

Installation, Operation and Maintenance Instructions 750°C Asphalt Binder Analyser - ABA Model: 35 Litres

ABA 7/35B

Contents

This manual is for guidance on the use of the Carbolite Gero product specified on the front cover. This manual should be read thoroughly before unpacking and using the furnace or oven. The model details and serial number are shown on the back of this manual. Use the product for the purpose for which it is intended.

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1.0 Symbols and Warnings

1.1 Switches and Lights



Instrument switch: when the instrument switch is operated the temperature control circuit is energised.



Printer Switch: when the printer switch is operated power is being supplied to the printer.



Safety Circuit Test Switch: activated to check the operation of the two red warning lamps situated above the main chamber on the right hand side of the ABA.



Heat light: the adjacent light glows or flashes to indicate that power is being supplied to the elements.



Afterburner Heater Light: the adjacent light glows to indicate that power is being supplied to the afterburner.

1.2 General Warnings



DANGER – Electric shock. Read any warning printed next to this symbol.

WARNING: Risk of fatal injury.

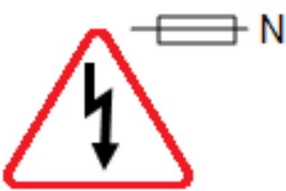


DANGER – Hot surface. Read any warning printed next to this symbol.

WARNING: All surfaces of a product may be hot.



DANGER – Read any warning printed next to this symbol.



Caution – Double Pole/Neutral Fusing

2.0 Supplied Item List

2.1 Parts Supplied

The following items should be present. These should all be checked and identified as soon as possible after receipt of the equipment. 2.2 shows photographs of many of the parts for identification purposes.

Quantity	Item	
1	Asphalt Binder Analyser: ABA 7/35B	
1	Chimney	
(1)	Optional Floor Stand (only if ordered) <i>(part number 00372-3-4000)</i>	
1	Adam Equipment Internal Balance Mechanism	
1	Balance Pan Extension	See Fig 1.
4	Sample Baskets <i>(part number 00336-3-2039 - set of 2)</i>	See Fig 2.
2	Sample Basket Lids	See Fig 2.
2	Sample of Sample Basket Clips (1 large, 1 small per set) <i>(part number 35-090-044-0010)</i>	
2	Sample Catch Trays <i>(part number 00336-3-2038)</i>	
1	Sample Basket Loading Handle <i>(part number 00336-3-2041)</i>	See Fig 3.
1	Hot Sample Safety Guard <i>(part number 00336-3-2042 including handles & fixing kit)</i>	See Fig 4.
1	Hot Sample Guard Handle Fixing Kit	See Figs 5. & Fig 6.
2	Door Lock Keys	
1	Front Brick Cover	See Fig 7.
1	Calibration Plate	See Fig 8.
2	Printer Paper Rolls (including 1 installed in printer) <i>(part number 22-222-356-0010)</i>	See Fig 28.
2	Touch Screen Protector Films <i>(part number 31-019-200-0010)</i>	
1	Operating Instruction Manual	

In addition, any spare parts ordered should be separately identified and put aside in safe storage.

2.2 Identifying the Parts



Fig 1 - Balance pan extension

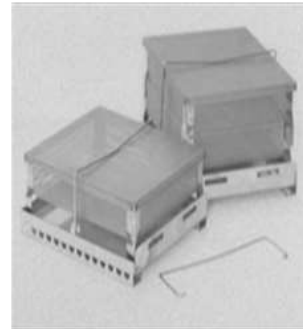


Fig 2 - Sample baskets on catch tray with lids and clips

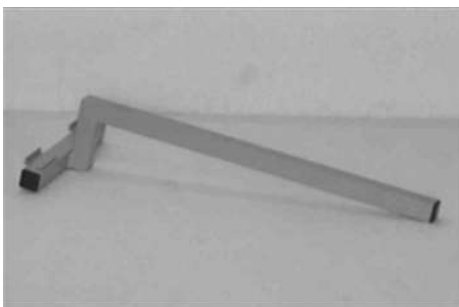


Fig 3 - Sample basket loading handle

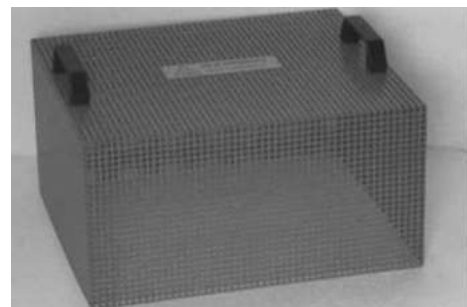


Fig 4 - Hot sample safety guards (assembled)

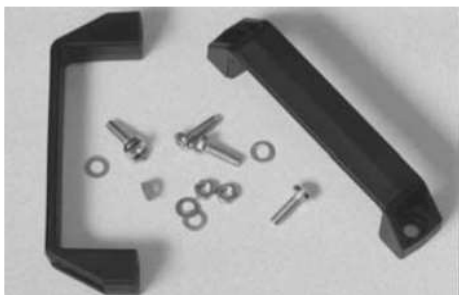


Fig 5 - Hot sample safety guard handle fixing kit



Fig 6 - Safety warning label for hot sample safety guard



Fig 7 - Front brick cover

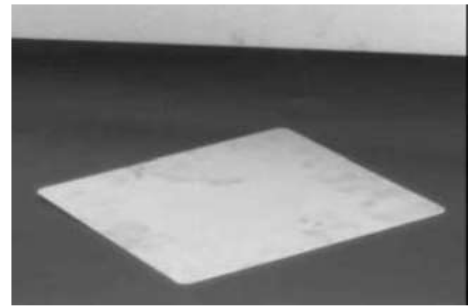


Fig 8 - Calibration Plate

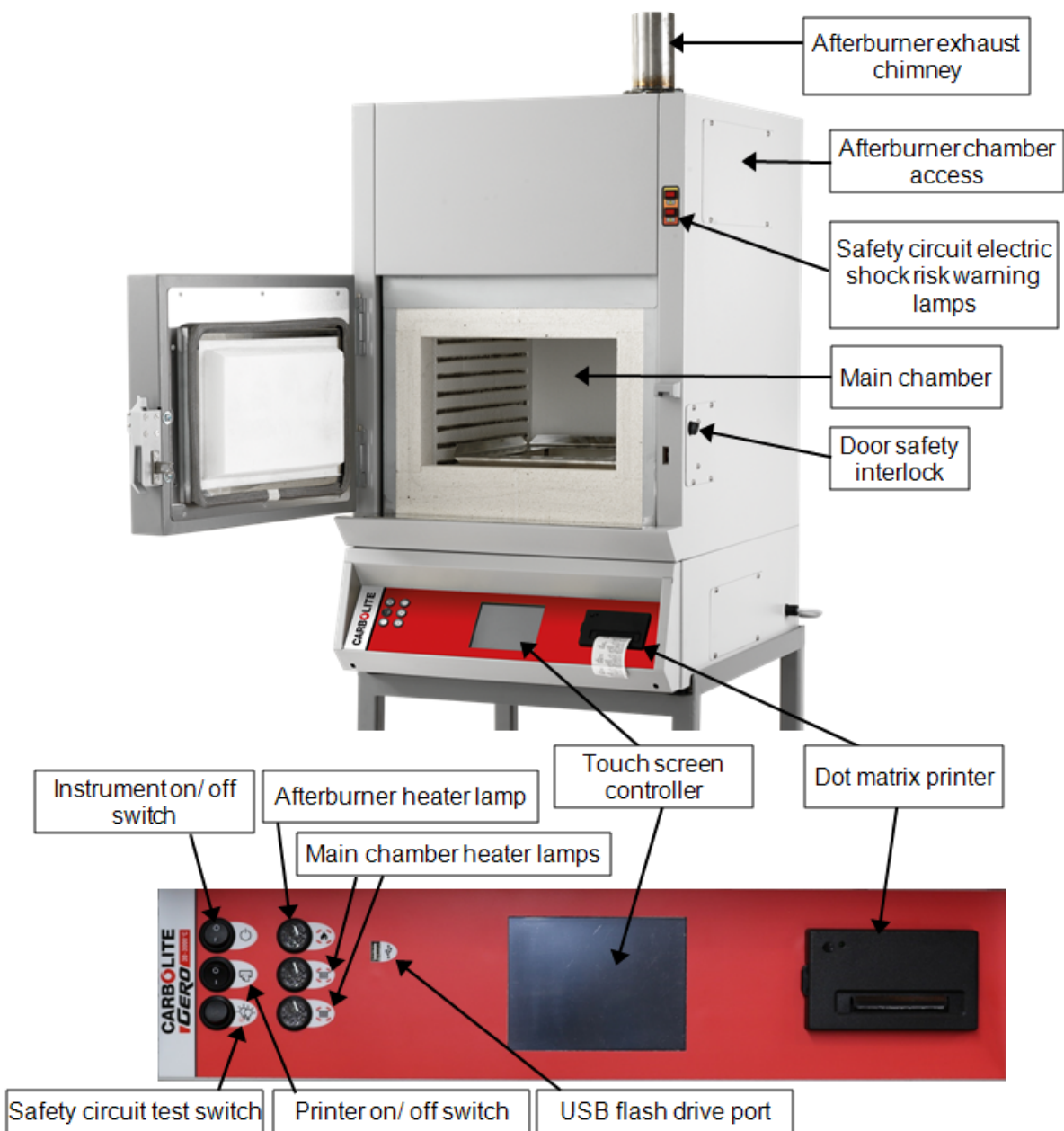


Fig 9 - Functional parts of the ABA

3.0 Installation

3.1 Unpacking and Handling

When unpacking or moving the product, always lift by its base; do not use the door or any other projecting cover or component to support the equipment when moving it. Use a fork lift or pallet truck to move the product; position the product on a level surface and use an adequate number of personnel to safely move the product into position.

Carefully remove any packing material from inside and around the product before use. Avoid damaging the surrounding insulation when removing packing materials.

This product is fitted with a safety door lock; when there is no power connected to the equipment the door has to be opened using the key supplied. The keyhole is located on the right hand side of the case.

Lock the door again after checking and clearing the interior. See section 4.2.



NOTE: This product contains Refractory Ceramic Fibre (also known as Alumino Silicate Wool - ASW). For precautions and advice on handling this material see section 22.2.

3.2 Siting and Setting Up

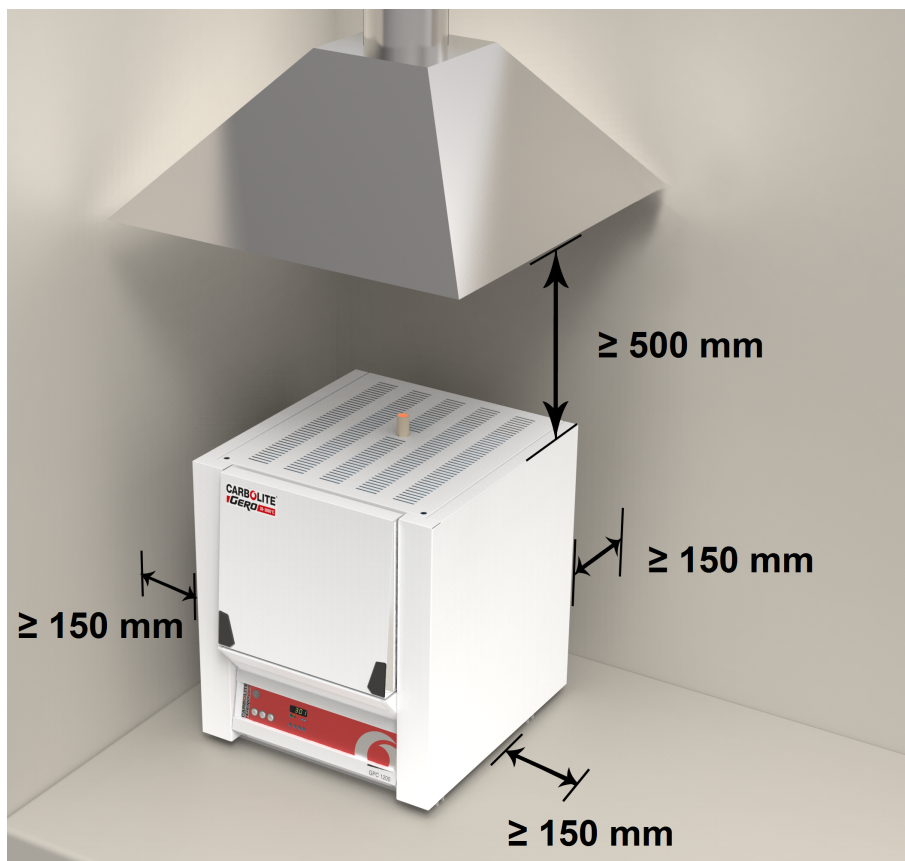
Place the product on a level surface in a well ventilated area.

Site away from other sources of heat and on a non-flammable surface that is resistant to accidental spillage or hot materials.

The surface on which the equipment is mounted should be stable and not subject to movement or vibrations.

The height of the mounting surface is important to avoid operator strain when loading and unloading samples.

Unless otherwise stated elsewhere in this manual, ensure that there is **at least 150 mm** of free space around the back and sides of the product. Clear space is required above the product to dissipate heat.



If sited in a prefabricated or mobile laboratory additional stiffening of the floor may be required to ensure stability of the internal weighing system.

If the optional metal stand (part number 00372-3-4000) is supplied, this is best placed on a solid (concrete) floor.

Ensure that the product is placed in such a way that it can be quickly switched off or disconnected from the electrical supply.



Under no circumstances should any objects be placed on top of the product. Always ensure that any vents on the top of the product are clear of any obstruction. Always ensure all cooling vents and cooling fans (if fitted) are clear of any obstruction.

3.3 Tools Required

- 10 mm spanner
- 12 mm spanner
- Cross point screwdriver
- Flat blade screwdriver
- Allen key (supplied)
- 5 kg calibration mass (not supplied)
- Spirit level (supplied)

3.4 Fitting the Chimney

- Remove the chimney panel, (see Fig 10.)
- Fasten the chimney to the top of the product using the screws provided, (see Fig 12.)
- Replace the chimney panel, (see Fig 11.)

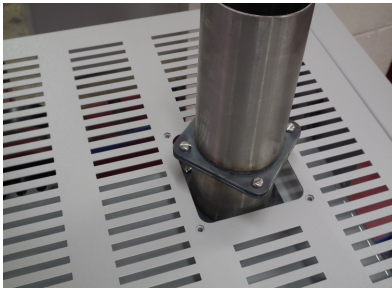


Fig 10 - Remove the chimney panel

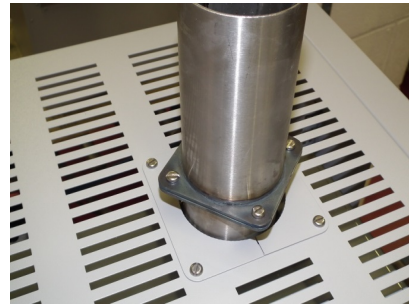


Fig 11 - Replace the chimney panel



Fig 12 - Chimney screws

3.5 Ducting

The chimney must either be placed under a powered exhaust hood, or connected directly to a 76 mm duct (not supplied) to the outside of the building; any such duct must NOT have powered extraction.

The fumes should be ducted by either of the above methods to at least 1 metre above the level of the building.

Rules for ducting:

- Ducting diameter must be 76 mm or more.
- Ducting must be 76 mm where it connects to the chimney.
- Ducting length must not exceed 3 metre for 76 mm diameter; for longer lengths consult a ducting engineer.
- Flexible ducting, if used, must be suitable for exhaust gas extraction.
- If an extraction fan is fitted an extraction hood is required with free flow of air around the chimney.
- Do not connect more than one product to a single duct. (Exception: where a fanned duct with hoods is used)

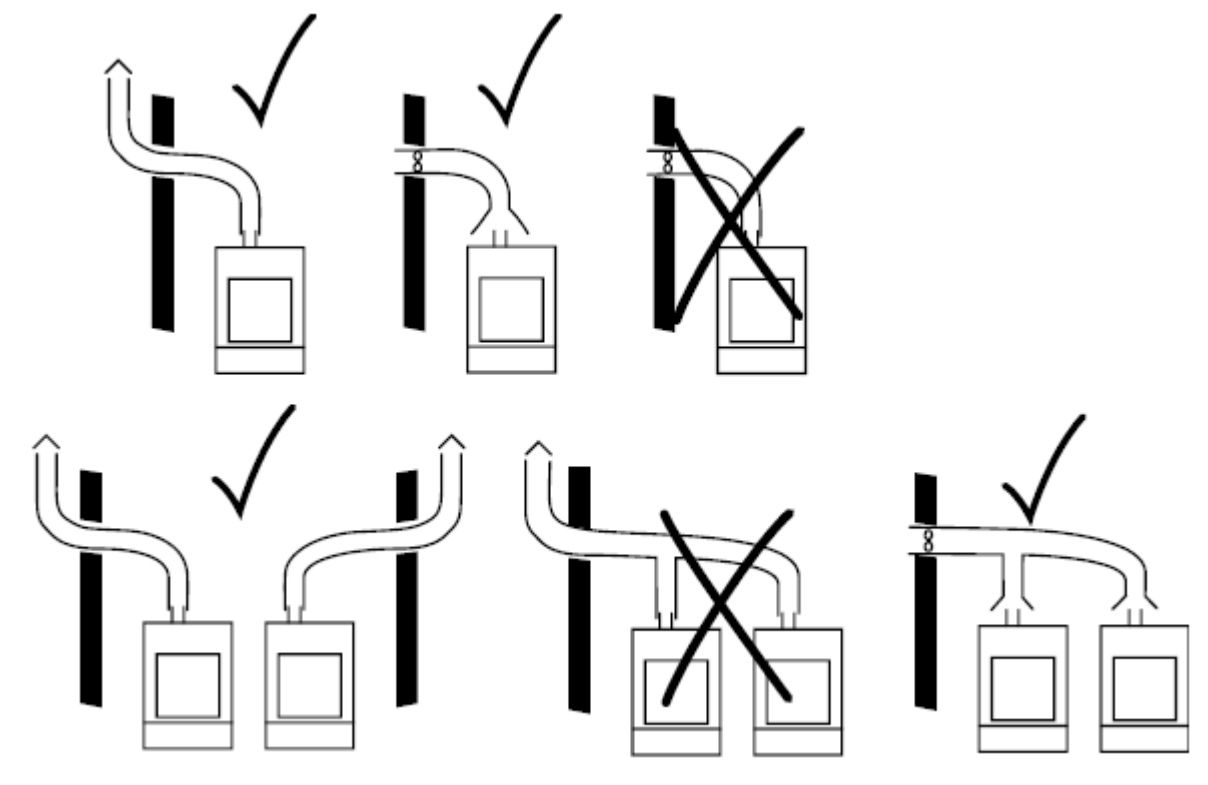


Fig 13 - Ducting Schematic

3.6 Hot Sample Guard Assembly

The hot sample safety guard is supplied as a kit comprising the guard, the handles and fixing screws and a warning label and fixing screws. See Fig 4. to Fig 6. to assemble the handles and the warning label to the guard.

3.7 Electrical Connections



Connection by a qualified electrician is recommended.



Model ABA 7/35B is designed for connection to a range of power supplies with the minimum of circuit modifications. It is initially supplied to suit the voltage for which it was ordered.

Look at the rating label before connection to check the electrical supply voltage and frequency for which the unit is configured. If there is a difference between the actual supply and the rating label, reconnect the wires between the terminal block and the EMC filters according to the appropriate diagram below.

If there is a need to connect the ABA to a voltage other than that shown on the label when it is delivered, it is essential to first ensure that wiring configuration shown in table below is configured correctly for the intended new mains supply.

The electrical supply should be fused at the next standard size equal to or higher than the rated current. A table of fuse ratings is given in section 29.0

Either wire directly to an isolator or fit with a line plug. An isolating switch should operate on both conductors (single phase) or on all live conductors (three phase); it should be within reach of the operator. A line plug should be easily removable and should be within reach of the operator.

The electrical supply **MUST** incorporate an earth (ground).



Failure to wire to the appropriate diagram may damage the ABA.

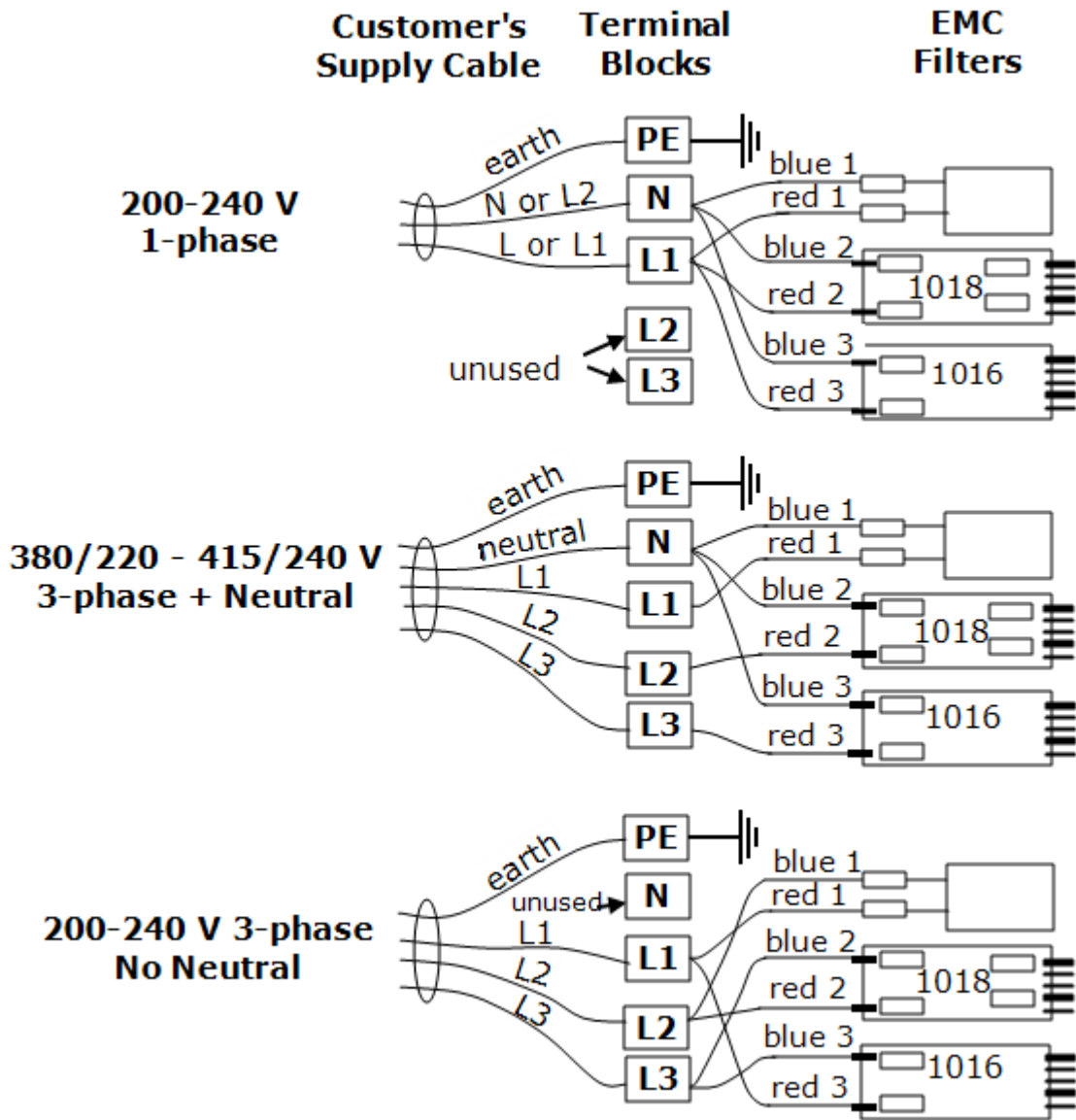


Fig 14 - Schematic for Mains Electrical Connections

3.8 Balance Installation

Remove the balance from its packing and isolate the ABA from the electrical supply.

Remove both lower side covers.

With the furnace in its intended final location, place the spirit level on the balance location plate, as shown in Fig 15.

If the plate is not level then adjust the whole furnace, either by placing suitable shims under the furnace feet, or adjusting the stand legs.

Open the chamber door and make sure that there are no obstructions, such as loose packing or insulation material in the four holes in the chamber hearth that the legs of the balance pan extension pass through.

Position the front brick cover over the front of the chamber (see Fig 16.).

In the base compartment, loosen the four screws holding the balance location plate using a 10mm spanner.

Partly insert the balance into the left side opening of the furnace with the 'front' sloping portion of the balance facing towards the rear of the furnace (see Fig 17.). Connect the combined balance data and power supply lead marked 'internal' to the balance body, lightly tightening the plug's retaining screws, then connect the balance's earth cable to the spade connector in the upper rear part of the recess (see Fig 19. and Fig 20.).

Open the door lock with the key provided. Insert the balance pan extension into the main chamber with the extension legs fitting through the four holes in the chamber hearth (Fig 24. to Fig 25.). Note that the front edge of the extension is folded down.

Fasten the balance pan extension to the balance using the four screws and Allen key supplied (see Fig 26. to Fig 27.).

Place the sample tray and spirit level in the furnace chamber, as shown in Fig 22.

Adjust the threaded balance legs until the tray is level.

The balance pan extension legs should pass centrally through the holes in the chamber floor (see Fig 28.); this can be seen from the balance side access panel (see Fig 21.).

If it is necessary to adjust the balance position, slacken the four screws holding the location plate. Gently tap or slide the plate until all four legs are central, then retighten the screws.

Note that for accurate and reliable weight measurement, there must be no mechanical contact between any fixed parts of the furnace and the balance pan extension. The method described above is designed to ensure this across the entire operating temperature range.

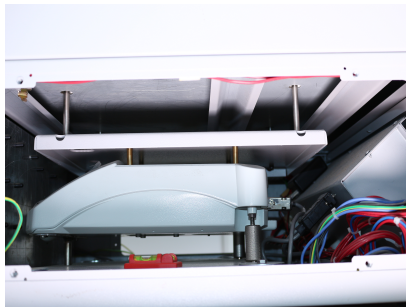
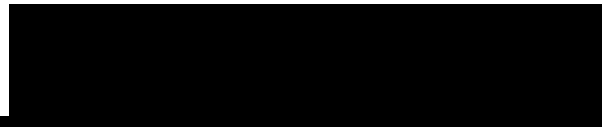


Fig 15 - Checking the furnace is level



Fig 16 - Positioning the front brick cover



Fig 17 - Partly insert the balance through the left hand opening then connect the cable and earth lead



Fig 18 - Connecting the cable to the balance



Fig 19 - Balance the earth cable position

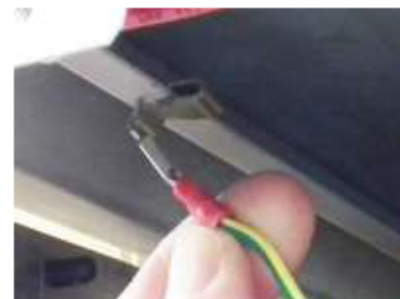


Fig 20 - Close up of balance earth cable attachment



Fig 21 - Insert the balance through the left side with the read of the balance towards the front of the furnace

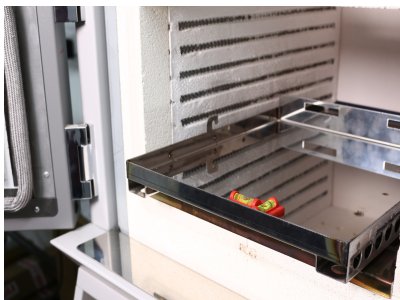


Fig 22 - Use sample tray and spirit level to level the balance



Fig 23 - Using a spanner adjust the legs on the balance until the indicator on the bubble arm shows that it is level



Fig 24 - Inserting the balance pan



Fig 25 - Balance pan extension in place

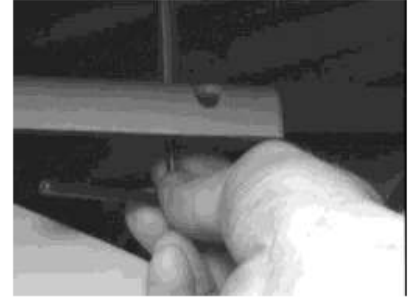


Fig 26 - Fastening the balance pan



Fig 27 - Allen key and screws

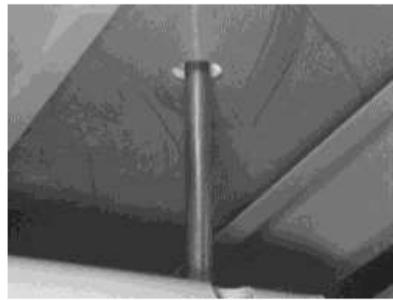


Fig 28 - Checking that the balance pan legs are central

3.9 Installing Printer Paper

The printer is located on the right hand side of the control panel.

Access to the printer for changing the paper is provided by a hinged front panel. Depress the spring catch on the left hand side of the printer to release the front panel. The paper roll carrier is mounted on the rear of the printer front panel and will swing out from the main body for ease of printer paper roll changing (See Fig 30.) squeeze the spindle pins to release the roll and its retaining disc. Replace the printer roll using the paper path shown in Fig 31.

Insert the straight edge of the paper into the slot at the bottom of the front panel and press the paper feed button at the same time, which will draw the paper through the printer. Close the printer to continue.



Fig 29 - Release clip and swing open the printer



Fig 30 - Squeeze the spindle pins to release printer roll

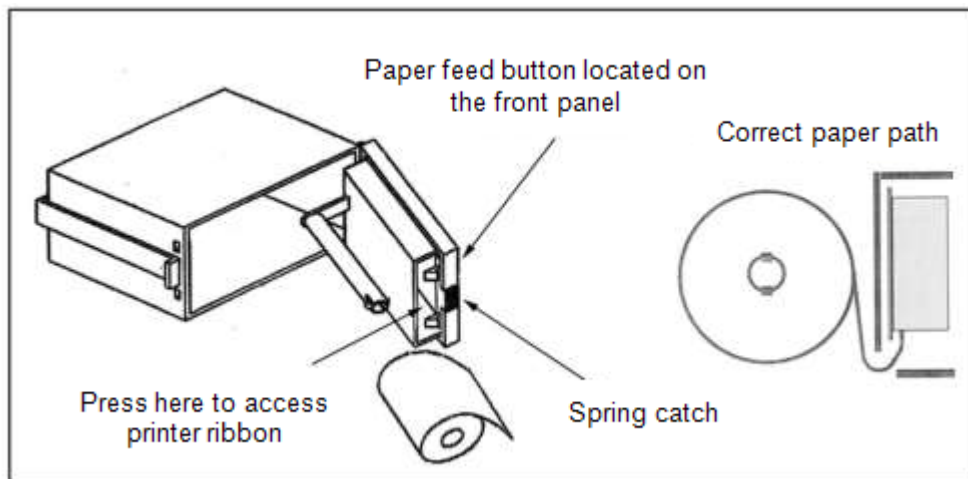


Fig 31 - Feed paper through the path shown using the paper feed button

3.10 Calibrating Internal Balance

After installation or if the ABA has been moved the internal balance must be calibrated (see section 17.3).

3.11 Connecting External Balance

As a more accurate alternative to manually entering sample weights the ABA 7-35B can directly import sample weight values from certain external balances. These include Ohaus Explorer models pre 2011 (with monochrome LCD display) and post 2011 with colour interface as well as Adam Equipment Balances, see section 7.9 for connection details.

4.0 Safety Features

In this section the word 'user' is to be interpreted as any person with access to or responsibility for the ABA 7/35B and its ancillary equipment.

4.1 Electric Shock Risk Lamps



Opening the chamber door causes power to the heating elements to be disconnected at both ends of the circuit.

Any failure of the relays involved in this switching causes one or two red Electric Shock Risk lamps to illuminate; see sections 5.1 and 5.2.

The user is thereby warned that if, when the door is open, either or both of the electric shock risk lamps are illuminated, then there is risk of electric shock from the exposed heating elements.

The user should disconnect the equipment from the power supply and correct the fault (see section 27.0).

A switch is provided to test that the warning lamps are themselves working; see section 5.0.

The user is responsible for regular checking using the test switch.

4.2 Power Failure Safety Feature



A power failure could occur during a test, leaving an incompletely burnt sample and a chamber containing explosive or volatile matter. An interruption of power is normally signaled by the display of the Carbolite Gero logo on the balance display screen.

On a power failure, the door remains locked and automatically opens only on restarting and safe completion of the test.

It may be necessary in some circumstances to bypass the door lock and a key is provided for this purpose. Safe use of the key is the user's responsibility.

4.3 Access to the Plenum Chamber



Soot can accumulate in the airway following the after-burner, giving rise to fire risk.

The plenum chamber can be cleaned by first removing the upper panel on right side of the case. Then loosen the 6 screws (DO NOT remove the screws) holding the removable panel of the plenum chamber and remove the panel by sliding it sideways off the screws to reveal the inside of the plenum chamber. see section 21.5.

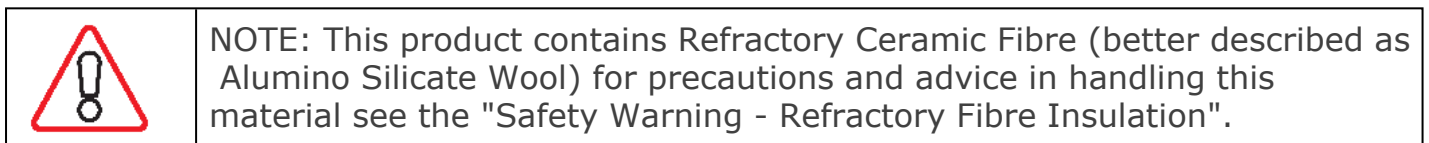
The user is responsible for maintaining a clean plenum chamber and also for regular cleaning of the chimney and the external flue or ducting system.

4.4 Door Lock Indication 'Lamps' on Touchscreen




A 'door locked lamp' is shown on the top status bar on the user interface (see Fig 32.). If the door is locked then it is illuminated in orange, otherwise it is grey. The user should always check that the 'door locked lamp' is lit when a test is started.

4.5 Maintenance or Dismantling



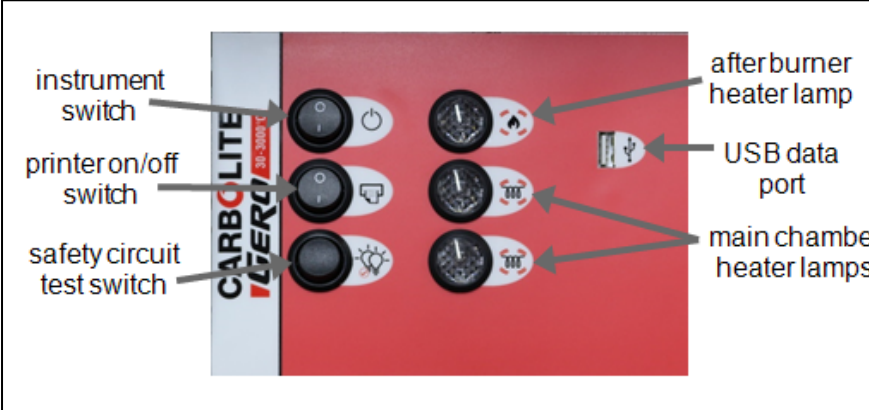

The user should disconnect the equipment from the electrical supply before removing panels to access the electrical connections and control equipment. Caution : Double pole/ neutral fusing may be used in this product.

5.0 ABA Operation


	<p>This section describes how to heat the chamber up to temperature and how the automatic door locking system operates.</p>
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5.1 Switches - Control Panel

The main control switches are on the left hand side of the control panel (see Fig 33.).

	
<p>Fig 33 - Mains switch panel</p>	<p>Fig 34 - Electrical Shock Warning Lights</p>

The 'instrument switch' cuts off power to the controllers, other devices (including the balance) and heating circuit contactors.

	<p>The 'safety circuit test switch' is used to check the operation of the two red warning lamps referred to in section 4.0 (see both Fig 33. and Fig 34.).</p>
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The heater lamps indicate when the power control relays are on; they flash while the chamber is heating or maintaining temperature. They are also used to diagnose faults – see section 27.0.

5.2 Door Operation and Status Display

In previous models 'door open' and 'door locked' indicator lamps were positioned above the 'Electric shock risk' lamps on the upper right front of the furnace. These door status indicators are now included (see Fig 32. and Fig 36.) in the status bar at the top of the touch screen display panel.


When the door is open power to the main chamber elements are automatically cut off. If a fault occurs then one or both of the red warning lamps above the door on the left (see Fig 34.) will light up. These warning lamps should be tested daily by pressing the test switch on the lower mains switch panel (see Fig 33.) when the door is closed and no test is operating.

The door open warning indicator in the header bar of the main menu screen (see Fig 35.) will appear red if the door is open or the lock is not properly fastened.



Fig 35 - Screen-view: Door Open Warning

The door locked indicator (see fig 34.) shows that the door is locked after a test has started.

	<p>If either or both of the shock risk warning lamps (see Fig 34.) light up when the door is open, do not load or remove a sample. Samples may be removed if the power is first turned 'Off'. Contact a Carbolite Gero approved service engineer immediately.</p>
---	--

The door lock is automatically controlled but has an override key, the lock is on the right hand side of the ABA case. Ensure that the key override has been correctly left in the 'locked' position after installation.

If the door lock is unlocked when a test is started the test will fail to start and a continuous warning tone will be emitted along with a warning screen indicating that "The door has failed to lock". The door must be locked before the test can be started.

If the door is unlocked during a test a continuous warning tone will be emitted along with a warning screen indicating that "The door should be closed and locked immediately". This warning should not be ignored; failure to do so may result in serious injury. The test will continue when the door is once again locked.

Door Lock will operate under the following conditions:

- when the ABA is disconnected from the power supply the door is locked
- when the illuminated furnace power switch (see Fig 33.) is switched on the door normally unlocks
- If however there has been an interruption in an operating test, for example by a power cut or the ABA being switched off, the door lock remains locked when the ABA is once again switched on. To unlock the door, the test must be cancelled using the test cancel code (see section 7.7) .
- at the start of a test the door locks automatically
- at the end of a test the door unlocks automatically

5.3 General Operating Notes

Heating element life is shortened by use at temperatures close to maximum. Do not leave the ABA at high temperatures when not required. The maximum temperature for the main chamber is 750 °C (1380 °F) and is factory set for the after burner at 900 °C (1652 °F)

The chimney and should always be correctly fitted and unobstructed (see Fig 13.). see section 20.0 for information about maintenance.

5.4 Operator Safety



The ABA incorporates a safety switch which interrupts the heating element circuit when the door is opened. This prevents the operator from touching a live heating element, but also prevents heating up if the door is left open.

When a test is started the door is automatically locked until a constant weight loss (end-point) is achieved. This is to prevent the operator from opening the door whilst volatiles are being driven off from the test sample. If the door were to be opened during this time the addition of air could cause the volatile materials to ignite in an explosive manner.



The red sample basket cover must be used to cover the hot sample baskets whilst they are allowed to cool.



Before removing any hot objects from the chamber make sure that you have a safe place to put them down.

Do not place hot objects on inflammable surfaces. Wear appropriate safety clothing; gloves, mask and safety glasses are recommended.

5.5 Touch-screen Main Menu

The main menu is accessed directly from the button in the top left corner of the home screen as shown in Fig 36.

The table below gives a reference to a section of this document where detailed information is given for each of the buttons on the Main Menu.

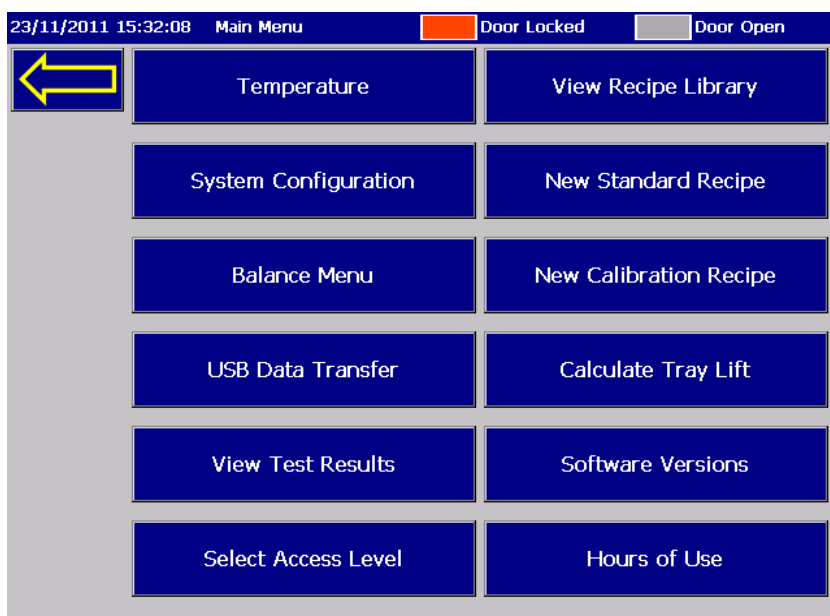
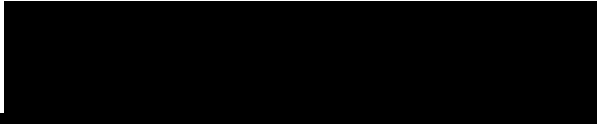


Fig 36 - Screen-view: Main Menu

5.5.1 Table: Main Menu References

Main Menu Button	Reference Section
Temperature	10
System Configuration	6 & factory settings
Balance Menu	17
USB Data Transfer	16
View Test Results	15
Select Access Level	9
View Recipe Library	13
New Standard Recipe	14
New Calibration Recipe	14
Calculate Tray Lift	8
Software Versions	23
Hours of Use	0



6.0 System Configuration Menu

6.1 Accessing System Configuration Menu

Screen-view: System Configuration Menu shows the System Configuration Menu which is accessed via:

Home Screen → Main Menu → System Configuration

Table: System Configuration Menu References gives a reference to a section of this document where detailed information is given for each of the buttons on the Configuration Menu.

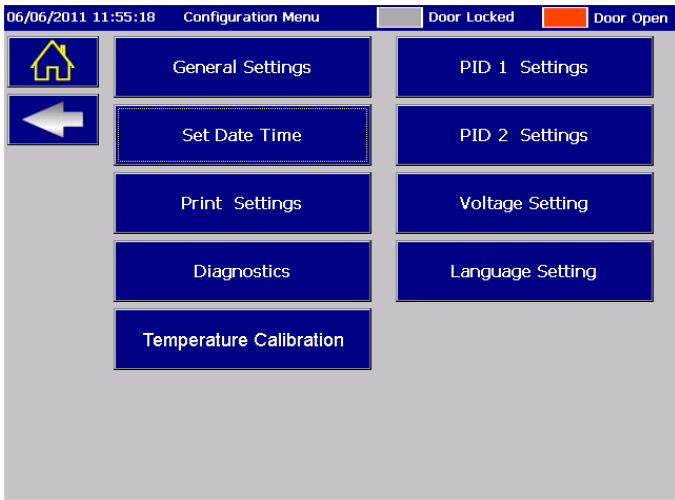


Fig 37 - Screen-view: System Configuration Menu

6.1.1 Table: System Configuration Menu References

System Configuration Menu Button	Reference Section
General Settings	7.12 & 10.2
Set Date Time	11.0
Print Settings	12.0
Diagnostics	26.0
PID 1 Settings	Factory Set
PID 2 Settings	Factory Set
Voltage Settings	19.0
Language Settings	18.0
Temperature Calibration	20.0

7.0 Running a Test

7.1 Set up

Before running the test for the first time, ensure the tray lift calculation has been performed as described in section 8.0.

Before every test, the weights of the sample tray and sample must be determined as described in section 7.13.

7.2 Selecting a Recipe

To start a test a recipe must first be created and then selected. Refer to the section 14.0 for details on creating a recipe. To select a recipe go to the Recipe Library by pressing the 'View Recipe Library' button on the Main Menu. Select the required recipe from the displayed list and then press the 'Run' button (see section 13.5). The 'Home' screen will then be displayed with the selected recipe in the recipe name field, the temperature setpoint from the recipe and depending on the recipe type, either the calibration factor or binder % from the recipe will be displayed as shown in Fig 36. The furnace will heat the main chamber to the temperature specified in the recipe setpoint. If the furnace has just been switched on from cold, it should be allowed to dwell at the setpoint temperature for 30 minutes. The after burner will be heated to 900 °C. Tare balance (see section 17.2), then load the sample and tray. The operator should check that the pre-requisite test conditions are satisfied before attempting to start the test, refer to the section 7.3. If the conditions are satisfied, the test can be started by pressing the 'Run Test' button.

Note: the text on this button will change, depending on the state of the system, as shown in the table below.

06/06/2011 11:52:30		Home		Door Locked		Door Open	
Main Menu		Run Test		Enter Weights			
Test Status	<input type="text"/>	Sample Start Weight	<input type="text"/>	0g			
Recipe Name	<input type="text" value="CARBO2"/>	Tray Weight	<input type="text"/>	0g			
Temperature Setpoint	<input type="text" value="520 °C"/>	Combined Weight	<input type="text"/>	0g			
Calibration Factor %	<input type="text" value="1.20"/>	Lift Correction	<input type="text"/>	0g			
			Binder %	<input type="text" value="0.00"/>			

Fig 38 - Screen-view: Home Screen Recipe Settings

7.2.1 Table: Run Test Button Text

State	Button Text
Idle	Run Test
Running a Test	Cancel Test
Test Complete	Clear Results

7.3 Pre-Test Requirements

When the 'Run Test' button is pressed the controller will make several checks on the state of the system, which must pass, before the controller will allow the test to start. The checks and errors that are reported if a check fails are listed in the table below.

7.3.1 Table: Pre Test Requirement Checks

Check	Error Message
Main Chamber heater power is ON	Main Chamber heater power is switched off
After burner heater power is ON	After Burner heater power is switched off
A recipe has been selected	Select recipe from library
Furnace door is closed	Test not started due to open door
Sample weight > zero	Enter Weights
Tray weight > zero	Enter Weights
Temperature setpoint is at the required test temperature	Recipe temperature setpoint is zero
Standard recipe calibration factor is > zero	Recipe Calibration Factor is zero
Door lock operates	Door has failed to lock

7.4 Displayed Data Updates

When the test starts the items displayed on the bottom half of Home screen will change from temperature data (see Fig 39.) to weight data (see Fig 40.). If a test is cancelled then the display reverts to the temperature data display. If a test completes normally the display remains showing the weight data until the operator presses Clear Results (ref. Table: Test Status).

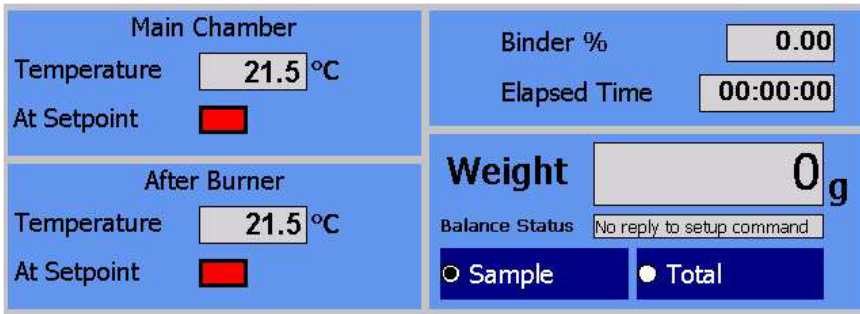


Fig 39 - Screen-view: Pre-test Display



Fig 40 - Screen-view: In-test Display

During a test the controller will continuously update the values circled in green, shown in Fig 38.


The values circled in red are updated every 30 seconds after the initial delay time + constant weight time has elapsed. For example, if the initial delay time is set to 10 minutes in the recipe and constant weight time is set to 3 minutes, then the values will be updated after 13 minutes and then every 30 seconds until the end of the test. These values indicate the weight loss during previous 'x' minutes, where 'x' is the constant weight time. If the recipe type is 'calibration', the calibration factor, circled in yellow, will be updated on test completion and if the recipe type is 'standard' then the binder %, circled in blue, will be updated on test completion. If a calibration recipe has been selected then its name will be preceded by a tilde '~' in the recipe name field. The recipe names use the same indicator in the recipe library.

The 'Test Status' field has the possible states shown in the table below.

7.4.1 Table: Test Status

Test Status Text	Conditions
In Progress (delay)	Test operating during initial delay time
In Progress	Test operating after initial delay time
Complete	Test completed normally
Cancelled	Test cancelled by operator

7.5 Power Failure During Test

	<p>The door remains locked after a power failure. The key switch can be used to override the lock, but this feature is not recommended because of danger to the operator.</p>
---	---

Note that when power returns the display shows a message to indicate the power was interrupted during a test, see Fig 41. The test will re-start automatically, once the control software has started. The test results should be discarded.

If the sample temperature within the chamber is under 120 °C, or if there is no sample present in the chamber, then it is permissible to immediately cancel the test using the procedure given in section 7.7.

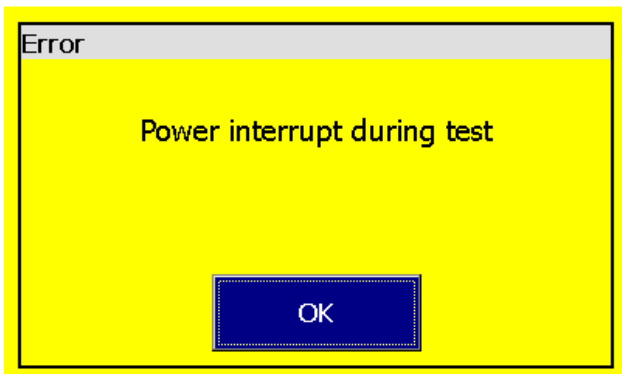


Fig 41 - Screen-view: Power Interrupt During Test Warning

7.6 End of Test Trigger

The end of the test is determined by the three recipe parameters, see Fig 42. The system can be set to use either Min % Weight Change or Constant Mass Limit; Fig 42. shows the example where Constant Mass Limit has been selected. For a test to end, the weight variation must be less than or equal to the set limit during the period defined by Constant Weight Time.

Note; the monitoring for the end of test conditions being met will not start until the Initial Delay Time, defined in the recipe, has expired. This setting has a range from 0 to 60 minutes.

In ASTM D6307-10, the end of test is defined as when the change in weight of the sample does not exceed 0.01% of the initial sample weight. In standard BS / EN 12697-39:2004 it is defined as a constant mass limit, in grams rather than per cent, with different values for different aggregate sizes.

When the end of test has been reached an audible alarm will sound every ten seconds and a message dialog box will appear allowing the operator to cancel the beeper. The door will automatically be unlocked. The final results will be printed out and saved to the Test Results log file (refer to the section 15.0 for more details).



Fig 42 - Screen-view: Test End Parameters

7.7 Cancelling a Test

	<p>A test can be cancelled by pressing the 'Cancel Test' button, shown in the 'In Test Display' screen (see Fig 38). A pass number must then be entered.</p>
---	--

The pass number should be communicated only to authorised operators: this is a safety feature because of the danger of opening the door part way through a test (the operator should know the danger: others may not). The password is fixed at 728.

It is safe to cancel a test by this method if there is no sample in the chamber (e.g. if a 'test' has been started by accident), or if the sample temperature is less than 120 °C. At other times it is not safe to cancel a test and the test should be allowed to go to completion even if the results are not required.

7.8 Weight Entry

The 'Weight Entry Screen' is accessed directly from the Home screen using the 'Enter Weights' button (see Fig 43.). Weight entry for the tray and sample can be entered manually or automatically using an external balance. Weights must be entered before attempting to run a test.



Fig 43 - Screen-view: Weight Entry Screen

7.9 Connecting an Adam Equipment™ External Balance

Automatic weight entry requires an external balance to be connected to the 9 way female D-type connector mounted at the rear of the furnace. To connect to an Adam Equipment™ balance, use a 9 way, null modem, female to male cable. The required pin connections are 2-3, 3-2, 5-5, all other pins are unused. The external balance type must be set to Adam Equipment in the 'General Settings' screen (see Fig 45.).

The balance settings are shown below:

Baud Rate	9600
Parity	None
Stop Bits	1
Number of Bits	8

Refer to the Adam Equipment balance user manual for instructions on setting these parameters.

7.10 Connecting an Ohaus Explorer™ External Balance

This section refers to the Ohaus Explorer balance with a membrane key pad and monochrome display.

The external balance type must be set to Ohaus Explorer™ in the General Settings screen (see Fig 45.).

To connect an Ohaus Explorer™ balance a non-standard RS232 cable with the connections shown in Fig 42. must be used. The cable connects the balance to the 9 way female D-type connector at the rear of the furnace.

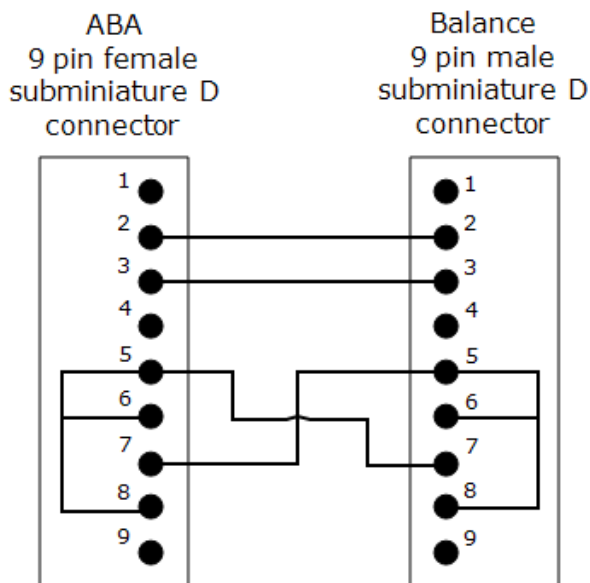


Fig 44 - Ohaus Explorer Serial Cable Connections

The balance settings are shown in the table below.

7.10.1 Table: Ohaus Balance Settings

Auto Print	Off
Print Internal	Off
Numeric Data	Off
Units: Gram (g)	On
Baud Rate	9600
Parity	None
Data Bits	8
Stop Bits	1

7.11 Connecting an Ohaus Explorer Pro™ External Balance

This section refers to the Ohaus balance with a colour touch screen interface.

The external balance type must be set to Ohaus Explorer™ in the 'General Settings' screen (see Fig 45.).

A standard straight through RS232 cable is used to connect the balance to the 9 way female RS232 connector at the rear of the furnace.

The balance settings are shown in Table: Ohaus Balance Settings in the previous section (same settings as for Ohaus Explorer).

7.12 External Balance Configuration

The external balance type must be configured in the 'General Settings' screen (see Fig 45.).

This screen is accessed via:

Home Screen → Main Menu → System Configuration → General Settings



Fig 45 - Screen-view: External Balance Type Configuration

When the Enter Weights button is pressed, the controller will attempt to communicate with an external balance. If it successful then external balance status on the Weight Entry screen will read 'Ready' (see Fig 43.). If it fails then 'No reply to weight request' will be displayed. To retry the connection, return to the Home screen and then press 'Enter Weights' again. If a successful connection is made then 'Ready' will be displayed.

7.13 Entering Weights

To enter weights just two weights are required, the third weight will be calculated. There is no specific order required. If using automatic weight entry, just place the item to be weighed on the external balance and press either 'Get Tray Weight', 'Get Combined Weight' or 'Get Sample Weight' as appropriate. The relevant weight will appear opposite the button.

To manually enter weights, press the white box for the required weight and the number pad will be displayed as shown in Fig 46.

Note; the top of the number pad indicates the item requiring a weight with the units and the maximum and minimum weight range.

Weights can be re-entered at any time by pressing the white box again. Also the 'Clear Weights' button can be used at any time. Once the weights have been entered the 'back' button changes from a yellow arrow to a green tick (compare Fig 43 with Fig 47). Pressing the green tick causes the Home screen to be displayed, with the newly entered weights shown in the top right quarter of the screen. If the 'Enter Weights' button is pressed again then the current weight readings will be displayed on the Weight Entry screen, allowing the operator to amend just one or more values either manually or automatically.

Tray Weight (grams)
 Max = 10000 Min = 0

0

Backspace		Clear	
7	8	9	Cancel
4	5	6	
1	2	3	Enter
0	.		

Fig 46 - Screen-view: Weight Entry Number Pad

14/12/2011 16:34:13 Weight Entry Door Locked Door Open



Manual Entry		External Balance	
Tray Weight	3996.0 g	<input type="button" value="Get Tray Weight"/>	
Combined Weight	5996.0 g	<input type="button" value="Get Combined Weight"/>	
Sample Weight	2000.0 g	<input type="button" value="Get Sample Weight"/>	
<input type="button" value="Clear Weights"/>			
External Balance Status	Ready		

Fig 47 - Screen-view: Successful Weight Entry

7.14 Weight Entry Error Checking

There is some basic built in error checking in the weight entry processing for both manual and automatic entry methods. If the combined weight entered is less than or equal to the tray weight then the error message shown in Fig 48. pops up.

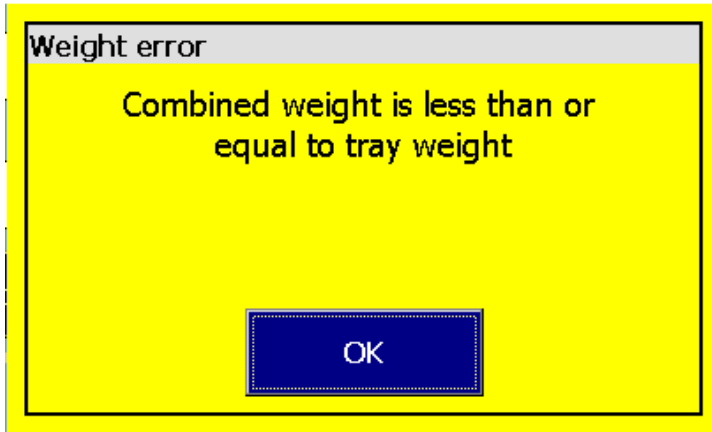


Fig 48 - Screen-view: Weight Entry Error Message

8.0 Tray Lift Calculation

8.1 Lift Correction

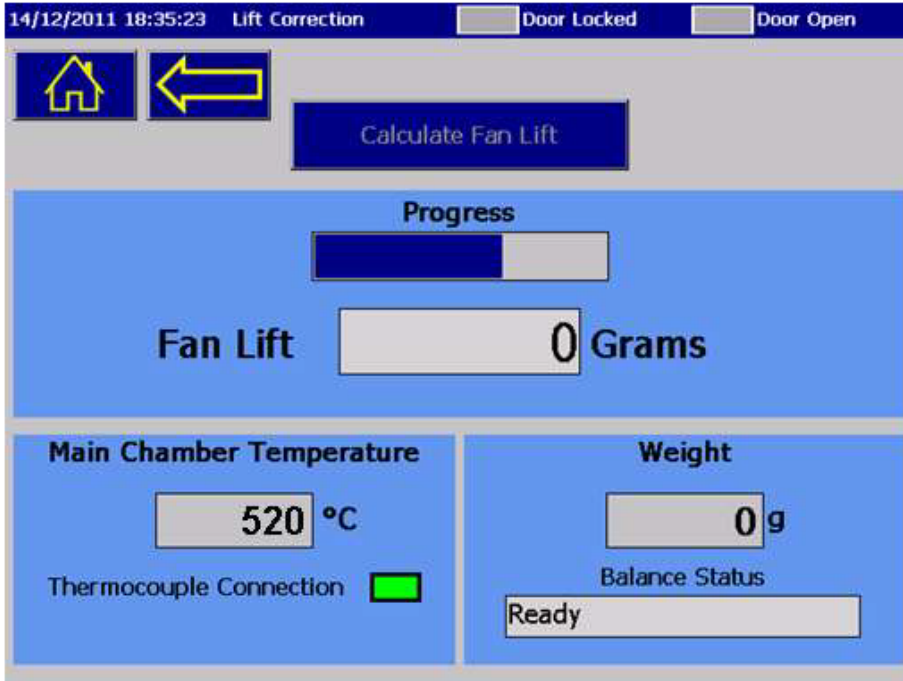


Fig 49 - Screen-view: Tray Lift Correction - In Progress

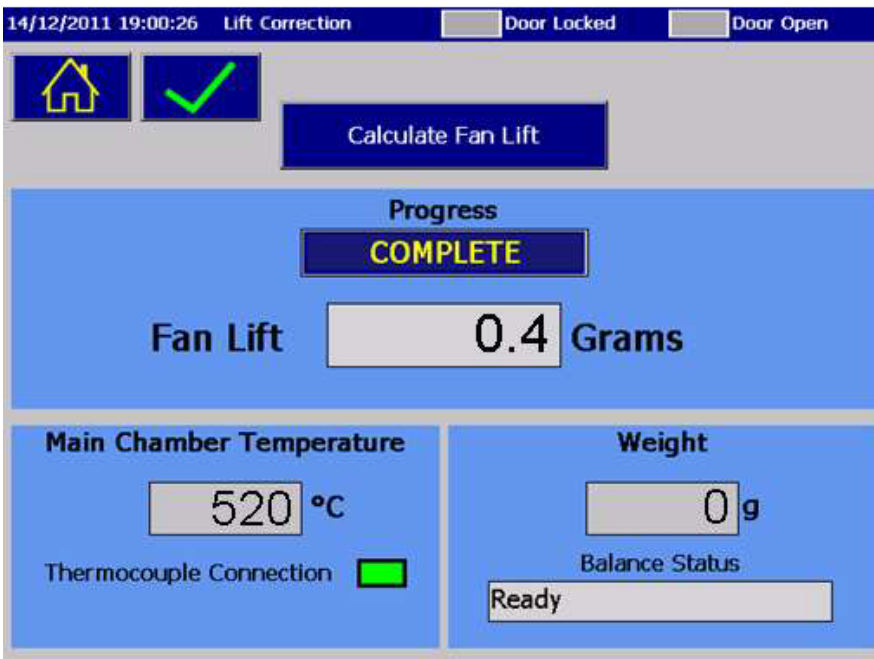


Fig 50 - Screen-view: Tray Lift Correction - Complete

Fig 49. and Fig 50. are accessed via:

Home Screen → Main Menu → Calculate Tray Lift.

The air flow through the chamber causes lifting of the sample tray and balance; the amount of lift should be measured after installation and should be checked from time to time.

Load the chamber with an empty sample basket assembly and catch tray, after it has reached its normal operating temperature (e.g. 500 °C). Allow the baskets to heat up for 10 minutes.

The main chamber temperature is displayed on the screen for convenience (see Fig 49.). If the temperature is below 100 °C and a calculation is attempted, an error message pops up.

When the Calculate Fan Lift button is pressed the ABA automatically performs the following sequence:

1. Stop the extractor fan
2. Tare the balance
3. Start the extractor fan
4. Wait for the system to stabilize
5. Take a weight measurement and store the result in flash memory
6. Stop the fan
7. Indicate the calculation is complete
8. Write a message to the Event Log

A progress bar shows the relative status of the calculation and when the procedure has finished the word Complete appears across the bar and the yellow back arrow changes to a green tick (see Fig 50.).

The calculation can be repeated as many times as required.

When a test is operated the lift correction factor will automatically be applied.

9.0 Access Levels

9.1 Setting Operator and Supervisor Access Levels

Selected buttons have user access configured at different levels. Access control is split into three levels: Configuration Level, Supervisor Level and Operator Level. Setting the access level for the Configuration and Supervisor levels is pass-number protected and is changed on the access control screen, see Fig 51.

Access Control Screen is accessed via:

Home Screen → Main Menu → Select Access Level.

The default pass code number for Supervisor Level = 2222 (see Fig 52.)

Supervisor and Operator access is controlled using a system configuration file which is held in the flash memory on the controller. Changes to this file can be requested and a new copy uploaded to the system from a USB memory stick. The default settings for this file are shown in the table below.

If an operator presses a button for which they do not have adequate privilege, then an 'Insufficient Privilege' message pops up.

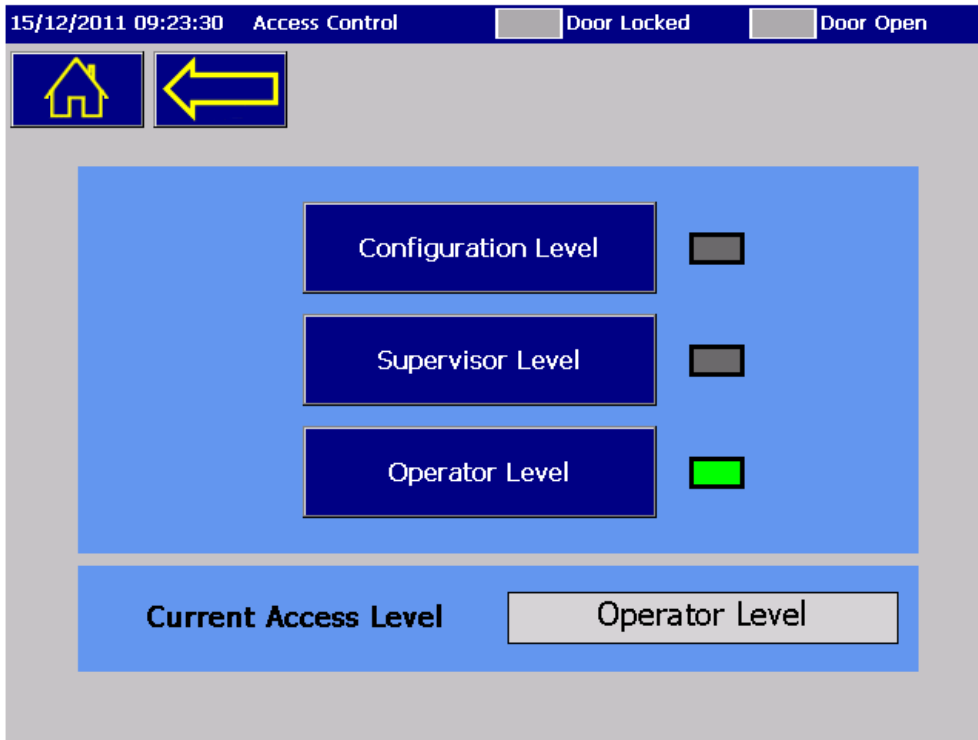


Fig 51 - Screen-view: Access Level Screen

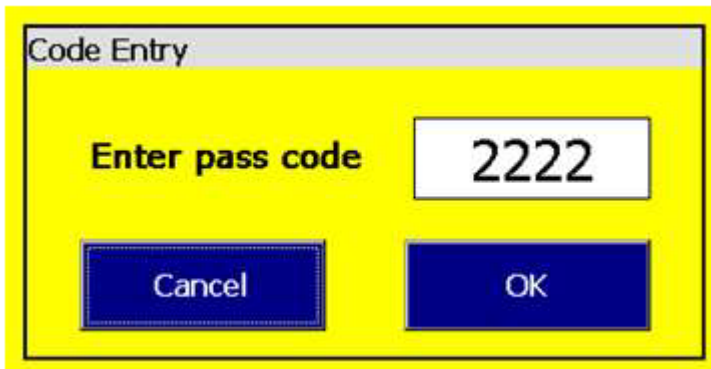


Fig 52 - Screen-view: Supervisor Pass Code Entry

9.1.1 Table - Access Level Settings for Buttons (default factory settings)

Button Name	Supervisor Access	Operator Access
After Burner Setpoint	N	N
Balance Menu	Y	N
Calculate Tray Lift	Y	N
Calibrate	Y	N
Cancel Test	Y	N

Button Name	Supervisor Access	Operator Access
Cleaning Setpoint	Y	N
Copy Configuration Settings	N	N
Copy Error Log Files	Y	Y
Copy Language	N	N
Copy Passwords	Y	Y
Copy Recipes	Y	Y
Copy Test Log Files	Y	Y
Diagnostics	N	N
Enter Weights	Y	Y
General Settings	Y	N
Language Settings	Y	Y
Load Access File	Y	Y
Load Passwords	Y	Y
Load Recipes	Y	N
Load Settings	N	N
Main Chamber Setpoint	Y	Y
Main Menu	Y	Y
New Calibration Recipe	Y	N
New Standard Recipe	Y	N
PID Settings	N	N
Print Settings	Y	N
Recipe Copy	Y	N
Recipe Delete	Y	N
Recipe Edit	Y	N
Recipe Run	Y	Y
Reset Hours of Use	N	N
Run Test	Y	Y
Save Recipe	Y	N
Set Date Time	Y	N
System Configuration	Y	Y
Tare	Y	Y
Temperature	Y	N
USB Data Transfer	Y	Y

Button Name	Supervisor Access	Operator Access
View Recipe Library	Y	Y
Voltage Settings	N	N

If a button is not listed in the above table, then it is accessible at all levels, e.g. the 'Select Access Level' button.

10.0 Temperature Control

10.1 Main Chamber & After Burner

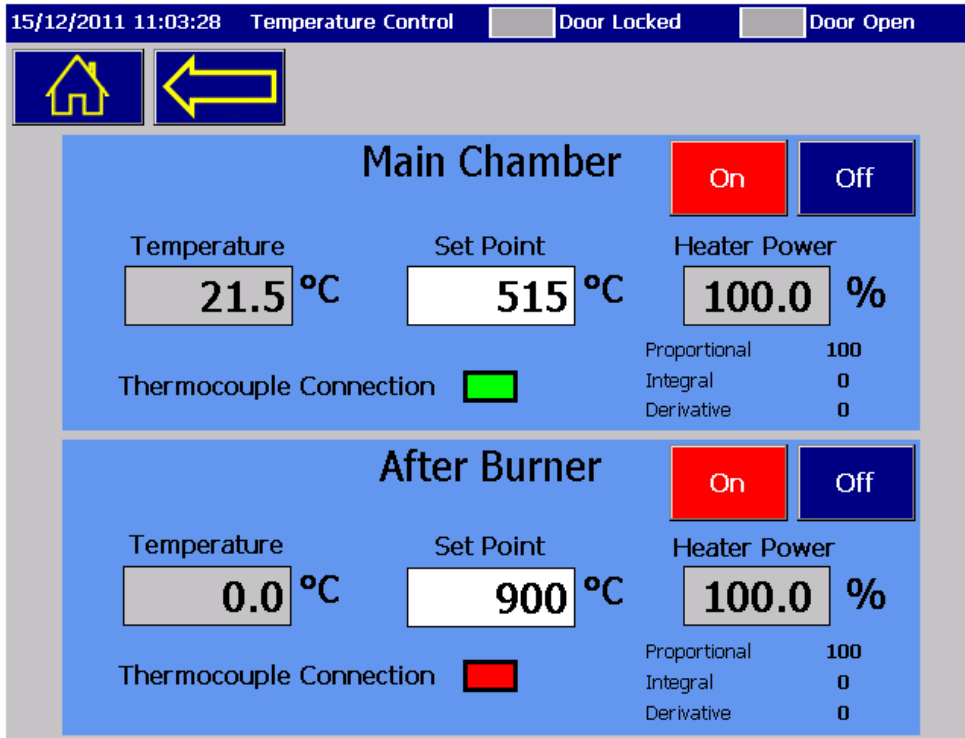


Fig 53 - Screen-view: Temperature Control Screen

Temperature control of the Main Chamber and After Burner is made using two independent PID control algorithms. The status of the control can be viewed on the Temperature Control screen (see Fig 53.).

Temperature Control Screen is accessed via:

Home Screen → Main Menu → Temperature

The temperature readings on the left of the screen show the current temperature of the chambers. If a thermocouple connection is broken then the LED colour is red, as shown for the after burner in Fig 53. If the connection is good, the LED is coloured green. The Main Chamber setpoint can be changed by pressing the white box, which will cause a number pad to pop-up. The After Burner setpoint is factory configured to be 900 °C. If a recipe is selected, (see section 7.2) then the Main Chamber temperature set in the recipe will show on this screen. The temperature setpoint can be changed during a test. The After Burner operating temperature is factory set and should not need to be changed.

The heater power percentages, on the right hand side of the screen, indicate the amount of power being applied to the electric heating elements. This is controlled by the PID algorithm.

The constituent elements of the PID control are also shown on the screen as Proportional, Integral and Derivative (see Fig 53.).

10.2 Heater On / Off Control

The heater power can be switched on or off at any time using the red and blue buttons on the right hand side of the screen (see Fig 54.). On system power up the on/ off status of the heater power is determined by an 'Initial Heater Setting' which is located on the General Settings screen (see Fig 54.).

General Settings Screen is accessed via:

Home Screen → Main Menu → System Configuration → General Settings

The factory default for this setting is 'off'. This ensures the furnace will not heat up after applying power for the first time during installation and hence protects any items that may still be packed inside the main chamber.



Fig 54 - Screen-view: General Settings

11.0 Setting the Date and Time

11.1 Date and Time Setting Screen

The date and time setting screen (see Fig 55.), is accessed via:

Home Screen → Main Menu → System Configuration → Set Date Time

To change a date or time element, press the relevant white box. This will open the number pad screen (see Fig 56.) and the relevant number can be adjusted accordingly.

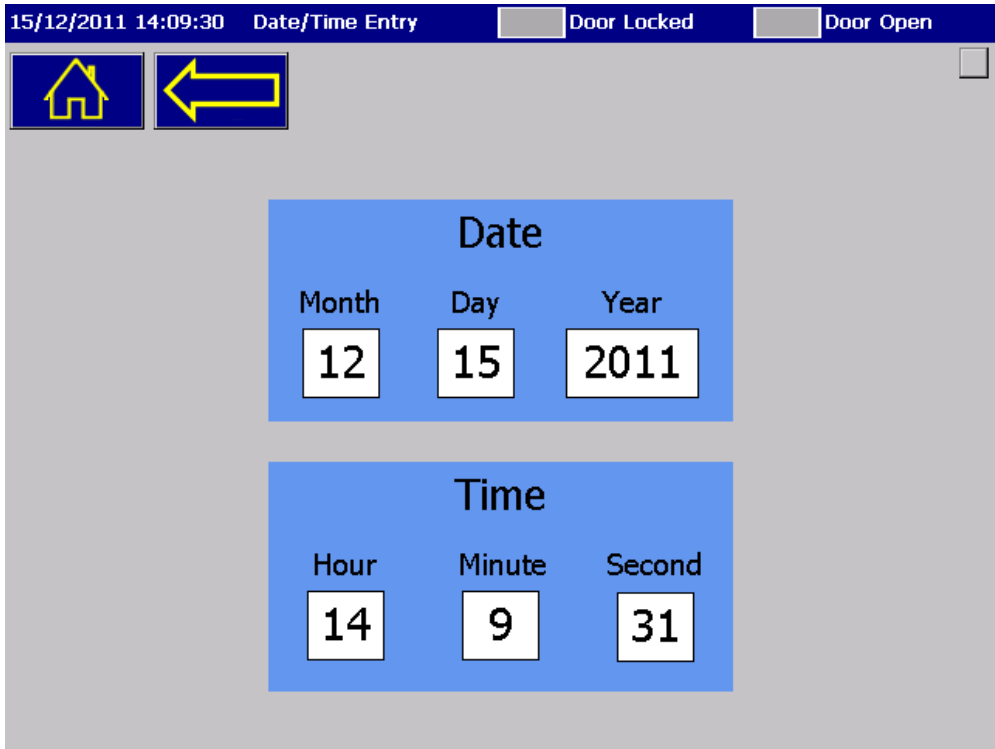
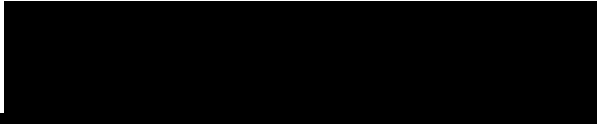


Fig 55 - Screen-view: Date and Time Setting Screen



Fig 56 - Screen-view: Date Time Number Pad

12.0 Printer Settings

12.1 Printer Setting Screen

The printer settings screen (see Fig 57.) is accessed via:

Home Screen → Main Menu → System Configuration → Print Settings

If the printer is not powered or disconnected from the controller (internal wiring) then the Printer Ready LED will be coloured red, otherwise this LED will be green.

Pressing the 'Printer Test' button causes the current date, time, temperatures and weight to be printed in English.

The 'English' and 'Current Selected Language' option allows the printer to be set to print in English if a 'local' language has been selected for the screen display. This is useful because the printer does not currently support Cyrillic and Kanji fonts.

Note: if the screen language is set to English and the printer is set to 'Current selected language', then printouts will be in English.

The Print Period setting controls the time interval between printouts during a test and can be configured to be from 30 to 300 seconds. If a recipe Print Format is configured as 'Full' (see Fig 58.), then the following information will be printed at the configured time interval:

- Date and Time
- Recipe Name
- Elapsed time since the start of the test (hh:mm:ss)
- Main Chamber temperature
- Sample weight
- Total weight loss
- Total percentage weight loss

If the recipe Print Format is configured as 'Final Result' then only the test start information and final test report will be printed.



Fig 57 - Screen-view: Printer Setting Screen

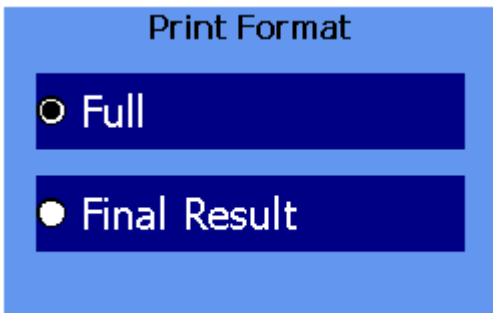


Fig 58 - Screen-view: Recipe Setting for Print Output

13.0 Recipe Library Functions

13.1 Recipe Library Screen

The Recipe Library screen (see Fig 59.), is accessed via:

Home Screen → Main Menu → View Recipe Library

If the list of recipes is empty then a new recipe will need to be created. Refer to the section 14.0 for how to create a new recipe. When the list of recipes is greater than 10 a scroll bar will appear on the right hand edge of the screen, see Fig 59. To perform any of the four operations: copy, edit, delete or run, on a recipe, touch the recipe name. This will cause it to be highlighted in dark blue, as shown for '~RCP1' in Fig 59.

Note: A recipe name preceded with the tilde character '~' is a calibration type recipe. Recipe type is determined at the point of creation and cannot be changed later.

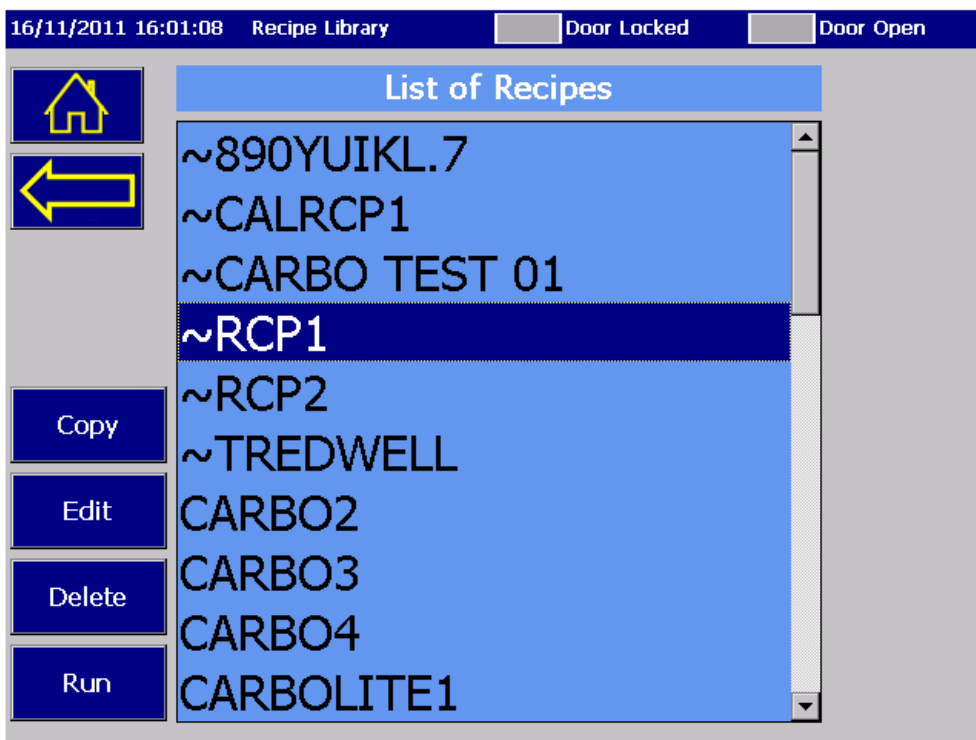


Fig 59 - Screen-view: Recipe Library

13.2 Copy Recipe

To copy a recipe, first select it by touching on the name, then press the copy button and this will cause the Alpha Pad to be displayed as shown in Fig 60. Type the new name and press 'Enter' which will return the display to the Library. If a recipe name is chosen that already exists a warning message pops up asking if the existing recipe should be overwritten. Press 'Cancel' to abort the copy operation or 'OK' to overwrite.

Note; if a configuration type recipe is being copied, the name will automatically be preceded by the tilde '~' character when it is displayed in the Library list.



Fig 60 - Screen-view: Cope Recipe Alpha Key Pad

13.3 Edit Recipe

To edit a recipe, first select it by touching on the name and then press the 'Edit' button. The recipe editor will be displayed and populated with the values from the selected recipe. Refer to the section 14.0 for details on the recipe editor.

13.4 Delete Recipe

To delete a recipe, first select it by touching on the name and then press the 'Delete' button shown in Fig 59. A confirmation dialog box will be displayed. Press 'OK' to continue deleting or 'Cancel' to stop the operation.

13.5 Run Recipe

To run a test with a recipe, first select it by touching on the name and then press the 'Run' button shown in Fig 59. The controller will display the Home screen, populated with the values from the selected recipe, ready for the operator to press the Run Test button to start the test (refer to 7.0 for more information on running a test).

Note; if a test has been previously run, then it will be necessary to press 'Clear Results' before being able to press 'Run Test' (refer to the table under section 7.0 for information on the button text).

14.0 Recipe Editor

A recipe is used to control the system behaviour during a test and allows for precise repeatability from one test to another.

14.1 Standard and Calibration Recipes

The recipe editor operates in two modes: Standard and Calibration. The items displayed on the recipe editor screen differ between the two modes and resultant recipe will result in different calculations being performed at the end of the test.

The key difference between the recipes is the standard recipe has Calibration Factor % and Calibration Format parameters, (see Fig 61.) and the Calibration recipe has a Binder Content % parameter, (see Fig 62.). The Calibration recipe is run with a sample where the binder content is known. This is zero for an aggregate only test. The final test result will give the calibration factor. This factor can then be used in standard recipes.

The standard recipe editor (see Fig 61.) is accessed via:

Home Screen → Main Menu → New Standard Recipe

The calibration recipe editor (see Fig 62.) is accessed via:



Home Screen → Main Menu → New Calibration Recipe

Also the recipe editor can be started from the Recipe Library screen (see Fig 61.), if the operator wishes to edit an existing recipe. The button sequence is:

Home Screen → Main Menu → View Recipe Library → <select required recipe> → Edit

Each new recipe, standard and calibration, is populated with some default values, as shown in Fig 61.

17/11/2011 17:07:56 Recipe Settings Door Locked Door Open



 

Recipe Name

<input checked="" type="radio"/> Min % Weight Change	<input type="text" value="0"/>	Print Format
<input checked="" type="radio"/> Constant Mass Limit	<input type="text" value="0"/>	
Constant Weight Time	<input type="text" value="3"/>	<input type="radio"/> Full
Initial Delay Time	<input type="text" value="10"/>	<input checked="" type="radio"/> Final Result
Temperature Setpoint	<input type="text" value="500"/>	Calibration Format
Calibration Factor %	<input type="text" value="0"/>	
		<input type="radio"/> Asphalt
		<input checked="" type="radio"/> Aggregate

Fig 61 - Screen-view: Standard Recipe

17/11/2011 17:10:57 Recipe Settings Door Locked Door Open

Recipe Name

<input checked="" type="radio"/> Min % Weight Change	<input type="text" value="0"/>	Print Format
<input checked="" type="radio"/> Constant Mass Limit	<input type="text" value="0"/>	
Constant Weight Time	<input type="text" value="3"/>	<input type="radio"/> Full
Initial Delay Time	<input type="text" value="10"/>	<input checked="" type="radio"/> Final Result
Temperature Setpoint	<input type="text" value="500"/>	
Binder Content %	<input type="text" value="0"/>	

Fig 62 - Calibration Recipe

14.2 Recipe Name

The recipe name is entered by touching the white box below the 'Recipe Name' label. The controller displays the Alpha pad (see Fig 60.), which allows a name, consisting of up to twenty characters, to be entered.

14.3 Save Recipe

The save button will save the recipe file to flash memory. If a recipe with the same name already exists then a warning dialog will be displayed asking the operator if they wish to overwrite or cancel, see Fig 63.

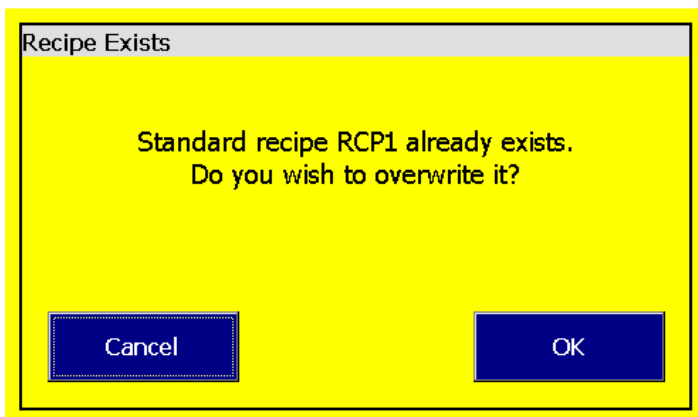


Fig 63 - Screen-view: Recipe Overwrite Warning Dialog

14.4 End Triggers

The functions of the Min % Weight Change, Constant Mass Limit and Constant Weight Time are described in section 7.6.

14.5 Initial Delay Time

The "Initial Delay Time" parameter is the time period, in minutes, from the start of the test to the point where the "End of Test" conditions are monitored. This prevents a false "End of Test" condition from being detected at the start of the test. When testing an aggregate to determine an aggregate only calibration factor the weight change may be so small that the trigger would cut in prematurely. The "Initial Delay Time" should be set to an extended time, say 40 minutes.

14.6 Temperature Setpoint

The temperature setpoint is the target temperature for the Main Chamber.

14.7 Print Format

The "Print Format" settings are described in section 12.0

14.8 Calibration Format

(Applicable only to standard recipes)

This setting, Asphalt or Aggregate selects which calculation is used to determine the binder content.

The Asphalt setting uses the British Standard calculation:

$$\text{Binder \%} = \text{Total Weight Loss \%} - \text{Calibration Factor}$$

The Aggregate option uses the following ASTM equation:

$$\text{Binder \%} = ((M1 - M2) / M1 \times 100) - \text{Calibration Factor}$$

Where:

M1 = total mass of sample prior to ignition

M2 = total mass of aggregate remaining after ignition

14.9 Calibration Factor

(Applicable only to standard recipes)

This value is obtained by operating a calibration recipe with a known sample.

14.10 Binder Content

(Applicable only to calibration recipes)

This is the percentage binder content of a known sample. This is zero for an aggregate only test.

15.0 Test Log Viewer

15.1 Test Log File

When a test is run the interim and final results are output to a test log file and the printer.

Note: if the Print Format in the recipe is set to Final Result, only the final results will be saved to the test log file and sent to printer.

The test log file is held in flash memory on the system and can be accessed via:

Home Screen → Main Menu → View Test Results

When selecting this, a list of test results is displayed, in date order, with the most recent test at the top of the list, as shown in Fig 64. A new test log file is created at the start of each day that tests are run and has the following naming convention: 'ABA_Test_Logyyyy-mmdd' where yyyy is the four digit year, mm is the month (1 to 12) and dd is the day (1 to 31). The number of log files held on the system is limited to 100. When the number of files held on the system reaches 100, the oldest file will automatically be deleted when a new one is created. The log files can also be copied to a USB memory stick, as described in "USB Memory Stick Data Transfer", and viewed on a PC, using a text editor such as Notepad.

To open a log file, first select a file by touching the one required in the list, then press Open File. The file contents are then displayed as shown in Fig 65, with the file name circled in green. The tests are displayed in chronological order with the most recent test being displayed at the top of the file. The current test number being viewed and the total number tests for the day are displayed, as can be seen circled in red in Fig 63. If more than one test has been run during the day, then a Next Test button is displayed, which, when pressed will navigate to the start of the next test. When the last test is reached, pressing the Next Test button will return the display to the top of the file. The scroll up and scroll down buttons can be pressed once to move incrementally through the file or can be held down to continuously scroll. The page up and page down buttons will jump by one screen.

The end of the file is marked by the text

```
` ***** END OF FILE ***** '
```

Pressing 'Close File' will return to the list of test files.

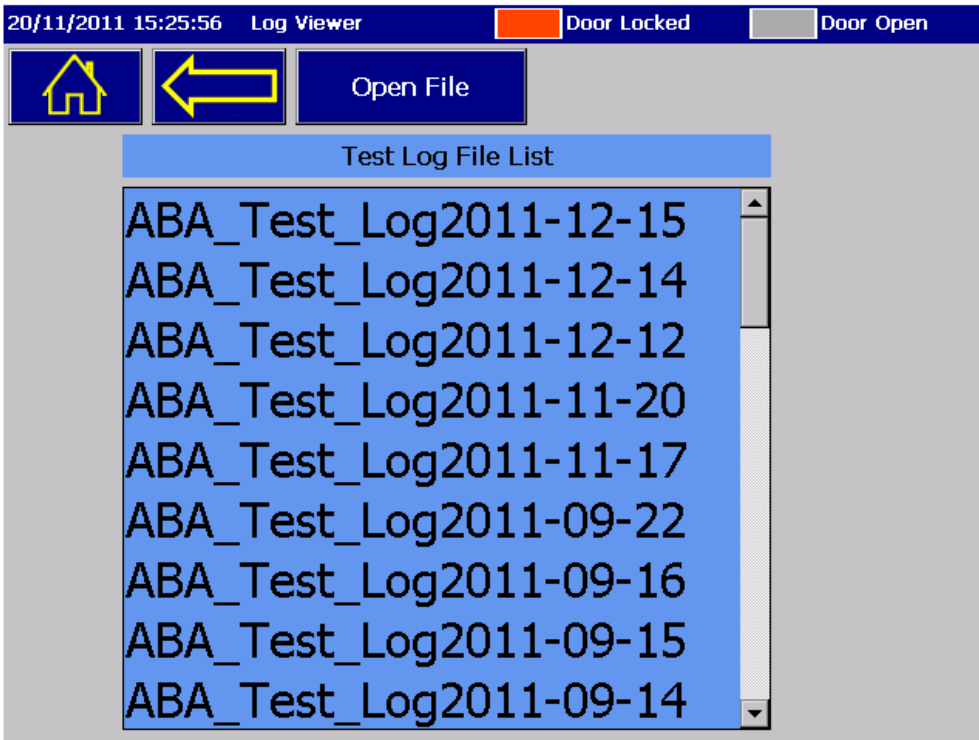


Fig 64 - Screen-view: Test Log Viewer - File List

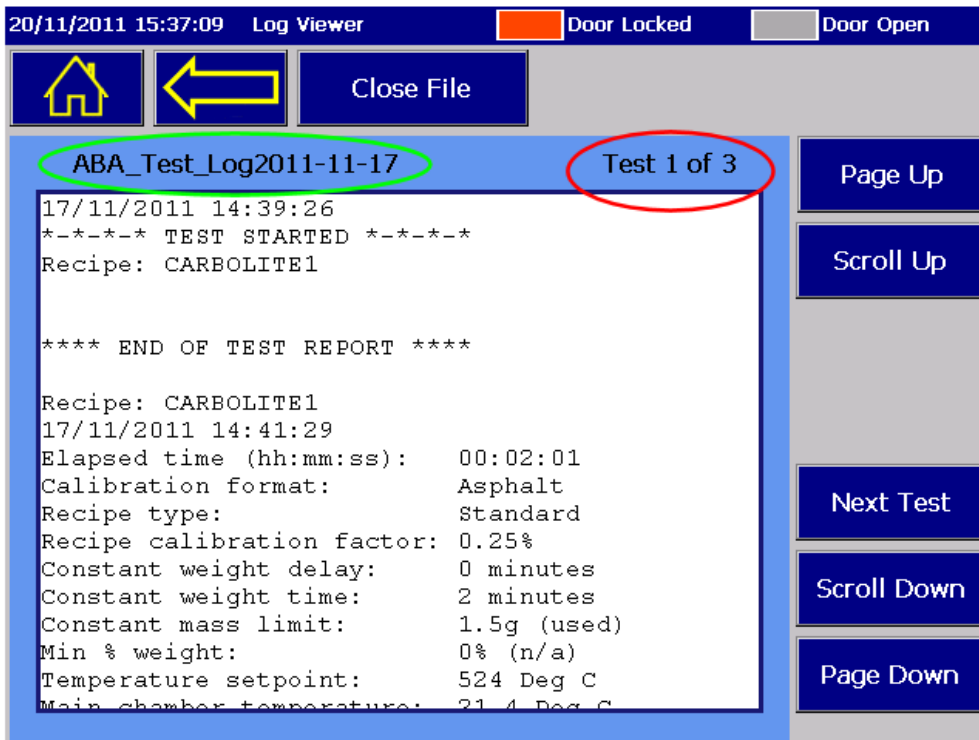


Fig 65 - Screen-view: Test Log Viewer - File Contents

16.0 USB Memory Stick Data Transfer

16.1 File Types and Copy Direction

The following data files can be copied from the controller to a USB memory stick:

- Test Log Files
- Event Log Files
- PID Configuration Settings
- General Configuration Settings
- Password File
- Recipe Files

The following data files can be copied from a USB memory stick to the controller:

- PID Configuration Settings
- General Configuration Settings
- Password File
- Recipe Files
- Language Files
- Access File

This data transfer system allows the operator to easily share recipe, access control and configuration files across multiple systems. It allows test results and event information to be stored and viewed on a PC. It provides a method for adding or updating new local languages.

The file details are listed in the table below.

16.1.1 Table: USB Files

File	Description	Reference
Test Log File	Contains test results	"Test Log Viewer"
Event Log File	Contains significant event information and time stamp, e.g. power up, tray lift calibration, access level change.	"Event Log Messages"
Password File	User access passwords.	"Access Levels"
Recipe File	Up to 100 recipe data files	"Recipe Editor"
Language Files	English/ Foreign Language translation	"Language Selection"
Access File	Access level definition file for selected buttons.	"Access Levels"

All of these are accessible using the 'Operator' access level with the default settings.

16.2 Screen Layout

The USB Data Transfer screen is found via:

Home Screen → Main Menu → USB Data Transfer

The screen is split into three tabs:

- Test / Event Logs
- Configuration / Recipes
- Language / Access

These tabs can be seen in Fig 66.

The colours of the LEDs on the USB Data Transfer screen, for different actions, are shown in table below.

16.2.1 Table: LED Colours

		LEDs and Colour		
Memory Stick Inserted	File Transfer in Progress	Memory Stick Detected	Copy Files	Safe to Remove Memory Stick
No	N/A	Grey	Grey	Grey
Yes	No	Green	Grey	Green
Yes	Yes	Green	Red	Red

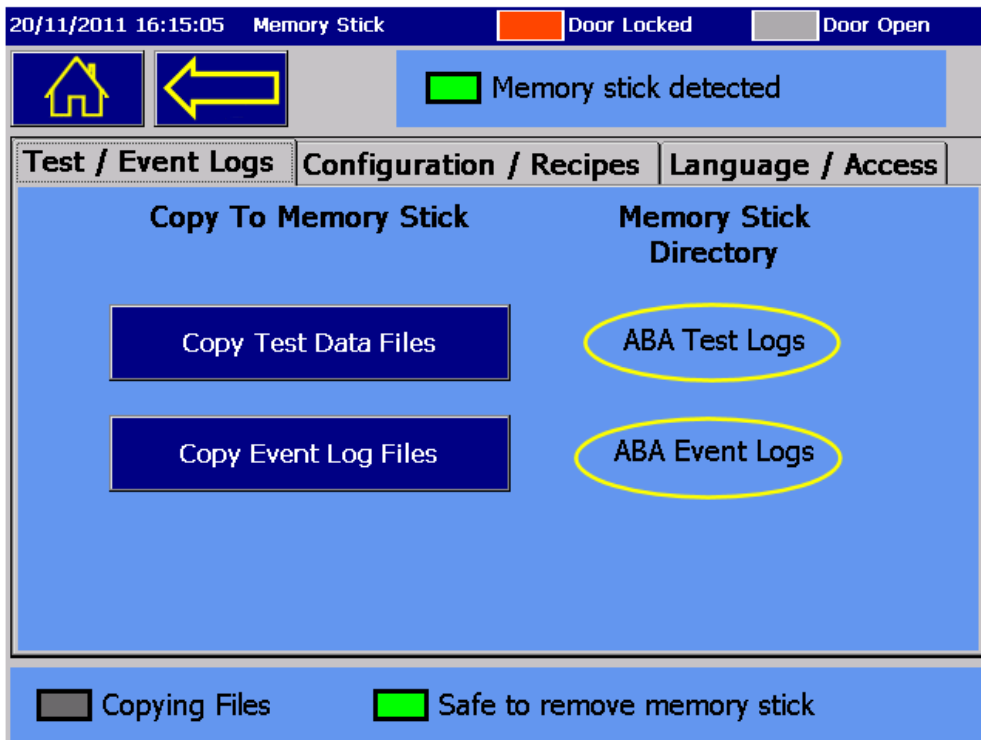


Fig 66 - USB Data Transfer - Test/ Event Log Tab

17.0 Internal Balance Commands

17.1 Balance Command Screen

The balance command screen is accessible via:

Home Screen → Main Menu → Balance Menu

The screen is shown in Fig 65. The balance commands are:

- Tare
- Calibrate
- Adjust Filter

If the balance is operating normally, then the balance status will display 'Ready'. If communication is lost between the balance and the controller, the balance status will display 'No reply to set up command' and the cable between the controller and balance should be checked.

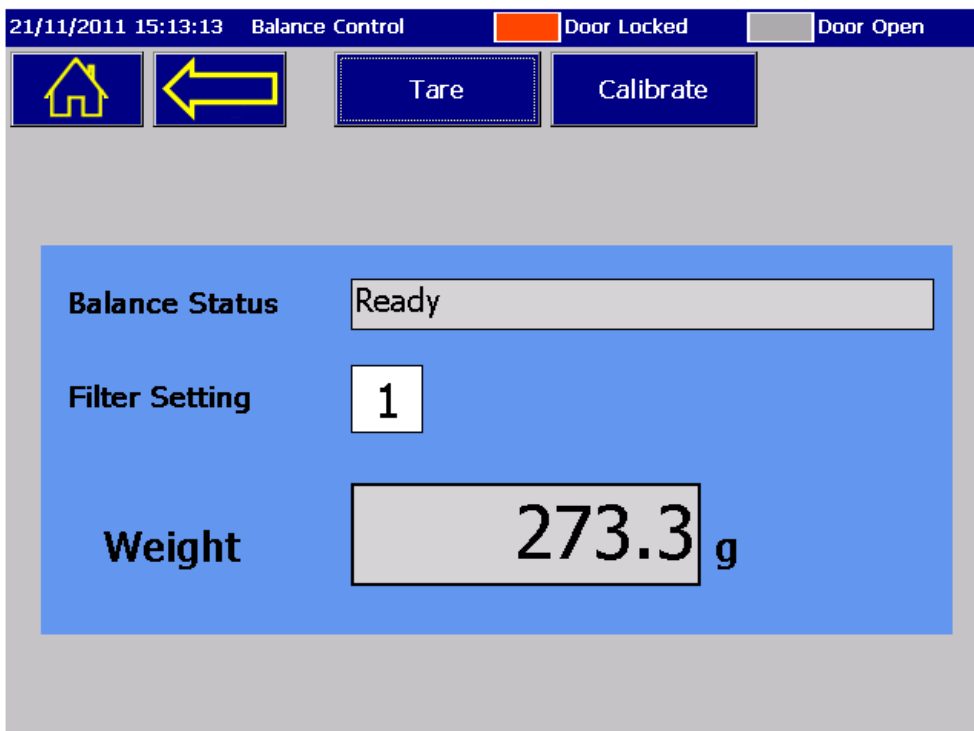


Fig 67 - Screen-view: Balance Control Screen - Idle

17.2 Tare Command

Pressing the tare button will zero the balance by sending a tare command to the balance. The balance status will display 'Tare started...' then 'Tare complete', for approximately 2 seconds before displaying 'Ready' again. The weight reading should read zero grams.

17.3 Calibrate

To calibrate the balance a 5 kg calibration mass is required. The balance must be calibrated after installation and if the equipment is moved it is also good working practice to check calibration periodically. This should be done with the chamber at room temperature and with the afterburner fan switched off. To start the calibration process, place the calibration plate (See Fig 8.) onto the balance extension press the calibrate button. The status message sequence for normal operation is:

- Clear pan then press Next
- Load 5 kg then press Next
- Calibration Complete

After pressing the calibration button the 'Next' and 'Cancel' buttons appear. 'Cancel' can be pressed at any time to abort the operation. These buttons can be seen in Fig 68.

NOTE: When loading 5 kg the weight reading will remain at zero, this is normal. After the calibration is complete the balance weight will read 5000 g, until the weight is removed.

NOTE: After calibration, remove the calibration plate. This will result in a negative weight value showing in the display. Restart the furnace using the main power switch in order to clear this value and commence normal operation.

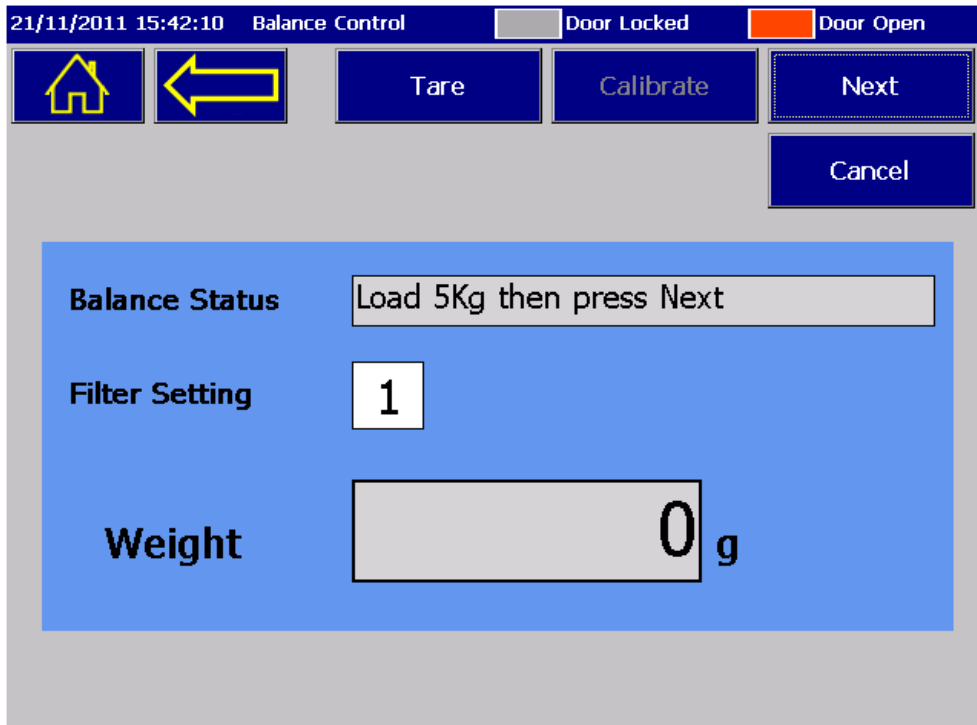


Fig 68 - Screen-view: Balance Control Screen - Calibration

17.4 Filter Setting

The white number box, next to Filter Setting screen label, can be touched to change the balance filter setting. The controller will display the number pad and a value from 1 to 3 can be entered. The effect of the filter numbers are explained below:

1 = minimal filter – fastest response (default setting after power up)

2 = medium filter

3 = maximum filter – slowest response

When a filter setting is changed the status will read 'Setting filter x' then 'Filter x set', followed by 'Ready', where x is the filter number being set.

18.0 Language Selection

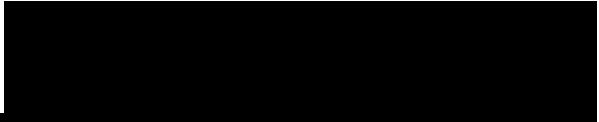
The screen can display text in different languages, provided the relevant language translation files have been loaded onto the controller. Also the test results (see section 15.0) will be stored in the selected language. The language selection screen is accessed via:

Home Screen → Main Menu → System Configuration → Language Setting

The screen is shown in Fig 69. with 'English' selected. To change a language, press the required button and if the language files are present, then a message will appear asking the operator to restart the system. This is necessary as the language translation is loaded during the initialisation process. If a language translation file is not present a warning message: 'Language files not loaded' will be displayed.



Fig 69 - Screen-view: Language Selection Screen



19.0 Reconfigure Voltage Settings For Alternative Electrical Supply

	Caution: Do not increase the power limit value to a value above the design level for the operating voltage as shown in the table below.
--	---

In the default configuration a 'Supervisor' level security access is required. The power limit is a feature which is used to match the heating elements to the supply voltage. If the voltage is stated at the time of order, no adjustment is necessary. Adjustment is required if the equipment is relocated to a different voltage power supply.

Adjustment of the power limit should not be made arbitrarily (for example 'to increase the power') - the heating elements could burn out, or heating could become slow.

The voltage setting screen, (Fig 70.) is accessed via:

Home Screen → Main Menu → System Configuration → Voltage Setting

The voltage setting can be changed by pressing one of the five selection buttons. The current setting is indicated by the green LED.

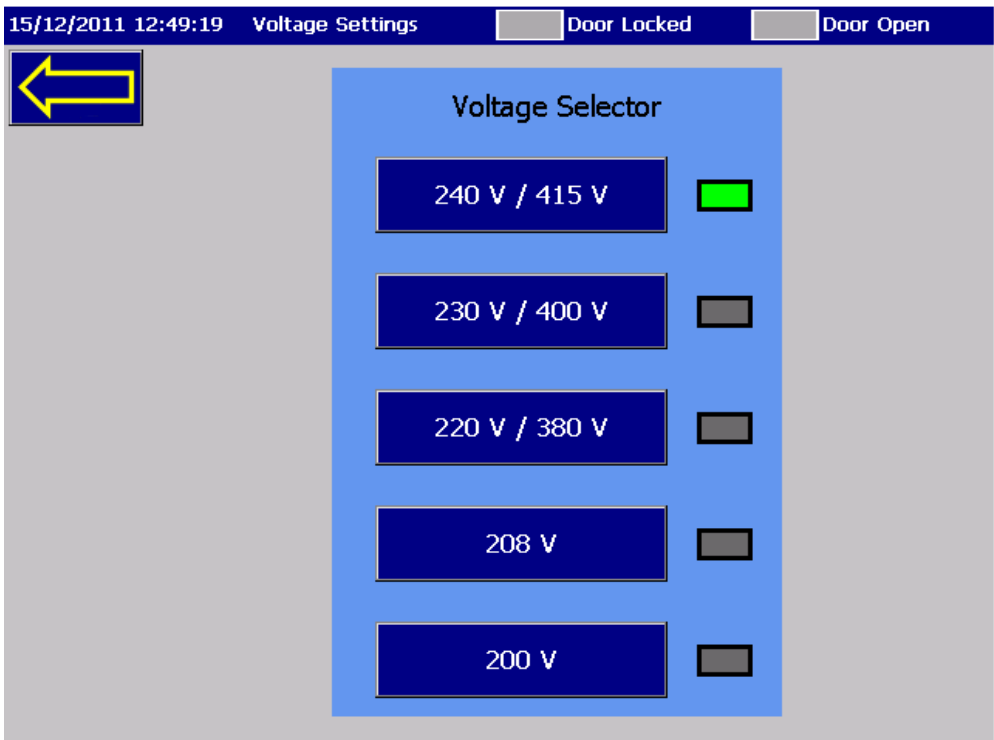


Fig 70 - Screen-view: Voltage Setting Screen

20.0 Temperature Calibration

After prolonged use the controller and/or thermocouple could require recalibration. This would be important for the process. A quick check using an independent thermocouple and temperature indicator should be made from time to time to determine whether full calibration is required.

20.1 Single Point Calibration

Single point calibration uses one offset value across the temperature range (see Fig 71.).

Home Screen → Main Menu → System Configuration → Temperature Calibration

Select "Single Point" Calibration.

In the "Temperature Point" box enter the temperature at which you want to apply your offset.

In the "Offset" box enter the offset value.

This offset will be applied across the respective temperature range.

The "Calibrated Temperature" box then will display the result of the offset at the selected "Temperature Point".

Select "Validate" and the temperature displays below the Validate button will show the "Non- Calibrated Temperature" and the calculated "Calibrated Temperature" of the current chamber temperature.

Once the required offset has been validated and the calibrated temperature is confirmed, then select the green tick at the top of the screen, the values will be accepted and the display will return to the System Configuration screen (see Fig 37.).

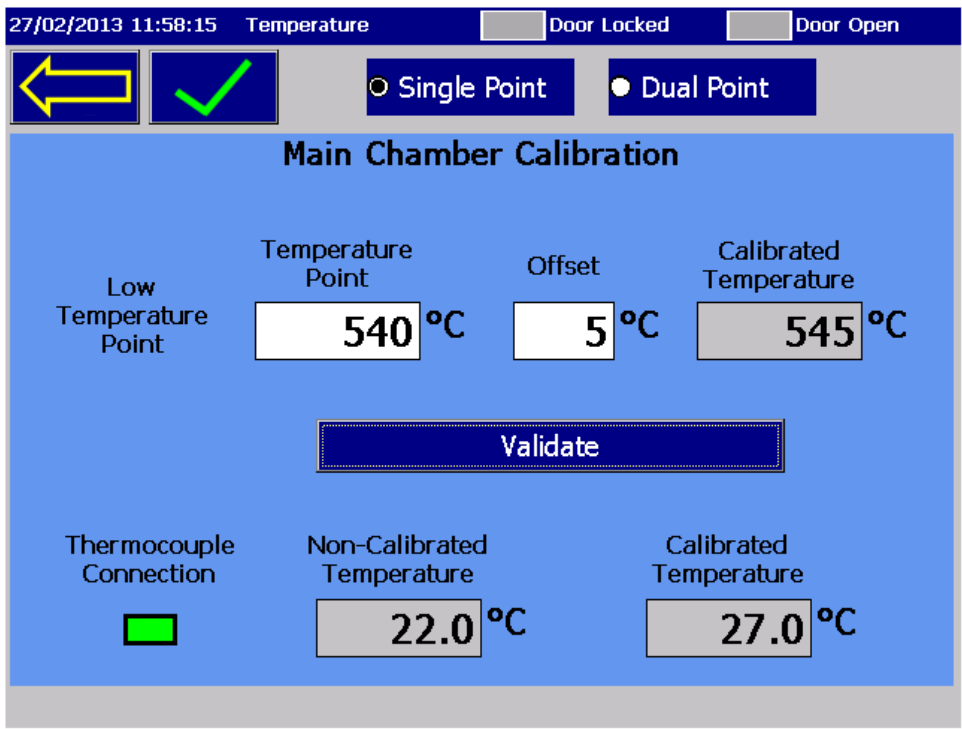
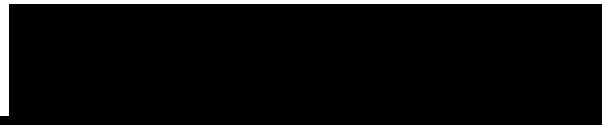


Fig 71 - Screen-view: Single Point Calibration

20.2 Dual Point Calibration

Dual Point Calibration uses two offset values and creates a linear temperature slope between the two values (see Fig 72.).

Home Screen → Main Menu → System Configuration → Temperature Calibration

Select "Dual Point" Calibration.

In the "Low Temperature Point" box enter the lower temperature at which you want to apply your offset.

In the "Offset" box enter the offset value for the low temperature point.

The "Calibrated Temperature" box will then display the result of the offset at the selected "Temperature Point"

In the "High Temperature Point" box enter the higher temperature at which you want to apply your offset.

In the "Offset" box enter the offset value for the high temperature point.

The "Calibrated Temperature" box will then display the result of the offset at the selected "Temperature Point"

Select "Validate" and the temperature displays below the Validate button will show the "Non- Calibrated Temperature" and calculated "Calibrated Temperature" of the current chamber temperature.

Once the required offset has been validated and the calibrated temperature is confirmed, then select the green tick at the top of the screen, the values will be accepted and the display will return to the System Configuration screen (see Fig 35.).

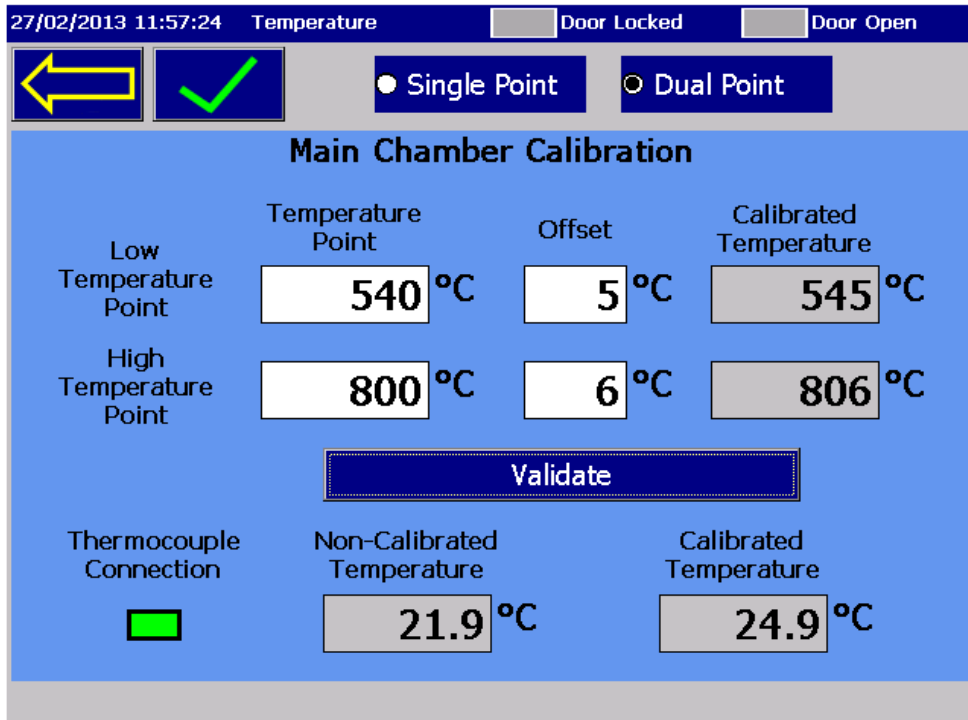


Fig 72 - Screen-view: Dual Point Calibration

21.0 Maintenance

21.1 General Maintenance

Preventive rather than reactive maintenance is recommended. The type and frequency depends on the product use; the following are recommended.














21.2 Maintenance Schedule


 CUSTOMER

 QUALIFIED PERSONNEL



DANGER! ELECTRIC SHOCK. Risk of fatal injury. Only electrically qualified personnel should attempt these maintenance procedures.

Maintenance Procedure	Method	Frequency				
		Daily	Weekly	Monthly	Bi-Annually	Annually
Safety						
Safety Switch Function	Set a safe temperature above ambient, and open the door to make sure the bottom two heater lights for the main chamber go out					
Safety Switch Function	With the mains supply to the furnace switched off, ensure that the door is locked					
Safety Switch Function	Electrical measurement 					
Safety Circuit Test Switch	Test the operation of the 'Electric Shock Warning Lights' by operating the 'Safety Circuit Test Switch' as described in this manual					
Door Plug	Visual inspection, checking the seal and whether it is free of damage					
Door Plug	Replacement where necessary					
Door Seal	Visual inspection - check for splits or fraying					
Door Seal	Replacement					
Chimney / Extraction	Check inside the plenum chamber as described in this manual, and clean if necessary					
Chimney / Extraction	Clean inside the plenum chamber, including carefully removing the build-up of debris in the blades of the extraction fan.					
Electrical Safety (external)	Visual check of external cables and plugs					
Electrical Safety (internal)	Physically check all connections and cleaning of the power plate area					

Function						
Temperature Calibration	Test using the calibration port fitted at the rear using certified equipment (frequency dependent on the standard required). Please contact Carbolite Gero Service if no port has been fitted					6
Operational Check	Check that all functions are working normally					
Operational Check	Thorough inspection and report incorporating a test of all functions					6
Performance						
Element Circuit	Electrical measurement 					6
Power Consumption	Measure the current drawn on each phase / circuit					6
Balance Pan Extension	Visually check to make sure the pan is level and undamaged. With an empty chamber, make sure the balance reading is stable					

21.2.1 Cleaning

Soot deposits may form inside the furnace, depending on the process. At appropriate intervals remove these by heating as indicated in the General Operation Notes.



The product's outer surface may be cleaned with a damp cloth. Do not allow water to enter the interior of the case or chamber. Do not clean with organic solvents.

21.3 After Sales Service

Carbolite Gero Service has a team of Service Engineers who can offer repair, calibration and preventive maintenance of furnace and oven products both at the Carbolite Gero factory and at customers' premises throughout the world. A telephone call or email often enables a fault to be diagnosed and the necessary parts to be despatched.

In all correspondence please quote the serial number and model type given on the rating label of the product. The serial number and model type are also given on the back of this manual when supplied with the product.

Carbolite Gero Service and Carbolite Gero contact information can be found on the back page of this manual.

If possible you should supply the software release version which is shown on the screen during the start-up sequence.

21.4 Cleaning and Hours of Use Monitoring

Soot can accumulate in the airway following the after-burner, giving rise to fire risk. There is a plenum chamber with removable panels to give access to cleaning; see section 21.5. The operator is responsible for maintaining a clean plenum chamber and also for regular cleaning of the chimney and the external flue or ducting system.

There is an hours of use screen which can be used to set the cleaning interval, which is the hours of use, after which a warning message will be displayed. The hours of use screen (see Fig 73.) is accessed via:

Home Screen → Main Menu → Hour of Use

Hours of Use screen (see Fig 73.), shows the total elapsed test time and provides a button, at the top of the screen, for resetting this value. To alter the cleaning interval, touch the white box and a number pad will be displayed with an input range from 0 to 9999 hours. When the total test time exceeds the cleaning interval the warning message will be displayed, as shown in the Cleaning Warning Message (see Fig 72.).

The message can be cleared by pressing OK and it will reappear every 10 minutes until the total test time is reset. To disable this facility the cleaning interval may be set to zero.

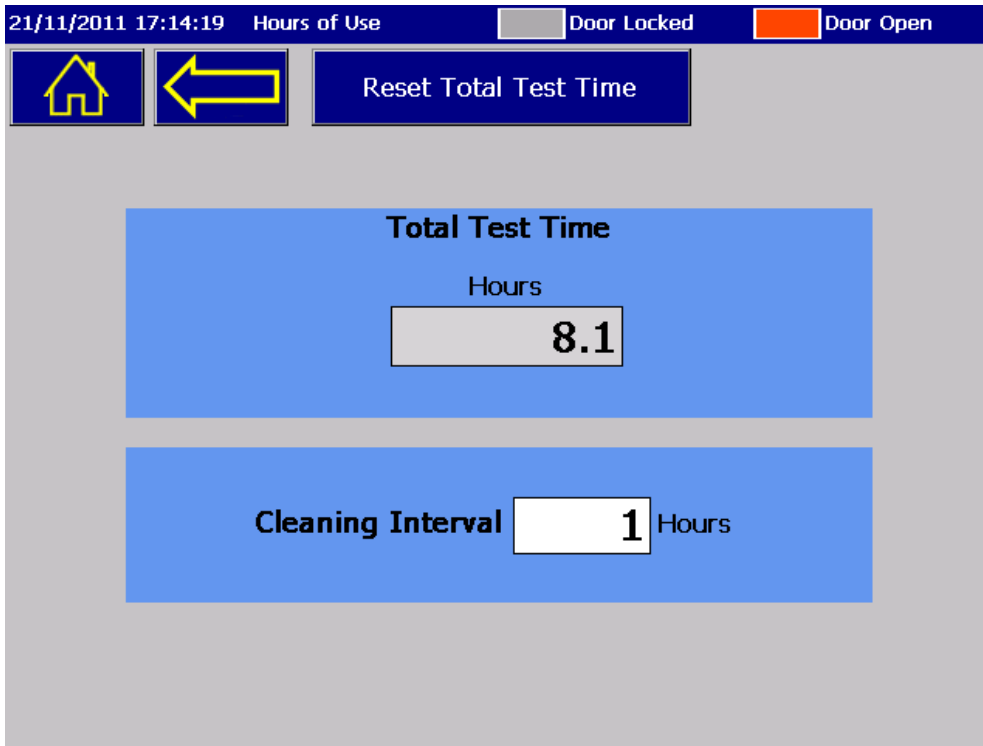


Fig 73 - Screen-view: Hours of Use

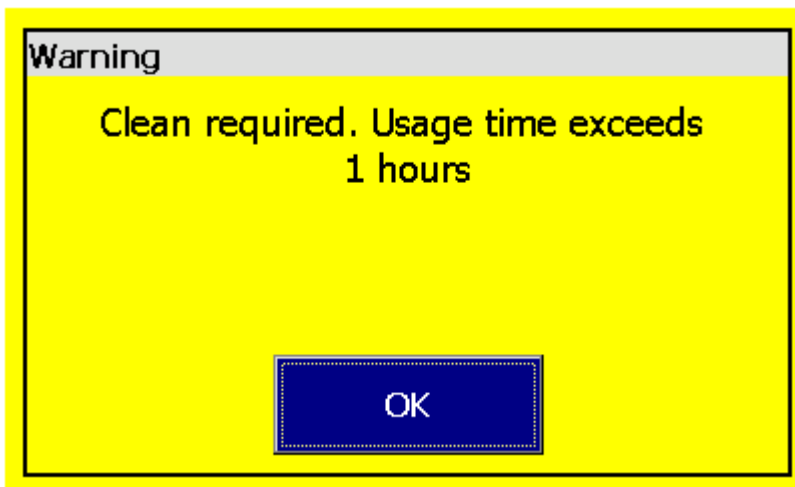


Fig 74 - Screen-view: Cleaning Warning Message

21.5 Cleaning the Plenum Chamber & Fan Impeller

Remove the upper side access panel and the cover of the plenum chamber (see Fig 75. and Fig 76.). Clean out all accumulated soot and debris using a vacuum cleaner. Also clean any accumulated soot and debris from the fan impeller located at the back of the plenum chamber. If the accumulation of soot on the impeller is significant, it may be necessary to remove the motor/ impeller assembly from the back of the plenum chamber to give good access for cleaning.

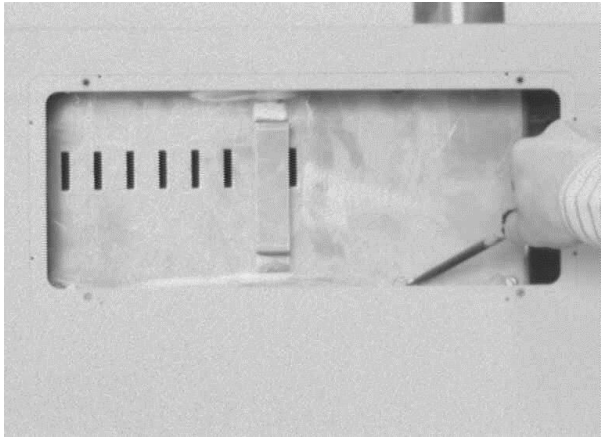


Fig 75 - Access to the Plenum Chamber

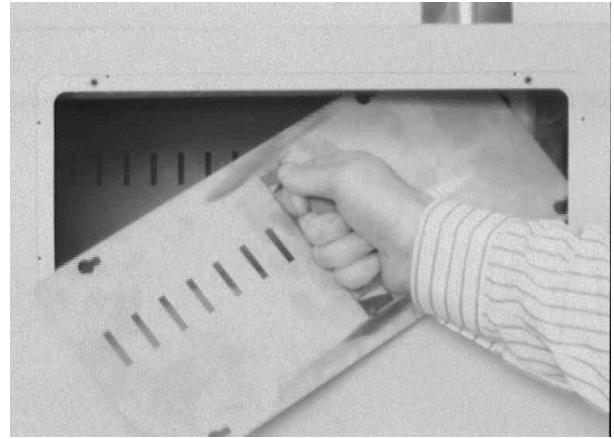


Fig 76 - Plenum Chamber Access Panel

21.6 Recommended Spare Parts and Spare Parts Kit

Carbolite Gero can supply individual spare parts or a kit of the items most likely to be required. Ordering a kit in advance can save time in the event of a breakdown.

Please consult Carbolite Gero's Sales Department for details of recommended spare parts.

22.0 Repairs and Replacements

22.1 Safety Warning - Disconnection from Power Supply



Immediately switch the product off in the event of unforeseen circumstances (e.g. large amount of smoke). Allow the product to return to room temperature before inspection.



Always ensure that the product is disconnected from the electrical supply before repair work is carried out.

Caution: Double pole/neutral fusing may be used in this product.

22.2 Safety Warning - Refractory Fibre Insulation



Insulation made from High Temperature Insulation Wool Refractory Ceramic Fibre, better known as (Alumina silicate wool - ASW).

This product contains **alumino silicate wool** products in its thermal insulation. These materials may be in the form of blanket or felt, formed board or shapes, slab or loose fill wool.

Typical use does not result in any significant level of airborne dust from these materials, but much higher levels may be encountered during maintenance or repair.

Whilst there is no evidence of any long term health hazards, it is strongly recommended that safety precautions are taken whenever the materials are handled.

Exposure to fibre dust may cause respiratory disease.

When handling the material, always use approved respiratory protection equipment (RPE-eg. FFP3), eye protection, gloves and long sleeved clothing.

Avoid breaking up waste material. Dispose of waste in sealed containers.

After handling, rinse exposed skin with water before washing gently with soap (not detergent). Wash work clothing separately.

Before commencing any major repairs it is recommended to make reference to the European Association representing the High Temperature Insulation Wool industry (www.ecfia.eu).

Further information can be provided on request. Alternatively, Carbolite Gero Service can quote for any repairs to be carried out either on site or at the Carbolite Gero factory.

22.3 Temperature Controller Replacement

Temperature control in both the main chamber and the after burner for this version of the ABA is managed by the central control unit. We would recommend that replacement of the central control unit is done by a Carbolite Gero authorised engineer.



Before handling the controller: wear an anti-static wrist strap or otherwise avoid any possibility of damage to the unit by static electricity. Refer to the detailed instructions supplied with the replacement controller.

22.4 Solid-state Relay Replacement



Disconnect the product from the power supply and remove the appropriate cover as given above.

1. Make a note of the wire connections to the solid state relay, then disconnect them.
2. Remove the solid state relay from the base panel or aluminium plate.
3. Replace and reconnect the solid state relay ensuring that the bottom of it has good thermal contact with the base panel or aluminium plate.
4. Replace the access panel.

22.5 Thermocouple Replacement



Disconnect the product from the power supply. Remove the appropriate panel to gain access to the thermocouple connections. Make a note of the thermocouple connections.

Thermocouple cable colour codings are:

Thermocouple leg	Colour
positive (type K)	green
negative	white

Disconnect the thermocouple from its terminal block and withdraw the thermocouple from its sheath by bending the metal tag or releasing the screw to release. It is also advisable to remove the sheath and shake out any broken pieces of thermocouple.

Re-assemble with a new thermocouple, observing the colour coding, ensuring that the thermocouple is not twisted as it is being inserted and that the metal tag is bent back to grip the sheath.

Refit the element access panel.

22.6 Element Replacement

If the elements should require replacement a complete insulation assembly or a new insulated chamber will be supplied.

22.7 Door Plug Replacement

Contact Carbolite Gero Service Department should this need replacing.

22.8 Catch Tray Straightening

The stresses caused by repeated heating and cooling can cause the catch tray (see Fig 2.) to distort, allowing the catch tray to rock in use, giving an unstable balance reading. The distortion takes the form of two opposite corners bending up and the other two opposite corners bending down.

Straighten the tray by resting the two lower corners on supports and pressing down on the higher corners. Repeat this operation until the tray is flat.

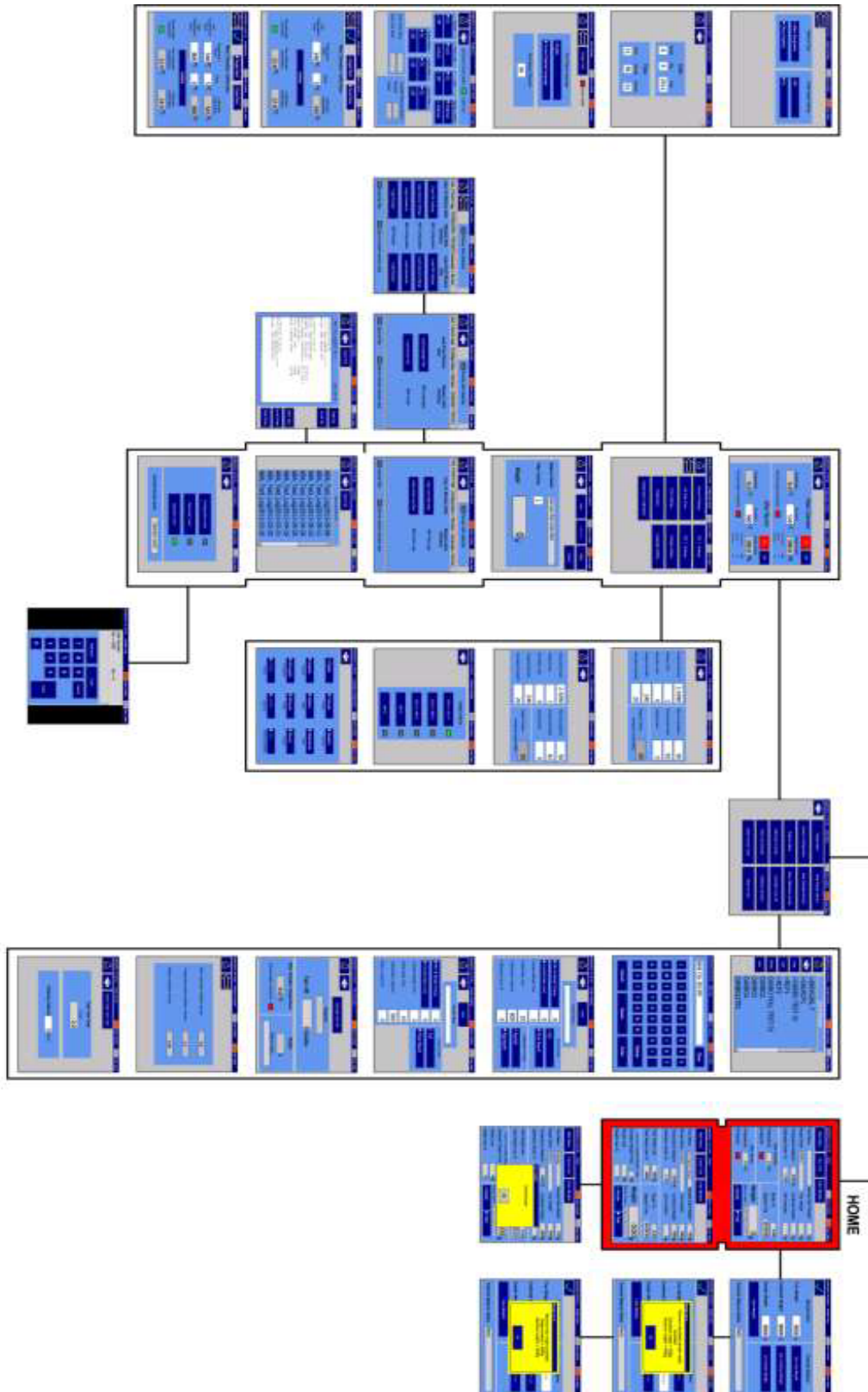
22.9 Consumables

Printer Paper: standard till roll paper 2¼' (57 mm) wide Carbolite Gero part number 22-222-356-0010.

Printer Ribbon: Epson ERC-09.

23.0 ABA 7/35B - Interface Layout

34 screens which are mapped out as shown below, the settings do not represent default values:



24.0 Event Log Messages

Significant events that occur during operation are recorded with a time stamp in an event log text file, which is stored in flash memory on the controller. A new event log file is created every day the system is used. The file name has the following format:

ABA_Event_Logyyyy-mm-dd.txt

Where yyyy is the four digit year, mm is the two digit month and dd is the day of the month.

E.g. ABA_Event_Log2011-03-24

The number of files held on the system is limited to 100. Upon reaching this limit, the oldest file will automatically be deleted.

The log files can be copied to a USB memory stick and opened on a PC using a text editor such as Notepad. This information can be used as an aid to diagnosing problems or used to find out when a change to the system configuration was made. Refer to section 16.0 for details on copying files to a USB memory stick.

The possible events that are written to the log file are:

- Power Up
- Supervisor access level set
- Operator access level set
- Configuration access level code changed
- Supervisor access level code changed
- Tare balance command
- Calibrate balance command
- Cancel calibrate command
- New weights entered:
 - Tray Weight = xxx.x
 - Combined Weight = xxx.x
 - Sample Weight = xxx.x
- Save recipe: overwriting existing recipe <recipe name>
- Overwriting existing recipe: <recipe name> with <recipe name>
- Copying recipe: <recipe name> to new recipe <recipe name>
- Deleted recipe: <recipe name>
- Fan lift calculation complete:
 - Fan life = x.xg
- Error initialising I/O Board comms. Code: xx
- Error setting I/O Board initial values. Code: xx
- Error communication with I/O Board. Code: xx
- Voltage settings changed to xx

An example of the log file contents is shown below:

Note: some internal wiring was disconnected to deliberately create the I/O board communication errors.

09:40:37 Power up
09:49:10 Configuration access level set
09:50:44 Save recipe: overwriting existing recipe CARBOLITE1
09:51:02 Tare balance command
09:56:03 New weights entered:
09:56:03 Tray Weight = 214.3
09:56:03 Combined Weight = 272.9
09:56:03 Sample Weight = 58.6
09:57:48 Tare balance command
09:58:43 New weights entered:
09:58:43 Tray Weight = 214.3
09:58:43 Combined Weight = 279.1
09:58:43 Sample Weight = 64.8
10:46:23 Error communicating with I/O Board. Code: 2
10:46:36 Error communicating with I/O Board. Code: 3
10:46:50 Error communicating with I/O Board. Code: 3
10:47:02 Error communicating with I/O Board. Code: 3
10:47:46 Power up
10:48:21 Error initialising I/O Board comms. Code: 11
10:48:23 PIC comms error
10:49:27 Power up
11:29:28 Configuration access level set
11:30:00 Overwriting existing recipe CARBO3 with CARBOLITE1
11:30:08 Deleted recipe: CARBO3
11:30:57 Save recipe: overwriting existing recipe CARBO4
11:32:15 Copying recipe CARBO4 to new recipe TT768
11:35:37 Save recipe: overwriting existing recipe TEST135
11:36:15 Voltage setting changed to 230 V / 400 V
11:45:33 Calibrate balance command
11:52:32 Cancel calibrate command

25.0 Software Versions

25.1 Software Applications

There are three software applications that control different elements of the system:

- Balance
- Temperature Control Board
- Main Controller (including user interface)

As the software for each of these elements can be changed independently, a software version number is reported for each one. These version numbers can be found via:

Home Screen → Main Menu → Software Versions

Fig 75. shows the software versions screen. On entering this screen a request is sent to both the balance and the temperature board to send their version numbers. If the balance is not connected then '000.00' will be displayed.

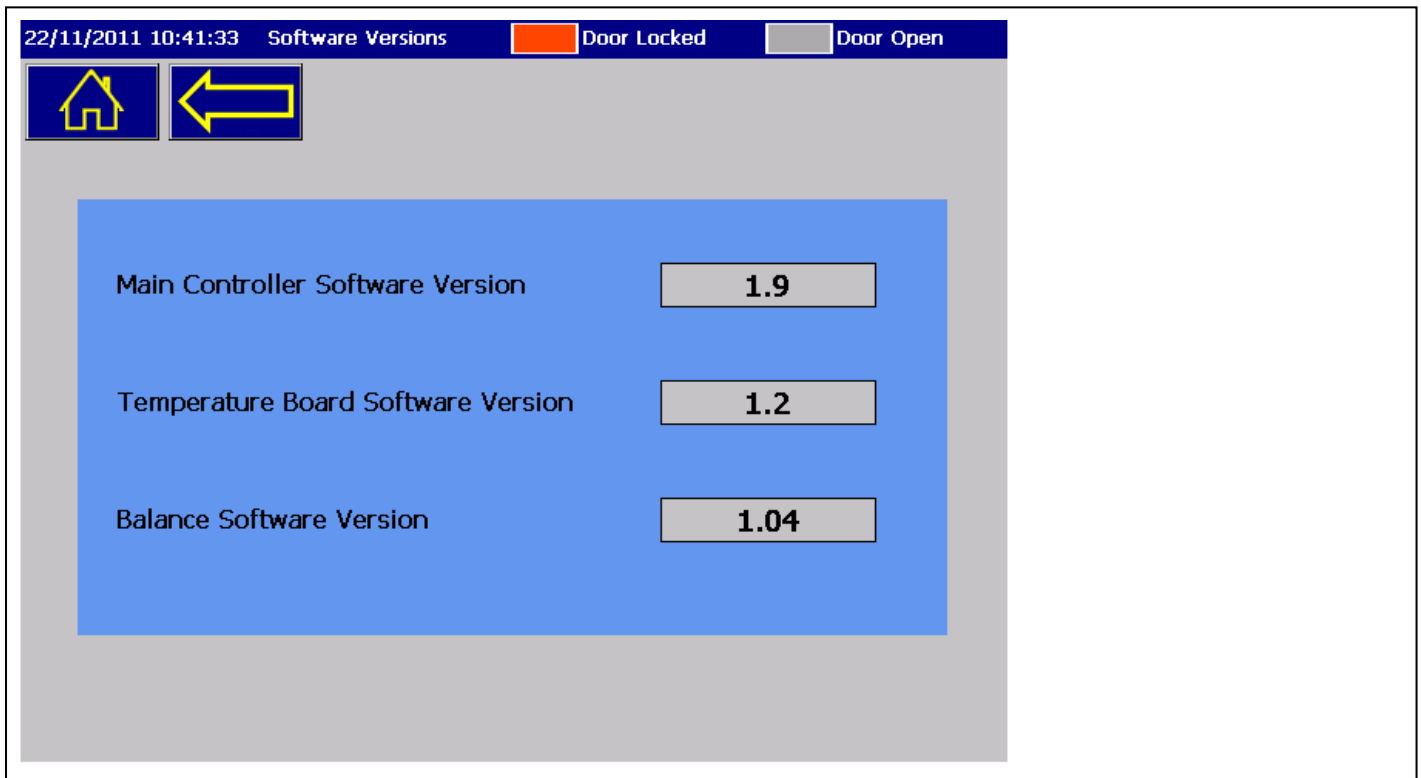


Fig 75 - Screen-view: Software Versions Screen

26.0 Diagnostics

26.1 Diagnostic Screen

There is a diagnostic screen which is accessible via:

Home Screen → Main Menu → System Configuration → Diagnostics

This screen is shown in Fig 76. The screen allows manual override of the following controls: buzzer, door lock, fan and balance switch.

Note: the balance switch in this case refers to a relay which switches the RS232 communication link between the internal and external balance.

This setting should not be left set to 'external' otherwise internal weight readings will be disabled. The 'spare' items shown on the screen are for possible future expansion. There is also a fault LED indicator, which turns red if there is an internal problem with the temperature control PCB. In the event of a fault, a fault code number may be displayed to the right of this LED. Under normal operation this LED should be green, as seen in Fig 76.

The door relay input indicates the state of the contacts within the door lock mechanism. If the door is open these contacts are open. This is also indicated by the 'Door Open' LED displayed on the status bar shown at the top of every screen.

The door lock input indicates the state of the lock feedback within the door lock mechanism. This is also indicated by the 'Door Locked' LED displayed on the status bar shown at the top of every screen.

The available memory refers to free memory in the main furnace controller.

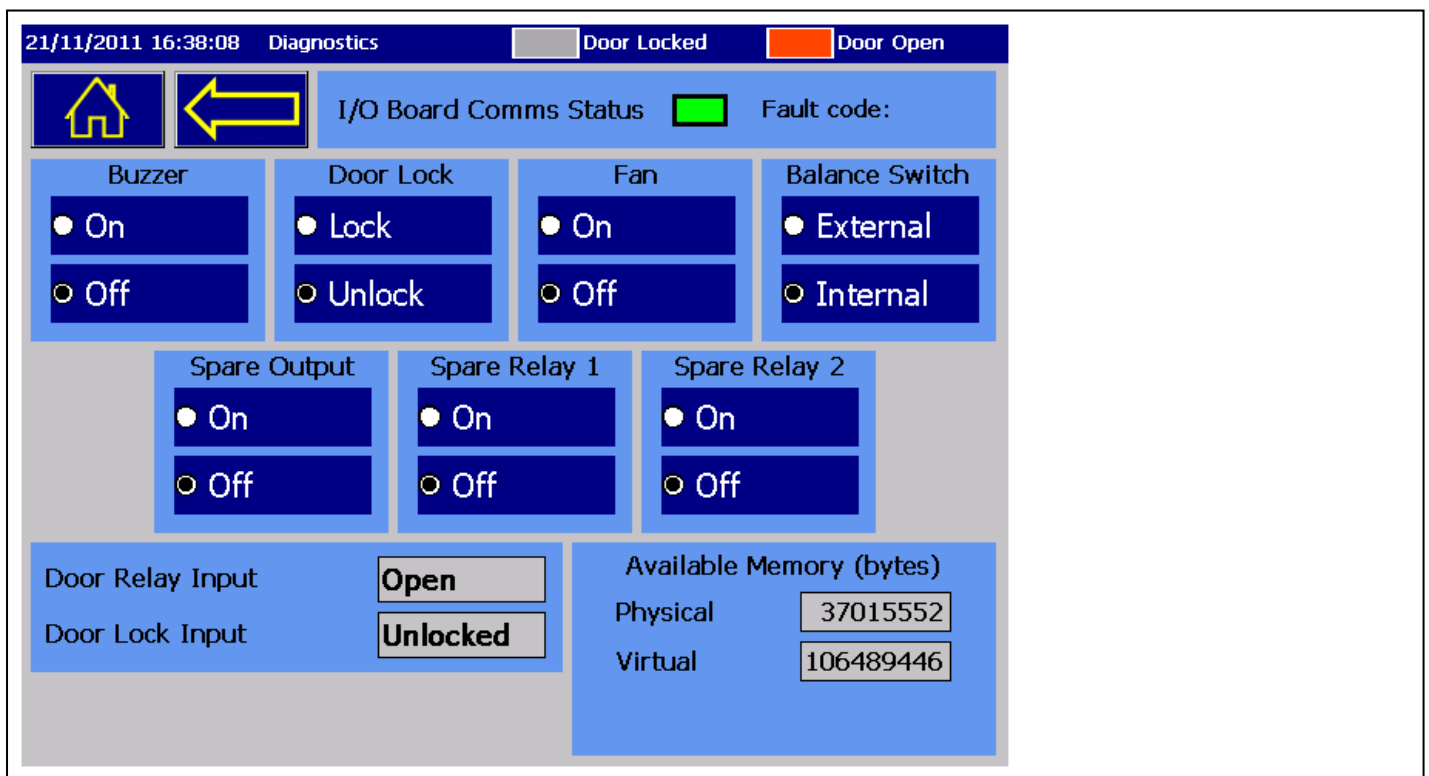


Fig 76 - Screen-view: Diagnostics Screen

27.0 Fault Finding



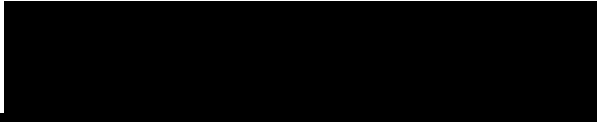
Disconnect the equipment from the electrical supply before carrying out any internal investigations.

A. The Furnace Main Chamber or After-burner Does Not Heat			
The Heat lamp(s) is/ are ON	▶	The heating elements may have failed	▶ Check also that the SSRs are working correctly
The Heat lamp(s) is/ are OFF	▶	The controller shows a zero temperature	▶ The thermocouple may have broken or may have a wiring fault
	▶	The controller shows a low temperature	▶ The door switch may be faulty
			▶ A relay may be faulty
			▶ The SSR could be failing to switch on due to internal failure, faulty logic wiring from the controller or faulty controller
	▶	The controller is not illuminated	▶ Check the supply fuses and any fuses in the control compartment
		▶ The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault	

B. The Main Chamber or After-burner is Slow to Heat Up			
One of the Heat lamps does not light	▶	A fuse may have blown	▶ Check the supply fuses
The heat lamps all light up	▶	An element may have failed	▶ Check that the SSRs are working correctly

C. Furnace Overheats

The heated lamps never turn off	▶	The controller shows a very high temperature	▶	The controller may be faulty
	▶	The controller shows a low temperature	▶	The thermocouple may have been shorted out or may have been moved out of the heating chamber
			▶	The thermocouple may be connected the wrong way round
			▶	The controller may be faulty
The heat lamp(s) remain on when the controller is off	▶	The SSR has failed 'ON'	▶	Check for an accidental wiring fault which could have overloaded the SSR
A temperature that is higher than the setpoint is shown during the test	▶	No fault. Burning bitumen causes the temperature to increase above the setpoint. This is normal.		

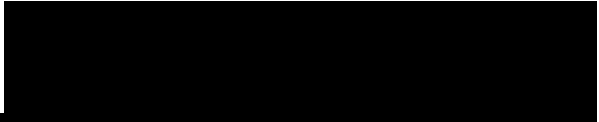


D. Warning Lamp & Door Faults			
Red Electric Shock Risk lamp lights when door is opened	▶	Failed cut-off relay SR1 or SR2	▶ DO NOT USE until relay replaced
	▶	Fuses for left side of chamber blown	▶ Check and replace fuse
Red Electric Shock Risk lamp does not light when tested	▶	Faulty lamp	▶ DO NOT USE until lamp replaced
	▶	Faulty relay SR3 or SR4	▶ DO NOT USE until relay replaced
	▶	Faulty momentary switch	▶ DO NOT USE until switch replaced
	▶	Faulty door switch	▶ DO NOT USE until door switch replaced
Door does not unlock	▶	Furnace may have been turned off during a test or there may have been a power failure during a test	▶ Enter START PROCESS then cancel the test. THE RELEASE CODE ' 728 ' is REQUIRED
	▶	Failure of interface board	
	▶	Loose connection lead	▶ Check all leads
Door does not lock at start of test	▶	The key has been used and left in unlocked position	▶ Set the manual override to the locked position
	▶	Door switch failure	
	▶	Interface board failure	
	▶	Loose connection lead	▶ Check all leads

E. Chimney Emits Smoke			
Some light smoke is emitted in the middle of the test	▶	No fault	
Dense smoke is emitted	▶	The after-burner elements or control may have failed	▶ Investigate or contact Carbolite Gero
	▶	A fuse may have blown	▶ Check the Supply fuses

F. Balance Errors

Weight readings not stable	▶	Balance not properly installed	▶	Re-install balance
	▶	Balance pan extension not free to move	▶	Check for obstructions such as aggregate in the balance pan extension holes
	▶	Loose wires obstructing balance pan	▶	Check control compartment
	▶	Unit not on firm base	▶	Reposition ABA or adjust stand
	▶	Fan motor support bracket has failed	▶	Check/ adjust motor support bracket
	▶	Fan failure causing vibration	▶	Check/ replace motor or impeller



G. Fan Problems			
Fan not switching off	▶	Faulty relay FS in fan circuit	▶ Do not use until the relay is replaced
	▶	Faulty Control Board	▶ Check diagnostics screen
Fan not switching on	▶	Main chamber temperature less than 100 °C	▶ Check heater is on
	▶	Door is open	▶ Close Door
	▶	Test not in progress	▶ Run test
	▶	Fan motor failure	▶ Replace motor
	▶	Faulty relay FS	▶ Replace relay
	▶	Faulty Control Board	
	▶	Loose connection lead	▶ Check all leads

H. Test Problems			
Early termination of test	▶	Test parameters of trigger weight set too high	▶ Adjust to suitable setting
	▶	Test parameter of constant weight delay set too low or zero	▶ Adjust to correct setting and save; delete any old setting
	▶	Balance unstable	▶ See balance errors

I. Printer Problems			
Printer does not print	▶	Printer is out of paper	▶ Add more printer paper
	▶	Faulty printer supply switch	▶ Replace switch
	▶	Faulty printer	▶ Replace printer
	▶	Loose lead	▶ Check connector at back of printer
	▶	Wrong settings in printer	▶ Run 'Printer Test' 12

29.0 Fuses

The following fuse types are present:

Supply Fuses: 38 mm x 10 mm type F, 16 A – 6 total (4 on board EMC filter units; 2 in separate holders).

Auxiliary Fuses (on board EMC filter unit): 20 mm x 5 mm glass type F, 2 A.

29.1 Customer Supply Fusing

High break capacity fuses should be used. Avoid fast-blow fuses and magnetic trip circuit breakers - consult Carbolite Gero if in doubt.

The supply fuse rating should be as follows:

Model	Phases	Volts	Supply Fuse Rating
ABA 7/35	1-phase	200 V - 240 V	40 A
ABA 7/35	3-phase with neutral	380/220 V - 415/ 240 V	16 A per phase
ABA 7/35	3-phase delta	200 V - 240 V	25 A per phase

29.2 Power Settings

The ABA 7/35 uses electronic power limiting to enable the same heating elements to be used over the complete range of voltages from 200 V to 240 V.

It is important to set the voltage setting as described in "Reconfigure Voltage Settings For Alternative Electrical Supply".

Please refer to the rating label for product specific information.

30.0 Specifications

30.1 Representations Covered by this Manual

Carbolite Gero reserves the right to change the specification without notice.

The Carbolite Gero model ABA 7/35B, Asphalt Binder Analyser, designed and built to comply with BS/EN 12697-39:2004 and ASTM D6307-10 and AASHTO T308-10.

Height without chimney	980 mm
Heights with chimney	1160 mm
Width	600 mm
Depth (length)	770 mm
Optional Stand	600 mm high
Weight	120 kg (approximate)
Power Rating	8000 Watts

30.2 Updates

Serial Number	Update
21-400274 onwards	New door Lock key

30.3 Environment

The equipment contains electrical parts and should be stored and used in indoor conditions as follows:

Temperature:	10 °C - 40 °C
Relative humidity:	Maximum 80%

ProductLabel

The products covered in this manual are only a small part of the wide range of ovens, chamber furnaces and tube furnaces manufactured by Carbolite Gero for laboratory and industrial use. For further details of our standard or custom built products please contact us at the address below, or ask your nearest stockist.

For preventive maintenance, repair and calibration of all furnace and oven products, please contact:

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