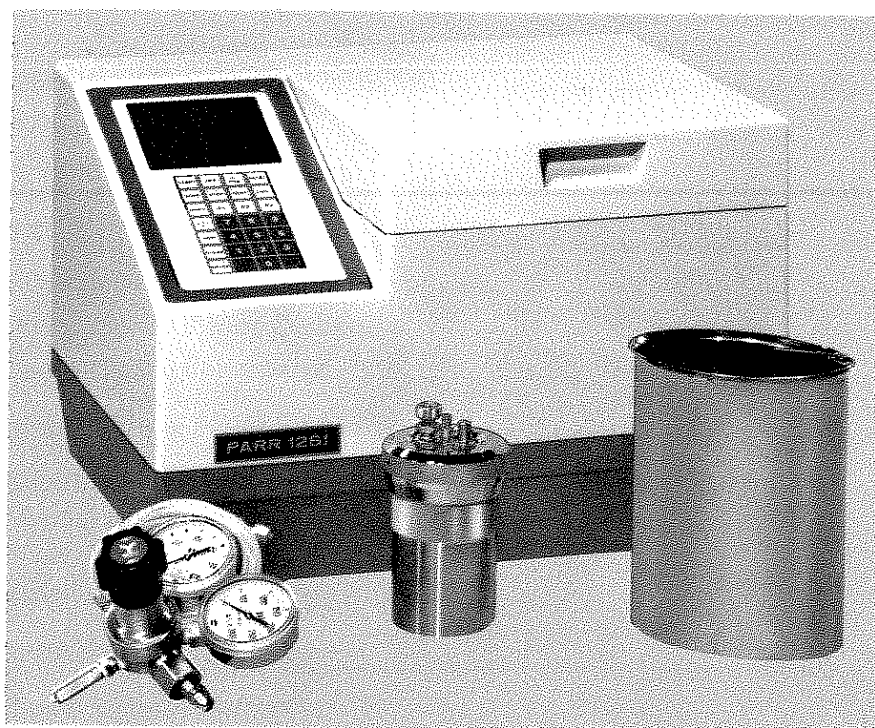


No. 242MM



1261 ISOPERIBOL BOMB CALORIMETER

Operating Instruction Manual



© 1994 Parr Instrument Company
All Rights Reserved

Table of Contents

Preface	I
Scope	I
Getting Started	I
Concept of Operation	1-1
Isoperibol Operation	1-1
Dynamic Operation	1-1
Full Microprocessor Based Process Control	1-1
Full Microprocessor Based Data Acquisition and Handling	1-2
Full Microprocessor Based Communications Capabilities	1-2
Flexible Programming	1-2
Installation	2-1
Installing the Calorimeter	2-1
Installing the Oxygen Filling System	2-3
Instrument Description	3-1
Program Installation & Control	4-1
Software Installation	4-1
Revised Default Settings	4-2
Operating Instructions	5-1
Operating the 1108 Oxygen Bomb	5-1
Operating the Filling Connection	5-1
Operating the Calorimeter	5-2
Corrections & Final Reports	6-1
Entering Corrections and Obtaining the Final Report	6-1
Manual Entry	6-1
Fixed Corrections	6-1
Automatic Data Transfers	6-1
Reporting Instructions	7-1
Report Option Selection	7-1
Report Generation	7-1
Displayed Reports	7-2

Table of Contents

Memory Management	8-1
Clearing Memory	8-1
Editing Memory	8-1
Appendix A - Star Codes	A-1
I. Function Codes	A-2
II. General Purpose & Utility	A-5
III. Calibration Summary Status	A-8
IV. Calorimetry Calculations	A-10
V. Communications & Interfacing	A-14
VI. Operating Options & Units Section	A-17
Appendix B - Error Messages	B-1
Appendix C - Standardization	C-1
Calculating the Heat of Combustion	C-1
General Calculations	C-1
Thermochemical Corrections	C-1
ASTM and ISO Methods Differ	C-2
Thermochemical Calculation Details	C-2
ISO Calculations	C-3
Spiking Samples	C-4
Reporting Units	C-4
Conversion to Other Moisture Bases	C-5
Calculation of Net Heat of Combustion	C-5
Magnitude of Errors	C-5
Appendix D - Standardization	D-1
Standardizing the Calorimeter	D-1
Standard Materials	D-2
Automatic Statistical Calculations	D-2
Appendix E - Communication Interfaces	E-1
Required Software Versions	E-1
Required Hardware	E-2
Smart Link Configurations	E-2
Termination Switches	E-2
Smart Link Configuration Checklist	E-2
Smart Link Configuration Cabling	E-3



RS232C Connection	E-3
Appendix F - Function Keys	F-1
Defining a Function Key	F-1
Viewing a Function Key	F-2
Clearing a Function Key	F-2
Appendix G - Maintenance	G-1
Filter	G-1
Oxygen Bomb	G-1
Program Updates	G-1
Replacing Bucket Thermistor Probe	G-2
Installing Support Rod Mounting Plates	G-2
Appendix H - Trouble Shooting	H-1
Instrument Lockups and Cold Restart	H-1
VBulk Voltage	H-2
Regulated 5 Volts	H-3
Keyboard Inoperative	H-3
Temperature Problems	H-4
Bomb Firing Circuit	H-4
Low Oxygen Pressure	H-5
Bucket Thermistor Replacement	H-6
Instructions for Adjusting Cover	H-6
1261 Ignition Problems	H-6
Error 3600	H-7
Appendix I - Controller Replacement	I-1
Logic Pack Removal	I-1
Combined Power Pack/Logic Pack Removal	I-1
Appendix J - Technical Service	J-1
Return for Repair	J-1
Appendix K - 1261 Program Installation	K-1
Appendix L - Parts List	L-1

Table of Contents

Figures

3-1	1261 Keyboard & Display	3-3
4-1	Main Menu	4-2
L-1	1261 Calorimeter Rear View	L-2
L-2	1261 Calorimeter Controller	L-3
L-3	1261 Calorimeter Cover (Fiberglas Cover Removed)	L-4
L-4	1261 Calorimeter Wiring Diagram	L-5
L-5	A590DD Circuit Board (In A600DD Sub-assembly (Lower Half))	L-6

Tables

3-1	Default Function Key Definitions	3-4
A-1	Star Code Directory	A-2
E-1	Required Software Versions	E-1
E-2	Smart Link Cables	E-3
E-3	Balance Port Specifications	E-4
F-1	Default Function Key Definitions	F-1
F-2	Procedure for Defining a Function Key	F-1
F-3	Viewing a Function Key	F-2
F-4	Keycode Assignments	F-2
H-1	Fuse Identification	H-2



Preface

Scope

This manual contains instructions for installing and operating the Parr 1261 Calorimeter. For ease of use, the manual is divided into nine chapters as follows:

Concept of Operation
Installation
Instrument Description
Program Installation and Control
Operating Instructions
Corrections & Final Reports
Reporting Instructions
Memory Management
Appendices

Subsections of these chapters are identified in the Table of Contents.

To assure successful installation and operation, the user must study all instructions carefully before starting to use the calorimeter to obtain an understanding of the capabilities of the equipment and the safety precautions to be observed in its operation. Instructions concerning the installation and operation of various component parts and peripheral items used with the 1261 Calorimeter are provided in separate in-

structions. Copies of these related instructions, which apply to the user's installation, should be added to and made part of these instructions. They are as follows:

<u>No.</u>	<u>Description</u>
201M	Limited Warranty
202M	Introduction to Bomb Calorimetry
205M	1108 Oxygen Combustion Bomb
207M	Analytical Methods for Oxygen Bombs
240M	1760 Sulfur Analyzer
244M	1755 Printer
245M	1552 Water Cooler
246M	1563 Water Handling System

Getting Started

These steps are offered to help install, become familiar with, operate and develop the full capabilities of the Parr 1261 Calorimeter.

CUSTOMER SERVICE

Questions concerning the installation
or operation of this instrument can be answered
by
the Customer Service Department of
Parr Instrument Company
(309)762-7716 (800)872-7720
Fax: (309)762-9453
Telex: 270226



1. Unpack and install the calorimeter in accordance with the installation instructions. This simple, step-wise procedure will acquaint the user with the various parts of the calorimeter and make it easier to understand the operating instructions which follow.
2. Review the Concept of Operations to get an understanding of the overall capabilities of the calorimeter and microprocessor control.
3. Turn on the power switch on the back of the Calorimeter Controller. Turn to the Instrument Description chapter to find definitions of the key controls and annunciator lights on the display.
4. Turn to the Star Code descriptions in Appendix A to review the codes which are used to modify the program contained in the 1261 Calorimeter. Reviewing the Star Codes will provide an idea of the capabilities and flexibility designed into this instrument.
5. Review the Program Installation and Control chapter to see that the factory settings match your intended mode of operation. Star Code 50 should be used to access the program parameters through the Main Menu. A program installation checklist is in Appendix K for users who do not have a printer to access the Main Menu.
6. Review the Reporting and Memory Management chapters to become familiar with the manner in which calorimetry corrections are entered. These sections also discuss generating final reports, editing and clearing memory.
7. Review the Error Message descriptions given in Appendix B.
8. Review the Calculations performed by the 1261 Calorimeter in Appendix C.
9. Consult Appendix E, Communication Interfacing, for the correct installation of any Smart Link peripherals to the 1261 Calorimeter.
10. Standardize the calorimeter. This will serve two important functions. First, it will generate the energy equivalent factor required to calculate the heat of combustion of unknown samples. Secondly, it will give the operator the opportunity to run tests on a material with a known heat of combustion to become familiar with the instrument and confirm the instrument and operating procedures are producing results with acceptable precision. Most 1261 Calorimeters with 1108 Oxygen Bombs and 2000 grams of water will have an energy equivalent of 2405 ± 5 calories per $^{\circ}\text{C}$. The operating instructions for Standardization Runs and Determinations are identical, except for the setting of the instrument to standardization or determination.
11. After successful standardization, the 1261 Calorimeter should be ready for testing samples.

Concept of Operation

The Parr 1261 Oxygen Combustion Bomb Calorimeter has been designed to provide rapid and reliable heat of combustion values for solid and liquid fuels. This instrument combines third generation microprocessor hardware and software with the calorimeter designs, technical knowledge and customer support developed by Parr in the 91 years that calorimetry has been a principal thrust of our company. This chapter explains the important design and operating concepts incorporated into the 1261 Calorimeter.

Isoperibol Operation

In isoperibol operation, the calorimeter jacket is held at a constant temperature while heat from the burning sample causes the bomb and bucket temperature to rise. The small heat flow between the bucket and its surroundings during a test is monitored by a microprocessor in the calorimeter, which continuously determines the effect of any heat leak and applies the necessary correction automatically. This system differs from adiabatic operation in which the jacket temperature must be adjusted continuously to match the bucket temperature in an attempt to maintain a zero temperature differential with no heat leaks between the bucket and its surroundings. Calorimetrists have long recognized the advantages of simplification and better precision obtainable with a well designed and executed isoperibol system as opposed to the rapidly changing jacket temperature required in an adiabatic calorimeter.

Dynamic Operation

In its Dynamic Operating Mode, the calorimeter uses a sophisticated curve matching technique to compare the temperature rise with a known thermal curve to extrapolate the final temperature rise without actually waiting for it to develop. Repeated testing, and over 5 years of routine use in fuel laboratories, has demonstrated that this technique can cut the time required for a test by one-half without significantly affecting the precision of the calorimeter.

Full Microprocessor Based Process Control

The microprocessor controller in this calorimeter has been preprogrammed to automatically prompt the user for all required data and control input and to:

- A. Generate all temperature readings in the calorimeter.
- B. Monitor jacket as well as bucket temperatures.
- C. Confirm equilibrium conditions.
- D. Fire the bomb.
- E. Confirm that ignition has occurred.
- F. Determine and apply all necessary heat leak corrections.
- G. Perform all curve matching and extrapolations required for dynamic operation.
- H. Terminate the test when it is complete.
- I. Monitor the conditions within the calorimeter and report to the user whenever a sensor or operating condition is out of normal ranges.



Full Microprocessor Based Data Acquisition and Handling

In addition to its process control functions, the microprocessor in the calorimeter has been preprogrammed to:

- A.** Collect and store all required test data.
- B.** Apply all required corrections for combustion characteristics.
- C.** Compute and report the heat of combustion for the sample.

Full Microprocessor Based Communication Capabilities

The 1261 Calorimeter is ready for use on the Parr Smart Link network, as well as equipped with an RS232C output for local printing using an optional printer. The 1261 Calorimeter can communicate as follows:

- A.** With the 1741 Balance Interface to receive sample weights.
- B.** With the 1750 Proximate Analyzer to receive sample weights and provide Btu's for Proximate reports.
- C.** With the 1760 Sulfur Analyzer to receive sulfur and acid corrections and to send sample weights.
- D.** With the 1742 Sulfur Interface to receive sulfur corrections.
- E.** With any 1730/1720 Calorimeter Controller to send calorimetric reports.
- F.** With the 1745 Computer Interface to send heat of combustion data for consolidated reporting.

Flexible Programming

The third generation software built into this calorimeter and accessed through the STAR CODE routines permit the user to customize the operation of the calorimeter to meet a wide variety of operating conditions including:

- A.** A large selection of printing options.
- B.** Choice of accessories and peripheral equipment.
- C.** Multiple options in regard to handling thermochemical corrections.
- D.** Choice of ASTM or ISO correction procedures.
- E.** A variety of memory management and reporting procedures.
- F.** Complete freedom for reagent concentrations and calculations.
- G.** Unlimited choice of reporting units.
- H.** Automatic bomb usage monitoring and reporting.
- I.** A choice of Equilibrium or Dynamic test methods.
- J.** Automatic statistical treatment of calibration runs.
- K.** Enhanced testing and trouble shooting procedures.

Installation

Installing the Calorimeter

The 1261 Calorimeter is completely assembled and given a thorough test before it is shipped from the factory. If the user follows these instructions, installation of the calorimeter should be completed with little or no difficulty. If the factory settings are not disturbed, only minor adjustments will be needed to adapt the calorimeter to operating conditions in the user's laboratory.

1. Unpack the calorimeter carefully. If shipping damage is discovered, report it immediately to the delivering carrier. The calorimeter and all of its component parts are packed in one carton. The unit has had all internal connections made, and other than connections to cooling water and oxygen supplies, no additional assembly should be required. Set the calorimeter on a sturdy bench or table in a location that is reasonably free from drafts and protected from sources of radiant heat; preferably in an air conditioned room. There should be convenient access to running water, to a drain and appropriate grounded electrical outlet. Running water and a drain are not required when the unit is used in conjunction with a Parr 1563 Water Handling System.
2. Raise the cover of the calorimeter and swing it vertically to the back. Remove the calorimeter bucket and discard the packing material. Check the calorimeter bucket and note the three dimples in the bottom which rest on supporting pins when the bucket is placed in the jacket. The single dimple must always be placed to the back of the jacket. There will also be two ignition wires extending into the oval chamber through the opening in the left side of the jacket.
3. If operation of the calorimeter will be done in conjunction with a 1563 Water Handling System, make the water connections at this time. Connect the line supplying water from the filling system to the connection at the lower left hand corner at the water jacket (rear view). The metering valve at this connection should be fully open when used with a 1563 Water Handling System. Adjustment of the systems temperature to between 29° and 31°C will provide water at the correct temperature for the 1261 Calorimeter. Step 4 may be skipped if the water connection has been made to the 1563 Water Handling System.

Please Note

While some print functions (such as the main menu) will always be sent to the printer, the default setting sends reports to the display and not the printer. This can be changed using the main menu or *402.



4. Connect a cold water line to the inlet valve in the lower left hand corner of the water jacket on the back of the calorimeter. This is the water connection to the cooling coil within the jacket. It will not fill the jacket with water. The inlet water connection is made with 1/4" copper tubing furnished for this purpose. Keep all water lines as short as possible to avoid unwanted temperature changes. If the supply pressure exceeds 60 psig, it will be necessary to install a reducing valve to keep the pressure below the 60 psig maximum. Ideally, the product of the cooling water flow rate in liters per minute, and the difference between the jacket set point and the inlet water temperature in degrees C should be 3.6 degree liters per minute.
5. Attach a drain line to the discharge connection of the solenoid valve attached to the back of the calorimeter jacket. Flexible plastic tubing is normally used for the cooling water outlet or drain. A small white collar is wired to the outlet fitting on the calorimeter. Slip this collar over the opening and insert the tubing into the connector. To remove the tubing, press in on the white collar and pull out on the tube.
6. If a printer is to be used with the calorimeter, connect it to the calorimeter at this time. The Parr 1755 Printer is configured and furnished with a cord to connect directly to the RS232C port of the calorimeter.
7. Plug the power cord into any grounded outlet providing power which matches the specification on the nameplate of the calorimeter. The calorimeter will draw approxi-

mately 1000 watts of power. Grounding is very important not only as a safety measure, but also to ensure satisfactory controller performance. If there is any question about the reliability of the ground connection through the power cord, run a separate earth ground wire to the controller chassis.

CAUTION:
CALORIMETER MUST BE
FILLED WITH WATER BEFORE
F1 KEY IS USED. THIS WILL
PREVENT IMMEDIATE
HEATER BURNOUT

8. The water jacket of the calorimeter must be filled manually with approximately 9 liters of water. To fill the jacket, raise the cover and remove the filling plug which is the 1/2" diameter plug located on top of the jacket between the bucket chamber and the right-hand cover hinge. Add water through this opening until the water level is just below the top plate of the jacket. Now turn on the main power switch on the back of the control chassis and push the F1 key to start the pump. As water is circulated to the cover of the calorimeter, the water level will fall. Top off the jacket until it remains within approximately 1/8" below the top plate and replace the filling plug. To turn off the pump, push the F1 key again.
9. With the power switch turned on, the 1261 Calorimeter panel should light up and automatically perform several self-tests. A successful test concludes with the display of the revision number of the software. If the test is not successful, an error mes-

Installation

sage is displayed. The calorimeter should be turned off when not in use for long periods of time. A battery backup feature is included in the instrument to protect the memory in the event of a power shut-off or accidental power interruption.

10. Next, connect and check out the oxygen filling connection using the following detailed instructions.

Installing the Oxygen Filling System

The 1261 Calorimeter is equipped with an automatic bomb filling system which consists of an oxygen pressure regulator with a relief valve and mounts on the oxygen tank, a control and measurement system mounted in the calorimeter case, and connection tubes which connect the regulator to the control and the control to the bomb itself.

To install the regulator, unscrew the protecting cap from the oxygen tank and inspect the threads on the tank outlet to be sure they are clean and in good condition. Place the ball end of the regulator in the outlet and draw up the union nut tightly, keeping the gages tilted slightly back from an upright position. Connect the regulator to the inlet fitting on the back of the calorimeter case. Flexible high pressure, 1/8" diameter nylon tubing is provided.

Attach the bomb filling hose (1/8" tubing) to the tubing connector nearest the back of the calorimeter case. These hoses should be routed so that they will not kink or come in contact with any hot surface. All connections should be checked for leaks. Any leaks detected must be stopped before proceeding. Instructions for operating the filling connection are in the

Operating Instructions chapter. The pressure regulator was set at the factory to deliver oxygen at 450 psig, the recommended charging pressure, and should be checked before starting to use the system by observing the pressure attained during an actual filling operation.

To do this, assemble the oxygen bomb without a charge and attach the filling hose to the bomb inlet valve. Then push the O₂ button on the calorimeter control panel and observe the delivery pressure as shown on the 0-600 psi gage while oxygen is flowing into the bomb. Adjust the regulator, if needed, to bring the pressure to 450 psig. If there is any doubt about the setting, release the gas from the bomb and run a second check.

During extended periods of inactivity (overnight or longer), close the tank valve to prevent leakage. When changing oxygen tanks, close the tank valve and depress relief valve to exhaust the system. Do not use oil or combustible lubricants on this filling system or on any devices handling oxygen under pressure. Keep all threads, fittings, and gaskets clean and in good condition.



The recommended 450 psig filling pressure is slightly higher than the 30 atm prescribed in Parr bomb and calorimeter instruction manuals. This difference is insignificant. Higher or lower settings can be used, but the bomb must never be filled to more than 600 psig (40 atm). If pressures below 28 atm are used, the low pressure warning will always occur.

Instrument Description

Before using the 1261, the user should understand the various keys and lights on the control and display panels. The brief descriptions given here will identify these controls and their functions. Instructions in later sections will provide detailed operating directions.

<u>Key</u>	<u>Description</u>
START	This command key is used to start a test. After it has been depressed, the calorimeter will prompt the user to enter all preliminary data required for the test.
RPT	This key is used to initiate the reporting process. Reports can be sent to the display of the 1261 Calorimeter, to an attached printer, or over the Smart Link to a controller. Before any preliminary reports can be made final, the controller will prompt the user to provide any missing data, such as fuse, acid and/or sulfur corrections.
O₂ FILL	This key is used to activate the oxygen filling system which is used to fill the bomb. The reset key can be used to abort the filling procedure.
RESET	This key is used to abort a test or to escape from a special subroutine. (i.e. reporting or memory management.)
DONE	This key is used to indicate the completion of a test and to transfer all of the determined values into the mem-

ory of the calorimeter. The DONE key is also used to exit from the Star Code Editor.

STEP	This key is used to review or step through multiple data elements stored in the memory for a single Sample ID or Star Code, as displayed on the calorimeter.
NEXT & LAST	The next key is used to advance one value when reviewing or editing the data contained in a series of Star Codes. The LAST key is used to backup one value.
SHIFT	This key is used to change the function of another key in much the same way that the shift key operates on a typewriter. For example, the function keys can be shifted to provide a total of six programmed functions on the three keys.
F1	The F1 key is used to turn on and off the heater, circulating pump and water solenoid valve. This key is a toggle which turns these functions as well as the jacket temperature control function on and off. It must be turned on and the controller given enough time to bring the jacket to the starting temperature before a test can be run.
F1, F2, F3	These are three user definable keys. They can be programmed to enter any commonly used series of



keystrokes. They can be shifted to provide a total of six readily available programs. Frequently used Star Codes are one example of their use.

**0-9
· and ***

This keyboard is used for all manual data entries. It includes a decimal (.) key and a star (*) key whose function is described later in this manual. See Appendix A.

+/-

This key is used to enter negative numbers. It operates as a toggle.

SKIP

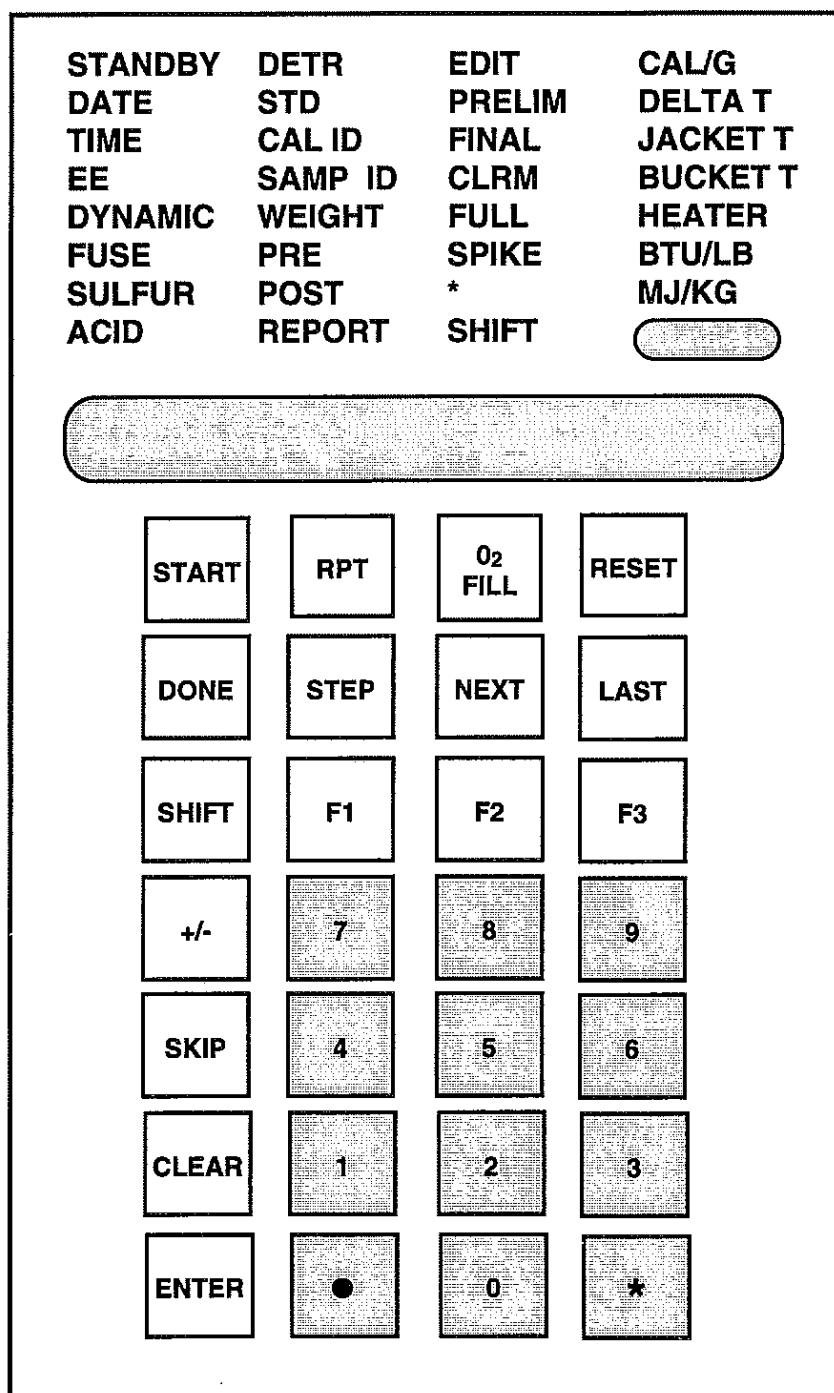
This key allows the user to omit the entry of data requested by the calorimeter. It may also be used to pass over a prompted request for information already held in memory or in connection with certain Star Code functions.

**ENTER
&
CLEAR**

Any numerals and decimals keyed onto the keyboard will appear on the display before they are entered into the system. If the user is satisfied with the value shown on the display, strike the ENTER key to enter them into the controller. Incorrect values are erased from the display by pressing the CLEAR key.

Instrument Description

Figure 3-1
1261 Keyboard & Display





PROMPT The DATE, TIME, CAL ID, SAMP ID, FUSE, SULFUR, WEIGHT, ACID, & SPIKE annunciators on the display board will flash to prompt the user to enter the required information.

STATUS The STANDBY, DETR, STD, DYNAMIC, PRE, POST, REPORT, EDIT, *, SHIFT, HEATER, JACKET T, & BUCKET T lights inform the user of the current mode of operation or status of the instrument.

REPORT The DATE, TIME, EE, FUSE, SULFUR, ACID, DETR, STD, CAL ID, SAMP ID, WEIGHT, PRELIM, FINAL, SPIKE, DELTA T, cal/g, Btu/lb, & MJ/kg lights will come on to identify values shown on the numerical display. The FULL, CLRM, EDIT lights are used to monitor and manipulate the memory of the instrument.

**Table 3-1
Default Function Key
Definitions**

F1	Toggle heater, pump, and water solenoid On/OFF(*101)
SHIFT F1	Clear Memory (*20)
F2	Unused
SHIFT F2	Toggle Between Standardization and Determination Mode (*103)
F3	Unused
SHIFT F3	Activate Ignition Circuit (*41)

Program Installation & Control

Software Installation

The program in the model 1261 Calorimeter can be extensively modified by the user to tailor it to a wide variety of operating modes, reporting units, laboratory conditions, available accessories, and communication modes. In addition the calculations, thermochemical corrections and reporting modes can be modified to adapt them to conform to a number of standard test methods and procedures. Numerous provisions are also included to permit the user to use his own reagent concentrations, techniques, combustion aids and short cuts appropriate for his or her work.

Changes to the program are made by use of the menu structure described in Appendix A. Any of these items can be individually entered at any time to revise the operating program.

Units are preprogrammed with DEFAULT SETTINGS which will be effective until they are changed by the user. Battery backed-up memory is provided to retain any and all user initiated program changes; even if power is interrupted or the unit is turned off. If the unit experiences an intentional or unintentional "Cold Restart", the calorimeter will return to its default settings.

Please Note

The default setting sends the calorimetric reports to the display. Users with printers will want to change this to the printer by using either the Main Menu or *402.

A MENU DRIVEN, conversational program is available to automatically set the commonly used Star Codes. This menu operates through the printer and is activated by pressing *50 ENTER. The calorimeter will then print the Main Menu shown as Figure 4-1. The user should carefully review all of the items listed to see that they match his desired operating modes. Any of these items can be revised by entering the item number from the Main Menu. The calorimeter will prompt the user for the appropriate response. The user can go up one level in the prompt sequence at any time by entering the decimal (.) point. The Main Menu can be reprinted to confirm any changes by pressing 0 at the "select" prompt in the Main Menu. The user can exit directly to the Main Menu from any sub menu by pressing the SKIP key. Pressing the DONE key exits from this utility.

Some of the more esoteric Star Codes such as those that control the communication speeds and protocols for printers other than the Parr 1755 Printer, the password protector, and the conversion factors for non-standard units or concentrations are not accessible through the menu and must be set manually. For this reason, the user should review all the Star Codes to become familiar with the capabilities of the instrument beyond those controlled by the Main Menu.

Users who do not have a printer attached to their calorimeter will want to use the installation checklist found in Appendix K to review and modify the default settings of the calorimeter.



Revised Default Parameters

The default parameters of the 1261 Controller can be changed in order to guarantee that the 1261 Calorimeter, when cold restarted, is always in the desired configuration before beginning a series of tests. Users who wish to permanently revise their default settings may do so using the following procedure.

After the calorimeter operating parameters have been established, the user may store this "setup" as the default set of parameters. Star Code 98 will prompt the user for a "User ID" which can be any number that is helpful in identifying this "setup" to the user. Pressing the SKIP key will display the current user revision which can either be entered or revised. The user revision is printed as a header upon executing Star Code 50 or displayed at any time by executing Star Code 97. After providing the User ID, the current setup will be stored to EEPROM. If error 1700 is displayed, the OP1 jumper on the CPU board of the logic pack must be installed. Refer to Appendix I to gain access to the logic pack. The OP1 EEPROM write enable jumper is located on the left hand perimeter of logic pack while looking at the keyboard. Remove the jumper which is stored on one pin of OP1 and install it on both pins. After the user setup has been stored, the user may wish to remove the OP1 jumper to prevent unauthorized revision to the contents of the EEPROM and the default user setup.

**Figure 4-1
Main Menu**

1. Time: HH:MM:SS (Current)
2. Date: MM/DD/YY (Current)
3. Units: BTU/LB
4. Operating Mode: Dynamic
5. Jacket Temperature: 35.00000
6. Jacket Set Point Tolerance: 0.05
7. Standard Material:
Heat of Combustion = 6318.CAL/G
8. Automatic Cal ID Selection: ON
9. Report To: Display
10. Printer: RS232C - 1755 Printer
11. Overwrite Final Reports: OFF
12. Edit Final Reports: OFF
13. Data Entry Modes:
Manual Weight Entry
Manual Spike Weight Entry
Manual Acid Entry
Manual Sulfur Entry
14. Auto Sample ID: OFF
15. Corrections:

	STD	DETR
Fuse	15	15
Acid	10	10
	Mixed Acid	Mixed Acid
Sulfur	0.00, Fixed	0.00
	Percent	Percent
16. Spiking: Not Used
17. EE Value Based On: Latest 10
18. EE RSD% Tolerance: 0.15%
19. Energy Equivalent Status:

Cal ID	Value	Protect	RSD	Runs
	Cal/Deg		%	
1	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
000000	0.000000	No	0.000000	0
20. Bomb Service Interval: 500
21. Bomb Use Counters:

Cal ID	Count
000000	0
000000	0
000000	0
000000	0
000000	0
000000	0
000000	0
000000	0

Select Menu Entry (0-Prints Main Menu)

Operating Instructions

Operating the 1108 Oxygen Bomb

Detailed instructions for preparing the sample and charging the 1108 Oxygen Bomb are given in Operating Instructions No. 205M. Follow these instructions carefully, giving particular attention to the precautions to be observed in charging and handling the bomb.

Operating the Filling Connection

To fill the bomb, connect the hose to the bomb inlet valve and push the O₂ button on the calorimeter control panel. The calorimeter will then fill the bomb to the preset pressure and release the residual pressure in the connecting hose at the end of the filling cycle. The main display will read O₂ FILL while the bomb is being charged. It will take approximately 40 seconds to fill the bomb. (Pushing the RESET key will stop the flow of oxygen at any time.) Once the display returns to its normal reading, the user can disconnect the coupling and proceed with the combustion test.

If the charging pressure fails to reach approximately 28 atmospheres during the filling cycle, an ERROR 3600 message will be reported on the display or printer. If

this occurs, check the system carefully for low tank pressure, a closed tank valve or leaks in the system.

The charging cycle can be started at any time, but once it is started it will lock out any other keyboard or reporting activity until it is completed. It will not interrupt a test in progress. If the charging cycle should be started inadvertently, it can be stopped immediately by pushing the RESET key.

During extended periods of inactivity, overnight or longer, close the tank valve to prevent leakage. When changing oxygen tanks, close the tank valve and push the O₂ FILL key to exhaust the system. Do not use oil or combustible lubricants on this filling system or on any devices handling oxygen under pressure. Keep all threads, fittings, and gaskets clean and in good condition. Replace the two 394HC O-rings in the slip connector if the connector fails to maintain a tight seal on the bomb inlet valve.

The recommended 450 psig filling pressure is slightly higher than the 30 atm prescribed in Parr bomb and calorimeter instruction manuals. This difference is insignificant. Higher or lower settings can be used, but the bomb must never be filled

WARNING - DO NOT OVERFILL THE BOMB.

The safety relief valve on the regulator should protect the system from an overfill. If for any reason, the bomb should accidentally be charged to more than 600 psig (40 atm), do not fire the bomb. The dangerous pressures which might develop under such conditions could damage the bomb and injure the user. If there is any reason to believe that the bomb has been over-filled, stop the filling operation immediately, exhaust the bomb and open it to check for any loss of sample before repeating the filling procedure.



to more than 600 psig (40 atm). If pressures below 28 atm are used, the low pressure warning will always occur.

Operating the Calorimeter

All operations required to standardize the 1261 Calorimeter, or test an unknown sample, should proceed step-wise in the following manner:

1. Turn on the calorimeter and press the F1 key to activate the pump, heater and flow of cooling water. Allow at least 20 minutes for the controller to warm up and the jacket temperature to stabilize. The STANDBY annunciator will turn on when the jacket temperature has reached the setpoint. The bomb parts should be wetted and then dried in the manner used at the conclusion of a test. This serves to wet all sealing parts, as well as leaving the bomb with the same amount of residual water which will exist in all subsequent testing.

If the calorimeter takes longer than 20 minutes to heatup 6°C, either the flow rate of the cooling water is too high or the temperature of the incoming water is too low. If the calorimeter jacket temperature stays higher than the setpoint (normally 35°C), then the opposite of the above conditions exist.

Keep in mind that the product of the cooling water flow as read in liters/min and the absolute difference between the jacket setpoint (normally 35°C) and the inlet water temperature is °C should be between 2 and 4. These settings will maintain heater duty cycles of between 30% and 60%.

2. Prepare the sample and charge the oxygen bomb as described in Operating Instructions No. 205M, the Filling Connection section.

The throughput of the 1261 Calorimeter can be increased by using multiple bombs and water buckets. With this arrangement, the calorimeter can operate almost continuously since the operator will be able to empty a bomb and recharge it while a run is in progress. A bomb and bucket for the next run will be ready to go into the calorimeter as soon as it is opened. Each bomb and bucket combination will have to be standardized separately and the proper energy equivalent for each set must be used when calculating the heat of combustion.

3. Fill the calorimeter bucket by first taring the dry bucket on a solution or trip balance; then add 2000 (+/- 0.5) grams of water. Distilled water is preferred, but demineralized or tap water containing less than 250 ppm of dissolved solids is satisfactory. The water temperature should be approximately 3 to 5°C below the jacket temperature. It is not necessary to use exactly 2000 grams, but the amount selected must be duplicated within +/-0.5 gram for each run. Instead of weighing the bucket, it can be filled from an automatic pipet, or from any other volumetric device if the repeatability of the filling system is within +/-0.5 ml.

To speed and simplify the bucket filling process, and to conserve water and energy, Parr offers a closed-circuit Water Handling System (No. 1563). This provides a water supply, cooled to the starting temperature and held in an automatic pipet

Operating Instructions

ready for delivery in the exact amount needed to fill the bucket. A 1552 Water Cooler is required when using the 1563 Water Handling System. Instructions for this automatic system are given in Operating Instruction No. 246M.

4. Set the bucket in the calorimeter. Attach the lifting handle to the two holes in the side of the screw cap and partially lower the bomb in the water. Handle the bomb carefully during this operation so that the sample will not be disturbed. Push the two ignition lead wires into the terminal sockets on the bomb head. Orient the wires away from the stirrer shaft so they do not become tangled in the stirring mechanism. Lower the bomb completely into water with its feet spanning the circular boss in the bottom of the bucket. Remove the lifting handle and shake any drops of water back into the bucket.
5. Close the calorimeter cover. This lowers the stirrer and thermistor probe into the bucket.
6. Push the START key or SHIFT START to initiate the test. Pressing SHIFT START will automatically toggle the mode between stand-

ardization and determination. If *516 has been set ON, there will be no prompting for the CAL ID (this is the factory default). If *516 has been set OFF, the CAL ID light will now flash requesting the identification number for the bomb and bucket to be used in this test. Enter this number. The calorimeter will check its memory to make certain that it has a usable EE value for this CAL ID, and it will advise if NO match is found. Next, the calorimeter will prompt for the Sample Identification Number by flashing the SAMPLE ID light. Enter this number by using any number, up to six digits, to identify the sample. The calorimeter will check its memory and will not accept duplicate SAMPLE ID numbers. Enter this value. If you want to automatically assign Sample ID Numbers, please see Star Codes 150, 152, and 154. Finally, the calorimeter will prompt for the sample weight by flashing the WEIGHT light.

7. The calorimeter will now take over and conduct the test. During the time it is establishing the initial equilibrium, it will light the PREPERIOD light. Just before it fires the bomb, it will sound a series of short beeps to warn the user to move away from the calorimeter.

Once the bomb has been fired, the POST light will come on. The calorimeter will check to make certain that a temperature rise occurs and will then look for the final equilibrium conditions to be met. If it fails to meet either the initial or final equilibrium conditions, or if it fails to detect a temperature rise within

CAUTION:

Do not have the head, hands, or any part of the body over the calorimeter when the bomb is being fired. Continue to stand clear for 30 seconds after firing.



the allotted time, the calorimeter will terminate the test and advise the user of the error.

8. At the conclusion of the test, the calorimeter will signal the user. Press the DONE key to store the test result in the memory of the calorimeter. Pressing START or SHIFT START to begin a new test will automatically store the results from the previous test. Pressing the SKIP key at the end of the test will prompt for the necessary calorimetry corrections (fuse, acid, sulfur) which are discussed later. If these numbers are not available at the conclusion of the test, press DONE to simply store the test results for later reporting.
9. Open the cover and remove the bomb and bucket. Remove the bomb from the bucket and open the knurled valve knob on the bomb head to release the residual gas pressure before attempting to remove the cap. This release should proceed slowly over a period of not less than one minute to avoid entrainment losses. After all pressure has been released, unscrew the cap; lift the head out of the cylinder and place it on the support stand. Examine the interior of the bomb for soot or other evidence of incomplete combustion. If such evidence is found, the test will have to be discarded.
10. Wash all interior surfaces of the bomb with a jet of distilled water and collect the washings in a beaker.
11. Remove all unburned pieces of fuse wire from the bomb electrodes; straighten them and measure their combined length in centimeters. Subtract this length from the initial length of 10 centimeters and multiply this burned length by 2.3 calories per cm (for Parr 45C10 Fuse Wire) to obtain the fuse correction. The scale on the fuse wire card can be used to obtain this value directly.
12. Titrate the bomb washings with a standard sodium carbonate solution using methyl orange, red or purple indicator. A 0.0709N sodium carbonate solution is recommended for this titration to simplify the calculation. This is prepared by dissolving 3.76 grams of Na_2CO_3 in the water and diluting to one liter. NaOH or KOH solutions of the same normality may be used.
13. Analyze the bomb washings to determine the sulfur content of the sample if it exceeds 0.1 percent. Methods for determining sulfur are discussed in Operating Instructions No. 207M.
14. At the end of the testing period, turn OFF the calorimeter at the power switch.

Corrections & Final Reports

Entering Corrections and Obtaining the Final Report

Final reports for each test can be obtained whenever the user is prepared to enter the corrections for acid, sulfur and fuse. The user has a choice of manual entry, fixed corrections or automatic data transfer for entering those corrections.

The user may select any combination of these methods which suit his needs and installation. Refer to the Reporting Instructions, Chapter 7, for the steps necessary to initiate a report from the calorimeter.

Manual Entry

During the reporting process, the calorimeter will prompt the user to enter the following values:

Fuse Correction: Key in the Fuse Wire Correction and press the ENTER key. The default setting for this value is to be entered in calories.

Acid Correction: Key in the Acid Correction and press the ENTER key. The default setting for this value is to be entered in milliliters of standard alkali required to titrate total acid or calories.

Sulfur Correction: Key in the Sulfur Correction and press the ENTER key. The default setting for this value is entered as percent sulfur in the sample.

Enter these values when requested by the corresponding prompt light. After the last entry has been made, the calorimeter will automatically produce a final report. If values for these corrections are not available, the user can use the SKIP key to pass over any of these corrections. However, a final report will not be printed until an

entry is made for each of the three correction factors. The user can terminate this process at any point by pressing the DONE key.

Fixed Corrections

In many cases, fixed values for fuse and acid can be used without introducing a significant error since the corrections are both relatively small and constant. Fixed sulfur corrections can also be used whenever a series of samples will be tested with a reasonably constant sulfur content. Details for applying fixed corrections are found in the Thermochemical Calculation Details Section of Appendix C. Any value setup as a fixed correction will be automatically applied and the calorimeter will not prompt the user for this value.

Automatic Data Transfers

Acid and/or sulfur corrections can be automatically transferred into the calorimeter from a Parr 1760 Sulfur Analyzer. Sulfur corrections can also be transferred from a Parr 1742 Sulfur Interface. Star Codes 130 and 140 are used to set up the automatic transfer from devices connected via the Smart Link when setup for automatic control. The calorimeter will poll the attached device when the user initiates the reporting process. If a value is not found, the user will have the option of entering it manually.



Reporting Instructions

Report Option Selection

The 1261 Calorimeter can transmit data over the Smart Link for formatting and printing on either another 1261 Calorimeter or an attached computer. Data can also be transferred over the RS232C port to a 40 or 80 column printer to provide a printed report. This port can also be used to transmit data to a host computer if the Smart Link is not used. In this case, the data will have to be received, stored and formatted by programs residing in the host computer. In addition to the cabling and communication requirements contained in the installation manual, the calorimeter must be programmed to format and direct the report to the desired printing device. These options are set up using the Star Codes described in Appendix A.

Please Note: The default setting sends the calorimetric reports to the display. Users with printers will want to change this to the printer by using either the Main Menu or Star Code 402.

Report Generation

There are two kinds of calorimeter reports which can be issued; preliminary and final. Preliminary reports are generated at the conclusion of a test run when one or more of the calorimeter corrections (FUSE, ACID, SULFUR, SPIKE) is not fixed. A final report contains all of the final or fixed calorimetric corrections needed in order to give either an energy equivalent or heat of combustion value.

Reports may be obtained by pressing the RPT key. This will illuminate the SAMP ID annunciator which will flash to prompt the user to key in the Sample Identification Number of the desired report followed by the ENTER key. The desired report will

now be sent to the designated device. The RESET key may be used to terminate this process. To obtain a block of reports between two specified sample numbers, press the RPT key. The SAMP ID light prompts for an entry, as above. Enter the first sample number to the display, press the DECIMAL (.) key, which indicates a block of reports are to be reported, and enter the last sample number to the display, followed by the ENTER key.

During the reporting process, any preliminary reports will cause the Sample ID to be displayed with the SAMP ID annunciator flashing. Pressing the "STEP" key will prompt the user for any required information needed to make the report final, such as FUSE, ACID, and SULFUR corrections. If Smart Link communication is enabled for acid and sulfur information, and a fixed fuse correction is enabled, this prompting of information is eliminated.

Pressing the SHIFT key, followed by the RPT key, will report the test information "as is". Preliminary reports will remain preliminary and the energy equivalent or heat of combustion value which is reported will reflect the fixed constants taken from Star Codes 317 thru 321 or 367 thru 371.

The printing of large numbers of reports may be avoided at any time using the RESET key. The reset action will take effect after the current report has been completely transmitted.



Users that want the Net Heat of Combustion printed as a part of preliminary and final reports will need to turn ON *366. At the prompt, the user will enter the hydrogen (H) value and a Net Heat of Combustion will print as an extra line on the report. This information will not transfer over the Smart Link.

Displayed Reports

Reports may also be obtained through the display on the 1261 Calorimeter. The procedure for obtaining reports on the display is the same as for obtaining printed reports. Information in the displayed report is accessed by using the STEP key. Data is reported in the following order with the appropriate annunciator lit: SAMPLE ID, DATE, TIME, CAL ID, WEIGHT, SPIKE, FUSE, ACID, SULFUR, starting temperature (given as Bucket T), DELTA T, EE or Heat of Combustion followed by percent hydrogen (%H) and Net Heat of Combustion when *366 is turned ON.

Percent hydrogen (H) is annunciated using the unlabeled bar LED in the lower right hand corner of the 1261 Controller. It will flash when the user is being prompted for the percent hydrogen (H) entry. The calculated Net Heat of Combustion value is annunciated by the flashing of the user selected units LED.

Memory Management

The calorimeter will hold data for 150 tests within its memory. These tests may be either preliminary, final, determination or calibration reports. Once the memory of the calorimeter is filled, any attempt to start a new analysis will cause the calorimeter to display ERROR 600 and turns on the FULL light. The user must then clear some of the memory using the following procedure. Note that turning Star Code 170 "ON" permits the calorimeter to automatically replace the oldest existing final reports with new tests.

Clearing Memory

This capability allows the user to delete Sample ID numbers and all related data and results for a single report, a sequence of reports or for all reports.

To clear a single report, press SHIFT F1 which causes the CLRM light to turn on, and the Sample ID light will flash for the entry of a Sample ID Number. Key in the Sample Identification number and press the ENTER key to initiate the deletion of this sample number and all related results and data.

To clear a sequence of reports, press shift F1, key in the first Sample ID Number in the sequence and then press the DECIMAL (.) key. This will clear the display and indicate a block deletion process. The ID light will prompt for the last number in the sequence of reports. Key in this Sample ID and press the ENTER key to complete the process. To clear all reports, use the sequence procedure with 1 as the first Sample ID and 999999 as the last number of the sequence.

Editing Memory

The user is able to add data and information to the previously gathered information for a test by using the Memory Editing procedures described below. This feature is provided principally to permit adding sample weights or other information to preliminary tests. Sample weights and even determined values can be revised on final reports, but only when Star Code 172 has been set to authorize this editing. The calorimeter must be set to report to the display before attempting to edit reports. This is done by setting Star Code 402 to 1.

To edit a report, press the RPT key or SHIFT RPT. The calorimeter will then prompt for the Sample ID Number which is keyed in and entered. The calorimeter will identify the report as either preliminary or final. The user then steps through the stored data by pressing the STEP key. Data is reported in this order: DATE, TIME, CALID, WEIGHT, SPIKE, FUSE, ACID, SULFUR, starting temperature (given as Bucket T), DELTA T, EE or Heat of Combustion in the selected units. To edit a value, step through data til the value to be edited is on the display. Press the DECIMAL (.) key and then the new value followed by ENTER. The calorimeter will double beep and reject any value which cannot be edited. This sequence is canceled by pressing the RESET key.



Appendix A - Star Codes

Special commands and program controls can be entered into the instrument using a system of Star Codes. To enter these codes, strike the star (*) key, followed by the code number, then use the ENTER key to put the code into the system. These entries can be made only when the system is in STANDBY.

The Star Codes used in the 1261 Calorimeter may operate somewhat differently from the Star Codes of other Parr devices. There are 5 basic types of Star Codes including:

1. **On/Off Toggles.** When these codes are entered the current setting will be displayed. It can be changed by pressing the STEP key.
2. **Value Entry Codes.** These codes are used to enter data into the program. The code may be set to:
 - A. Accept any value entered from the keyboard.
 - B. Accept only discrete values from a table which is part of the code. The STEP key is used to step through the table until the desired value is displayed.
3. **Display Calculated Values.** These codes display values calculated by the controller. They are informational only and cannot be changed.

4. **Option Setting Codes.** These codes set an option from a table. The calorimeter will display the current option and the user can revise this by keying in the desired option followed by ENTER.

5. **Command Codes.** These codes initiate an action. These codes are grouped in Section I (*0-*99). The type of code is shown at the end of each description using the above numbers. For convenience, the user can step through a series of sequential Star Codes to review their values or settings by pressing the NEXT or LAST keys. The DONE key will return the user to the standby condition. The INCREMENT feature cannot be used for the Command Codes in Section I, Star Codes. After a Star Code has been used to enter a program control, it will remain in effect until revised or changed. Star Code 8 can be used to print the currently active Star Codes. These codes will be printed in blocks of 100, starting at 100, 200, 300, etc., as specified.

Default Values for each Star Code are shown. IT IS RECOMMENDED THAT THE USER MAKE NO ATTEMPT TO CHANGE THE VALUE OF ANY UNDERLINED DEFAULT SETTINGS without first contacting the Technical Service Department of Parr Instrument Company.



Table A-1
Star Code Directory

Star Code Range	Purpose
0-99	I. Function Codes
100-199	II. General Purpose & Utility
200-299	III. Calibration Summary Status
300-399	IV. Calorimetry Calculations
400-499	V. Communications & Interfacing
500-599	VI. Operating Options & Units Section

I. Function Codes

Key	Description
*0	Self Test. This code initiates an internal check of the ROM and RAM memories and initializes communications with the attached devices. (5)
*1	Free Run Areas. This code displays the Free Run Areas available for additional samples. (5)
*2	Software Version. This code displays the version of the software number in the calorimeter. (5)
*3	Edit Date/Time. This code allows the user to examine and change the date and time in the calorimeter. The

date will be displayed and prompted first. The SKIP key is used to confirm the existing value, if correct, or enter the revised date followed by ENTER. The calorimeter will then prompt for the time which is entered in the same manner. Once entered, the date and time will update automatically. (2a)

***4** **Stored Sample IDs.** This code allows the review of the Sample ID's, in chronological order, at the display only, using the STEP key. (5)

***5** **Print Stored Sample ID's.** This code will produce a report listing of all Sample ID's and the type, status, and date of the test. When *5 is entered, it will prompt

Appendix A - Star Codes

for the desired CAL ID. To print all stored tests, press the SKIP key. (5)

- | | |
|---|---|
| <p>*8 Print Operating Parameters. This code will produce a report listing all of the current operating parameters (Star Codes) in groups of 100. The controller will prompt for a "group" of Star Codes, values of 0, 100, 200, etc., should be entered at the prompt. For users with a printer, this function along with Star Code 50 should be used in troubleshooting if the calorimeter does not appear to be operating in the expected fashion.</p> | <p>*40 Activate Oxygen Filling System. This code will turn on the oxygen flow to fill the oxygen bomb. Oxygen flow can be stopped by pressing RESET. (5)</p> |
| <p>*9 EEPROM Version. This code displays the version of the EEPROM installed in the calorimeter and the date it was programmed. (5)</p> | <p>*41 Activate Ignition Circuit. This code will first charge and then fire the electrical ignition system. It can be used to manually fire the bomb or test the system. Always make certain that the leads are not shorted before activating this code. (5)</p> |
| <p>*20 Clear Memory. This code is used to clear a single report, a block of reports, or all of the reports from the memory of the calorimeter. Operating instructions are in the Clearing Memory section on page 8-1. (5)</p> | <p>*50 Print Main Menu. This code will print the Main Menu on the printer and prompt the user through the steps required to revise the main features of the operating program. See Program Installation and Control, Chapter 4. (5)</p> |
| <p>*30 Update Individual EE Value. This code will cause the EE Value for a single calorimeter ID to be updated using the standardization runs currently in memory. (5)</p> | <p>*60 Define a Function Key. This code is used to start the process of programming function keys. Review Instrument Description, Chapter 3, for a complete description of the use of this function. (5)</p> |
| <p>*32 Update All EE Values. This code will cause the EE Value for all calorimeter IDs</p> | <p>*62 View a Function Key. This code allows the user to view a function key definition. Review Appendix F for a complete description of the use of this function. (5)</p> |



- *70 Print Error Code List.** This code will print on an attached printer a complete listing and description of all error messages for the calorimeter. (5)
- *86 Cold Restart.** This code will reinitialize the system. It will return all Star Codes to the default settings. To prevent accidental entry, the calorimeter will respond with a SURE prompt. The user then presses the ENTER key to cold restart or the RESET key to escape the sequence. All valid test data will be retained during this cold restart procedure. (5)
- *92 Re-load Cold Passwords.** This function may be executed if the password used to protect a group of Star Codes is forgotten. Executing *92 will default the passwords to their unlocked value. (5)
- *94 Re-load Cold Parameters.** Executing this function will invoke the default Star Codes. This function may be useful in bringing the controller to a known state before changing any Star Code values. (5)
- *96 Display Hardware Version.** This code displays the version of the controller hardware installed in the calorimeter and the date of its revision. (5)
- *97 Display User's Setup Revision and Date.** This code displays the revision # and date that the user last revised the default settings in the EEPROM. See *98. (5)
- *98 Copy Current Setup to EEPROM.** This code is used to replace the factory default settings with the current calorimeter settings. It will only copy Star Codes and function key definitions to the EEPROM. Refer to page 4-2 for further instructions.

Appendix A - Star Codes

II. General Purpose and Utility

Default Key Setting	Description		
*100 0000	Password for 100 Codes. This code is used to enter a password of up to eight digits to prevent unauthorized or accidental access to the settings and data contained in Star Codes 100 thru 199. To enter a password, clear the existing password and enter the new one. Eight zeros turn off password protection. To change a password protected code, enter the desired changes in the normal manner and when the display goes blank following entry, enter the password. (2a)	*120 4	Weight Entry Mode. This code selects the method of entering the sample weight. The mode is entered by using an option from this table. (4)
*101 off	Heater, Pump, and Solenoid Switch. In the ON position this code turns on the jacket heater, the circulatory pump, and the water cooling solenoid valve. In the OFF position these components are switched off. Turning the controller off at the main power switch will automatically turn *101 OFF. When the main power switch is turned ON, *101 will need to be toggled in order to bring the water jacket of the calorimeter to the designated set point and before any testing can begin. (1)		<p>1 = Fully automatic weight transfer from Proxi-mate Analyzer or Balance Interface on Smart Link.</p> <p>2 = Automatic entry with weight displayed for 3 seconds on calorimeter display.</p> <p>3 = Automatic entry with operator verification. User must press ENTER key when weight is displayed to enter the weight and permit the test to proceed. User can edit value while displayed.</p> <p>4 = Manual Weight Entry from keyboard.</p>
*103 off	Standardization Mode. In the ON position, this code uses the test run to standardize the calorimeter. In	*122 off	Prompt for New ID if No Weight Found. When this code is set in the OFF position, the calorimeter will prompt the user for manual sample weight entry if no sample weight is found in devices connected on the link. In the ON position it will prompt the user to a new Sample ID. (1)



***123 4**

Spike Weight Entry

Mode. This code changes the method of entering the spike weight. When using an automatic transfer method, users should develop a Sample ID pattern to tie together the Sample ID and have different numbers. (4)

- 1 = Fully automatic weight transfer from Proximate Analyzer or Balance Interface on Smart Link.
- 2 = Automatic entry with weight displayed for 3 seconds on calorimeter display.
- 3 = Automatic entry with user verification. User must press ENTER key when weight is displayed to enter the weight and permit the test to proceed. User can edit value while displayed.
- 4 = Manual Weight Entry from keyboard.

***130 4**

Acid Entry Mode. This code changes the method of entering the acid correction. The mode is entered by using an option from this table. (4)

- 1 = Fully automatic acid correction transfer from a 1760 Sulfur Analyzer over Smart Link Network.
- 2 = Automatic entry with correction displayed for 3 seconds on calorimeter display.
- 3 = Automatic entry with user verification. User must press ENTER key when weight is displayed to enter the weight and permit the test to proceed. User can edit value while displayed.
- 4 = Manual correction entry from keyboard.

***140 4**

Sulfur Entry Mode. This code changes the method of entering the sulfur value. The mode is entered by using an option from this table. (4)

- 1 = Fully automatic sulfur correction transfer from a 1760 Sulfur Analyzer over Smart Link Network.
- 2 = Automatic entry with value displayed for 3 seconds on calorimeter display.
- 3 = Automatic entry with user verification. User must press ENTER key when value is displayed to enter the value and

Appendix A - Star Codes

permit the test to proceed. User can edit value while displayed.

4 = Manual correction from keyboard.

***150 off Automatic Sample ID Increment.** In the ON position, this code will automatically increase the Sample ID Number by the increment set in *152 for each determination. (1)

***152 1 Automatic Increment Value.** When *150 is turned ON, the Sample ID will be increased by the value set into this code for each test. (2a)

***154 0 Automatic Increment Base.** When the automatic increment code is turned ON (*150), the increment value (*152) will be added to the value set into this code. Example, it is the first number in the current sequence. (2a)

***160 12 Alternating Display Register.** This Star Code allows the user to display any or all of the following items:

Date (64)
Time (32)
Heater Duty Cycle (16)
Jacket Temperature (8)
Bucket Temperature (4)
Heat of Combustion (2)
Delta T (1)

The sum of the values in parentheses associated with

each item selected to be displayed yields the number to be stored in *160. **Example:** A value of 12 stored in the *160 will give an alternating display of the bucket and jacket temperature. All items, with the exception of the Heater Duty Cycle, are accompanied by the appropriate identification light. (2a)

***162 40 Alternating Display Rate.** The time that an individual display is held on when an alternating display is programmed is adjusted with this code. Each item will be displayed for a length of time equal to 50 milliseconds times the value entered into this code. (2a)

***170 off Overwrite Final Reports.** When this code is set in the OFF position, final reports will be protected from being overwritten by subsequent tests. In the ON position the calorimeter will automatically replace old results with current tests when the memory is full. (1)

***172 on Edit Final Reports.** In the ON position this code permits the user to revise the sample weight, CAL ID, and sulfur values of final reports. (1)

***174 on Recalculate Final Reports.** This code will cause the calorimeter to recalculate stored final reports using the calibration data and



star code configuration currently in the controller. During the reporting process it permits the user to revise his calculation if an error in calibration is determined after the fact. The unit can be recalibrated and the stored results recalculated using the revised calibration. (1)

- *176 off Use New EE Value in Recalculation of Results.** When this code is set in the OFF position, all calculations for a test will be made using the EE Value which was effective at the time the test was started. In the ON position, all reported tests will be recalculated using the most recent EE Value in memory at the time the report is made if used in conjunction with *174 to recalculate reports. (1)

III. Calibration Summary Status

Default	
Key Setting	Description
*200 0000	Password for 200 Codes. This code is used to enter a password of up to eight digits to prevent unauthorized or accidental access to the settings and data contained in Star Codes 200 thru 299 to enter a password, clear the existing password and enter the new one. Eight zeros turn off password protection. To change a password protected code, enter the desired changes in the normal manner and when the display goes blank following entry, enter the password. (2a)
*210 1	Calorimeter ID Number. This code is used to enter the Calorimeter ID Number for the first bomb and bucket combination to be used in the calorimeter. (2a)

Note: New Calorimeter ID's will automatically be assigned whenever a new Calorimeter ID Number is used for the first time. Calorimeter ID Numbers and the bomb firing count can only be cleared manually. A Calorimeter ID of 000000 and a bomb firing count of zero will return the Cal ID block to the operating system.

Appendix A - Star Codes

- *211 First Energy Equivalent Value.** This code displays the current Energy Equivalent Value for the bomb and bucket combination identified by *210. The value is calculated automatically as described in the Calibration Section of this manual. If *215 is turned ON, the user may manually enter his desired EE value.
- Note:** Only final standardization tests are included in the statistical analysis.
- *212 Number of Calibration Runs.** This code displays the number of calibration runs which have been included in determining the first EE value in *211. (3)
- *213 EE Standardization Deviation.** This code displays the relative standard deviation of the first EE value in *211. (3)
- *214 Bomb Firing Count.** This code displays the number of times the bomb used in *210 has been fired. It can be reset to zero whenever the vessel is serviced by simply clearing and entering 0 into the register. (3-2a)
- *215 off Protect EE Value.** In the OFF position, new standardization runs made under the first CAL ID number will automatically be included in determining a revised EE Value for this combination. In the ON position, the value in *211 will be protected and will not be changed by subsequent standardization tests. (1)
- *220-*225** These codes store and display the Calorimeter ID Number, EE value, number of calibration runs, standard deviation, and number of firings for the second bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.
- *230-*235** These codes store and display the Calorimeter ID Number, EE value, number of calibration runs, standard deviation, and number of firings for the third bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.
- *240-*245** These codes store and display the Calorimeter ID Number, EE value, number of calibration runs, standard deviation, and number of firings for the fourth bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.
- *250-*255** These codes store and display the Calorimeter ID Number, EE Value, number of calibration runs, standard deviation, and number of firings for the fifth bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.



***260-*265** These codes store and display the Calorimeter ID Number, EE Value, number of calibration runs, standard deviation, and number of firings for the sixth bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.

***270-*275** These codes store and display the Calorimeter ID Number, EE Value, number of calibration runs, standard deviation, and number of firings for the seventh bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.

***280-*285** These codes store and display the Calorimeter ID Number, EE Value, number of calibration runs, standard deviation, and number of firings for the eighth bomb and bucket combination. They correspond to *210-*215 for the first Calorimeter ID.

IV. Calorimetry Calculations

Default	
Key Setting	Description
*300 0000	Password for 300 Codes. This code is used to enter a password of up to eight digits to prevent unauthorized or accidental access to the settings and data contained in Star Codes 300 thru 399, to enter a password, clear the existing password and enter the new one. Eight zeros turn OFF password protection. To change a password protected code, enter the desired changes in the normal manner and when the display goes blank following entry, enter the password. (2a)
*301 off	Use Fixed Fuse in Final Standardization Reports. When this code is turned on, the value entered in *317 will be used in final reports. There will be no prompting for the fuse value during the reporting process. (1)
*303 off	Use Fixed Acid in Final Standardization Reports. When this code is turned on, the value entered in *319 will be used in final reports. There will be no prompting for the acid value during the reporting process. (1)

Appendix A - Star Codes

- *305 on Use Fixed Sulfur In Final Standardization Reports.** When this code is turned ON, the value entered in *321 will be used in final reports. There will be no prompting for the sulfur value during the reporting process. (1)
- *307 off Acid Value is Nitric Only; Standardization.** When this code is turned OFF, the value entered for the acid correction represents the total of nitric plus sulfuric acid. When this code is turned ON, the value entered represents only the nitric acid. This flag is used in calculating standardization runs. (1)
- *309 on Sulfur Value is Percent Sulfur Standardization.** When this code is turned on, the value entered is percent sulfur in the sample. When this code is turned OFF, the value entered is the sulfur correction and is not multiplied by the mass of the sample. This flag is used in calculating standardization runs. (1)
- *311 off Fixed Spike Value Standardization.** When this code is set in the ON position, the calorimeter will apply the value stored in *558 to all standardization runs as the Spike Value when *315 is ON. (1)
- *313 off Offset Correction; Standardization.** When this code is set in the ON position, the calorimeter will apply the value stored in *560 to all standardization runs as the Offset Correction which is sometimes used in dealing with special testing procedures. (1)
- *315 off Spike Correction; Standardization.** When this code is set in the ON position, the calorimeter will prompt for a spike value. This correction will be the product of the heat of combustion of the spiking material stored in *554 and the mass of the spike which will be entered through the keyboard or taken as a fixed value. (1)
- *317 15 Fixed Fuse Correction Value; Standardization.** When *301 is turned ON, the value entered into this code will be multiplied by the factor entered into *540 and applied to all standardization runs as the Fuse Correction in converting preliminary results to final reports. This value is used for all preliminary reports. (2a)
- *319 10 Fixed Acid Correction Value; Standardization.** When *303 is turned ON, the value entered into this code will be multiplied by the factor entered into *542 and applied as to all standardization runs in converting preliminary results to



- final reports. This value is used for all preliminary reports. (2a)
- *321 0 Fixed Sulfur Correction Value; Standardization.** When *305 is turned ON, the value entered into this code will be multiplied by the factor entered into the *544 and applied to all standardization runs as the Fixed Sulfur Correction in converting preliminary results to final reports. This value is used for all preliminary reports (2a)
- *351 off Use Fixed Fuse in Final; Determination Reports.** When this code is turned ON, the value entered in *367 will be used in final reports. There will be no prompting of fuse value during the reporting process. (1)
- *353 off Use Fixed Acid in Final; Determination Reports.** When this code is turned ON, the value entered in *369 will be used in final reports. There will be no prompting of acid value during the reporting process. (1)
- *355 off Use Fixed Sulfur in Final; Determination Reports.** When this code is turned ON, the value entered in *371 will be used in final reports. There will be no prompting of sulfur value during the reporting process. (1)
- *357 off Acid Value is Nitric Only; Determination.** When this code is turned OFF, the value entered for the acid correction represents the total of nitric plus sulfuric acid. When this code is turned ON, the value entered represents only the nitric acid. These values are used in calculating determination runs. (1)
- *359 on Sulfur Value is Percent Sulfur; Determination.** When this code is turned ON, the value entered is percent sulfur in the sample. When this code is turned OFF, the value entered is the sulfur correction and is not multiplied by the mass of the sample. These values are used in calculating determination runs. (1)
- *361 off Fixed Spike Value; Determination.** When this code is set in the ON position, the calorimeter will apply the value stored in *558 to all determination runs as the Spike Value when *365 is ON. (1)
- *362 off Used Fixed Hydrogen Value.** When this code and *366 are ON, the value in *574 will be used in both the preliminary and final Net Heat of Combustion calculations. There will be no prompting for the hydrogen value in the reporting process.

Appendix A - Star Codes

***363 off** **Offset Correction; Determination.** When this code is set in the ON position, the calorimeter will apply the value stored in *560 to all determination runs as the Offset Correction. This is sometimes used in special testing procedures. (1)

***365 off** **Spike Value; Determination.** When this code is set in the ON position, the calorimeter will prompt for a Spike Value. This correction will be the product of the Heat of Combustion of the spiking material stored in *554 and the weight of the spike which will be entered through the keyboard or taken as the fixed value in *558. (1)

***366 off** **Net Heat of Combustion Calculation.** When this code is ON the calorimeter will calculate the Net Heat of Combustion in the current reporting units (as set in *520). The formula is:

$$H_{net} = H_c - (*556) (*572) (H)$$

where H is percent hydrogen and H_c is Gross Heat of Combustion in the units selected in *520.

***367 15** **Fixed Fuse Correction Value; Determination.** When *351 is turned ON, the value entered into this code will be multiplied by the factor entered into *540 and applied to all determination runs as the Fuse Correction in converting preliminary results to final reports. (2a)

***369 10** **Fixed Acid Correction Value; Determination.** When *353 is turned ON, the value entered into this code will be multiplied by the factor entered into *542 and applied as to all determination runs in converting preliminary results to final reports. (2a)

***371 0** **Fixed Sulfur Correction Value; Determination.** When *355 is turned ON, the value entered into this code will be multiplied by the factor entered into the *544 and applied to all determination runs as the Fixed Sulfur Correction in converting preliminary results to final reports. (2a)



V. Communications & Interfacing

Default	
Key Setting	Description

***400 0000 Password for 400 Codes.** This code is used to enter a password of up to eight digits to prevent unauthorized or accidental access to the settings and data contained in Star Codes 400 thru 499, to enter a password, clear the existing password, and ENTER the new one. Eight zeros turn OFF password protection. To change a password protected code, enter the desired changes in the normal manner and when the display goes blank following entry, enter the password. (2a)

***402 1 Report Destination.** This code enters the display or device to which reports are to be sent, as selected from the following table. (4)

- 1 = Display of 1261 Calorimeter
- 2 = Printer
- 3 = Null device. This can be used to update blocks of reports based upon new factors or calibration information.

Note: The calorimeter display must be selected as the report destination prior to editing any reports.

***404 off Automatic Reporting.** In the ON position, this code sends the report to the device selected by *402 automatically at the conclusion of each test. (1)

***412 off Print Individual Reports.** When this code is turned ON, it directs the calorimeter to insert header information on each report during a block reporting procedure. When OFF, a header is only printed on the first report of a series. (1)

***416 on Print Error Message Descriptions.** When this code is turned OFF, the calorimeter will display the number of any error condition when it occurs. When it is turned ON, it will also send a description of the error to the designated reporting device. (1)

***418 1 Text or Data Reports.** Reports can be formatted as text for reporting on the designated reporting printer attached on the Smart Link, or as a data stream for transfers to a computer through the 1745 RS232 port. This choice is entered using the following table. (4)

- 1 = Text format
- 2 = Data format

Appendix A - Star Codes

- *460 0 Calorimeter Unit ID.** (0-15) If more than one 1261 Calorimeter is connected to the Smart Link, each must have a unique ID, starting with 0 and incrementing up by one for each attached controller. (2a)
- 469 1 Smart Link Baud Rate.** This code enters the baud rate to be used for communications on the Smart Link Network. The baud rate is entered by using an option from the following table. All devices on the Smart Link must have the same baud rate! (4)
- 0 = 19200
 - 1 = 9600
 - 2 = 7200
 - 3 = 4800
 - 4 = 3600
 - 5 = 2400
 - 6 = 2000
 - 7 = 1800
 - 8 = 1200
- *481 4 RS232C Character Size.** This code enters the character size to be used for communications on the RS232C Communications Port. The character size is entered by using an option from the following table. (4)
- 1 = 5 bits
 - 2 = 6 bits
 - 3 = 7 bits
 - 4 = 8 bits
- *483 1 RS232C Parity.** This code enters the parity to be used for communications on the RS232C Communications Port. The desired parity is entered using the following table. (4)
- 1 = None
 - 2 = Even
 - 3 = Odd
- *485 1 RS232C Stop Bits.** This code enters the number of stop bits to be used for communications on the RS232C Communications Port. The desired stop bits are entered using the following table. (4)
- 1 = 1 Stop Bit
 - 2 = 2 Stop Bits
- *487 2 RS232C Handshake.** This code enters the handshaking to be used for communications on the RS232C Communications Port. The desired handshaking is entered using the following table. (4)
- 1 = None
 - 2 = X-ON X-Off
 - 3 = RTS/CTS
- *489 1 RS232C Baud Rate.** This code enters the baud rate to be used for communications on the RS232C Communications Port. The baud rate is entered by using an option from the following table. (4)
- 0 = 19200
 - 1 = 9600
 - 2 = 7200
 - 3 = 4800
 - 4 = 3600
 - 5 = 2400



6	=	2000
7	=	1800
8	=	1200
9	=	600
10	=	300
11	=	150
12	=	135
13	=	110
14	=	75
15	=	50

***494 0**

Printer Destination. This code enters the Smart Link address for the device containing or connected to the printer (0-15). (2a)

***490 2**

Size of Reports from

Smart Link Peripherals.

This code tells the 1261 Calorimeter what report size to expect from devices on the Smart Link, such as the 1750 Proximate Analyzer. (4)

1	=	80 Column
2	=	40 Column
3	=	20 Column

***492 1**

Printer Destination.

This code enters the directions for sending reports to a printer. The destination for printed reports is entered using the following table. (4)

- | | | |
|---|---|--|
| 1 | = | Printer attached to RS232C Port |
| 2 | = | Printer attached to another 1261 connected on Smart Link |
| 3 | = | Printer in 1730/1720 Calorimeter Controller connected on Smart Link. |

Appendix A - Star Codes

VI. Operating Options & Units Section

Default		
Key Setting	Description	
*500 0000	Password for 500 Codes. This code is used to enter a password of up to eight digits to prevent unauthorized or accidental access to the settings and data contained in Star Codes 500 thru 599. To enter a password, clear the existing password and ENTER the new one. Eight zeros turn OFF password protection. To change a password protected code, enter the desired changes in the normal manner and when the display goes blank following entry, enter the password. (2a)	from the set point by more than this amount, an error condition will be reported. The Standby Annunciator will turn OFF and tests cannot be run. (2a)
*504 on	Dynamic Mode. In the ON position, this code applies the curve fitting techniques of the dynamic method to predict the final temperature rise and substantially shortens the test period. In the OFF position, the test will run until all energy from the combustion has been detected. (1)	*510 on Calibration Run Limit. In the ON position, this code will use only the ten most recent standardization tests to determine the energy equivalent values. Old tests will automatically be cleared. In the OFF position, it will use all stored values for the Calorimeter ID in use.
*506 35	Jacket Temperature. This code sets the temperature of the calorimeter jacket in °C. (2a)	*512 0.15 Energy Equivalent Maximum; Standard Deviation. This code establishes the maximum standard deviation of the energy equivalent in relative percent. If the EE Values for any of the Calorimeter ID Numbers exceed this value, an error condition will be reported. (2a)
*508 0.05	Jacket Temperature Tolerance. This code sets the tolerance for the jacket temperature in °C. If the actual temperature should deviate	*514 500 Bomb Service Interval. This code establishes the maximum number of times a bomb may be fired before it is flagged "due for service". (2a)
		*516 on Eliminate Prompting for CAL ID. In the ON position, this code will not prompt for a CAL ID when a test is started. The CAL ID information found in *210-215 is automatically selected, and used for all tests. (1)



***520 2 Reporting Units.** This code enters the units to be used in reporting the results of the calorimeter test. (4)

- 1 = Megajoules per kilogram
- 2 = Btu per pound
- 3 = Calories per gram
- 4 = Other (must use appropriate multiplier in *528)

***522 4.1868 MJ/kg Multiplier.** This code contains the multiplier to convert from calories per gram to MJ/kg. This factor is automatically selected when *520 Option 1 is selected. The value is entered in scientific notation in two steps...4. 1868, ENTER, SKIP, -3 ENTER. (2a)

***524 1.8 Btu/lb Multiplier.** From calories per gram to Btu-lb. This factor is automatically selected when *520, Option 2 is selected. See *522 for format instructions. (2a)

***526 1.0 Cal/g Multiplier.** This code contains the factor 1.0 which is used as the multiplier when *520, Option 3 is selected. See *522 for format instructions. (2a)

***528 1.0 Reporting Units Multiplier.** This code is used to enter a multiplication factor for units other than MJ/kg, Btu/lb, or Cal/gram. This multiplier is automatically

selected when *520, Option 4 is selected. The multiplier is entered in two parts in scientific notation as described in *522. (2a)

***540 1.0 Fuse Multiplier.** Values entered by the user for the fuse correction are multiplied by *540 to get the product into energy units. This multiplier can be used to convert to any other basis. For example, Parr 45C10 Fuse Wire has a Heat of Combustion of 2.3 calories per centimeter. If 2.3 were entered for this multiplier, the fuse correction could then be entered in centimeters of fuse wire burned. (2a)

***542 0.0709 Acid Multiplier.** Values entered by the user for the acid correction are multiplied by *542 to get the product into units which are compatible with *548. The default number given here requires that the acid correction be entered in calories or milliliters of 0.0709N base used for the acid analysis. (2a)

***544 0.6238 Sulfur Multiplier.** Values entered by the user to be used for the sulfur correction are multiplied by *544 to get the product into units compatible with *550. The default number here requires that the sulfur value be entered in weight %. (2a)

Appendix A - Star Codes

- *548 14.1 Heat of Formation of HNO_3 .** This code enters the heat of formation of nitric acid in calories per milliequivalent. (2a)
- *550 36.1 Heat of Formation of H_2SO_4 .** This code enters the heat of formation of sulfuric acid in calories per milliequivalent. (2a).
- *552 6318 Heat of Combustion of Standard.** This code enters the heat of combustion of benzoic acid at 6318 calories per gram in the standardization calculations (2a).
- *554 6318 Heat of Combustion of Spiking Material.** This code enters the heat of combustion (in calories per gram) of any combustion aid used to promote complete combustion (2a).
- *556 1.8 Final Multiplier.** This code contains the active multiplier used to convert the heat of combustion to the desired reporting base. It is loaded automatically from *520-528. (3)
- *558 0 Fixed Spike Value.** If a constant amount of a spiking material is being added to each sample, the weight is entered into this code and *311 and/or *361 are turned ON. (2a)
- *560 0 Offset Value.** The value stored here is applied with the other calorimetry corrections mentioned above when
- *313 and/or *363 are turned ON. This value is sometimes used in dealing with special testing procedures. (2a)
- *570 3.4 Temperature Rise Limit.** This code contains the temperature rise in $^{\circ}\text{C}$ which corresponds to the 8000 calorie energy release which is the safe upper limit for the 1108 Oxygen Bomb. If temperatures rises exceed this value, an error 2000 is reported as a warning. The test will be completed in the normal manner. (2a)
- *572 5.0680 Hydrogen Multiplier.**
- +1 This value is used in the net heat of combustion calculation. (Formula given in *366). The default value given above assumes hydrogen (H) entered as a mass % and the gross heat of combustion is calculated in calories per gram.
- *574 0 Fixed Hydrogen Value.** This is the hydrogen (H) value used for the preliminary report when *366 is turned ON. When the report is finalized the user will be prompted for the actual hydrogen value.



Appendix B - Error Messages

When an error message occurs, the display will provide the error number. If the calorimeter is equipped with a printer, a brief description of the error will also be printed.

<u>Error</u>	<u>Message</u>
1	Self-Test ROM1 Error. The unit has detected an error in the check sum of ROM1 during a self-test.
2	Self-Test ROM2 Error. The unit has detected an error in the check sum of ROM2 during a self-test.
3	Self-Test EEPROM Error. The unit has detected an error in the check sum of EEPROM during a self-test.
4	RAM Error. The unit has failed in an attempt to read or write to the RAM section of the memory during a self-test.
200	Duplicate ID. A sample with the same Sample ID already exists in the memory of the calorimeter. (Data entry mode)
300	Non-existent ID. No sample with this ID exists in the memory of the calorimeter. (Reporting mode.)
400	Non-existent Star Code. The calorimeter does not recognize the Star Code which has been entered or a password is required.

500

Smart Link Error. The calorimeter has failed in an attempt to communicate with another device from which it was requesting or sending data.

600

Memory is Full. There is no free space in the memory. User must either clear space in the memory or use *170 to permit Final Reports to be overwritten.

900

Run In Progress. The calorimeter cannot perform the requested task until the test in progress is completed.

1100

No EE Value Available.
No energy equivalent value for this calorimeter ID Number exists in the memory of the calorimeter.

1200

Post-period Time Limit Violated. The calorimeter has failed to establish an acceptable final equilibrium temperature within the time allowed.

1300

Pre-period Time Limit Violated. The calorimeter has failed to establish an acceptable final equilibrium temperature within the time allowed.



1400	Misfire. The calorimeter has failed to detect a minimum temperature rise during the first 50 seconds after attempting to fire the bomb.	1800	No Bucket Temperature Reading. The calorimeter is not receiving a temperature signal from the Thermistor Probe in the bucket.
1501	Calibration Limit Exceeded for CALID1. The relative standard deviation for the standardization runs in memory for the bomb and bucket combination used in the First CAL ID exceeds the limit set in *512.	1801	No Jacket Temperature Reading. The calorimeter is not receiving a temperature signal from the temperature sensor in the jacket.
1502	Calibration Limit Exceeded for CAL ID2.	1900	Electronics Over Temperature. Check to determine if cooling fan is operational or if filter needs replacing. See page G-1, Filter.
1503	Calibration Limit Exceeded for CAL ID3.	2000	High Delta T. The temperature rise of the previous test exceeded the warning limit. This indicates that the maximum loading limit of 8000 calories for the bomb has been exceeded.
1504	Calibration Limit Exceeded for CAL ID4.		
1505	Calibration Limit Exceeded for CAL ID5.		
1506	Calibration Limit Exceeded for CAL ID6.	2100	Weight Not Found. The calorimeter has not found a weight for the Sample ID entered in the devices connected on the Smart Link. The response to this error is set by *122.
1507	Calibration Limit Exceeded for CAL ID7.		
1508	Calibration Limit Exceeded for CAL ID8.	2200	Spike Weight Not Found. The calorimeter has not found a weight for the Spike ID entered in the devices connected on the Smart Link. The response to this ERROR is set by *122.
1700	EEPROM Write Protected. The current EEPROM program cannot be changed unless the write enable jumper is reinstalled. See page 4-2 for instructions.	2300	Cold Restart. The instrument has just completed a cold restart. All memory and calibration data has been erased. All Star Codes have

Appendix B - Error Messages

	been reset to their default values. This could have been caused by initial startup, disconnection of the CPU board, or failure of the battery backup system.	2600	Run Aborted. A test in process has been aborted by pressing the RESET key.
2301	Cold Restart (List O.K.). This message is given after a cold restart has been completed. The List O.K. message indicates that all the test data in the controller memory has remained intact. All Star Codes have been reset to their default values. The values of Star Codes 200-299 may be restored using the standardization data in memory by executing *32.	2900	High Temperature Limit Exceeded. The temperature in the jacket of the calorimeter has exceeded the maximum allowable temperature set at the factory.
		3000	Acid Value Not Found. The calorimeter has failed to find an acid correction value for the indicated SAMPLE ID when it polled the designated device connected on the Smart Link.
2302	Cold Restart (List Modified). Same as above, except that at least one memory test location has failed a test of its checksum and has been erased. It is possible that an empty cell was affected and then reinitialized.	3100	Sulfur Value Not Found. The calorimeter has failed to find a sulfur correction value for the indicated SAMPLE ID when it polled the designated device connected on the Smart Link.
2303	Warm Restart (List Modified). During a power-up or self-test sequence, one or more test locations had faulty checksums. These test data are then erased. It is possible that an empty cell was affected and then reinitialized.	3201	Bomb Use Exceeds Limit for Bomb in CALID1. The servicing interval set in Star Code 514 has been reached for the bomb used in the First CALID.
		3202	Same as 32-1 for CALID2.
		3203	Same as 32-1 for CALID3.
		3204	Same as 32-1 for CALID4.
		3205	Same as 32-1 for CALID5.
2304	Warm Restart (List Erased). Same as above, except that the entire run table (150 tests) was erased due to faulty checksums or linking information.	3206	Same as 32-1 for CALID6.
		3207	Same as 32-1 for CALID7.
		3208	Same as 32-1 for CALID8.



- 3400 Function Key Nesting Error.** The calorimeter is unable to accept and execute the specified function key definition properly. This error will result if a function key calls another function key which in turn calls the first key. The endless loop created by this definition will result in ERROR 3400, upon execution.
- 3600 Low Oxygen Charge.** The Bomb Filling System was unsuccessful in filling the bomb to the desired pressure; usually indicates an open valve on the bomb, a leak in the system, or low pressure in the filling tank. (See page H-3, Low Oxygen Pressure.)
- 3700 Oxygen Pressure Switch Error.** The Oxygen Pressure Switch was found to be closed at the beginning of the oxygen filling cycle. This probably indicates that a mechanical failure has occurred in the Oxygen Filling System.
- 3800 Jacket Temperature Out of Limits.** The calorimeter cannot start the test because the actual jacket temperature differs from the Jacket Set Point by more than the tolerance set by *508.
- 4600 CAL ID Table Full.** The Calorimeter already has values for all eight permissible CAL ID's and cannot accept another.
- Note: There are other error codes which are printed when *70 is executed. The additional messages given are for factory testing and low level troubleshooting.

Appendix C - Calculations

Calculating the Heat of Combustion

While the Model 1261 Calorimeter will automatically make all of the calculations necessary to produce a gross heat of combustion for the sample, it is important that the user understand these calculations to ensure that the instrument is set up so that the calculations match the procedures used and that the units are consistent throughout the entire procedure and calculations.

General Calculations

Basically, the calculation of the gross heat of combustion is done using the following equation:

$$H_c = \frac{WT - e_1 - e_2 - e_3}{m}$$

Where:

- H_c = Gross heat of combustion.
- T = Observed temperature rise.
- W = Energy equivalent of the calorimeter being used.
- e_1 = Heat produced by burning the nitrogen entrapped in the bomb to form nitric acid.
- e_2 = Extra heat produced due to burning sulfur to sulfur trioxide and forming sulfuric acid instead of sulfur dioxide.
- e_3 = Heat produced by the burning fuse wire.
- m = Mass of the sample.

For convenience and by tradition, these calculations are usually made in calories, grams, and degrees Celsius, and then converted to other units if required.

Temperature rise. The 1261 Calorimeter produces a corrected temperature rise reading automatically. Corrections for heat leaks during the test are applied as discussed in the isoperibol method described earlier in this manual. Similarly, the method for extrapolating the end point of the test is discussed in the dynamic method description.

Energy equivalent. The energy equivalent (represented by W in the above formula, or abbreviated as EE) is determined by standardizing the calorimeter as described in the Standardization Section of this manual. It is an expression of the amount of energy required to raise the temperature of the calorimeter one degree. It is commonly expressed in calories per degree Celsius. Since it is directly related to the mass of the calorimeter, it will change whenever any of the components of the calorimeter (i.e. the bomb, bucket, or amount of water) is changed.

Thermochemical Corrections

Nitric acid correction. In the high pressure oxygen environment within the oxygen bomb, nitrogen that was present as part of the air trapped in the bomb is burned to nitric oxide which combines with water vapor to form nitric acid. All of this heat is artificial since it is not a result of the sample burning.

Sulfur correction. In the oxygen rich atmosphere within the bomb, sulfur in the sample is oxidized to sulfur trioxide which combines with water vapor to form sulfuric acid. This liberates additional heat over the normal combustion process which converts sulfur to sulfur dioxide. The sulfur correction removes this excess heat from the calculations.



Fuse wire correction. The wire used for a fuse to ignite the sample is partially consumed in the combustion. Thus, the fuse generates heat both by the resistance it offers to the electric firing current and by the heat of combustion of the wire that is actually burned. It is normally assumed that the heat generated by the electrical resistance will be the same when standardizing the bomb and when testing an unknown sample, and can therefore be ignored. Significant variances can, however, occur in the amounts of fuse wire actually burned in each test. So this energy is subtracted to account for the heat of combustion of the metal.

ASTM and ISO Methods Differ

Current ASTM, ISO, and British Standard Methods differ on their treatment of the nitric acid, and sulfuric acid thermochemical corrections. ASTM Methods call for titrating the bomb washings to determine the total acid present. This is assumed to be all nitric acid with a heat of combustion of -14.1 Kcal per mole. The amount of sulfur is then determined and converted to equivalents of sulfuric acid. The difference between the heat of formation of sulfuric acid (-72.2 Kcal per mole) and nitric acid is then subtracted as the sulfur correction.

Most other test methods treat nitric and sulfuric acid corrections as entirely separate values rather than as combined values. This eliminates the requirement for a total acid figure and permits the nitric acid correction to be handled in a variety of ways; including the assumption of a fixed nitric acid correction.

The 1261 Calorimeter can be set up to apply the acid correction by either the ASTM or ISO Method. Care must be used to ensure that the corrections are applied,

and that the calculations made are consistent with the procedure used. Please review the following section on Acid Corrections. Different standard test methods have used different values for the heat of formation of sulfuric acid. These differences are generally insignificant. The 1261 Calorimeter uses the most recent published values for all thermochemical data.

Thermochemical Calculation Details

Traditionally, standard solutions and procedures have been established to simplify the calculations and thermochemical calculations. The 1261 Calorimeter has been programmed to permit the user to use standard solutions and units which are most convenient, since the microprocessor can easily apply any conversion factors which might be required.

Fuse Correction. The fuse correction applied by the calorimeter is calculated as:

$$\begin{aligned} e_3 &= (\text{fuse value})(\text{fuse multiplier}) \\ e_3 &= (\text{entered value})(*540 \text{ value}) \end{aligned}$$

The *540 value is normally set to 1.0 so that the entered value is in calories, determined from the fuse wire card. If a multiplier of 2.3 (calories per centimeter) is entered into *540, the centimeters of burned fuse wire can be entered directly.

Users may find it convenient to enter a fixed value for the fuse correction and avoid the need to determine this correction for each test.

Fixed fuse corrections are entered by turning *301 and/or *351 ON. A correction of 15 calories is a good value for *317 and

Appendix C - Calculations

*367. Total errors of more than 5 calories will seldom occur when using a fixed fuse correction.

ACID and SULFUR Corrections. In certain ASTM methods, the amount of sodium carbonate used to titrate the bomb washings is equated with e_1 . In the treatment below, e_1 is the heat contributed only by the nitric acid formation. The value given in the 1261 Calorimeter reports for the acid and is the user entered value. This is treated as "total acid" if *307 and/or *357 are OFF. If *307 and/or *357 are ON, then the value is treated as nitric acid only.

$$e_1 = [((\text{Total Acid})(\text{Acid Multiplier}) - (\text{Percent Sulfur})(\text{Sample Mass})(\text{Sulfur Multiplier})) \\ [(\text{Heat of Formation of Nitric Acid})]$$

$$= [((\text{Total Acid})(*542)) - (\text{Percent Sulfur})(\text{Sample Mass})(*544)] \\ [*548]$$

$$e_2 = (\text{Percent Sulfur})(\text{Sample WT}) \\ (\text{Sulfur Multiplier})(\text{Heat of Formation of Sulfuric Acid})$$

$$= (\text{Percent Sulfur})(\text{Sample WT})(*544)(*550)$$

When *307 and *357 are turned ON, indicating that the acid value is nitric acid only, calculations are made as follows:

$$e_1 = (\text{Acid Value})(\text{Acid Multiplier})(\text{Heat of Formation of Nitric Acid})$$

$$e_2 = (\text{Entered Sulfur Value}) \\ (\text{Sample Mass})(*544)(*550)$$

Users may find it convenient to enter a fixed value for the acid correction and avoid the need to determine this correc-

tion for each test. To enter Fixed Acid Corrections, turn *307, *357, *303, and *353 ON. A correction of 10 calories is a good value for *319 and *369. Total errors of more than 3 calories will seldom occur when using Fixed Acid Corrections.

Fixed Sulfur Corrections can be entered if a series of samples contain a constant amount of sulfur. To enter Fixed Sulfur Corrections, turn *307, *357, *305, *355 ON and enter percent sulfur in *371. Any errors will be proportional to the difference between the actual and assumed value for sulfur.

ISO Calculations

Both the ISO 1928 and BSI 1016: Part 5 methods for testing the calorific value of coal and coke, deal with acid and sulfur corrections in a manner which is somewhat different than ASTM procedures. Provision has been made in the 1261 Controller for dealing with these different procedures.

The analysis of bomb washings in these methods call for a titration, first using 0.1N barium hydroxide (V_2) followed by filtering, and a second titration using 0.1N HCl(V_1) after 20 ml of a 0.1N sodium carbonate has been added to the filtrate. The Star Code settings below allows the results of the two titrations, V_1 and V_2 , to be entered into the controller directly for the calculation of the total acid correction. V_1 should be entered at the prompt for acid and V_2 is entered at the prompt for sulfur. These Star Code settings are as follows and assume that the same procedure is carried out for both standardization and determination.

*303	off	*359	off
*305	off	*363	on
*307	on	*369	13



*309	off	*371	7
*313	on	*542	0.10
*319	13	*544	0.10
*321	7	*548	21.7
*353	off	*550	36.1
*355	off	*560	-43.5
*357	on		

The value given in *560 is the product of -1, *548, *542, and 20ml, the amount of 0.1N sodium carbonate used in the analysis. The formula used to get the total correction in calories is as follows:

$V_1(*542)(*548)+V_2(*544)(*550)+(*560)$
The values given in *319, *321, *369, and *371, which are used in preliminary reports, will reflect a sulfur correction of 0, and a nitric acid correction of 10 calories.

Spiking Samples

It is sometimes necessary to add a spiking material to samples which are very small, have a low heat of combustion, or have a high moisture content to add sufficient heat to drive the combustion to completion. Benzoic acid is an excellent material for spiking for all of the same reasons it is a good standard material. White oil is also an excellent material; particularly for liquid samples. The 1261 Calorimeter can automatically compensate for the addition of spiking materials to these samples. The calculations are modified in these cases as follows:

$$H_c = \frac{WT - e_1 - e_2 - e_3 - (H_{cs})(M_s)}{m}$$

where H_{cs} = Heat of combustion of the spiking material

M_s = Mass of spiking material

This factor is added to the calculations when *315 or *365 is turned ON. The heat of combustion of the spiking material is entered into *554 as calories per gram. The controller will prompt the operator to enter the weight of spiking material. Fixed spikes can be used by turning *315 and *365 OFF, turning *311 or *361 ON, and entering the mass of the spike into *558.

It is seldom necessary to spike standardization samples, but the provision to do so is provided by the 1261 Calorimeter.

Reporting Units

By default, all calculations in the 1261 Calorimeter are made using calories, degrees Celsius and grams. The reported heat of combustion of the sample is calculated using the following procedure:

Reported H_c = (Calculated H_c)(Final Multiplier)

where Final Multiplier = Factor for converting to desired reporting units.

Appendix C - Calculations

Star Code 520 is used to select the reporting units. If Option 1 is selected, the calorimeter loads the factor (4.1868×10^{-3}) stored in *522 into *556 and lights the MJ/kg light on the display panel. If Option 2 is selected, the factor in *524 (1.8) is loaded into *556 and the Btu/lb indicator is turned ON. If Option 3 is selected, the factor in *526 (1.0) is loaded into *556 and the Cal/g indicator is turned ON. Users can select any other reporting units by selecting Option 4 and entering the appropriate conversion factor into *528. This value will then be automatically loaded into *556, but no unit indicator will be lighted on the display if Option 4 is selected.

Conversion to Other Moisture Bases

The calculations described above give the calorific value of the sample with moisture as it existed when the sample was weighed. For example, if an air-dried coal sample was tested, the results will be in terms of heat units per weight of air-dry sample. This can be converted to a moisture free or other basis by determining the moisture content of the air-dry sample and using conversion formulae published in ASTM Method D3180 and in other references on fuel technology.

Calculation of Net Heat of Combustion

The calorific value obtained in a bomb calorimeter test represents the gross heat of combustion for the sample. This is the heat produced when the sample burns, plus the heat given up when the newly formed water vapor condenses and cools to the temperature of the bomb. In nearly all industrial operations, the water vapor escapes as steam in the flue gases and the

latent heat of vaporization, which it contains, is not available for useful work. The net heat of combustion obtained by subtracting the latent heat from the gross calorific value is therefore an important figure in power plant calculations. If the percentage of hydrogen H, in the sample is known, the net heat of combustion, H_{net} Btu per pound can be calculated as follows:

$$\begin{aligned} H_{\text{net}} &= 1.8H_c - 92.7H \\ &\quad \text{(Solid fuels, ANSI/ASTM} \\ &\quad \text{D2015)} \\ H_{\text{net}} &= 1.8H_c - 91.23H \\ &\quad \text{(Liquid fuels, ANSI/ASTM} \\ &\quad \text{D240)} \end{aligned}$$

In the 1261 Calorimeter this value is obtained by inserting the fixed hydrogen value in *574 and turning ON *366. This will calculate a net heat of combustion and add it to the preliminary report. In the final reporting process the user will be prompted for the actual hydrogen (H) value unless *362 is turned ON.

Magnitude of Errors

The following examples illustrate the magnitude of errors which may result from faulty calorimeter operations. They are based upon an assumed test in which a 1.000 gram sample of benzoic acid produced a 2.8000°C temperature rise in a calorimeter having an energy equivalent of 2400 calories per $^\circ\text{C}$.

An error of 1 milliliter in making the acid titration will change the apparent energy detected by 1.0 cal.

An error of 1 centimeter in measuring the amount of fuse wire burned will change the apparent energy detected by 2.3 cal.



An error of 1 gram in measuring the 2 kilograms of water will change the apparent energy detected by 2.8 cal.

An error of 1 milligram in weighing the sample will change the apparent energy detected by 6.7 cal.

If all of these errors were in the same direction, the total error would be 12.8 cal.

Appendix D - Standardization

Standardizing the Calorimeter

The energy equivalent factor. The term "standardization", as used here, denotes the operation of the calorimeter on a standard sample from which the energy equivalent or effective heat capacity of the system can be determined. The energy equivalent, W or EE, of the calorimeter is the energy required to raise the temperature one degree, usually expressed as calories per degree Celsius. Standardization tests should be repeated after changing any parts of the calorimeter, and occasionally as a check on both the calorimeter and operating technique.

Relative Standard Deviation Calculation. A measure of the precession for the 1261 Calorimeter is found in the relative standard deviation (RSD) calculation. This is determined by dividing the standard deviation by the average energy equivalent. An estimate of the RSD for 10 tests may be determined by:

$$\frac{(\text{Range of Ten Tests} \times .33)}{\text{Average Energy Equivalent}} \times 100$$

The instrument computes the exact standard deviation by the formula:

$$\left[\sum_{1}^N \frac{(X_i - \bar{X})^2}{N - 1} \right]^{1/2} = S$$

where:

X_i = One Test Result

\bar{X} = The Average Energy Equivalent

N = The Number of Tests

The instrument then calculates the relative standard deviation as:

$$\frac{S}{\bar{X}} \times 100 = RSD$$

This value is an indication of how well your instrument is working. ASTM allowance is .15% and most customers are operating in the .05 - .10% range. To put any other value than .15 into *512 is only hiding problems that exist in the calorimeter. This should be avoided particularly during the warranty period.

Standardization procedure. The procedure for a standardization test is exactly the same as for testing a fuel sample. Use a pellet of calorific grade benzoic acid weighing not less than 0.9 or more than 1.25 grams. Determine the corrected temperature rise, T, from the observed test data. Also titrate the bomb washings to determine the nitric acid correction and measure the unburned fuse wire. Compute the energy equivalent by substituting in the following equation:

$$W = \frac{Hm + e_1 + e_2 + e_3}{t}$$

CAUTION:

BENZOIC ACID MUST ALWAYS BE COMPRESSED INTO A PELLET BEFORE IT IS BURNED IN AN OXYGEN BOMB TO AVOID POSSIBLE DAMAGE FROM RAPID COMBUSTION OF THE LOOSE POWDER. THIS IS BEST ACCOMPLISHED BY USING A PARR 2811 PELLET PRESS.



Where:

W = Energy equivalent of the calorimeter in calories per degree Celsius.

H = Heat of combustion of the standard benzoic acid sample in calories per gram.

m = Mass of the standard benzoic acid sample in grams.

t = Temperature rise in °C.

e₁ = Correction for heat of formation of nitric acid in calories.

e₂ = Correction for sulfur which is usually 0.

e₃ = Correction for heat of combustion of the firing wire in calories.

Standard Materials

A bottle of 100 one-gram benzoic acid pellets is furnished with each calorimeter for standardizing purposes. Additional benzoic acid pellets can be obtained from Parr. For very high precision measurements, a primary standard benzoic acid powder can be purchased from the National Institute of Standards & Technology, Washington, D.C. The NIST also offers standard 2,2,4-trimethyl-pentane (Isooctane) for checking calorimeters which are to be used for testing volatile fuels.

The heat of combustion of benzoic acid referenced to 25°C is 6318 calories per gram. This value is entered into *552. If any other material is used as a standard, its heat of combustion must be entered into *552.

It is not common to have sulfur in standard materials or to use spikes in standardizations, but the capabilities have been included in this calorimeter.

Users should take great care to ensure that the conditions during standardization runs and determinations are as identical as possible.

Automatic Statistical Calculations

The 1261 Calorimeter includes a provision for calculating and using a mean energy equivalent for each of up to 8 separate bomb and bucket combinations. ASTM procedures recommend that the energy equivalent be determined by averaging ten tests. The 1261 Calorimeter automatically determines and uses up to 10 tests in its memory and will update the EE value as additional standardizations are run. Only final tests will be used in determining and updating EE values. These values are stored in *211, *221, *231, etc. The relative standard deviation for the tests used in determining the EE value are stored in *213, *223, *233, etc.

The user can choose to turn off the automatic averaging and updating procedure and protect his EE values by turning ON *215, *225, *235, etc. EE values can then be entered manually into *211, *221, *231, etc.

Any outliers or other tests which should not be included in the average EE value must be deleted from the memory using the memory management procedures. For those users with a printer, Star Code 5 can be used to print a list of all tests associated with any Cal ID. The user can elect to use either all stored standardization runs or only the latest ten by turning *510 OFF or ON. Star Code 512 establishes the maxi-

Appendix D - Standardization

mum allowable standard deviation for the EE value before an error condition is reported. The default limit of 0.15% corresponds to the ASTM guidelines.

If the user presses SHIFT - START, the calorimeter will be shifted to the Standardization Mode. To switch back to the Determination Mode, press SHIFT - START again. This key stroke sequence is a rapid way to change Star Code 103. Star Code 103 can be used to shift the calorimeter into the Standardization Mode for a series of tests. If Star Code 103 is used, it will have to be changed back to run determinations.



Appendix E - Communication Interfaces

The Parr Smart Link is designed to facilitate the connection and control of a network of equipment which can include the 1261 Calorimeter, 1760 Sulfur Analyzer, 1720 or 1730 Calorimeter Controllers, 1741 Balance Interfaces, 1750 Proximate Analyzers with their attached analytical balances, 1745 Computer Interface and its associated computer and 1742 Sulfur Interface for automatically entering and storing sulfur values.

Successful installation of the Smart Link Network will depend upon all elements of the communications network (Smart Link) being pre-set, properly configured and connected. A step-by-step review of the Smart Link communications network and the configuration requirements for all devices installed on the link is provided later to ensure that the system is properly addressed before attempting to use it.

The Parr Smart Link is a combination of the hardware (circuit board, connectors and cables) used to interconnect these devices and the software (programs) required to identify the devices on the network and control the bi-directional transfer of data between these devices. Inherent in the programs, which are an integral part of the Smart Link, are the protocols for sending and receiving data,

avoiding interference when the network is busy and ensuring the security and validity of the data.

In addition to the intelligent network control feature of the Smart Link, there are two additional important advantages offered by the communications link when compared with more conventional direct coupling methods such as multiple RS232C connectors. Since devices can be connected in series (or daisy-chained) there is no practical limit to the number of devices that can be connected and only a single connection port is required for each device. The Smart Link is also capable of communicating with devices up to 1000 meters away as opposed to the 50 foot restriction for RS232C lines.

Required Software Versions

Before proceeding with the installation of the 1261 Calorimeter on the Parr Smart Link, the user must ensure that all of his devices have the versions of software capable of communicating over the Smart Link and have been configured for the intended network.

Table E-1
Required Software Versions

Device	Software
1261	Calorimeter Version 61.0 or higher
1720	Controller Version 20.4S or higher
1730	Controller Version 30.2S or higher
1741	Balance Interface Version 41.3S or higher
1745	Computer Interface Version 45.1S or higher
1750	Proximate Analyzer Version 50.2 or higher
1760	Sulfur Analyzer Version 60.1 or higher



The version of software installed in a Parr device can be determined by performing the self-test procedure and checking the printed or displayed message. Users who do not have the required software installed should contact the Technical Service Department at Parr Instrument Company.

Required Hardware

This 1261 Calorimeter is fully equipped for operation on the Smart Link. The 1760 Sulfur Analyzer, as well as 1720 and 1730 Controllers must have the optional 1722 Smart Link Board installed to communicate on the Smart Link. The 1750 Proximate Analyzer and the 1741, 1742 and 1745 Interfaces include all of the required Smart Link hardware. If a 1760 Sulfur Analyzer or 1720 or 1730 Controller will be used in the installation and the 1722 Board has not already been installed, it must be installed at this time.

Smart Link Configurations

Each device on the Smart Link has several parameters associated with it which help to identify the instrument and control the flow of information to and from instruments on the link.

Each category of device has its own fixed identification which automatically identifies it on the Smart Link. Addresses of individual instruments within a class, such as calorimeter controllers, must be changed from the default setting of zero (*460) only if more than one device in the same category is installed on the link. The second device within the category must have its address set to one, and the third set to two, etc.

All devices on the Smart Link are set, by default, to communicate at a rate of 9600 baud (*469=1). All devices on the Smart Link must communicate at the same transmission speed.

Termination Switches

The termination switches of the 1261 Controller are located below the Smart Link connectors at the rear of the calorimeter (see Figure L-2). The six levers on the DIP switch should be on only when there is one Smart Link cable plugged into the 1261 Calorimeter. Improper communication may result if the switches are on when two Smart Link cables are installed.

Smart Link Configuration Checklist

1. Software versions verified for all devices connected on the Smart Link.
2. Any devices which are not the only device within their category have had their addresses changed to 1, 2, or higher, as needed.
3. The two devices at the ends of the Smart Link have had all levers of the terminator switches closed.
4. All other devices, other than the ones on the ends, have all levers of the terminator switches open.
5. All devices have been checked to see that a transmission rate of 9600 baud has been set.
6. All devices on the Link have been turned ON.

Appendix E - Communication Interfaces

Smart Link Configuration Cabling

Smart Link devices, including the 1261 Controller, can be connected using any of the cables listed in Table E-2.

Smart Link cables can be linked as extension cords. If a device is removed from the link, the two cables should be connected to maintain the continuity of the link. Cables should only be connected or disconnected after all devices on the link have been turned off.

Parr offers the A643E Connecting Cable for connections from the identified RS232C port to devices located within five feet of the calorimeter. Users may have longer cables designed to match their devices and installations using these specifications. RS232C ports are not designed for communicating over distances greater than 50 feet.

RS232C Connection

The 1261 Calorimeter is also equipped with an RS232C port for connection to either a 40 or 80 column printer or a computer. Before making either of these connections the data transmission rate of the calorimeter and the printer or computer must be matched. Generally the baud rates on either device can be changed to achieve this match. Baud rates and communication protocols for the 1261 Calorimeter are set by Star Codes 480 - 490.

The default parameters given by Star Codes 480 - 490 are set up for use with the Parr 1755 Printer. Table E-3 identifies and describes the pinout for the RS232 port.

**Table E-2
Smart Link Cables**

Part No.	Description
A597E	Smart Link Cable, 25 Feet
A597E2	Smart Link Cable, 100 Feet
A597E3	Smart Link Cable, Custom to 1000 Feet



Table E-3
Balance Port Specifications

Pin No.	Name	Direction	
		1261	Printer
1	Frame Ground		
2	Received Data	←	
3	Transmitted Data		→
4	Clear to Send (CTS)	←	
5	Request to Send (RTS)		→
6	Data Set Ready (DSR)*		→
7	Signal Ground		

* Held at +12V (space or logic 0) while the 1261 is ON.

Appendix F - Function Keys

There are a total of six user definable function keys built into the 1261 Calorimeter Controller. These six keys, F1 thru F3, and SHIFT F1 thru SHIFT F3 can be used to store a frequently used set of keystrokes. These stored keystrokes can then be invoked by pressing the function key. The default definitions for the function keys of the 1261 Controller are given in Table F-1. Star Codes 60 and 62 allow the user to define and view a function key's contents.

Defining a Function Key

Table F-2 provides a demonstration of the procedure for defining a function key. In this example, the F3 key will be programmed to view the state of Star Codes 120 thru 150.

During the function key definition, the display will indicate the most recent key in terms of its row, column, and position in the key matrix. The number keys 0 thru 9 have keycodes 0 thru 9 respectively. A shifted key is identified with an S prefix to the left of the keycode. In Table F-2,

Table F-1
Default Function Key Definitions

F1	Toggle heater, pump, and watersolenoid ON/OFF (*101)
SHIFT F1	Clear Memory (*20)
F2	Unused
SHIFT F2	Toggle Between Standardization and Determination Mode (*103)
F3	Unused

SHIFT. (S72) invokes a time delay so that the display can be read. Table F-4 gives a complete list of keys and their associated keycodes. Note that the keycode programming sequence is ended with the pressing of the function key currently being defined.

Table F-2
Procedure for Defining a Function Key

Press Keys	Display	Comments
*60 Enter		
F3 Enter	F3	Start Setup for F3 Definition
*	74	
1	1	
2	2	
0	0	
ENTER	71	
Shift .	S72	View *120
NEXT	23	
Shift .	S72	View *122
NEXT	23	
Shift .	S72	View *123
NEXT	23	
Shift .	S72	View *130
NEXT	23	
Shift .	S72	View *140
NEXT	23	
Shift .	S72	View *150
DONE	21	Exit *Code Routine
F3	Current Display	Exit Key Definition



Viewing a Function Key

The "STEP" key is used to step through the keystrokes which have been previously stored. The "DONE" key should be used to escape from the viewing process, if needed.

Now, after viewing the F3 definition, press the F3 key. The display should pause and display the Star Code number and either its state (ON/OFF) or the number which has been previously stored.

Clearing a Function Key

Any function key may be "written over" by simply entering a new set of keystrokes to that function key. To "clear" the keystrokes at the F3 key enter *60 ENTER F3 ENTER F3.

Table F-3
Viewing a Function Key

Press Keys	Display	Key
*62 ENTER		
F3 ENTER	74	*
Step	1	1
Step	2	2
Step	0	0
Step	71	ENTER
Step	S72	Shift.
Step	23	NEXT
Step	S72	Shift.
Step	23	NEXT
Step	S72	Shift.
Step	23	NEXT
Step	S72	Shift.
Step	23	NEXT
Step	S23	Shift.
Step	21	Done
Step	Current Display	

Table F-4
Keycode Assignments

Key	Keycode	Key	Keycode
START	11	CLEAR	61
RPT	12	ENTER	71
02 FILL	13	•	72
RESET	14	*	74
DONE	21	0	0
STEP	22	1	1
NEXT	23	2	2
LAST	24	3	3
F1	32	4	4
F2	33	5	5
F3	34	6	6
+/-	41	7	7
SKIP	51	8	8
		9	9

Appendix G - Maintenance

Filter

There is a filter inside the fan cover 573DD located at the rear of the calorimeter controller (844DD Coarse Filter). 844DD Coarse Filter can be cleaned with warm water and should not need replacement unless it appears worn. If error 1900 Electronics Over Temperature warning occurs, a filter change on the controller may be required.

Oxygen Bomb

Under normal usage the 1108 Parr Oxygen Bomb will give long service if handled with reasonable care. However, the user must remember these bombs are continually subjected to high temperatures and pressures that apply heavy stresses to the sealing mechanism. The mechanical condition of the bomb must therefore be watched carefully and any parts showing signs of weakness or deterioration should be replaced before they fail. It is recommended the 1108 Oxygen Combustion Bomb have O-rings and valve seats replaced after 500 firings or at more frequent intervals if the bomb has been subject to heavy usage or if it shows any evidence of damage. Detailed information can be found in Bulletin 205M supplied as a part of this manual.

Program Updates

The EPROM located inside the logic pack may need replaced in order to support new Parr equipment as it is developed. When purchasing new equipment, Parr will advise of any need for new software revisions.

To replace the EPROMS, first follow the procedure given in Appendix I for the removal of the logic pack. Parts U4 and U5 located in the upper right-hand corner of

the logic pack are the EPROMS which hold the program. To remove it, simply pry the part from its socket using a thin blade screwdriver. Be careful not to bend any of the pins of the EPROM. The new EPROM may be inserted into the socket, making sure that the notch at one end of the EPROM (981E) faces the outer perimeter of the board. Part U1 is the EEPROM (A1162E) and may also require replacement in the event the EPROM is changed. Then execute *94. The part is located in the upper left-hand corner of the logic pack. It can be removed using the same procedure as the EPROM.

Software changes will almost always result in a cold restart of the 1261 Controller. Care should be taken that all important data and star code settings are recorded before making a program replacement.

Replace the logic pack after the EPROM has been switched and turn the controller ON. The controller should display the new software revision number after completing the self-test. If the unit does not get to the self-test, turn the controller OFF and then on, holding down the reset key at the same time until the self-test has completed.



Replacing Bucket Thermistor Probe

Turn off the instrument and open the calorimeter cover. Use a 5/64" Allen wrench to remove the 12 button head socket screws which secure the cover to the bottom plate of the cover assembly. The screws at the rear of the cover will be easier to remove with the cover in a partially pushed back position. Before removing the last screw, grasp the cover assembly so that it does not drop and become damaged.

Remove the two cable clips which secure the thermistor cable to the hinge assembly. Also remove the cable ties which secure the cable to the plastic water tubing and to the mounting bracket. With the cover closed, remove the nut and plastic ferrule which secure the probe to the cover water jacket assembly. Remove the probe from cover through the cover and jacket hinge openings. Disconnect the BNC connector from the microprocessor case.

Install the new thermistor probe, to reverse the above procedure and secure the cover, with the previously removed button head socket screws.

Installing Support Rod Mounting Plates

Turn off the instrument, disconnect the harness plug from the logic pak and open the cover. Then loosen the eight set screws that secure the lower link assemblies (S shaped) to the assembly shaft rod. Remove the flat head machine screws from the lower linkages which connect to the cover brackets. These flat head machine screws and retaining washers have been fastened with loctite which may require more than normal effort to loosen them. Care must

be exercised in this step as the cover may slip down and possibly bend the thermistor probe.

Remove the round head machine screw that secures the tube clips to the lower linkages and carefully move the cover to the closed position. Remove the two flat head machine screws that secure the upper linkage to the support rod mounting plates.

From the rear of the calorimeter, with a nut driver or socket wrench, remove the six nuts that secure the support rod mounting plate to the calorimeter chassis. Remove the two snap rings that secure the retaining pin to the upper U bracket and gas spring, and remove retaining pin. The lower linkages that were previously loosened via set screws can now be moved toward the center on the shaft assembly rod.

Lower the shaft assembly rod and remove both support rod mounting plates from the shaft assembly rod. Position the new mounting plates, A536DD3 and A535DD3 on the shaft assembly rod. Secure the mounting plates with previously removed nuts, finger tight. With previously removed flat head machine screws and retaining washers, secure the upper linkage to the support rod mounting plates. Use the retaining pin to secure the gas spring to the U bracket. Reattach the snap rings on the retaining pin. Push the lower linkages to the outer most position on the shaft assembly rod. Raise cover to open position. Attach tube clips to the lower linkage assembly with the nut and washer between the two linkage assemblies. Reattach lower linkage arms to the cover bracket with the flat head machine screws and retaining washers.

Appendix G - Maintenance

Position lower linkage assemblies to outermost position against the support rod mounting plate. Lower the cover and align cover so that cover has a uniform alignment with calorimeter chassis, front, side and rear. No air gap should exist between rear portion of cover and the calorimeter chassis. Now secure the nuts on the support rod mounting plates, alternating between left and right hand plates until all six nuts have been tightened.

Raise cover and recheck the lower linkages to be sure they are at outermost position adjacent to respective mounting plates. Secure the 8 set screws. Reattach cable connector, lower cover and recheck cover adjustment.



Appendix H - Troubleshooting

The 1261 Calorimeter Controller is equipped with a generous set of error messages to inform the user in the event of a malfunction. Error messages can be printed with a full description of the error by turning *416 on. Otherwise, the error given in the display can be translated from the error code list given in Appendix B. Additionally, a complete error code list can be printed by activating *70.

Some of the error messages refer to conditions that may exist if certain inputs are not sensed properly, such as the temperature probes. Other error conditions may result if certain outputs are not activated at the proper time. The rear panel of the 1261 Control Assembly has a series of 10 holes which serve as test points and indicators for the various electrical outputs of the controller. The neon lamp associated with each output will glow when the respective output has been turned ON. The neon bulb may glow dimly all the time if the load has been removed or is defective (open). The fuses for these respective outputs are located underneath the cover located next to the 18 pin connector block on the side of the controller. Power should be removed from the controller before removing the fuse cover. Refer to Table H-1 for fuse assignments. When replacing fuses, do not use ordinary glass fuses for the ceramic rectifier fuses. Protection of the solid state relays cannot be achieved with ordinary glass fuses.

With the exception of the heater, the output corresponding to the neon indicator may be forced on by shorting the two pins located through the hole above the indicator lamp. These pins may be shorted by using a thin blade screwdriver. There is no danger if the screwdriver touches the case since only low voltages are present at these pins. A blown fuse or a problem with the solid state relay is indicated if the output or indicator lamp fails to come on

when these pins are shorted. If the indicator light comes on when the pins are shorted and the output (pump, solenoid, etc.) is not activated, then the output device needs servicing or replacement.

There are no user serviceable parts inside the controller. If a problem is suspected with the output circuitry on the basis of the above test procedure, the entire power pack should be returned to Parr Instrument Company for repair. Schematics, wiring diagrams, parts and parts lists for the controller are not available.

Instrument Lockups and Cold Restart

Microprocessor based instrumentation is susceptible to temporary failures due to interruptions in the electrical supply or stray electrical pulses. Fluctuations in electrical voltages and static electricity are the two most common sources of electrical noise which will disrupt normal operations in the microprocessor portion of the calorimeter. In most cases when this occurs, the microprocessor is unable to absorb the shock and continue with routine operations, the unit will automatically undergo a cold restart procedure to return the instrument to a known operating condition. If this occurs, the user will have to restore any Star Codes which are not default settings.

If the system locks up and is unresponsive after turning the unit off and then on, the system may be restarted by following these steps:

1. Turn the calorimeter on and press the SHIFT key followed by the RESET key. This keystroke sequence can be used to unlock an unresponsive keyboard if the SHIFT and RESET keys respond when pressed.



2. If the above procedure is ineffective, turn the calorimeter OFF, press the RESET key (holding it down) while turning on the power switch. This procedure causes the controller to perform a cold restart.

Line conditioners and/or static mats, used on personal computers should be installed if repeated cold restarts or lockups are encountered.

The DC voltages should be checked when the calorimeter is cold-restarting or losing memory while running, will not start or complete the self-test or is operating erratically. (If the calorimeter cold-restarts only when the power is turned off and on and otherwise operates correctly, then the problem is probably the 3.9 volt lithium battery (Parr Part No. 701E) on the CPU Board in the Logic Pack.)

VBulk Voltage

Measuring - To make this measurement remove the six screws and the bezel around the keyboard/display and then raise the logic pack (the keyboard/display and the two circuit boards mounted beneath it) a couple of inches so that the voltmeter probes can be attached to various points on the circuit boards of the logic pack while the cables are still attached to the logic pack and the 1261 is turned on. Measure from digital ground (the metal standoffs or metal bottom plate on logic pack) to the input terminal (the one to which the black wire is connected) on the voltage regulator mounted on the logic pack bottom plate. The voltage should measure around 11 volts.

Correction - If the VBulk voltage is less than 11 volts, the problem is most often the CR1 diode bridge (the largest diode bridge) (Parr Part No. 919E) on the

Table H-1
Fuse Identification

Output	Fuse	120 VAC Service	Parr No.	240 VAC Service	Parr No.
O ₂	F1	1A*	959E	1A*	959E
Solenoid					
Water	F2	1A*	959E	1A*	959E
Solenoid					
Stirrer	F3	1A*	959E	1A*	959E
Pump	F4	4A*	959E3	4A*	959E3
Heater	F5	7A*	959E4	4A*	959E3
Ignition	F6	1.5A 3AG	139E2	1A 3AG	139E6
		* Rectifier Type Fuse			

Appendix H - Troubleshooting

A580DD Board (the circuit board mounted on the left side of the lower electronic panel).

Regulated 5 Volts

Measuring - Measure from digital ground (the metal standoffs or metal bottom plate on logic pack) to pin 28 (the one in the upper right corner) of integrated circuit socket U5 (the one in the upper right corner) of the CPU board. (The CPU board is the lower of the two circuit boards mounted beneath the keyboard/display.) The voltage should measure between 4.95 and 5.05 when the voltmeter is set to DC voltage and less than .005 when the voltmeter is set to AC voltage (ripple).

Correction - The 5 volts can be adjusted using potentiometer R15 (in the extreme lower left corner) on the Display/Power board. (The Display/Power Board is the upper of the two circuit boards mounted beneath the keyboard/display.) If the V_{Bulk} voltage is good, but the 5 volts cannot be adjusted to 5 volts using R15, then there is a bad component in the logic pack. The most common faulty component is the LM323K voltage regulator attached to the logic pack bottom plate or the cable from the regulator to the Display/Power circuit board. (The bottom plate, voltage regulator and cable assembly is Parr Part No. 1170E.) Some logic packs with serial numbers less than 1100 have (if the original cable has not been replaced) faulty crimp connections on the voltage regulator cable which can cause intermittent problems.

Keyboard Inoperative

Symptoms - A bad keyboard panel will result in the calorimeter responding to only some rows or columns of keys and ignoring others. If the keyboard has failed

completely, the calorimeter will respond to no key presses. In either case, the calorimeter will power-up and display the bucket and jacket temperatures normally. If the calorimeter does not power-up normally and display the bucket and jacket temperatures, then there is another problem and the lack of response to key presses is probably a symptom of this other problem and not the result of a failed keyboard panel.

Solution - When any row or column of keys fail on the keyboard panel of a 1261 Calorimeter, the panel is unrepairable and must be replaced. A replacement keyboard panel can be ordered from Parr (Parr Part No. 1158E). Replace the keyboard panel by removing the logic pack from the 1261 Calorimeter using the "Logic Pack Removal" procedure from Appendix I in the 1261 Operating Instructions. Turn the logic pack upside down and remove the six nuts holding the bottom plate. Remove the bottom plate and cable, noting first where and how the cable is connected so that it can be properly reconnected later. Remove the long standoffs, the CPU board, the medium standoffs and the power/display circuit board. Remove the six short standoffs from the old keyboard panel and screw them onto the new keyboard panel. Attach the ribbon cable from the new keyboard panel to the connector on the display/power circuit board and then fold the cable back as you mount the display/power circuit board on the short standoffs so that the ribbon cable does not extend out past the edge of the circuit board. Reassemble the standoffs, CPU board, back panel and nuts.



Temperature Problems

Temperature problems on the 1261 Calorimeter can be incorrect or erratic temperatures or "No Temperature" error messages for either the bucket or jacket or both.

Problems with either the bucket or the jacket temperature, but not both. Determine if the problem is in the probe by temporarily connecting the jacket probe to the bucket probe socket and the bucket probe to the jacket probe socket on the back of the electronic cabinet. If the problem changes channels, then the probe is faulty (Parr Part No. 893E). If the problem does not change, then the problem is a faulty electronic component. The faulty component is often one of six wire-wound, precision, low-temperature-coefficient resistors in the lower right corner of the CPU board on the logic pack. Resistors in the bucket circuit are R16 (38K), R19 (25K) and R14 (2K). Resistors in the jacket circuit are R17 (38K), R18 (25K) and R15 (2K). If the problem is "No Temperature" the faulty resistor will measure open when tested with an ohmmeter. If the problem is erratic or intermittent temperatures, the faulty resistor may measure slightly different than its rated value or may change values when heated with a heat gun. Good precision, low-temperature-coefficient resistors will measure almost exactly at their rated resistance and the resistance will change only slightly when the resistor is heated.

Problems with both the bucket and jacket temperatures. "No Temperature" errors on both the bucket and jacket. (i.e. Error 1800 appears every time the 1261 is turned on and if the clear key is pressed, Error 1801 appears.)

Check the cable inside the electronics cabinet from the thermistor probe sockets to the bottom left corner of the CPU board (the lower of the two circuit boards in the logic pack.) If the cable is properly connected at both ends, then the problem is either both thermistor probes are bad (check by measuring the resistance of the probe) or a problem in the logic pack which will probably require factory repair.

Both jacket and bucket temperature incorrect and/or erratic. Cold restart the 1261 by either holding down the reset key while turning on the power switch or by executing Star Code 86. If this does not correct the problem then there is an electronic problem which will probably require factory repair.

Bomb Firing Circuit

If no voltage is measured on pins 1 and 2 at the end of the firing cycle. If a voltmeter attached to pins 1 and 2 on the 18 pin connector socket does not measure 24 volts DC after the controller beeps at the end of the firing cycle, then the problem must be in the power pack or the logic pack.

Attach a DC voltmeter to the large (81000 MFD) capacitor in the power pack and enter *41 on the controller to initiate a firing cycle. While the controller displays "CHARGING", the voltage on the capacitor should be ramping up to around 28 volts DC. If little or no voltage is measured on the capacitor during the charging period, then check the capacitor charging circuit. If the voltage ramps up to 28 volts during the charging period, but still no voltage is seen at pins 1 and 2 at the end of the firing cycle, check the capacitor discharge circuit.

Appendix H - Troubleshooting

On schematic 2932EK the charging circuit consists of transformer T1, diode bridge U3, transistor Q2, diodes D2 and D3, resistors R12 and R11 and relay RLY5. Check the voltage from the anode of D2 to the anode of D3. This should measure around 32 volts DC whenever power is on. If this voltage is not present, check Q2 U3 and T1.

If the 32 volts is present on D2 and D3, check to see if relay RLY5 is pulling in during the firing cycle. If it is, 32 volts should be seen on resistor R11. If relay RLY5 is not pulling in, check U2 and U4 and the DISARM line from the logic pack.

The capacitor discharge circuit consists of SCR Q1, optoisolator U1 and the FIRE line from the logic pack. A common source of problems in this circuit are the solder connections on Q1 and the inductor coil below it, which is not shown on the schematic.

Early models of the controller could experience the problem of a reset key action during pre-period which would ignite the sample. The problem may be resolved by replacing the existing capacitor across OPT 6 with a 937E Capacitor, .1 microfarad. Remove the A600DDEB Controller sub-assembly from the 1261 Calorimeter. Remove the right panel by removing seven Phillip head screws at the outer most edge of the panel. Remove the black connector to the logic pack and 4 wire connector adjacent to the transformer. Remove the six kep nuts securing the circuit board to the right side panel. Locate the coil at OPT 6, left bottom quadrant of the circuit board. Remove the capacitor on opposite side. Replace with the 937E Capacitor and reassemble unit.

Low Oxygen Pressure

Error 3600 signifies low oxygen pressure in the line filling the bomb. The pressure switch must reach 27 (400 psi) atmospheres in this line otherwise there is the display of this error message. Our recommended oxygen line pressure to the calorimeter is 440-450 psi to allow for some pressure drop in the line to the calorimeter's oxygen solenoid.

The most common reason for this error message is partially plugged orifice at the input of the oxygen solenoid block and generally occurs when replacing the oxygen tank. The problem may be resolved by reversing oxygen connections at the solenoid block assembly. Close the valve for the oxygen tank.

Move the connection from the input connector of the block to the output connector of the block assembly. Cycle the oxygen fill process with the tank valve open to flush any particles which may be blocking the orifice. After the completion of the fill process, close the oxygen tank valve to avoid emptying the tank. If the error 3600 message occurs at the end of this process, oxygen is not flowing to the solenoid block assembly or the pressure switch is faulty. If oxygen is being supplied to the block, then failure of the pressure switch to close may be confirmed with an ohm meter measurement of approximately zero resistance across pins 1 and 2 of the 626DD Connector (see Figure L-5) during the fill process with the oxygen connections still in the reversed position.



Bucket Thermistor Replacement

Open the calorimeter cover, and turn off the instrument. Use a 5/64 allen wrench to remove the 12 button head socket screws (BHSCS) which secure the cover to the bottom plate of the cover assembly. The screws at the rear of the cover must be removed with the cover in a not fully pushed back position. Before removing the last screw, grasp the cover assembly so that it does not drop and become damaged.

Remove the 2 cable clips which secure the thermistor cable to the hinge assembly. Also, remove the cable ties which secure the cable to the plastic water tubing and to the mounting bracket. With the cover closed, remove the nut and plastic ferrule which secures the probe to the cover water jacket assembly. Remove the probe from cover through the cover and jacket hinge openings. Disconnect the BNC connector from the microprocessor case.

Reversing the above removal procedure, install the new thermistor probe and secure to the cover with the previously removed nut and ferrule.

Instructions for Adjusting Cover

1. Turn off instrument and open cover.
2. Loosen 8 set screws that secure the lower link assemblies, S shaped, to the assembly shaft rod.
3. Carefully move the cover to the closed position.
4. From the rear of the calorimeter, with a nut driver or socket wrench, loosen the six kep nuts that secure the support rod mounting plate to the calorimeter chassis.
5. Align cover so that cover has a uniform alignment with calorimeter chassis, front, side and rear. No air gap should exist between rear portion of cover and the calorimeter chassis.
6. Position lower linkage assemblies to outer most position against the support rod mounting plate.
7. Now secure the nuts on the support rod mounting plates, alternating between left and right hand plates until all six nuts have been tightened.
8. Raise cover and recheck the lower linkages to be sure they are at outer most position adjacent to respective mounting plates. Secure the 8 set screws.
9. Lower cover and recheck cover adjustment.

1261 Ignition Problems

Ignition problems on the 1261 Calorimeter are generally attributed to one of three possible sources, after having checked the fuse.

1. Breakdown of insulator and o-ring on the insulated electrode assembly in the 1108 Oxygen Bomb. Any reading on an ohm meter, when set to the RX1 scale with the leads connected to the ignition terminals of the oxygen bomb head, is an indication of insulation breakdown.
2. The ignition lead wires have broken internal wire strands. This may be detected by connecting the ohm meter to the ends of the wire, and flexing the wire. Any change in reading from 0-20 ohms would indicate broken strands of wire. Readings for bad ignition wires generally go to infinity when flexing the wire.
3. Connections in the terminations of the 18 pin connector to the A600DD Control Unit. The wire terminations

Appendix H - Troubleshooting

for ignition wire are not fully inserted into the orange connector.

The voltage output from 18 pin connector on the A600DD Control Unit may be confirmed with volt meter measurement at pins 1 and 2. When *41 is activated, the system will beep and then output approximately 33 volts D.C. If the problem has not been resolved, then the A600DD Control Unit must be the source of the problem and returned to the factory for repair.

If the error 3600 message occurs at the end of this process, oxygen is not flowing to the solenoid block assembly or the pressure switch is faulty. If oxygen is being supplied to the block, then failure of the pressure switch to close can be confirmed with an ohm meter measurement of approximately zero ohms across pins 1 and 2 of the 626DD Connector during the fill process.

Error 3600

Error 3600 signifies low oxygen pressure in the line filling the bomb. The pressure must reach 27 atmospheres (400 psi) in this line or error 3600 will display. Our recommended oxygen line pressure to the calorimeter is 440-450 psi (29-30 ATM) to allow for some pressure drop in the line to the calorimeter's oxygen solenoid.

The most common reason for this error message is partially plugged orifice at the input of the oxygen solenoid block and generally occurs when replacing the oxygen tank. The problem may be resolved by reversing oxygen connections at the solenoid block assembly.

Close the valve for the oxygen tank, move the connection from the input connector of the block to the output connector of the block assembly. Cycle the oxygen fill process with the tank valve open to flush any particles which may be blocking the orifice. After the completion of the fill process, reclose the oxygen tank valve to avoid emptying the tank with this reverse connection.



Appendix I - Controller Replacement

The 1261 Calorimeter Controller can be physically separated into two halves. The upper logic pack consists of the keyboard, display and associated microprocessor and A/D circuitry. This logic pack is attached to the lower power pack with two ribbon cables and a shielded cable that is routed to the BNC jacks at the rear of the controller case. Six screws are used to mate the logic pack to the power pack.

Logic Pack Removal

1. Disconnect the power cord from the rear of the controller.
2. Remove the six screws located on the display bezel.
3. Remove the bezel.
4. Separate the logic pack from the power pack by lifting the logic pack up from the lower edge.
5. Unplug the 4 conductor, shielded, thermistor probe cable from the logic pack at P4. Note that the red wire of the cable goes to Pin 1 in the logic pack.
6. Unplug the two ribbon cables using the two ejectors on the mating sockets.

Combined Power Pack/Logic Pack Removal

1. Disconnect the power cord and any Smart Link and/or printer cables from the rear of the controller.
2. Disconnect the 18-Pin connector plug.
3. Disconnect the BNC connectors attached to the ends of the bucket and jacket thermistor probes.
4. Remove the six screws located on the display bezel and remove the bezel.
5. Push the rear of the controller near the bottom of the case which will force the display panel up.
6. Grab hold of the front edge of the controller which has been forced up in the preceding step, and guide it out of the front of the calorimeter case, tilting where necessary to provide clearance for the BNC jacks.
7. The logic and power packs may now be separated, if desired, by following the procedure given for the logic pack removal.

If logic pack and power pack are returned, they may be secured together with screws. Otherwise, they must be separated to avoid damage in transit.



Appendix J - Technical Service

Should you need assistance in the operation or service of your instrument, please contact the Technical Service Department.

**Telephone (309)762-7716
1-800-872-7720
Fax (309)762-9453**

When calling, please make note of and have available the following:

1. The serial # of the calorimeter.
2. Date purchased.
3. Software revision (via *0).
4. EEPROM revision and revision date (via *9).
5. Hardware version # and revision date (via *96).
6. User's setup # and revision date (via *97).
7. Whether or not a printer is attached to the 1261 Calorimeter.
8. The number and type of any Smart-Link peripherals and their software revisions.

It is also helpful if the person calling is close to the 1261 Calorimeter to implement any changes recommended by the Technical Service Department.

Return for Repair

To return the instrument for repair, please call the Technical Service Department for shipping instructions and a **RETURN AUTHORIZATION NUMBER**. This number must be clearly shown on the outside of the shipping carton or it will be refused. Ship to:

**Attn: Service Department
Parr Instrument Company
211-53rd Street
Moline, Illinois 61265**



Appendix K - 1261 Program Installation

The following is to assist users, without a connected printer, in setting up the program of the 1261 Calorimeter by modifying the default settings as required. Users with a printer attached to the 1261 Calorimeter, a menu driven installation program is available through Star Code 50. The operation of this is described in this chapter. It is recommended that the user circle or highlight any changes made while using this list so that it can be reinstalled quickly if required due to a cold restart.

ENTER DATE AND TIME

1. Use *3 to enter the correct date (MMDDYY) and time (HHMM) (24 hour clock) into memory of Calorimeter. Go to step 2.

OPERATING MODE

2. Do you want to use the Dynamic operating mode?
 - A. Yes - Go to step 3.
 - B. No - Set *504 to OFF and go to step 3.

MULTIPLE SAMPLE ID NUMBERS

3. Do you want to use more than one bomb and bucket combination in your calorimeter?
 - A. Yes - Set *516 to OFF and go to step 4.
 - B. No - Go to step 4.

STANDARDIZATION MATERIAL

4. Do you want to use a material other than benzoic acid as the material to standardize your calorimeter.

- A. Yes - Enter the heat at combustion of your standard material in calories per gram in *552 and go to step 5.
 - B. No - Go to step 5.

UNITS

5. Do you want your reporting units to be BTU/lb?
 - A. Yes - Skip to step 8.
 - B. No - Go to step 6.
6. Do you want your reporting units to be either calories/gram or megajoules/kilogram?
 - A. Yes - Calories/gram set *520 to 3. Megajoules/kilogram set *520 to 1 and skip to step 8.
 - B. No - Go to step 7.
7. For units other than BTU/lb. Calories/gram or MJ/kg, set *520 to 4 and enter correct multiplier for selected units in *528 using scientific notation as discussed. The calorimeter will report these units, but will not label the value.

PRINTER CONTROL

8. Will you be using a printer connected to the RS232C port of the calorimeter?
 - A. Yes - Set *402 to 2 and go to step 9.
 - B. No - Skip to step 10.
9. Is the printer you are using a Parr 1755 Printer?
 - A. Yes - Skip to step 11.



- B. No - Set *481, *483, *485, *487, and *489 to the correct communication values to match your printer and skip to step 11.

10. Do you want to have your reports printed on a remote printer instead of one connected to the RS232C port?

- A. Yes - Enter the correct codes from the tables into *490, and *492. The address of the unit to which the printer is connected into *494 and go to step 11.

- B. No - Go to step 11.

REPORT GENERATION

11. Do you want to have a report printed automatically at the conclusion of each test?

- A. Yes - Set *404 to ON and go to step 12.

- B. No - Go to step 12.

12. Do you want to have header information printed for each report when a block of reports is being printed?

- A. Yes - Set *412 to ON and go to step 13.

- B. No - Go to step 13.

FINAL REPORTS MANAGEMENT

13. Do you want to protect final reports from being overwritten automatically when the memory of the calorimeter is full.

- A. Yes - Go to step 14.

- B. No - Set *170 to ON and go to step 14.

14. Do you want to be able to revise sample weight, CAL ID, sulfur values and recalculate final reports?

- A. Yes - Go to step 15.

- B. No - Set *172 to OFF and go to step 15.

AUTOMATIC CALCULATION OF EE VALUES

15. Do you want to have the Calorimeter automatically calculate and use an EE value for each bomb and bucket combination based upon the mean of the most recent ten standardization runs within this CAL ID?

- A. Yes - Skip to step 18.

- B. No - Go to step 16.

16. Do you want to automatically calculate the EE values as above using all available standardization runs for each CAL ID?

- A. Yes - Set *510 to OFF and skip to step 18.

- B. No - Go to step 17.

17. To manually calculate and enter the EE values for your CAL ID's or to prevent established values from being updated automatically, set *215, *225, *235, etc. as appropriate to ON and go to step 18.

18. Do you want to have an error message reported if the relative standard deviation of the standardization runs used to determine the EE value for a Sample ID exceeds 0.15 percent?

- A. Yes - Go to step 19.

- B. No - Enter the desired limit in *512 and go to step 19.

JACKET TEMPERATURE

19. Do you want your jacket temperature to be 35.0°C?

Appendix K - 1261 Program Installation

A. Yes - Go to step 20.

B. No - Set *506 to desired temperature (deg. C) and go to step 20.

BOMB SERVICE INDICATOR

20. Do you want to have the Calorimeter advise you when a bomb has been fired 500 times so that routine maintenance can be performed?

A. Yes - Go to step 21.

B. No - Enter the desired service interval in *514 and go to step 21.

DETERMINATION CORRECTIONS

21. Do you want to enter your fuse wire correction, either fixed or actual, for your determinations directly in total calories?

A. Yes - Go to step 22.

B. No - Enter the conversion factor required to correct the units chosen into calories in *540 and go to step 22.

22. Will you report the acid correction as total acid per ASTM techniques as opposed nitric acid only? If you plan to use fixed acid corrections you must choose to report nitric acid only.

A. Yes - Mixed acid, go to step 23.

B. No - Nitric acid only, set *357 ON and go to step 23.

23. Do you want to enter your acid correction, either fixed or actual, for your determinations directly in total calories.

A. Yes - Go to step 24.

B. No - Enter the conversion factor required to convert the units chosen into calories in *542 and go to step 24.

24. Will you enter your sulfur correction, either fixed or actual, for your determinations in percent sulfur?

A. Yes - Skip to step 26.

B. No - Set *359 to OFF and go to step 25.

25. If you are entering your sulfur values for your determinations in units other than percent sulfur, enter the conversion factor required to convert the units chosen to calories into *544.

NOTE: The value selected must represent total sulfur present since it will not be multiplied by sample weight in this option. Go to step 26.

26. Do you want to use fixed values for any of the corrections for fuse wire, acid, or sulfur in calculating the final reports for your samples.

A. Yes - Go to step 27.

B. No - Skip to step 30.

27. Do you want to use a fixed value for the fuse wire correction in your determination runs?

A. Yes - Set *351 to ON, enter correction into *367 for the units selected in step 20 and go to step 28.

B. No - Go to step 28.

28. Do you want to use a fixed value for the acid correction in your determination runs?



- A. Yes - Set *353 to ON, enter the correction into *369 for the units in selected in step 23 and go to step 29.
 - B. No - Go to step 29.
29. Do you want to use a fixed value for the sulfur correction in your determination runs?
- A. Yes - Set *355 to ON and enter the correction into *371 for the units in selected in step 24 or 25 and go to step 30.
 - B. No - Go to step 30.
33. Do you want to use fixed values for any of the corrections for fuse wire, acid or sulfur in calculating your final reports for your Standardization Runs?
- A. Yes - Go to step 34.
 - B. No - Skip to step 37.
34. Do you want to use a fixed value for the fuse wire correction in your standardization runs?
- A. Yes - Set *301 to ON, enter correction into *317 for the units chosen in step 21 and go to step 35.
 - B. No - Go to step 35.

STANDARDIZATION CORRECTIONS

30. Do you want to assume that there is no sulfur in the material used for your standardization runs? (Benzoic acid contains no sulfur.)
- A. Yes - Skip to step 33.
 - B. No - Set *305 to OFF and go to step 31.
31. Will the sulfur correction for your standardization runs be entered in percent sulfur?
- A. Yes - Skip to step 33.
 - B. No - Set *309 to OFF and go to step 32.
32. If you are entering your sulfur values for your standardization in units other than percent sulfur, they must be entered in the units previously selected in 25 as they will be multiplied by the conversion factor set into *544.
35. Do you want to use a fixed value for the acid correction in your standardization runs?
- A. Yes - Set *303 to ON, enter the correction into *319 for the units chosen in step 23 and go to step 36.
 - B. No - Go to step 36.
36. Would you rather not use a fixed percent sulfur in your standardization runs?
- A. Yes - Set *305 to OFF and go to step 37.
 - B. No - You do plan to fixed values which should be entered into *321 and go to step 37.

DETERMINATION SPIKING

37. Do you want to spike your samples during determination runs with a combustion aid?
- A. Yes - Set *365 to ON and go to step 38.
 - B. No - Skip to step 39.

NOTE: The value selected must represent total sulfur present since it will not be multiplied by sample weight in this option. Go to step 33.

Appendix K - 1261 Program Installation

38. Will benzoic acid be used as a combustion aid to spike your samples in your determination runs?

- A. Yes - Go to step 39.
- B. No - Enter the heat of combustion of your spiking material in calories per gram into *554 and go to step 39.

39. Will a fixed amount of combustion aid be used to spike your samples in your determination runs?

- A. Yes - Set *361 to ON, enter the mass in grams of the fixed spike in *558 and go to step 40.
- B. No - Go to step 40.

STANDARDIZATION SPIKING

40. Do you want to spike your samples during standardization runs with a combustion aid?

- A. Yes - Set *315 to on and go to step 41.
- B. No - Skip to step 43.

41. The spiking material used for standardization runs must be the same material used for spiking determination runs. The heat of combustion in calories per gram was set into *554 in 38 above. Go to step 42.

42. If you will be using a fixed amount of combustion aid to spike your standardization runs, it must be the amount that was previously set into *558 in 39 above. Will you be using fixed spikes in your standardization runs?

- A. Yes - Set *311 to ON and go to step 43.
- B. No - Go to step 43.

AUTOMATIC SAMPLE WEIGHT ENTRY

43. Do you want to transfer sample weights to the calorimeter from a 1741 Balance Interface or a 1750 Proximate Analyzer connected on the Smart Link?

- A. Yes - Enter the correct operating mode code from the table into *120 and go to step 44.
- B. No - Go to step 44.

44. Do you want the user to be able to enter weights manually if no stored weight is found during the automatic transfer from the balance interface?

- A. Yes - Go to step 45.
- B. No - Set *122 to ON and go to step 45.

AUTOMATIC ACID CORRECTION ENTRY

45. Do you want to automatically transfer the acid correction value to the calorimeter from a 1760 Sulfur Analyzer connected on the Smart Link?



- A. Yes - Enter the correct operating mode from the table into *130 and go to step 46. (NOTE - step 22 must be set to yes.)
- B. No - Go to step 46.

COMPLETION OF INSTALLATION

- 50. Your program installation should now be complete.

AUTOMATIC SULFUR CORRECTIONS ENTRY

- 46. Do you want to automatically transfer the sulfur correction value to the Calorimeter from a 1760 Sulfur Analyzer or 1742 Interface connected on the Smart Link?
 - A. Yes - Enter the correct operating mode from the table into *140 and go to step 47.
 - B. No - Go to step 47.

AUTOMATIC SAMPLE ID ENTRY

- 47. Do you want to automatically enter Sample ID number in a sequential pattern?
 - A. Yes - Set *150 to ON and go to step 48.
 - B. No - Go to step 48.
- 48. For automatic generation of Sample ID numbers, enter the sample number (or base number) into *154 and set the increment value into *152. Go to step 49.

PASSWORD PROTECTION

- 49. Do you wish to use password protection for your operating parameters?
 - A. Yes - Enter the desired "passwords" as described in *100 into *100, *200, *300, *400, *500 as required and go to step 50.
 - B. No - Go to step 50.

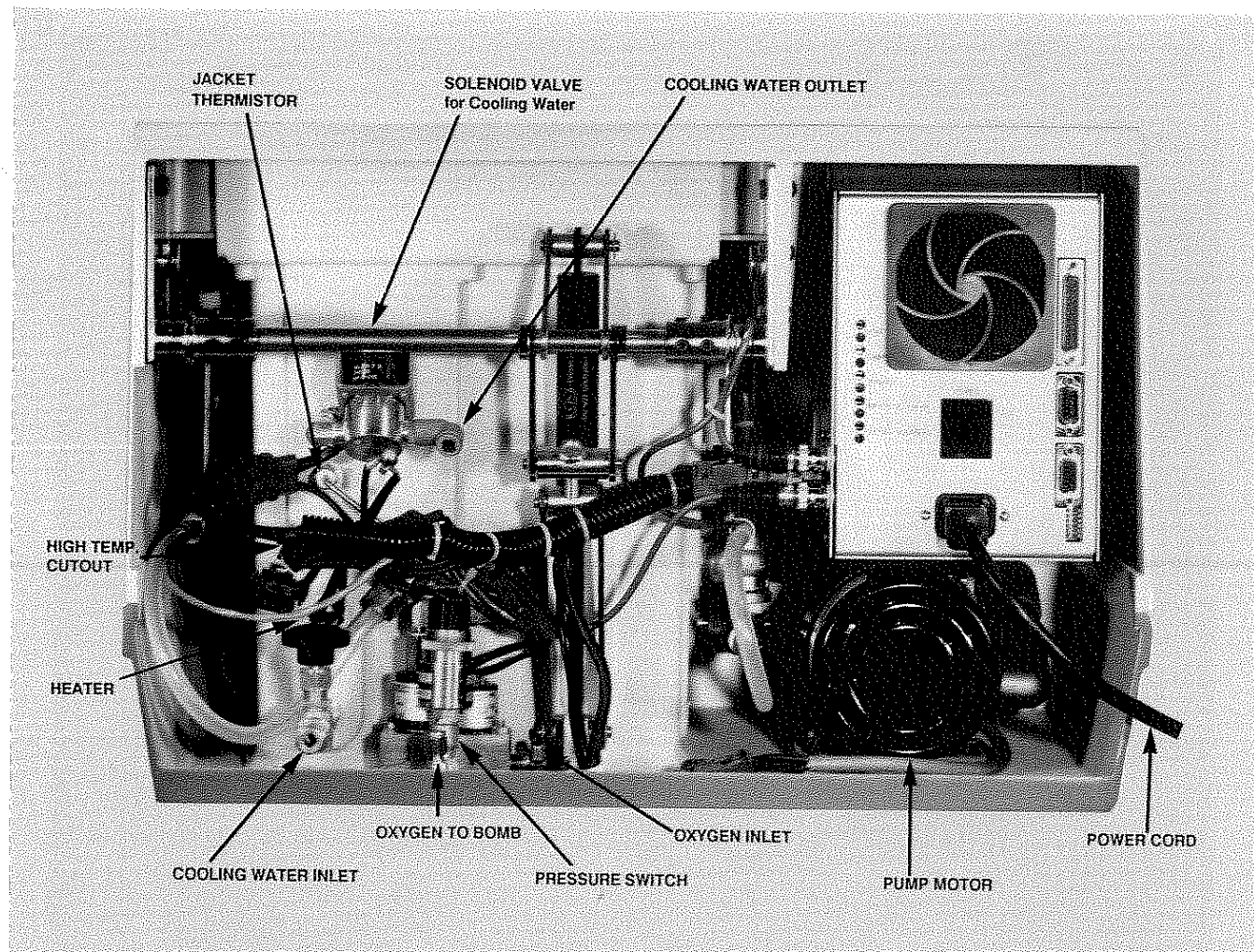
Appendix L - Parts List

1261 Calorimeter Parts List

Item	Description	Item	Description
A476A2	Connector, 1/8 NPTF	A600DDEA	Controller sub-assembly, 115V
A391DD	Oval, bucket	A600DDEF	Controller sub-assembly, 230V
393DD	Bucket support	A297E	Lead wire, single
531DD	Coupler, stirrer shaft	A719E	Cord set, 115V
538DD	Serpentine Coil	893E	Thermistor, 1/8 OD, 7.8" L
549DD	Spring, gas	907E	Capacitor, 0.82 MFD, 115V
558DD	Seal, cover	957E	Jumper
573DD	Guard, filter; fan	961E	Capacitor, 0.22 MFD, 230V
578DD2	Pin, retainer, 1.52 in.	1200EEE	Cord set, 230V, CE Plug
579DD	Pin, retainer, 1.6 in.	1158E	Keyboard
581DD	Ring, retainer	394HCJE	O-Ring
585DD	Pin, extraction tool	697HC2	Gas filter
844DD	Filter, coarse fan	HJ0025TB035	Tubing, cooling
A540DD	Stirrer assembly	HX0012TB024	Tubing, oxygen
A570DD	Oxygen regulator assembly	HX0038TB062	Tubing, cover
A575DD	Logic pack	HX0062TB062	Tubing, pump
A591DDEB	Heater, 500 watt, 115V	181VB	Insert tubing, 5/8 OD
A591DDEE	Heater, 500 watt, 230V	183VB	Insert tubing, 3/8 OD
A592DD	Thermoswitch assembly	196VB	Valve, brass, 1/4 tube
A593DDEA	Pump & motor assembly, 115/60	213VB	Compression nut, 1/8OD
A593DDEF	Pump & motor assembly, 230/50	214VB	Ferrule set, 1/8 OD
A594DDEA	Stirrer motor, 115/60	217VB	Compression nut, 1/4 OD
A594DDEF	Stirrer motor, 230/50	218VB	Ferrule set, 1/4 OD
A595DDEB	Water solenoid assembly, 115V	221VB	Compression nut, 3/8 OD
A595DDEE	Water solenoid assembly, 230V	222VB	Ferrule set, 5/8 OD
A596DDEB	Oxygen solenoid assembly, 115V	226VB	Ferrule set, 5/8 OD
A596DDEE	Oxygen solenoid assembly, 230V		
A598DD	Pressure switch assembly		
A599DD	Replacement tubing set		



Figure L-1
1261 Calorimeter
(Rear View)



Appendix L - Parts List

Figure L-2
1261 Calorimeter Controller

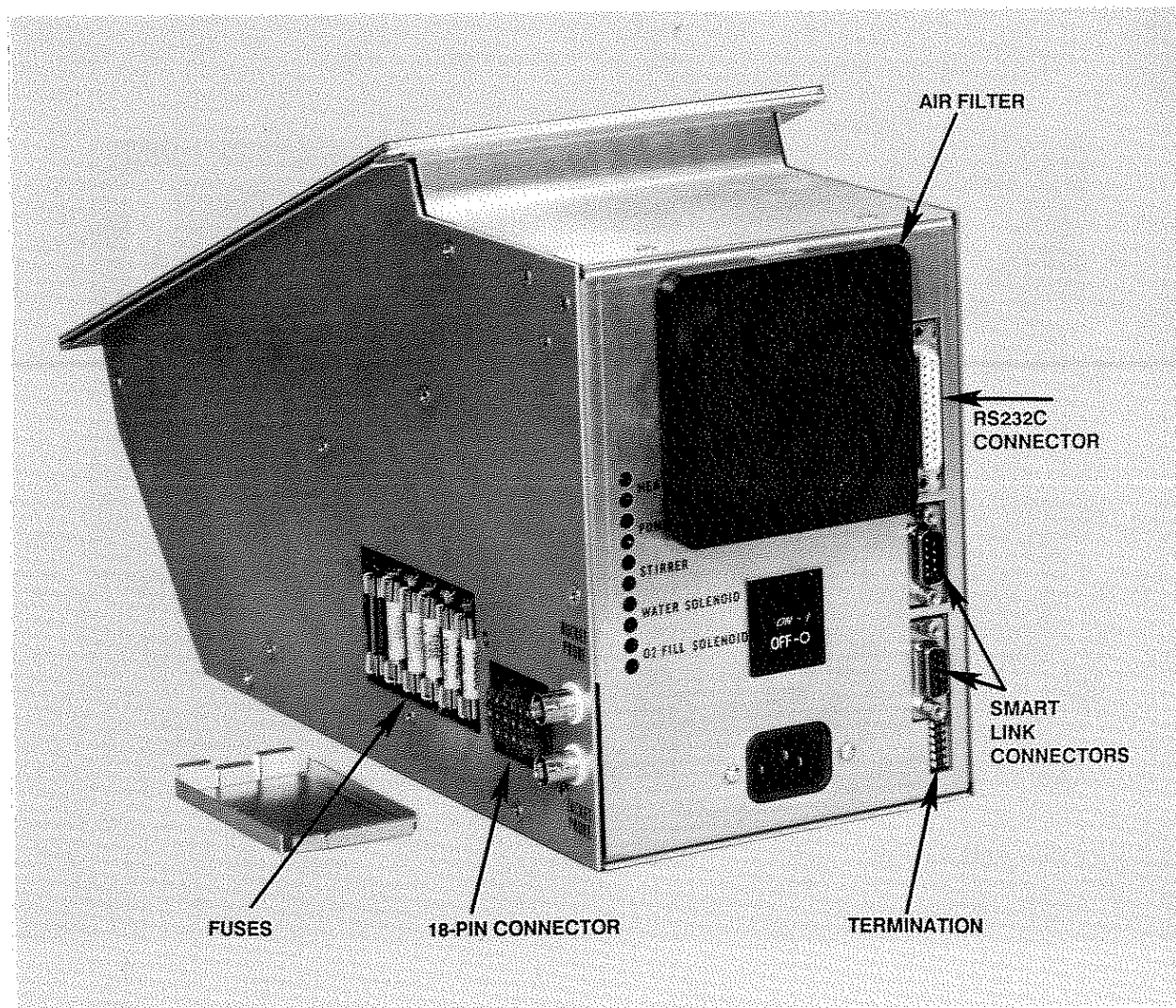
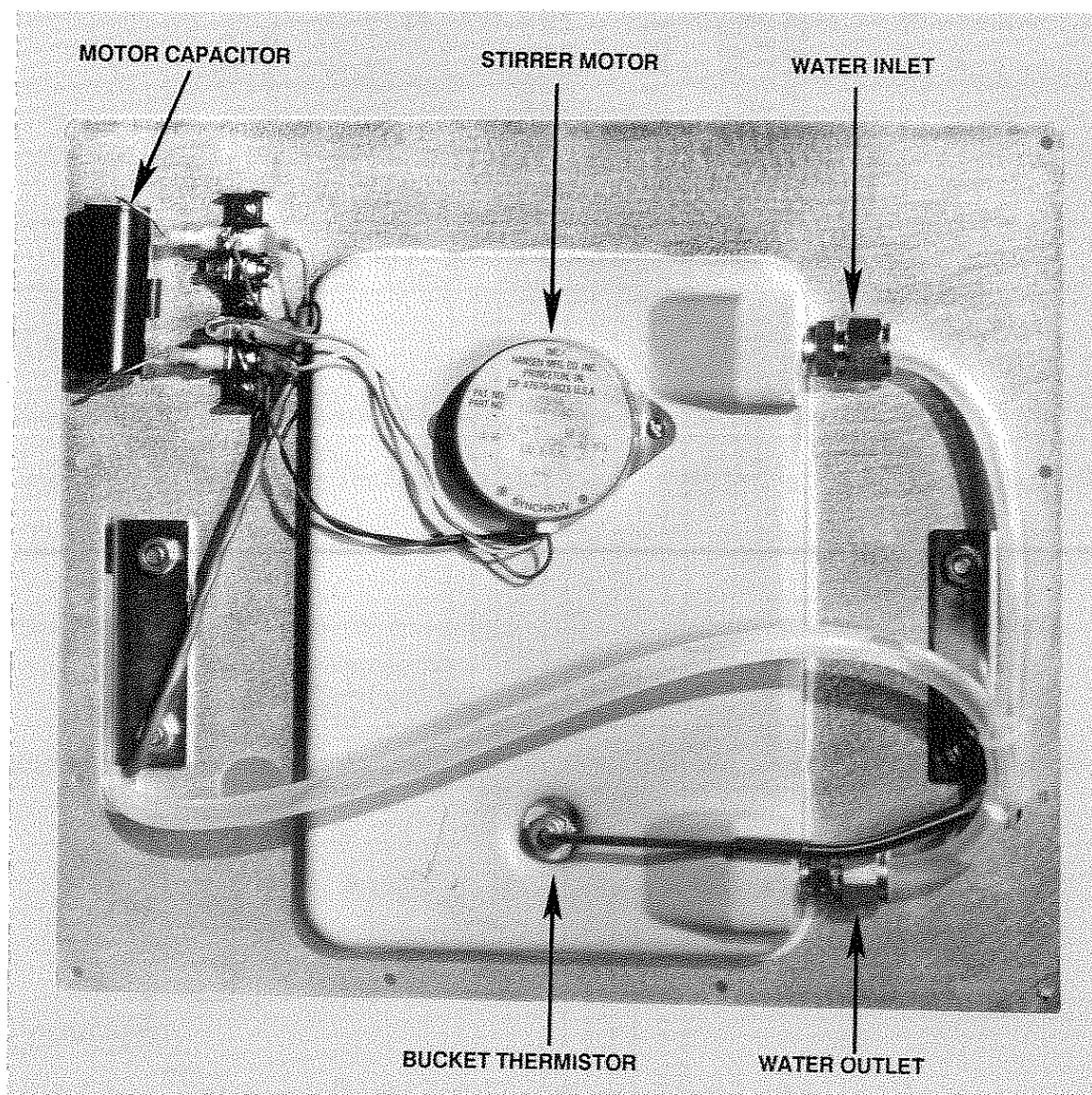




Figure L-3
1261 Calorimeter Cover
(Fiberglass Cover Removed)



Appendix L - Parts List

Figure L-4
1261 Calorimeter Wiring Diagram

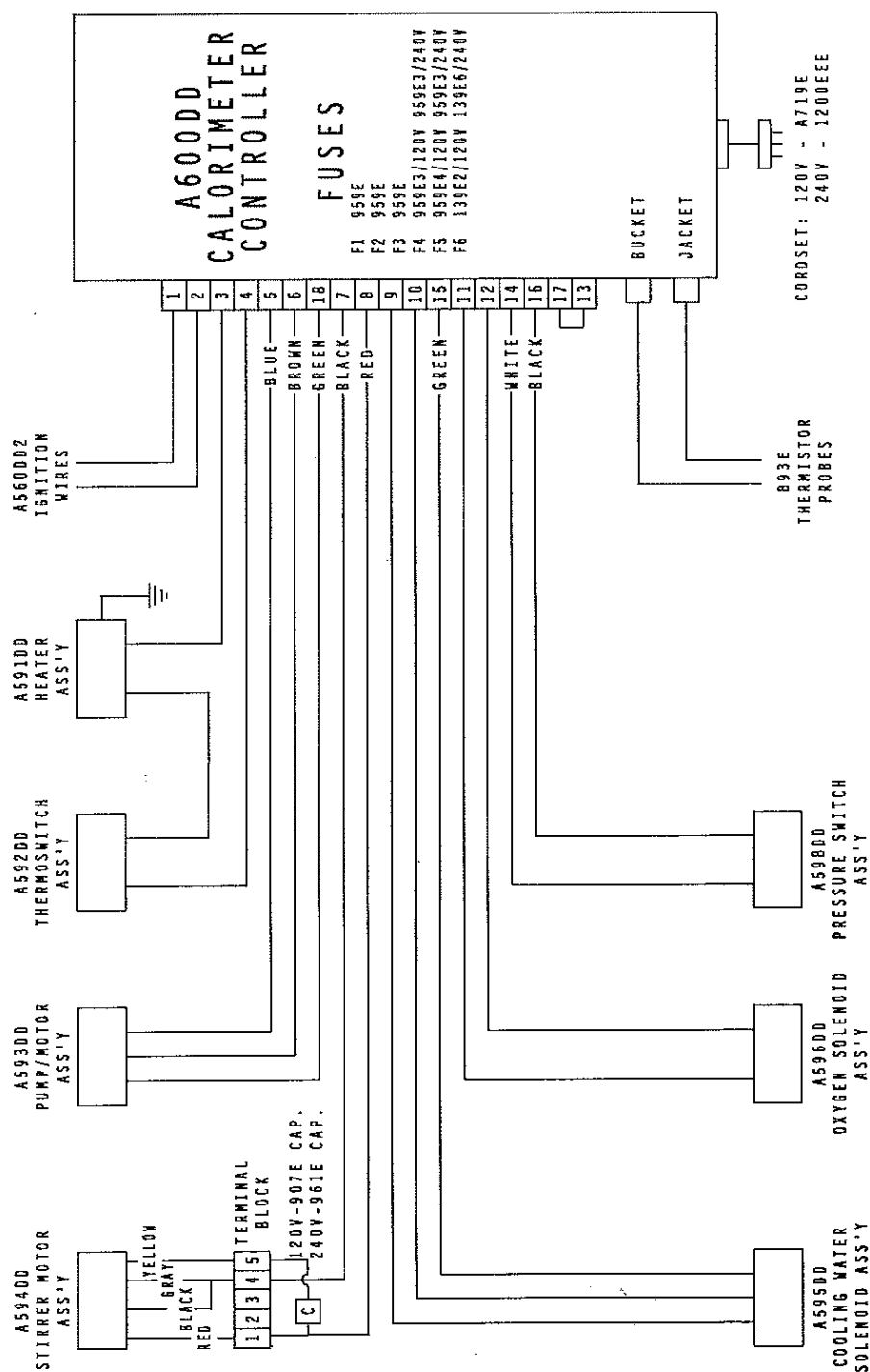
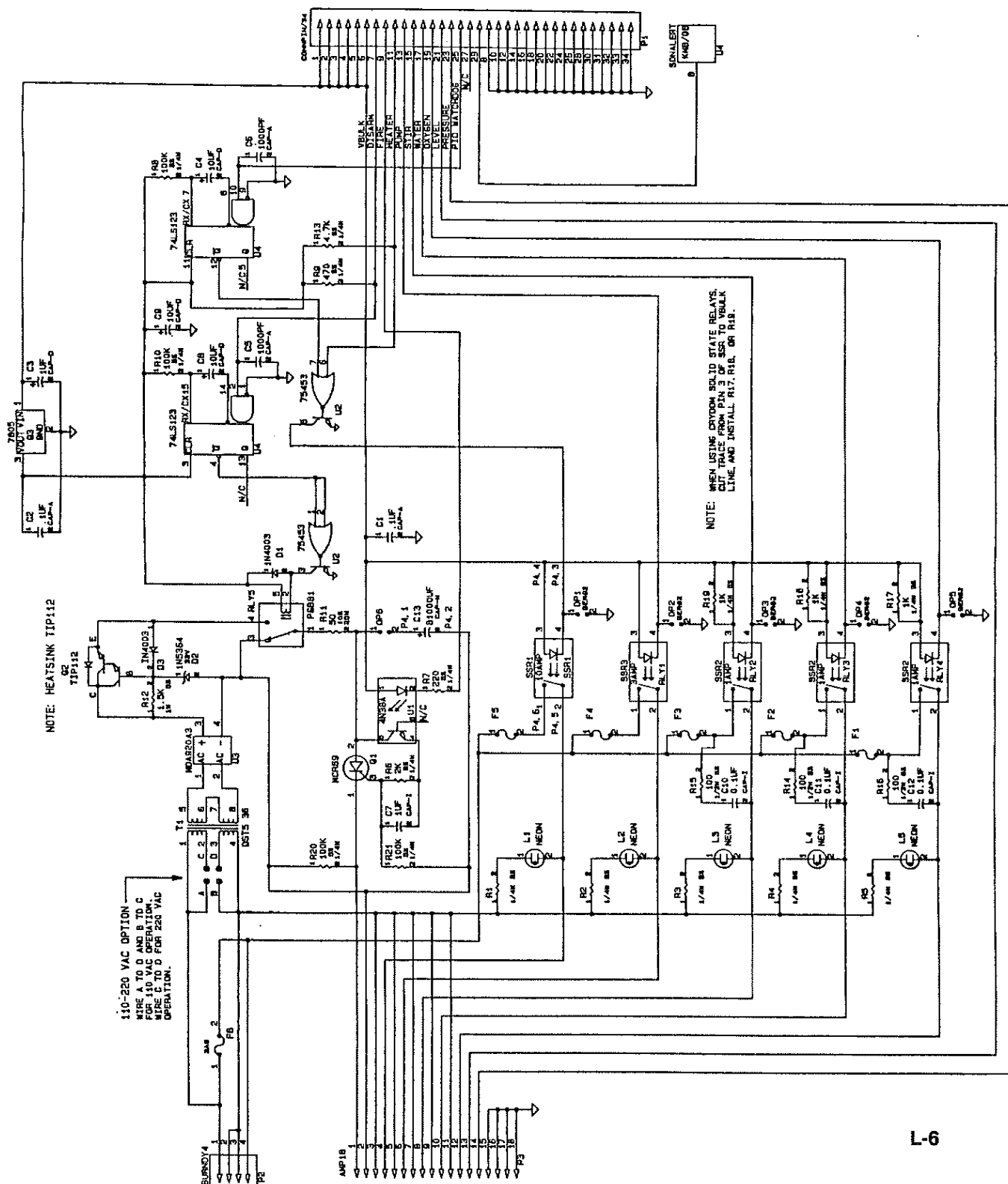




Figure L-5
A590DD Circuit Board
(In A600DD Sub-assembly (Lower Half))





PARR INSTRUMENT COMPANY

**211 Fifty-Third Street
Moline, Illinois 61265 USA
309/762-7716 800/872-7720
Fax 309/762-9453
Telex 270226**