



AUSTIN POWDER

MODULE - 12

Best Practice Procedures

Version 1.13 ENGLISH
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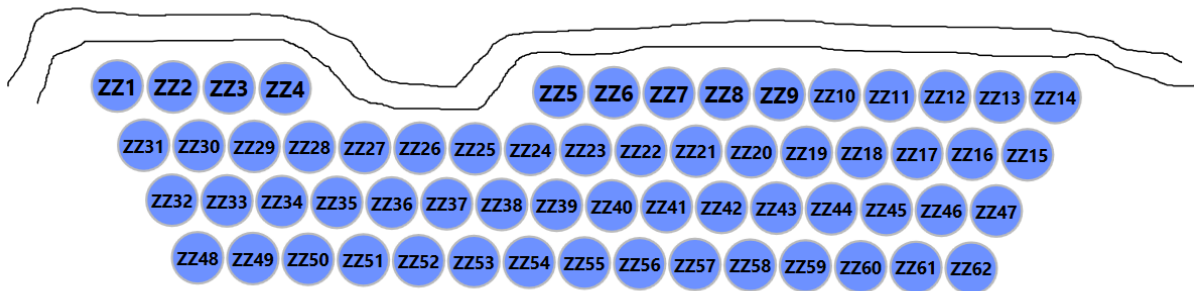
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1 Best Practice Procedures

1.1 Prepare blast pattern

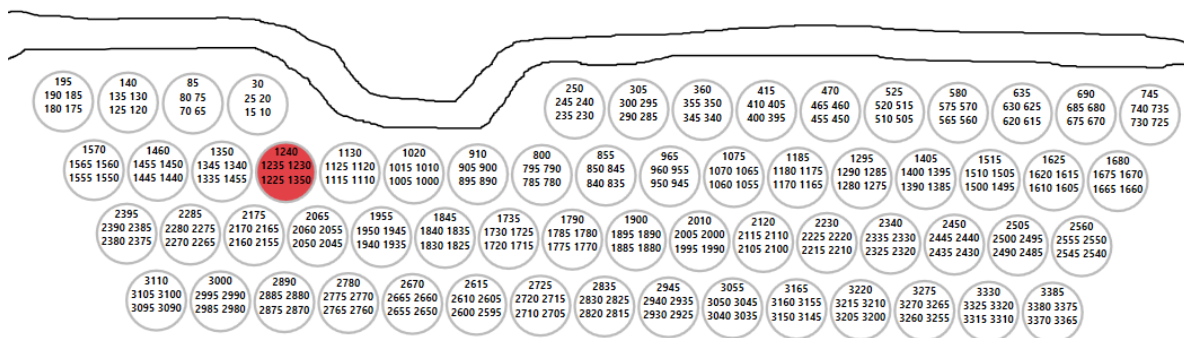
To prepare a blast pattern you should use the E*STAR PROGRAMMER software. It's designed for this purpose.

Distribute the holes according to your blast plan, draw lines showing important features like (crest, toe, access road, drain etc.).



1.2 Prepare timing + branch + detonator number plan

Prepare your timing using the above explained functions, set up branches, timing, programming order and assign timing.



1.3 Transfer data to logger

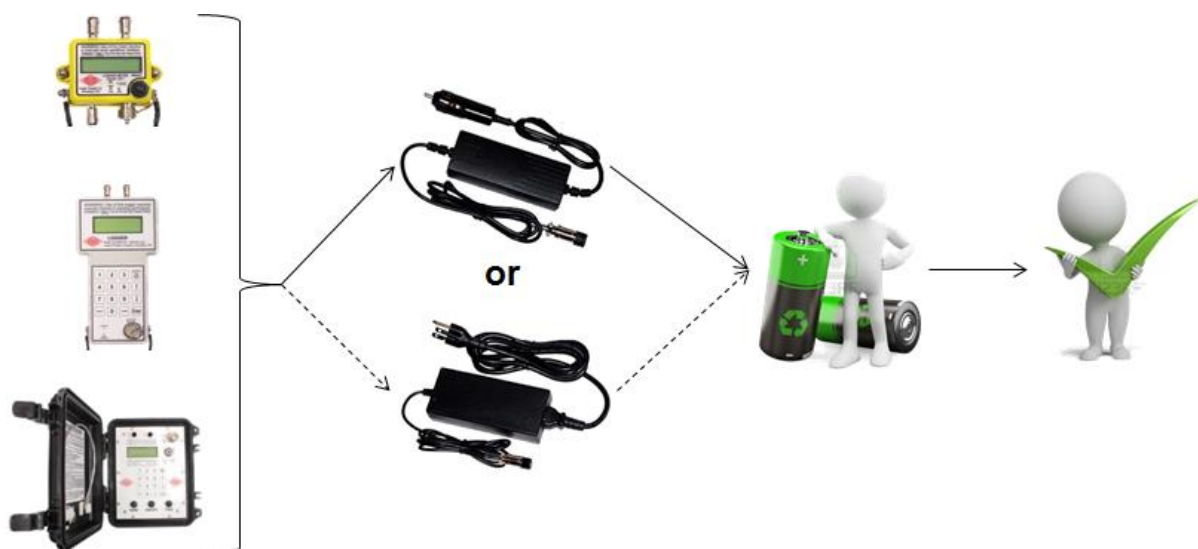
Transfer your prepared data from PC to logger / loggers using above described functions.





1.4 Prepare Equipment

Best practice is to make sure equipment has been fully charged before use on a blast.



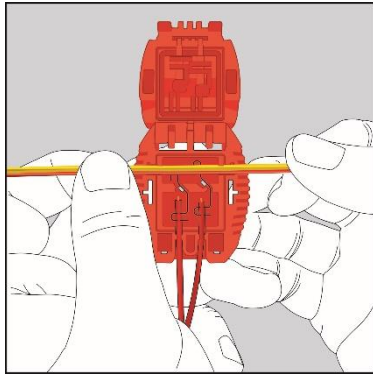
1.5 Random holes check for current leakage

Monitor during the loading phase to make sure that there's not something happening during loading that can cause damage to the wire insulation. If wire damage is observed, check detonator(s) for any type of leakage. The LM-2 Leakage Meter is designed for this purpose.



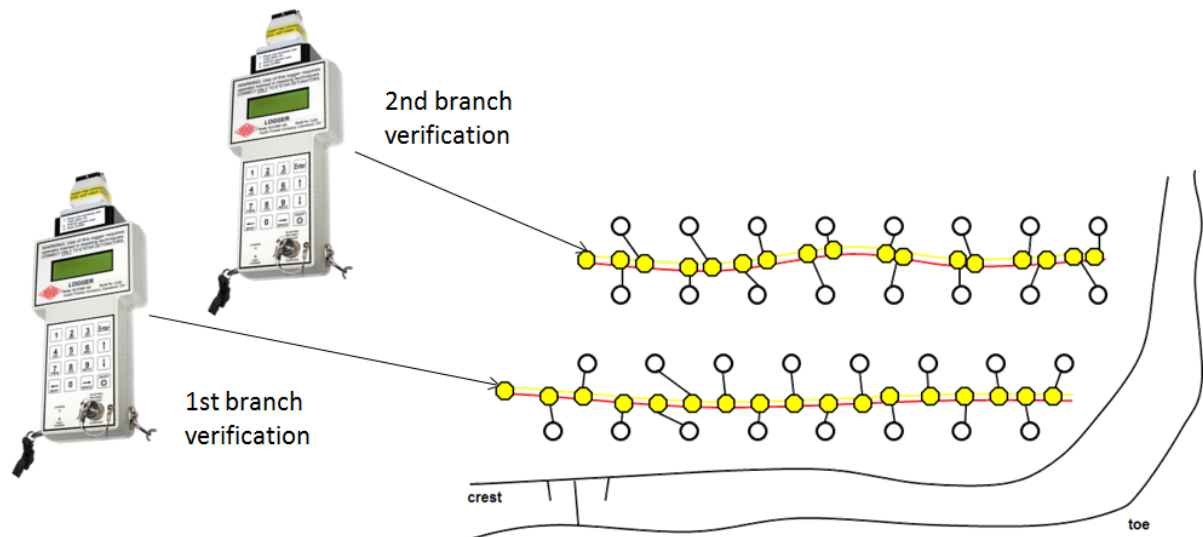
1.7 Connect detonators to branch line

After programming, connect all detonators to the proper branch wires. Best practice is to apply fishbone connection.



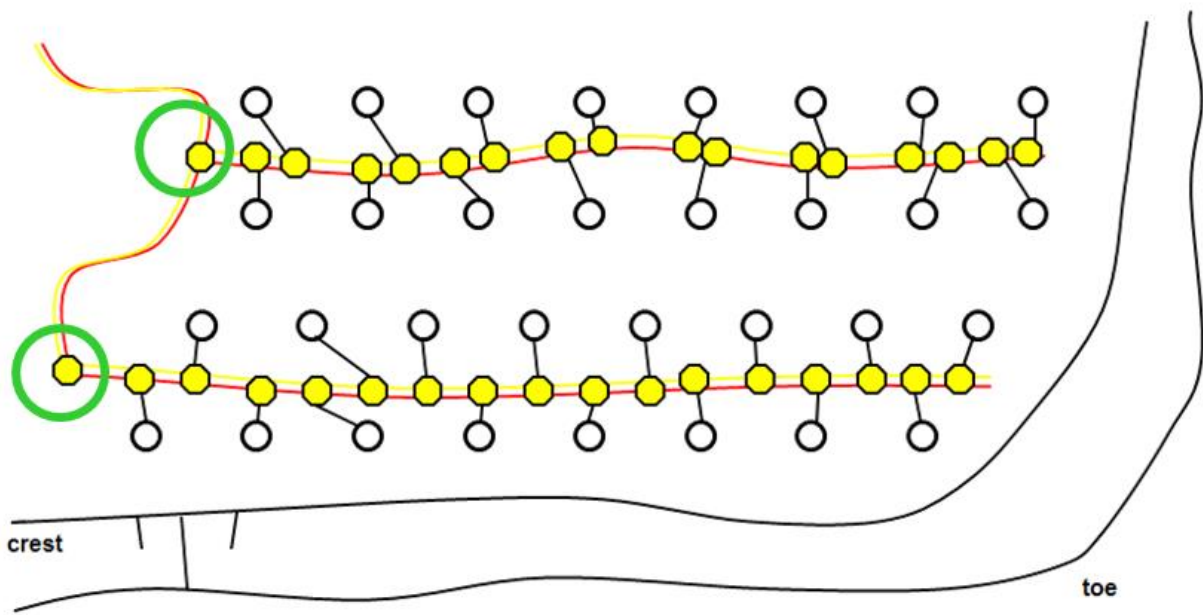
1.8 Verify detonators in branches

Complete the verification of all branches individually using the logger. If you skip this step, you are more likely to have issues later when you perform “verification” with the blasting machine prior to charging and firing all detonators. The best practice is to perform this verification when you are connected to a connector positioned at the end of the branch wire.



1.9 Connect branches together

At this point it's very important to be certain that all detonators are communicating when performing the "verification" procedure. Connect the branches to the firing line. Make certain that all mechanical connections were performed carefully. You can check the current with the logger. Make sure that each and every branch is connected to the firing line.



1.10 Transfer data from logger to blasting machine

Transfer data from one logger or multiple loggers to the blasting machine. Ensure that you've erased the previous blasts data from the blasting machine's memory. Be certain not to send the same data twice. If you do by mistake, the blasting machine will indicate the incorrect number of detonators in the blasting machine memory, due to multiple "duplicates".





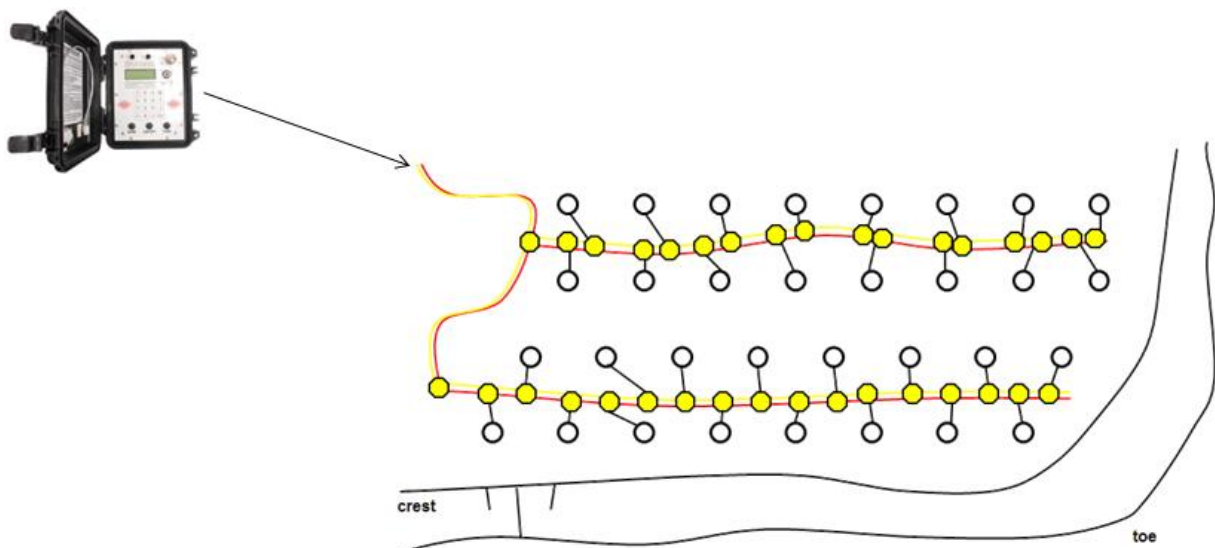
1.11 Clear blast area

Because a blasting machine is designed to fire the blast, before connecting blasting machine to firing line, it is mandatory that you clear blast area and ensure that no one is present.



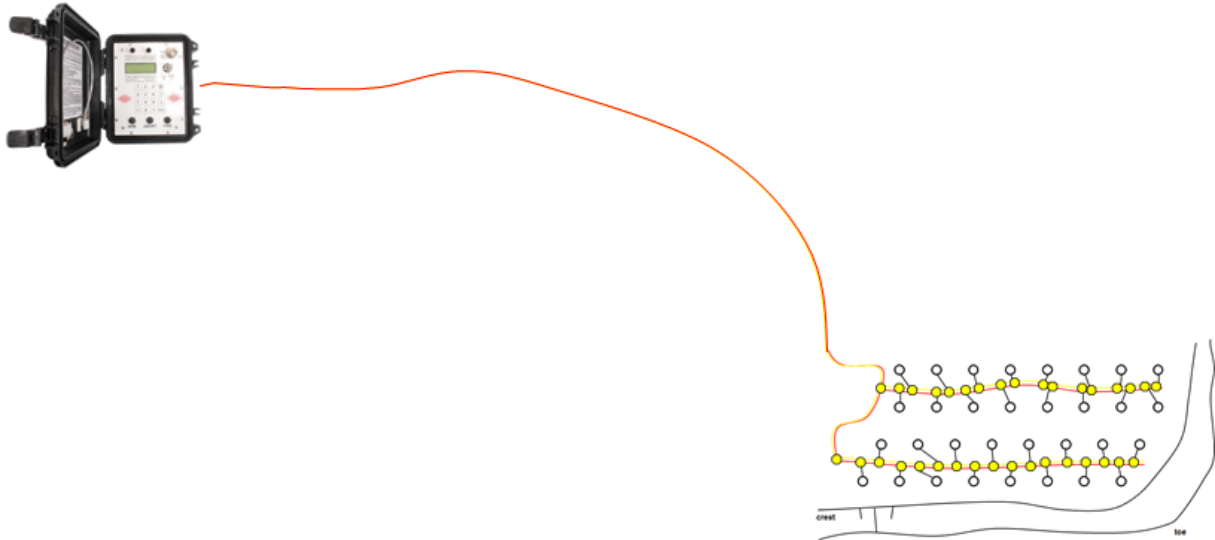
1.12 Verify all detonators in all branches

Connect the firing line to the blasting machine terminals, turn on the blasting machine by turning the key. Select the desired mode and proceed to “Check” or “verify” that all detonators in all branches can be verified, and that they are communicating to the blasting machine.



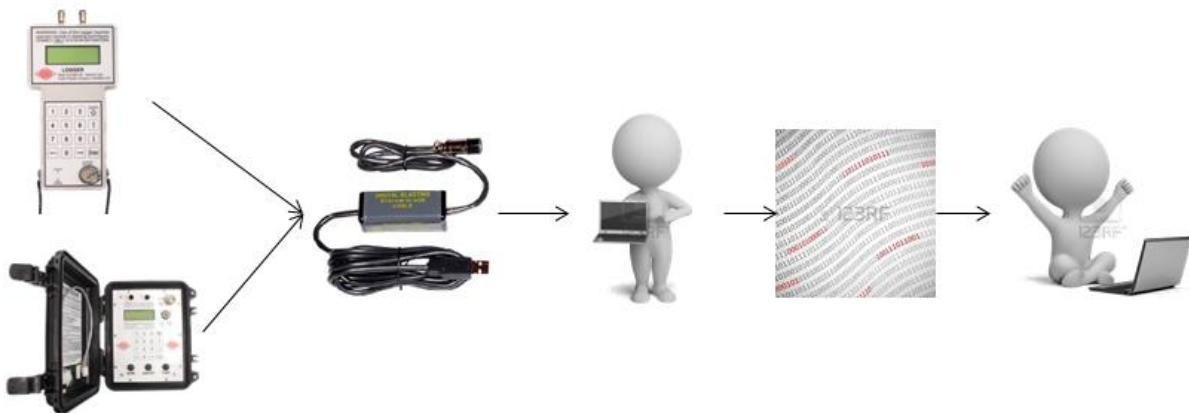
1.13 Charge all detonators, Fire all detonators

After finishing the charging of all detonators and receiving the “Ready to Fire” signal, proceed the next step in the firing procedure. “Press and Hold” the “ARM and FIRE” plunger switches until the blast is fired.



1.14 Transfer the data from logger and blasting machine to the PC

After a successful blast, download data from the logger and the blasting machine to the E*STAR PROGRAMMER to have a complete record of the detonator serial numbers and the detonator assigned number.



2 One page manual

Measuring current by LM2 tester

1. Pressing the ON/OFF button turns on the device
2. Detonator leakage is indicated by BUS-BUS on display. The nominal value for detonator leakage is 0,08 or 0,09 mA
3. Short press ON/OFF button switches the measuring mode between BUS-BUS and BUS-SHELL
4. Ground leakage is indicated by BUS-SHELL on display. The nominal value for ground leakage is 0,00 mA
5. Long press of the ON/OFF button turns off the device

Starting logger DLG1600-100

1. Pressing the ON/OFF button turns on the device, preset code is 1111, press ENTER, erase Detonator & EBR memory, it is possible to turn on the backlight. When using EBR data, transfer data from PC to the logger using USB data transfer cable.

Manual programming

1. In main screen press #1 to LOG DETS, press #1 to LOG DETONATORS, type in programmed branch number and press ENTER
2. Connect detonator, press ENTER to read the detonator, the logger will show detonator details
3. Default is selection CHANGE DELAY, then press ENTER, use the keyboard type the delay, press ENTER
4. Using ↑ ↓ select CHANGE BRANCH #, then press ENTER, by keyboard type branch #, press ENTER
5. Using ↑ ↓ select CHANGE DET #, then press ENTER, by keyboard type detonator #, press ENTER
6. If all values are OK using ↑ ↓ select SAVE SETTINGS, press ENTER and disconnect the detonator
7. Repeat steps 2 - 6

Programming using EBR data

1. In main screen press #1 to LOG DETS, press #2 to LOG USING EBR DATA, select if you like to CONFIRM ALL or use ONE TOUCH.
2. Logger will show you detonator number, connect to this detonator, press ENTER, logger will show data prepared in PC, default is selection SAVE SETTINGS, press ENTER and disconnect the detonator (when in ONE TOUCH no action is needed, data are saved automatically)
3. Repeat step 2

Programming using Auto Delay

1. In main screen press #1 to LOG DETS, press #3 to LOG AUTO DELAY, select if you like to CONFIRM ALL or use ONE TOUCH.
2. Enter 1st 2 delays and the interval between 1st and 3rd delay.
3. Enter detonator number you like to start with, enter branch number you are starting with
4. Logger will ask for connecting detonator, after connecting the screen will display detonator number, delay and branch number which will be programmed. Default is selection SAVE SETTINGS, but with using ↑ ↓ is possible to roll to CHANGE DELAY, CHANGE DET#, CHANGE BRANCH#. Confirm saving by pressing enter when selected option is SAVE SETTINGS and disconnect the detonator (when in ONE TOUCH no action is needed/allowed, data are saved automatically to the detonator).
5. Repeat step 4

Connecting detonators

1. Connect all detonators to the branch(es), attention to polarity "is not" required, make sure that wires are properly inserted into the connector

Branches verification using logger DLG1600-100

1. In main screen press #3 to VERIFY, type in branch #, press ENTER, logger will automatically verify whole branch
2. There should be no missing (not connected) detonators or unexpected (not programmed) detonators

Branch current using logger

1. In the main screen press #5 to CURRENT, type in the branch #, logger will measure the leakage of branch
2. Expected and measured values should match, on occasion the measured will read 1 mA lower
3. When measuring ground leakage, connect both bus line wires to one terminal and ground rod to second terminal, the correct reading is 0 mA

Connect branches

1. Connect all of the branches to the firing line

Turn on the blasting machine

1. Turn on the blasting machine by key, preset code is 1111, press ENTER, select your mode, it is possible to turn on the backlight
2. In the main screen, press #3 to ADMINISTRATOR, press #1 to ERASE MEMORY, press ENTER, the blasting machine will reboot, repeat point 1

Data transfer to blasting machine

1. Connect the logger and the blasting machine using DATA TRANSFER CABLE
2. In the main menu of the blasting machine press #2 to select DATA TRANSFER, press #1 to select LOGGER RECEIVE
3. In main menu of the logger press #2 DATA I/O, press #1 to SEND TO BLASTER, press #1 to SEND ALL

Turning off logger

1. After successful data transfer disconnect the blasting machine and the logger, long press of the ON/OFF button turns off the logger

Blast verification and firing procedure

1. Connect the firing line to the blasting machine terminals, in main screen press #1 DETONATORS, press #1 to CHECK DETS, the blasting machine will verify all of the detonators in all branches
2. After successful verification press #2 to BLAST, press ARM to begin ARMING the detonators
3. Once the green READY TO FIRE light is on, "Press and Hold" the ARM and FIRE plunger switches together

Turning off blasting machine

1. To Turn Off the Blasting Machine, turn off the key switch

Record data from the blast in the BLAST RECORD REPORT.

3 Blast Check lists

3.1 One-page check list (pre-blast / during / post blast)

Check ✓ if successfully completed or ✗ if point is not completed. Only if point is successfully completed proceed to next point.

Pre blast:

1. Do you have a blast pattern? ☐
2. Do you have timing plan of blast? ☐
3. Do you have wiring plan of blast? ☐
4. Is equipment ready / charged / working? ☐
5. Do you have tester LM-2 and adapter model 1? ☐
6. Do you have ground rod? ☐
7. Do you have logger DLG1600-100 and adapter model 2? ☐
8. Do you have blasting machine DBM1600-2-K / RC? ☐
9. Did you transfer EBR data from PC to logger? ☐

During blast:

10. Did you measure all detonators for bus-bus leakage and all values are 0,08 a 0,09 mA? ☐
11. Did you measure all detonators for bus-shell leakage and all values are 0 mA? ☐
12. Did you program all detonators? ☐
13. Did you use all EBR data? No EBR data still remaining? ☐
14. Are all detonators connected to branches? ☐
15. Did you successfully verify all detonators in branches one by one? ☐
16. Do you have 0 (zero) missing detonators? ☐
17. Do you have 0 (zero) unexpected detonators? ☐
18. Did you measure current / branch leakage same as expected? ☐
19. Did you measure ground leakage 0 mA of whole branches? ☐
20. Are all branches connected to firing line? ☐
21. Did you transfer detonators data from logger to blasting machine? ☐
22. Is blast area clear without any personnel? ☐
23. Did you successfully verify all detonators in all branches? ☐
24. Do you have 0 (zero) missing detonators? ☐
25. Do you have 0 (zero) unexpected detonators? ☐
26. Do you have on READY TO FIRE light? ☐
27. Did hear the sound of blast after press and holding ARM and FIRE buttons? ☐
28. Did you turn off blasting machine? ☐

Post blast:

29. Did you transfer data from logger to PC? ☐
30. Did you transfer data from blasting machine to PC? ☐

E*STAR PRIMING / BLAST PREPARATION LEAKAGE REPORT

Measured after booster priming

Blast ID						Date		
If detonator leakage (BUS – BUS) is not in range 0.08 – 0.1 mA fill information below								
Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	
Number of detonators with detonator leakage out of range 0.08 – 0.1 mA								
If ground leakage (BUS – SHELL) is higher than 0.00 mA fill information below								
Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	
Number of detonators with ground leakage higher than 0.00 mA								
Total number of detonators in blast								

E*STAR BLAST REPORT

Leakage measuring before stemming

Blast ID						Date		
If detonator leakage (BUS – BUS) is not in range 0.08 – 0.1 mA fill information below								
Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	
Number of detonators with detonator leakage out of range 0.08 – 0.1 mA								
If ground leakage (BUS – SHELL) is higher than 0.00 mA fill information below								
Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	Hole #	Leakage	
Number of detonators with ground leakage higher than 0.00 mA								
Total number of detonators in blast								

Programing of the detonators

Programing / logging method	☐ Manual	☐ EBR	☐ Auto delay	☐ One-Touch
I-H (ms)		I-D (ms)		I-R (ms)

Connection and branches

Total number of branches in the blast					
Branch #	Number of Detonators	Number of Unexpected	Detonator leakage (mA)	Ground leakage (mA)	Verified
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
Spare connectors used to connect branches together?				☐ Yes / ☐ No	
Value of network leakage measured with Logger (mA) – up to 54 mA					

Firing, use of the blasting machine

Length of firing line (m)					
Properties of firing line (wire core diameter, duplex wire, core diameter)					
Value of network leakage measured with blasting machine during verification (mA)					
Any verification issues?	☐ Missing dets.	☐ Unexpected dets.	☐ Line overload	☐ Other	
Value of network leakage measured with blasting machine during charging (mA)					
Number of charging cycles					
Waiting time before blasting after “READY TO FIRE” signal (in minutes)					

After blast

Blast without misfires?		☐ Yes / ☐ No
Data downloaded to the E*STAR Programmer?		☐ Yes / ☐ No
Notes about the blast		
	Name	Signature
Report prepared by		
Report approved by		

Attach blasting pattern, timing scheme, branch and connection scheme. If data were downloaded to the E*STAR programmer attach also the validation report.

Emergency contact for Austin representative

~~Austin detonator~~

Ondrej Cermak ondrej.cermak@austin.cz +420 730 166 246

Vojtech Kala vojtech.kala@austin.cz +420 731 623 616

~~Austin Powder Company~~

Bryan Papillon bryan.papillon@austinpowder.com +1 216 215 2352

In case of problems, have this report (as it is) ready for submission to above listed contacts or available to provide answers during telephone consultation.

In case of any misfires contact Austin representative before taking any action.

4 Troubleshooting

4.1 General rules of troubleshooting

When solving any issue in the field, there exist general rules which should be followed:

- 1) Think twice, do once. Same axiom a "Measure twice, cut once".
- 2) When any problem / issue / error appear, repeat the procedure which was causing the problem / issue / error. This might help to understand the reason.
- 3) Every problem / issue / error should be reported to your colleagues. This will help them in the future to prevent such a reoccurrence.

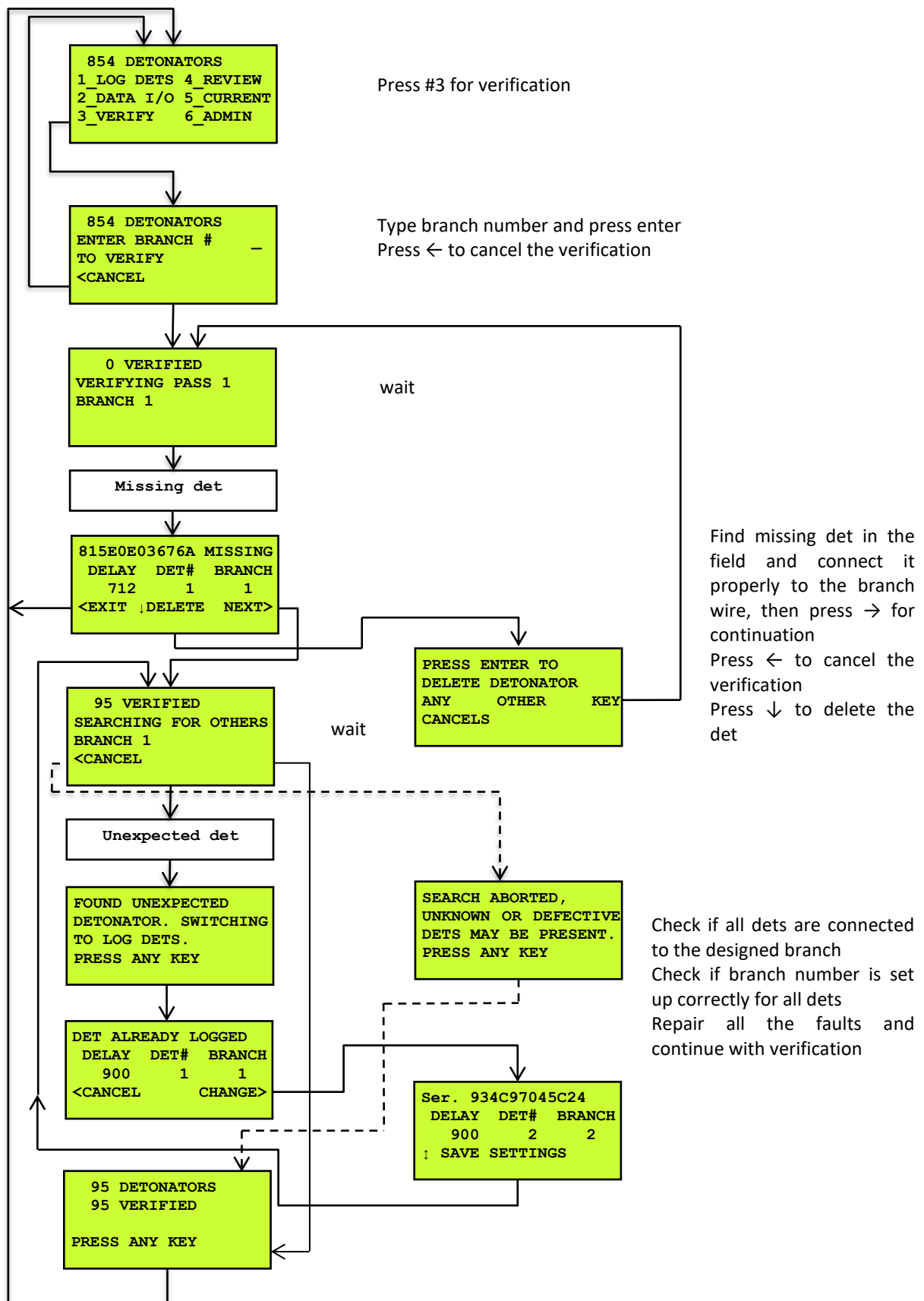
4.2 Logger DLG1600-100 troubleshooting

Logger DLG1600-100 error message	Interpretation	Solution
BATTERY LOW	Recharge batteries soon.	This message should Start appearing when the battery is below approximately 20% of capacity. Recharge logger using main / car char. 2 hours of charging will probably charge logger for 80 % of battery capacity.
BRANCH MUST BE 1 TO 99		Type in value from range 1 to 99. Restart logger (turn off, turn on). Repeat procedure. Report problem.
CANNOT RESOLVE ALL DETS. BAD DETS MAY BE PRESENT. LOG ALL DETS.	Message during Auto bus Detect (ABD) command when looking for unlogged detonators. Ensure all detonators have been logged	Two detonators are causing a response conflict during Auto bus Detect. Detonators must be logged individually.
COMMUNICATION ERRORS, REMOVE POWER, CHECK ALL CONNECTIONS	Check wiring, all connections and current leakage in system.	Restart logger, repeat procedure, and measure leakage. Report problem
CONTINUITY ERRORS DETECTED	The bridge wire is open.	Restart logger. Disconnect detonator, remove from blast, don't try to fire. Report problem.
DEFECTIVE DETONATOR REMOVE FROM CIRCUIT		Restart logger, repeat procedure, when again, disconnect detonator and don't use it. Report problem.
DELAY AND DET# MUST NOT BE 0		A zero value has been entered for either the delay time or the detonator number. Zero is not permitted. Type in value from range 1 to 20,000.
DELAY MUST BE 1 TO 20000	Delays less than 1 and greater than 20,000 (in 1 millisecond increments) cannot be entered.	Type in value from range 1 to 20,000.
DET # MUST BE 1 TO 1600	Detonator numbers must be between 1 and 1,600.	Type in value from range 1 to 1,600.
DETONATOR ALREADY LOGGED		Disconnect detonator, continue with programming.

DETONATOR FAILED SELF TEST. REMOVE DETONATOR		Restart logger, repeat procedure. If continue, disconnect from circuit and don't use. Report all.
DEVICE ERROR DETECTED	Detonator reporting improper status.	Restart logger, if problem continue, don't use logger. Report problem.
ERROR NO COMMUNICATION	Communication error	Repeat procedures, restart logger, check connection logger/adaptor, adaptor/connector and connector/detonator line. Measure leakage using LM-2, report problem.
ERROR DETECTED	Detonator reporting improper status.	Repeat procedures, restart logger, check connection logger/adaptor, adaptor/connector and connector/detonator line. Measure leakage using LM-2, report problem.
ERROR: CANCELED TRANSFER	Download of data failed.	Repeat data transfer procedure.
FAILED LINE TEST CHECK DETONATOR TYPE RESOLVE ERROR	A low resistance was detected. The detonator may be the wrong type. Resolve error before proceeding.	Check wire ends (not in water), check for shorted wires, measure leakage, locate high leakage source, replace bus line, report problem.
FOUND UNEXPECTED DETONATOR. SWITCHING TO LOG DETS	Detonator either has not been logged, or detonator not logged in the branch being verified.	Try to locate on blast plan, program detonator, continue, report procedure.
LINE OVERLOAD TURN POWER OFF	High current due to excessive leakage or shorted line or detonator.	Check wire ends (not in water), check for shorted wires, measure leakage, locate high leakage source, replace bus line, report problem.
LOGGER FAILED SELF TEST	Return logger to Dan-Mar Co. for analysis and repair.	Restart logger, if problem continue, don't use logger. Report problem.
MISSING	A detonator in memory is missing.	Locate detonator in time plan, check detonator connection to bus line, repeat verification.
NO RESPONSE	There is no response from the detonator.	Repeat procedures, restart logger, check connection logger/adaptor, adaptor/connector and connector/detonator line. Measure leakage using LM-2, report problem.
RECHARGE BATTERY		The battery is below the capacity needed for proper operation of the logger. It must be recharged. Recharge logger using main / car char. 2 hours of charging will probably charge logger for 80 % of battery capacity.

SEARCH ABORTED,UNKNOWN OR DEFECTIVE DETS MAY BE PRESENT		This message indicates that the Auto bus Detect process was manually aborted by the user. Repeat verification procedure.
WARNING: MAXIMUM DETONATOR COUNT		Review your blast design; disconnect holes to get under 1,600 pcs, blast separately.
WRONG DATA	Data stored in memory does not match data stored in detonator.	Investigate who changed data in detonator, check data with plan, reprogram to correct figures.

4.2.1 Verification - issues



4.3 Blasting machine DBM1600-2-K troubleshooting

Blasting machine DBM1600-2-K error message	Interpretation	Solution
AUTO BUS DETECT ERROR	Message during Auto bus Detect (ABD) command when looking for unlogged detonators. Ensure all detonators have been logged.	Restart blasting machine, repeat procedure, report issue.
BATTERY LOW	Recharge batteries soon.	Charge blasting machine using main / car charger, 2 hours will charge to 80% capacity. Charging should be done prior blasting.
BLAST ABORTED ERROR DURING FIRING CHECK CONNECTIONS TURN POWER OFF		Restart blasting machine, repeat procedure, report issue.
BLASTER FAILED BUS VOLTAGE TEST. CONTACT DAN-MAR CO. INC.	Return blasting machine to Dan-Mar Co. for analysis and repair.	This message refers to the timing calibration of the detonators. Retry the ARMING procedure. Restart blasting machine, report issue.
CALIBRATION ERROR DETS MAY MISFIRE		Restart blasting machine, repeat procedure, report problem.
CHARGE ERROR, SOME DETS MAY NOT FIRE	Not all detonators are charged.	Blast box will try to recharge 5 times. A choice to abort or charge is given. Choose "CHARGE". Don't abort blast, restart blasting machine, repeat procedure, proceed to fire, report problem.
COMMUNICATION ERRORS, REMOVE POWER, CHECK ALL CONNECTIONS		Restart blasting machine, repeat procedure, report issue.
COMMUNICATION ERROR RECOMMEND ABORT AND RE-VERIFY	Error when confirming the first and last detonator in memory.	Restart blasting machine, repeat procedure, report issue.
CONTINUITY ERRORS DETECTED	Some bridge wires are open.	Already eliminated during logging.
DELAY MUST BE 1 TO 10000	Delays less than 1 and greater than 10,000 (in 1 millisecond increments) cannot be entered.	This message can only appear if a detonator delay time is being changed by the operator. Type in value from range 1 to 10,000. Actual firmware is not yet able to work with 20,000 ms.
DETECTING ARM OR FIRE SWITCH PRESSED. RELEASE SWITCHES TO CONTINUE	Arm and fire switches should not be pressed at this time. One or both switches may be defective if message occurs and switches are not being operated.	Release ARM or FIRE button, repeat procedure.
DETONATOR FAILED SELF TEST REMOVE DETONATOR	Detonator is defective.	Repeat procedure, restart blasting machine, report issue, and check connection.

DETONATORS MUST BE VERIFIED BEFORE BLASTING		Repeat procedure, don't press abort.
DISCHARGE ERROR DETECTED	Some detonators did not respond to discharge command.	Wait 30 minutes, restart blasting machine.
ERROR	Communication errors.	Check connections, measure leakage.
ERROR: CANCELED TRANSFER	Download of data failed.	Repeat procedure.
FAILED LINE TEST CHECK DETONATOR TYPE RESOLVE ERROR	A low blasting circuit resistance was detected. Some or all detonators may be the wrong type. Resolve error before proceeding.	Restart blasting machine, repeat procedure, check ends of bus line for shorting, measure leakage on each branch using logger, locate leakage source by half cutting, disconnect source of leakage, proceed to blasting, report issue.
LINE OVERLOAD TURN POWER OFF	A low resistance was detected. The detonator may be the wrong type. Resolve error before proceeding.	Restart blasting machine, repeat procedure, check ends of bus line for shorting, measure leakage on each branch using logger, locate leakage source by half cutting, disconnect source of leakage, proceed to blasting, report issue.
MISSING	Detonator is missing.	Using identifications (det number, delay) locate on blast, check connection, repeat procedure, and report issue.
WARNING: MAXIMUM DETONATOR COUNT	Maximum number of detonators reached in memory.	Review your blast design; disconnect holes to get under 1,600 pcs, blast separately.
WRONG DATA	Data stored in memory does not match data stored in detonator.	Investigate who changed data in detonator, check data with plan, reprogram to correct figures.

4.3.1 Charge error

This message occurs when the Blasting machine is trying to charge all connected dets during the charging (arming). There will be up to 5 cycles attempting to charge the connected detonator(s). Important Note: This message can be generated by a single or multiple detonators in the blast.

Charging procedure:

- blasting machine Starts with cycle number 1
- green light ready to fire appears if all dets have enough energy after cycle number 1
- blasting machine attempts charge cycle number 2 if one or more of the detonators does not have the required energy to fire
- green light ready to fire appears if all dets have enough energy after cycle number 2
- ...
- blasting machine Starts with cycle number 5
- green light ready to fire appears if all dets have enough energy after cycle number 5
- message: "Charge error, some dets may not fire" appears if any of the det doesn't have enough energy

It is most likely that the message is related to high leakage current! Pressing the Abort switch and turning off the blasting machine completely, then reversing the polarity of the firing line, then restarting the entire procedure to fire may correct the Charge Error condition. If the same sequence is experienced, then continue to the next steps by;
Press any key, Do Not Press cancel (abort).

```
CHARGE ERROR i<XYmA  
SOME DETS MAY NOT  
FIRE.  
ABORT or CONTINUE_>
```

Message: "Calibration error dets may misfire" appears because the det doesn't have adequate energy stored in the capacitor to calibrate the det.
Press any key, Do Not Press cancel (abort).

```
CALIBRATE ERRORi<XYmA  
SOME DETS MAY  
MISFIRE.  
ABORT or CONTINUE_>
```

You will have the possibilities on the next screen:

- Scan all dets
- Proceed to firing
- Recharge

Choose option n. 3 - Recharge. Blasting machine will go for another 5 charge cycles trying to charge all dets. Green light ready to fire appears if the charging is done successfully. If green light does not appear and the charge error message appears again, continue but Do Not Press cancel (abort).

Choose option number 1 - Scan all dets.

Blasting machine will try to identify which det(s) are causing the issue.

```
<_SCAN ALL DETSi<XYmA  
>_PROCEED TO FIRING  
^_RECHARGE
```

On the next screen will be info about problematic det: serial number, delay, det. number, branch number. Write this information down, it is not stored anywhere in the blasting machine!!! If more than one are causing the problem they will be identified when you press next.

```
8182D80276AA i<XYmA  
DELAY DET# BRANCH  
901 1 1  
48 <EXIT NEXT>
```

Locate this det(s), eliminate it from the circuit, restart blasting machine and continue the entire charging procedure again.

It is not recommended to choose option number 2 - Proceed to firing when charge error appears. Blasting machine will fire only dets which have enough energy. Dets can be left in the blast in an unfired state. Said again, you are likely to leave unfired dets and explosives in the blast!

5 Notes