



NEXT GENERATION CALORIMETERS

CAL3K-U

OPERATIONS MANUAL

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DDS CALORIMETERS

Scientific Analytical Calorimeter Solutions



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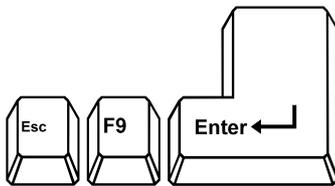
1 SYSTEM TESTING

The system components are:

CALORIMETER:	CAL3K_U
VESSEL(s):	3K_5
FILLING STATION:	3K_3
COOLER(s):	3K_2

1.1 HOW TO TEST CAL3K-U HARDWARE

The CAL3K has a hardware test built in, which is referred to as the USER or FIELD TEST. It is activated by entering the following on the calorimeter keyboard:



Once you have entered the Field/User Test Mode the CAL3K will cycle through all the installed tests. When all CAL3K hardware tests are done it will proceed with the vessel test and ask you to insert a vessel and close the lid.

All the above tests are displayed with the appropriate comments. If a test fails then the test sequence will stop at the failed test. The failed test is logged into Event Logging. Once the hardware test is completed the test is logged into the Event Logging and the User Test Log.



It is recommended to repeat the hardware test once a day or once per shift. The hardware test takes approximately 1 minute to complete.

NOTE: While the test runs or when it stops at a particular step then the F10 HELP key can be used to provide more information.

The test can be terminated at any given time with ESC



1.2 HOW TO TEST THE VESSEL

The vessel test is done in two stages:

- 1) Automatic, Internal self-diagnostics every time the vessel is inserted into the calorimeter well
- 2) Operator initiated test: TEST CALORIMETER + VESSEL



1.2.1 3K-5 SELF DIAGNOSTIC TEST

The vessel has a built in diagnostic program, which is activated every time the vessel is inserted in the calorimeter well. The outcome of the internal check is transmitted to the calorimeter and is available (visible) on the PC Software as VESSEL STATUS. This status includes the following items:

- Fire Warning limit exceeded
- Fire Inspection Fault
- Supply Fault
- Reference Fault
- Memory Fault
- Temperature Sensor #1 Fault
- Temperature Sensor #2 Fault
- Temperature Fault

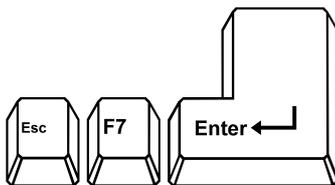


If a fault is detected, then the vessel is prevented from further use and the operator is informed accordingly. Note that the self-diagnostic test only tests the vessels electronics.

To test how the vessel operates within the calorimeter the following test must be used.

1.2.2 3K-5 OPERATOR INITIATED TEST

This test checks the vessel performance inside the calorimeter environment. For this test the vessel must have a firing wire, but does not need to be pressurised. This test is the last portion of the CAL3K-F hardware test.



The unit cycles through the following steps and stops for operator action or when a fault is encountered.



Terminates the test



NOTE: The results of the test and any faults are logged together with the 'Vessel Name' and time into Event Log.



NOTE: This test MUST be repeated for each vessel.



2 DAILY SAFETY STEPS



The 3K-5 vessel is a high-pressure apparatus, and should be treated with care. This section is IMPORTANT. PLEASE TAKE NOTE.



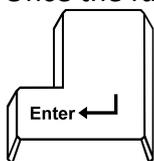
- Handle the vessel over a table or solid surface.
- Do not drop a vessel.
- Do not use any tools to open or close the vessel. If the vessel fails to deflate use the pre-scribed 'emergency deflate' procedure as outlined in the CAL3K-U Operations Manual.
- Do not use any oil or grease on any of the oxygen fittings or the O-rings. A very small amount of high-pressure (vacuum) grease is allowed on the O-ring to make them pliable. Wipe them clean afterwards.
- Store the vessel with the lid open.
- Clean the inside of the vessel with paper towel after every use.
- Weigh the crucible every week and discard it when it has lost 10% of its original mass.
- Discard the crucible when the bottom is distorted and extremely discoloured.
- Remove the deflector plate every week and clean the top surface. It does accumulate residue and must be clean regularly.
- Clamp the high pressure oxygen pipe to the wall or work surface

3 OPERATING

3.1 BASIC KEYBOARD OPERATIONS

The key command processor checks the key sequence and if no ambiguity exists it will complete the full command. This feature is sometimes described as 'look ahead'. The following sections describe the FULL keyboard command but the user needs to press the first 3 to 5 characters (depending on ambiguity) only to display the full command.

Once the full command is on the display it must be followed by:



accepting the command



rejecting the command

After acceptance one of the following happens:

- A) The command is executed if it is of no consequence (eg. Display firing voltage)
- B) A NO/YES dialogue for operations with a consequence (eg ABORT)
- C) A YES or NO display indicating the present state (eg CALIBRATION ON or OFF)
- D) A number display indicating the PRESENT value



At this point the command sequence can be terminated by:



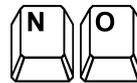
Or the command can be executed by:



Execute the command



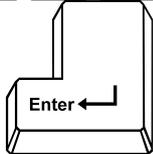
to switch the state ON



to switch the state off

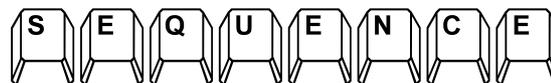
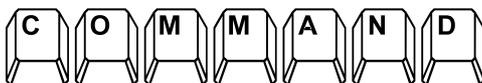


a number to set the value



Followed by the 'ENTER' key

A keyboard command consists of up to 16 characters, but only the first 2-5 characters need to be typed and if no ambiguity exists then the command processor completes the full command. In the following pages the command is indicated with ALL 16 characters.



All the keyboard commands are indexed with a number, which is indicated with each key sequence. This number is used to report a problem to the factory (Software bug?) when a unit is used with a foreign keyboard. It bridges any possible language barriers. The command index and default setting if any, is indicated below the command:

- Index Nn (Default=XX.XX)
- Nn = Command index number
- XX.XX = Possible (if applicable) default setting

3.2 PASSWORD PROTECTION

The Keyboard commands have three levels:

- Always accessible
- Accessible after a password is entered



Blocked, not accessible unless authorised
(Not installed, not applicable)

The password protected commands are seldom needed. The unit should be operated with the standard 'always accessible' commands. The installed (default) password is: DDS3K. This password can be changed via the PC interface, which is not explained here.

The password can be RESTORED (to DDS3K) with the 'PARA DEFAULTLOAD' load procedure.

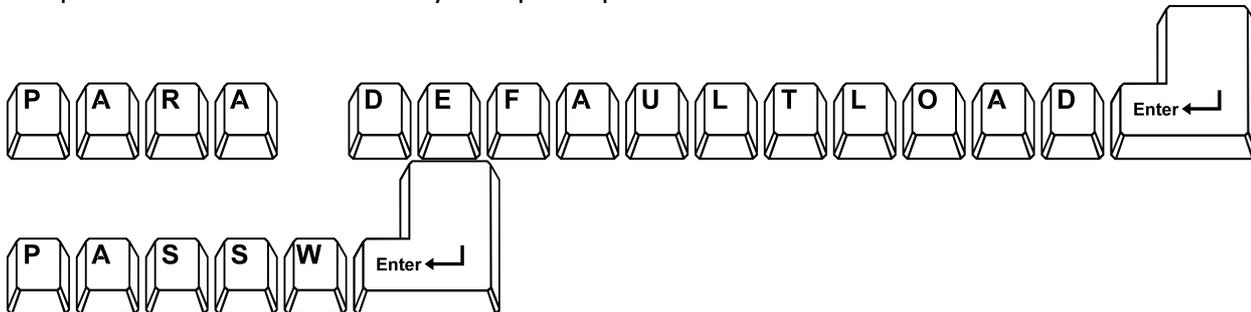
3.3 LOADING THE DEFAULT PARAMETERS

The default parameters are loaded before shipment. All vital parameters are checked, and if they are out of specification then the DEFAULT PARAMETERS must be loaded.



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The password can be re-stored by the special procedure:



3.4 KEYBOARD COMMANDS

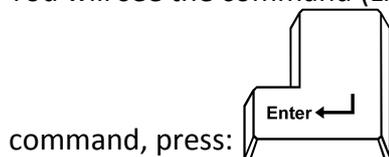
The Unit is delivered with a password activated. In this mode NOT all commands are accessible. The default password is: DDS3K.

The available commands can be checked by:



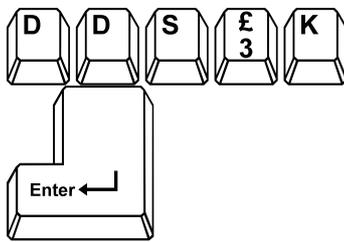
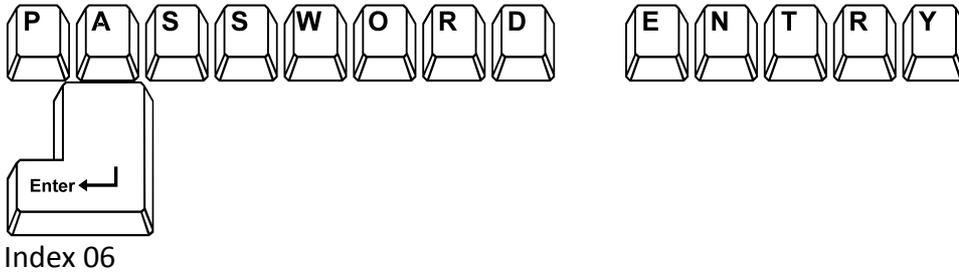
Press repeatedly!

You will see the command (Line#3) and a short explanation (Line#2). If you wish to operate the indicated





To see the FULL list of commands:



If you hear a loud audible beep after pressing enter, you've entered the wrong password. Try again, only once the password has been correctly entered will the rest of the password protected menu options become available.

Function keys: They serve as a shortcut to the keyboard commands. The following function keys are used:



Mass Entry



Sample identification (SID)



Group identification (GID)



Spike mass



Balance mass



Test Vessel hardware



Terminate user test, print displayed result



Test CAL3K hardware



Help

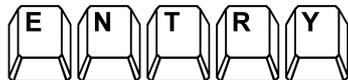
MASS ENTRY

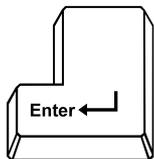


The mass is a weight in the range 0.2 to 0.9 grams. Once the mass has been entered, the calorimeter will display the mass in the first row of the display. At this point the mass entered is LOCKED and will only be deleted by the calorimeter once it has been ignited.

MASS ERASING

Once the mass has been entered, it is 'LOCKED' in to the present operation until it is ignited. The only way to 'ERASE' the mass or 'UNLOCK' it is as follows:





The to be erased mass is displayed



SAMPLE IDENTIFICATION



The sample ID is a 16-character (or shorter) string of characters. The last character will be automatically incremented at each firing. That is to say that a 5 is incremented to 6, and 'C' increments to 'D'. If a short SID is used, followed by spaces, then the last non-space character is incremented. The SID is right orientated.

GROUP IDENTIFICATION



The Group ID is a 16 character (or shorter) string.

SPIKE MASS



Enter the weight of the spike mass here. A spike mass of zero disables spiking. For details of spiking see www.ddscalorimeters.com

BALANCE MASS



The supplied balance cable (Part No: 3K-1-117) can be connected to a suitable balance and then the weight is transferred automatically to the CAL3K-U display. Then 'ENTER' must be pressed to LOCK the mass in to the calorimeter.

VESSEL USER TEST



This requires that the vessel is in the well and that the vessel has a firing wire.



TERMINATE USER TEST



If a user test 'hangs' on a problem, then pressing this key terminates it. It is a little more powerful than Esc.

CAL3K-U USER TEST



The test cycles through all tests and checks the hardware connections and functionality. A Vessel is not required. Some interaction is required.

SUBJECT HELP



Every time that the unit waits for an action, a more detailed subject help is available to explain what is needed.

3.5 OTHER KEYBOARD COMMANDS

Here are some handy commands, which have to be typed. The Unit checks the typing, and if no ambiguity exists it will complete the command for you.



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This is a reset. The unit terminates ALL operations and starts fresh.

FIRE MANUALLY

This can be used to shorten the initial period. The firing conditions are circumvented and the Vessel charge is ignited. It is useful to test the firing/ignition procedure. It is not recommended for use during normal operation, as this will affect the accuracy of your sample being determined.



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CALIBRATION

This directs the unit to perform a calibration procedure with the next sample. During this procedure the Sulphur correction (if set), the moisture correction, and fibre correction is disabled.



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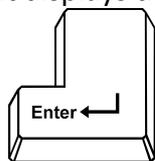
READ RESULT

This command is required to read the previous stored results. The 'last one first' result can be retrieved by:



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The unit displays the Last result number and the result details in line #4.



The unit displays the previous result

3.6 CONNECTING TO A BALANCE

This step is not absolutely necessary. The weight (mass) of the sample can be entered on the keyboard. The balance connection cable is included in the kit. If the calorimeter is installed near the balance then we recommend it being connect up. The default balance speed is 2400baud. Set your balance to this speed! Test the connection by pressing (F5). Then the stable balance weight should show on the display. If you press (Enter) then the mass is locked. See MASS ENTRY to unlock it.

4 PERFORM THE FIRST SAMPLE

The object of this exercise is to check that everything functions. We assume that the CAL3K and the Vessel hardware has been tested and found to be OK. We also assume a stable regulated oxygen supply has been connected to the CAL3K-U and that the exhaust pipe is connected.

**The sample test requires the following:**

The default setup (set by the factory)

One Benzoic Acid (3K-4-71) tablet, supplied in 3K-MAN-KT Installation kit

Firing cotton (3K-4-51), supplied in 3K-4-KT Installation Kit

Firing wire (3K-4-32), (already fitted to vessel lid assembly, also supplied in 3K-4-KT Installation kit), check that this is present

Minimum fuss, Minimum explanations, Minimum keyboard entry

Herewith the operating sequence:

1. TAR a clean dry crucible on a 4 decimal place balance.
2. Weigh a Benzoic Acid (supplied) on a scale to 4 decimal places within the tarred crucible. Do not touch the tablet but use the supplied tweezers.
3. Enter the sample MASS (weight of sample) by selecting F1, ENTER, or Type MASS (e.g.: 0.5432) and ENTER.
4. Prepare a vessel: Attach Firing cotton thread to the Firing wire. Insert the crucible with the BA tablet in to the holder, and position the tablet on top of the cotton thread. Handle the lid gently because if the tablet moves and does not touch the cotton thread it is unlikely that the tablet will fire. Then gently close the vessel.
5. Please make sure the two marked notches line up. Do not over tighten.
6. Fill the vessel with oxygen in the filling station.
7. Place the filled vessel in the well, close the lid until you hear a click. You may have to press the lid down.
8. The 3K-U checks everything out and issues a warning if something is missing.
9. The 3K-U will then go into an INITIAL waiting period. The time is indicated in the top line on the LCD screen.
10. After 2 to 3 minutes the sample is fired. This is displayed and announced with a short beep. You will notice on the top line of the display the FIN period
11. After 3-4 minutes the result is displayed in the bottom line of the display.
12. Remove the vessel from the CAL3K
13. Put the (warm) vessel in to the cooler. You will hear the fan coming on, and after a while (time is indicated) the cooler fan will stop and the message "VESSEL READY" is displayed. The cooling time depends on the vessel temperature target and is indicated as such. The actual cooling time depends on the cooler setup and the room temperature.

The above is just a short step-by-step procedure to run your first CV sample to make sure your calorimeter is in working order.

There are many additional steps and procedures that you can do whilst running an actual CV sample. You will find these 'How to Steps' via the On-line Help Guide available on the website:

<https://www.ddscalorimeters.com/CAL3K-U-calorimeter-support/>



Please note the CAL3K Windows Software can be downloaded from the following link:
<https://www.ddscalorimeters.com/software/cal3k/>

5 CALIBRATION

All vessels are calibrated in the factory with the calorimeter before shipment. Note that the calibration is saved for a particular CAL3K chassis and for a particular vessel number. The pre-calibration is not very good but sufficient for the first samples. It should be replaced with a 'on site' calibration once the unit has settled down and is in a stable environment. Here follows a SHORT description of the various calibration procedures:

5.1 CALIBRATION

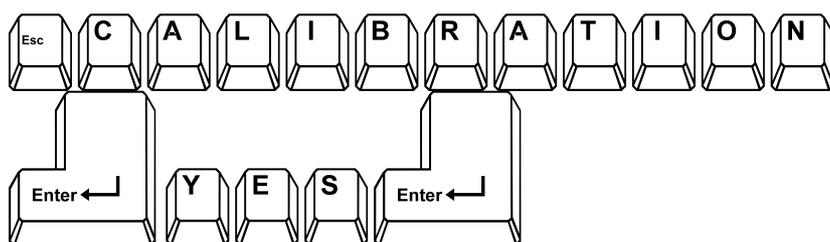
During a calibration the initial conditions and up to 32 'Bomb factors' are saved in the vessel together with other information. This calibration should be performed once a day/week. See: CHECK SAMPLE

5.2 VESSEL CALIBRATION WITH MORE THAN ONE CALORIMETER

If you have more than one calorimeter and you like to operate every vessel in every calorimeter then you must calibrate each vessel in every calorimeter. A maximum of seven calorimeters are allowed per vessel and operating mode.

5.3 ROUTINE CALIBRATION

Each vessel must be calibrated. The calibration is best performed at the normal operating conditions. Prepare the vessel as outlined previously and set the unit to the calibration mode by:



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Then close the LID and wait. You will notice that the calibration operation is indicated in the top left corner. Once done, remove the vessel and repeat the procedure with the second vessel.

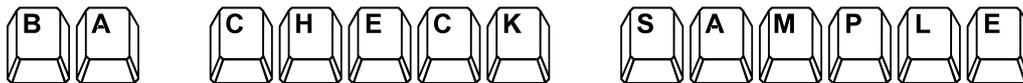
Note: that the state is displayed during the initial period as: ICA

The calibration data set is stored in the vessel calibration history for the chassis number.



5.4 CHECK SAMPLE (AND CALIBRATE)

During a check sample a benzoic Acid (BA) tablet is burned and the result is checked against the standard. The CAL3K performs the check with the last (or average) calibration and then saves the data as a calibration afterwards. In essence this is a 'CHECK AND CALIBRATE' procedure. The same rules apply as to a normal calibration. See: CALIBRATION.



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The CAL3K can perform a 'RANGE CHECK' on the 'BA CHECK SAMPLE' if required.

6 ROUTINE SAMPLE DETERMINATION

The procedure is the same. If you perform multiple determinations in a row then the operating cycles with two vessels overlap:

Place prepared vessel in well	Place warm vessel in cooler
Tare a crucible and weigh a sample, but leave crucible in balance	
Vessel fires (short beep)	Warm vessel is still cooling
Enter mass from balance <i>F5 Enter</i>	
Wait until cooler is ready	Cooler fan switches off
Remove cooled vessel and prepare it	
Wait until lid opens	

7 ADVANCED KEYBOARD OPERATIONS

In order to satisfy all of our customers we have included many features. However not all are used by 95% of the users. In this process we have increased the complexity and added complications. We have acknowledged this and have gone back to the drawing board by compressing the complexity into the default settings.

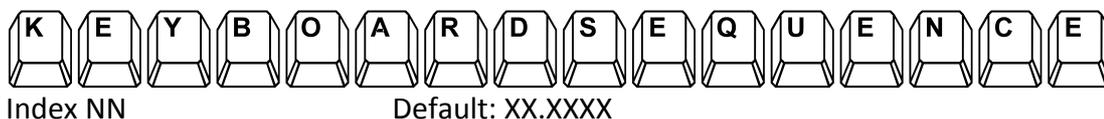
A better way to express this: The following (complex) advanced keyboard commands are not needed and the unit can be operated from the default settings. The following section serves as a reference only.

This Section deals with keyboard commands, their meaning and use. This section is organised in activities and their associated commands. It is important for users, which have special requirements and like to explore the limits of the CAL3K. A basic knowledge of bomb calorimetry is a pre-requisite.

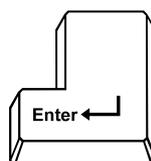
The CAL3K display and response is presented in the following pages as follows:



Keyboard commands are shown in the following places as the complete 16-character string:



The command sequence should be preceded by:



Once the complete command is displayed accept it with:

Note: Only the first keys must be pressed until the ambiguity is resolved!

The keyboard commands in the following pages are sometimes:

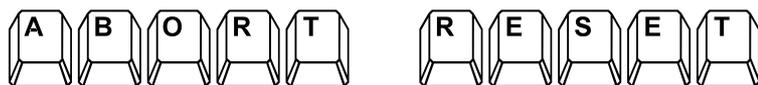
- Accessible without a password
- Accessible with a password
- Not installed (in your software version)

7.1 ABORT

The CAL3K is locked closed once a vessel is in the well. Two commands stop the present operation and will eventually open the lid. The exact sequence of events depends on the operation the unit is performing and the vessel pressure.

Note: It is scary when the lid is opened with high pressure in the vessel. It is dangerous when the lid is opened with very high pressure 30 seconds after firing. The escaping gases have a temperature of 300 to 600 degree C. Therefore the lid opening procedure is complex and prevents any scary and dangerous situations.

The ABORT is the same as a RESET. It can be performed at any time.



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7.2 PASSWORD

The most frequent used commands are accessible without a password. However, most of the commands are protected by a password. The factory-installed password is: DDS3K



This password can be changed via the USB interface from a PC. The password has a timeout of 6 minutes.



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7.3 DEFAULT PARAMETERS

The unit has two sets of operating parameters:

Parameters	(like firing voltage)	Common to all modes
Mode Parameters	(Like Main Time)	One for each mode

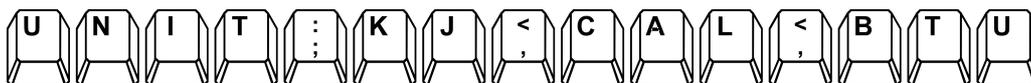
At Reset/Abort/Power up the last parameters are loaded.



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7.4 UNITS OF MEASURE

The unit works in KJ/g and Centigrade. However, the CV value can be expressed in other units of measure by:



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Enter the letters:

KJ	for KJ/g
CAL	for CAL/g
BTU	for KBTU/lb

The following conversion applies:

$$1\text{KJ/g} = 429.9226 \text{ BTU/lb} = 0.4299226 \text{ KBTU/lb}$$

$$1\text{KJ/g} = 0.2388459 \text{ CAL/g}$$

Therefore: The 26.454KJ/g = 11.373 KBTU/lb = 6.3184 CAL/g



Note: The unit conversion is only used in communicating with the CAL3K.

We know that the KBTU/lb is not conventional, but they fit nicely in to the display format.



7.5 SPIKING

The spiking method is called for when a sample has a very low CV or burns reluctantly. At this point a better burning material is added to the sample to help the process. The better burning sample is the spike.

The 'Spike' must be of a known calorific value, usually benzoic acid of approx. 26.454MJ/Kg. On some occasions a Gelatine Capsule (CAL2K-4-GC) or Crucible Cover Disc (CAL2K-FLDS) needs to be used as a Spike.

A Gelatine Capsule is used when burning:

- Fine powdery substances, which 'scatter' easily
- Benzoic acid powder

A crucible cover disk is used when burning:

- Volatile samples

When using these items, you will first need to determine the energy value of the Spike.

GELATINE CAPSULE FOR POWDERY SUBSTANCES: The gelatine capsule is the Spike.

CRUCIBLE COVER DISK FOR VOLATILE SUBSTANCES: The cover disk is the Spike.

BAD/RELUCTANT BURNING SUBSTANCES: The BA is the Spike.

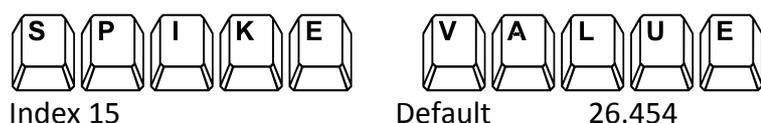
BA POWDER IN A CAPSULE: The gelatine capsule is the spike.

The following method is the traditional method. Later a 'EASY CAPSULE' spiking method is explained.

7.5.1 SPIKE VALUE

You need to burn the spike material and determine its calorific value. If a BA tablet is the spike then the value is known. The CV of the gelatine capsule is also known, but the cover disk needs to be determined. This is best done by burning let say 10 cover disk and dividing the result by 10 to obtain the CV of a single disk. This obtained CV value must be entered as the SPIKE VALUE in the CAL3K.

Setting the spike CV value:



7.5.2 SPIKE MASS

This is the mass of the substance to be used for spiking. The procedure to follow is to place the crucible on the balance and press TARE. Then add the substance to be used for spiking to the crucible. This Mass



value is the “Spike Mass” and must be entered manually into the Calorimeter. Tare the balance again. Then add the sample. This mass is the sample mass and must be entered in as the Mass (Balance Mass)

Setting the spike Mass (F4):



The spike mass must be ZERO, which disables the spike calculation if a spike is not used. Otherwise enter the mass of the spiking material. The spike mass is cleared after a determination.

7.5.3 STEP BY STEP ENTERING THE SPIKE MASS

- Place the crucible on the Balance.
- Press “Tare” to clear the weight of the crucible and get to 0.0000g
- Place one Benzoic Acid tablet (as a spike) and note the Mass = Spike Mass
- Enter the Spike mass by ‘Spike Mass’ enter, mass value
- Tare the balance
- Add the sample to the crucible and note the sample mass
- Enter the sample mass electronically (F5) or manual (F1)
- Place the prepared crucible (benzoic acid tablet with sample) in the lid assembly, inside the Vessel, close the Vessel and insert it in to the well.
- When using MANUAL FILLING, then fill the vessel with oxygen BEFORE inserting it in to the well.
- Enter the SID, e.g. 001
- Close the Lid of the Calorimeter
- The CAL3K Calorimeter will now perform some standard checks and if all is okay, it will begin with the “Initial Phase”, “Fire”, “Main” phase and then indicate that the determination has been completed.

Once the determination is complete, the result will display the calculated calorific value of the sample. The calorimeter will automatically take the end result, minus the spike energy and present the final result of your sample.

A ‘SPIKE MASS’ greater than zero indicates that the sample was spiked. The spike mass is set to zero after each CV determination.

7.5.4 EASY CAPSULE SPIKING

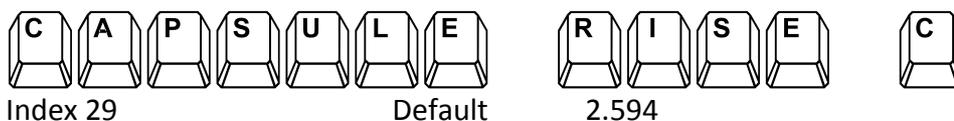
Here is a summary of the spiking commands and an EASY spiking method.

The traditional **SPIKE VALUE** and **SPIKE MASS** are not used. However, the **SPIKE MASS** must be zero.



EASY SPIKING: When a gelatine capsule is used to contain powdery substances then the gelatine capsule compensation can be enabled. This relies on the promise that all capsules are the same and don't need to be measured every time. The gelatine capsule has a standard weight, which is tarred and results in a repeatable temperature rise. The temperature rise of the capsule is deducted from the total temperature rise. This method is reasonable accurate and very convenient.

Set the capsule temperature rise:



If a gelatine capsule is used for the sample then temperature rise of the capsule alone can be entered here. The capsule compensation must be ENABLED:



Enable the capsule compensation:



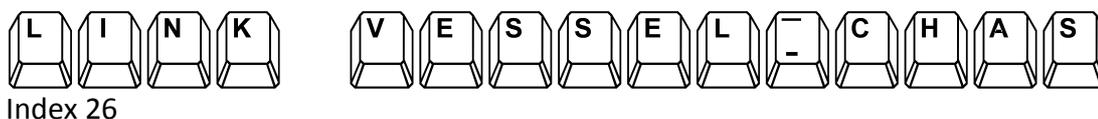
Note that the 'GELATINE CAPSULE' enable setting is retained. If a sample without a capsule is burned then the capsule compensation must be DISABLED or the **CAPSULE RISE** set to zero.

See: **CAPSULE CORRECTION** for details

7.6 LINK AND UN-LINK

The calibration data are stored in the vessel. The vessel holds up to 10 calibrations per chassis and has space for 7 chassis or modes. The calibration in the vessel is associated with a particular chassis and mode. This association is the 'LINK'.

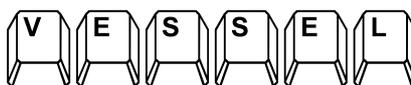
When a vessel is inserted in the well then the CAL3K checks if the vessel has a calibration for this chassis and mode. If not it will ask you to LINK it.





This command does nothing if the vessel was linked already. Otherwise it checks for an open space in the vessel (or the oldest calibration), cleans it and downloads the default IntelCal. After this a calibration must be performed.

The 'UN-LINK' does the opposite: It clears the calibration space in the vessel so that other chassis and modes can use it.



Index 27



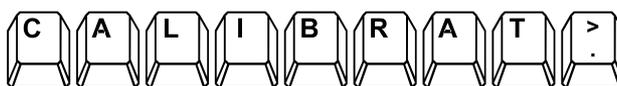
Note: All data associated with this chassis are cleared!

7.7 CALIBRATION

This section explains normal calibrations; the PC calibrations are not explained.

Each determination requires a calibration data set before commencing the determination. Then the present data are compared to the calibration and the difference is used to compensate the result.

The calibration is actually a curve of up to 32 points spread over the main time plus other vital data. The vessel can hold up to 10 calibration data sets, which can be averaged as required.



Index 32

Default

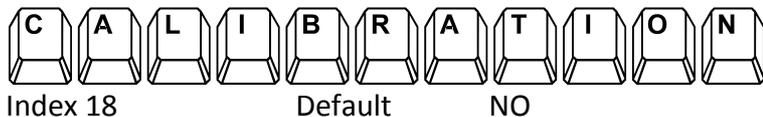
0

An average=0 means the last calibration is used (No Average!), where an average=1 means the last two calibrations are used to form an average. If the average setting is higher than the available data then the available are used and the operator is informed accordingly.

The average has some pros and cons: If one calibration is bad in an average then it takes many calibrations to eliminate the bad one. Experience has resulted of an average calibration of 0 or 1.

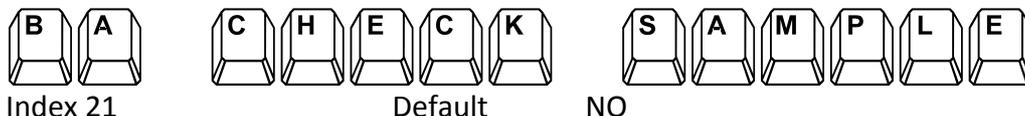
We recommend using NO averaging when starting to use the instrument. But use the calibration more often and check it with the 'BA CHECK SAMPLE' procedure. This also calibrates the unit, but AFTER the determination (with the previous calibration). Once the 'BA CHECK SAMPLES' are acceptable routine sampling can begin, and if required, the average calibration can be increased.

The calibration is performed by burning a Benzoic Acid (BA) tablet:



The calibration run is stored in the vessel with the chassis number and mode and with the MAIN period timing.

The calibrations can be checked with:



During a check sample operation a BA tablet is burned. The CAL3K will not use the Sulphur correction, or the Fibre (in Food) correction, or the moisture correction.

The Check sample performs a normal sample determination and shows the result obtained with the LAST calibration. Once finish, it will re-calculate the calibration (Bomb factor) and save this as a calibration. When the check sample is done it can perform a 'RANGE CHECK' if enabled.



If the 'CV Range' has a number it other than zero then the check sample result is compared to fall within the range and the operator is warned accordingly.

7.8 CORRECTIONS

Corrections must be made to the gross CV, because energy is added during the determination, which is not normally present.

The corrections are grouped in to two:

Cotton correction, including

Firing energy

Wire oxidation

Electronic heating

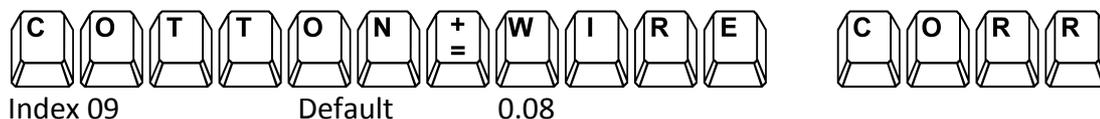
Cotton thread

Sulphuric Acid correction

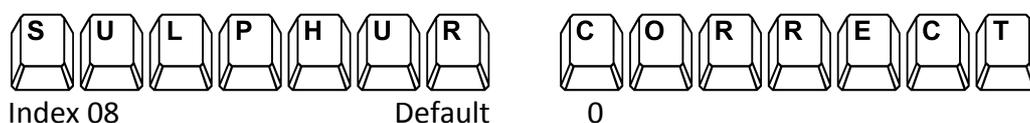
Heat released by the formation of SO₂



The 'Cotton correction' is constant. It is therefore treated as temperature rise compensation:



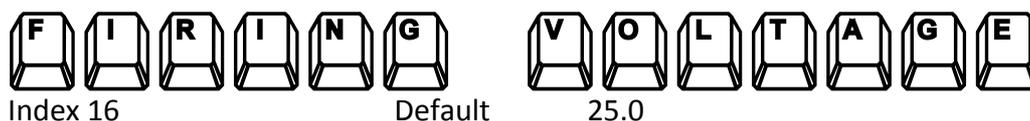
The sulphuric acid correction depends on the sulphur content of the sample. This is measured with other instruments, and it can be entered by:



The Sulphur correction is entered as KJ/g. The Sulphur correction reduces the result.

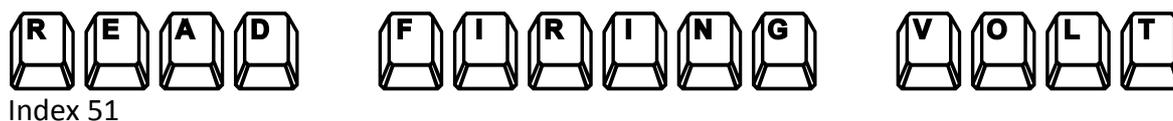
7.9 FIRING

The CAL3K automatically fires the sample by sending a very high current through the firing wire, which glows and ignites the cotton, which in turn ignites the sample. When to fire and how much current to send through the wire can be programmed.



The firing voltage must be decreased if the 'semi-permanent' firing wire melts too often. You should get 20 to 50 firings out of the wire depending on how corrosive your sample is.

The actual firing voltage is produced by a charging circuit, which takes about 2 minutes to charge. The charged voltage can be monitored by:



Type ESC to end the firing voltage display. The firing takes place when the firing conditions are met. If this is not possible then you can fire the sample manually:



Index 17

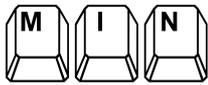
The manual firing should be avoided during routine operations.



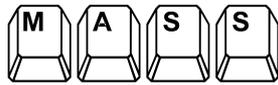
7.10 MASS LIMITS

The units can impose a minimum and maximum Mass limit. This is to prevent accidental entry. The limits apply to the manual and the balance mass entry.

Set the minimum mass limit:



Index 30



Default

0.2



Set the maximum mass limit:



Index 31



Default

1.5



7.11 SAMPLE IDENTIFICATION

The CAL3K has a 16 character Group Identification (GID) and a 16 character Sample Identification (SID). Both can be set from the keyboard by:

Set the group identifier:



Index 03

Default



Default group ID

Enter up to 16 characters text. The text is right orientated if less than 16 characters are used. The GID seems pretty useless, but a print command relies on it.

Set Sample Identification:





Index 02

Default



dds Default 001

Enter up to 16-character text. If less than 16 characters are used then the text is right orientated.

The SID is self-incrementing after each determination. The incrementing affects numbers and letters: An A9 is incremented to B0. Both GID and SID can be read in via a barcode reader.

Every time the SID is changed the memory is searched for a duplicate and if found a two digit number is attached to the 16 character SID, thus allowing 99 duplicates per SID. The operator is informed of the found duplicate.

7.12 MOISTURE COMPENSATION

If the sample has known moisture content then the result can be compensated for the moisture. The moisture entry is in percent, and the sample mass is reduced to a NETT MASS. The compensation is enabled by:



Index 33

Default

0



The 'Moisture Percent' entry will be retained until set to zero. The moisture compensation is not used during calibration or 'BA Check samples'.

7.13 FOOD COMPENSATION

Traditional food was burned in a combustion calorimeter, although a body uses a different process. This is best explained by burning sawdust: It burns nicely and produces energy but consuming it yields no benefit and probably makes one sick. However, a calorimeter is a nice, fast and convenient tool to determine the calories.

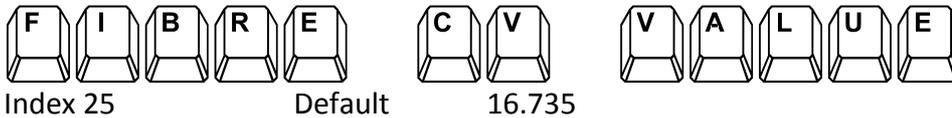
Food is measured in CALORIES or KJ. The ATWATER specification reads:

Protein	4Kcal	16.736KJ
Carbohydrates	4Kcal	16.736KJ
Fat	9Kcal	37.656KJ
Alcohol	7Kcal	29.288KJ
Fibre	4Kcal	16.736KJ

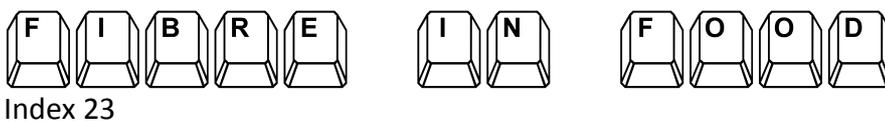
The last item (Fibre) is the interference factor: It burns nicely like the sawdust but....



To compensate for fibres:



The actual percentage of fibres is entered by:



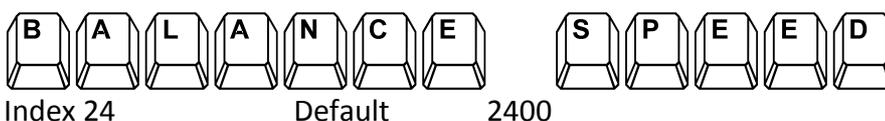
Entering a fibre percentage REDUCES the calorific value of the result.
The 'FIBRE IN FOOD' entry is retained. But not used during calibration or BA checks.

7.14 INTERFACE SPEED

The CAL3K has four communication channels:

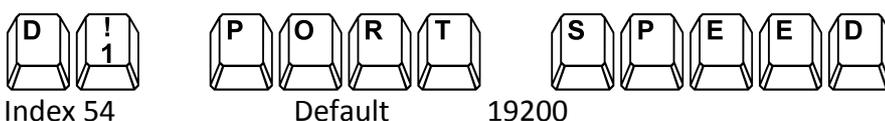
		SPEED
USB port		USB2
Balance port:	RS232	600-9600
Printer port D1:	RS232	1200-115200
Port D2:	RS232	115200

Set the Balance speed:



The balance speed can be set between 1200 to 38400 baud.

Set port D1 speed:



The range of the printer port D1 speed is: 1200 to 115200 baud. The D2 port speed is not settable. The RS232 port specifications are:



Data: 8 bits
Parity: none
Stop: 1 bit

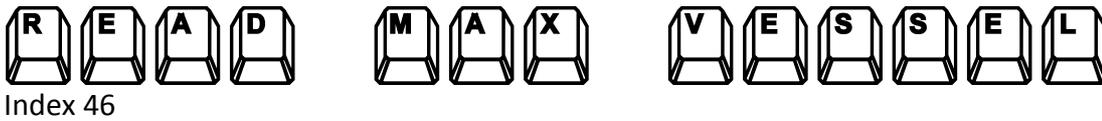
7.15 MAXIMUM RECORDINGS

The System records maximum data in the vessel and in the CAL3K. The recordings are retained during power failure.

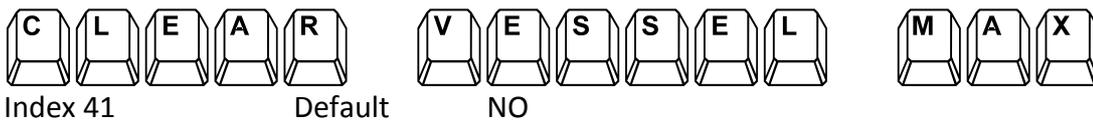
The Vessel records:

- Maximum Temperature
- Firings at which the maximum temperature was recorded
- Date and time of the maximum temperature

The vessel maximum recordings can be read by:



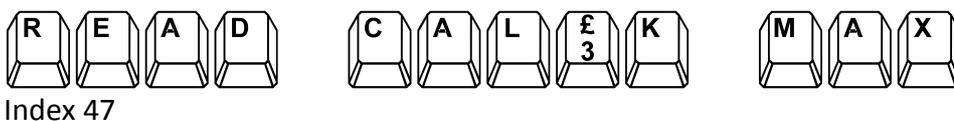
The Date and time is displayed, followed by the maximum temperature (Tmax) and the firing count (Fcnt). The maximum recordings in the vessel can be cleared by:



The CAL3K records:

- Date at which the maximum start temperature occurred
- Maximum Start temperature (St=)
- Maximum Vessel Temperature (Bmb=)
- Maximum Ambient Temperature (Amb=)

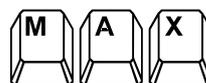
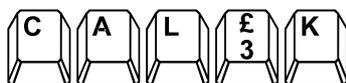
The CAL3K maximum data can be read by:



The CAL3K maximum data are cleared by:



Index 40



Note: The maximum data are updated during a determination.

7.16 MISS-FIRE LIMIT

The CAL3K has a miss-fire limit, which is monitored during the MAIN period. The miss fire limit is a temperature limit and if the vessel temperature has not reached this limit within 30 seconds from firing the determination is aborted.

Customers with very little sample material will need to lower this limit. Otherwise the sample is inadvertently declared a miss fire.

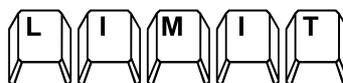
Set Miss Fire Limit:



Index 37

Default

0.2



7.17 DATE AND TIME

The CAL3K keeps date and time for about a week without power. Should the date and time become corrupted then it can be set manually by the following commands:

Set Date:



Index 05



Note that the last two digits of the YEAR are used. A space can be used to separate the digits!

Set Time:



Index 04



7.18 PRINTING

The unit has a 'PRINTING' port, sometimes referred to as 'LIMS' port.

A 'Laboratory Information Management System' (LIMS) can have many forms:

1. Connect the CAL3K to a printer: Easy, but uses paper, and data are not digital.
2. Connect to a PC which listens only: Easy, but the PC must be online continuously and monitor the port for data. Data are available in a spread sheet (.CSV) format.
3. Connect to a PC, which asks for the data: Difficult, but very good. The computer sends some commands to the CAL3K and 'milks' the data once a day/hour or whenever. Data can be in a spread sheet format or directly entered into a database for further processing.

Step 3) above is available on PORT #2. It is also available on PORT #1 if all the outputs are disabled. As soon as an output is enabled the 'listening for a PC command' is disabled. For details on step 3) above contact the factory or the website.

The following section applies to printing: An output on PORT D1! The output happens when the data are ready!

7.18.1 SETTING THE PORT SPEED

The D1 port is a SERIAL RS232 port. The port D1 speed can be set with:



Index 54



Default

19200



The range of the printer port D1 speed is: 1200 to 115200 baud.

7.18.2 REAL TIME (RT) OUTPUTS

A real time (RT) output is available on the D1 RS232 port. A real time output is every 6 seconds starting 30 seconds before firing and every 'Record Step' thereafter ending at the last record step of the main period. The output on the D1 port is shared with the result (LIMS) output, which will output the result AFTER the RT output. The following steps must be taken to produce a real time printout:

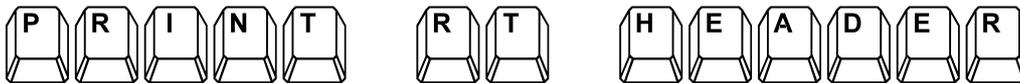
Enable the Real Time Output:



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The Real Time (RT) output is available in three forms: W, X, Y, Z. Specifying any of the forms ENABLES the real time printout. Type anything but WXYZ to disable the real time printout.

The four output forms W, X, Y, Z are all printer friendly. The Form content may change with time. To find out which form suits your application you can print the header. The header is a text line describing each item:



Index 53

You may set the output form to another form and try the header print again until you found the suitable output.

The real time output can be preceded by a:

- Customer header
- Parameter header

Customer header: This is a 4-line customer header, describing the customer operation. The content of the customer header can be set via a PC only.

Parameter header: This describes the parameters, which are used to obtain the real time printout, which follows the header.

To enable either header or both:



Index 60

The 'C' stands for 'Customer' and the 'P' for parameter. Enter XX to disable both.

7.18.3 SETTING LIMS PRINTOUT FORM

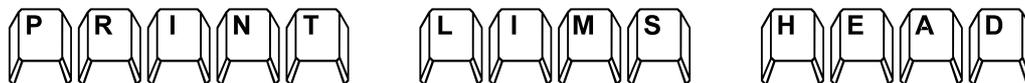
The printer output comes in 8 forms, labelled A-H. Only output form A-F fit on to an 80 column printer. Choose a printer output form by:



Index 63

7.18.4 PRINTING A HEADER

A header is a text string, which identifies each data column. The identifications are 'cryptic' but you get the gist:



Index 56

This command prints the header of the selected output form A-H.

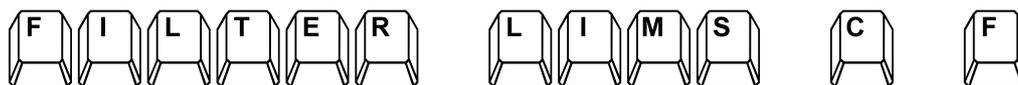
7.18.5 PRINT FILTER

If required a filter can be applied before printing. Results (memory entries), which are:

Calibrations

Faulty determinations

can be suppressed with the following command:



Index 55

7.18.6 PRINTING RESULTS

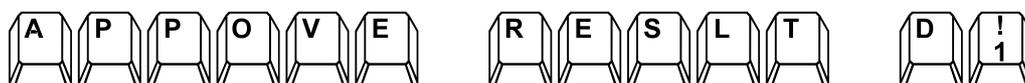
The result is always stored in memory first.

AUTOMATIC PRINTING, NO APPROVAL REQUIRED (APPROVAL=OFF):

The result memory is searched for results and if found the results are output to the printer D1 port at the set form A-H.

MANUAL PRINTING OF APPROVED RESULTS (APPROVAL=ON):

The results must be read (See: READ RESULT) and if acceptable they can be printed with the F8 function key in the form A-H.



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7.18.7 PRINTING RESULTS BY GID

If required all results with the specified GID can be printed.



Index 64

9.16.8 PRINTING TODAY'S RESULTS PER VESSEL

All the results, which have today's date stamp and are done on the specified vessel can be printed by:



Index 65

Enter the vessel number (4 characters).

7.18.8 PRINT TODAY'S RESULT IN FORM A-H

All results of today can be printed in the specified form by:



Index 57

Enter a form A-H. The above command does not change the output form selected by the 'OUT FORM' command.

7.18.9 PRINT DATA FROM DAY

The day number is the calendar day number 1-31.

Print results from day:



Index 52



7.18.10 PRINTING STATISTICS

The unit accumulates every event in memory. The event memory is searched for the specified time period and the events are printed.

This produces a summary from the event log as follows:

- Customer name
- Present date and time:
- Reporting Start Date and Time
- Reporting End Date and Time
- Hours reporting:

- Normal Determinations
- Abnormal determinations
- Suspect determinations
- Calibrations
- Check Samples
- Keyboard/Bomb Aborts
- PC parameter access
- Firing wire missing
- Manual fired
- Bomb Inserted
- Bomb removed
- Initial time started
- Bomb Fired
- Miss-fires
- O-ring changes
- Wrong or new bomb
- Bomb Temperature too high
- Power On/Off
- CAL3K Hardware test
- CAL3K Hardware failures
- CAL3K hardware good
- Bomb hardware test good
- Bomb Hardware test Fail
- Parameter change
- Load Default
- Setup Wrong
- Temp Sensor/Offset bad
- Bomb problem
- Initial time
- Vessel in, lid open



The printout is obtained by:



Index 69

The printout is from Start Day, Start Hour to Stop Day, Stop Hour.

An entry: 15 0 17 23 means that the statistical analysis starts on the 15th midnight and ends on the 17th at 23:59.

The data come from the event log. The full event log (not the above summary) is available on a PC. The data in the event log are cleared by:

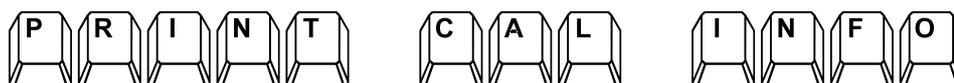


Index 68

This command clears the event memory! This is required when the card is exchanged or when the memory becomes un-manageable.

7.18.11 PRINT CAL INFO

A printout of the CAL3K configuration and setup can be obtained by:



Index 58

This printout shows all the relevant information of the CAL3K.

7.18.12 PRINT VESSEL INFO

This printout shows all information of the inserted vessel:



Index 59



7.19 CLEARING

It is possible that the CAL3K memory becomes useless because too many items are clogging up the effective search and storage. It is therefore advisable to clear the memory once every 1 to 6 month depending on usage.

7.19.1 CLEAR RESULT MEMORY

The result memory is cleared by:

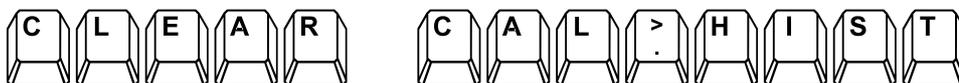


Index 39

The complete result memory is cleared. This action is advisable when the parameters are changed.

7.19.2 CLEAR VESSEL CAL HISTORY

The Calibrations are cleared by:



Index 42

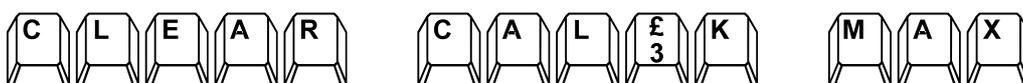
The vessel must be inserted! The vessel must be calibrated after clearing.

7.19.3 CLEAR EVENTS



Index 68

7.19.4 CLEAR CAL3K MAXIMUM



Index 40



7.19.5 CLEAR VESSEL MAXIMUM



Index 41

This command should be repeated for all vessels!

7.20 READING

The CAL3K provides limited information on the display. More information is available with a PC.

7.20.1 READ DRIFT AND STABILITY

The drift is the first derivative of the vessel temperature. The stability is the second derivative of the vessel temperature. Both can be read by:



Index 44

It displays the vessel temperature drift and stability every 6 seconds. The vessel must be in the well. Press ESC to stop.

7.20.2 READ VESSEL TEMPERATURE

The vessel temperature is displayed by:



Index 43

This command displays the vessel temperature until the ESC key is pressed.

7.20.3 READ AMBIENT TEMPERATURE



Index 49



7.20.4 READ RESULT



Index 50

The results from the memory are displayed last one first. The CAL3K holds approx. 740 results

The last result is displayed first. Press {enter} to read the next oldest result. If one of the LIMS form A-H is enabled then the displayed result can be printed with the F8 function key.

Press [enter] to display the next OLDER result.

7.20.5 READ FIRING VOLTAGE



Index 51

This is the actual firing voltage. The firing circuit charges up to standard target of 25V in approx. 2 minutes.

7.20.6 READ CALIBRATION

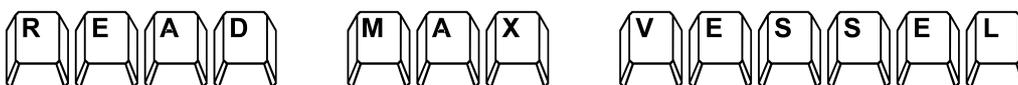
Read the calibration details:



Index 45

The LAST calibration date/time is displayed followed by mode info.

7.20.7 READ VESSEL MAXIMUMS

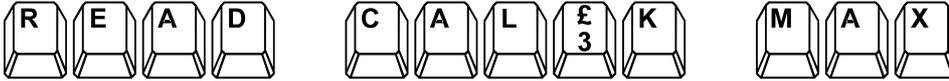


Index 46

The vessel accumulates the maximum temperature and the date at which this has happened.



7.20.8 READ CAL3K MAXIMUMS



Index 47

The CAL3K accumulates the max vessel firing, Maximum vessel and maximum ambient temperature.

7.20.9 READ VESSEL INFO

The vessel information can be displayed by:

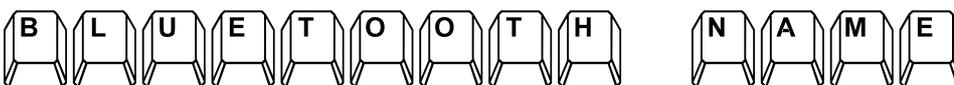


Index 59

7.21 BLUETOOTH

The RS232 D2 port can be used to connect to a PC. It is also possible to use the Bluetooth wireless link if the PC (or laptop) has no RS232 port. The Wireless Bluetooth link operates over approx. 30 metres and connects to the D2 port and a USB port on the computer. This wireless link avoids wiring and lengthens the USB distance considerable.

The Bluetooth link needs a name if more than one BLUETOOTH device is used. The name is assigned with the following Command:



Index 72

The Text entry is up to 20 characters and this name will be visible on the PC when establishing the link. For further details on BLUETOOTH wireless links contact the factory. Note that the wireless link is also used as a 'RS232 to USB' conversion.

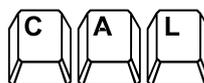
7.25 TEMPERATURE CALIBRATION

The temperatures are calibrated in the factory. The word calibration is actually an 'equalisation'. Note that no attempt is made to perform an ABSOLUTE calibration. Because the vessel is the most ACCURATE (but not perfect!) temperature the vessel must be in the well.

Before the temperature calibration is performed the vessel and CAL3K must be at room temperature for at least 8 hours so that all sensors are at the SAME temperature.



Temperature calibration:



Index 35

The temperature sensors are calibrated to the bomb temperature. The calculated offsets are displayed for reference. This can only be performed when the bomb and the CAL3K are at the same temperature after 8 hours in the same room.

7.26 TESTING

Before every determination various items (Setup, Defaults, Parameters, Reading) are checked and if a problem is encountered the operator is informed. However, some hardware must be tested manually.

TEST CAL3K HARDWARE:



Index 13

This test checks all system components. The test stops when a fault is found.

TEST VESSEL HARDWARE:



Index 14

Repeat this test for each vessel.

7.27 SIMULATION

The CAL3K can be operated in a SIMULATED determination mode to check the performance and calculations. Of course the data it produces are 'junk'. But the simulation produces a real time output, saves a result and does everything a normal determinate does except 6 times faster and with a fixed temperature rise of 12C. The factory checks the unit with this feature.



S I M U L A T I O N

Index 20

A simulated calibration can be followed by a simulated determination. A simulated calibration destroys the normal calibration. The simulation runs on a one second time interval.

7.28 ENABLE D1 PORT FOR COMPUTER ACCESS

The D1 port is normally dedicated to a printer. That means it is 'blind' to incoming messages from a computer. In order to make this port accessible from a computer (or BLUETOOTH) the following steps must be taken:

Set port D1 speed:

D 1

Index 54

P O R T

Default

S P E E D

19200

Enable RT header:

To enable either header:

E N

Index 60

R T

H E A D E R

Enter **X X** to disable.

Set RT Form:

S E T

Index 61

R T

F O R M

W X Y Z



Enter   to disable.

Set output form:



Index 63



Enter   to disable.

8 CALCULATIONS AND COMPENSATION

8.1 UNIT CONVERSION

The CAL3K works internal in KJ/g=MJ/Kg. Calorific values are indicated to the outside in the specified units. Here are the conversion factors which are applied by the CAL3K :

1	KJ/g	=	429.9226	BTU/lb	
1	KJ/g	=	0.238846	CAL/g	
1	CAL/g	=	4.1868	KJ/g	
1	KJ/g	=	0.4299226	KBTU/lb	Note!

The standard BA value of 26.454KJ/g is indicated as follows:

J=26.454	KJ/g	
C=6.3184	CAL/g	
B=11.3732	KBUT/lb	Note!

The max display range is: 99.9999



8.2 CALCULATIONS

$$\begin{aligned} CV &= ((C_{\text{rise}} * BF) - (Sv * Sm)) / \text{Mass} - \text{Scorr} \\ &= ((C * KJ/C) - (Kj/g * g)) / g - KJ/g \end{aligned}$$

Where:

- C_Rise = Compensated temperature rise in C
- BF = Bomb Factor (approx. 1)
- Sv = Spike value
- Sm = Spike mass
- Mass = Sample weight in gram
- Scorr = Sulphur correction, in KJ/g

Note that the Sulphur correction is switched off during a calibration!

8.3 COMPENSATION

Some of the following corrections and compensations are always 'ON', others need to be enabled. This allows setting up the unit for your specific needs and application.

8.4 COTTON CORRECTION

The cotton correction is the sum of:

- Cotton thread
- Firing wire reduction
- Firing energy

Note: The sum is expressed in degree C.

8.5 AMBIENT COMPENSATION

The CAL3K is sensitive to the ambient temperature and a suitable compensation is applied. The ambient compensation depends on the vessel to ambient difference and the temperature rise. The ambient compensation is applied in degree C.

8.6 CAPSULE CORRECTION

Some samples require a gelatine capsule or a plastic film over the crucible. The compensation for this additional burned material can be done via the spiking method. However, if the film or capsule results in a constant temperature rise then the capsule correction can be used. This method is referred to as 'EASY SPIKING'

It relies on the promise that all capsules are the same (weight and constitution)!

Gelatine capsules are very popular with powdery substances like wood chips. A film is used with volatile substances to prevent evaporation.



The capsule correction process must be enabled before taking effect. The following keyboard commands are used:

GELATINE CAPS EN	This enables the capsule compensation
CAPSULE RISE C	This is the temperature rise in C attributed to the capsule or film

Note: This correction is useful when the capsule(s) or film have a CONSTANT mass!

The capsule correction for 'EASY SPIKING' can be measured with a trick as follows:

Determine the Cotton + Wire correction first by burning the cotton alone. 30 seconds after firing the unit will declare it a 'MISS FIRE' and display the temperature rise.

The default setting is 0.098C.

To determine the gelatine capsule temperature rise is the tricky part because burning the capsule results in a temperature rise of approx. 3C. Setting the 'Miss fire limit' that high is not allowed BEFORE the preparation cycle, but it can be set high during the initial phase.

Prepare the vessel with cotton and an empty capsule and insert the vessel in the unit. Once the unit is in the INITIAL PHASE set the '**MISS FIRE LIMIT**' to 4C. Then wait for the unit to fire and after 30 seconds the unit will declare a 'miss fire' and display the temperature rise. This temperature rise is the result of:

Cotton + wire
Gelatine capsule

Subtract the Cotton correction (0.098) from the gelatine rise and enter the value in the CAPSULE RISE.

The default capsule rise setting is 2.594C.

This value is only used after the '**GELATINE CAPS EN**' is set to 'ON'.

8.7 TOTAL COMPENSATION

$C_Rise = \text{Temperature rise} - \text{Cotton correction} + \text{Ambient Compensation} - \text{Capsule Rise}$

Where:

C_Rise	=	Compensated temperature Rise in 'C'
Temperature Rise	=	Raw temperature rise in 'C'
Cotton Correction	=	Cotton and wire correction in 'C'
Ambient Compensation	=	Ambient difference in 'C'
Capsule Rise	=	Temperature rise from gelatine capsule in 'C'



8.8 MOISTURE COMPENSATION

The moisture compensation must be enabled to take effect. Then the mass is reduced by the entered moisture percent.

$$\text{Nett Mass} = \text{Mass} - (\text{Mass} * \text{Moisture percent})$$

This compensation requires that the moisture is known before the CV determination!

The Following keyboard commands are used:

MOIST.COMP EN	This enables the moisture compensation
MOISTURE PERCENT	Enter the moisture in Percent (of mass)

8.9 FIBRE IN FOOD COMPENSATION

The fibre compensation must be enabled to take effect. Then the following calculations are performed:

$$\text{CV} = \text{CV} - (\text{FVal} * \text{FPerc})$$

Where:

CV	=	Calorific value as determined above
FVal	=	Fibre CV, e.g. 16.75KJ/g
FPerc	=	Fibre percentage

ATWATER SYSTEM:

PROTEIN	~	4 Cal/g ~16.75KJ/g
CARBOHYDRATES	~	4 Cal/g
FAT	~	9 Cal/g ~37.68KJ/g
ALCOHOL	~	7 Cal/g ~29.31Kj/g
FIBRE	~	4 Cal/g

The following Keyboard commands are available:

FIBRE COMP EN	Enables the fibre compensation calculation
FIBRE IN FOOD %	Enter fibre contents in percent
FIBRE CV VALUE	The estimated Fibre CV



9 PRODUCT IDENTIFICATION

All electronic parts have product identification such as:

- Factory test date and time
- Firmware version
- Manufacturer information
- Branding
- Customer information
- Serial Number
- More...

In addition each unit retains statistical and max data. Some of this information is contained on the control card, and a different data set is in the vessel.

If a vessel, chassis, or control card is replaced in the field then some of the product identification may be different from what our records reflect and we need your assistance to inform us accordingly.

To print this information the 'D1 PORT SPEED' must be correct!

The CAL3K identification is obtained by:



Index 58

The vessel information is obtained by:



Index 59

The vessel must be in the well!

10 MAINTENANCE

The CAL3K-U was designed to work in a laboratory. However, all laboratories are different and the maintenance depends largely on:

10.1 DAILY USE

This works out to samples per day. The CAL3K-U is capable of up to 12 samples per hour running 3 vessels and 2 air coolers. The maintenance of the system is fairly in line with the usage of the system.



10.2 MATERIALS TESTED

This is the biggest maintenance contributor. The materials differ from powdery substances (which may have explosive combustion) to environmental hazardous samples. They all affect the O-rings. The powdery substances are the worst: The material settles on the O-ring surface and 'cracks' the O-ring. Corrosive materials effects the crucible and the deflector plate. But the effects are highly visible and can be sustained.

10.3 ENVIRONMENT

Dust, temperature, installation conditions also affect the system and maintenance. Dust being the main influence on the calorimeter. It blocks the fan (in the cooler and calorimeter) and is electrically conductive if it is coal dust.

10.4 MAINTENANCE SCHEDULE (GUIDELINE)

The following maintenance schedule serves as a guide line only: Please adjust it to suit your conditions.

The following parts require maintenance:

- Large Lid O-ring (3K-4-55)
- Centre electrode (3K-4-20)
- Outside electrode (3K-4-28)
- Firing wire (3K-4-32)
- Top & Bottom O-ring (3K-4-63)
- FAN (Both for Cooler and Calorimeter)
- Crucible (3K-4-47)
- Deflector Plate (3K-4-05)
- Nozzle O-Ring for filling station (3K-3-29)

When to change consumables:

VESSEL CLEANING:	After each sample: wipe the vessel clean with paper towel
LARGE LID O-RING:	Worst conditions: 2-5 samples Average conditions: 40 samples Good conditions: 100-200 samples
CENTRE ELECTRODE:	20-50 samples
OUTSIDE ELECTRODE:	30-120 samples
TOP & BOTTOM O-RINGS	20-50 samples
FAN CLEANING:	WEEKLY to MONTHLY depending residue build up



CRUCIBLE	When weight loss >10%
	When bottom distorts and becomes completely discoloured
DEFLECTOR PLATE	30-150 samples
	Weekly to Monthly, or when centre electrode O-ring is changed.
	Wipe top of deflector plate clean weekly.
FILLING STATION NOZZLE O-RING:	50-100 samples

11 EMERGENCY DEFLATE

It is possible that the vessel fails to deflate when using the deflate tool. This can happen when the centre electrode O-ring is old or deformed. The O-ring folds (walks) out of the electrode groove and seals on the centre electrode stem and the vessel fails to deflate.

NOTE: DO NOT USE ANY OTHER TOOLS NOT PROVIDED BY DDS, OR PUT THE VESSEL IN A VICE, OR USE ANY OTHER FORCE TO PRY THE VESSEL OPEN.

This is the proper procedure:

- 1) Loosen the nut (13mm) on top of the vessel lid, or take it completely off.
- 2) Put the 'Emergency deflate tool' (a black plastic cap) on top of the vessel. It slips over the nipple!
- 3) Put the vessel on the floor and step on it (approx. 60Kg)
- 4) The nipple will be forced in to the vessel and the vessel deflates with a hissing sound.
- 5) It is possible that the complete centre electrode fall in to the vessel
- 6) Open the lid and assemble it again
- 7) Remove the valve retaining screw and remove the centre electrode
- 8) Replace the top O-ring (That is the offending item)
- 9) The bottom O-ring(s) are there for insulation. Replace them if they are deteriorated.
- 10) Then assemble the lid with the centre electrode and valve retaining screw.
- 11) Check that the centre electrode moves approx. 1mm (up and down)
- 12) If it is more than that you may use two O-rings at the bottom of the centre electrode



12 CALORIMETER ERROR CODES & SOLUTIONS

M100 WARNING: CARD NUMBER NOT SET!

"The card number is a unique number assigned by the factory to this particular CAL3K-U control card. Contact the factory for further instructions."

M101 THIS VESSEL MUST BE CALIBRATED !

"This vessel has no calibration history! Set 'CALIBRATE' and prepare the vessel with a Benzoic Acid tablet for calibration."

M102:

"POWER UP: ESC TO START, USER TEST: F9 "

"The unit had a power up condition. It requires a HARDWARE test (F9) or ESC to proceed. The Hardware test can be performed at any time later with the F9 key or 'CAL3K TEST' command."

M103 ___ More calibration are required

"WARNING: The vessel requires more calibrations to form the average over N (parameter) entries. The CAL3K uses the available calibrations, but more is better!"

M104:

"PREP: M=_____ SID=_____ "

"The Unit is in the PREPARATION mode. At this stage it requires a vessel with a calibration inserted in the well, the oxygen supply connected, and the sample mass entered. Then the unit will proceed and check the rest."

"M105: COOLING FAULT DELAY __. _ MINUTES "

"A fault was detected in the cooling sequence and a delay is imposed. This fault should not happen when the CAL3K AIR COOLER is used. Remove the vessel and wait the indicated time!"

"M106: INSERT PREPARED BOMB, CHECK SID "

"The CAL3K does not communicate with the vessel or the vessel is missing. The vessel communication can be checked with the 'VESSEL-TEST'."

"M108: ENTER MASS, CHECK SID "

"The CAL3K requires that a MASS is entered before proceeding. The MASS can be entered from the balance port, or from the keyboard, or from the Vessel(Docking). Once entered the unit will check more PREPARATIONS before switching to INITIAL."

"M110: ENTER MASS, INSERT BOMB, CHECK SID"

"The CAL3K needs a prepared vessel and the sample mass to proceed. Prepare the vessel with a ~0.5gr sample measured to 0.0001gr, fill the vessel with oxygen, and insert the prepared vessel in the well. Then enter the mass (F1)."

**"M112 VESSEL LINK FAILURE, USE LINK.. CMD"**

"The vessel is not authorised (linked) to be used in this CAL3K. The vessel can be linked with the keyboard 'LINK...' command or can be auto linked by enabling the system definition in single CAL3K installations."

M114:**"VESSEL ____ NOT CALIBR. IN CARD # ____"**

"The indicated vessel was not calibrated with this card. Put the vessel in the correct CAL3K or calibrate it with Benzoic Acid by typing 'CALI., Enter, YES' to proceed."

M116 WARNING: BOMB IS NEAR INSPECTION

"The firing count has exceeded the 'Fire warning' parameter and the vessel needs to be inspected soon. The inspection is a safety precaution and must be performed by authorised personnel."

M118 BOMB EXCEEDED FIRING LIMIT: INSPECT

"The Vessel has a WARNING and an INSPECTION limit, which is now exceeded. As a safety precaution all further operations are blocked. The Firing limit can be changed/reset via the USB port after an inspection is carried out by the agent."

M146 FIRING VOLTAGE OUT OF SPEC: 5-35V

"The Firing voltage setting in the parameter section is out of the range from 5 to 35 Volts."

M147 MAIN TIME BAD! LOAD DEFAULT MODE!

The main time is limited to be from 1.0 to 10.0 minutes. Load the default mode parameters.

M148: BENZOIC ACID CALIBRATION VALUE BAD

"The BENZOIC ACID (BA) CALIBRATION value is out of range 15 to 30MJ. The standard value is 26.454MJ/Kg. If other calibration material is used it must be in the range. Use the 'ENTER BA VAL MJ' command to set it!"

M149 INITIAL TIME BAD! LOAD DEFAULT MODE

The initial time is limited to 1.0 – 10.0 minutes. Load the default mode parameters.

"M150 SPIKE CALIBRATION VALUE PARA BAD "

"The 'Spike Value' parameter is used when the 'Spike Mass' entry > zero. The Spike Value should read 26.454Kj/g if Benzoic Acid is used for spiking."

M151 BAD RECORD STEP PARAMETER! DEFAULT?

The 'main time' divided by the 'Record step' parameter must not exceed 32. The main time may be too long or the record step too short. Load the mode default default parameters.

"M154 AMBIENT TEMP. READING BAD ____ C "

"The Ambient temperature reading is outside the 5-50C range. This can be caused by a faulty sensor or a faulty temperature calibration."

**"M157 MIN MASS PARAMETER TOO LOW "**

"The Minimum Mass parameter must be higher than 0.05g! The parameter can be changed from the keyboard!"

"M159 MAX MASS PARAMETER TOO HIGH "

"The Maximum Mass parameter must be lower than 1.6g! The parameter can be changed from the keyboard!"

"M161 MISSFIRE LIMIT TOO HIGH "

"The Miss Fire limit must be lower than 0.5C. A Zero disables the misfire check. The parameter can be changed from the keyboard."

"M163 CV RANGE TOO HIGH "

"The CV Range parameter is used to verify the Check sample range. The entry must be in the range from 0 (disabled) to 1.0KJ/g. A 0.3Kj/g is a normal entry."

"M168 DOOR LOCK CONNECTION FAULT! "

"The LID UN-LOCK connection is open circuit! The CAL3K can't open (unlock) the lid. Call your service agent. Exit this test with F8 and perform a 'CAL3K TEST' field test."

"M170 CALIBRATION LENGTH TOO SHORT "

"The present calibration length setting is less than the MainTime parameter. Reduce the MainTime or increase the calibration time and re-calibrate."

"M171 TOO MANY RECORD STEPS IN MAIN TIME "

"The CAL3K Main time is too long or the Record step is too small. The MainTime (parameter) divided by Record Step (Parameter) must be less than 32er than 32. A 0.2 or 0.3 minute Record Step is recommended."

"180 VESSEL SHOWS INTERNAL FAULT: TEST IT"

"The Vessel displays an internal fault. The details can be confirmed with the vessel test. Type 'BOMB-TEST', Enter, Yes and check for details."

M182**"LAST CALIBRATION: __/__/__ __:__:__ "**

"The displayed date and time is from the last 'Calibration'. Calibrations should be performed daily to weekly."

"M184: PLEASE CLOSE THE LID "

"Every thing is OK, but the LID needs closing. The CAL3K has a bomb and a mass and has performed all system checks. It is ready to proceed after the LID is closed."

"M186 FAULT: FIRING WIRE OPEN CIRCUIT! "

"The Firing wire in the vessel is open circuit or makes no contact. Open the vessel and replace the wire or check the contacts to the outer and inner electrodes."

**"M190 FAULT: AMBIEN SENSOR OFFSET ____." "**

"The Ambient sensor offset calibration is bad. A temperature calibration is needed. If the fault persists after the calibration then the sensor is faulty and the sensor must be replaced."

"M192 FAULT: ATC TOP SENSOR OFFSET ____." "

"The top ATC sensor offset calibration is bad. A temperature calibration is needed. If the fault persists after the calibration then the sensor is faulty and the sensor must be replaced."

"M193 FAULT: ATC BOT SENSOR OFFSET ____." "

"The bottom ATC sensor offset calibration is bad. A temperature calibration is needed. If the fault persists after the calibration then the sensor is faulty and the sensor must be replaced."

M194 PRESSURE SENSOR OFS FAULT ____ BAR

The pressure sensor has a high offset value. The reason can be a bad 'ZERo' calibration or a faulty sensor. Recalibrate the sensor with the lid open.

M195 SYSTEM FAULT IS DETECTED! IGNORE=F8

A system fault is pending. The fault can be the result of bad calibration, a changed setup parameter or a hardware failure. Load the default parameters, re-calibrate and test the CAL3K hardware.

M196 HARDWARE TEST FAULT! IGNORE=F8

A hardware test fault is pending. Repeat the hardware test (F9) and judge the severity. You may carry on or call the maintenance/agent with the fault number.

12.1 INITIAL STAGE 200-299**M202: FAULT: NO OXYGEN PRESSURE! OPEN?**

The oxygen pressure is below the FAULT PRESSURE. The reason could be that the bottle is not open or that the hardware is faulty. If the hardware test is OK and the bottle is open then the inlet filter is blocked and authorised personal must replace the filter.

M204: WARNING: FILLING PRESSURE BELOW MIN

WARNING: The vessel filling pressure is below the set minimum. This could be intentional or the supply (bottle) is low.

M206: WARNING: PRESSURE READING TOO LOW

WARNING: The absolute pressure reading is too low (<0.5bar). The reason could be that the oxygen supply is shut down ore that the hardware is faulty. The hardware can be tested with the F9 key.

M207: WARNING: THE VESSEL HAS LOST PRESSURE

The vessel has lost more pressure in the main period as the set limit. Check O-rings and replace if needed.

M210 VESSEL COMMUNICATION LOST IN INITIAL

The vessel communication was lost in the initial stage. The vessel will be deflated. Check the vessel with the hardware test F7

**M212: HARDWARE SYSTEM FAULT IN INITIAL**

A hardware fault was detected. To find out what it is run the CAL3K test F9 and the vessel test F7.

M214: FILLING TERMINATED, START FRESH

The filling process was interrupted by an 'OPEN LID' or an 'ABORT'. The sample is lost and the vessel must be prepared with a fresh sample.

M216: INITIAL TERMINATED: START FRESH

The Initial period was interrupted by a keyboard entry. The vessel will deflate and a new sample must be prepared.

M230

FILL PRESSURE=___ TARGET=___s

The oxygen filling is in progress. The oxygen pressure should increase to the target pressure. If the pressure is stable and above the minimum pressures then the initial period starts.

M240 Initial stage display

"INI ___"

"The initial stage is required to stabilize the vessel temperature before firing the charge."

M250 IntelCal Warning: Vessel Temp High

"The Vessel temperature is too high compared to the IntelCal calibration range. Perform a 'Calibration' at this temperature or cool the vessel."

"M252 IntelCal Warning: Vessel Temp Low "

"The Vessel temperature is too low compared to the IntelCal calibration range. Perform a 'Calibration' at this temperature or heat the vessel."

"254 IntelCal Warning: Ambient Temp. High"

"The Ambient temperature is higher than the IntelCal range. Proceed with reduced accuracy or perform a 'Calibration' at this ambient temperature and perform a IntelCal (PC) calibration."

"M256 IntelCal Warning: Ambient Temp. Low"

"The Ambient temperature is lower than the IntelCal range. Proceed with reduced accuracy or perform a 'Calibration' at this ambient temperature and perform a IntelCal (PC) calibration."

"M258 INITIAL TEMP TOO WARM: COOL VESSEL!"

"WARNING: The INITIAL temperature is above the allowed limit. Once the vessel is fired the end temperature could be too warm to touch. Be careful! At high vessel temperatures the calibration should be repeated!."

"M260: WAITING FOR THE INITIAL DRIFT "

"The unit waits for the vessel temperature drift to fall within the parameter limits. The CAL3K has the option to fire on 'Drift' or 'Time after drift' or on 'Time' only. The details are set up via the operating modes or the USB port."

**"M262: WAITING FOR THE INITIAL TIME "**

"The unit waits for the initial time to complete before firing. The initial time is set via the modes or via the USB port."

M270 WAIT UNTIL FIRING BATTERY CHARGED

"The firing charger has not charged the firing battery to the stipulated voltage. Wait! If the charger gets 'stuck' perform an 'ABORT' followed by a bomb hardware test."

"M280 FIRING: THE CHARGE IS IGNITED "

"All the initial conditions are fulfilled and the vessel is fired. When the sample ignites then the temperature will rise by approx. 12C."

12.2 MAIN (+END) STAGE 300-399**"M300 BOMB FAULT DETECTED: ABORTED MAIN "**

"The vessel failed to update! Any further operation is aborted! The bomb should be subjected to a 'BOMB TEST'!"

M302: KEY BOARD ABORT IN MAIN**"M302: ABORT/LID OPEN IN PROGRESS, WAIT! "**

"A manual abort or a open lid request was detected in the main period. As a safety precaution the vessel can't be removed in the first 60 seconds after firing. Please Wait!"

M304: FILLING PRESSURE LEAKED _____. _ BAR

The filling pressure has decreased before firing by more than the specified limit. Either the vessel is leaking or the leak limit is too small.

M306: EXHAUST OR FILTER BLOCKED, CHECK

The deflation of the vessel was too slow compared to the limit. Increase the 'Deflate time limit' or investigate.

"M310 MISSFIRE! TEMPERATURE RISE: _ . ____ "

"The CAL3K has detected a temperature rise of less than the miss fire parameter after firing and considers this a MISSFIRE. Please open the vessel and make sure that the cotton thread touches the sample."

M316**"FIN _____ "**

"This is the main operating stage. It starts by firing the vessel and ends with the result display. The time is set up as a parameter: MAIN TIME."

"M318 WARNING: VESSEL TEMPERATURE > 55C "

"The vessel temperature has exceeded 55C. It may be too hot to handle when removing from the well! Depending on the calibration the accuracy may be affected!"



12.3 GENERAL

M502: Introduction display

" "

"The unit detected a power up or Abort. It displays the Introduction for N Seconds, where N is a parameter. The parameter can be set via a PC connected to the USB port."

M504 DEFLATE SYSTEM

M504 DEFLATE: CLOSE OXY. CYL. , ESC=STOP

The DEFLATE command open the inflation (and exhaust) valve in order to deflate the pressure hose from the bottle to the CAL3K.

M506: ENTER YES or NO to proceed

"ENTER 'YES' OR NO',OR PRESS Esc to EXIT "

"By typing 'YES' the command will be executed, or the state is set. Typing 'NO' the command is not executed or the state is reset (switched off!). Pressing 'ESC' terminates the command and has no effect on the state."

M508 BOMB FAILED

"M508 VESSEL FAILURE! DO NOT USE VESSEL "

"The vessel can't be used unless the fault is rectified. If the Reference, Memory or any sensor is at fault then the vessel must be returned to the manufacturer. If the supply is faulty then this must be investigated by the agent first."

M514 ABORT COMPLETE

"514 ABORT COMPLETE! WAIT FOR LID TO OPEN"

"The Abort procedure has worked! Please wait until the lid opens. You should hear a rattling sound."

M518 ABORT VESSEL PRESSURE __. __ BAR

The vessel pressure may not be real. It can be the result of a faulty pressure sensor or offset value.

M522 PERFORM HARDWARE TEST

"M522 PERFORM HARDWARE TEST AFTER 10SEC "

"The ABORT procedure detected some abnormality and it is advisable to perform a hardware test."

M526: BLUETOOTH INITIALISED

"M526: MOBILE NAME INITIALISED OK "

"The CAL3K has initialised the dds BLUETOOTH device to the 'Chassis Name'. If two devices are connected then BOTH are set to the same name!"

M528: NO BLUETOOTH DEVICE FOUND

"M528: NO MOBILE ADAPTER (DEVICE) FOUND "

"The CAL3K has found no BLUETOOTH device on either the DATA#1 or the DATA#2 port during the initialisation procedure. Please connect the dds BLUETOOTH dongle to either port."



M530 MASS LOCKED

"THE MASS: _._ ____ IS LOCKED! Details: F10"

"The MASS for the NEXT determination is locked. To un-lock the mass: Type MASS, {enter}, DELETE."

M532 LEAK TEST ACTIVE

LEAK TEST: TARGET __._ VESSEL __._ BAR

The leak test fill the vessel to the target pressure less 5 bar. And closes the inflate valve. Monitor the vessel pressure! A rapid declining vessel pressure indicates a leak.

M534 LEAK TEST ERR: NO BOMB OR LID OPEN

The leak test requires that the lid is closed and that a vessel is in the well.

M535 STATS PRINTING NOT ENABLED

STATISTICAL ANALYSIS PRINT NOT ENABLED

The stats printout must be enabled via the 'STATS EN ON D1' command. The printer port output speed must be set correctly.

M540: ENTRY WAS BAD

"540 ENTRY WAS UN-SUCCESSFULL, NO CHANGE!"

"The Keyboard entry was not understood by the unit and no action was taken, or no data are saved. The reason could be: Decimal point versus comma, too much or too little data, or alpha numeric entry in a numeric field."

M542 SYSTEM TEST ACTIVE

**M541 TEMP CALIBRATION REQUIRES BOMB
BOMB REQUIRED FOR SENSOR CALIBRATION**

This temperature calibration requires that the bomb is in the well and was equalised for at least 8 hours.

"M542 DDS SYSTEM TEST ACTIVE: WAIT "

"A system test procedure was initiated from the USB port. The CAL3K will not function unless ABORTED."

M544 INSERT VESSEL TO READ DATA

"M544 INSERT VESSEL TO READ INFORMATION "

"Insert the vessel in the well to read the Test Date and serial number and other information."

M548 BLUETOOTH MESSAGE

M548: BT MESSAGE: _____

Test: This is a message from the wireless BLUETOOTH link.

M548 BLUETOOTH MESSAGE

"M100 BT Message: _____ "

""



M550 VESSEL INFO

"VESSEL ID=_____ FIRINGS=_____"

The info from the vessel presently in the well is displayed.

M551 DISPLAY MAX CAL3L DATA

The maximum data are displayed.

M552 Vessel S/N

"Sn=_____"

This is the vessel serial number and the customer name

M554 VESSEL IS LINKED

"M554 VESSEL LINKED TO CAL3K! CALIBRATE! "

"The vessel was 'LINKED' to this CAL3K and requires calibration. This LINK process loads the CAL3K default IntelCal data in to the vessel and the vessel can be used in this chassis from now on."

M556 VESSEL NOT LINKED

"M556 VESSEL NOT LINKED TO THIS CAL3K! "

"The vessel is not 'LINKED' to operate in this CAL3K. Use the keyboard 'LINK..' command to link this vessel to this unit or enable auto-linking in the System definition."

M558 FACTORY TEST

M558: FACTORY TEST IN PROGRESS! WAIT!

The factory test is running. Terminate it with ABORT.

M559 SETUP CHANGE? RECALIBRATE IF NEEDED

It appears that the record step or the main time have changed and a recalibration is required. It is also possible that the software version of the vessel is old and needs upgrading.

M560 Testing not allowed

"M560 TESTING NOT ALLOWED in MAIN PERIOD "

"Testing is only allowed during the PREPARATION stage, because the testing operates on the same hardware. Wait until the INITIAL or MAIN mode is finished."

M562: MASS NOT IN RANGE

"MASS OUTSIDE LIMITS __.____ to __.____ "

"The Mass is outside the set limits of MinMass and MaxMass parameters. The limits can be changed via the PC."

M564 ATC TARGET

"ATC TARGET = _____.__ ATC AVRG = _____.__"

""



M566 CALIBRATION INFO

"Calib __/__/__-__:__:__"

M568 PC INTEL CAL INFO

"PC IntelCal: __/__/__-__:__:__ Mode: __"

This are the IntelCal (PC) calibration date and mode

M569 VESSEL MAX DATA

_____ Tmax=_____ Fcnt=_____

The vessel maximum data are displayed

"M572 LIMS PORT D1 NOT ENABLED"

"To send a message to the LIMS port D1 a output format X,Y,Z must be ticked in the System Definition field."

"M574 REALTIME (RT) NOT ENABLED IN SYSDEF"

"To send the header information to the D1 port a output format A or B (both = C) must be ticked."

"M576 STATISTIC DATA PORT D1 NOT ENABLED"

"The requested statistical report requires that the 'PORT DEFINITION' is enabled via the USB."

M578 DUPLICATE SID FOUND

"DUPLICATE FOUND, SAMPLE ID APPENDED: __"

"A duplicate Sample Identification (SID) was found! To identify the duplicate a number 1-99 is appended to the original SID."

M580 CALIBRATION ERROR: RECALIBRATE VESSEL

The unit found a calibration error. This can be fixed by re-calibrating or reducing the 'AVERAGE CALIBRATION' number.

M582 SET CALIBRATION IN PREP MODE ONLY

Setting the unit to perform a calibration is only allowed in the 'PREPARATION' stage.

M584 PARAMETER MEMORY DEFAULT LOAD

A fault was detected in the parameter memory and the default values were loaded. Should this happen regularly then the control card must be returned to the factory.

M587 TEXT MEMORY DEFAULT LOADED

A fault was detected in the 'text' memory and the default values were loaded. Should this problem happen regular then the control card must be returned to the factory.



12.4 TESTING

M900 Hardware field test

"CAL3K HARDWARE TEST: __ WAIT AND OBSERVE "
""

"902: MEMORY #1 OK "

"T02: The Parameter memory #1 is located on the control card and is vital for the operation of the unit. If faulty it can't be replaced in the field and must be returned to the agent or the manufacturer."

"903: MEMORY #2 OK "

"T03: The Parameter memory #1 is located on the control card and is vital for the operation of the unit. If faulty it can't be replaced in the field and must be returned to the agent or the manufacturer."

"M905: AMBIENT TEMPERATURE SENSOR OK "

"T05: The ambient sensor is located on the outside of the ambient box (cage). The test assumes that the temperature is between 5C and 32C. If the ambient temperature is wrong by far, then it may affect the determination."

"M907: LCD BACKLIGHT SUPPLY OK "

"T07: The LCD backlight voltage should be between 4.5 and 5.2Volts. It improves the display contrast. It is generated on the control card. Apart from the visibility it is of no consequence."

"M908: REAL TIME __/__/__-__:__:__ OK "

"T08: The unit has a real time clock calendar, which is needed for logging. The real time clock has a one week battery for power outages. If it fails then the control card must be returned."

"M910: LID SWITCH OPERATION OK "

"T10: The LID open/close recognition is tested. If it fails then the lid switch is faulty or the wires are disconnected. Your service agent can help!."

"M911: VESSEL SUPPLY IS OK "

"T11: The Supply to the VESSEL should be between 5.2 and 5.8Volts. This can be measured on the INNER contact in the well. The voltage is generated on the control card, and if not then the control card must be returned."

"M912: FIRING CHARGER OK "

"T12: The Unit waits for the charger to charge the firing battery to ~25V. The firing voltage should increment slowly. If it stays at approx. 12V then the firing board is at fault and needs to be replaced."

"M915: FAN DRIVE CIRCUIT OK "

"T15: The FAN circuit has a fault. The connection from the controller to the FAN is missing."

"M918: POWER SUPPLY NO LOAD OK "

"T18: The power supply to the CAL3K should be 11 to 13 Volts without load."

**"M919: POWER SUPPLY MAX LOAD OK "**

"T19: The power supply should be a 12V 3A unit. It must support this current for short times only."

M923 5VOLT RAIL SUPPLY OK

"T23: The 5V rail voltage should be between 4.8 and 5.2Volts. This voltage feeds to the LCD backlight and various other devices. It is generated on the control card from the 12V supply."

"M924: LCD BACKLIGHT SWITCHING OK "

"T24: The LCD backlight is switched OFF to preserve power and ON when a keyboard or other operation demands it."

M929 CAL3K HARDWARE TEST SUMMARY**"M929: CAL3K HARDWARE TEST SUMMARY OK "**

"T29: The outcome of ALL hardware test are summarised and logged to the Event store."

12.5 BOMB TESTS START HERE**"M930 VESSEL COMMUNICATION OK "**

"T30: If the bomb communication is bad then the Vessel is not in the well or there is no communication with the vessel. The centre contact pin should have approx. 5.5V on them. If not then the connections are faulty."

"M931 VESSEL SUPPLY IS _____ V OK "

"T31: The CAL3K supplies approx. 5.6V to the vessel. If it goes below 5.2V when the vessel is inserted then the vessel is at fault (Try a different Vessel!) or the control card is faulty."

"M932 VESSEL FIRING WIRE OK "

"After the Lid is closed the CAL3K checks the firing wire. The firing wire detection is handled by the FIRING PCB and the control card."

"M933: VESSEL FIRING OK "

"T33: The CAL3K has fired the Vessel but has failed to observe the discharge of the firing battery. This is a fault in the firing PCB and the unit must be returned."

"M934: BOMB INTERNAL TEST OK "

"T34: In this step all the vessel report bits are checked and combined. If a fault persists then the vessel must be returned to the factory."

"M935: BOMB INFLATION TEST OK "

"If this test fails then it is possible that the oxygen supply is blocked or not turned ON."

"M935: BOMB TEST SUMMATION OK "

"The bomb test was completed! If the test has failed then the vessel must be returned to the manufacturer."



"M940: LID IS CLOSED, DOES NOT OPEN: BAD"

"T10: The LID switch indicates that the lid is permanent closed. This is a fault and must be rectified before proceeding."

"M941: LID IS OPEN, PLEASE CLOSE IT "

"The indication is that the LID is open and needs closing."

"M942 VESSEL FIRING WIRE CHECK, CLOSE LID"

"T32: The unit likes to test the connection to the firing wire INSIDE the vessel. It can only do this once the lid is closed."

"M943: WAIT, CHARGING to 20V: _____ V"

"Wait: The unit charges the Firing battery. The voltage should increase slowly to 20V and then the unit will fire the vessel."

M950 Hardware field test

"BOMB HARDWARE TEST: __ WAIT AND OBSERVE "

""

"M960 FACTORY TEST IN PROGRESS, WAIT! "

"Factory test is performed on PC."



13 WARRANTY – FOR NEW PRODUCTS

13.1 PURPOSE OF PRODUCT WARRANTY

Any part of a product is subject to ageing and eventual failure. These failures occur during normal use. The purpose of a warranty is to protect the Owner against a part failure caused by manufacturing defects in workmanship, material or design for a specific time.

13.2 OWNER'S WARRANTY

In the event of the Owner contracting directly with Digital Data Systems (Pty) Ltd “**dds**”, or in the event of the installation of a unit arising out of a contract between the Owner’s Dealer or any other party on his/her behalf and the said “**dds**”, the Owner records that notwithstanding same, this warranty is the only warranty applicable to “**dds**” units and is expressly in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose. No amendments or additions to this warranty shall be binding on “**dds**”, unless recorded in writing and signed by a duly authorised officer of the company. **“dds” agrees to repair and replace with a new or remanufactured part, any part, other than those excluded below, which after inspection, upon its return to the factory in Randburg, Johannesburg by the Owner or the authorised Dealer to which he/she returns the unit, is proven to be defective.**

Replacement of a defective part will be made only within the applicable warranty period of **12 (twelve) months from date of shipment**. Notwithstanding anything to the contrary herein, any labour involved in repairing or replacing a defective part will be charged at “**dds**” rates applicable at the time.

If upon inspection it is found that the pressure vessel was submerged in water the warranty will automatically be null and void and the owner will be responsible for the labour and parts charges.

13.3 EXCLUDED (NON-WARRANTY) PARTS

“**dds**” shall be entitled to treat this warranty as void unless the relevant warranty form (attached) is sent by registered post to “**dds**” by the Owner within 10 (ten) days from date of original installation.

Regardless of warranty-status, the Owner shall be responsible for labour charges connected with periodic maintenance requirements involving visual and functional inspection of the systems.

This warranty expressly covers the unit(s) “**dds**” supplied only and does not cover any other part, which may, as a consequence of the installation and operation of the unit, become damaged in any way whatsoever.

Special attention should be given to the safe operation of the high-pressure Vessels. The published rules are guidelines only and enclosed in this leaflet for the convenience of the User. The manufacturer is not responsible for any damages, consequential, indirect or direct, or loss whatsoever, resulting out of electrical shock, Vessel explosion, or any other cause.



13.4 WARRANTY – REPAIRED PRODUCTS

Any “**dds**” scientific product that has been repaired has a warranty period of **30 Days from date of shipment** for the Repair request only. If something else goes wrong that is not part of the original Repair, the warranty does not apply. Each product that is sent to “**dds**” for Repair is tested and checked and leaves “**dds**’s” Factory in 100% working order. It is the Owner’s responsibility to inspect any repaired product on receipt thereof and confirm in writing, any faults, errors or problems with the said product. If a fault, error or problem is reported after the 30 Day warranty period, and “**dds**” finds that the product has been damaged and requires another repair, the full cost of repair will be applicable and paid for by the Owner.

13.5 GENERAL – WARRANTY VOID

All serial numbers on any relevant “**dds**” Scientific product need to remain on the product at all times, or warranty will be void. Warranty will also be void if any of the branding stickers or decals have been removed and/or the colour of the Scientific product has been changed in any way.



13.6 WARRANTY REGISTRATION FORM

SERIAL NUMBERS (S/N): _____

Calorimeter: _____

Air Cooler: _____

Vessel(s): _____

Other: _____

DEALER NAME: _____

OWNER'S/CUSTOMER'S COMPANY NAME: _____

AUTHORISED BY: _____

INSTALLED AT: _____

TEL NO: _____ FAX NO: _____

CONTACT PERSON: _____

INSTALLED BY: _____

DATE INSTALLED: _____ (REPRESENTATIVE OF DEALER/AGENT)

CUSTOMER ORDER NUMBER AND DATE: _____

INSTALLATION DETAILS (LOCATION, WATER SUPPLY, AIR-CONDITIONING ETC.):

ACCEPTED IN GOOD CONDITION:

DATE: _____ SIGNATURE: _____

NAME (printed): _____

WITNESS: _____

I have read, understood and accepted the conditions of this warranty, the details of which are printed in this Manual.

CUSTOMER'S SIGNATURE: _____

NAME (printed): _____

DATE: _____