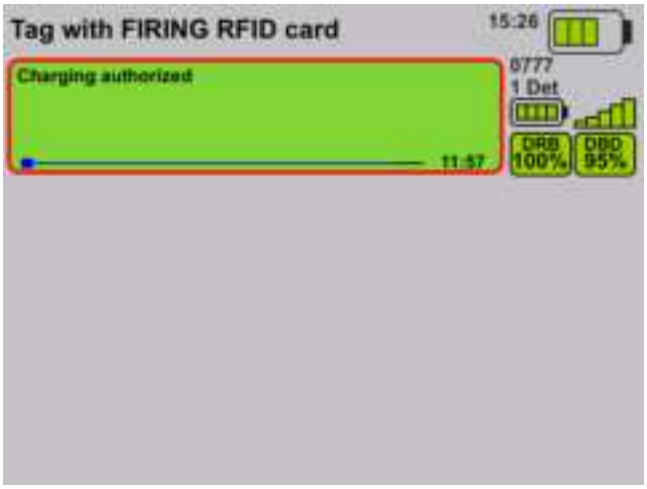




If any error occurs during the test, an error rmessage is displayed on the green section of the screen of the specific network where the error has been encountered (refer to the

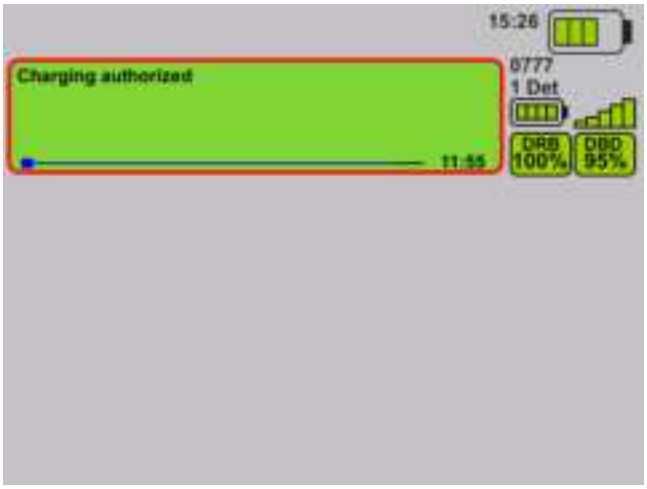
Dealing with errors during the firing phase chapter).

If no error is detected during the tests and they have been completed, the system authorizes the charging of the detonators firing capacitors with an onscreen message **"Charging authorized"** and a voice message ***"READY TO CHARGE".*** Charging of each network, must be started before the unique timer expires.



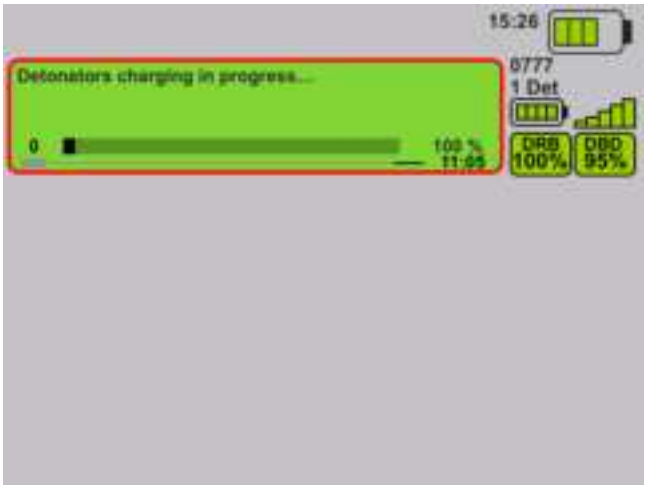
Charge

The operator has to enable the charge button by tagging the FIRING RFID card: charging is activated for 10 seconds.



NOTE: Charging and Firing is only possible after tagging the DRB2 with the FIRING RFID safety tag. The FIRING RFID safety tag should always remain in the blast controller's possession.

Then press and hold the button to charge the detonators.



Fire

When charging is complete, a charge test is performed and firing is authorised. The button is illuminated and the vocal message "***READY TO FIRE***" is heard.

Press to fire the blast.

If the detonators are not fired by the time the unique countdown timer has expired, the DRB2 informs the user that the time has expired and the procedure has to be restarted, starting from the line test phase. A cancel command will automatically be sent to the relevant network and the detonators will discharge their capacitors and return to safe mode

Note: The authorized time to charge other network continues to decrease during the firing process of the selected network.

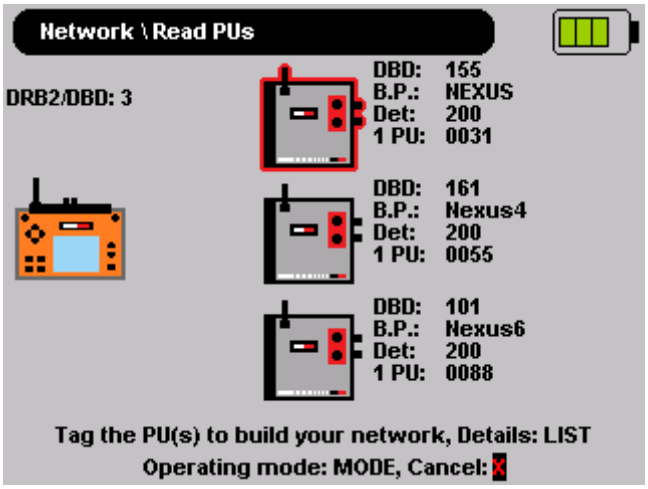
IMPORTANT: If the operator presses the button before the DRB2 displays the "FIRING AUTHORIZED" message, the system will display "Release the FIRING button".

IMPORTANT: If the operator releases the charge button, the system will go into safety mode, the capacitors are discharged and the firing procedure has to be restarted from the detonators testing. The only consequence of this action is the extra time taken to run the procedure again.

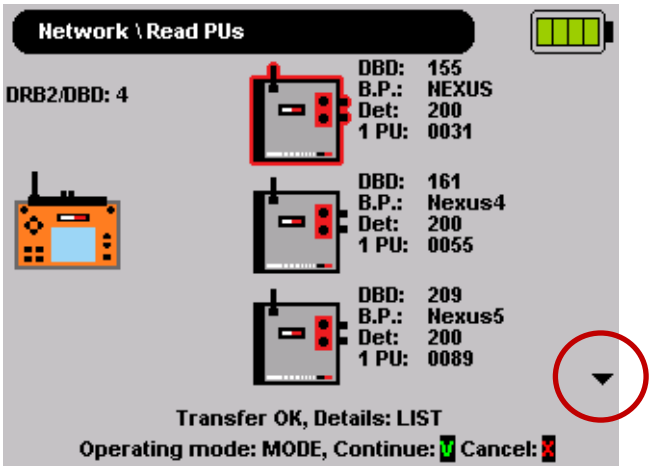
Multiblast

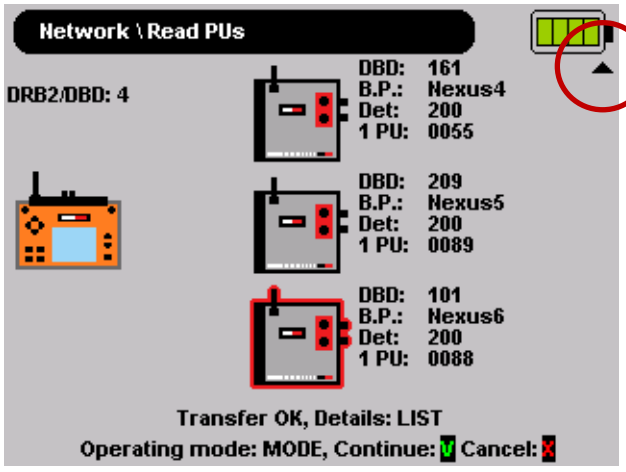
Read PU

Refer to the Read PU chapter.
In Multiblast mode, the blasting system is able to control up to 8 DBD networks.



When more than 3 DBDs are associated, up and down arrows are displayed on the right of the screen (surrounded in red below) and navigation through the DBDs is possible by using the ▲/▼ buttons.





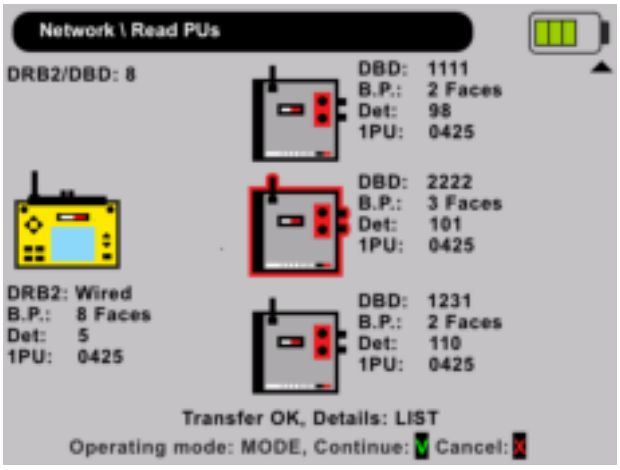
Note: The message below is displayed if a tagged PU is associated with a 9th DBD

Press  to proceed with blast procedure.

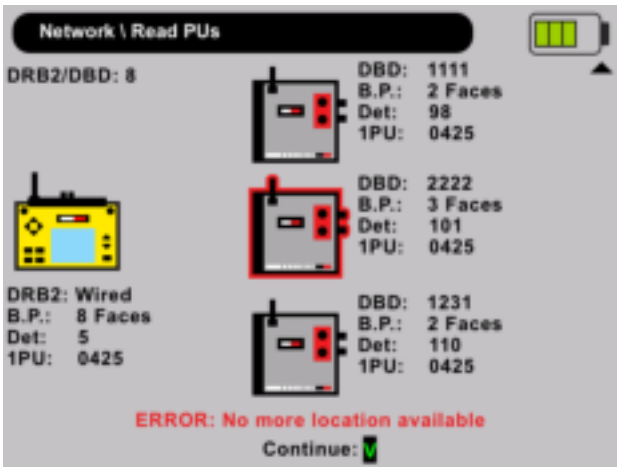
Read PU (Swift)

Refer to the Read PU and Read PU (Swift).

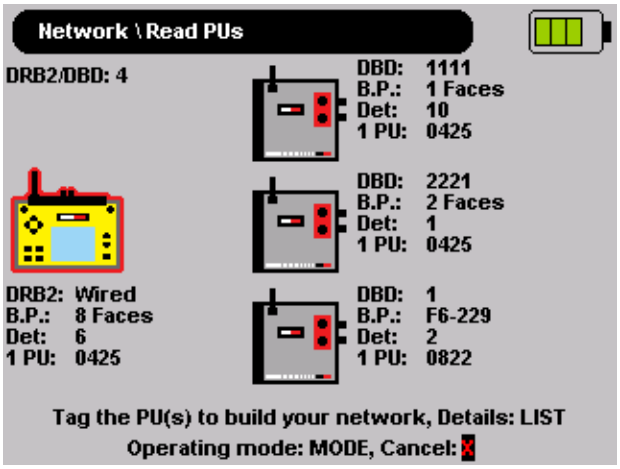
The blasting system is able to control up to 8 DBD networks with Swift detonators.



The maximum number of devices (DRB2/DBD) in the multiblast is 8. The DRB2 will raise the following error as soon as 9th DBD is added in the Multiblast:



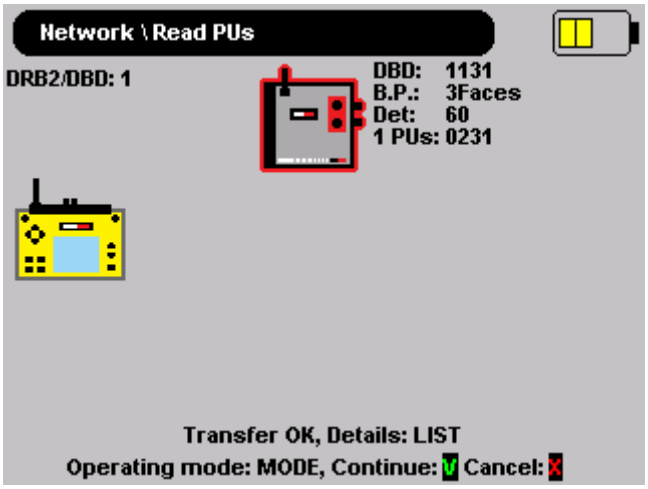
The blasting system is able to control DBD assigned to Swift and non-Swift detonators in the same Multiblast:



Self-test and blast mode detection

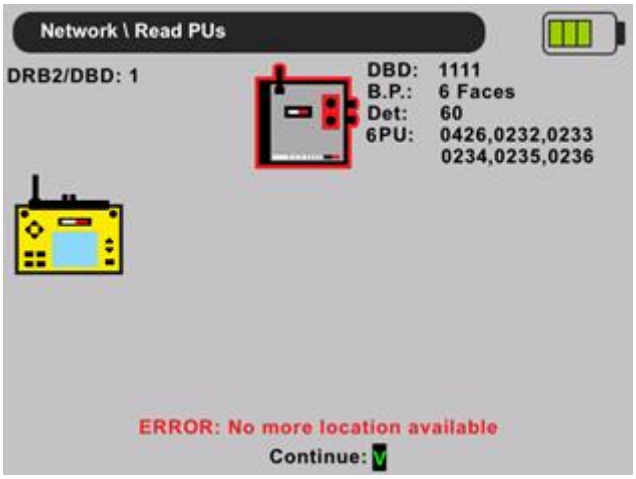
Refer to the Read Pus (Swift)
Refer to the Read PU chapter.

When the transfer of a Swift PU is completed a summary of the transferred data is displayed showing ***"DBD #XXXX"*** blast , number of faces, the total number of detonators and PU with its serial number.

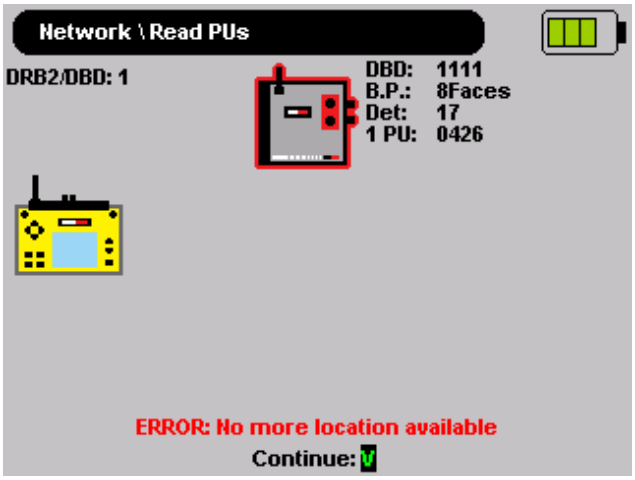


To select the faces to be fired, press LIST button (see "Multiface selection in Swift" chapter)

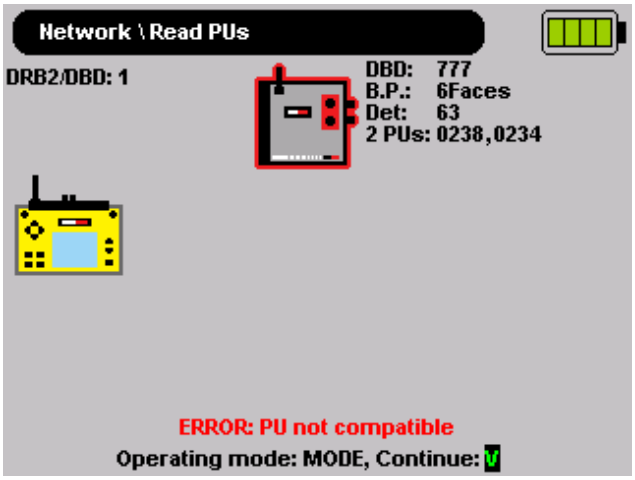
The maximum number of Swift PU per DBD is 6:



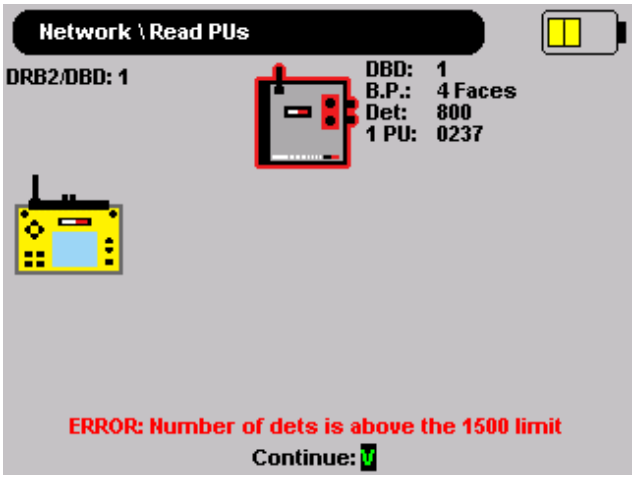
The maximum number of faces is 8:



If Swift detonators are already assigned to a DBD, impossible to tag another PU that contains non Swift detonators

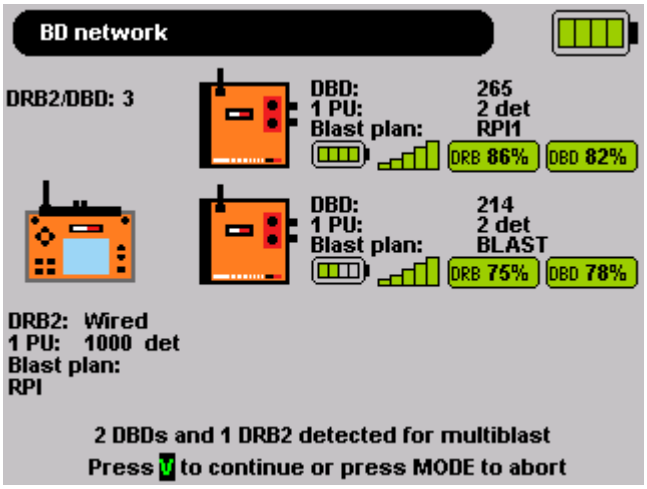


Impossible to have more than 1500 detonators per DBD:

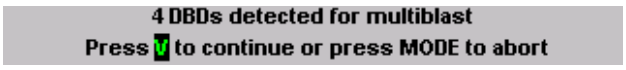


Self-test and blast mode detection chapter.

Example of Multiblast screen:



Other configuration examples:

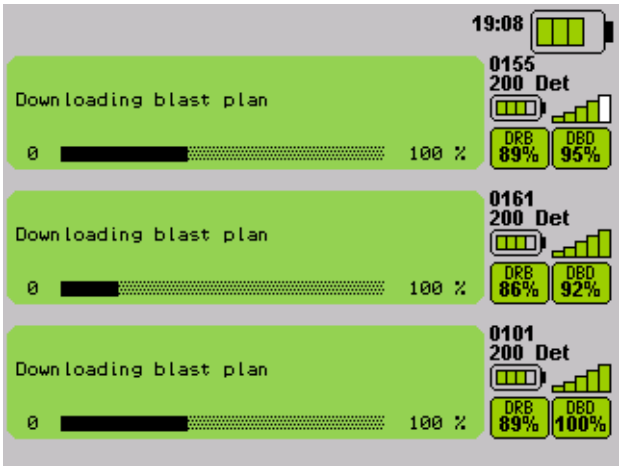


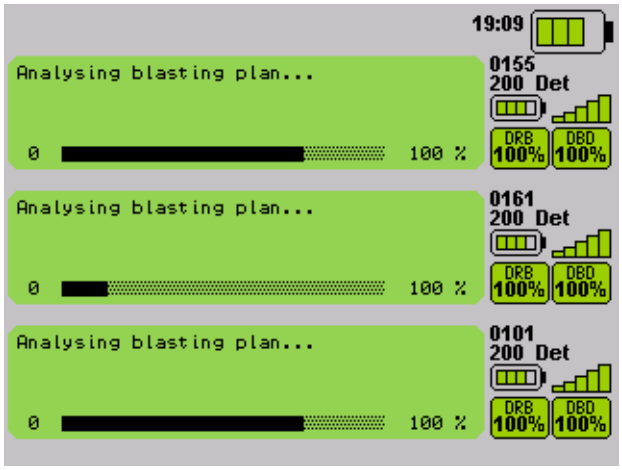
Once blast mode has been detected successfully, the operator is prompted to press √ to continue the firing procedure.

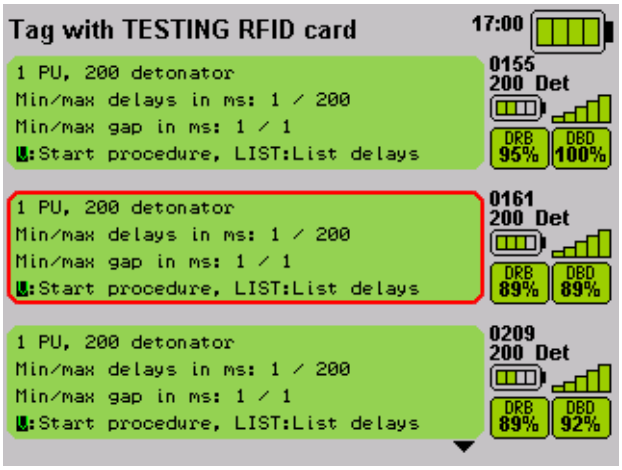
Preliminary checks

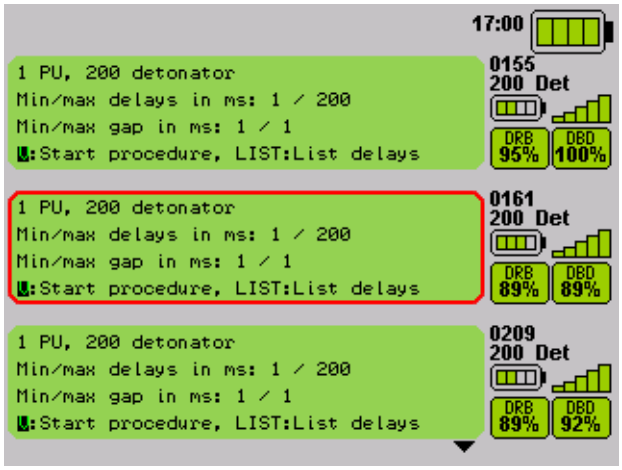
Refer to the Préliminary checks chapter.

Examples of multiblast screens:









Use ▲/▼ on the right hand side of the DRB2 to scroll through screens: the selected screen is surrounded in red.

Detonator test

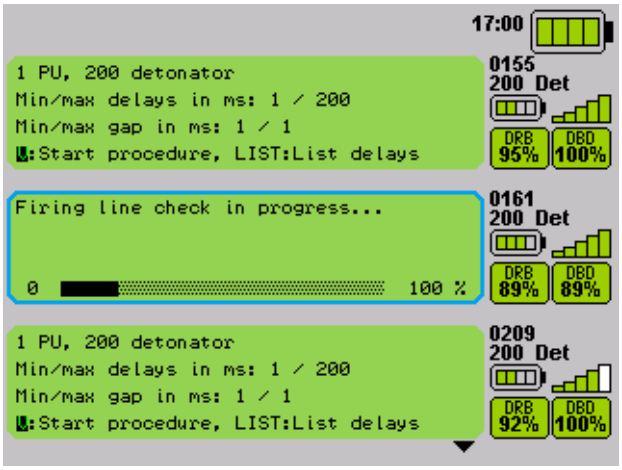
Refer to the Detonator test chapter.

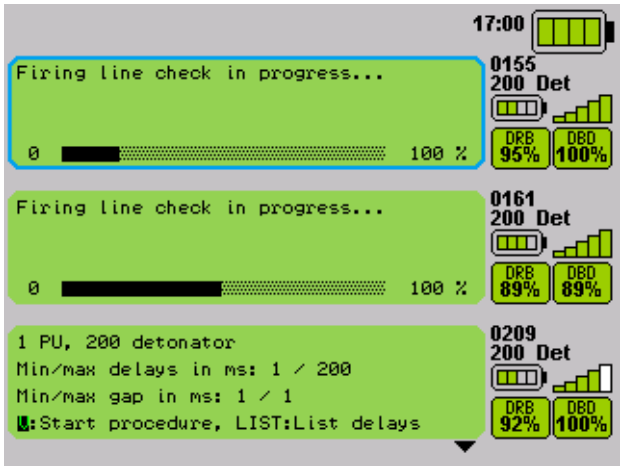
The test procedure begins by testing the line. Operators should select a DBD network and press √ to start the test of the selected network.

The screen below displays the line test started for the network of DBD 0161 (green screen / blue border)

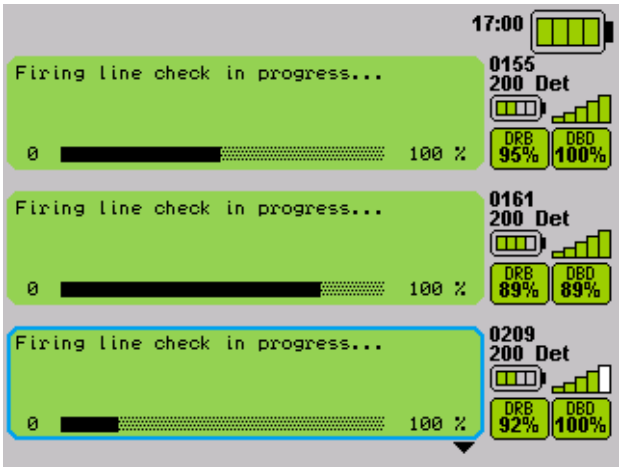
The selected green screen will be surrounded in:

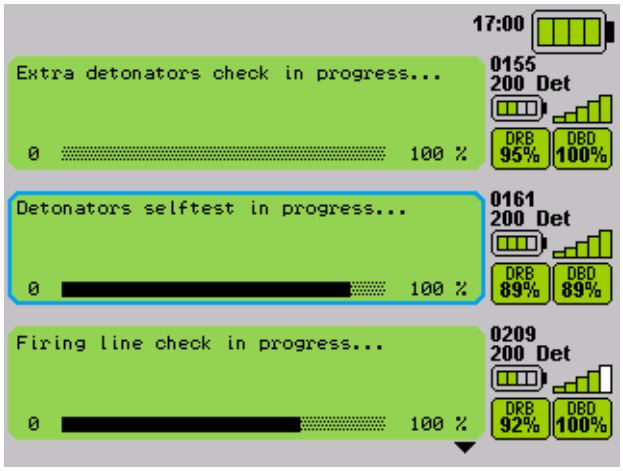
- blue if no user intervention is required and more than 3 DBDs are used
- red if user intervention is required for a particular DBD network





The networks can be controlled independently from each other, although the firing line test can be started in parallel on all networks. Press ▲/▼ on the right hand side of the DRB2 to select another network (surrounded in blue) and press √ in order to start its line test.





Charge

Refer to the Charge chapter.

Charging and firing is a sequential and continual process, this means that once a network has begun charging it must be fired or aborted before selecting the next network to charge and fire. You cannot charge two networks at the same time in Multiblast mode.

To charge the detonators of a DBD network, use the right ▲/▼ of the DRB2 to highlight the desired network (indicated by the green surrounded by red).

Fire

Refer to the Fire chapter.

To fire, the operator must press the button **while still holding down the charge button**.

In WIRELESS mode, the operator must hold the button down until the shot starts to fire.

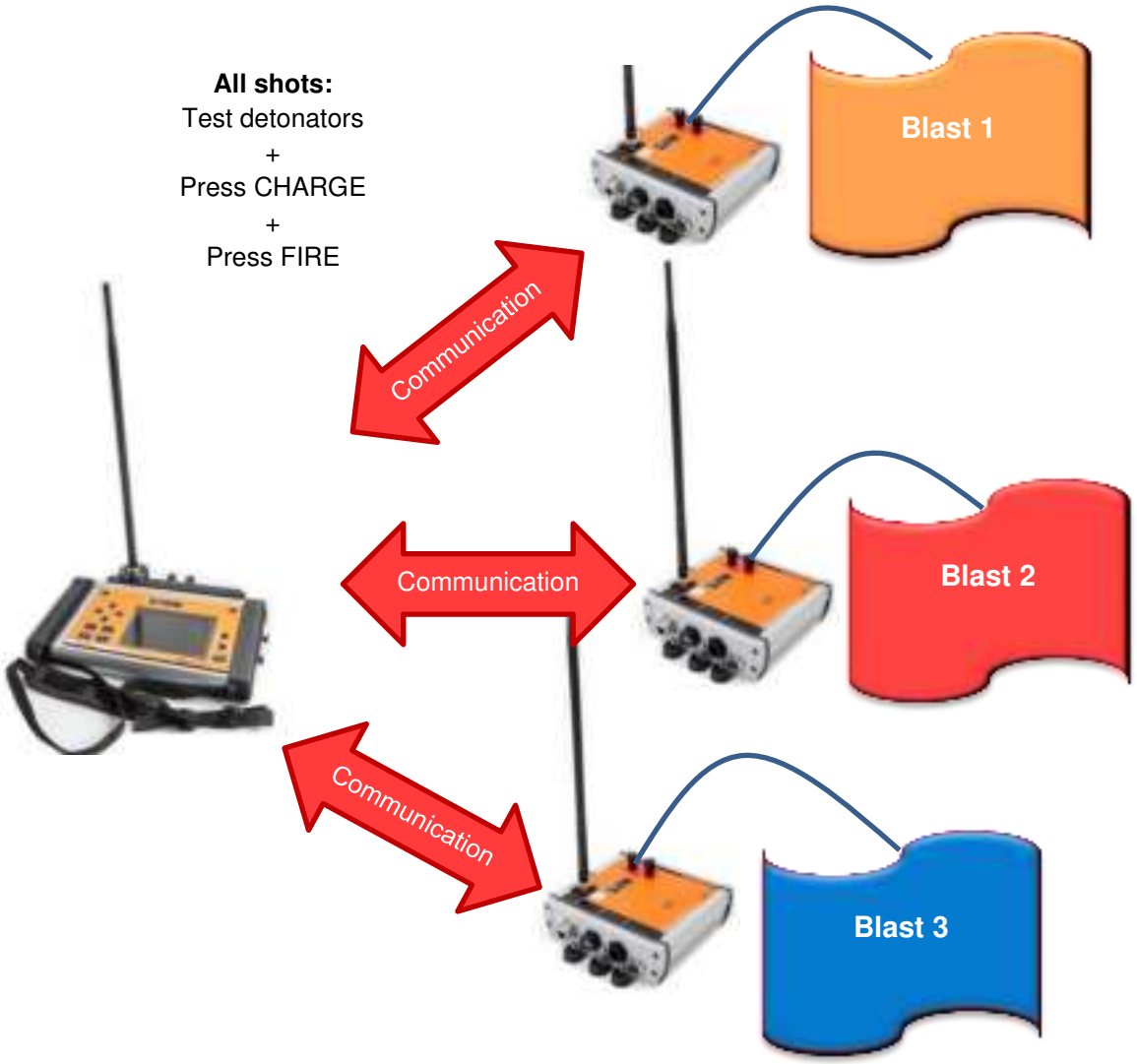
A line at the bottom of the screen shows the blast progress. (This can be very fast for maller shots).

After firing a shot the screen below is displayed. Operators are able to select the next screen and then fire the remaining networks by following the same charging and firing procedure.

Onetouch Multiblast

In ***Onetouch Multiblast*** mode, up to 8 DBDs can be operated using the same with the use of either internal or external modems. *Onetouch Multiblast* mode allows users to run the different blast procedures in parallel until the system is “READY TO FIRE”. Once, the system is “READY TO FIRE”, all blast are triggered after pressing and holding the button, then pressing the button only once.

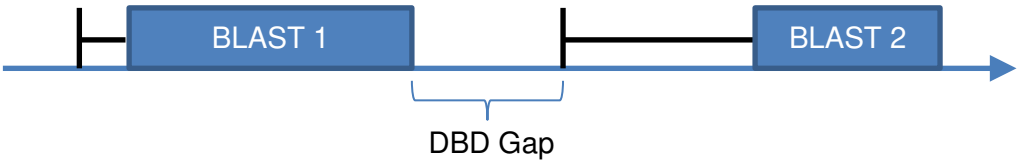
By default, *Onetouch Multiblast* is not enabled. Contact your local Enaex representative to enable *Onetouch Multiblast*.

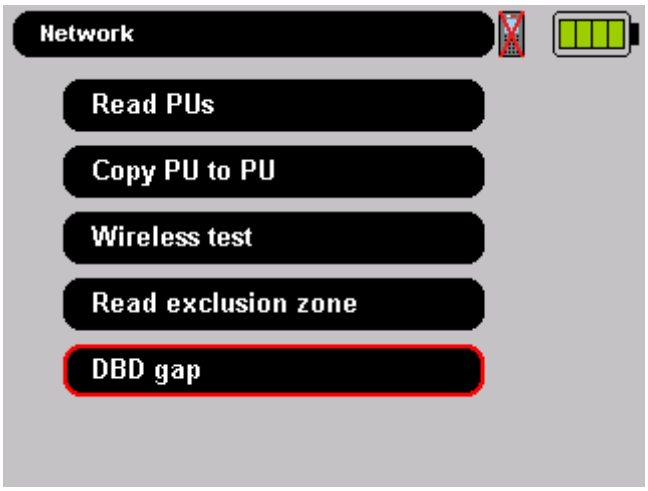


Warning:
Onetouch Multiblast does not prevent the possibility of cut offs if used with multiple shots in close proximity to each other with the possibility of fly rock damaging the wires on the shot not initiated yet..

DBD gap (for Onetouch Multiblast only)

DBD gap is the delay between two successive blast when blast is operated in Onetouch Multiblast mode:





Use the ↑/↓ arrow key on the left hand side of the DRB2 to select **Network** \ **DBD gap** and press √.

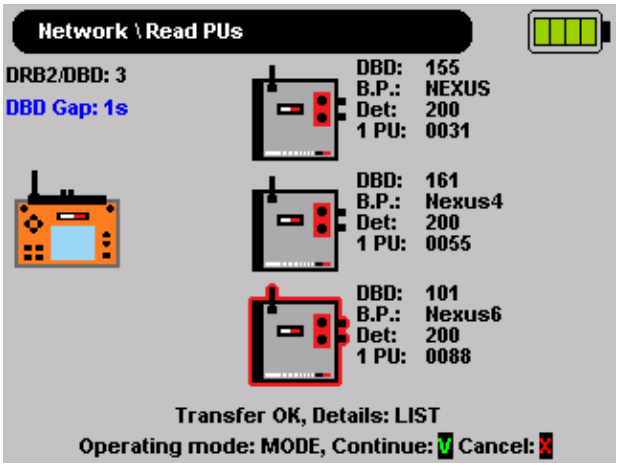
Use the ←/→ arrow key on the left hand side of the DRB2 to change the Gap value and press √.

Gap value is between 1sec and 5 sec by step of 1sec.

Read PU

See Read PU Chatper.

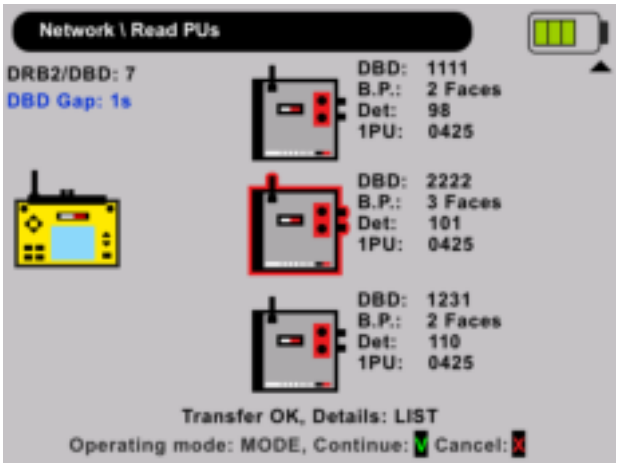
The blasting system is able to control up to 8 DBDs in Onetouch Multiblast. The DBD firing sequence follows the order in which the Pus have been tagged on the DRB2.



Note: The message below is displayed if a tagged PU is associated with a 9th DBD in Onetouch Multiblast mode

Read PU (Swift)

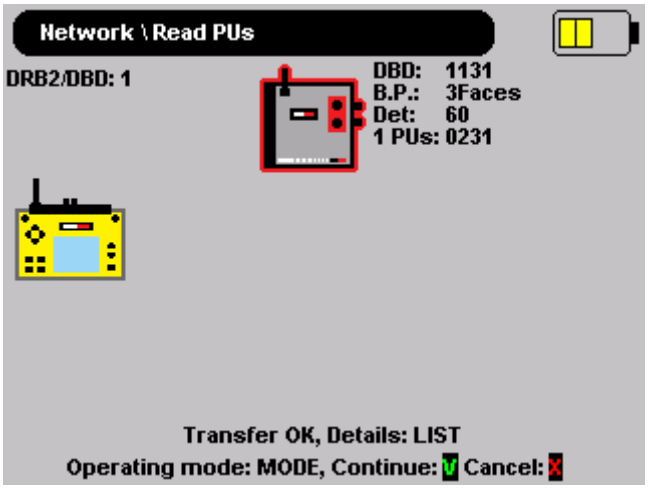
Refer to Multiblast Read PU and Read PU Chapters



Self-test and blast mode detection

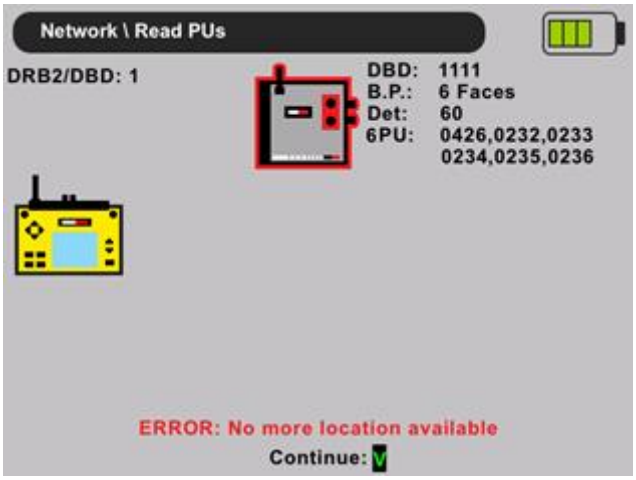
See Read Pus (Swift)
Refer to the Read PU chapter.

When the transfer of a Swift PU is completed a summary of the transferred data is displayed showing ***"DBD #XXXX"*** blast , number of faces, the total number of detonators and PU with its serial number.

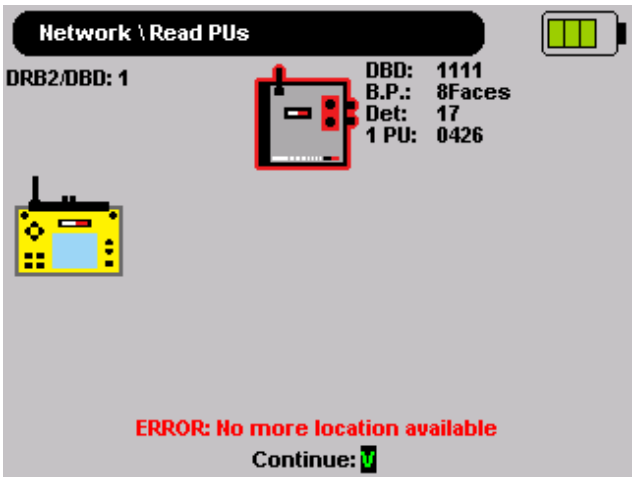


To select the faces to be fired, press LIST button (see “Multiface selection in Swift” chapter)

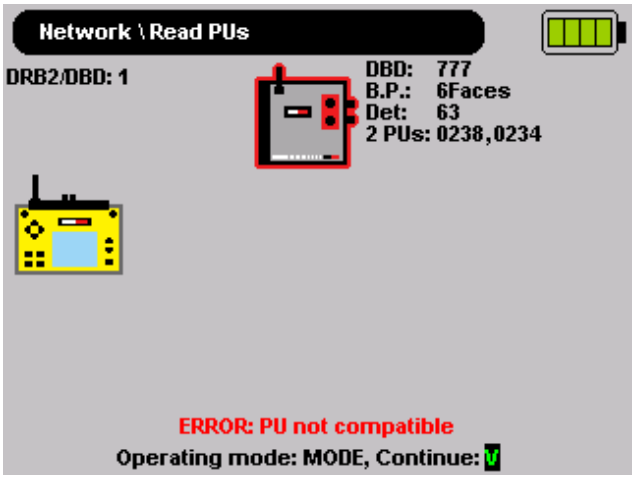
The maximum number of Swift PU per DBD is 6:



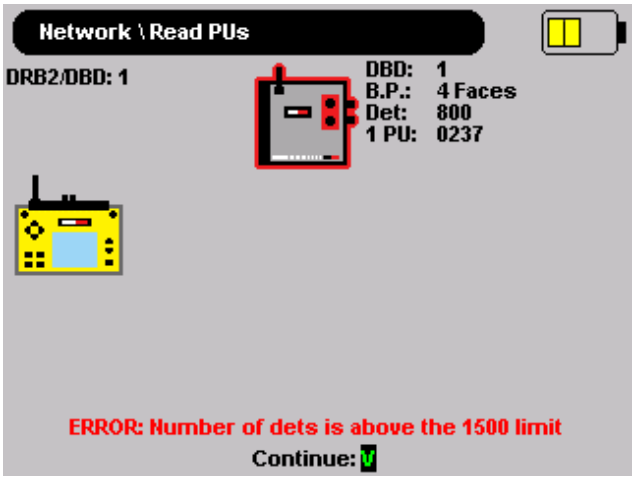
The maximum number of faces is 8:



If Swift detonators are already assigned to a DBD, impossible to tag another PU that contains non Swift detonators

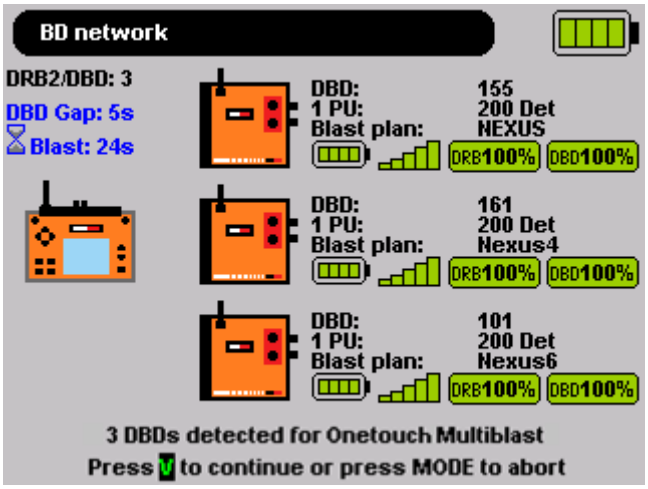


Impossible to have more than 1500 detonators per DBD:



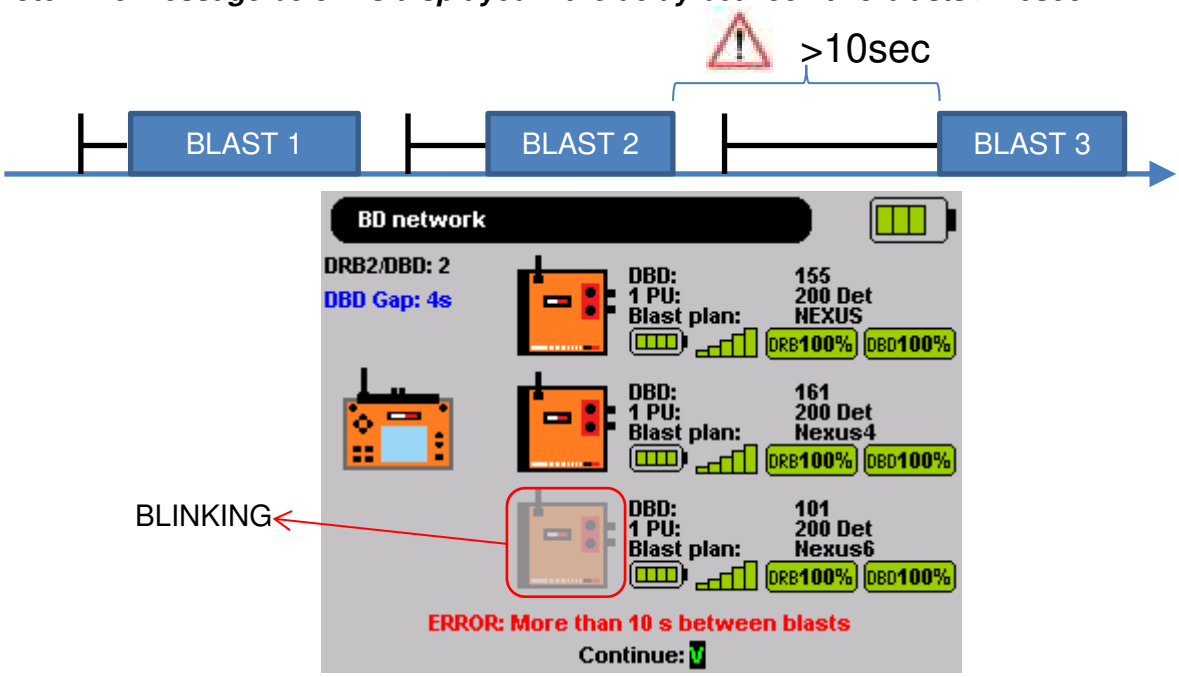
Self-test and blast mode detection chatper.

In case of Onetouch Multiblast (“Automatic blast mode” or “Mono/MultiBlast forced” AND Onetouch Multiblast option enabled), the screen below is displayed according to the number of DBDs in the blast plan. The operator is prompted to press √ to continue the firing procedure.



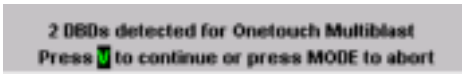
Once blast mode has been detected successfully, the operator is prompted to press √ to continue the firing procedure.

Note: The message below is displayed if the delay between two blasts > 10sec



To fix the problem, decrease the DBD gap value or/and decrease the first delay of the corresponding blast plan (blast plan 3 – DBD 101 in above example).

If √ is pressed, the corresponding blast is discarded for the rest of the blast procedure. In above example, the following message would be displayed:



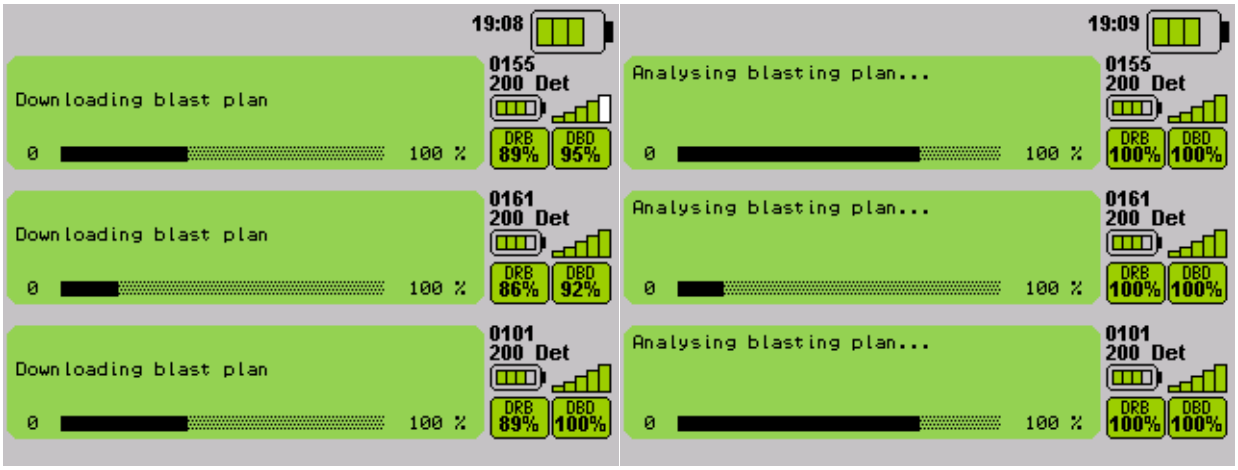
…and corresponding DBD greyed for the rest of the blast procedure

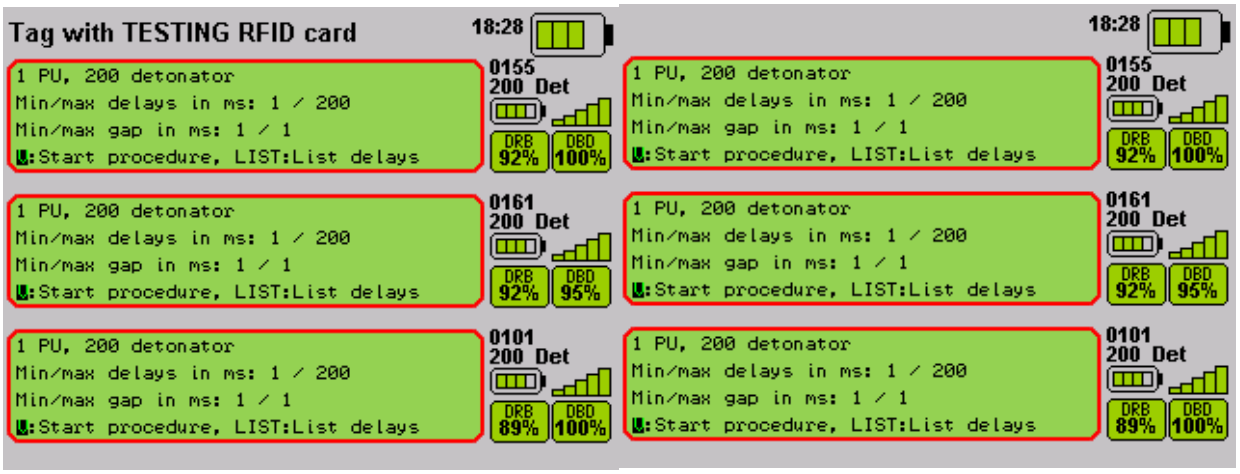
NOTE that extra detonators delays are not taken into account for this test.

Preliminary checks

See Preliminary checks Chatper.

Examples of Onetouch Multiblast screens:



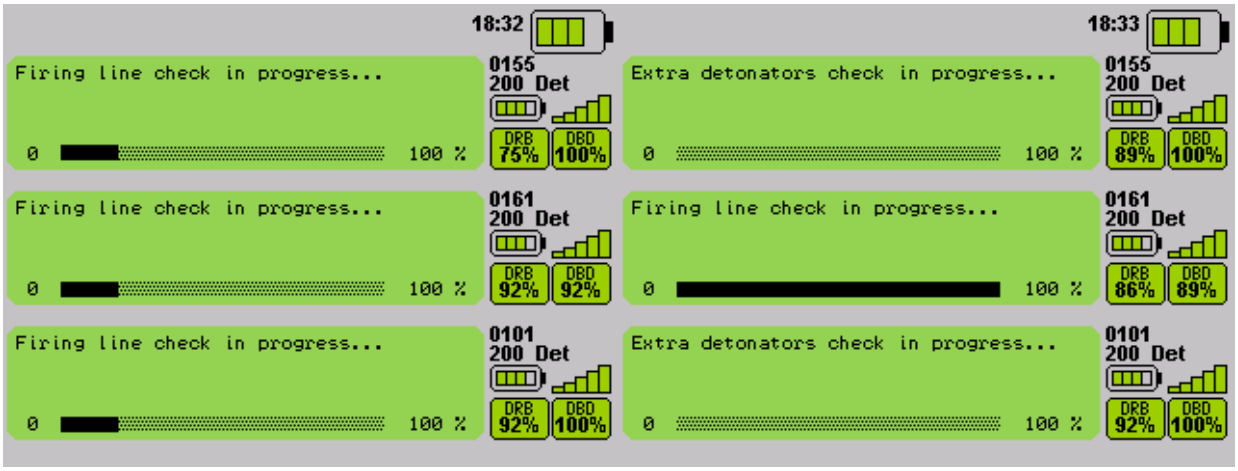


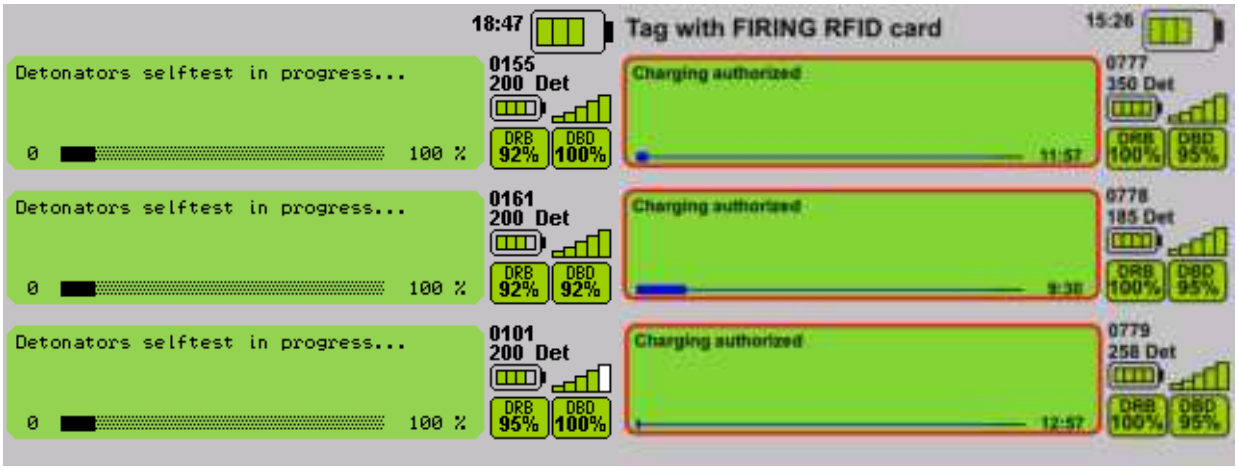
Note: Impossible to continue procedure as long as detonator tests are not finished for all DBD

Detonator test

See Detonator test chatper.

The test procedure begin by testing the line. Operators should press √ to start the test of tall blast in parallel.





Note: it is not possible to continue the procedure if all blasts do not reach "Charging authorized" step, unless one of the blast is greyed

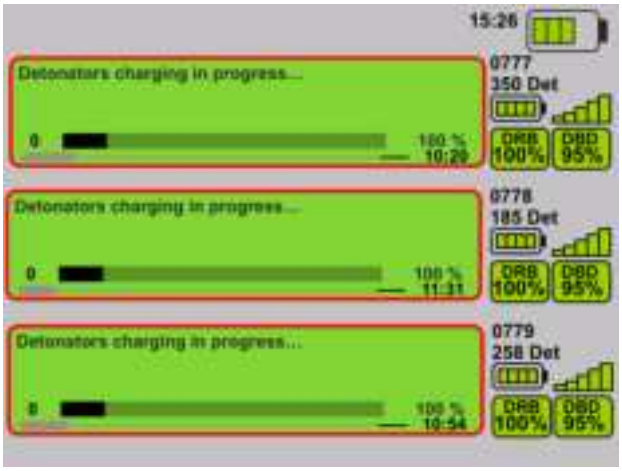
Example: DRB←→DRB2 communication failure

In this example it is possible to continue blast procedure with blasts 1 and 3

Charge

See Charge chatper.

Then press and hold the key to charge the detonators. All blasts will be charged in parallel.



Fire

See Fire chapter.

When charging is complete for all DBDs, a charge test is performed and firing is authorised. The button is illuminated and the vocal message "***READY TO FIRE***" is heard.

Press at least 2 seconds to fire the blast.

Once the fire order has been sent and the firing is in progress, the firing button can be released.

“Release the FIRE button” is displayed whether the button is released or not.

After firing the blast, the green window below are displayed.

Note: Once the button has been pressed, blasting sequence can be interrupted.

To stop the sequence for blast #2 and/or #3, press then press √

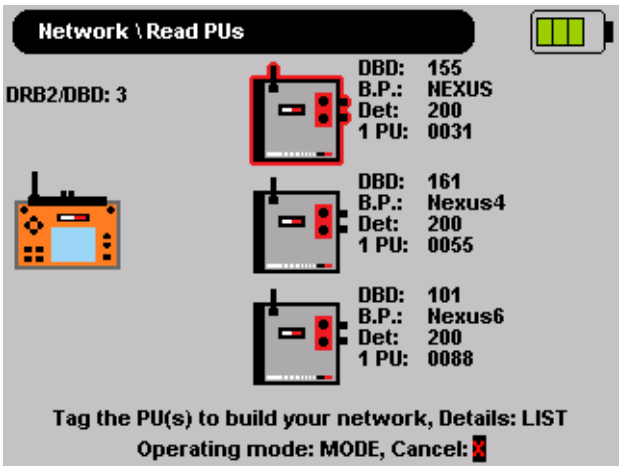
<u>If DRB2/DBD communication is still possible,</u> it will switch of DBD line driver and FIRE command won’t be transmitted to detonators.

Synchroblast

Read PU

Refer to the Read PU chapter.

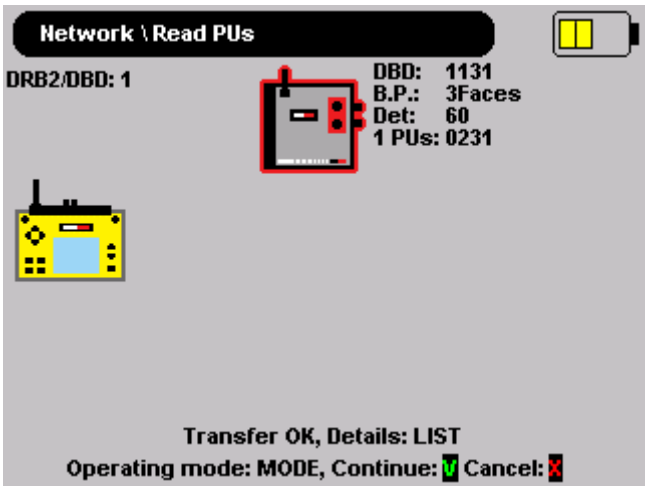
The DT SP/UG system is capable of controlling up to a maximum of 3 DBDs in Synchroblast mode.



Self-test and blast mode detection

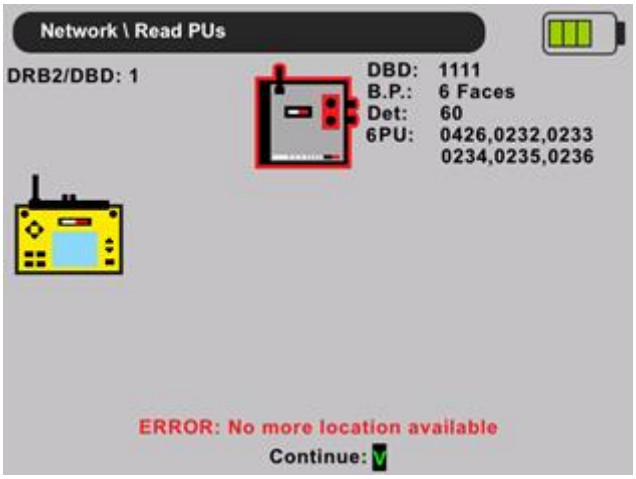
Refer to the Read Pus (Swift)
Refer to the Read PU chapter.

When the transfer of a Swift PU is completed a summary of the transferred data is displayed showing ***"DBD #XXXX"*** blast , number of faces, the total number of detonators and PU with its serial number.

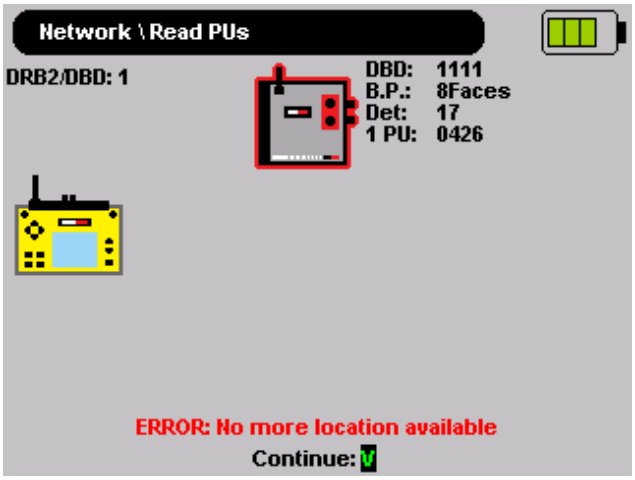


To select the faces to be fired, press LIST button (see "Multiface selection in Swift" chapter)

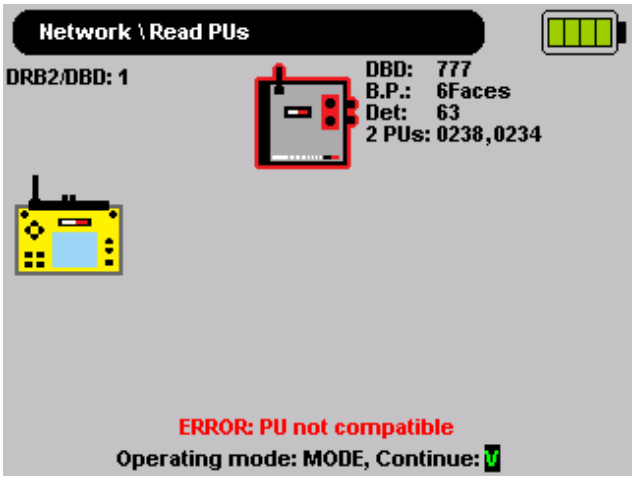
The maximum number of Swift PU per DBD is 6:



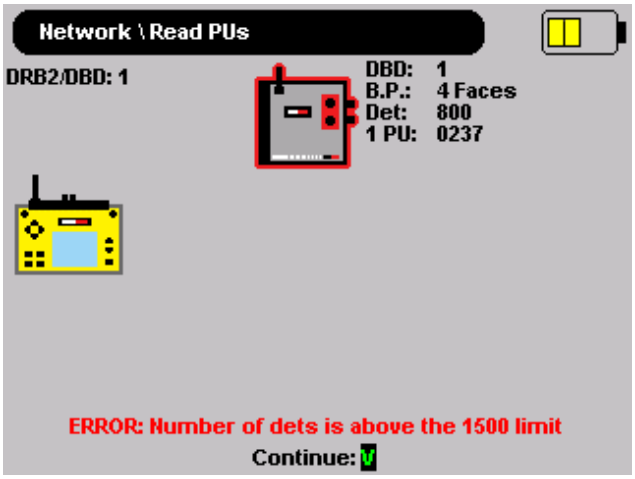
The maximum number of faces is 8:



If Swift detonators are already assigned to a DBD, impossible to tag another PU that contains non Swift detonators



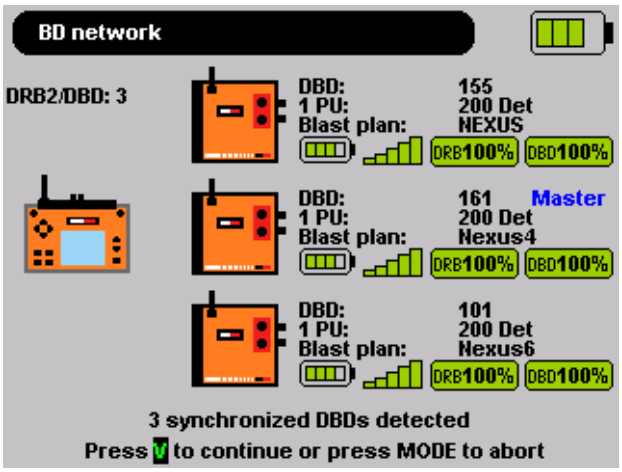
Impossible to have more than 1500 detonators per DBD:



Self-test and blast mode detection chapter.

When performing a Synchroblast®, (“Automatic blast mode” or “Synchroblast mode only”) the master DBD is automatically selected according to the synchro-line wiring. (based on the wire length detection of the system)

When the sync test is successfully completed the screen below is displayed.



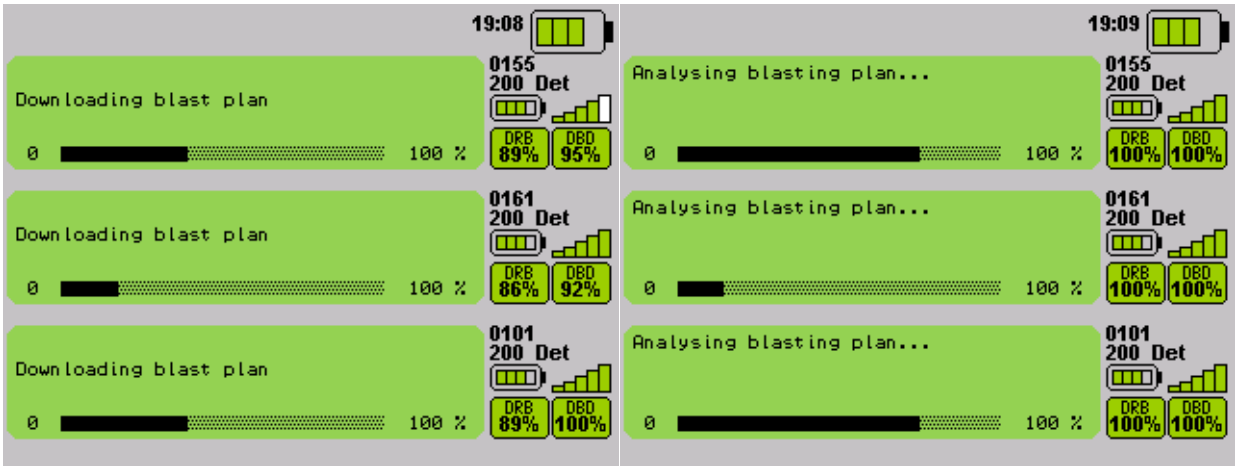
If the synchro line is not correctly connected between two of the DBDs, the following error message will be displayed:

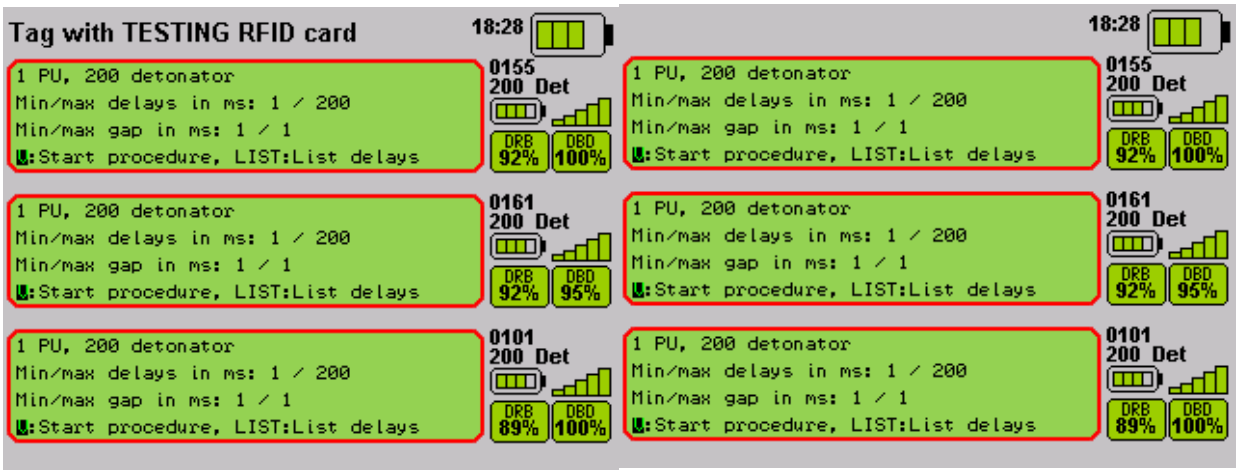
“ERROR: Check synchronisation line connection”

The operator must press √ to continue the firing procedure.

Preliminary checks

Refer to the Preliminary checks chapter.



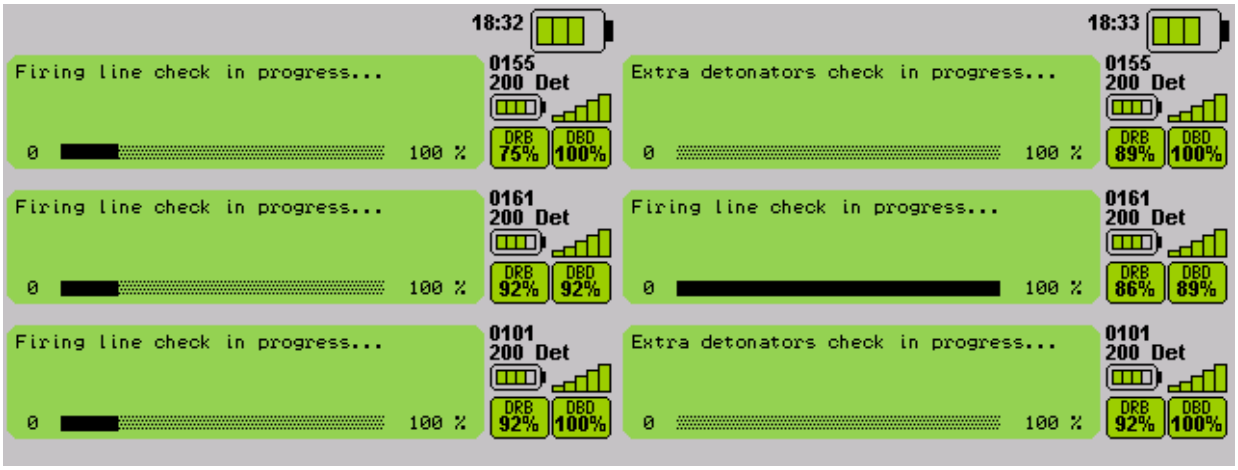


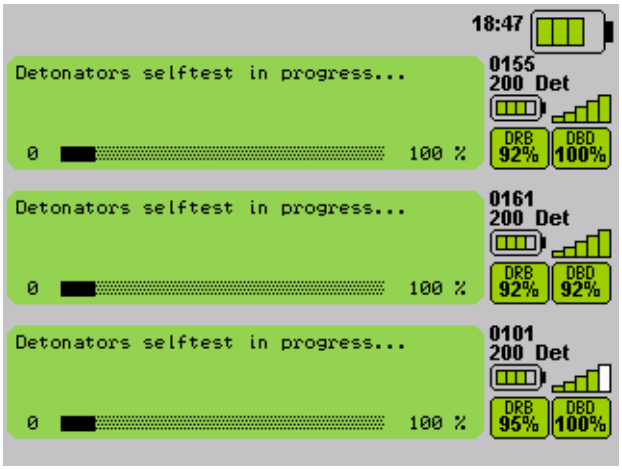
Note: Impossible to continue procedure as long as detonator tests are not finished for all DBD

Detonator test

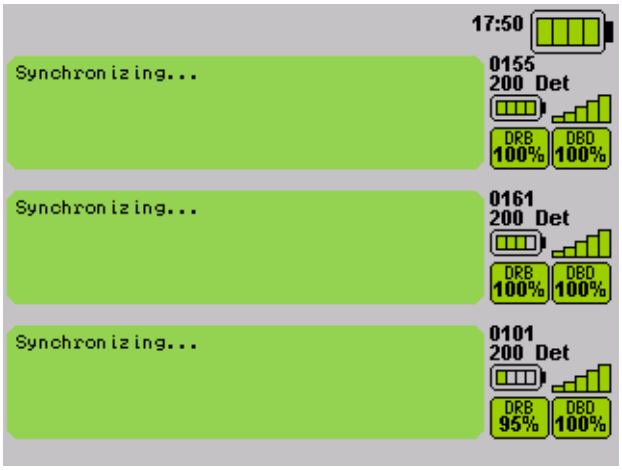
Refer to the Detonator test chapter.

The test procedure begin by testing the line. Operators should press √ to start the test of tall blast in parallel.

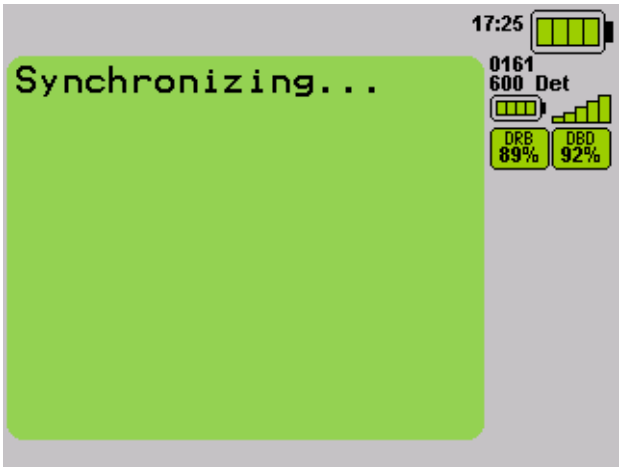


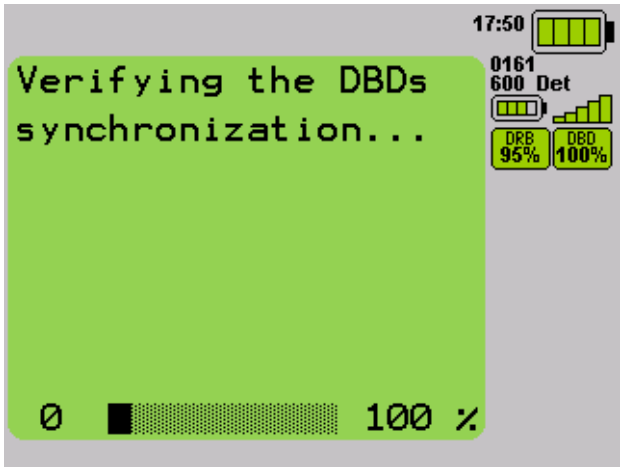


After detonator selftest has completed on all networks, all DBDs are Synchronized as described below.

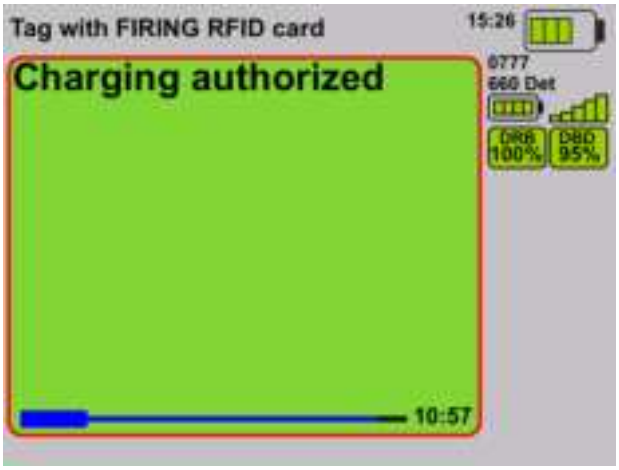


The multiple screens changes to a single screen and only the master DBD information is displayed. Only the master DBD is controlling all the detonators from this point forward.



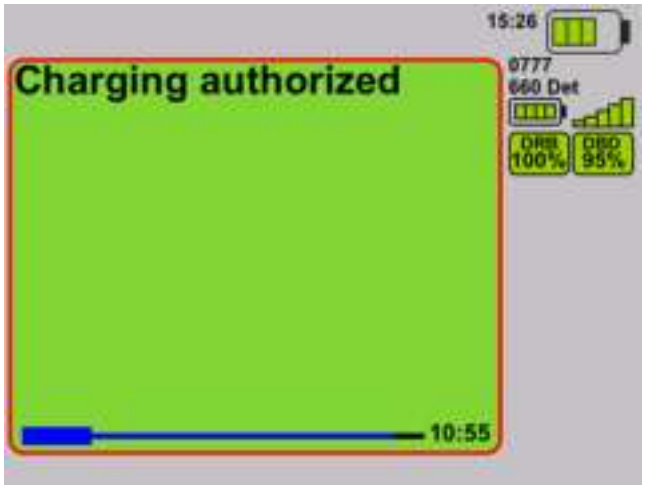


If no error is detected and the tests / synchronization is finished the procedure authorizes the operator to charge the detonators' firing capacitors. The DRB2 screen will display a "Charging authorized" message accompanied by a voice message ***"READY TO CHARGE"*** . Charging must be started beofre the unique countdown timer, time expires.

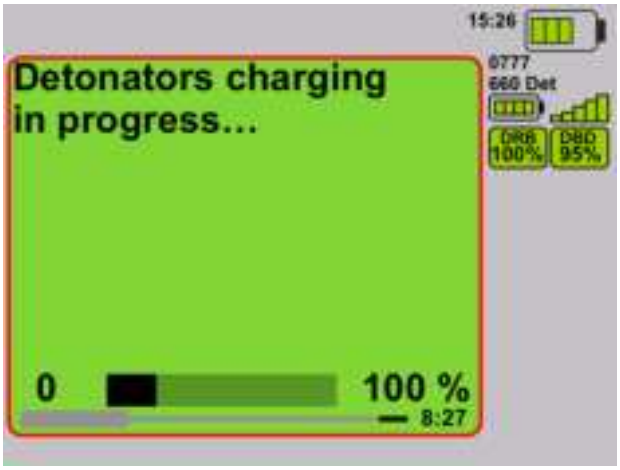


Charge

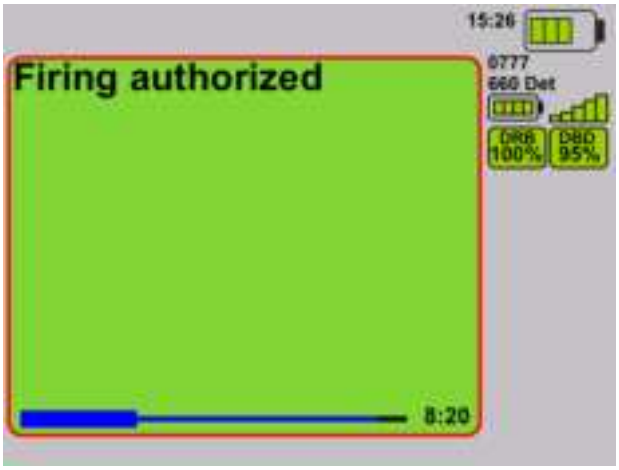
Refer to the Charge chapter.



Then press and hold the ● button to charge the detonators…



… unitil the detonators are ready to be fired…



Fire

Refer to the Fire chapter.

Safety lockout

The safety lockout is a feature of DT SP/UG system that enhances the safety of the user of the DT equipment:

The first safety feature is the enhanced security TAG

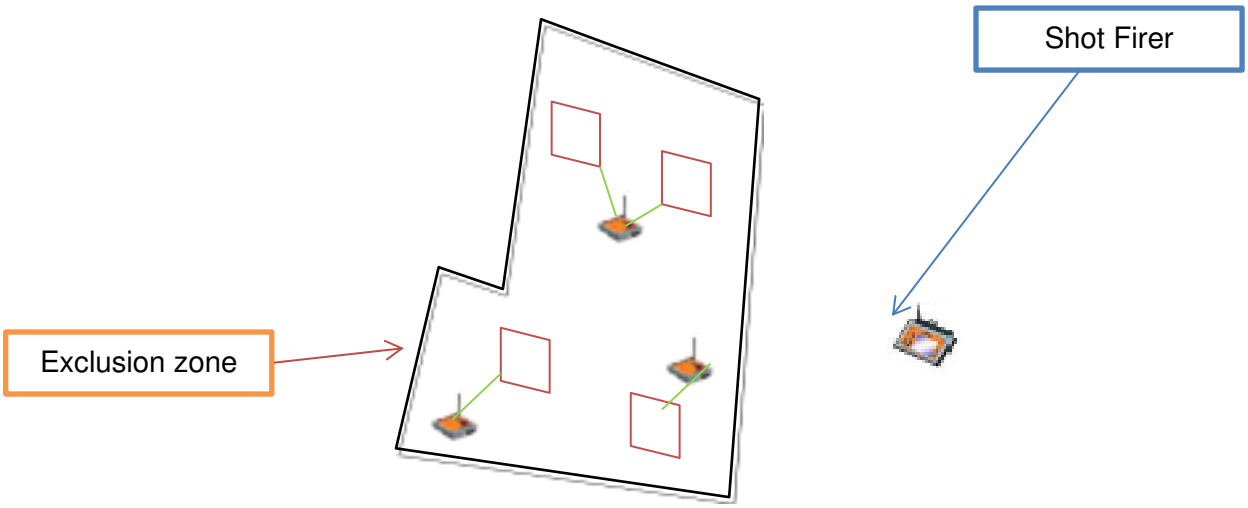
- Testing TAG - required to proceed with Testing after summary blast
- Firing TAG - to proceed to Charge and Fire
- Safety Lockout TAG to
    - Adjust Firing Window setup
    - Change Date/time when Firing window is enabled
    - Bypass DRB2 position check errors when Exclusion zone has been enabled

By default the DRB2 is set to have three security TAGs. It is still possible to have one single TAG for Testing, Firing and Firing window, please contact your Regional Enaex respresentative for this configuration.

The second safety feature on DTSP only, ensures the operator can fire from a position of safety. This is possible by checking the position of the shot firer to ensure the DRB is not inside the “exclusion zone”. The exclusion zone safety feature, available on the DTSP system only, is the predefined exclusion zone uploaded by D&B engineers. The zone is determined during the design of the shots and specialized software is required.

An Exclusion zone is designed and the GNNS module on the DRB2 ensures the equipment is not inside the exclusion zone.

- Exclusion zone : a polygon corresponding to the exclusion zone for the blast
- Position of the shot firer (available only with the GNSS optional accessory on the DRB2)



Enhanced security tag setup

For security purposes, the DT SP/UG system has the option to configure three different RFID tags in order to modify setup or unlock the testing or firing procedures.

TESTING RFID tag

The testing RFID tag is a mandatory requirement to enable the testing phase of the shots.

The testing RFID TAG can be configured in the DRB2 administrator menu (contact your local Enaex representative for assitance)

FIRING RFID tag

The FIRING RFID tag is a mandatory requirement to enable the charging phase of the shots. Without fhe FIRING RFID tag, it is impossible to Chareg or Fire the shots.

The Firing RFID tag can be configured in the DRB2 administrator menu (contact your local Enaex representative for assitance)

Safety Lockout RFID tag

The SAFETY LOCKOUT RFID tag is mandatory:

- To setup the firing window option if it has been enabled on the DRB2 and enables the user to:
  - modify the time window setup
  - change date / time if time window is enabled.
- To bypass the exclusion zone feature if the GNSS position is not available during DRB2 position checks.

The SAFETY LOCKOUT RFID tag can be configured in the DRB2 administrator menu (contact your local Enaex representative for assitance)

Refer to the Firing window chapter for more information regarding Firing window feature.

Additional setup

While the TESTING and FIRING RFID tags may be configured to be the same card, the SAFETY LOCKOUT RFID tag must be different from the cards used for TESTING and FIRING tags. Contact your local Enaex representative to assist with either a setup of the RFID tags.

Shotfirer positioning vs Exclusion zone

This feature is usable only if the user is programming in automatic mode and the use of compatible blast design software.

If the exclusion zone has been uploaded to the DRB2, the DTSP system detects if the e shotfirer is outside the exclusion zone.

Exclusion zone

The exclusion zone is a polygon of a maximum of 256 points corresponding to the exclusion zone set for the blast by the mine. The exclusion zone is defined by means of two files:

- EXC_ZONE.csv : it contains exclusion zone coordinates (in UTM reference).
- UTM_DATA.txt: it contains all necessary information in order to interpret EXC_ZONE.csv and perform the convertion from WGS84 reference (longitude/latitude from GPS) into local UTM projection (Easting/Northing).

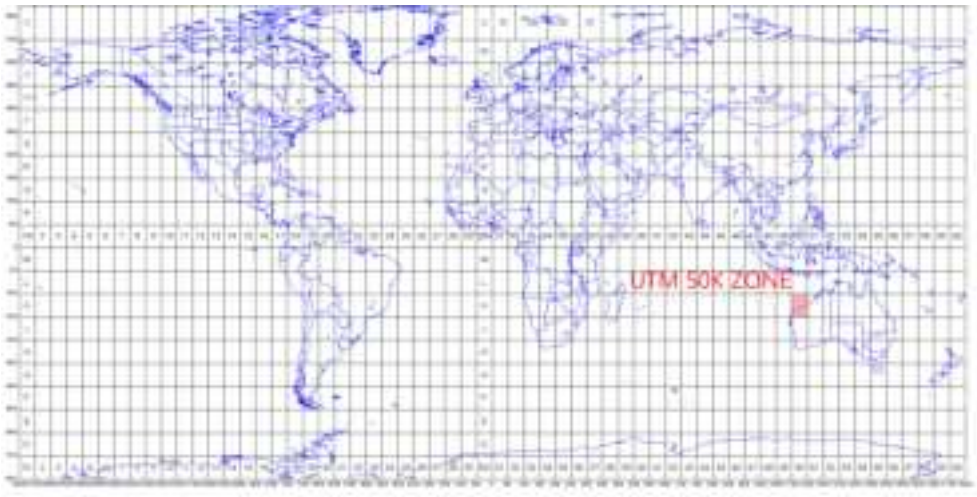
EXC_ZONE.csv:

```
0;683349.481;7442314.353;710.000
1;683352.834;7442282.603;710.049
2;683349.895;7442254.923;710.124
3;683350.073;7442212.381;710.273
4;683356.853;7442164.698;710.453
5;683388.306;7442139.805;729.842
6;683390.611;7442132.340;729.729
7;683433.963;7442102.142;749.813
8;683437.805;7442096.713;750.436
[…]
```

2nd row 3rd row

UTM_DATA.txt:

<LINES_TO_IGNORE>**0**</LINES_TO_IGNORE>	Number of line to ignore at the beginning of EXC_ZONE.txt file
<ROW_SEPARATOR>**;**</ROW_SEPARATOR>	Column separator
<DECIMAL_POINT>.</DECIMAL_POINT>	Decimal separator
<EASTING_ROW>2</EASTING_ROW>	Eastings are in the 2nd row of EXC_ZONE.csv table
<NORTHING_ROW>3</NORTHING_ROW>	Northing is in the 3rd row of EXC_ZONE.csv table
<UTM_ZONE>50K</UTM_ZONE>	See the following figure

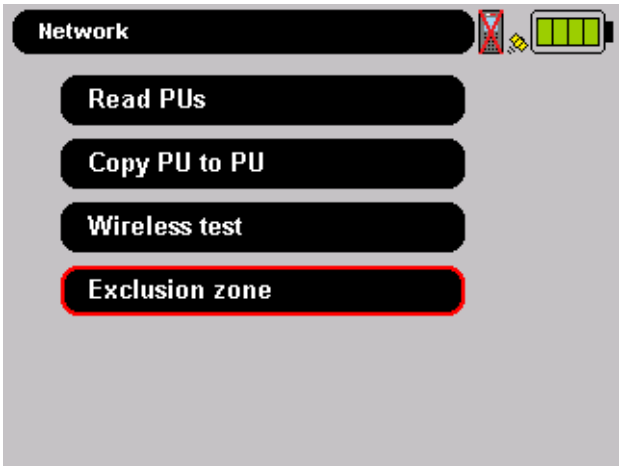


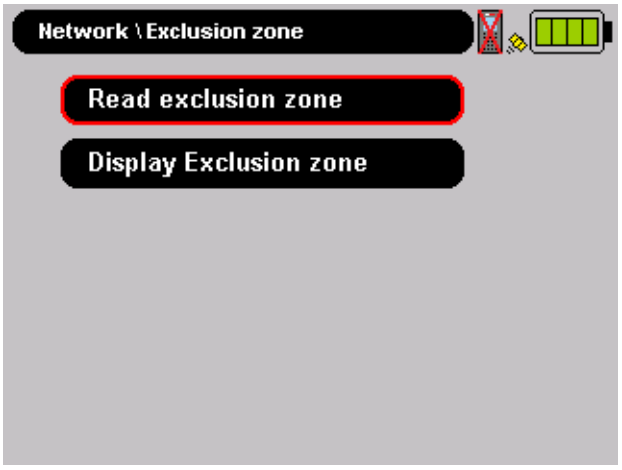
All mines have their own coordinate sytem. All points from the exclusion zone will have to be converted into UTM before being loaded into the DRB2.

To import the CSV and TXT Exclusion zone files, the Read exclusion zone option must be used and can be found in the Network menu of the DRB2.

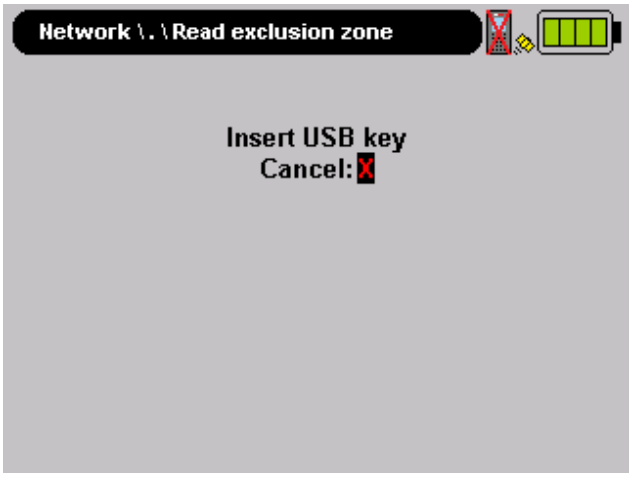
NOTE: Exclusion zone features can be disabled / enabled independantly.

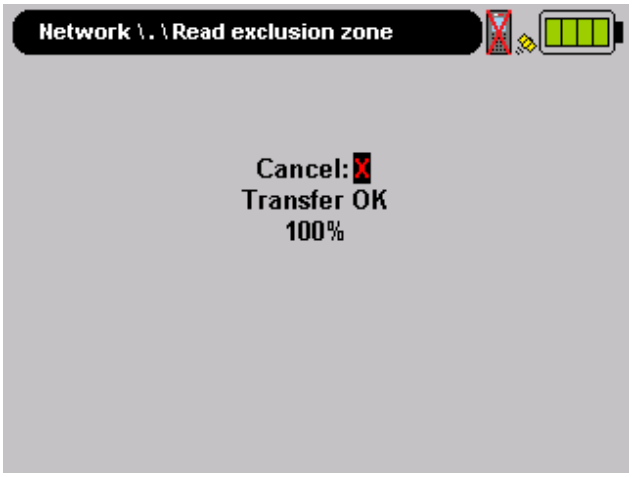
Read Eclusion zone





The required exclusion zone files (*EXC_ZONE.CSV* and *UTM_DATA.TXT*) are transferred to the DRB2 by means of a USB key. Both files must be in the root folder of the USB key.



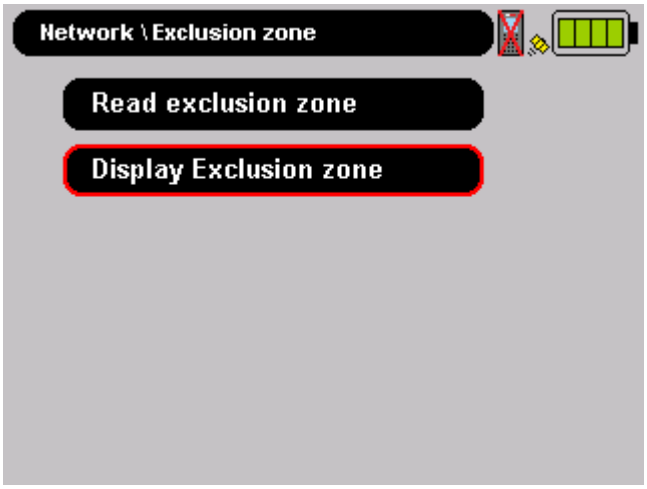


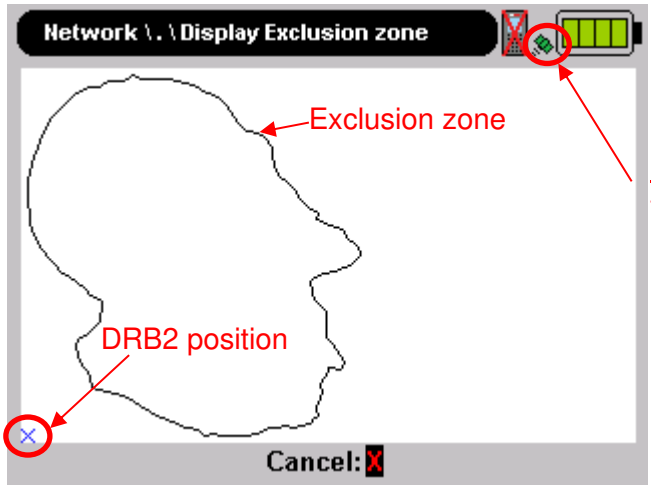
The exclusion zone file is checked and verified before the files are transferred to the DRB2.

If the file format or any of the data in the exclusion zone file is incorrect (EXC_ZONE.CSV), the following message is displayed:

If the file format or any of the data in the definition and format file is incorrect (UTM_DATA.TXT), the following message is displayed:

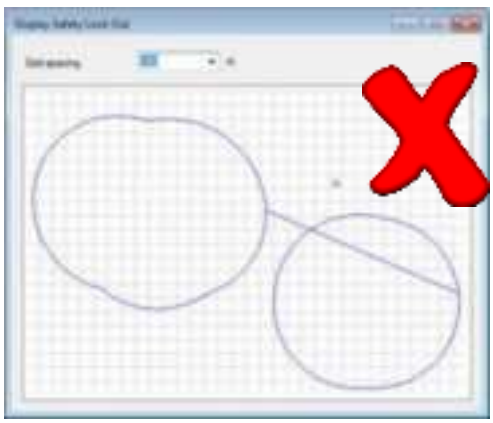
Display Exclusion zone

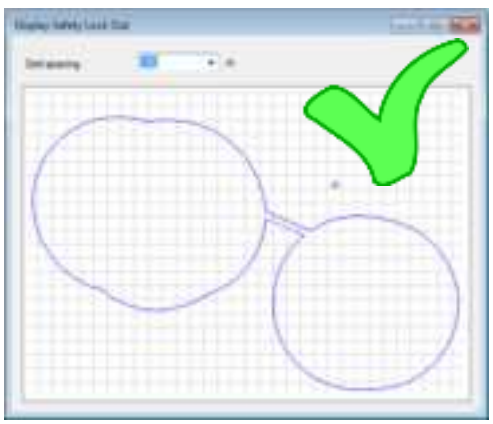




Note : To get DRB2 position on the display, a valid GPS position is requested

The exclusion zone can be integrated into different shots and/or pits and is compatible with Multiblast. All the blast locations must be inside a single polygon (refer to the following figure).





When imported to a DRB2 the exclusion zone will be automatically erased after 24hrs or immediatly after firing of all the blasts (In Multiblast the exclusion zone is available untill the last blast is fired)

WARNING: If the exclusion zone feature is enabled, it is impossible to to complete the firing procedure without the correct EXC_ZONE.csv and UTM_DATA.txt files loaded into DRB2.

Position of the DRB2 (and the shotfirer)

An optional external GNSS accessory is available for the DTSP sytem. When utilizing the accessory and function, the DRB2 software will be able to monitor the position of the DRB2 and continuously check during key steps of the procedure if the DRB2 is outside of the exclusion zone.

Communication with the GNSS device is checked during the DRB2 selftest and if an error occurs the following message is displayed:

Safety checks during the firing procedure

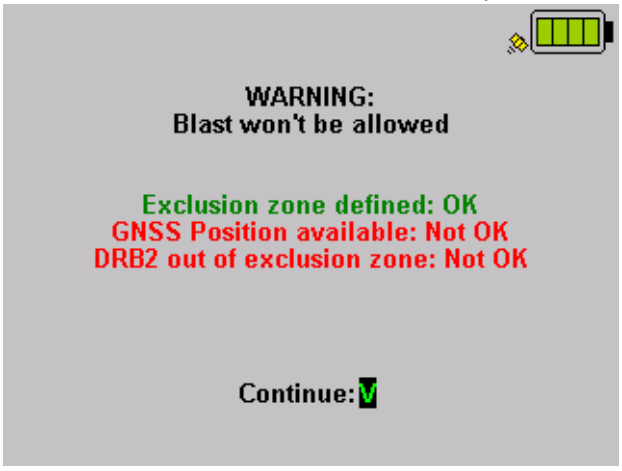
The position of the DRB2 is checked:

- When the MODE button is pressed. A screen is displayed to show the status of the safe position and the user must press the √ button to proceed.
- When √ is pressed after the user is asked for TESTING RFID TAG to start detonator test
- When the user is asked to press CHARGE button

NOTE: If the GNSS position is not available during above checks, it is possible to bypass the safety checks by using the "SAFETY LOCKOUT RFID Card" to continue the blast procedure.

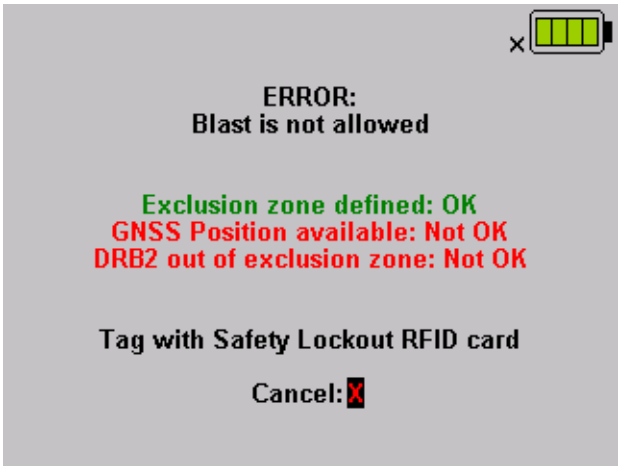
Examples:

- The GNSS position not available after the MODE button is pressed to start blast procedure:

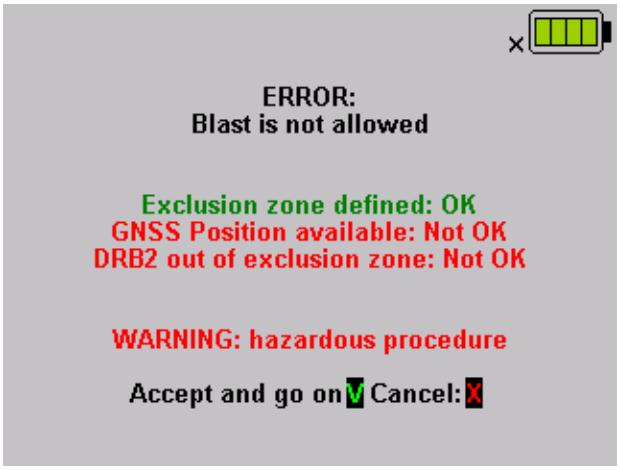


  If √ button is pressed, the blast procedure starts.
- The GNSS position not available when √ is pressed after the user is asked for the TESTING RFID TAG

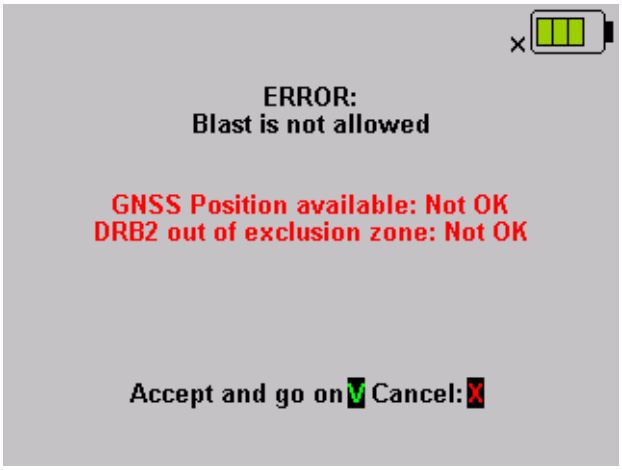
Press √



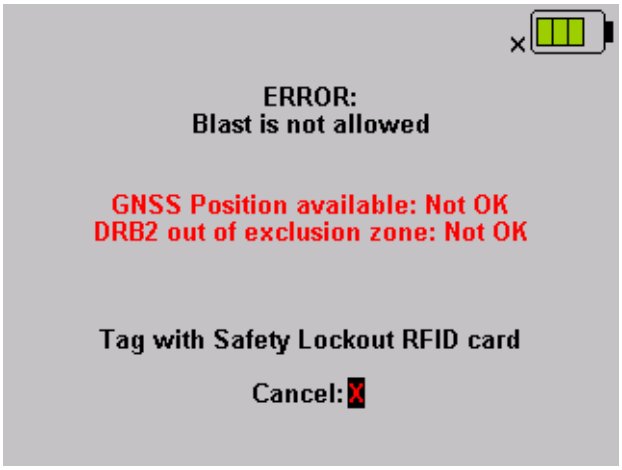
Tag the TIME WINDOW RFID card



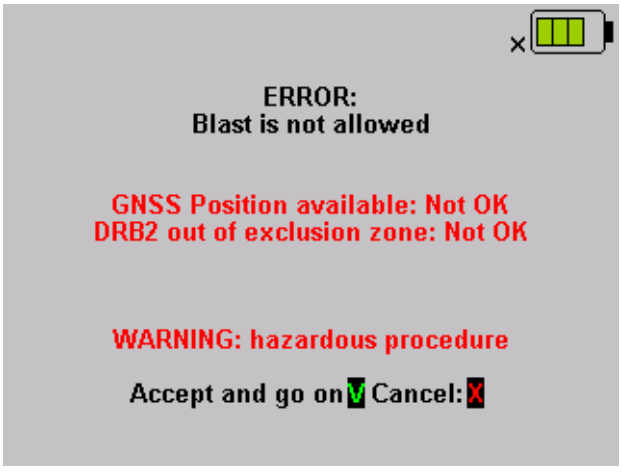
- When the GNSS position is not available when the user is asked to press CHARGE button (after ready to charge voice message):



Press √



Tag the TIME WINDOW RFID card



GNSS status

The status of the GNSS accessory is verified during the safety checks. This status is displayed in the top right corner of the DRB2 screen near the battery level icon.

The status icon is the following:

 When the GNSS position is not required by the software

 When the GNSS position is required and the GNSS accessory is not responding

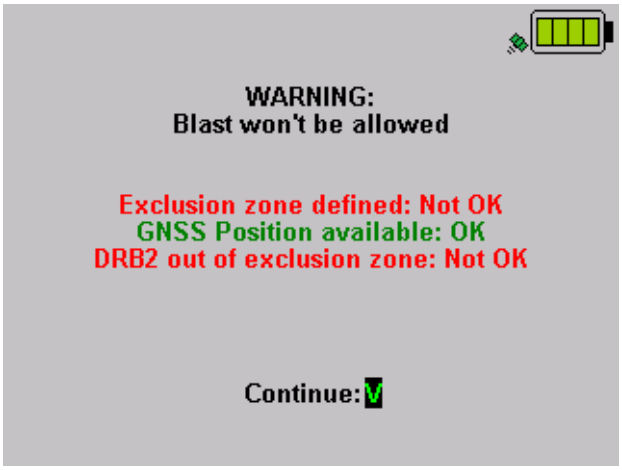
 When the GNSS position is required and the GNSS accessory sends a invalid position (No Fix)

 When GNSS position is required and the GNSS accessory sends a valid position (Fix OK)

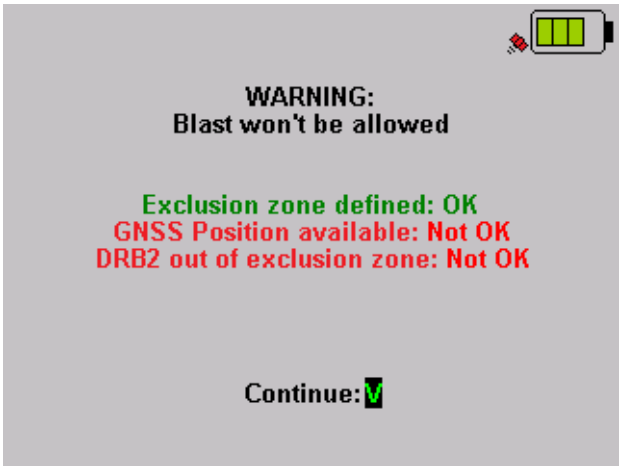
NOTE: The GNSS status is also displayed in the menus before pressing the operational mode button.

Examples

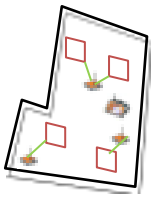
Exclusion zone not defined or expired



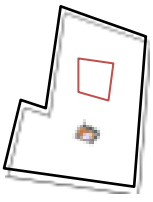
GNSS position not available

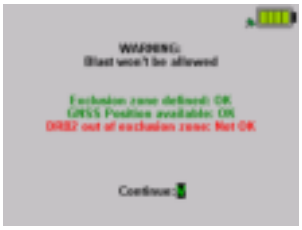


DRB2 inside the exclusion zone



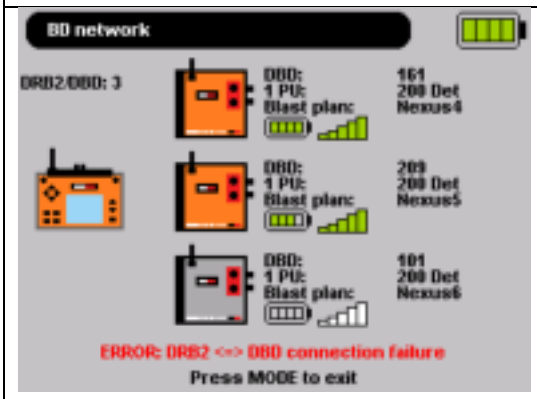
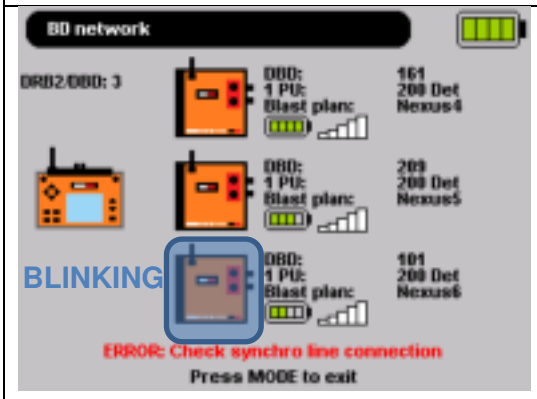
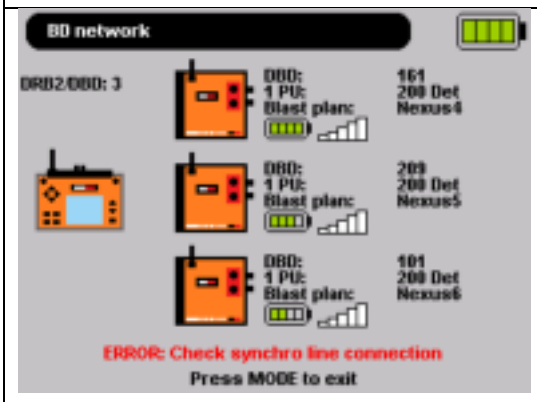
or

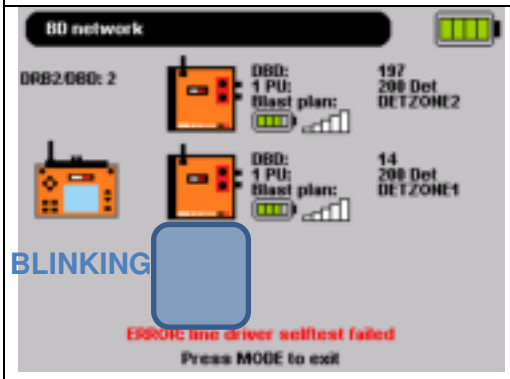




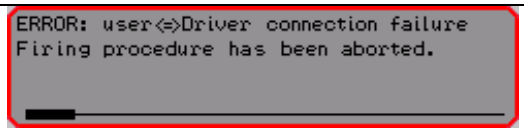
Dealing with errors during the firing phase

Dealing with errors during synchro-line test procedure

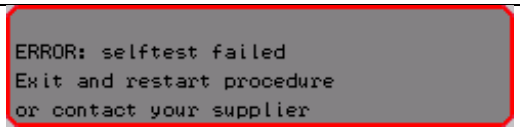
Error	Cause	CORRECTIVE ACTIONS:
	Communication error with the related DBD	Check the related DBD
	Short circuit on synchro line (Related DBD is blinking)	Check the synchro line
	Interconnection between firing line and synchro-line (All DBDs are blinking)	Check the firing line and synchro-line

Error	Cause	CORRECTIVE ACTIONS:
	The self-test of the related blast driver failed (The related DBD is blinking)	The system has detected an error during the self - test when switched to operational mode. Contact your Enaex representative.

Error messages during the procedure

MESSAGE	INTERPRETATION:
	**The related DBD fails**
CAUSES	**CORRECTIVE ACTIONS:**
The system has detected that the DBD stops working during the firing procedure: hardware failure.	Quarantine the DBD and contact your Enaex representative

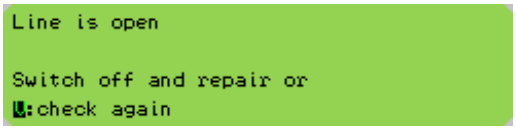
Error messages during the DBD auto-test

MESSAGE	INTERPRETATION:
	**The auto-test of the related DBD failed**
CAUSES	**CORRECTIVE ACTIONS:**
The system has detected an error during the auto-test when switched to operational mode.	Contact your Enaex representative

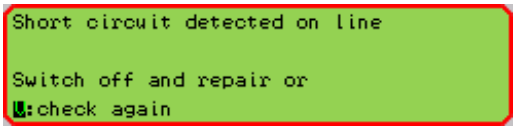
Error messages during the line test

IMPORTANT: IT IS NOT POSSIBLE to continue with the procedure if a fault is detected during the line test phase.

Open line

MESSAGE	INTERPRETATION:
 **Voice message : 'WARNING, FIRING LINE MALFUNCTION'**	**No detonators on the line.**
CAUSES	**CORRECTIVE ACTIONS:**
Firing line not connected to the firing line terminals	• Check the connection.
Bus line not connected to firing line	• Check the connection.
Firing line cut	• Check the continuity of the line.

Short-circuit in line

MESSAGE	INTERPRETATION:
 **Voice message: 'WARNING, FIRING LINE SHORT CIRCUIT'**	**Low or minimal resistance detected in the circuit.**
CAUSES	**CORRECTIVE ACTIONS:**
End of one bus line not separated	• Check the ends of the bus lines.
Short-circuit in firing line	• Check the insulation of the line.
Bus lines / firing line connection	• Check the insulation of the splices.

Error messages during detection of extra dets

If the bus lines are correctly checked after the detonators have been connected, this type of error should not occur.

Extra detonators detected

MESSAGE	INTERPRETATION:
 **Voice message: 'WARNING, EXTRA DETONATORS DETECTED'**	**Non-programmed detonators connected to the firing line have been detected**
CAUSES	**CORRECTIVE ACTIONS:**
Non-programmed detonators connected to the bus line	• Turn off, disconnect the firing line and go to the blast, identify the non-programmed detonator and program the detonator • To override, select 'SPECIAL PROCEDURE'.

Extra detonator firing time note:

Extra detonators' firing times are assigned using the following rule:

The **first** listed extra detonator is programmed with a delay equal to the highest blast plan delay (=programmed delay) + **1 x** 19ms.

The **second** listed extra detonator is programmed with a delay equal to the highest blast plan delay (=programmed delay) + **2 x** 19ms (38ms).

The **third** listed extra detonator is programmed with a delay equal to the highest blast plan delay (=programmed delay) + **3 x** 19ms (57ms).

And so on…

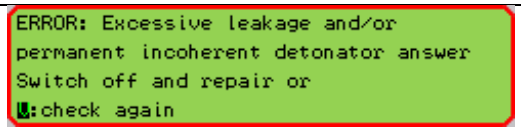
If the calculated delay is above 14000ms, the detonators will fire at 14000ms.

Here is an example of a 5 detonators blast plan (5 programmed detonators) with 3 extra detonators.

Firing times assigned to the 3 extras detonators are shown in the following table. Note that the highest programmed blast delay is at 13960ms

Det number	ID	Delay (ms)	Remark
#0001	45DFFC	10	Original blast plan
#0002	567E01	40	
#0003	8AA299	70	
#0004	5DE871	**13960**	
#0005	B14BC4	400	
Extras det 1	**05F23A**	13979	13960 +19
Extras det 2	**F42928**	13998	13960 +2*19
Extras det 3	**BD05FF**	14000	13960 +3*19 >= 14000

Permanent incoherent Det answer

MESSAGE	INTERPRETATION:
	**The system finds extra detonator but is unable to communicate with it.**
CAUSES	**CORRECTIVE ACTIONS:**
An intermittent and incoherent detonator is connected to the line	• Turn off, disconnect the firing line and go to the blast, identify the detonator and disconnect it.

IMPORTANT: If 2 PUs have been used and if the content of one PU has not been transferred to the DRB2, its detonators will be detected as EXTRA DETS.

WARNING: If more than 10 extra detonators or incompatible detonators are detected, the "special procedure" option is not available: the error must be repaired to fire the blast

Intermittent connection

At the end of the of extra detonators detection test, the following will be displayed if there are intermittent detonators

MESSAGE	INTERPRETATION:
 **Voice message: 'DETONATOR COMMUNICATION ERROR**	**The DRB2/DBD has detected a poor or intermittent connection for detonator 1**
CAUSES	**CORRECTIVE ACTIONS:**
A cut line or a splice causes an intermittent connection	● Turn off, disconnect the firing line and go to the blast area, identify and repair the wire (cut, splice, or poorly connected to DRB2/DBD terminals)

IMPORTANT: The list displayed is limited to 100 defective detonators.

WARNING: The intermittent connection problem must be solved. No special procedure can be performed.

Error messages during detonator self-test

At the end of the detonator self-test, the errors are displayed on the DRB2's screen:

MESSAGE	INTERPRETATION:
 **Voice message : 'DETONATOR COMMUNICATION ERROR'**	**Detonators with the sequence number 0070 and 0170 on the PU 0055 are defectives**

IMPORTANT: The list displayed is limited to 100 defective detonators.

IMPORTANT: The firing procedure will automatically abort after 3 mins, if an option is not selected

WARNING: To be able to continue with the procedure, it is necessary to scroll through the entire list. If more than 30 defective detonators are detected, the "special procedure" option is not available: the error must be repaired to fire the blast

No Dialogue

TYPE OF DEFECT	INTERPRETATION:
	**The detonator does not answer to the test command**
CAUSES	**CORRECTIVE ACTIONS:**
Detonator is poorly/not connected at all	• Re-establish a connection.
Wires are cut	• Check accessible wire
Detonator is suspect or defective	• If the detonator is properly connected and if the wires do not appear to be damaged, disconnect the detonator and check it with the PU: • If the PU reading is correct, reconnect and restart the test. • If the PU reading gives 'NO DIALOGUE' or 'INCOHERENT ANSWER', treat the detonator as defective, in accordance with applicable rules.

WARNING: If the 'NO DIALOGUE' message continues, treat the detonator as defective in accordance with applicable rules.

Incoherent answer

TYPE OF DEFECT	INTERPRETATION:
	**The detonator's answer is corrupted and cannot be decoded.**
CAUSES	**CORRECTIVE ACTIONS:**
Detonator is suspect or defective	● Turn off, disconnect the firing line. Disconnect the detonator and check it with the PU: • If the PU reading is correct, check for leakage and/or check line to reduce lengths. • If the PU reading gives 'NO DIALOGUE' or INCOHERENT ANSWER', treat the detonator as defective, in accordance with applicable rules.
Length / resistance of a bus line exceeds the limit	● Check length and resistance of bus line
Current leakage	● Locate and minimize leakage.

WARNING: If the 'INCOHERENT ANSWER' message continues, treat the detonator as defective in accordance with applicable rules.

Out of order

TYPE OF DEFECT	INTERPRETATION:
	**The detonator is properly connected but answers it is defective.**
CAUSES	**CORRECTIVE ACTIONS:**
Detonator's firing circuit failure	•Treat the detonator as defective, in accordance with applicable rules.

WARNING: Treat the detonator as defective in accordance with applicable rules.

WARNING: By accepting the 'SPECIAL PROCEDURE' and by firing the blast, the detonator will be a potential misfire and must be reported as such

Delay error

TYPE OF DEFECT	INTERPRETATION:
	**The delay read in the detonator is different from the programmed delay.**
CAUSES	**CORRECTIVE ACTIONS:**
Detonator is out of order	• Restart the procedure, if the same error happens, disconnect the detonator and treat the detonator as defective in accordance with applicable rules.

WARNING: If the 'DELAY ERROR' message continues, the detonator will be initiated but with an incorrect firing time. Treat the detonator as defective in accordance with the applicable rules

Low accuracy Delay

TYPE OF DEFECT	INTERPRETATION:
	**The calibration process of the detonator was not successful.**
CAUSES	**CORRECTIVE ACTIONS:**
Calibration failed or Detonator is defective	• Restart the procedure, if the same error happens, disconnect the detonator and treat the detonator as defective in accordance with applicable rules.

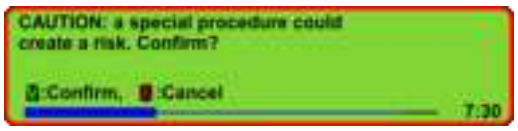
WARNING: If the 'Low Accuracy delay' message continues, the detonator will be initiated but with an incorrect firing time. Treat the detonator as defective in accordance with the applicable rules

Special procedure

The special procedure can be selected after the extra detonator test and detonator self-test when all error messages have been read. The ***ADMINISTRATOR*** menu section of the manual describes the limitations that can be applied to special procedures.

Use ▲/▼ to select “ACCEPT AND GO ON” and confirm with √.

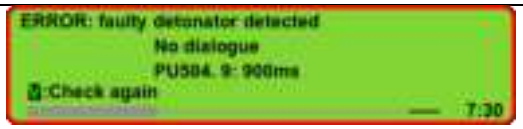
Confirm with √ to continue in special procedure.



WARNING: It is the blaster’s responsibility to assess the errors and the consequences before selecting ‘SPECIAL PROCEDURE’ mode. A ‘SPECIAL PROCEDURE’ does not correct the detected errors. Accepting the ‘SPECIAL PROCEDURE’ means the user has assessed the errors and risks, and accepts responsibility for those errors and risks.

Error messages during charging and firing authorized window

Line cut Monitoring:

MESSAGE	INTERPRETATION:
	**A detonator has been detected missing. DT Evolution now displays the detonator number immediatly**
CAUSES	**CORRECTIVE ACTIONS:**
Bad or poor connection	The detonator should be detected as "no dialogue" if the test procedure is run again. Use a special procedure or disconnect the detonator and treat the detonator as defective in accordance with applicable rules

Error messages during charge test

Low firing energy

MESSAGE	INTERPRETATION:
 **Voice message : 'DETONATOR COMMUNICATION ERROR"**	**The detonator has detected a charging defect in its firing capacitor and cannot store the energy required for safe firing over the 14s range.**
CAUSES	**CORRECTIVE ACTIONS:**
Firing capacitor insufficiently charged to fire over the 14s range.	• Reduce the level of current leakage. • Reduce the length and resistance of bus lines. • Use a special procedure or disconnect the detonator and treat the detonator as defective in accordance with applicable rules.
Detonator out of order	• Use a special procedure and treat the detonator as defective in accordance with applicable rules.

WARNING: Treat the detonator as defective in accordance with applicable rules.

WARNING: By accepting the 'SPECIAL PROCEDURE' and by firing the blast, the detonator will be a potential misfire and must be reported as such.

WARNING: When "firing energy low" is detected, if no button is pressed before timeout. "TIME EXPIRED" is displayed and special procedure will be unavailable.

Check that bus line lengths and leakage complies with Enaex recommendations (refer to the chapter "program dets")

Firing button released

MESSAGE	INTERPRETATION:
No voice message, long beep	**When the operator presses the charge button, the DRB2 detects that the firing button is already depressed.**
CAUSES	**CORRECTIVE ACTIONS:**
Firing button faulty	• Keypad faulty. Report to Enaex representative.
Firing button held down by operator	• No corrective action, the procedure has to be restarted from the test procedure step.

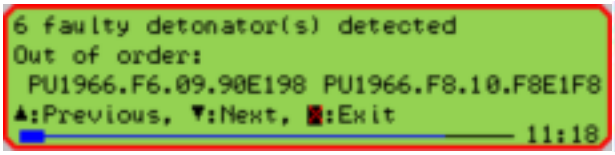
Charge button released

MESSAGE	INTERPRETATION:
No message	**Charge button released before firing.**
CAUSES	**CORRECTIVE ACTIONS:**
Charge button released before firing	No corrective action, the procedure has to be restarted from the test procedure step.

Error message with a Swift detonator

On SP/UG a detonator in error will be described with the PU number that programmed it, its sequence number and its delay. On Swift for each detonator in error the following information will be displayed:

- PU number
- Face name
- Detonator category
- Detonator unique ID



ERRORS FOR SWIFT DETONATORS

ERRORS FOR SP/UG DETONATORS

History and Datalogger File Transfer

The history file is a record of the events tracked by the equipment (DRB2 and DBD) from the start of the firing procedure up until the end of the firing procedure. This record allows users to keep track of previous blasts and to trace the sequence of events in case of irregularities.

The record of the events can be obtained as a .TXT file on a USB key. The history file can be downloaded from the DRB2 after a blast in WIRED mode and from the both the DRB2 and DBD after a blast in WIRELESS mode (the two units record their own events which are complementary).

The events are recorded in the history file based on the First-in-First-out principle. When recording a new event exceeds the memory assigned to the history file, the first recorded event in the history file will be erased to free up space for the new event. The history file can store approximately 15 blasts of 500 dets.

Note: Some USB keys are not fully compatible with DaveyTronic® equipments. It is important to use USB 1.1 standard mass memory key, USB 2.0 keys are usually compatible, and USB 3.0 keys are not compatible. Here are some recommendations to optimize the use of a USB key:

- *Do not use USB key with capacity larger than 4 GB.*
- *The USB key must be formatted using FAT or FAT32. NTFS format is not compatible (XP, Vista, Seven standards for HDD)*
- *Always use a blank USB key*
- *If USB key does not work properly, format it (using a PC and selecting FAT32) and try again. If it still not working, try another USB key before suspecting host hardware.*
- *Always eject the USB key using the Windows command before disconnecting it from the PC.*

Enaex strongly recommends downloading the history file after every blast.

The datalogger records information regarding the line driver.

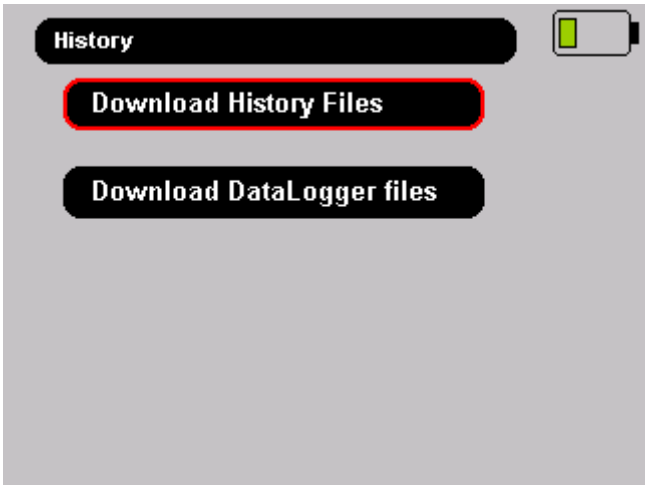
Datalogger records 3 different logs of 24 minutes maximum.

Note: Plug in the charger during the data transfer, as it will avoid a complete battery discharge. The downloading process may take several hours to be completed if large blast have been fired with these units

WIRED mode

History file

In the **MAIN** menu, use ▲/▼ on the left hand side of the DRB2 to select **HISTORY** and press √. In screen below, select **Download History Files** and confirm with √.



Insert a USB key. The USB port can be accessed by removing the dustproof plate on the right hand side of the DRB2 (simply pull on the 2 fast opening terminals). Press √ to start the transfer of the history file.

The message “**Transfer in progress.**” is displayed and the progress is indicated by the increasing percentage.

The USB key can be extracted once the message “**Transfer OK 100%”** is displayed.

The history of the procedures will be contained in the *.txt file on the USB key. The history file is named "***HISTO_YYYXXXX.txt"*** where yyy is the type of equipment and XXXX is its serial number.

Datalogger files

In the **MAIN** menu, use ▲/▼ on the left hand side of the DRB2 to select **HISTORY** and press √. In screen below, select **Download Datalogger Files** and confirm with √.

Insert a USB key and press √ to start the transfer of the files. Data stored will contain only the 3 last firing procedures.

The message "**Transfer in progress.**" is displayed and the progress is indicated by the increasing percentage. The three *.bin files are transferred to a USB key and transfer is complete when the message "**Transfer OK"** is displayed. The USB key can then be extracted. This datalogger file is named "***DRBzzz_yymmdd_hhmmss.bin"*** where zzz is the serial number of the DRB2, yyyymmdd is the date and hhmmss is the time when started the related firing procedure.

Note: Plug in the charger during the data transfer, as it will avoid a complete battery discharge. The downloading process may take several hours to be completed if large blasts have been fired with these units.

WIRELESS mode

History file

In wireless mode, it is important to download the history file of the DRB2 and the DBD as the events recorded and complementary.

To download the history file of the DRB2, please refer to the the previous chapter.

To download the history file of the DBD:

1. Connect the USB key to the corresponding port on the left side of the DBD (unscrew protecting cap first) and power on.
2. The 4 LEDs will start flashing back and forth.
3. Wait until the LEDs stop flashing back and forth and only the green LED starts flashing
4. Extract the USB key and power off the DBD.

The history of the procedures will be contained in the *.txt file on the USB key. The history file is named ***"HISTO_YYYXXXX.txt"*** where yyyy is the type of equipment and XXXX is its serial number.

Datalogger files

To download the datalogger files of the DBD:

1. Create a new "Logger.bin" text file containing a single letter (1kb), then save the file on the USB key
2. Switch off the DBD
3. Insert the USB key
4. Switch on the DBD
5. Wait untill the LEDs stop flashing back and forth and only the green LED starts flashing
6. Extract the USB key and power off the DBD

The data saved during the three last firing procedures will be contained in three *.bin files on the USB key. This datalogger file is named "***DBDzzz_yymmdd_hhmmss.bin"*** where zzz is the serial number of the DBD, yyyymmdd is the date and hhmmss is the time when started the relevant firing procedure.

Note: Plug in the charger during the data transfer, as it will avoid a complete battery discharge. The downloading process may take several hours to be completed if large blast have been fired with these units

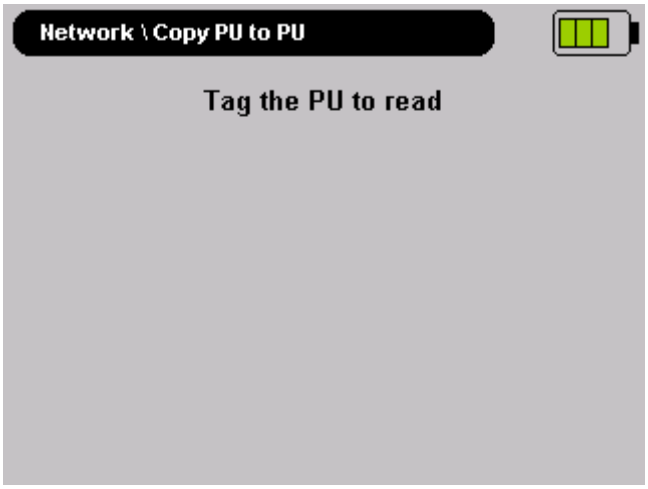
Additional procedures

PU to PU transfer

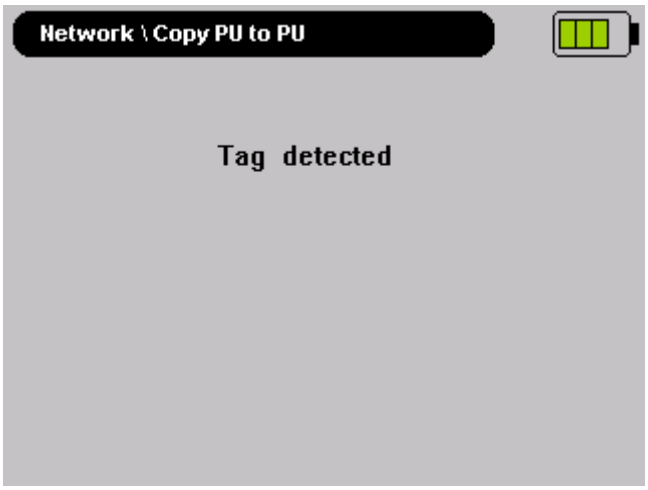
In the event of a PU failure (e.g. battery problems), the data contained in a PU can be recovered by the DRB2 and transferred to another PU. The function is accessible through the **NETWORK** menu.

*Note: It is assumed that "*PU to DRB2 data transfer*" has been read before reading this chapter*

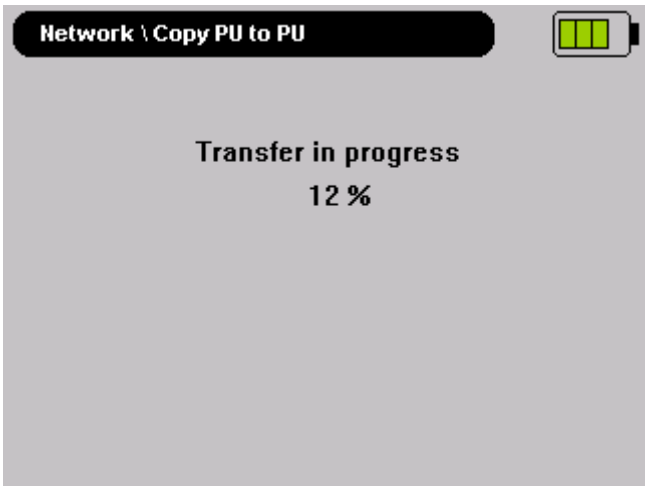
In the **MAIN** menu of the DRB2, use ↑/↓ on the left hand side of the DRB2 to select **NETWORK** and press √. In the **NETWORK** menu screen, use ↑/↓ on the left hand side of the DRB2 to select **Copy Pu to PU** and press √.



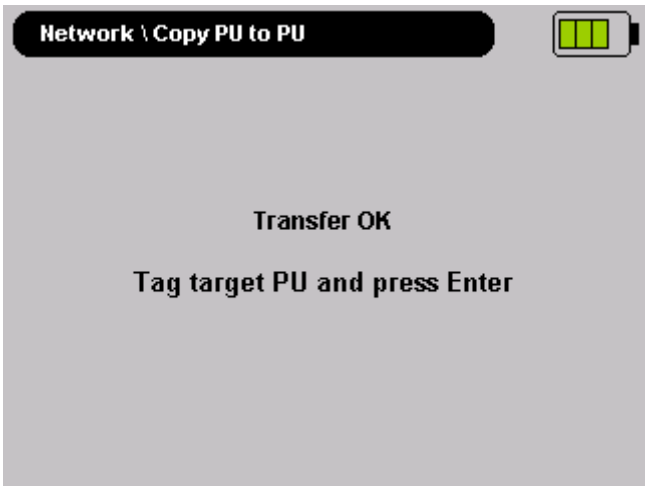
Tag the PU of which the data has to be recovered (source PU) with the DRB2.



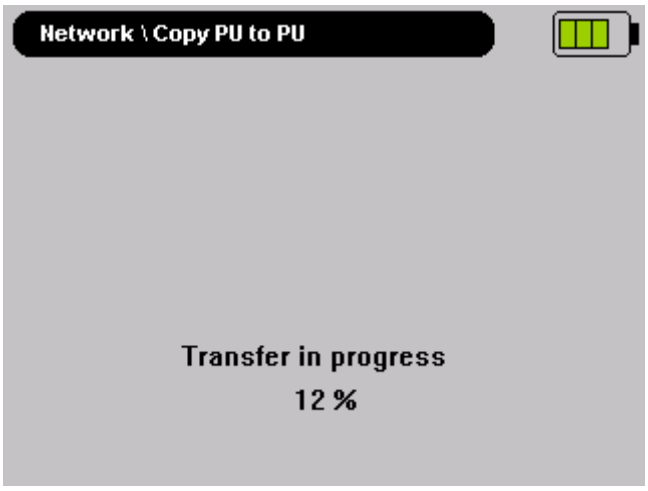
The transfer of the blast plan of the source PU to the DRB2 continues as long as the percentage increases and the message "***Transfer in progress….***" is displayed.



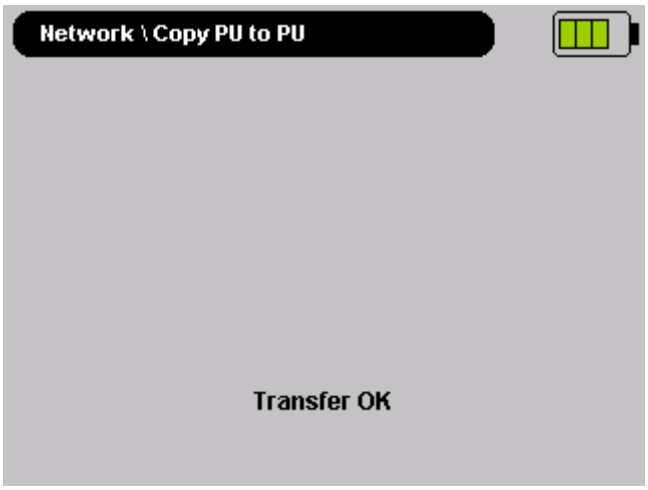
The next screen below displays the message "***Transfer OK***" and prompts the users to tag the PU to which the data will be copied (target PU), with the DRB2.



The transfer of the blast plan from the DRB2 to the target PU continues as long the percentage value increases and the message "***Transfer in progress…..***" is displayed.



When the message ***"Transfer OK"*** is displayed for the second transfer, the process is completed. The blast plan has been transferred from the source PU to a target PU.



Maintenance

Temperature

Operating temperature:	-20°C to +50°C / -4°F to +122°F
Battery charging:	0°C to +40°C / -32°F to +104°F
Storage temperature:	-40°C to +70°C / -40°F to +158°F

Battery management

Only use the "spider" charger provided to charge the batteries of the equipment. Recharge all equipment at least once a month. The user must not remove the batteries.

Battery Information – DRB2 and DBD

Type: MP 176065 xlr Prismatic Lithium-ion rechargeable battery pack – 1 Cell 3.65V 6,8Ah

Reference:	N° 176065 xlr, INP20/60/65
Manufacturer:	SAFT SA
Nominal voltage:	3.65 Volts
Nominal capacity:	6.8 Ah
Nominal energy:	24.8 Wh

Battery Information – Only in DBD in Australia and last design version

Type: Lithium-ion rechargeable battery pack – 3 cells / 3.65v / 10.5Ah

Reference:	N° 1S3P ISA 38966 – Davey Bickford reference = M1-165203
Manufacturer:	L.S.A ELECTRONIQUE
Nominal voltage:	3.65 Volts
Nominal capacity:	10.5 Ah
Nominal energy:	38 Wh

Charger:

REFERENCE:	Mean Well Enterprises Co Ltd
INPUT:	100-240 VAC, 50/60 HZ, 1.3A
OUTPUT:	12 V, 6.67A, 80W max

Spider adapter:

REFERENCE: 60284

For indoor use only

Notes on environmental conditions to be respected during charge:

> Altitude up to 2000 m (6560 ft)

> Ambient temperature between 0 °C and 40 °C (14 °F and 104°F)

> Maximum relative humidity 80 % for temperatures up to 31 °C (88°F) decreasing linearly to 50 % relative humidity at 40 °C (104°F)

> Mains supply voltage fluctuations not exceeding ±10 % of the nominal voltage.

NOTE : For charging the battery at an altitude between 2000 m and 4000 m (6560 ft and 13120 ft), your Enaex representative can recommend a suitable charger that conforms to the «…. IEC 62368-1 (2nd Ed.) : 2014 standard

Note :

- Do not store the battery fully charged at high temperature (over 25/30°C) this will reduce the battery life.

- Ideal storage temperature is between 5 and 15°C (New batteries, or equipment stored)

- Unutilized equipment should not be stored fully charged for more than one month, but between 20 and 60% of charge.

- Avoid charging at high temperature (room temperature over 30/35°C) as this is shortening battery life, and may stop the charge cycle before fully charging, resulting in reduced capacity.

- Charging below 0°C is not possible (the hardware does not allow the charging, but the software show the animation)

- Charge should be checked every 6 months, for unutilized equipment.

- Capacity is reduced when operated below 0°C

- Discharge at temperature over 60°C is difficult to monitor. (This is the case when equipment is under direct sunlight) The capacity bargraph may not reflect real capacity.

WARNING:

Charging mode (plugged in to mains supply) is prohibited in outdoor use; charging mode (plugged in to mains supply) is for indoor use ONLY.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The level of safety of this equipment is only guaranteed for usage that conforms to the intended use, as described in this manual.

Equipment must be connected to electrical installations respecting the regulations of the country in which they are used. They must include protections against voltage and current surge, and earth defects

Risk of explosion is high if the battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

Maintenance of the equipment can only be performed by trained and authorised personnel.

Equipment must be connected to a source limited in power (PS2<100W) and conform to IEC60950_1 or IEC62368_1 safety standard.

The power cable plug is used as a circuit cutter. The power plug must be close to the equipment. The power plug and the jack plug must be easily accessible at all times during charging

Do not install the equipment close to a heat source or close to a humidity source.

For your own safety, it is imperative that before any maintenance operation, the equipment is switched off.

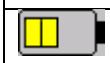
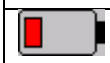
The user of the equipment must not access the inside of the units. Contact your Enaex representative in case of issues or suspected malfunctions.

While the equipment is being recharged, it cannot be used (except during datalogger downloading). This precaution prevents the equipment from functioning while it is connected to a power source.

Power consumption and battery autonomy

The Remote Blaster (DRB2)

Autonomy of the DRB2 is around 2 hours in WIRED mode (screen and keyboard backlight on) and 3 hours in WIRELESS mode (screen and keyboard backlight on). The DRB2 continuously displays a battery level indicator in the upper right-hand side of the screen. The charge level is indicated according to the following rule;

	89 to 100% charged
	69 to 88% charged
	38 to 68% charged
	19 to 37% charged
	0 to 18% charged

When the battery of the DRB2 is worn the following screen is displayed at power ON and the battery icon is crossed out

The Blast Driver (DBD)

Autonomy of the DBD is 2.5 hours (while communicating and with consumption on the line). The battery level indicator of the DBD is continuously displayed on the DRB2's screen when it is in operational mode, and follows the same rule as the DRB2 battery indicator. The battery level is also indicated by a LED combination at start up, according to the following rule.

After switching on, the second time the LEDs light up :

- indicating a battery status of <25% charged

➢ indicating a battery status of 25 to 49% charged

➢ indicating a battery status of 50 to 74% charged

➢ indicating a battery status of >75% charged

When the DBD and the DRB2 are communicating during a blasting procedure, the battery level of the DBD is displayed on the screen next to the wireless indicators.

When the battery of the DBD is worn the LED battery indicator level blinks and on the DRB2, the battery icon is crossed out.

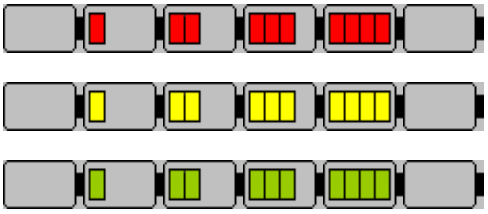
Recharging the battery

Charging duration from a flat battery is around 4 hours, and up to four units can be charged at the same time using the spider charger. Only use the "spider" charger, or the car adapter provided for recharging the batteries of the equipment. Recharge all equipment at least once a month.

The Remote Blaster (DRB2)

Batteries of the DRB2 are recharged by plugging one of the spider charger cables in to the charging point of the DRB2. The charging point can be accessed by removing the dustproof plate at the right hand side of the DRB2.

When charging, the battery charge indicator indicates the battery charge level according to the following rule:



Less than 85% of the battery charged

Between 85%and 95% of the battery charged

More than 95% of the battery charged

The DRB2's screen displays ***"Battery charged……Unplug the charger"*** when the battery is fully charged.

The Blast Driver (DBD)

Batteries of the DBD are recharged by plugging one of the spider charger cables to the charging point of the DBD. The charging point can be accessed by unscrewing the protective cap on the left hand side of the DBD.

When charging, the battery charge level is indicated according to the following rule:

DBD LED sequence indicating battery level while charging

0% to 24% :

25% to 49% :

50% to 74% :

75% to 99% :

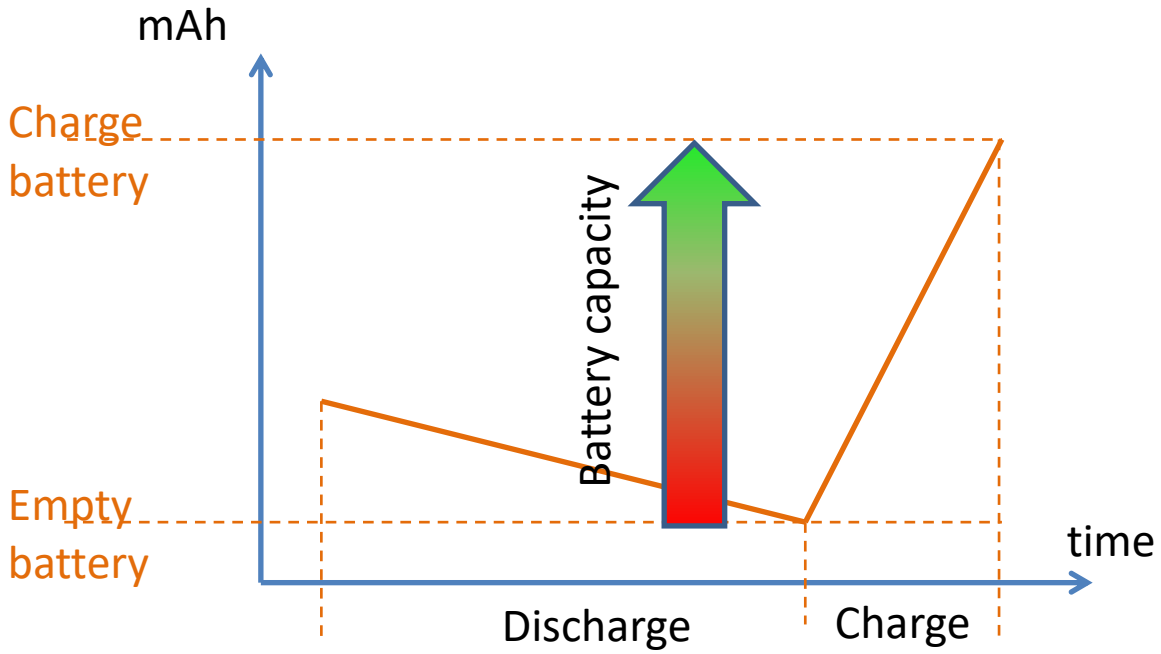
100% :

4 LEDs stay on

The DBD's 4 LEDs stay on when the battery is fully charged.

Battery calibration

Battery calibration is a process than computes the real capacity of the equipement's battery. During this process, the equipement drains its own battery. Once it is empty, it starts a charge cycles and measure the quantity of energy that is stored in the battery. At the end of the process, equipement computes the capacity of the battery in mAh.



Advantages:

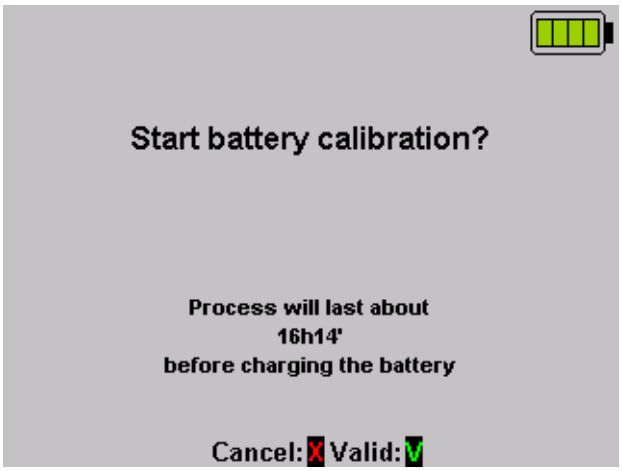
- Computed battery capacity takes into account battery aging and equipement battery indicators reliability is improved
- Equipement will prompt a warning as soon as the battery is depleted (computed battery capacity too low)

Calibration process is started every 30 charges of over 30 mins (refer to the

WARNING: Battery calibration includes a battery discharging phase that can take a very long time. If the equipment proposes a calibration it is recommended to begin this calibration with depleted battery to minimize the discharge time. If you launch a battery calibration with a fully charged battery the calibration could last more than 12 hours for DRB2 and DBD and 24 hours for the PU.

The Remote Blaster (DRB2)

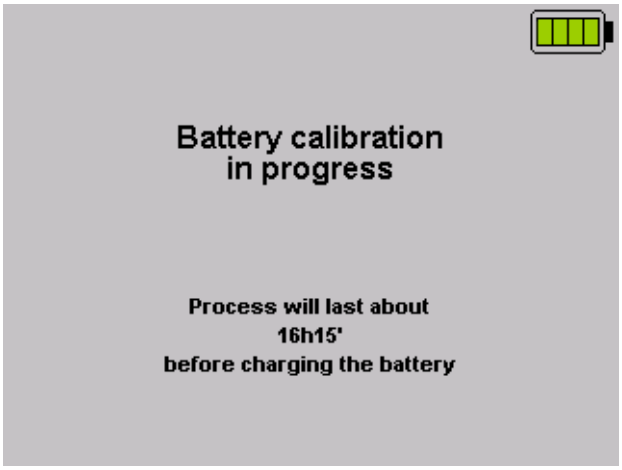
Like the PU, when the number of charge is more than 30 charges, the DRB2 prompts the user to calibrate the battery



The calibration process time is estimated and displayed because the complete process of discharging / charging can last a maximum 12h on a DRB with a brand fully charged new battery.

As for the PU, if the button is pressed or after 5 minutes, the DRB2 proceeds with standard charging. (If calibration process is too long for the user, the cancel button must be used)

Once the button is pressed, the device launches the calibration procedure.



The discharge of the battery is launched (luminosity of the display is temporarily set to 100%)

Discharging phase: ⇨⇨⇨⇨⇨⇨…

Note that the estimated time of calibration is continuously updated.

When battery reaches the minimum charge level, the calibration begins to charge the battery to identify the real battery capacity. This capacity is then used to display the battery gauge.

Charging phase: ⇨⇨⇨⇨⇨⇨…

The Blast Driver (DBD)

Once a calibration is necessary, the DBD, as the DRB2, first completely discharges its battery and then charges it.

As with the DRB2, it is possible to postpone the calibration if the user needs their units before the end of the estimated calibration time. Postponing is done by unplugging the power cord and plugging it again,

During discharge, the 4 LEDs are blinking (Long ON, short OFF)

The charge phase has the same behavior as standard charging.

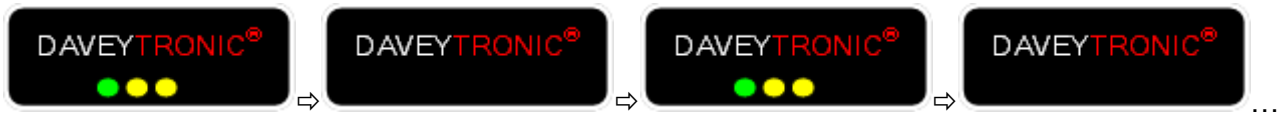
Battery status indicator – Used battery

After calibration, the battery is calibrated and the equipment displays a more accurate status of the battery. The indicator is now proportional to the real capacity of the battery (not to the theoretical value of a brand new battery).

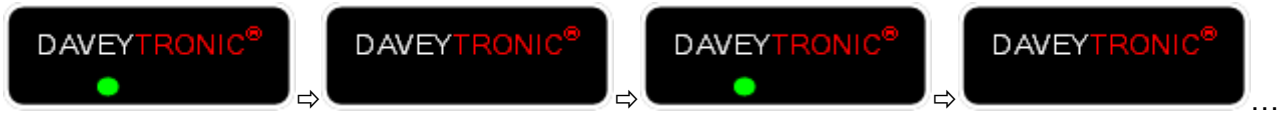
When a battery should be replaced (after 2 consecutive calibration that recorded a used battery) the battery indicator changes from  to  for the DRB2 and from  to  for the PU

On the DBD, when displaying the battery level (after self-test, or during battery charge), if the battery is worn, the battery level is quickly blinking (Short ON, short OFF) LEDs.

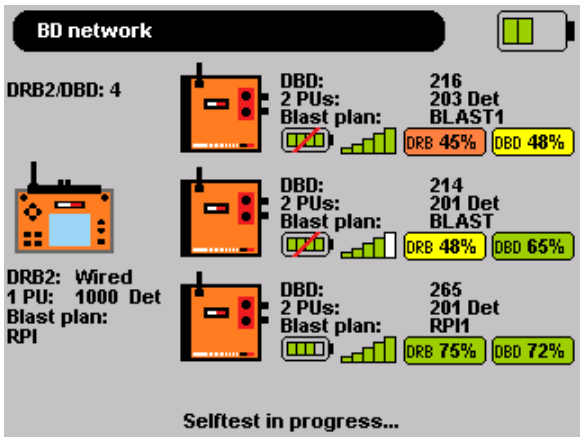
75% charged / used battery:



25% charged / used battery:



During the firing procedure, the DBD battery level is displayed and if the battery is worn the indicator is  .



Cleaning

For a longer use, keep the equipment as clean as possible.

- Clean with a ***SOFT*** cloth and cleaning product
- Do not use corrosive substances
- Do not spill liquids on the equipment

Annual inspection

The devices of the blasting system must undergo annual maintenance by the manufacturer or an agency approved by the manufacturer.

IMPORTANT: Like any other blasting machine, DRB2s, DBDs and PUs, must be checked annually by Enaex or an Enaex certified agent, in accordance with the manufacturer's specifications and applicable regulations. Contact Enaex for this service.

WARNING: All work performed on the blasting equipment must be carried out by the manufacturer or a certified agent.

Consumable material or parts subject to wear and tear will be replaced according to the Enaex preventive maintenance plan. Spare parts will be provided and installed by your Enaex representative.

Auto test / Self-test

After switching on the equipment, self-tests are processed automatically. Check on the screens (PU and DRB2) and on the LED's (DBD) for the result of these self-tests. If an error occurs, and is

repeated after a second attempt to re-start the equipment, return the affected equipment to the manufacturer or an agency approved by the manufacturer.

Software revisions

Enaex constantly develops new software to offer customers additional functions. Contact your Enaex representative for the latest software versions.

Rating and characteristics of fuses

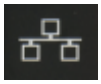
Fuses used in the equipment are NANO Slo-Blo Fuse 452/454 Series and have interruptive ratings of 50 amperes at 125 VAC/VDC.

Symbol and Tags

In addition to the symbols used on the buttons, the following symbols and tags are used on the equipment:

USB connection 

Aerial plug 

Ethernet connection 

RFID tag or tag reader 

Earthing plug

Connection for synchronising multiple DBDs 

Caution: Fire line terminals 

All pieces of the DAVEYTRONIC® SP/UG Blasting System (DRB2, DBD, PU) are considered as dangerous goods, UN 3481 **Class 9,** due to the capacity of the contained Lithium-ion battery**.** In order to ship this equipment:

1. No particular packaging is required. The usual packaging protecting the equipment from damage during transport is sufficient.
2. A particular sticker, as provided by your Enaex representative has to be put on the packaging.
3. The sticker has to be completed with the correct shipment data:
    a. the shipper's name and address
    b. the consignee's name and address
    c. The total net weight of the batteries in the package. The weight of 1 battery is 0.153 kg. The weight to be indicated on the sticker is the total net battery weight calculated as 0.153 kg X Number of devices

Example: shipment of 2 PUs and 2 DRB2s, is 4 pieces of equipment in total, 4 x 0.153 kg = 0.612 kg. The NET WEIGHT field to be filled in should be 0.612 kg.

4. Required document: the Shipper's Declaration for Dangerous Goods

Example: (https://www.iata.org/whatwedo/cargo/dgr/Documents/Shippers-Declaration-Open-Format-Non-Fillable.pdf)

Range of environmental conditions

Refer to the related technical datasheet.

Assembly, location and mounting

The PU and DRB2 are handheld units. They do not require any mounting or assembly. The DBD must be located close to the shot, at a location protected from flyrock.

The only mobile part in the equipment is the antenna that must be screwed onto the DRB2 and DBD, when configuring the WIRELESS mode. Gently screw (clockwise) the antenna on the equipment before operation, and unscrew (counter clockwise) after operation.

Connections

No cable connection between the equipment is required for the data transfer. All data transfer is done by RFID communication.

- The DBD includes an RFID tag that can be read by the PU.
- The PU includes an RFID tag that can be read by the DRB2. It also includes a RFID reader that can read the DBD RFID tag.
- The DRB2 contains a RFID reader/writer:
  - to read the PU's RFID tag
  - to writer data to PU RFID tag (Refer to the "PU to PU transfer" chapter).

Communication between the DRB2 and the DBD during the testing and firing procedure can be done by:

- Remote radio communication through RF modems

At the time of publication, all information in this manual is as accurate and up-to-date as possible. Since Enaex cannot anticipate or control the conditions under which this information and its products may be used, each operator should review the information in the specific context of its intended application. Enaex will not be responsible for damages of any nature resulting from the use or reliance upon the information. No express or implied warranties are given other than those implied mandatory by law.

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