

Carbon Controller

Model 1734 Operators Manual



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1. USING THIS MANUAL

This manual is intended to be used by the operator. It is not intended to describe how the 1734 carbon controller should be connected, configured or serviced. If more detailed information is required than is shown in this manual the 1734 Technical Manual should be used. This is supplied with each controller and is also available on the Novatech web site at www.novatech.com.au

It is assumed in this manual that the controller has been installed by competent personal and that the wiring to the main power supply, the carbon probe and all the associated signal devices complies with the local safety codes and regulations.

1.1 Cautions

Please read the safety information below before connecting power to the controller.

CAUTION

Please note that if this equipment is not installed and used in the manner described in this manual then the safety protection provided by the equipment may be impaired.

1.2 Connecting the Controller to the Power Supply

- The mains power must be either 100/110VAC or 220/240VAC with a mains frequency of 50 or 60Hz
- The supply circuit must be fused to at least 10Amps and have a dual pole isolation switch within easy access of the carbon controller. The isolation switch must be marked as the isolation switch for this equipment. It is recommended that a separate isolation switch be used for each controller so that a controller can be serviced individually.
- The power supply cables must be supplied and installed according to local regulations
- The earth connection must comply with the local regulations must have a current carrying capability equal or greater than the supply fuse current rating
- The earth connection must be connected to the primary earth stud inside the controller on the right hand side
- All other bonded earth connections from the external wiring must be connected to the primary earth stud

1.3 Mounting Position of the Controller

- The controller should be mounted in a position where the ambient temperature will not exceed 55°C/130°F or be less than -25°C/-10°F ambient temperature
- It must not be exposed to:-
 - radiation from appliances such as ovens or furnaces
 - direct sunlight
 - rain, snow or sleet
- The ventilation must be adequate to remove excess heat build up from the internal circuit of the controller

1.4 Warning Symbols



Danger, high voltage. Risk of electrical shock.



Caution hot surface.



Caution, risk of danger. See additional information in the manual.

2. INTRODUCTION

The Novatech 1734 Carbon Controller provides in-situ measurement for one or two carbon probes in furnace and gas generators with temperatures up to 1400°C. The controller provides local indication of carbon percentage and oxygen, plus numerous other related measurements.

Within the same process either one or two probes can be controlled providing average and/or individual probe readings. The controller provides two isolated 4-20mA outputs, 4 normally closed configurable relay outputs and digital communications via MODBUS. Alarms are displayed at the controller and the relay contacts can be configured to activate remote alarm devices. Using unheated Novatech zirconia carbon probes the analyser also provides automatic probe filter purging.

The model 1734 carbon controller is based on the well known model 1634 controller. It includes a number of hardware and software improvements such as a graphic display, larger characters, faster microprocessor, simplified set up menu, alarm logging, faster probe heater control and more accuracy in the calculation of carbon.

The 1734 Carbon Controller has a variety of user-selectable functions. The device is configured locally using a menu driven interface and the local keypad & display. For a description of the configuration process refer to Chapter **Error! Reference source not found.**

Features include:-

Inputs

Two Novatech zirconia carbon / oxygen probes

Carbon range up to 2.0%

Oxygen range from 10⁻³⁰ to 100%

Furnace or auxiliary thermocouple, field selectable as type K, J, R, S or N

Purge pressure or flow switch

Outputs

Two linearised 4-20mA or 0-20mA DC isolated outputs, max. load 1000Ω

The output function and the range are field selectable

Common alarm relay

Three other alarm relays with selectable functions

Digital Interface

RS-232 or RS-485 MODBUS™ for connection to a computer/DCS/PCL for diagnostics of the controller, probe or combustion process.

Display

Multi font graphical display

Large font characters for the carbon % on the top line

Selectable lower line items for the secondary display functions. ie Probe temperature, carbon % measurement on the second probe, oxygen etc

Alarm display mode that shows the time of the alarm, the acceptance time and the time that the alarm was cleared of up to 4000 alarm events

Power

Universal mains supply voltage, 100 to 240VAC

Automatically detects the mains voltage and frequency and set the power control accordingly

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3. SPECIFICATIONS

3.1 Hardware Specifications

Number of carbon probes:	2 maximum
Carbon range:	up to 2.0%
Oxygen range:	1 x 10 ⁻³⁰ to 100%
Oxygen accuracy:	±1% of actual measured oxygen value with a repeatability of ±0.5% of the measured value
Thermocouple types:	Type K, J, R, S & N
Temperature accuracy:	±2°C
Analogue outputs:	0-20mA or 4-20mA field selectable Active outputs (Do NOT loop power these outputs)
Output load:	1000 ohm max
Alarm relays:	4
Alarm relay contacts:	2A/240VAC, 2A/30VDC
(WARNING: Do not use both mains voltage and low voltage connections to adjacent alarm contacts)	
Mains voltage supply:	100 to 240VAC, -6 +10%, 50/60 Hz
Overvoltage:	Category II (IEC60364-4-443)
Power:	5W for controller plus probe power
Fuses:	3A, fast blow, 250v, 20x5mm (heater fuses, 2 of) 1A, slow blow, 250v, microfuse (PCB mtg fuse, 1 of)
Environmental Rating:	Operating Temperature -25°C to 55°C Relative Humidity 5% to 95% (non-condensing)
Altitude	2000m maximum
Degree of Protection:	IP65 IP54 with internal reference air pump
Case Size:	260mm (10.2") wide, 160mm (6.3") high, 90mm (3.5") deep
Weight:	3 Kg (6.6 lbs.)

WARNING: All signal level connections onto the controller must be treated as safety extra-low voltage (SELV) as defined in the standard IEC61140. Double insulation must be used when connecting these terminals to systems that might carry high voltage.

3.2 Operational Specifications

The 1734 controller has two fully configurable 4-20mA analogue outputs. The channels can be configured independently to output one of several calculated values.

The following outputs are available on channel #1:

Output	Zero	Span	Step	Min Span	Default
Probe 1 Carbon %	0%	0.1 to 1.5%	0.1%	0.1%	0 to 1.5%
Average Carbon % **	0%	0.1 to 1.5%	0.1%	0.1%	0 to 1.5%
Probe 1 EMF	0 to 1400mV	100 to 1500mV	100mV	100mV	0 to 100mV
Probe 1 TC Temperature	0 to 1500°C	100 to 1600°C	100°C	100°C	0 to 1300°C
Probe 1 Oxygen %	0 to 99%	1 to 100%	0.1%	1%	0 to 25%
Reducing Oxygen 1 exp	+2 to -28	0 to -30	1	2 decades	-1 to 30
Aux TC Temperature *	0 to 1500°C	100 to 1600°C	100°C	100°C	0 to 1300°C
No Output	-	-	-	-	-

** Only available in dual probe mode. * Only available in single probe mode.

The following outputs are available on channel #2:

Output	Zero	Span	Step	Min Span	Default
Probe 1 Carbon % *	0%	0.1 to 1.5%	0.1%	0.1%	0 to 1.5%
Probe 2 Carbon % **	0%	0.1 to 1.5%	0.1%	0.1%	0 to 1.5%
Average Carbon % **	0%	0.1 to 1.5%	0.1%	0.1%	0 to 1.5%
Probe 1 EMF *	0 to 1400mV	100 to 1500mV	100mV	100mV	0 to 100mV
Probe 2 EMF **	0 to 1400mV	100 to 1500mV	100mV	100mV	0 to 100mV
Probe 1 TC Temperature *	0 to 1500°C	100 to 1600°C	100°C	100°C	0 to 1300°C
Probe 1 TC Temperature **	0 to 1500°C	100 to 1600°C	100°C	100°C	0 to 1300°C
Probe 1 Oxygen % *	0 to 99%	1 to 100%	0.1%	1%	0 to 25%
Probe 1 Oxygen % **	0 to 99%	1 to 100%	0.1%	1%	0 to 25%
Reducing Oxygen 1 exp. *	+2 to -28	0 to -30	1	2 decades	-1 to 30
Reducing Oxygen 2 exp. **	+2 to -28	0 to -30	1	2 decades	-1 to 30
Aux TC Temperature *	0 to 1500°C	100 to 1600°C	100°C	100°C	0 to 1300°C
No Output	-	-	-	-	-

** Only available in dual probe mode. * Only available in single probe mode.

The zero and span of the selected output are set in the following two menus (functions 11&12 and 14&15).

Range of local indication:

The measurement of carbon is shown as the main and largest value on the display. It is shown with 2 decimal places as #.## %.

The measured oxygen content displayed on the Lower line is shown in either %, or in scientific notation. The format of the oxygen display changes to maintain the best resolution for the measurement.

Range	Display format
30.0 to 100.0%	##.##%
1.00 to 29.99%	##.###%
0.100 to 0.999%	#.####%
< 0.100%	scientific notation (#.## x 10 ^{-##} %)

Local display, secondary functions:

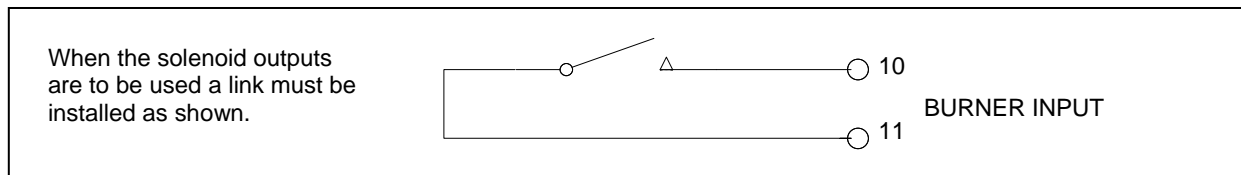
This function allows the operator to change the items that are available to be displayed on the lower line of the controller in RUN mode. If the word "Enabled" appears on the display for a selected lower line option, the measurement will be available to be shown on the display in the RUN mode by scrolling through the list using the DISPLAY UP and DISPLAY DOWN keys.

A lower line measurement can be "Enabled" or disabled by pressing the ENTER key.

	OPTIONS:	Enabled as Default
1	Probe 2 Carbon %	*
2	Average Carbon %	*
3	Probe 1 TC Temperature	*
4	Probe 2 TC Temperature	*
5	Probe 1 EMF mV	*
6	Probe 2 EMF mV	*
7	Probe 1 Sensor Impedance	*
8	Probe 2 Sensor Impedance	*
9	Probe 1 Oxygen %	
10	Probe 2 Oxygen %	*
11	Auxiliary TC Temperature	
12	Ambient Temperature	
13	Ambient Relative Humidity	
14	Controller Set Point	
18	Burner Run Time	
19	Service date	

NOTE: An asterisk (*) on the end of the line identifies the item is enabled by default after a COLD-START.

3.3 Heater Interlock Relays



Heater Supply Interlock Connection for Heated Probes

If the solenoid outputs are to be used, a link must be installed between terminals 10 & 11 to enable –

- Carbon control using ON/OFF control
- Carbon control using proportional ON/OFF control
- Carbon control using an up/down motor drive control
- Auto-purge and auto-cal checking.

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4. DISPLAY AND KEYPAD

The 1734 controller has a graphic display, 8 keys that are accessed from the outside of the cabinet and 5 LED indicators to show the status of the controller. All the keys have a dual function. The black text on the key is the function while the controller is in the RUN mode and the white text on the key is the function in the SETUP mode.

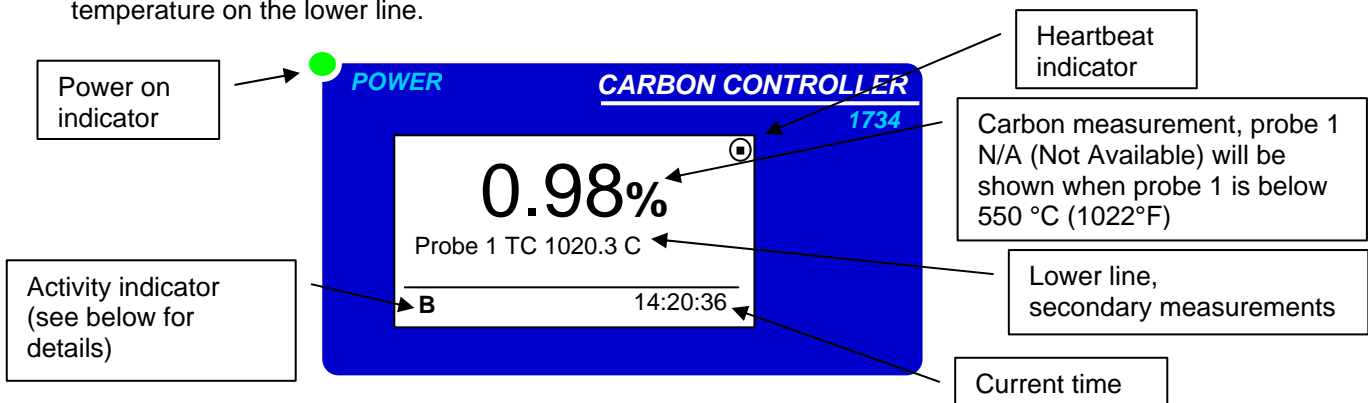
The SETUP mode is accessed by pressing the SETUP key. The controller will return to the RUN mode when the SETUP key is pressed again or one minute after the last key is pressed.



The front panel of the model 1734 carbon controller

4.1 Display

The 1734 display is used to show the carbon percentage in a large font and the secondary functions in a smaller font. The default display is shown below with probe #1 carbon on the top line and the probe #1 temperature on the lower line.



In addition to displaying the current carbon and the various secondary values, the display is also used to show the current and active alarm conditions and to configure the controller. This is achieved by entering the SETUP mode (see chapter 5). The backlight will turn off if the case temperature is over 35°C. It will come on again as soon as a key is pressed and remain on for 60 seconds.

The Activity indicators show actions that are happening in the background.

B The burner input has been enabled (terminals 10&11)

A The controller is doing an auto calibration. This happens every minute or when the AUTO CAL keys pressed in setup mode

T (Flashing) The probe(s) is(are) below operating temperature (650°C/1200°F)

Z The controller is doing an impedance check of the probe(s).

4.2 Keypad

There are 8 keys built into the decal on the outside of the door of the 1734 carbon controller. The key function is printed in BLACK and WHITE to identify the function of the key in either RUN mode or SETUP mode.

Key text	RUN mode (WHITE text)	SETUP mode (BLUE/BLACK text)
SETUP / RUN	<i>Enter SETUP mode</i>	<i>Return to RUN mode</i>
DISPLAY / FUNCTION ▲	<i>Display scroll up</i>	<i>Function scroll up</i>
DISPLAY / FUNCTION ▼	<i>Display scroll down</i>	<i>Function scroll down</i>
ALARM / OPTION ▲	<i>Alarm scroll up</i>	<i>Option scroll up</i>
ALARM / OPTION ▼	<i>Alarm scroll down</i>	<i>Option scroll down</i>
ALARM ACCEPT / ENTER	<i>Alarm accept</i>	<i>Enter</i>
GAS 1 PURGE 1 / SENS IMP	<i>Gas 1 / Purge 1 manual activate</i>	<i>Probe impedance</i>
GAS 2 PURGE 2 / AUTO CAL	<i>Gas 2 / Purge 2 manual activate</i>	<i>Auto calibrate</i>

4.2.1 Keypad in RUN Mode

When the controller is turned on, and has gone through the start-up procedure, it will go to the RUN mode. In this mode the top line of the display will show the carbon measurement from probe 1. The other key functions are –

SETUP / RUN Key

Pressing this key once will put the controller into the SETUP mode. The function of all the keys will then change to the functions that they have in the SETUP mode. Pressing the SETUP / RUN key again will return the controller to the RUN mode, or it will return automatically one minute after the last key press.

DISPLAY UP / DISPLAY DOWN Keys

The display keys are used to scroll the lower line up and down through the variety of measurements that are available on the lower line display. The list can be changed to suit the operator by using SETUP function #3.

ALARM UP Key

If there is either a new alarm or an active alarm the ALARM UP key can be pressed to examine the alarm status. The alarm light will be flashing if there is a new alarm or steady if there is an existing alarm. (see chapter 6, Alarms).

ALARM DOWN Key

When the controller is in the run mode or the alarm mode (the ALARM UP key has been pressed), the ALARM DOWN key and the ALARM UP key allow the operator to examine the alarm log. The date / time of last 4000 alarms can be scrolled through. Each alarm record consists of the alarm name and the date / time that the alarm was initiated, accepted and cleared (see chapter 6, Alarms).

ALARM ACCEPT Key

The ALARM ACCEPT key is used to accept a new alarm (see chapter 6, Alarms).

GAS 1 / PURGE 1 and GAS 2 / PURGE 2 Keys

These two keys are used to turn on the purge solenoids. When the controller is in the manual purge mode (Commissioning function #21 & 26) the solenoid will be activated for as long as the key is pressed. When the controller is in the auto purge mode the automatic purge cycle is started. The cycle can be stopped by pressing any key. (See chapter 7, Probe Purge)

4.2.2 Keypad in Setup Mode

When the SETUP / RUN key is pressed once, the controller will go into the SETUP mode.

For information about the additional user-selectable options, see the 1734 Technical Manual.

The following key functions are then available in the SETUP mode.

SETUP / RUN key

Pressing this key once will put the controller into the SETUP mode. The function of all the keys will then change to the functions that they have in the SETUP mode. Pressing the SETUP / RUN key again will return the controller to the RUN mode, or it will return automatically one minute after the last key press.

FUNCTION UP / FUNCTION DOWN Keys

These two keys allow the selection of the required setup function from the list shown at the start of chapter 5.1 (Setup Mode Function Summary).

OPTION UP / OPTION DOWN keys

These two keys allow for the selection of the options that are available in the selected function. See the details of these in chapter 5.2 (Setup Mode Details).

ENTER key

The ENTER key saves the selected option. If the ENTER key is not pressed when a new option is chosen, the previous option will be retained.

SENSOR IMPEDANCE key

When this key is pressed the controller will measure the impedance of the sensor in the probe(s). This will only happen if the burner is enabled (terminals 10 and 11) and the probe temperature is over 700°C/1290°F.

AUTO CALIBRATE key

When this key is pressed the controller will calibrate the analog output channels. This is done by directing the output current away from the output terminals (terminals 12 & 13 and 14 & 15) and directing the current back into the controller input. The controller will then calculate a zero and a span calibration factor for each of the output channels. The output calibration will only happen if the channel is not set to manual output calibration. (See Technical Manual for more details)

4.2.3 Information Screen

The 1734 carbon controller has an information screen available to the user to allow more detailed information about the running of the controller to be easily read by the user.

The information available is:

1. Model and version of the current firmware
2. The date/time that the firmware was compiled
3. The maximum temperature that the controller has measured inside the cabinet
4. Current date and time
5. The time of all the next timed events (Impedance test, cal/purge 1, cal/purge 2)
6. ADC calibration data (analogue input calibration)
7. DAC calibration data (analogue output calibration)
8. Probe temperature record (probe 1 and 2)

The information screen is entered from the run mode by pressing (and holding) the ALARM ACCEPT key and then pressing the SETUP key. The first data appears at the top of the screen and there is a scroll bar down the left hand side. The data can be scrolled through by using the DISPLAY up and down keys. The data cannot be changed.

The output and control functions continue as normal while the information screen is being displayed. The normal display is resumed by pressing the set-up key.

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5. SETUP MODE

This chapter describes the functions available when the SETUP mode is selected on the controller.

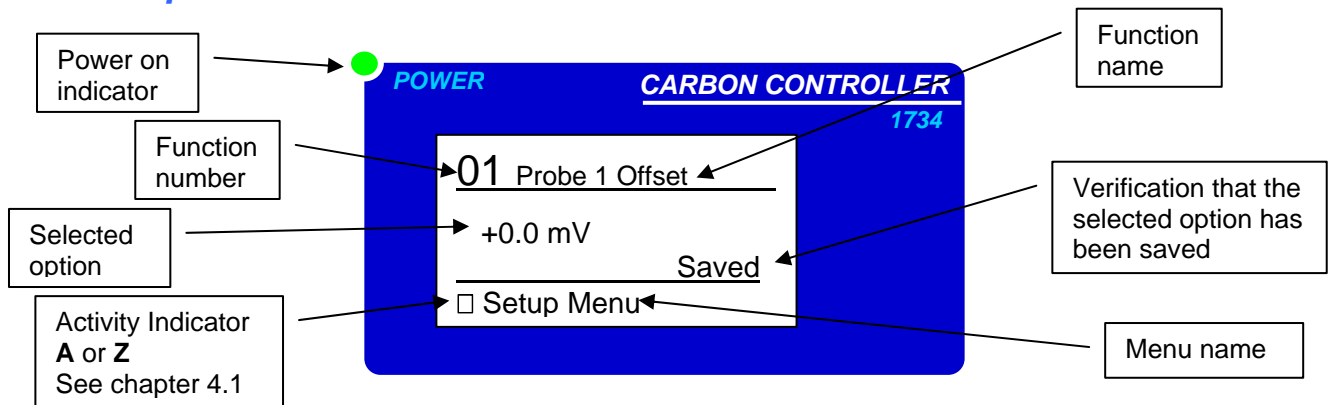
The SETUP mode is accessed by pressing the SETUP key. The controller will return to the RUN mode when the SETUP key is pressed again or 1 minute after the last key is pressed.

5.1 Setup Mode Function Summary

When the controller is in the SETUP mode the SETUP light will be on. The following table shows the SETUP menu functions:

Menu #	Function name (top line)	Range	Default value
01	Probe 1 offset	-6.0 to +6.0mV	0.0mV
02	Probe 2 offset	-6.0 to +6.0mV	0.0mV
03	Lower line items	-	See SETUP function #3 for details (chapter 5.2.2)
04	Damping factor	No damping to 10 samples averaged	5 samples averaged
05	Process alarms	Enabled / Disabled	Disabled
06	Carbon controller		See chapter 5.2.6
07	Carbon & set point	0.01 to 2.00%	1.20%
08	High carbon alarm	0.01 to 2.00%	1.50%
09	High carbon alarm delay	0 to 200 seconds	20 seconds
10	Low carbon alarm	0.01 to 2.00%	0.35%
11	Low carbon alarm delay	0 to 200 seconds	20 seconds
12	Carbon Deviation alarm	0.01 to 2.00%	2.00%
13	Carbon Deviation alarm delay	0 to 200 seconds	30 seconds

5.2 Setup Mode Details



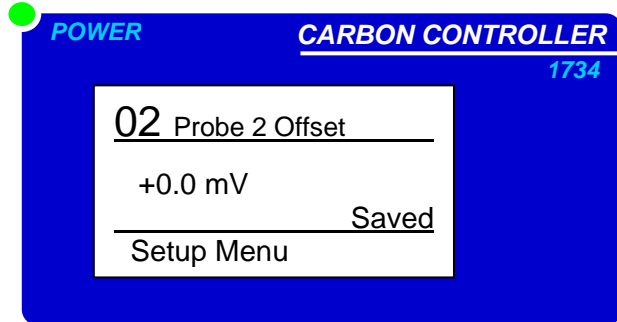
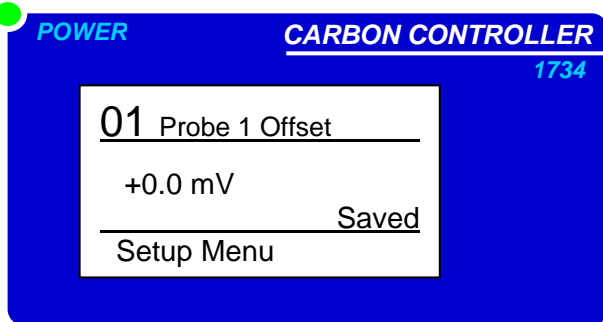
5.2.0 To Change an Option in the Setup Menu

1. Select the SETUP mode by pressing the SETUP / RUN key once. The SETUP light will come on and the display will have the format shown above. The operations of the keys are now the operations written in white on the keypad. The menu name is written at the bottom of the display.
2. When the SETUP mode has been selected the required function can be found by using the FUNCTION UP and FUNCTION DOWN keys.
3. The options available for that function can be seen by using the OPTION UP and OPTION DOWN keys.
4. When the required option is on the display the ENTER key is used to save that option.
5. Press the SETUP / RUN key to return to the RUN mode.

The details of each function are given below.

NOTE: An asterisk next to a listed option denotes default state after a COLD-START

5.2.1 Probe 1 & Probe 2 Offset



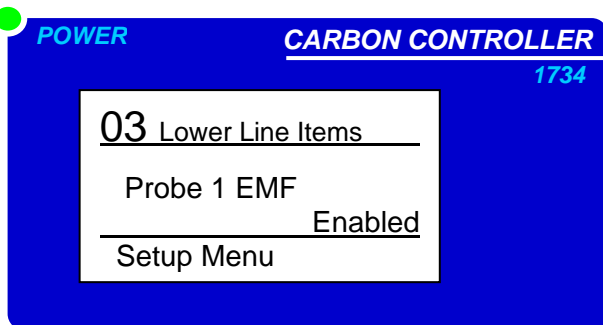
Each Novatech probe has an offset calibration value printed on a tag that is attached to the probe when it is dispatched. The offset value must be entered into this setup function to achieve the most accurate measurements. The value is usually between -1.0 to +1.0mV.

RANGE: -6.0 to +6.0mV (0.0mV is set after a COLD-START)

NOTE: An error of 1mV in the probe offset will change the carbon reading by about 0.01% carbon.

The function '02 Probe 2 Offset' will only appear if the controller has been configured for 2 probes.

5.2.2 Lower Line Items



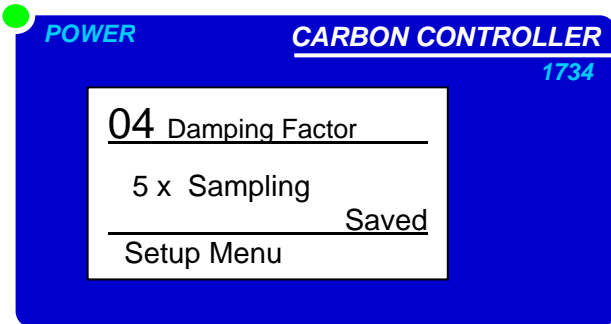
This function allows the operator to change the items that are available to be displayed on the lower line of the controller when it is in the RUN mode. If the word "Enabled" appears on the display for a selected lower line measurement option, the measurement will be available to be shown on the display in the RUN mode by scrolling through the list using the DISPLAY up and DISPLAY down keys. A lower line selection can be "Enabled" or disabled by pressing the ENTER key.

OPTIONS:

Probe 2 Carbon %	*	Oxygen, Probe #1	*
Average Carbon %	**	Oxygen, Probe #2	*
Temperature, Probe #1	*	Ambient Temperature	*
Temperature, Probe #2	*	Ambient RH%	
Sensor EMF, Probe #1	*	Controller Set Point	
Sensor EMF, Probe #2	*	Burner Run Time	
Sensor Impedance, Probe #1	*	Service Date	
Sensor Impedance, Probe #2	*	Auxiliary TC Temperature	

NOTE: An asterisk (*) identifies the item is enabled by default after a COLD-START.

5.2.4 Damping Factor

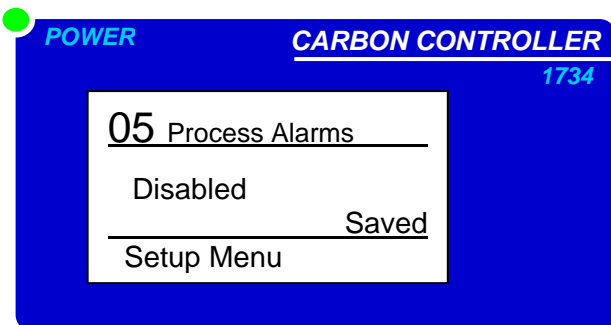


The carbon measurement can be damped if there are annoying fluctuations in the process gas. Of course any damping will slow down the reaction time of the controller. The larger the number selected here, the steadier the measurement will be.

The damping factor is also used to damp the oxygen measurement and the damped oxygen value is also used in the calculation of all other parameters that are based on the oxygen value.

RANGE: "No Damping" to 10 (5 x Samples is set after a COLD-START)

5.2.5 Process Alarms



This function allows the operator to "Disable" process alarms.

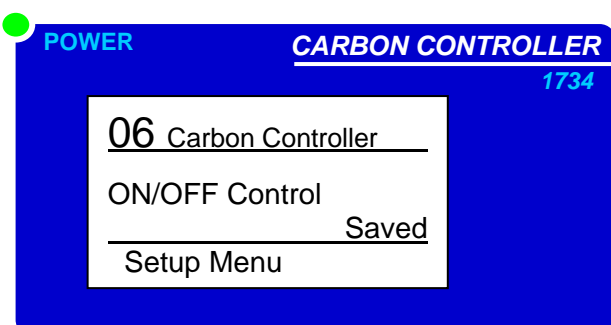
Setup functions 7 to 14 show the alarm trip points that have been set in the controller.

OPTIONS:

Enabled

Disabled *

5.2.6 Carbon Controller

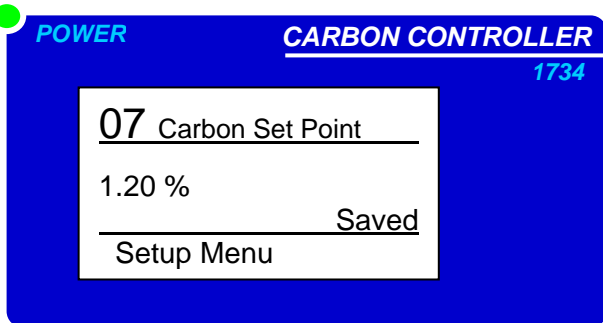


The 1734 is able to control the atmosphere to a specific carbon value. The type of control selected here will depend on the gas control valve being used.

Disabled (No control) *

OPTIONS:
 ON/OFF Control
 Proportional ON/OFF Control
 Proportional + Integral 4-20mA
 Floating Control

5.2.3 Carbon Set Point

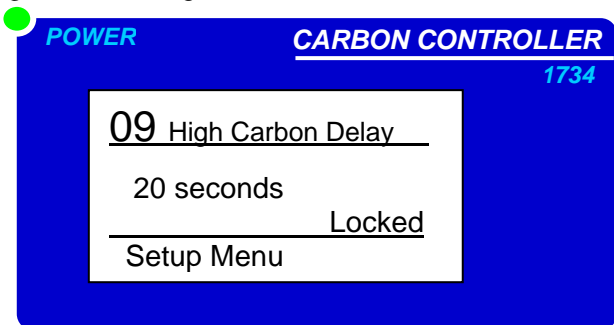
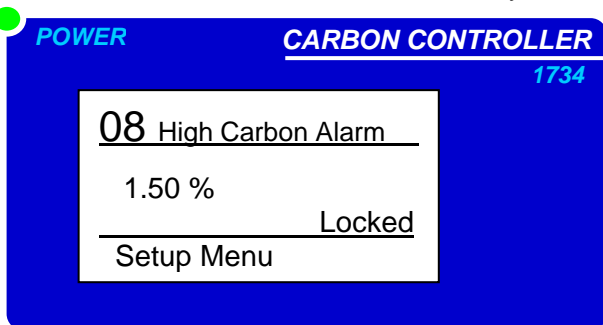


If a carbon controller type has been selected in the previous function, a set point carbon value can be entered here. The 1734 controller will operate the gas control valve to maintain the set point carbon in the process.

OPTIONS:
 Carbon % 0.01 to 2.00 (1.20% is set after a COLD-START)

5.2.6 High Carbon Alarm & Alarm Delay

NOTE: These menu functions are read only. To change these settings see, the Technical Manual.

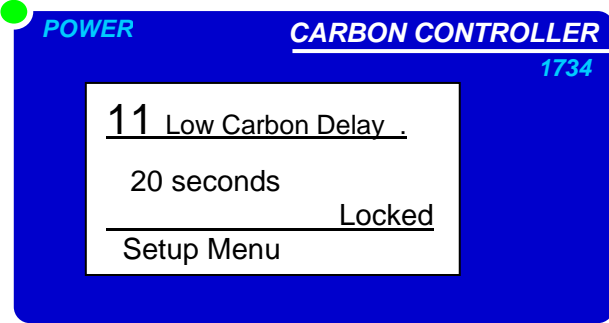
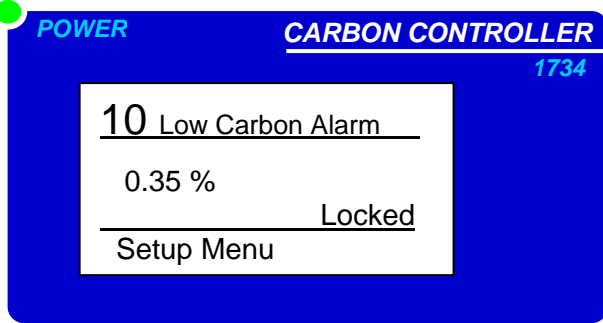


If the controller has been selected to run a single probe, it will show a high carbon alarm when the carbon measurement of probe 1 goes above the trip level for longer than the delay time. If the controller has been selected to run dual probes, it will show a high carbon alarm when the average of the two carbon measurements is below the trip level for longer than the delay time. If either one of the probes has a failure alarm (High sensor impedance, thermocouple open circuit, heater failure) the alarm will then trip on the carbon measurement from the remaining working probe alone.

RANGE: 0.01 to 2.00 % (1.50 % is set after a COLD-START)
 RANGE: 0 to 200 seconds (20 seconds is set after a COLD-START)

5.2.7 Low Carbon Alarm & Alarm Delay

NOTE: These menu functions are read only. To change these settings see, the Technical Manual.



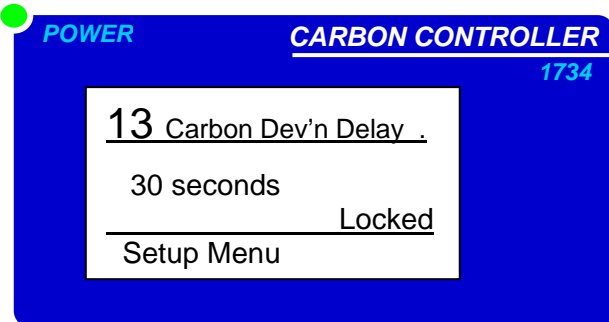
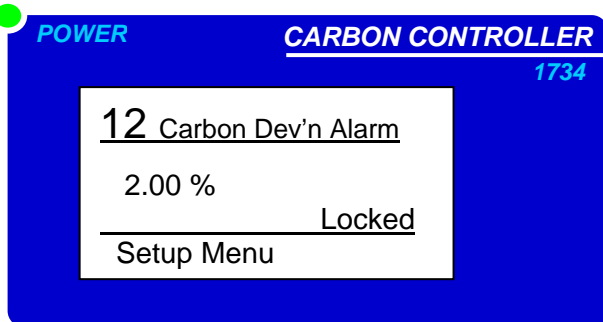
If the controller has been selected to run a single probe, it will show a low carbon alarm when the carbon measurement of probe 1 goes below the trip level for longer than the delay time.

If the controller has been selected to run dual probes, it will show a low carbon alarm when the average of the two carbon measurements is below the trip level for longer than the delay time. If either one of the probes has a failure alarm (High sensor impedance, thermocouple open circuit, heater failure) the alarm will then trip on the carbon measurement from the remaining working probe alone.

RANGE: 0.01 to 2.00 % (2.5 % is set after a COLD-START)
RANGE: 0 to 200 seconds (20 seconds is set after a COLD-START)

5.2.8 Carbon deviation Alarm & Alarm Delay

NOTE: This menu function is read only. To change this setting, see the Technical Manual.



If the controller has been selected to run a single probe, these two functions will be hidden.

If the controller has been selected to run dual probes, it will show a carbon deviation alarm when the deviation of the two carbon measurements is above the trip level for longer than the delay time. If either one of the probes has a failure alarm (High sensor impedance, thermocouple open circuit, heater failure) the alarm will not operate.

RANGE: 0.01 to 2.00 % (2.00 % is set after a COLD-START)
RANGE: 0 to 200 seconds (30 seconds is set after a COLD-START)

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6. ALARMS

The 1734 controller has 4 alarm relays and a built in alarm annunciator and an alarm log. When an alarm occurs and the ALARM up key is pressed, the controller goes into the alarm display mode. In this mode some of the keys take on a special function.

Key text	RUN mode	ALARM mode
SETUP / RUN		<i>Return to RUN mode</i>
DISPLAY / FUNCTION up		<i>Next alarm time</i>
DISPLAY / FUNCTION down		<i>Previous alarm time</i>
ALARM / OPTION up	<i>Enter ALARM display mode</i>	<i>Next Alarm</i>
ALARM / OPTION down	<i>Enter ALARM log mode</i>	<i>Previous Alarm</i>
ALARM ACCEPT / ENTER		<i>Accept alarm</i>

When the alarm mode has been entered the SETUP light flashes once a second.

All relays have fail-safe alarm contacts. That is –

- When the controller is off the contacts are open circuit
- When the controller is on but there are no alarms the contacts are closed
- When there is a current alarm event the contacts are open circuit

All alarms drive the alarm light on the front door.

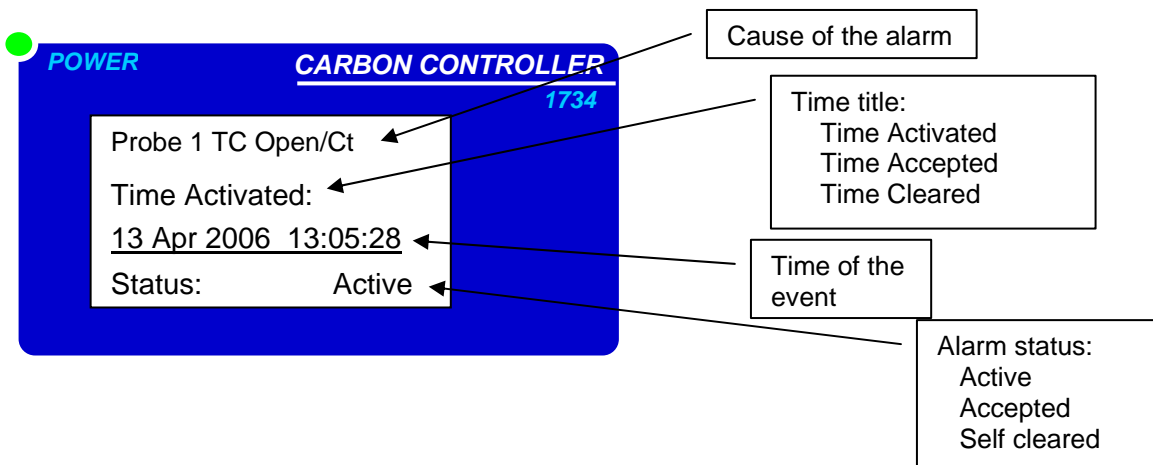
- The light will be off if there are no alarms current
- The light will flash if there is a current alarm that has not been accepted
- The light will be on steady if there are current alarm(s) that have been accepted
- The light will flash faster as more alarms occur

6.1 Checking and Accepting an Alarm

When a new alarm occurs, either a process alarm or an alarm that will appear in the common alarm list, the ALARM light will flash. The more new alarms there are, the faster the light will flash.

To check the cause of the alarm –

1. Press the ALARM up key. This will put the controller into the current alarm mode. The SETUP light will flash.
2. The alarm screen will appear displaying the cause of the alarm on the top line.



3. Press the ALARM ACCEPT key to accept the alarm.
4. Press the OPTION up key to see the next active alarm or the OPTION down to see the previous active alarm.
5. When all the new alarms have been ACCEPTED the ALARM light will stop flashing.
6. Accept each alarm and then press the SETUP / RUN key to return to the run mode.

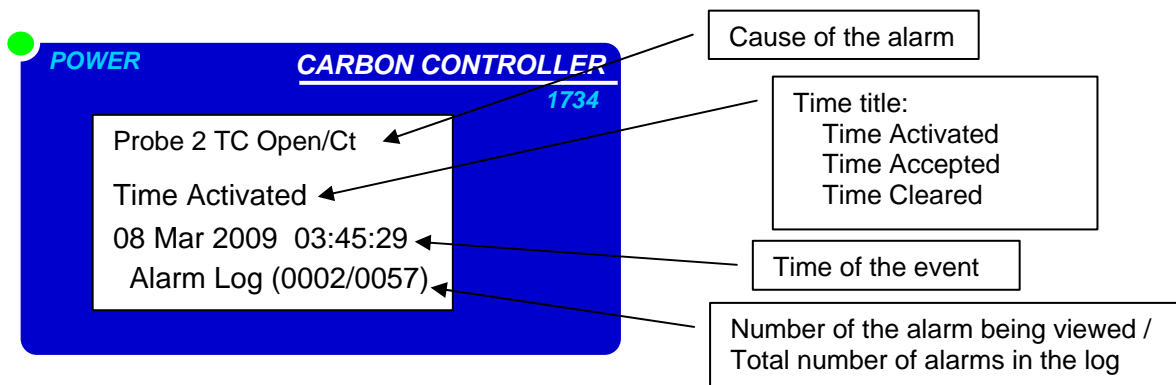
6.1.1 Current Alarms

To view the alarms that are still current press the ALARM up key from the RUN mode and then use the ALARM up and down keys to view all alarms. Use the DISPLAY up and down keys to view the Time Activated, Time Accepted and the Time Cleared of each alarm.

6.1.2 Alarm Log

The alarm log keeps a record of the alarm events after the cause of the alarm has been cleared. It will hold a record of up to 1000 alarm events and will be retained even with the controller power off.

To view all the alarms that have occurred in the alarm log press the ALARM down key from the RUN mode. The display will look like this:



Use the OPTION up and down to scroll through the alarm events that have been saved in the alarm log. The alarm event will be transferred to the alarm log when the alarm has been cleared.

The alarms are stored in the alarm log in chronological order. However, it may be seen that the current alarm number will skip some numbers. These numbers have been reserved for alarm events that are still current. When the alarm cause has been removed, these alarm events will be transferred to the alarm log.

6.2 Alarm Relays

The common alarm relay is used to monitor faults within the controller and the probe. The list of events that will cause the common alarm relay to be activated is shown in chapter 6.3, Common Alarms. The relay contacts will be open circuit if there is a current alarm condition.

The other three alarm relays are user defined and are used to monitor the process. The function of the process alarm relays is user selectable. See chapter 6.4, Selectable Process Alarms, and the Technical Manual for further information.

6.3 Common Alarms

The events that drive the common alarm relay are –

1. 'Probe 1 Heater Fail'
2. 'Probe 2 Heater Fail'

If a heated probe has been selected, in the first 20 minutes of power being applied to the heater after being switched on, this alarm will not occur, but a 'T' display will be shown on the bottom of the display. If an ADC alarm occurs, the heaters will automatically be turned off. If the probe has not reached 650°C/1200°F in 20 minutes the 'Probe 1(2) Heater Fail' alarm will be raised.

3. 'Probe 1 High Impedance'
4. 'Probe 2 High Impedance'

Carbon probe or electrode failure (high impedance). This alarm is inhibited when the probe temperature is under 650°C/1200°F.

5. 'Probe 1 TC Open Circuit'

6. 'Probe 2 TC Open Circuit'

Probe thermocouple is open circuit. The heater in heated probes will switch off.

7. 'Auxiliary TC Open Circuit'

Stack thermocouple is open circuit. If the thermocouple is not needed, select "NO T/C" for "Aux TC Type" or place a short circuit between terminals 7 & 8.

8. 'Reference Air Pump Fail'

The reference air pump in the controller is either disconnected or is drawing <20mA.

9. 'Reference Air Pump Overload'

The reference air pump in the controller has drawn >300mA. The power will be turned off to the pump to avoid damage to the pump driving circuit. The 1734 controller will attempt to restart the pump every minute. To force a restart, disconnect the pump and reconnect it.

10. 'ADC Calibration Fail'

The analog to digital converter has been found to fall outside the normal calibration specifications. In this case the probe heater will automatically be turned off.

11. 'Alarm Log Fail'

The alarm history is kept in an EEROM. This alarm will be raised if this memory device fails.

12. 'Output 1 Failure'

13. 'Output 2 Failure'

The digital to analog and voltage isolator circuit has been found to fall outside the normal calibration specifications. This check is only performed when the 'AUTO CAL' button is pressed.

Refer to chapter 4.2.2.

14. 'Heater 1 SSR Failure'

15. 'Heater 2 SSR Failure'

16. 'Heater SSR Leakage'

The 1734 controller has the ability to monitor the operation of the heater current in a heated probe. As a result, the controller will give an alarm within 1 second of a heater power control switch (Solid State Relay) failure. If either of the SSR's are found to be faulty, both heaters will be turned off immediately and the alarm will be raised. The SSR must be replaced. The 'SSR Leakage' alarm will occur if one of the heater SSR's are partly shorted.

If probe #1 SSR has failed and only one probe is being used, the 1734 Technical Manual describes how the SSR for probe #2 can be selected instead. If 2 probes are being used but neither of the solenoid outputs are being used consult the Technical Manual.

17. 'Probe 1 Filter Blocked'

18. 'Probe 2 Filter Blocked'

Blocked probe filter. This test is only performed when automatic purging of the probe is selected. This alarm will not reset until the next purge cycle. The cycle can be initiated manually or automatically.

19. 'BBRAM Fail'

All of the setup options are held in the battery backed memory (BBRAM). This is the battery shaped device at the bottom centre of the 1730-1 PCB labeled MEM1. This alarm will occur when this device fails and will need to be replaced.

6.4 Selectable Process Alarms

There are three user configurable alarm relays. Any or all of the following functions can be selected for each relay.

The description of how the trip levels and the delay times are set is in the 1734 Technical Manual.

NOTE: The process alarms will only be activated if they are enabled in SETUP menu function 06.

20. 'Carbon 1 Low

21. 'Carbon 2 Low

The measured carbon level on the indicated probe has been below the trip level shown in setup function #10 for longer than the delay time shown in setup function #11.

22. 'Carbon 1 High'

23. 'Carbon 2 High'

The measured carbon level on the indicated probe has been above the trip level shown in setup function #08 for longer than the delay time shown in setup function #10.

24. 'Carbon Deviation'

The difference between the carbon level measured on probe #1 and the carbon level measured on probe #2 is greater than the trip level shown in setup function #13 and the time delay shown in setup function #14 has expired.

25. 'Probe 1 Temperature Low'

26. 'Probe 2 Temperature Low'

The probe temperature is under 650°C (1200°F). The carbon reading is therefore invalid. If the probe heater has been on for more than 20 minutes and the temperature is less than 650°C (1200°F) a 'Probe # Heater Fail' alarm will occur if a heated carbon probe is being used .

NOTE: The 'Probe # Temperature Low' relay function is used with unheated probes to indicate oxygen reading is invalid (the probe is below 650°C (1200°F)), in case the process temperature falls below this level. With heated probes this relay will be de-energised while the probe is heating up from ambient, making the contacts open circuit.

27. 'Purge 1 in Progress'

28. 'Purge 2 in Progress'

A probe purge is occurring, either manual or automatic mode.

29. 'Carbon 1 Invalid Low'

30. 'Carbon 2 Invalid Low'

31. 'Carbon 1 Invalid High'

32. 'Carbon 2 Invalid High'

The carbon within the process may not be valid due to the probe EMF resulting in a carbon potential that is above/below the maximum carbon potential for the temperature of the process

6.5 Warning Messages

27. 'Probe 1 Temperature Low'

28. 'Probe 2 Temperature Low'

The probe temperature is under 650°C/1200°F. The carbon reading is therefore invalid. If a heated probe is being used, the probe heater has been on for more than 20 minutes and the temperature is still less than 650°C/1200°F a 'Probe 1(2) Heater Fail' alarm will occur. There will be a flashing 'T' symbol on the bottom left hand corner of the display until the temperature of the probe(s) is over 650°C/1200°F.

NOTE: The 'Probe 1(2) Temperature Low' function is also used with unheated probes to show that the probe temperature is below 650°C/1200°F when the process temperature falls below this level.

31. 'Purge 1 in Progress'

32. 'Purge 2 in Progress'

A probe purge is occurring, either manual or automatic mode.

7. PROBE PURGE

The Novatech oxygen sensor that is used in the Novatech carbon probe is extremely predictable, stable and reliable. For this reason, the calibration of a Novatech carbon system does not require the use of calibration gases.

However, it may be necessary to periodically purge a build up of carbon from around the sensor tip.

The 1734 controller has a timer and solenoid driving system that can be configured to admit an air supply to purge the probe through the gas connection on the probe. The purge gas must be piped to the port on the probe labelled "CAL/PURGE".

There are two solenoid drivers in the 1734 carbon controller. They can be used to independently purge a single probe if the 1734 controller has only one probe connected.

If the controller has two probes connected, one solenoid can be connected to two probes with a 'T' piece tube connector, or the solenoids can be connected independently to each probe.

Single Probe Configuration

Cal / Purge 1	Solenoid 1 should be connected to the purge gas and the gas connection on the probe
Cal / Purge 2	No connection

Dual Probe Configuration

Cal / Purge 1	Solenoid 1 should be connected to the purge gas and the gas connection on the first probe Or a 'T' piece can be used on the purge line to purge 2 probes at a time
Cal / Purge 2	Solenoid 2 should be connected to the purge gas and the gas connection on the second probe

The controller can also be configured to be in a MANUAL or AUTOMATIC purge mode.

The information on configuring the controller is contained in the 1734 Technical Manual.

7.1 Notes on purging the probe

Most probe failures are caused by probe sooting which can be avoided by regular in-situ cleaning. Passing a stream of air through the probe on the outside of the sensor and into the furnace causes combustion. The free oxygen behind the flame front will burn away the soot. However, the flame will also heat up the probe. The location of the flame front will be determined by the balance between the air pressure and the air flow against the furnace and the flow around the probe. This will depend on the furnace and its operating regime. The conditions of the furnace atmosphere near the probe is of great importance when establishing the correct flow rate of probe cleaning air. For example, if the furnace fan is switched off the furnace pressure will change and this will alter the flow rate of the purge air. The lower the probe mV during the more effective the cleaning action will be. In most cases 3 – 5 litres per minute of air will be required.

It is bad practice to let the flame front remain at the probe tip as it can cause dramatic over heating and probe damage. The probe signal should show greater oxygen levels if the cleaning process is working, and typical cleaning should take 3 – 6 minutes, and should be carried out at the start of a cycle to ensure correct operation during the process.

Care should be taken to avoid the combustion interface coinciding with the probe tip, a circumstance where the probe temperature may rise more than 120°C.

7.2 Actions that Occur when the Gas Solenoid Keys are Pressed

The 1734 carbon controller has a built in timer to operate the solenoid outputs. The menu functions allow setting of the purge start time, the purge period, the purge duration and the output freeze time.

If a timer has not been enabled in the commissioning menu, pressing the GAS1(2) / PURGE1(2) key will turn on the solenoid for as long as the key is pressed.

If the timer has been enabled in the commissioning menu, pressing the GAS1(2) / PURGE1(2) key will turn on the solenoid for as long as the programmed duration has been set for.

Refer to the person responsible for the commissioning to find out how the controller has been configured.

8. UPDATING THE SOFTWARE

The programme for 1734 carbon controller is run from memory that is inside the main microprocessor. The programme is inserted at the time of manufacture. If the software needs to be updated to a later version, the factory can supply an EEROM (electrically erasable read only memory) containing the update. The following procedure should be used –

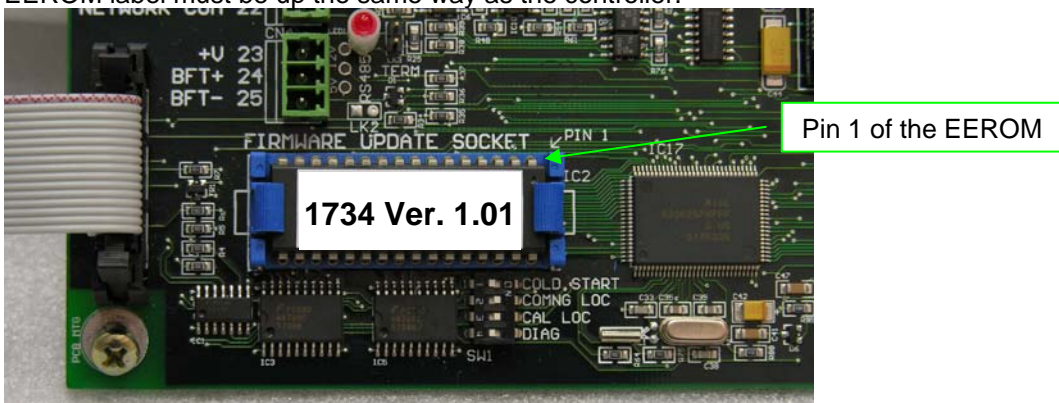
1. **Turn the power off to the controller**
2. Remove the hose from the reference air pump (if fitted)
3. Unplug the reference air pump DC power lead (if fitted)
4. Remove the shield from the main PCB in the back of the cabinet by undoing the 2 M4 screws
5. Carefully remove the update EEROM from the packaging

NOTE: The EEROM is static sensitive. Avoid static discharges through the pins of the EEROM by earthing yourself before picking up the EEROM.

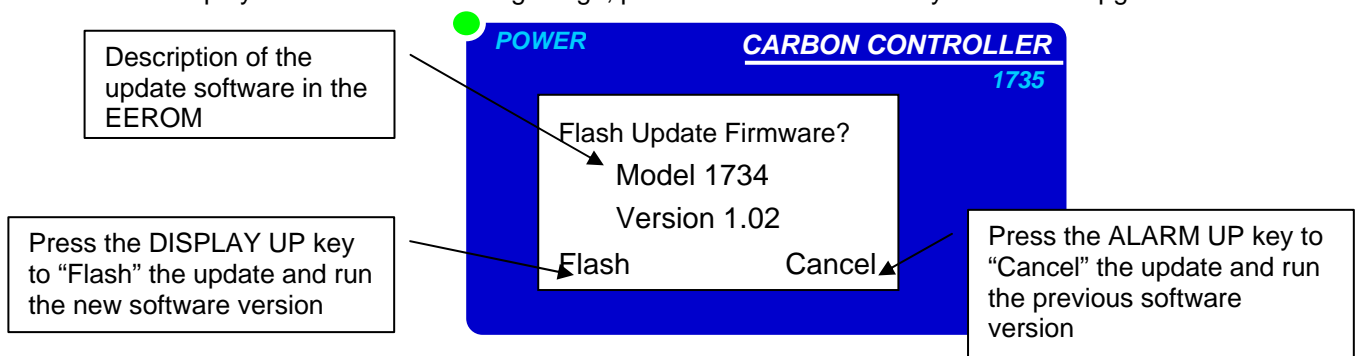
6. Plug the EEROM into the 32 pin socket in the lower left hand corner of the main PCB

NOTE: Be very careful not to bend any of the pins of the EEROM. If the EEROM does not have all the pins correctly plugged into the socket during upgrade the controller program may be destroyed and it will have to be returned to Novatech for service.

Note also the direction of the EEROM. Pin 1 is identified by a small dot on the EEROM. The writing on the EEROM label must be up the same way as the controller.



7. While the power is still turned OFF, press and hold the DISPLAY DOWN and the ALARM LOG DOWN keys. The following message should be shown on the display
8. If the message “Invalid EEROM, Unable to Upgrade” is displayed, turn the power off again and check the pins of the EEROM and that it was in the correct direction.
9. If the display looks like the following image, press the DISPLAY UP key to load the upgrade software



10. Turn the power off
11. Remove the EEROM and save it in the original packaging
12. Replace the main shield and secure it with the three screws.
13. Reconnect the reference air pump hose and plug (if fitted).
14. Turn the power back on without any keys pressed. The version number of the software will be shown on the first screen.

NOTE: The EEROM can be used to upgrade any number of controllers

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Declaration of Conformity

Application of Council Directives:

2004/108/EC
2006/95/EC

Standards to which conformity is declared:

EN50270:1999

Electromagnetic compatibility – Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen

CFR47 FCC Part 15, Subpart B (Class A)

Telecommunications

Vibration and Shock

IEC-68-2-2
IEC-68-2-3

Manufacturer's name:

Novatech Controls Pty Ltd

Manufacturer's address:

309 Reserve Road
Cheltenham VIC 3192
AUSTRALIA

Type of equipment:

Carbon controller

Model Number:

1730 Series Transmitter
1231 Oxygen Probe
1232 Oxygen Probe
1234 Oxygen Sensor

I hereby declare that the equipment specified herein conforms to the above directive(s) and standards(s) in 2007.



Full Name:
Position:

Fraser Chapman
R & D Manager