Instromet

ENCAL 2000
CONTROL UNIT

INSTRUMENT INSTRUCTION MANUAL

Encal 2000 CU V3.35
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In the design and construction of this equipment and instructions contained in this manual, due consideration has been given to safety requirements in respect of statutory industrial regulations.

Users are reminded that these regulations similarly apply to installation, operation and maintenance, safety being mainly dependent upon the skill of the operator and strict supervisory control.

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SECTION 1

1.0 INTRODUCTION

The ENCAL 2000 Control Unit (CU) is designed to provide the interface to the Model 2000 Process Gas Chromatograph (PGC).

The Control Unit provides the signal isolation necessary between the hazardous area and the safe area without the need for any additional safety barrier by using a fibre optical data communications link to the Process Gas Chromatograph.

The Control Unit enables the Process Gas Chromatograph to be interfaced to any personal computer with a windows environment for setting up the operation of the Process Gas Chromatograph.

The Control Unit gives local indication of the Gas data and status of the Process Gas Chromatograph, it also provided additional serial communication facilities and analogue 0/4-20 mA output signals.

All data is tested to ensure that they are within the designed operating limits, an alarm display records the time when alarms occur and clear.

A serial data printer output or a internal printer unit can be provided enabling reports to be printed at regular intervals.

Multiple serial outputs can be provided for interfacing to Gas Measurement Corrector systems using Modbus (ASCII) protocols.

SECTION 2

2.0 GENERAL DESCRIPTION

The Encal 2000 Control Unit (CU) comprises a standard size 19 inch rack which contains plug-in printed circuit boards connected to a mother board.

The Control Unit front panel contains a liquid crystal display, keyboard, display buttons and indicator LED's. The liquid crystal display (LCD) is a 4 line by 40 character type which is used to display the data entered and operating information. The keyboard is used to select the data to be entered into the Control Unit memory and select all of the displayed information, this can be accomplished by either using the Ý and ß keys to scroll through the display or by entering the individual location number of the required information to be displayed.

Input and output signals are connected to the Control Unit by D type connectors located at the rear of the unit and a optical connector (serial output) to interface with the Process Gas Chromatograph. The Control Unit is operated from a 24VDC supply.

The front and rear panel arrangement are shown in figures 1 and 2.

2.1 CONTROL UNIT FACILITIES

2.1.1 MODE SWITCHES

The manner of operation of the Control Unit is initiated by the setting of mode switches located on the back of the display circuit board.

The designation and function of the mode switches is as follows:-

Switch No.	ON	OFF
1	Default to first display page after 30 seconds.	Remain on last displayed page
2	Comms board No 1 fitted.	Comms board No 1 not fitted.
3	Comms board No 2 fitted.	Comms board No 2 not fitted.
4-6	Not used	
7(1)	Auto adj. of Retention times On	Auto adj. of Retention times Off
8(2)	Remote Access Security On	Remote Access Security Off
9(3)	Process Gas Chromatograph clock updated from CU clock On	Process Gas Chromatograph clock updated from CU clock Off
10(3)	CU clock updated from Process Gas Chromatograph clock On	CU clock updated from Process Gas Chromatograph Clock Off
11-12	Do not use (changing SW12 will clear all programmed data)	

Note (1) See par. 2.9

Note (2) See par. 2.8

Note (3) See par. 2.4

2.2 FRONT PANEL

All of the controls necessary to operate the Control Unit are located on the front panel and provide the following functions:-

2.2.1 KEY SWITCH AND SECURITY SWITCHES

The key switch can be set to one of four positions which are identified as **DATA**, **EDIT**, **CAL** and **RUN**.

The **DATA** position is used to enter all of the operating data into the Control Unit memory. In the **DATA** mode the Control Unit serves only to request the data required to operate in the manner selected by the mode switch settings. The LCD display requests essential data by showing **??????** after the data symbol or optional data by showing **-----**after the symbol, if data has previously been entered then the value of that data will be displayed. The data to be entered is prompted by a flashing cursor. After data has been entered the **DATA** position of the key switch can be inhibited by a security switch.

With the key switch in the **CAL** position the analogue output signals of the Control Unit can be calibrated. Normal analysis functions continues in this mode. The **CAL** mode can be inhibited by a security switch.

Setting the key switch to the **EDIT** position allows only data which is identified by an ***** adjacent to the parameter symbol on the LCD display to be changed, the new value of data will be used when the key switch is turned to the **RUN** position. The edit facility can be inhibited by a security switch.

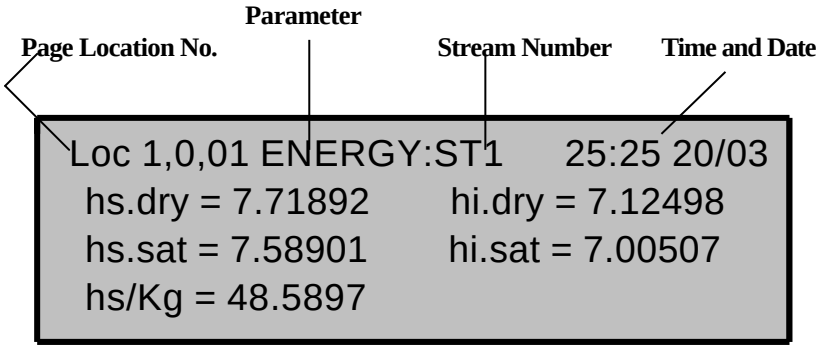
In the **RUN** mode the Control Unit operating data cannot be changed, the display can be used to show all of the analysis data as well as the data stored in memory by using the selector switches and keyboard.

When a key switch position is selected that is protected by a security switch in the on position then the Control Unit will ignore the key switch setting and continue in the run mode.

2.2.2 DATA DISPLAY FORMAT

The Control Unit uses a LCD display with a 4 lines of 40 characters presentation by which data and flow information is displayed. Each item of information having a unique location number which is shown on the display on the top line. The required information can be directly displayed by entering the location number on the keyboard or alternatively using the display scroll keys (Ý,ß) providing the key switch is in an allowable position.

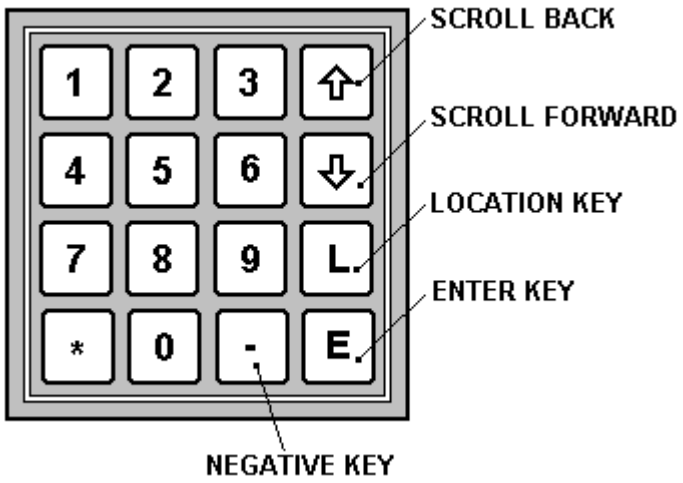
The location number of all items is given in appendix 1.



2.2.3 KEYBOARD FUNCTIONS

The keyboard serves the purpose of selecting the information to be displayed and entering the numerical values of data.

2.2.3.1 KEYBOARD LAYOUT



2.2.4 KEY FUNCTIONS

2.2.4.1 SCROLL FORWARD AND SCROLL BACK KEYS

These keys move the display cursor to the line of data before or after the present line, if the cursor is at the start or end of a page then the previous or next page of information will be displayed. The scroll keys (Ý,ß) can be used to advance the cursor from the start to the end. In the **DATA** mode the scroll keys allow the cursor to be advanced through all of the data. One press of the key advances or returns the cursor by one item when in the **RUN** mode.

In the data entry mode the ***** key can be used as a scroll key to step forwards to locations requiring essential data jumping over other data and similarly the **-** key can be used as a scroll key to step forwards to locations requiring optional data jumping over other data.

2.2.4.2 ENTER AND LOCATION KEYS

The enter key **E** allows the value of data to be entered into the Control Unit memory. A location key **L** permits a location number to be entered which will recall that location to the display.

Where a value is to be entered in memory the procedure is to press the enter key, press the digit keys to the value required followed by a second press of the enter key.

To display a particular page of data the location key is pressed, then the location number is entered using the digit keys followed by pressing the enter key. The location number of all information is given in appendix 1.

Note: The Control Unit will respond only to valid location numbers, if an invalid number is used it is ignored e.g. requesting an edit location with the key switch in the run position.

2.2.4.3 NEGATIVE KEY

The negative key (-) is used to enter a negative value and to delete functions which are not required, e.g. Alarms, default values are deleted by the negative key.

2.2.5 FUNCTION SELECTOR SWITCHES

Below the LCD display are eight push-button switches which are only operational with the Control Unit in the **RUN** mode. Two of the switches are used for printer functions and two provide quick access to displayed information, the switches have the following functions:-

2.2.5.1 PROGRAMMED DATA

The **DATA** button enables the values of operating data stored in memory to be recalled and examined while the Control Unit is in the **RUN** mode. Data cannot be changed.

2.2.5.2 INFORMATION

Pressing the Information button immediately displays the first information page, using the scroll keys allows the other information pages to be viewed.

The first line of the first information page is printed as the user header information when the gas chromatagraph Calibration report is printed.

The data can be entered on the information pages in two ways.

1) By using the serial link connected to a computer. This uses software which is available on a disk. The data is typed on the computer keyboard and then sent to the Control Unit via the serial link, the Control Unit key switch must be set to the **DATA** position when using this method.

2) By using the Control Unit keyboard. The Control Unit key switch must be set to the **DATA** position when using this method. To enter data press the **INFORMATION** button to display the first page, uses the scroll keys to display the page to be modified. Press the enter key **E**, **EDITING** is shown in the top right-hand corner of the display and the cursor will now be at the location where the first character can be entered or changed. Use the decimal point and the negative keys to position the cursor to the position where a character is required or to be changed then use the scroll keys to step through the characters until the required one is shown. Move the cursor to the next position and scroll to the required character, repeat this procedure until all the information has been entered on the page then press the enter **E** key to store the information in memory.

2.2.5.3 PRINTER DATA

Pressing the Printer Data button allows the selection of either all of the displayed data or the pre-set data (programmed data) to be printed instantaneously. Use the scroll keys to select the requirement then press enter (**E**). The selected data will be bracketed by **[ ]** when it

is being printed and **( )** when printing is pending. Press the button to return to the previous displayed function.

2.2.5.4 PRINTER RESET

This is used to reset the printer after a printer fault such as a paper jam. Clear the cause of the fault before pressing.

2.2.5.5 DISPLAY 1

Pressing this button will display the following information:-

Process Gas Chromatograph Status giving:-

- The time in seconds into the current analysis
- The number of the stream being analysed
- The number of the next stream to be analysed
- The function being carried out in the TSC table
- The state and data being communicated between the Process Gas Chromatograph and Control Unit.
- Mode of operation

Note: The definitions of the symbols used for the TSC table are given in the ENCAL 2000 PGC Users Guide

Process Gas Chromatograph Analysis data:-

Using the keyboard scroll keys the following information is displayed:

- The heating values of the last gas analysis for Stream 1 and Stream 2
- The Wobbe index of the last gas analysis for Stream 1 and Stream 2
- The relative density of the last gas analysis for Stream 1 and Stream 2
- The normal density of the last gas analysis for Stream 1 and Stream 2
- The individual gas component concentrations for the last Stream analysis
- The non-measured component concentrations.
- The average heating values for the current hour for Stream 1 and Stream 2
- The average heating values for the previous hour for Stream 1 and Stream 2
- The average mol % CO2 for the current hour for Stream 1 and Stream 2
- The average mol % CO2 for the previous hour for Stream 1 and Stream 2
- The average normal density for the current hour for Stream 1 and Stream 2
- The average normal density for the previous hour for Stream 1 and Stream 2
- The average heating values for the current day for Stream 1 and Stream 2
- The average heating values for the previous day for Stream 1 and Stream 2
- The average mol % CO2 for the current day for Stream 1 and Stream 2
- The average mol % CO2 for the previous day for Stream 1 and Stream 2
- The average normal density for the current day for Stream 1 and Stream 2
- The average normal density for the previous day for Stream 1 and Stream 2
- The average heating values for the current month for Stream 1 and Stream 2
- The average heating values for the previous month for Stream 1 and Stream 2
- The average mol % CO2 for the current month for Stream 1 and Stream 2
- The average mol % CO2 for the previous month for Stream 1 and Stream 2
- The average normal density for the current month for Stream 1 and Stream 2
- The average normal density for the previous month for Stream 1 and Stream 2

2.2.5.6 DISPLAY 2

Pressing this button will display the following information:-
Process Gas Chromatograph Status (as for Display 1)giving:-

- The time in seconds into the current analysis
- The number of the stream being analysed
- The number of the next stream to be analysed
- The function being carried out in the TSC table
- The state and data being communicated between the Process Gas Chromatograph and Control Unit.
- Mode of operation

Note: The definitions of the symbols used for the TSC table are given in the ENCAL 2000 PGC Users Guide

Using the keyboard scroll keys the following detailed information for the last analysis is displayed:-

- The time and date of the start of the last analysis
- The time and date of the end of the last analysis
- The time and date of the last calibration
- The un-normalised sum
- The compressibility Zn
- For the gas components of C6+, Nitrogen, Methane, Carbon Dioxide, Ethane, Propane, i-Butane, n-Butane, neo-Pentane, i-Pentane and n-Pentane the following data is displayed:-
  1. Retention time in seconds
  2. Peak area
  3. Response factor
  4. Normalised concentration
  5. Energy contribution
  6. Relative density contribution

2.2.5.7 ALARM

Pressing the **ALARM** button operates the alarm and fault display facility. This facility records on the alarm pages of the LCD display up to 24 alarm and fault conditions with the time and date that they occur and clear. The type of alarm or fault is identified by a code on the display, a list of codes is given in appendix 2 .

2.2.5.8 ALARM RESET

The **ALARM RESET** button enables the alarm display pages to be cleared, when cleared all locations show ---------. As alarms or faults occur they are pushed into the first location thus ensuring that the latest entry is in the first alarm page on the top line.

The Alarm Reset also extinguishes the Accountable Alarm LED

2.4 CLOCK

A clock is built into the Control Unit which gives the time and date shown on the display and is used with the error, print and serial facilities to give accurate timing of events. The clock is set in the data mode using the keyboard.

Indication of the time is given at the top right-hand edge of the display in normal operation and access to the time and date is given by location **0.0.02** using the data push-button in the run mode.

The clock is powered by an internal lithium battery when the Control Unit power is removed, the battery will power the clock for 10 years with the Control Unit unpowered.

The clock setting in the ENCAL Control Unit can be achieved in a number of different ways depending upon the mode switches 9 and 10.

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clkCU>AN *(MS 9)*	**clkAN>CU** *(MS 10)*	**Master Clock**	**Application**
OFF	OFF	**None**	*No requirements for clock synchronisation. Both clocks (Control Unit and Process Gas Chromatograph) are not synchronised and are free running.*
ON(1)	OFF	**Control Unit**	*Control unit will synchronise Process Gas Chromatograph clock. This is used if the clock signal is written to the Control Unit via the MODBUS communication ports (e.g.: DSf-GC unit with DCF77 clock)*
OFF	ON(2)	**Process Gas Chromatograph**	*Process Gas Chromatograph will synchronise Control Unit clock. This is used if the clock signal is written to the Process Gas Chromatograph via RGC software using a PC (e.g.: PC with DCF-77 clock) (e.g.: In RGConfig.ini TG TIME-UPDATE = ON)*
ON	ON	**Not allowed**	*It is not recommended to use both mode switches 9 and 10 in the ON position because duplicate master clocks can conflict in the ENCAL 2000 System.*

General remark:
The Statusflags On or Off on the CU display (programmed data) for the Mode-Switches 9 & 10 indicate the switch positions On or Off.

Note 1:
If Mode-Switch 9 (clkCU>AN) is in the ON position: The Process Gas Chromatograph clock will be synchronised to the CU clock every 1 minute interval (LOAD_TIME packet).

Note 2:
If Mode-Switch 10 (clkAN>CU) in in the ON position: The CU clock will be synchronised to the Process Gas Chromatograph clock every time the CU reads a valid STATUS packet from the Process Gas Chromatograph.

2.5 ANALOGUE OUTPUT SIGNALS

The Control Unit can be fitted with up to two optional output boards each board provides 3 analogue outputs of either 0-20 mA. or 4-20 mA.

The analogue output signals can be selected in the data entry mode to be proportional to items from the following list:-

Dedicated Stream parameters available:

Hs 1	Superior heating value Stream 1
Hs 2	Superior heating value Stream 2
Hi 1	Inferior heating value Stream 1
Hi 2	Inferior heating value Stream 2
Wob.s 1	Wobbe index (superior) Stream 1
Wob.s 2	Wobbe index (superior) Stream 2
rn 1	Normal density Stream 1
rn 2	Normal density Stream 2
CO2 1	Carbon Dioxide Stream 1
CO2 2	Carbon Dioxide Stream 2
N2 1	Nitrogen from Stream 1
N2 2	Nitrogen from Stream 2
d 1	Relative density Stream 1
d 2	Relative density Stream 2

Stream parameters available from the last stream analysed:

Hs	Superior heating value from last stream analysed
Hi	Inferior heating value from last stream analysed
Wob.s.	Wobbe index (superior) from last stream analysed
d	Relative density from last stream analysed.
rn	Normal density from last stream analysed
C6+	Hexanes from last stream analysed.
CO2	Carbon Dioxide from last stream analysed
N2	Nitrogen from last stream analysed.
Methane	Methane from last stream analysed.
Ethane	Ethane from last stream analysed.
Propane	Propane from last stream analysed.
i-Butan	i-Butane from last stream analysed.
n-Butan	n-Butane from last stream analysed.
neo-Pen	Neo-Pentane from last stream analysed.
i-Penta	i-Pentane from last stream analysed.
n-Penta	n-Pentane from last stream analysed.

All are current output signals of either 0 to 20mA. or 4mA. to 20mA.(this is selected by data entry location **0.0.04**. **Analogue O/P control** (0mA,4mA) and have an overrange capability of 24mA. The maximum load impedance that can be connected to an output to give 24mA. is 600Ω.

Associated with each output are two data entry locations, these are found on pages **0.0.05** to **0.0.08**.

O/Px	selects the function of the output from the above list
O/Px mn	scales the min. output i.e. 0mA or 4mA.
O/Px mx	scales the max. output i.e. 20mA.
	Where **x** is the output numbered. 1 to 6

The above scaling factors are entered in the same units as the output parameter for example, if the output has been selected to be superior heating value then **O/Px mn** and **O/Px mx** are entered in the units of as programmed

The values entered for **O/Px mn** and **O/Px mx** must be within the operating range of the parameter selected.

2.6 GENERAL ALARM OUTPUT

The general alarm is the combination of the Fault, Accountable alarm and non-accountable alarm. Page **0.0.09** allows the selection of these alarms which can be set to ON or OFF.

The transistor output is operated when any of the selected alarm condition exists.

2.6.1 NON-ACCOUNTABLE ALARMS

If an internal printer is installed a non-accountable alarm is given when a printer defect or paper jam is detected. Indication is given by the illumination of the non-accountable alarm LED on the front panel and by showing the alarm identification and time on the alarm pages of the LCD display.

The transistor output is operated when an alarm condition exists.

2.6.2 ACCOUNTABLE ALARM INFORMATION

The Control Unit gives alarm indication when any of the following conditions occur:-

1) C6+ component concentration alarm
2) Nitrogen component concentration alarm
3) Methane component concentration alarm
4) Carbon dioxide component concentration alarm
5) Ethane component concentration alarm
6) Propane component concentration alarm
7) i-Butane component concentration alarm
8) n-Butane component concentration alarm
9) neo-Pentane component concentration alarm
10) i-Pentane component concentration alarm
11) n-Pentane component concentration alarm
12) neo-Pentane component concentration alarm
13) Unknown component alarm
14) Area alarm
15) Energy out of range alarm
16) Relative density out of range alarm
17) Calibrate has not occurred within a programmed time period.

18) Response factor difference alarm limits are exceeded (on calibration).
19) A communication alarm time-out between CU and PGC has occurred.

The alarm LED will remain (latched) on even if the alarm condition has cleared until the Alarm Reset button is pressed. The transistor output is operated only when an alarm condition exists.

2.6.3 FAULT

The Control Unit provides continuous self checking during operation. During data entry the data is checked to ensure sufficient data has been entered in order that correct operation can be achieved. In normal operation the self checking routine tests the memory for data corruption, programme memory, random access memory, communications output, the key switch and the real time clock for correct operation. A watchdog circuit is also provided to detect failure of critical components such as the processor. When a fault occurs the fault LED is illuminated and the fault identification is shown on the alarm pages of the LCD display. The fault output is activated.

The fault alarm transistor output is operated if all of the following conditions occur:-

1) The Control Unit detects insufficient data for normal operation to proceed.
2) The Control Unit detects corruption of stored data.
3) The Control Unit detects a PROM failure.
4) The Control Unit detects a RAM failure.
5) The Control Unit detects a keyswitch failure.
6) The Control Unit detects a real time clock failure.
7) The Control Unit detects a communications failure

2.6.4 RATING OF SWITCHED ALARM/FAULT OUTPUTS.

Transistor outputs (open collector)

Maximum continuous voltage	30Vdc.
Maximum continuous current	50mA.

2.7 GC CALIBRATION MODE

When the Process Gas Chromatagraph is in the calibration mode, this is indicated by the yellow LED on the Control Unit front panel.

The next listed Calibration Alarms can be activated by the Control Unit:

1. If a calibration is not performed within the programmed calibration time interval (Cal. Time interval in hours Loc. 0,0,16,0) an accountable Calibration Alarm (Cal Alm) will be activated. If zero (0) is programmed for Cal. Time interval this alarm function is disabled.
2. If during a calibration cycle one or more Response Factor limits are exceeded (as programmed by RGC , Edit Alarm menu) a Response Factor Difference Alarm (RF Diff) will be activated. The RF difference alarm can be disabled by the RGC software if in the Edit Alarm menu the RF difference checkbox is not ticked. Remark: RF difference alarms are stream related.

Both the Cal.Alm and RF Diff alarms can activate a ModBus Calibration Alarm bit 6 at ModBus register 3046 depending on the programming of loc. **0.0.16.1** (if set to ON any calibration alarm will be signalized, if set to OFF this function is disabled).

2.8 DATA SECURITY IN THE PROCESS GAS CHROMATAGRAPH

The Process Gas Chromatagraph operating data (that can be entered by using the RGC software supplied with the Process Gas Chromatagraph), can be made secure i.e. write protected. The security mode switch 8 sets the security (Write protect) mode either ON or OFF. The position of the switch is indicated in display Page **0.0.00**. When the security mode is set to ON the only data that can be written into the gas chromatagraph is the Time and Date and the SST table parameters. If an attempt is made to write to any other data areas a warning message will be issued by the RGC software. When the Keyswitch is set to the EDIT position the security (write-protect) is overruled.

2.9 AUTOMATIC ADJUSTMENT OF RETENTION TIMES

Mode switch Number 7 allows the Adjustment of the retention times in the gas chromatagraph (for components detected in auto-peak mode only) to be either Automatic (ON) or Manual (OFF) . The setting of the mode switch is indicated on display location **0.0.01**. The Gas Chromatagraph operating instructions will give more details of this facility.

2.10 PRINTER FACILITY

The Control Unit can be selected to operate without a printer, or with an internal printer or an external printer. Location **5.0.00** is used to set the requirement.

If an external printer is selected then location **5.0.01** is used to set-up the serial data format which can be:-

7 or 8 data bits, parity none, parity odd or even and baud rates of 1200, 2400, 4800 or 9600 with or without CTS handshaking.

If the internal printer is selected the data format is automatically set.

The Control Unit can be selected to print the following reports:-

On demand:-

1) All displayed data.

2) A list of all the programmed data.

On timed intervals:-

The interval time can be set to 5, 15 or 30 minutes, 1, 2, 3, 4, 8, 12 or 24 hours.

1) All displayed data.

2) A list of all the programmed data.

Automatically printed reports of the following can also be selected:-

1) When an alarm condition occurs, print the alarm data and optionally all displayed data

2) All programmed data at power on and after a power supply interrupt with the power on and off times.

3) All programmed data after the operation of the key switch with the time of the key switch operation.

Automatically printed reports:-

1) At the end of each Analysis a summary report containing Stream analysed, Start time of Analysis, Value of Hs, Value of rn and Value of CO2.

2) At each hour on the hour a report detailing the average values of valid analysis results during the previous hour for all gas components, Hs, wobbe.s and rn.

3) At the contract hour at the start of each day a report detailing the average values of all hourly reports during the previous day for all gas components, Hs, wobbe.s and rn.

4) At the contract hour on the first day of each month a report detailing the average values of all daily reports during the previous month for all gas components, Hs, wobbe.s and rn.

5) At each calibration a calibration report containing Date and Time of Calibration, Calibration stream number, Certificate (reference), Last measured and % difference values for Hs, rn and CO2. A single line of 40 characters of user information can be added to the Calibration report header. This line of text is the first line of Information page No 1 and can be editted on user demand.

The printer operation is set in either the **EDIT** or **DATA** entry mode at locations **5.0.00** to **5.0.03**. Data is changed by moving the cursor to the required position using the scroll keys (Ý,ß) then pressing the enter (**E**) key followed by a scroll key until the required function is obtained followed by the enter (**E**) key to confirm the requirement.

2.11 SERIAL OUTPUTS 1 AND 2

The Control Unit is provided with two RS232 communication link without handshaking using Modbus ASCII as the data communication protocol. Both these outputs have the same data format. For full details of the data format and addresses see Appendix 4.

2.12 SERIAL OUTPUT 3

The Control Unit is provided with a RS232 communication link without handshaking using a data communication protocol in accordance with Gasunie Technical Standard OSC-01-E. For full details of the data format and addresses see Appendix 5.

2.13 SERIAL OUTPUT TO RGC COMPUTER

The Control Unit is provided with a RS232 communication link without handshaking (SKT 9) using the RGC data communication protocol. This allows full operation of the ENCAL 2000 Remote Gas Chromatograph (RGC) through the Control Unit. See RGC users guide for operation.

2.14 CONTROL UNIT POWER SUPPLY

2.14.1 POWER SUPPLY 24V dc OPERATED VERSION

The nominal 24 Vdc supply is connected to a terminal block located on the rear panel. Adjacent to the terminal block is a fuse rated at 5A. The Control Unit will accept supply voltages in the range 21 Vdc. to 28 Vdc. at a peak current of 4A. when a printer is fitted in the Control Unit and an average current of 1A. without a printer.

2.15 REMOTE ANALYSER REVISION

It is possible to activate calibrations and/or testgas runs (stream 3) using The writable modbus registers 65000 and 65001. Writing 1 to modbus register 65000 will activate a CAL 1 cycle and writing 2 will activate a CAL 2 run. The number of CAL runs and CCK runs preceding depends on the programming of the Autocal sequence which is set in the ENCAL 2000 PGC. This can be changed using the RGC 2000 Software.

Writing a 1 to modbus register 65001 will activate stream 3 (which is normally used for a reference gas). This setting will overrule the normal analyser sequence as set in the SST table. The stream 3 can be deactivated by writing a “0” to register 65001.

Reading register 65000 or 65001 will result in either a “0” (if the register is not been written to or a written value to the register has not been –correctly- received) or a “1” if there ís written to the register and the message is received correctly.

3.0 INSTALLATION

3.1 MECHANICAL

The outline chassis dimensions are given in figure 3 and provide for mounting in either a panel or standard rack. Under normal ambient conditions no special ventilation requirements are necessary. Where the Control Unit may be subject to high ambient temperatures- e.g. near heat producing apparatus or in direct strong sunlight. Adequate ventilation should be provided. The operating environment should be clean, dry and free from a corrosive atmosphere.

3.2 SERIAL CONNECTION TO THE PROCESS GAS CHROMATOGRAPH

The Control Unit can be connected to the Process Gas Chromatograph using either:

1. A direct core fibre optic cable (two 1 mm plastic fibres) for connecting the old style ENCAL 2000 Process Gas Chromatograph. Refer to paragraph 3.2.1. for connecting instructions.

   -or-

2. The ENCAL 2000 RS232 Optical board. The RS232 Optical board is connected to the Control Unit using a 9-wire male D-type cable (1 to 1) from SKT 2 directly to PL1 of the RS232 Optical board. Refer to figure xxxx

3.2.1 OPTICAL CABLE CONNECTING INSTRUCTIONS

The optical cable is terminated at the Control Unit end using Hewlett Packard HFBR-4503/4513 connectors and at the Process Gas Chromatograph end using HFBR-4501/4511 connectors. The maximum length of fibre optic cable should no exceed 30 metres of Hewlett Packard HFBR-RUD--- standard grade cable.

1) Cut the cable to the required length and separate the two fibres at each end for approximately 5 cm. (2.in.). Strip off 7mm. (0.3 in.) of the outer jacket.
2) Place the crimp ring and connector over the end of the cable; the fibre should protrude about 3 mm. (0.1 in.) through the end of the connector.
   Carefully position the ring so that it is entirely over the end of the connector with the ring rim flush with the connector end. Crimp the ring in place with a crimp tool. Note fit the blue connector to the fibre end to be connected to the transmitter and the grey connector to the end connected to the receiver.
3) The excess fibre protruding from the connector should be trimmed using a scalpel so that a minimum of 0.15 mm. (0.06 in.) extends from the connector.
4) Use the Hewlett Packard polishing kit HFBR-4593 to polish the fibre ends
   by inserting the connector in the polishing fixture. Using a 600 grit abrasive paper on a smooth flat surface press down on the connector in the fixture and polish the fibre using a figure of eight movement until the fibre is flush with the connector end. Wipe the end of the fibre clean.
5) Repeat the lapping procedure using the 3 micron pink lapping film for about 25 strokes. The fibre end should be flat, clean and smooth.
6) Insert the blue connector into the receiver connector and the grey connector into the transmitter connector of the Process Gas Chromatograph and similarly for the Remote Control Unit .

3.3 ELECTRICAL

3.3.1 POWER SUPPLY 24Vdc OPERATED

A power supply with a dc. voltage of between 21 V and 28 V is connected to the terminal block on the rear panel of the Control Unit ensuring that the polarity is as marked. Ensure that a 5A fuse is fitted in the fuse holder located above the terminal block.

3.4 OUTPUT SIGNAL CONNECTIONS

The output signal connections are via the 9 way 'D' type sockets on the rear panel and the connector pin designation is given in Appendix 3.

A typical connection to a alarm output is shown in fig.5.

4.0 INITIALISATION

4.1 GENERAL

Before the Control Unit can be operated it is necessary to set the internal mode switches to the required positions in order that the required data and calibration can be carried out. After data entry and calibration the security switches can be set. (see figure 9 for the location of the switches.)

4.1.1 ACCESS TO INTERNAL SWITCHES

To gain access to the mode and security switches release the two cross drilled screws located at the top and bottom of the display panel and hinge back the panel to reveal the back of the display circuit board, the switches are located on the back of the display board. When setting the switches, care should be taken to minimise the handling of any circuit board within the Control Unit to avoid the possibility of any electrostatic damage to the integrated circuits.

4.2 SETTING THE MODE SWITCHES

Each mode switch is set by pushing the coloured slider to the position required. The functions are given below:-

Switch No.	ON	OFF
1	Default to first display page after 30 seconds.	Remain on last displayed page
2	Comms board No 1 fitted.	Comms board No 1 not fitted.
3	Comms board No 2 fitted.	Comms board No 2 not fitted.
4-6	Not used	
7(1)	Auto adj. of Retention times On	Auto adj. of Retention times Off
8(2)	Remote Access Security On	Remote Access Security Off
9(3)	Process Gas Chromatograph clock updated from CU clock On	Process Gas Chromatograph clock updated from CU clock Off
10(3)	CU clock updated from Process Gas Chromatograph clock On	CU clock updated from Process Gas Chromatograph Clock Off
11-12	Do not use (changing SW12 will clear all programmed data)	

Note (1) See par. 2.9

Note (2) See par. 2.8

Note (3) See par. 2.4

4.3 RGC COMPUTER INPUT

The Control Unit serial port used for connection to the RGC computer uses a data transmission rate of 9600 baud. The computer must be set to 9600 baud to operate with the Control Unit.

4.4 OPERATION

After initialisation of the mode switches the power to the Control Unit is switched on, the operating Data can then be entered into the Control Unit memory as given below.

4.4.1 DATA ENTRY

The first time the Control Unit is operated the operating data has to be entered. The Control Unit will prompt the operator for the data required for operation to the selected mode switch settings. The data falls into two categories, data essential for the Control Unit to calculate flow and data which is optional and may or may not be entered depending on the operator requirements. The mode switch settings are displayed on the Configuration pages at locations **0.0.00** and **0.0.01** the configuration pages are also displayed in the **EDIT** and **RUN** modes

4.4.2 ESSENTIAL DATA

Essential data is requested by the Control Unit by displaying after the parameter to be entered **??????** Example: **pmax = ??????**

4.4.3 OPTIONAL DATA

Optional data is prompted for by the display showing after the parameter to be entered -------. If the choice is to use this parameter then the data is entered, if however this parameter function is not required then the negative sign should be entered which notifies the Control Unit to ignore this parameter.

4.4.4 SETTING THE CLOCK

The clock is set at location **0.0.02** the procedure for entering the time parameters is the same as for other data, enter, value, enter. Only the last two digits of the year are set, one or two digits are entered for the month and day, e.g. March is entered as 3. The 24 hour clock is used for hours. The seconds are set to zero when the enter key (**E**) is pressed for the second time when the value of the minutes are set and the clock then starts running. Please refer to par. 2.4 for detailed clock setting options.

4.5 PROCEDURE FOR ENTERING DATA

Ensure that the Data security switch SW2 position 1 is set to the OFF position, Set the key switch to the **DATA** position, the Control Unit will show the first page of parameters for which data is require with a flashing cursor against the first parameter to be entered.

To enter the value press the enter key marked **E** followed by the value which will be shown on the display as the digits are pressed, if correct, press the **E** key again to enter the value in memory. Where the parameter requires a selection rather than a value to be entered then press the **E** key followed by a scroll key (Ý,ß) until the desired selection is shown then confirm by pressing the **E** key.

Then press the (ß) key to advance the cursor to then next parameter, continue this procedure until pressing the key will not advance the cursor further when all of the data has been entered. Pressing the key allows the cursor to be stepped back to previous parameters which may be reviewed or changed using the same data entering procedure. To enter a negative (-) which deletes an optional parameter press **E** then **-** followed by **E**. To enter a negative value of temperature press **E** then **-** followed by the value, then **E**.

The Control Unit now has the data to operate and should now be calibrated. The calibration procedure is detailed in the CALIBRATION SECTION (section 5) of this manual. After calibration the security switches should be set.

4.6 SETTING THE SECURITY SWITCHES.

Switches are provided to give security of calibration data, editable data and operating data entered via the keyboard. Three switches are provided, (Cal., Edit and Data) with a security switch in the ON position there is no access to change the data for that function, data can only be changed with the security switch in the OFF position.

The security switch identification is:-

Switch SW2

Position	**ON**	**OFF**
1	Data secure	Data alterable
2	Edit secure	Edit alterable
3	Cal. secure	Calibration enabled.

Note: If all three security switches are set to ON then the Control Unit will remain in the **RUN** mode regardless of the key switch setting.

4.7 PRINTER UNIT

4.7.1 LOADING THE ROLL OF PAPER

Open the front panel by releasing the two knurled screws and hinge the panel downwards. remove the old roll of paper by pulling the rewind handle on the left hand side then pulling the paper from the drum. Remove the spindle from the paper holder, put the new roll onto the spindle with the paper flowing from the top of the roll as shown in figure 12. Clip the spindle into the holder and feed the paper into the bottom of the print mechanism. Press the paper feed button on the front of the printer to advance the paper through the mechanism until the paper comes through the slot in the front of the printer. Pull sufficient paper through to enable it to be inserted into the lower slot and onto the rewind drum, secure the paper with the rewind handle. Refit the front panel.

The paper specification is 57 mm. wide with a roll diameter of 50 mm. and a core diameter of 12.5 mm.

4.7.2 REPLACING THE INK CASSETTE

Remove the paper from the printer, see above section.

Remove the two front panel retaining knurled screws completely and separate the outer panel from the printer to reveal the ink cassette.

Remove the used cassette by pressing on the left hand side where marked, which will cause the right-hand side to lift away from the printer mechanism, carefully lift out the cassette.

Push a new cassette into the mechanism the left-hand end first and then push down the right-hand end making sure it clicks into place. if it does not fit easily into place at the right-hand end, turn the small knob on the cassette in the direction marked until it locates.

Refit the paper.

Use ink cassette Epson part No. ERC-09

SECTION 5

5.0 CALIBRATION

5.1 OUTPUT SIGNAL CALIBRATION

5.1.1 TEST EQUIPMENT

The calibration procedure given in this section requires the use of the following test equipment:-

1) Digital voltmeter 0 to 4 V dc. range (measurement error less than 0.01% of range).

2) Standard resistor 100Ω ±0.01Ω

Connect the test equipment to the Control Unit as shown in figure 6, set the calibration security switch to the off position, turn the key switch to the **CAL** position, the CAL LED will flash.

5.1.2 OUTPUT SIGNAL CALIBRATION PROCEDURE

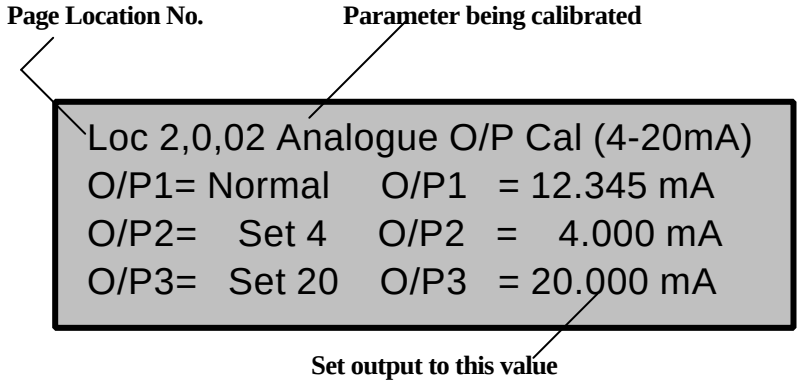
The analogue output signals are calibrated with the key switch set in the calibrate position. The range and zero potentiometers are located on the front edge of the output circuit boards and calibration is carried out in a similar manner for all outputs, see figure 8.

The Control Unit has six analogue outputs, output signals 1 to 3 are from the output board in chassis position 59 and output signals 4 to 6 are from the output board in chassis position 55. The output calibration potentiometers are identified as Z(0mA) and G(20mA). Both output circuit boards are identical except for the link settings as detailed in paragraph 7.3 and figure 8.

The Control Unit generates the calibration signals and no input signal generators are required. The output current is measured by connecting a 100Ω standard resistor across the output being calibrated with a voltmeter across the resistor.

When the key switch is turned to the **CAL** position the LCD display will show the first input to be calibrated, press the scroll key (ß) until the Analogue Output page is displayed, locations **2.0.00** or **2.0.01**

An example of the display is given below:-



5.1.3 CALIBRATION PROCEDURE

a) Set the cursor against the output to be calibrated, press the enter key (E) press a scroll key until **set 4** is shown then press the enter key.

b) Adjust the Z potentiometer to give an output of 4mA±0.01mA.

c) Set the cursor against the output to be calibrated, press the enter key (E) press a scroll key until **set 20** is shown then press the enter key.

d) Adjust the gain potentiometer G until the output is 20mA±0.01mA.

e) Repeat a) to d) above until the output is within the required limits.

f) Set the cursor against the output to be calibrated, press the enter key (E) press a scroll key until **normal** is shown then press the enter key.

The output is now calibrated and operational.

If an output range of 0-20 mA. is selected during data entry at location **0.0.04.0** an identical procedure is used.

SECTION 6

6.0 MAINTENANCE

No routine servicing is required to ensure continuous operation, however should a system failure occur during operation, then the most likely cause of malfunction is that of a requirement not being fully or correctly implemented. If a fault occurs, the cause should be determined in a logical and systematic manner and a guide is given below.

6.1 INITIAL CHECKS

1) Check that the power supply is of the correct type and value.
2) Check the fuse and that the power supply polarity is correct.
3) Ensure that all input and output connections to the plugs and sockets at the rear of the Control Unit are satisfactory and the plugs are engaged firmly and in the correct sockets.
4) Ensure that all of the data entered via the keyboard is correct and that all of the calibration data has been entered and is correct.
5) Switch off the power to the Control Unit and open the front panel and check that all of the circuit boards are fully engaged in their sockets and are positioned in the correct location.
6) Carry out a visual inspection of all wires and cables for obvious loose or broken connections.

6.2 COMPONENT REPLACEMENT

The remedial action for the failures indicated in the following table will entail in the majority of cases replacement of one or more printed circuit boards. The location of the boards is shown in figure 10. The fault finding list below should be used in conjunction with the alarm and fault codes given in appendix 2.

	FAILURE	ACTION
1	Analogue output are inoperative	Replace the output board.
2	Display indicates FAULT 1	Insufficient data, re-enter or check all data is entered
3	Display indicates FAULT 2	Data corruption, change Micro/memory board.
4	Display indicates FAULT 3	Defective RAM, change Micro/memory board.
5	Display indicates FAULT 4	Defective PROM, change Micro/memory board.
6	Display indicates FAULT 8	Replace key switch.

7	Display indicates FAULT 9	Defective real time clock, replace Micro/memory board.
8	Display indicates FAULT 11	Comms2 board No.1 is defective
9	Display indicates FAULT 12	Comms2 board No.1 is defective
10	Display indicates FAULT 13	Comms2 board No.2 is defective
11	Display indicates FAULT 14	Comms2 board No.2 is defective

SECTION 7

7.1 REPLACEMENT PARTS

The following replacement parts are available for maintenance purposes :

Description	Part No.
Micro/memory Board	700-3-118B
Output Board	700-1-009D
DC/DC Converter Board	210-2-009
Display Board	740-2-016
Comms 2 Board	700-3-093

When replacement boards are fitted it may be necessary to change the link positions, the following tables show the link functions on the circuit boards where changes may require to be made. All other boards do not have user changeable links.

7.2 MICRO/MEMORY BOARD LINK SETTINGS CHASSIS POSITION 75

LINK FITTED	**2, 5, 6 and 9**
LINKS NOT FITTED	**1, 4, 6, 7, 8, 10, 11, 12, 13, 14 and 15**

See figure 11 for the location of the links.

Note: If the plastic fibre connection on the backpanel is used link 3 should be fitted instead of link 5.

7.3 OUTPUT BOARD LINK SETTINGS CHASSIS POSITIONS 55 AND 59

LINK FITTED = X LINK NOT FITTED = O	1	2	3	4
OUTPUT BOARD IN CHASSIS POSITION 55	O	X	O	O
OUTPUT BOARD IN CHASSIS POSITION 59	X	O	O	O
LINKS 5, 6, AND 7 HAVE NO CUSTOMER OPTION AND ARE FITTED				
LINK 8 HAS NO CUSTOMER OPTION AND IS NOT FITTED				
LINKS 9, 10 AND 11 HAVE NO CUSTOMER OPTION AND ARE FITTED IN POSITION A				

See figure 8 for the location of the links.

7.4 COMMS 2 BOARD LINK SETTINGS

Note:- The two Comms 2 boards fitted in the Controller are the same except that the link setting are different, therefore the positions should not be changed without the link settings being set as given in the following tables:-

CHASSIS POSITIONS 67 (SERIAL COMMS 2 SKT 4 AND PRINTER SKT11)

LINK IDENTIFICATION . LINK FITTED = X LINK NOT FITTED = O	J	K	A	B	Y	Z
SERIAL OUTPUT 2 MODBUS ASCII RS485	X	O				
SERIAL OUTPUT 2 MODBUS ASCII RS232	O	X				
PRINTER INTERNAL			X	O		
PRINTER EXTERNAL RS232 WITHOUT HANDSHAKING			O	X	X	O
PRINTER EXTERNAL RS232 WITH HANDSHAKING			O	X	O	X
LINKS C, G, L, V, X, HH AND KK HAVE NO CUSTOMER OPTION AND ARE FITTED						
LINKS D, E, F, H, M, N, P, Q, R, S, T, U, W, AA, BB, CC, DD, EE, FF, GG, JJ, LL AND MM HAVE NO CUSTOMER OPTION AND ARE NOT FITTED						

CHASSIS POSITIONS 71 (SERIAL COMMS 1 SKT 3 AND OSC-01-E SKT 10)

LINK IDENTIFICATION . LINK FITTED = X LINK NOT FITTED = O	J	K
SERIAL OUTPUT 1 MODBUS ASCII RS485	X	O
SERIAL OUTPUT 1 MODBUS ASCII RS232	O	X
FIT LINKS B, C, F, L, P, U, X, Y, AA and HH HAVE NO CUSTOMER OPTION AND ARE FITTED		
LINKS A, D, E, G, H, M, N,Q, R, S, T, V, W, Z, BB, CC, DD, EE, FF, JJ, KK, LL and MM. HAVE NO CUSTOMER OPTION AND ARE NOT FITTED		

See figure 7 for the location of the links.

APPENDIX 1

PARAMETER LOCATION IDENTIFICATION CONFIGURATION of ENCAL 2000 CONTROL UNIT

Location	Symbol	Function	
0,0,00,0	timeout	On or Off	Display returns to Status page=On
0,0,00,1	board 1	On or Off	Comms board No. 1 fitted=On
0,0,00,2	board 2	On or Off	Comms board No. 2 fitted=On
0,0,00,3	Anlgue 1	On or Off	Analogue output board No. 1 fitted=On
0,0,00,4	Anlgue 2	On or Off	Analogue output board No. 2 fitted=On
0,0,00,5	Securty	On or Off	Security Access Mode switch 8 On or Off
0,0,01,0	Autoadj	On or Off	Auto adjustment of retention times mode switch 7 On or Off
0,0,01,1	ClkCU>AN	On or Off	Process Gas Chromatograph Clock updated from CU clock mode Switch 9 On or Off
0,0,01,2	ClkAN>CU	On or Off	CU Clock updated from Process Gas Chromatograph clock mode Switch 10 On or Off

DATA ENTRY

Location	Symbol	Parameter Description
0,0,02,0	Year	Set Clock Year
0,0,02,1	Month	Set Clock Month
0,0,02,2	Day	Set Clock Day
0,0,02,3	Hour	Set Clock Hour
0,0,02,4	Minute	Set Clock Minute
0,0,02,5	Day 1-7	Set Day of the week (Sunday = 1)

Miscellaneous

0,0,03,0	SN	Station or Serial Number
0,0,03,1	Dens. air	Density of air at base conditions
0,0,03,2	ctrct hr	Start of Day Hour (used for AVG calculations)

Analogue O/P Control

0,0,04,0	0mA,4mA	Analogue o/p 0-20mA or 4-20mA

Analogue O/P Control

0,0,05,0	O/P 1	Selects function of Analog O/P 1 from list
0,0,05,2	O/P 1mn	Min Value for O/P 1 ie 0,4mA= this value
0,0,05,4	O/P 1mx	Max Value for O/P1 ie 20mA= this value
0,0,05,1	O/P 2	Selects function of Analog O/P2 from list
0,0,05,3	O/P 2mn	Min Value for O/P 2 ie 0,4mA= this value
0,0,05,5	O/P 2mx	Max Value for O/P2 ie 20mA= this value

Analogue O/P Control

0,0,06,0	O/P 3	Selects function of Analog O/P 3 from list
0,0,06,2	O/P 3mn	Min Value for O/P 3 ie 0,4mA= this value
0,0,06,4	O/P 3mx	Max Value for O/P3 ie 20mA= this value

Analogue O/P Control

0,0,07,1	O/P 4	Selects function of Analog O/P 4 from list
0,0,07,3	O/P 4mn	Min Value for O/P 4 ie 0,4mA= this value
0,0,07,5	O/P 4mx	Max Value for O/P4 ie 20mA= this value
0,0,07,0	O/P 5	Selects function of Analogue O/P 5 from list
0,0,07,2	O/P 5mn	Min Value for O/P 5 ie 0,4mA= this value
0,0,07,4	O/P 5mx	Max Value for O/P5 ie 20mA= this value

Analogue O/P Control

0,0,08,1	O/P 6	Selects function of Analogue O/P 6 from list
0,0,08,3	O/P 6mn	Min Value for O/P 6 ie 0,4mA= this value
0,0,08,5	O/P 6mx	Max Value for O/P6 ie 20mA= this value

General Alarm Output

0,0,09,0	Fault	ON or OFF	Fault operates general alarm output
0,0,09,1	ac. Alm	ON or OFF	Accountable alarm operates general alarm output
0,0,09,2	n.ac Alm	ON or OFF	Non-accountable alarm operates general alarm output

Information

0,0,10 120 characters of information

Information

0,0,12 120 characters of information

Information

0,0,14 120 characters of information

Cal. Config

0,0,16,0	Cal time	Calibrate alarm time interval in hours	
0,0,16,1	MB C.alm	ON or OFF	MobBus register 3046 (bit 6) calibration alarm ON = enabled, OFF = disabled

Unit Type (Heating value)

0,0,17,0 Units kWh/m3, MJ/m3, kCal/m3 or kJ/m3

DISPLAYED PARAMETERS

Location	Symbol	Parameter Description
DISPLAY 1		
STATUS		
1,0,00,0	Time	Time in second into the current analysis
1,0,00,1	Stream	The number of the stream currently being analysed
1,0,00,2	Next	The next analysis operation
1,0,00,3	TSC	The function being carried out in the TSC table
1,0,00,4	State	The state of the data being communicated between the Process Gas Chromatograph and the Control Unit
1,0,00,5	Mode	The mode of operation
ENERGY :ST 1		
1,0,01,0	Hs.	Superior heating value Stream 1
1,0,01,1	Hi.	Inferior heating value Stream 1
ENERGY :ST 2		
1,0,02,0	Hs.	Superior heating value Stream 2
1,0,02,1	Hi.	Inferior heating value Stream 2
WOBBE :ST 1		
1,0,03,0	Wobbe.s	Superior wobbe value Stream 1
1,0,03,1	Wobbe.i	Inferior wobbe value Stream 1
WOBBE :ST 2		
1,0,04,0	Wobbe.s	Superior wobbe value Stream 2
1,0,04,1	Wobbe.i	Inferior wobbe value Stream 2
DENSITY :ST 1		
1,0,05,0	d	Relative density value Stream 1
1,0,05,1	rn	Normal density value Stream 1
DENSITY :ST 2		
1,0,06,0	d	Relative density value Stream 2
1,0,06,1	rn	Normal density value Stream 2

Note : On all of the following pages the Current Stream Number will be indicated on the top Line as **:ST X** where X= Stream Number

CONC.:ST X		
1,0,07,0	C6+	Normalized concentration of C6+ components
1,0,07,1	N2	Normalized concentration of nitrogen
1,0,07,2	Methane	Normalized concentration of methane
CONC.:ST X		
1,0,08,0	CO2	Normalized concentration of carbon dioxide
1,0,08,1	Ethane	Normalized concentration of ethane
1,0,08,2	Propane	Normalized concentration of propane

CONC.:ST X

1,0,09,0	i-Butne	Normalized concentration of i-butane
1,0,09,1	n-Butne	Normalized concentration of n-butane
1,0,09,2	neo-Pen	Normalized concentration of neo-pentane

CONC.:ST X

1,0,10,0	i-Pent	Normalized concentration of i-pentane
1,0,10,1	n-Pent	Normalized concentration of n-pentane

NON-MEASURED :ST X

1,0,11,0	H2	Non-measured percentage of hydrogen
1,0,11,1	Helium	Non-measured percentage of helium
1,0,11,2	Oxygen	Non-measured percentage of oxygen

NON-MEASURED :ST X

1,0,12,0	CO	Non-measured percentage of carbon monoxide

AVG.CUR.HR :ST 1

1,0,13,0	CO2	Average value of Mol % CO2 Stream 1 in current hour
1,0,13,1	rn	Average value of rn in Stream 1 current hour
1,0,13,2	Hs	Average value of Hs in Stream 1 current hour

AVG.CUR.HR :ST 2

1,0,14,0	CO2	Average value of Mol % CO2 Stream 2 in current hour
1,0,14,1	rn	Average value of rn Stream 2 in current hour
1,0,14,2	Hs	Average value of Hs Stream 2 in current hour

AVG.LST.HR :ST 1

1,0,15,0	CO2	Average value of Mol % CO2 Stream 1 in previous hour
1,0,15,1	rn	Average value of rn in Stream 1 previous hour
1,0,15,2	Hs	Average value of Hs in Stream 1 previous hour

AVG.LST.HR :ST 2

1,0,16,0	CO2	Average value of Mol % CO2 Stream 2 in previous hour
1,0,16,1	rn	Average value of rn Stream 2 in previous hour
1,0,16,2	Hs	Average value of Hs Stream 2 in previous hour

AVG.CUR.DAY :ST 1

1,0,17,0	CO2	Average value of Mol % CO2 Stream 1 in current day
1,0,17,1	rn	Average value of rn in Stream 1 current day
1,0,17,2	Hs	Average value of Hs in Stream 1 current day

AVG.CUR.DAY :ST 2

1,0,18,0	CO2	Average value of Mol % CO2 Stream 2 in current day
1,0,18,1	rn	Average value of rn Stream 2 in current day
1,0,18,2	Hs	Average value of Hs Stream 2 in current day

AVG.LST.DAY :ST 1

1,0,19,0	CO2	Average value of Mol % CO2 Stream 1 in previous day
1,0,19,1	rn	Average value of rn in Stream 1 previous day
1,0,19,2	Hs	Average value of Hs in Stream 1 previous day

AVG.LST.DAY :ST 2

1,0,20,0	CO2	Average value of Mol % CO2 Stream 2 in previous day
1,0,20,1	rn	Average value of rn Stream 2 in previous day
1,0,20,2	Hs	Average value of Hs Stream 2 in previous day

AVG.CUR.MON :ST 1

1,0,21,0	CO2	Average value of Mol % CO2 Stream 1 in current month
1,0,21,1	rn	Average value of rn in Stream 1 current month
1,0,21,2	Hs	Average value of Hs in Stream 1 current month

AVG.CUR.MON :ST 2

1,0,22,0	CO2	Average value of Mol % CO2 Stream 2 in current month
1,0,22,1	rn	Average value of rn Stream 2 in current month
1,0,22,2	Hs	Average value of Hs Stream 2 in current month

AVG.LST.MON :ST 1

1,0,23,0	CO2	Average value of Mol % CO2 Stream 1 in previous month
1,0,23,1	rn	Average value of rn in Stream 1 previous month
1,0,23,2	Hs	Average value of Hs in Stream 1 previous month

AVG.LST.MON :ST 2

1,0,24,0	CO2	Average value of Mol % CO2 Stream 2 in previous month
1,0,24,1	rn	Average value of rn Stream 2 in previous month
1,0,24,2	Hs	Average value of Hs Stream 2 in previous month

DISPLAY 2

STATUS

1,0,25,0	Time	Time in second into the current analysis
1,0,25,1	Stream	The number of the stream currently being analysed
1,0,25,2	Next	The next analysis operation
1,0,25,3	TSC	The function being carried out in the TSC table
1,0,25,4	State	The state of the data being communicated between the Process Gas Chromatograph and the Control Unit
1,0,25,5	Mode	The mode of operation

STATUS :ST X

1,0,26,0	Str Date	Start of last analysis date
1,0,26,1	Str Time	Start of last analysis time
1,0,26,2	End Date	End of last analysis date
1,0,26,3	End Time	End of last analysis time
1,0,26,4	Cal Date	Last calibration gas analysis date
1,0,26,5	Cal Time	Last calibration gas analysis time

DETAILS :ST X

1,0,27,0	Unnor. Sum	Unnormalised sum
1,0,27,1	Z	Gas compressibility factor

C6+ :ST X

1,0,28,0	Time	Retention time for C6+ components
1,0,28,1	Area	Peak area of C6+
1,0,28,2	RF	Response factor for C6+
1,0,28,3	Conc	Concentration of C6+ components
1,0,28,4	Energy	Superior energy content of C6+
1,0,28,5	Density	Density of C6+

NITROGEN :ST X

1,0,29,0	Time	Retention time for Nitrogen components
1,0,29,1	Area	Peak area of Nitrogen
1,0,29,2	RF	Response factor for Nitrogen
1,0,29,3	Conc	Concentration of Nitrogen components
1,0,29,4	Energy	Superior energy content of Nitrogen
1,0,29,5	Density	Density of Nitrogen

METHANE :ST X

1,0,30,0	Time	Retention time for Methane components
1,0,30,1	Area	Peak area of Methane
1,0,30,2	RF	Response factor for Methane
1,0,30,3	Conc	Concentration of Methane components
1,0,30,4	Energy	Superior energy content of Methane
1,0,30,5	Density	Density of Methane

CO2 :ST X

1,0,31,0	Time	Retention time for Carbon dioxide components
1,0,31,1	Area	Peak area of Carbon dioxide
1,0,31,2	RF	Response factor for Carbon dioxide
1,0,31,3	Conc	Concentration of Carbon dioxide components
1,0,31,4	Energy	Superior energy content of Carbon dioxide
1,0,31,5	Density	Density of Carbon dioxide

ETHANE :ST X

1,0,32,0	Time	Retention time for Ethane components
1,0,32,1	Area	Peak area of Ethane
1,0,32,2	RF	Response factor for Ethane
1,0,32,3	Conc	Concentration of Ethane components
1,0,32,4	Energy	Superior energy content of Ethane
1,0,32,5	Density	Density of Ethane

PROPANE :ST X

1,0,33,0	Time	Retention time for Propane components
1,0,33,1	Area	Peak area of Propane
1,0,33,2	RF	Response factor for Propane
1,0,33,3	Conc	Concentration of Propane components
1,0,33,4	Energy	Superior energy content of Propane
1,0,33,5	Density	Density of Propane

I-BUTANE :ST X

1,0,34,0	Time	Retention time for i-Butane components
1,0,34,1	Area	Peak area of i-Butane
1,0,34,2	RF	Response factor for i-Butane
1,0,34,3	Conc	Concentration of i-Butane components
1,0,34,4	Energy	Superior energy content of i-Butane
1,0,34,5	Density	Density of i-Butane

N-BUTANE :ST X

1,0,35,0	Time	Retention time for n-Butane components
1,0,35,1	Area	Peak area of n-Butane
1,0,35,2	RF	Response factor for n-Butane
1,0,35,3	Conc	Concentration of n-Butane components
1,0,35,4	Energy	Superior energy content of n-Butane
1,0,35,5	Density	Density of n-Butane

NEO-PENTANE :ST X

1,0,36,0	Time	Retention time for neo-Pentane components
1,0,36,1	Area	Peak area of neo-Pentane
1,0,36,2	RF	Response factor for neo-Pentane
1,0,36,3	Conc	Concentration of neo-Pentane components
1,0,36,4	Energy	Superior energy content of neo-Pentane
1,0,36,5	Density	Density of neo-Pentane

I-PENTANE :ST X

1,0,37,0	Time	Retention time for i-Pentane components
1,0,37,1	Area	Peak area of i-Pentane
1,0,37,2	RF	Response factor for i-Pentane
1,0,37,3	Conc	Concentration of i-Pentane components
1,0,37,4	Energy	Superior energy content of i-Pentane
1,0,37,5	Density	Density of i-Pentane

N-PENTANE :ST X

1,0,38,0	Time	Retention time for n-Pentane components
1,0,38,1	Area	Peak area of n-Pentane
1,0,38,2	RF	Response factor for n-Pentane
1,0,38,3	Conc	Concentration of n-Pentane components
1,0,38,4	Energy	Superior energy content of n-Pentane
1,0,38,5	Density	Density of n-Pentane

ENERGY :ST 3

1,0,39,0	Hs.	Superior heating value Stream 3
1,0,39,1	Hi.	Inferior heating value Stream 3

WOBBE :ST 3

1,0,40,0	Wobbe.s	Superior wobbe value Stream 3
1,0,40,1	Wobbe.i	Inferior wobbe value Stream 3

DENSITY :ST 3

1,0,41,0	d	Relative density value Stream 3
1,0,41,1	rn	Normal density value Stream 3

CALIBRATION DATA

Location	**Symbol**	**Parameter Description**
Analogue O/P Calibration		
2,0,00,0	O/P1	normal, set 4mA or set 20mA
2,0,00,1	O/P2	normal, set 4mA or set 20mA
2,0,00,2	O/P3	normal, set 4mA or set 20mA
2,0,01,0	O/P4	normal, set 4mA or set 20mA
2,0,01,1	O/P5	normal, set 4mA or set 20mA
2,0,01,2	O/P6	normal, set 4mA or set 20mA

PRINTER DATA

Location		Parameter Description
Printer Type		
5,0,00,0	Printer = Int, Ext or Off	Internal, External or Off
If External		
5,0,01,0	Baud	9600, 4800, 2400, 1200
5,0,01,1	Data	7 or 8 data bits
5,0,01,2	Parity	None, Odd or Even
5,0,01,3	Cts	OFF or needed
Internal or external printer		
5,0,02,0	Interval	Print interval
5,0,02,1	Start	Start print time
5,0,02,2	Last	Last print time
5,0,02,3	Next	Next print time
Printer Functions		
5,0,03,0	P-Keysw	Print on Keyswitch Operation On/Off
5,0,03,1	P-Pwr on	Print on Power On On/Off
5,0,03,2	P-Alarm	Print on Alarm On/Off
5,0,03,3	P-Disp	Print all Display Parameters on Alarm On/Off
Communications Port osc-01-e		
5,0,04,0	Baud	9600, 4800, 2400, 1200
5,0,04,1	Data	7 or 8 data bits
5,0,04,2	Parity	None, Odd or Even
Communications Port Modbus 1		
5,0,05,0	Baud	9600, 4800, 2400, 1200
5,0,05,1	Data	7 or 8 data bits
5,0,05,2	Parity	None, Odd or Even
5,0,05.3	MB id	Control Unit identification number for serial communication
Communications Port Modbus 2		
5,0,06,0	Baud	9600, 4800, 2400, 1200
5,0,06,1	Data	7 or 8 data bits
5,0,06,2	Parity	None, Odd or Even
5,0,06.3	MB id	Control Unit identification number for serial communication

APPENDIX 2

ALARM AND FAULT CODES

The alarm and fault codes shown on the display when the alarm pages are selected

The first eight digits define the code for any alarm or fault condition which exists and identifies the condition and state of the contributing parameter.

Digit 1 will be either an **N, C** or **F** identifying an NON-ACCOUNTABLE ALARM, ACCOUNTABLE ALARM or FAULT condition. (if a fault occurs digits 1 to 5 spell FAULT)

Digit 2 will be either a blank space or letter **A**.

Digits 3, 4 and 5 give the parameter code or are letters ULT.

Digit 6 is a blank space.

Digits 7 and 8 are either **Hi**, **Lo** or numbers **1** to **12**

PARAMETER SYMBOLS FOR NON-ACCOUNTABLE ALARMS (N)

N PRINT	Defective printer or paper jam

PARAMETER SYMBOLS FOR ACCOUNTABLE ALARMS (C)

C6+	C6+ component concentration alarm
N2	Nitrogen component concentration alarm
Methan	Methane component concentration alarm
CO2	Carbon dioxide component concentration alarm
Ethane	Ethane component concentration alarm
Propan	Propane component concentration alarm
i Butan	i-Butane component concentration alarm
n Butan	n-Butane component concentration alarm
neo Pen	neo-Pentane component concentration alarm
I Pentn	i-Pentane component concentration alarm
n Pentn	n-Pentane component concentration alarm
Unknown	Unknown component alarm
Area	Area alarm
Energy	Energy out of range
SG	SG or relative density out of range
G Comms	Communication to Process Gas Chromatograph has failed
Cal Alm	Calibrate time period exceeded
RF diff	RF difference limits exceeded during calibration

FAULT CODES

When an operational fault occurs the display indicates **FAULT** followed by the numbers **1** to **14** identifying the cause of the fault, the time of the fault is given if the failure allows the Control Unit to continue operating.

FAULT 1	Insufficient data has been entered to allow normal operation to proceed.
FAULT 2	The data stored in memory has been corrupted.
FAULT 3	The RAM memory is defective.
FAULT 4	The PROM programme memory is defective..
FAULT 8	The keyswitch is defective.
FAULT 9	A defect has occurred in the real time clock circuit.
FAULT 11	The Comms 2 communications board No.1 is defective.
FAULT 12	The Comms 2 communications board No.1 is defective.
FAULT 13	The Comms 2 communications board No.2 is defective.
FAULT 14	The Comms 2 communications board No.2 is defective.

APPENDIX 3

CONNECTOR PIN IDENTIFICATION FOR INPUT AND OUTPUT SIGNALS

SOCKET No SKT 2	**SERIAL COMMS. PORT TO PGC 2000**
D type Pin No.	**FUNCTION**
1	power supply +24 VDC (for fibre module)
2	RS232 RxD
3	RS232 TxD
4	not to be used
5	RS232 Common 0V
6	not to be used
7	not to be used
8	not to be used
9	not to be used

SOCKET No SKT 3	**RS232 MODBUS ASCII COMMS. PORT No.1**
D type Pin No.	**FUNCTION**
1	Latch input
2	No.1 RS232 RxD
3	No.1 RS232 TxD
4	not to be used
5	RS232 Common 0V
6	not to be used
7	No.1 RS232 RTS
8	No.1 RS232 CTS
9	not to be used

SOCKET No SKT 4	**RS232 MODBUS ASCII COMMS. PORT No.2**
D type Pin No.	**FUNCTION**
1	Latch input
2	No.2 RS232 RxD
3	No.2 RS232 TxD
4	not to be used
5	RS232 Common 0V
6	not to be used
7	No.2 RS232 RTS
8	No.2 RS232 CTS
9	not to be used

SOCKET No SKT 5	**OUTPUT ALARM SIGNALS**
D type Pin No.	**FUNCTION**
1	Fault
2	Non-accountable Alarm
3	not to be used
4	Power Supply 0V
5	Power Supply +24V
6	Accountable Alarm

7	General Alarm
8	not to be used
9	not to be used

SOCKET No SKT 6	**ANALOGUE OUTPUT SIGNALS**
D type Pin No.	**FUNCTION**
1	Analogue Output No. 6
2	Analogue Output No. 4
3	Analogue Output No. 2
4	Power Supply 0V
5	Power Supply +24V
6	Analogue Output No. 5
7	Analogue Output No. 3
8	Analogue Output No. 1
9	not to be used

SOCKET No SKT 7	**OUTPUT ALARM SIGNALS**
D type Pin No.	**FUNCTION**
1	Fault
2	Non-accountable Alarm
3	not to be used
4	Power Supply 0V
5	Power Supply +24V
6	Accountable Alarm
7	General Alarm
8	not to be used
9	not to be used

SOCKET No SKT 9	**RGC COMMS. PORT (TO RGC PC)**
D type Pin No.	**FUNCTION**
1	not to be used
2	RS232 RxD RGC
3	RS232 TxD RGC
4	not to be used
5	RS232 0V Common
6	not to be used
7	not to be used
8	not to be used
9	not to be used

SOCKET No SKT 10	**SERIAL OSC-01-E GASUNIE PROTOCOL PORT**
D type Pin No.	**FUNCTION**
1	not to be used
2	RS232 RxD OSC
3	RS232 RxD OSC
4	not to be used
5	RS232 0V Common

6	not to be used
7	not to be used
8	not to be used
9	not to be used

SOCKET No SKT 11 SERIAL PRINTER PORT

D type Pin No.	**FUNCTION**
1	TTL Printer CTS
2	RS232 Printer RxD
3	RS232 Printer TxD
4	not to be used
5	RS232 0V Common
6	TTL Printer TxD
7	not to be used
8	RS232 Printer CTS
9	not to be used

SOCKET No SKT 14 NO FUNCTION

D type Pin No.	**FUNCTION**
1	not to be used
2	not to be used
3	not to be used
4	Power Supply 0V
5	Power Supply +24V
6	not to be used
7	not to be used
8	not to be used
9	not to be used

SOCKET No SKT 15 NO FUNCTION

D type Pin No.	**FUNCTION**
1	not to be used
2	not to be used
3	not to be used
4	Power Supply 0V
5	Power Supply +24V
6	not to be used
7	not to be used
8	not to be used
9	not to be used

POWER SUPPLY TERMINALS

24V	24 Vdc positive power supply terminal
E	Earth connection terminal to signal cable screens
0V	Power supply 0V negative terminal

Chassis Earth connection screw

APPENDIX 4

MODBUS COMMUNICATION PORTS No.1 AND No. 2 SERIAL OUTPUT

The Controller is provided with a two RS232 communication link without handshaking using a ASCII Modbus data communication protocol

A4.1 COMMUNICATIONS PACKET DEFINITIONS

1) Read requests
:KK03ssssnnnnLL<CRLF>

2) Write requests
:**KK10ssssnnnnbb<DATA>LL<CRLF>**

Where:

a) : (colon) is an ASCII colon character , all characters before this are ignored except <CRLF>

b) KK is the Control Unit identification number this must be set to the identification number of the model ENCAL 2000 Control Unit

c) 03hex is the Modbus code "Read multiple registers"

d) 10hex is the Modbus code "Preset multiple registers"

e) ssss is the start address in the range 0000 to FFFF (0 to 63535 decimal). This corresponds to the 5 digit Control Unit locations, see APPENDIX 1

f) nnnn is the number of registers in the range 0001 to 001F (1 to 31 decimal)

g) bb is the number of bytes to be transferred In this Control Unit this will always be **nnnn** multiplied by 8.

h) LL is the LRC a checksum formed by adding the bytes represented by each pair of hex. digits and then subtracting the result from 0 , modulo 256

i) <DATA> data nnnn items 16 ASCII characters (8 bytes) each

j) <CRLF> Carriage return ,line feed in ASCII i.e. 0DH and 0AH

A4.2 CONTROL UNIT COMMUNICATION RESPONSES

The Control Unit response to the above packets is as follows:-

i) Valid Read Requests:
:KK03bb<DATA>LL<CRLF
all definitions as above

ii) Valid Write Requests:
:KK10ssssnnnnLL<CRLF>
all definitions as above

iii) Invalid Read Requests

:KK83ccLL<CRLF>

all definitions as above except **cc** which is an error code this can be:

1) 01 The message function received is not an allowable action, it is allowable to read (03hex) all addresses in the range 0-FFFFH (0-65535) and it is allowable to write (10hex) to addresses in the range FFFB (65531) to FFFFH (65535) in the ENCAL 2000 Control Unit. This code will be returned if the ENCAL 2000 Control Unit is in the data entry mode.

2) 04 The ENCAL 2000 Control Unit that was addressed has failed to respond. i.e. The ENCAL 2000 Control Unit was not powered.

iv) Invalid Write Requests

:KK90ccLL<CRLF>

all definitions as above .

v) Nothing

No reply will be received if either the request contains less than 17 characters, or a request packet that does not contain valid hex characters is received or the checksum is invalid.

A4.3 DATA FORMAT

When a valid **READ** request is received or a valid **WRITE** transmitted then the data format will be in the form of 8 bytes (64 BIT) per register ,represented as 16 ASCII hex digits with the following data format:

i) Floating point IEEE 64 bit double precision (double float) value MSB first

ii) Integer 64 bit binary (double long) value MSB first.

iii) Strings sent as integers see Paragraph A4.6

iv) Date and time sent as a specially defined String

A4.4 REGISTERS THAT CAN BE WRITTEN

Data that can be written into the ENCAL 2000 Control Unit is a s follows:-.

A4.4.1 Time and Date

Location 65535 (FFFFhex) Time and Date (Format as follows)

8byte string converted into 16 ASCII bytes as with all numbers where the year number is the LSB

i)	Year	<=99	
ii)	Month	>=1 and <=12	
iii)	Day	>=1 and <=31	
iv)	Hour	<=23	where 0 = midnight
v)	Min.	<=59	
vi)	Sec.	<=59	
vii)	Week Day	<=7	where 1 = Sunday
vii)	Spare not used.		

A4.4.2 Remote revision

It is possible to activate calibrations and/or testgas runs (stream 3) using The writable modbus registers 65000 and 65001. Writing 1 to modbus register 65000 will activate a CAL 1 cycle and writing 2 will activate a CAL 2 run. The number of CAL runs and CCK runs preceding depends on the programming of the Autocal sequence which is set in the ENCAL 2000 PGC. This can be changed using the RGC 2000 Software.

Writing a 1 to modbus register 65001 will activate stream 3 (which is normally used for a reference gas). This setting will overrule the normal analyser sequence as set in the SST table. The stream 3 can be deactivated by writing a “0” to register 65001

A4.5 REGISTER ADDRESSES THAT CAN BE READ

The ENCAL 2000 Control Unit location numbers may very easily be translated into register addresses for communication purposes. For Data entry and Display variables the 5 digit location number is used see APPENDIX 1. with leading zeros removed

Address 65535 FFFFhex has a special function .When read it returns the machine configuration i.e. the mode switch settings. The last 12 bits show the mode switch settings i.e. bit set = ON and not set = OFF. however only switches used are shown.

Edit pages that start 3 are not available via the communication port . Any attempt to read from unused addresses will result in -1.0E+38 being returned.

Error pages those addresses starting with a 6 have a format as follows, It is a contiguous block of 24 20-register messages corresponding to the maximum 24 Error locations **6.0.00.0** to **6.0.47.9** each message consists of one of each of the following 20 items.

i) Error code: CONTROL UNIT

0000	No error
0001	Internal error or Fault 1
0002	Fault 2
0003	Fault 3
0004	Fault 4
0008	Fault 8
0009	Fault 9
0011	Fault 11
0012	Fault 12
0013	Fault 13
0014	Fault 14
0100	Unknown alarm
0101	Area alarm
0102	Energy alarm
0103	SG or Relative Density alarm
0105	Oven Temperature alarm
0106	C6+ component alarm
0107	Nitrogen component alarm
0108	methane component alarm
	0109 CO2 component alarm
	0110 ethane component alarm
	0111 propane component alarm
	0112 i-butane component alarm
0113	n-butane component alarm
0114	neo pentane component alarm
0115	i-pentane component alarm
0116	n-pentane component alarm
0117	Process Gas Chromatograph Comms alarm
0118	Calibration alarm (Cal. Interval Time)
0119	Calibration RF Difference Alarm

ii) Error ON date

This is always 16 bytes in the following format:

a) 0000000000
b) Year No 0 to 99
c) Month No 1 to 12
d) Day No 1 to 31

If the error code is 0 then all the above will be 0

iii) Error ON time

This is always 16 bytes in the following format

a) 0000000000
b) Hour No 0 to 23
c) Minute No 0 to 59
d) 00

If the error code is 0 then all the above will be 0

iv) Error OFF date

This is always 16 bytes in the following format:

a) 0000000000
b) Year No 0 to 99
c) Month No 1 to 12
d) Day No 1 to 31

If the error code is 0 or the error is still present then all the above will be 0

v) Error OFF time

This is always 16 bytes in the following format:

a) 0000000000
b) Hour No 0 to 23
c) Minute No 0 to 59
d) 00

If the error code is 0 or the error is still present then all the above will be 0

vi) zero
to
xx) zero

A4.6 DISPLAY STRING INTERGER VALUES

As previously stated in Paragraph A4.3 items shown on the ENCAL 2000 Control Unit display in string form cannot be transmitted in that form and are transmitted as integer numbers the following is a list of the display strings with the corresponding integer code and function .The integer must be transmitted as a 64 bit number as previously stated.

CODES FOR ENCAL 2000 Control Unit CONTROL UNIT DATA

Code	Variable	
00000	Mode switch 1	1= ON 0=OFF
00001	Mode switch 2	1= ON 0=OFF
00002	Mode switch 3	1= ON 0=OFF
00003	Analogue output board1	1= ON 0=OFF
00004	Analogue output board2	1= ON 0=OFF
00005	Mode Switch 8	1= ON 0=OFF
00010	Mode Switch 7	1= ON 0=OFF
00011	Mode Switch 9	1= ON 0=OFF
00012	Mode Switch 10	1= ON 0=OFF
00040	Analogue outputs	0=0-20mA, 1=4-20mA.
00050	Analogue output 1	
00053	Analogue output 2	
00060	Analogue output 3	
00070	Analogue output 4	
00073	Analogue output 5	
00080	Analogue output 6	

0=OFF,	11= Rel. Dens	22= CO2 2
1=methane	12= CO2	23= N2 1
2=ethane	13= Hs	24= N2 2
3= propane	14= Hi	25= d 1
4= i-butane	15= Wobbe.s	26= d 2
5= n-butane	16=.rn	27= rn 1
6= neo-pentane	17= Hs 1	28= rn 2
7= i-pentane	18= Hs 2	29= Wobbe.s 1
8= n-pentane	19= Hi 1	30= Wobbe.s 2
9= C6+	20= Hi 2	
10= nitrogen	21= CO2 1	

00090	General alarm Fault	1=ON	0=OFF
00091	General alarm Accountable alarm	1=ON	0=OFF
00092	General alarm Non-accountable alarm	1=ON	0=OFF

50000	Printer	0= None, 1=Internal, 2= External
50010	Printer baud rate	0=1200, 1=2400, 2=4800, 3=9600
50011	Printer bits	0=7 bits, 1=8 bits
50012	Printer parity	0=None, 1=Even, 2=Odd
50020	Print interval	HH:MM integer value in minutes
50021	Print start time	HH:MM integer value in minutes
50022	Last print time	HH:MM integer value in minutes
50023	Next print time	HH:MM integer value in minutes

50030	Print on keyswitch operation	0=OFF	1=ON
50031	Print on power on	0=OFF	1=ON
50032	Print on Error	0=OFF	1=ON
50033	Print error and display data	0=OFF	1=ON

50040	OSC-01-E Serial 1 baud rate	0=1200, 1=2400, 2=4800, 3=9600
50041	OSC-01-E Serial 1 bits	0=7 bits, 1=8 bits
50042	OSC-01-E Serial 1 parity	0=None, 1=Even, 2=Odd

50050	Modbus 1 Serial 2 baud rate	0=1200, 1=2400, 2=4800, 3=9600
50051	Modbus 1 Serial 2 bits	0=7 bits, 1=8 bits
50052	Modbus 1 Serial 2 parity	0=None, 1=Even, 2=Odd

50060	Modbus 2 Serial 2 baud rate	0=1200, 1=2400, 2=4800, 3=9600
50061	Modbus 2 Serial 2 bits	0=7 bits, 1=8 bits
50062	Modbus 2 Serial 2 parity	0=None, 1=Even, 2=Odd

A4.7 SERIAL COMMUNICATION ADDRESSES

The following Tables numbers 1 to 3 contain lists of data that is normally read from either of the available MODBUS communication ports by other equipment , for example 793-SC Station Controllers or a DSf-GC Unit. This data is presented in the format stated for each address and is the same as the data that is available either on the display or via the other communication options.

ENCAL 2000 CU COMMUNICATION LOCATIONS

Table 1 Component codes and Status information

Addr.	Function	Code	Number Format
3001	Component code for C6+	108	unsigned 16 bit integer
3002	Component code for N2	114	unsigned 16 bit integer
3003	Component code for Methane	100	unsigned 16 bit integer
3004	Component code for CO2	117	unsigned 16 bit integer
3005	Component code for Ethane	101	unsigned 16 bit integer
3006	Component code for Propane	102	unsigned 16 bit integer
3007	Component code for i-Butane	103	unsigned 16 bit integer
3008	Component code for n-Butane	104	unsigned 16 bit integer
3009	Component code for neo-pentane	107	unsigned 16 bit integer
3010	Component code for i-pentane	105	unsigned 16 bit integer
3011	Component code for n-pentane	106	unsigned 16 bit integer
3012	Component code for H2	112	unsigned 16 bit integer
3013	Component code for Helium	113	unsigned 16 bit integer
3014	Component code for Oxygen	116	unsigned 16 bit integer
3015	Component code for CO	115	unsigned 16 bit integer
3016	Component code for H2O	144	unsigned 16 bit integer
3017	Component code for Argon	146	unsigned 16 bit integer
3034	GC Stream Number	1, 2 or 3	unsigned 16 bit integer
3046	GC Status register 1 (See Table 2 for details)	0 = OK	unsigned 16 bit integer
3047	GC status register 2 (See Table 2 for details)	0 = OK	unsigned 16 bit integer
3059	Analysis/Calibration	1=Analysis 0=Calibration	unsigned 16 bit integer
3062	Process Gas Chromatograph State	0=Idle 1=Analysing 2=Calibrating	unsigned 16 bit integer
3067	Control Unit Keyswitch Status	1=DATA 2=RUN 3=EDIT 4=CAL	unsigned 16 bit integer
3093	Energy Units	0=KWh/m3 1=KJ/m3 2=KCal/m3 3=MJ/m3	unsigned 16 bit integer

Addr.	Function	Code	Number Format
3100	CAL stream nr.	1 = CAL 1 2 = CAL 2	unsigned 16 bit integer
3101	Current stream nr.	0 to 23 (See table 4 for details)	unsigned 16 bit integer
3102	Next stream nr.	0 to 23 (See table 4 for details)	unsigned 16 bit integer

Table 2 Alarm Status definitions

3046 STATUS WORD No 1		3047 Status WORD No 2	
LSB	Function	LSB	Function
1	Unknown peak Alarm	1	C6+ Component Alarm
2	Area alarm	2	N2 Component Alarm
3	Energy Alarm	3	Methane Component Alarm
4	Rel. dens Alarm	4	CO2 Component Alarm
5	Concentration Alarm	5	Ethane Component Alarm
6	Calibrate Alarm (see par.2.7)	6	Propane Component Alarm
7		7	i-Butane Component Alarm
8		8	n-Butane Component Alarm
9		9	neo-Pentane Component Alarm
10		10	i-Pentane Component Alarm
11		11	n-Pentane Component Alarm
12		12	
13		13	
14	CU Fault	14	
15	Comms to Process Gas Chromatograph Alarm	15	
16	Reserved	16	

Table 3 Gas Analysis results

Address	Function	Number Format
7001	Mol % C6+	IEEE 32 bit Float
7002	Mol % N2	IEEE 32 bit Float
7003	Mol % Methane	IEEE 32 bit Float
7004	Mol % CO2	IEEE 32 bit Float
7005	Mol % Ethane	IEEE 32 bit Float
7006	Mol % Propane	IEEE 32 bit Float
7007	Mol % i-Butane	IEEE 32 bit Float
7008	Mol % n-Butane	IEEE 32 bit Float
7009	Mol % neo-Pentane	IEEE 32 bit Float
7010	Mol % i-Pentane	IEEE 32 bit Float
7011	Mol % n-Pentane	IEEE 32 bit Float
7012	Mol % H2	IEEE 32 bit Float
7013	Mol % Helium	IEEE 32 bit Float
7014	Mol % Oxygen	IEEE 32 bit Float
7015	Mol % CO	IEEE 32 bit Float
7016	Mol % Water Vapour	IEEE 32 bit Float
7017	Mol % Argon	IEEE 32 bit Float
7033	Superior Heating Value (Dry)	IEEE 32 bit Float
7034	Superior Heating Value (Sat)	IEEE 32 bit Float
7035	Relative Density	IEEE 32 bit Float
7036	Z factor	IEEE 32 bit Float
7037	Wobbe index (Superior)	IEEE 32 bit Float
7038	Un-normalised sum	IEEE 32 bit Float
7087	Inferior Heating Value (Dry)	IEEE 32 bit Float
7088	Inferior Heating Value (Sat)	IEEE 32 bit Float
7089	Wobbe index (Inferior)	IEEE 32 bit Float
7090	Density Kg/m3	IEEE 32 bit Float
7095	Response factor C6+	IEEE 32 bit Float
7096	Response factor N2	IEEE 32 bit Float
7097	Response factor Methane	IEEE 32 bit Float
7098	Response factor CO2	IEEE 32 bit Float
7099	Response factor Ethane	IEEE 32 bit Float
7100	Response factor Propane	IEEE 32 bit Float
7101	Response factor i-Butane	IEEE 32 bit Float
7102	Response factor n-Butane	IEEE 32 bit Float
7103	Response factor neo-Pentane	IEEE 32 bit Float
7104	Response factor i-Pentane	IEEE 32 bit Float
7105	Response factor n-Pentane	IEEE 32 bit Float
7500	CO2 Soll	IEEE 32 bit Float
7501	CO2 Ist	IEEE 32 bit Float
7502	CO2 abw	IEEE 32 bit Float
7503	rn soll	IEEE 32 bit Float
7504	rn ist	IEEE 32 bit Float

7505	rn abw	IEEE 32 bit Float
7506	Hs Soll	IEEE 32 bit Float
7507	Hs Ist	IEEE 32 bit Float
7508	Hs abw	IEEE 32 bit Float
7509	d soll	IEEE 32 bit Float
7510	d ist	IEEE 32 bit Float
7511	d abw	IEEE 32 bit Float
7520	CO2 soll	IEEE 32 bit Float
7521	CO2 ist	IEEE 32 bit Float
7522	C6 soll	IEEE 32 bit Float
7523	C6 ist	IEEE 32 bit Float
7524	N2 soll	IEEE 32 bit Float
7525	N2 ist	IEEE 32 bit Float
7526	CH4 soll	IEEE 32 bit Float
7527	CH4 ist	IEEE 32 bit Float
7528	C2H6 soll	IEEE 32 bit Float
7529	C2H6 ist	IEEE 32 bit Float
7530	C3H8 soll	IEEE 32 bit Float
7531	C3H8 ist	IEEE 32 bit Float
7532	i-C4H10 soll	IEEE 32 bit Float
7533	i-C4H10 ist	IEEE 32 bit Float
7534	n-C4H10 soll	IEEE 32 bit Float
7535	n-C4H10 ist	IEEE 32 bit Float
7536	Neo-C5H12 soll	IEEE 32 bit Float
7537	Neo-C5H12 ist	IEEE 32 bit Float
7538	i-C5H12 soll	IEEE 32 bit Float
7539	i-C5H12 ist	IEEE 32 bit Float
7540	n-C5H12 soll	IEEE 32 bit Float
7541	n-C5H12 ist	IEEE 32 bit Float

Table 4 (Register 3101 and 3102)

Code	Function
0	CAL1
1	CCK 1
2	Stream 1
3	Stream 2
4	Stream 3
5	Stream 4
6	Stream 5
7	Stream 6
8	Stream 7
9	Stream 8
10	CAL 2
11	CCK2
12	CAL 3
13	CCK 3
14	SST-END
15	SST-None Selected
16	Stream 9
17	Stream10
18	Stream11
19	Stream12
20	Stream13
21	Stream14
22	Stream15
23	Stream16