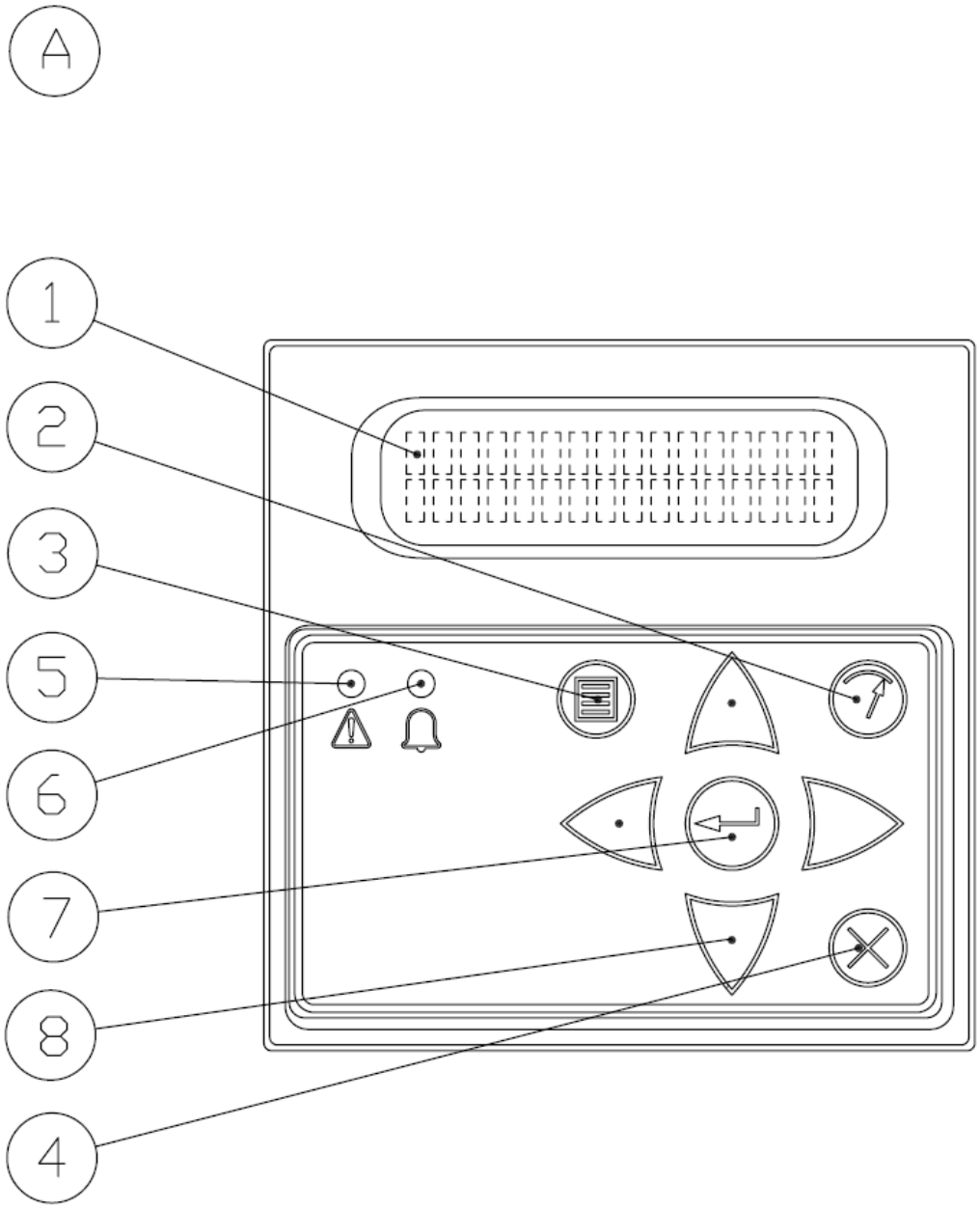
SERVOMEX
ANALYZERS
HIGH-PERFORMANCE GAS ANALYSIS

SERVOTOUGH SpectraExact 2500

QUICK START MANUAL

Part Number: **02500003E**
Revision: **0**
Language: **UK English**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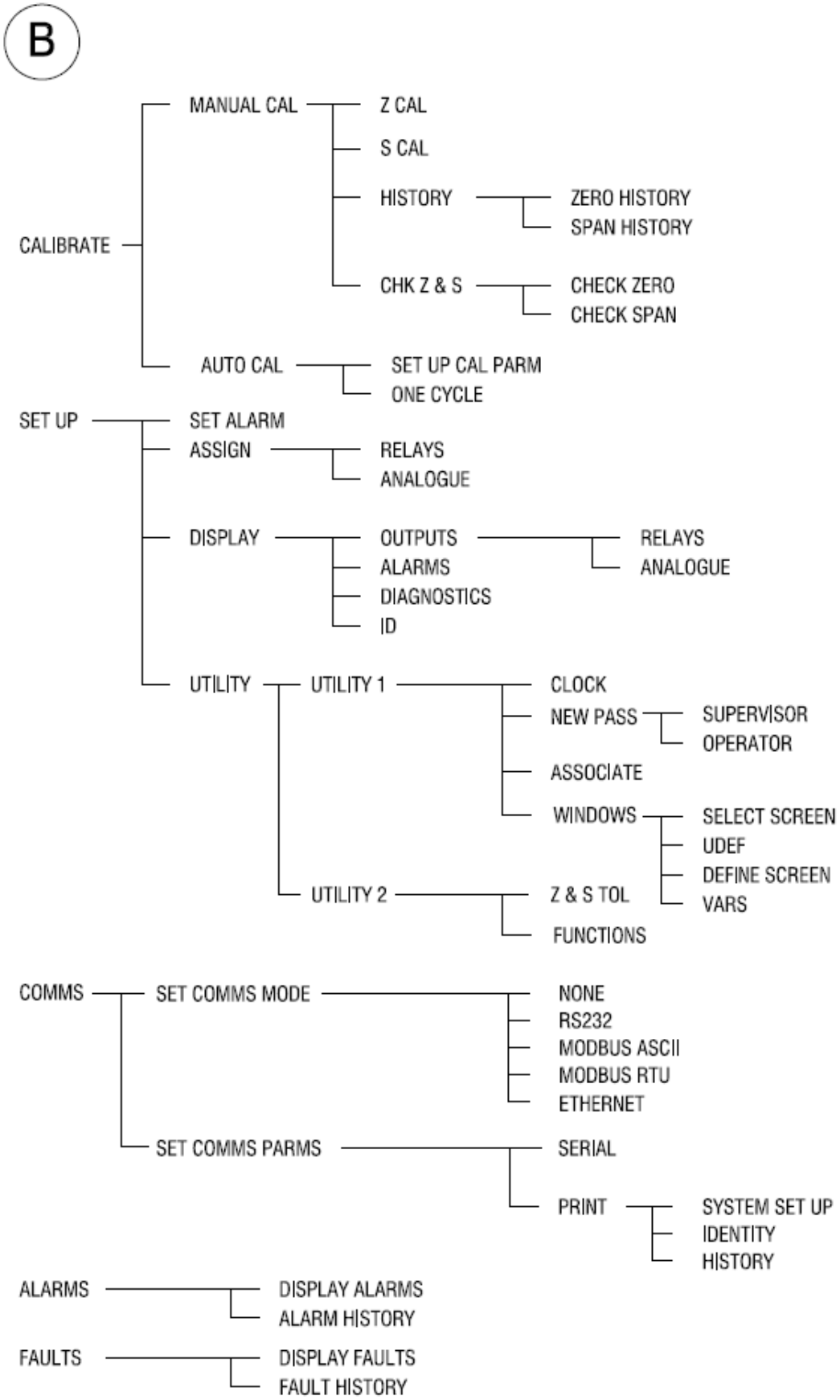
B
CALIBRATE
MANUAL CAL
Z CAL
S CAL
HISTORY
ZERO HISTORY
SPAN HISTORY
CHK Z & S
CHECK ZERO
CHECK SPAN
AUTO CAL
SET UP CAL PARM
ONE CYCLE
SET UP
SET ALARM
ASSIGN
RELAYS
ANALOGUE
DISPLAY
OUTPUTS
RELAYS
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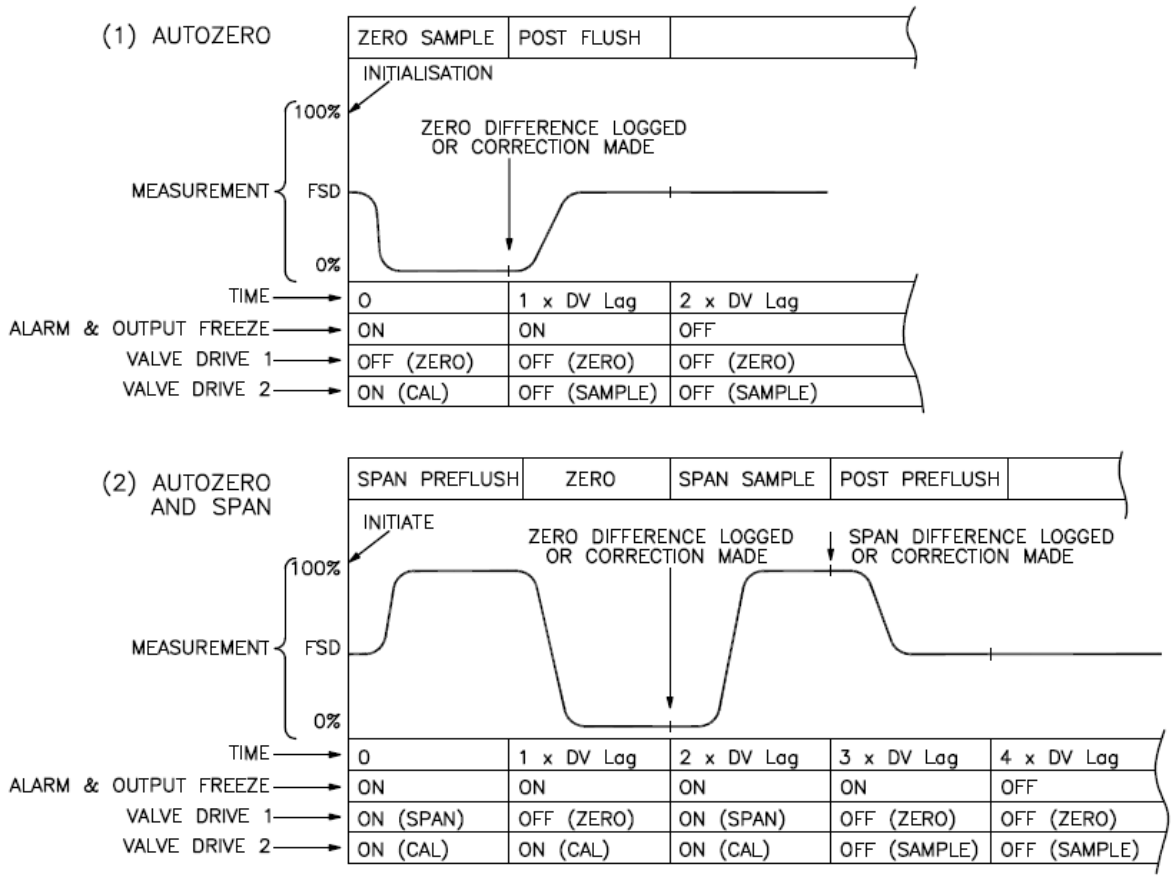
ALARMS
DIAGNOSTICS
ID
UTILITY
UTILITY 1
CLOCK
NEW PASS
SUPERVISOR
OPERATOR
ASSOCIATE
WINDOWS
SELECT SCREEN
UDEF
DEFINE SCREEN
VARS
UTILITY 2
Z & S TOL
FUNCTIONS
COMMS
SET COMMS MODE
NONE
RS232
MODBUS ASCII
MODBUS RTU
ETHERNET
SET COMMS PARMS
SERIAL
PRINT
SYSTEM SET UP
IDENTITY
HISTORY
ALARMS
DISPLAY ALARMS
ALARM HISTORY
FAULTS
DISPLAY FAULTS
FAULT HISTORY

C


(1) AUTOZERO
ZERO SAMPLE
POST FLUSH
INITIALISATION
100%
ZERO DIFFERENCE LOGGED
OR CORRECTION MADE
MEASUREMENT
FSD
0%
TIME
0
1 x DV Lag
2 x DV Lag
ALARM & OUTPUT FREEZE
ON
ON
OFF
VALVE DRIVE 1
OFF (ZERO)
OFF (ZERO)
OFF (ZERO)
VALVE DRIVE 2
ON (CAL)
OFF (SAMPLE)
OFF (SAMPLE)
(2) AUTOZERO AND SPAN
SPAN PREFLUSH
ZERO
SPAN SAMPLE
POST PREFLUSH
INITIATE
ZERO DIFFERENCE LOGGED
OR CORRECTION MADE
SPAN DIFFERENCE LOGGED
OR CORRECTION MADE
100%
MEASUREMENT
FSD
0%
TIME
0
1 x DV Lag
2 x DV Lag
3 x DV Lag
4 x DV Lag
ALARM & OUTPUT FREEZE
ON
ON
ON
ON
OFF
VALVE DRIVE 1
ON (SPAN)
OFF (ZERO)
ON (SPAN)
OFF (ZERO)
OFF (ZERO)
VALVE DRIVE 2
ON (CAL)
ON (CAL)
ON (CAL)
OFF (SAMPLE)
OFF (SAMPLE)

1 INTRODUCTION

1.1 Warnings, Cautions and Notes

This publication includes WARNINGS, CAUTIONS and NOTE which provide information relating to the following:

WARNINGS

Hazards which could result in personal injury or death.

CAUTIONS

Hazards which could result in equipment or property damage.

NOTES

Alert the user to pertinent facts and conditions.

1.2 About this manual

This manual covers software configuration and operation for the 2500, 2520 and 2550 range of analysers. Further copies of this manual may be ordered (part number 02500/003E).

Addresses for technical assistance and spares are given on the back cover.

An installation manual is supplied with the analyser which includes the technical specification, routine maintenance and spares information.

A service manual is available for use by qualified personnel.

Some variants may be supplied with a certification manual.KEY TO FIGURES

KEY TO FIGURES

Figure A Analyser Front View

1. 16 Character 2 line VF Display
2. Hard key to select Measurement Display
3. Hard key to select Menu Display
4. Hard key to exit to the previous menu level
5. Fault warning LED
6. Alarm warning LED
7. Hard key to enter data or accept highlighted option within Menu
8. Up/Down/Left/Right Cursor keys to select Menu options and increase/decrease numerical values

Figure B Analyser Menu Map

Figure C Auto calibration Examples Schematic

1. Autozero
2. Autozero and Span

1.3 Introduction to the user interface

See Figure A.

The keypad and display used on the 2500 series analysers have been designed to be easy to operate and have a minimum number of keys. There are only 4 single-function ('hard') keys: MEASURE; MENU; ENTER; EXIT. There are also 4 cursor (directional) keys: Up; Down; Left; Right; these are arrow-head shapes. All keys require only a modest pressure to operate them, and give tactile feedback.

Information is displayed on a 2-line, 16-character vacuum fluorescent display which ensures good visibility under all conditions. Items on the display which require user-selection are highlighted, i.e. appear flashing.

Also fitted to the keypad are red warning LEDs, one for 'FAULT' and one for 'ALARM'. These are normally only illuminated when a fault or a concentration alarm is being signalled.

The 2500 series is controlled by the user via a 'menu-driven' interface; in other words, at each level of operation the user is offered a selection, or menu, of items on the display and he/she selects the appropriate one by highlighting it with the cursor keys and then pressing the ENTER key. Where required, data is also entered by using the cursor keys to increase/decrease values displayed.

Certain operations require the use of a password. There are two passwords, an operator password and a supervisor password. These are factory set to 2000, but may be changed if required (see Section 2.3).

Under normal operating conditions, the actual measurement result is continuously displayed. This measurement display is the 'default' display. To perform any user operations on the 2500, the user must first obtain the top-level menu display by pressing the MENU key.

NOTE

During any operations within the menu, the fundamental measurement of the sample is still being made by the 2500 and all relevant outputs, alarms and diagnostics remain fully active and functioning.

To return to the (measurement) default display at any time and from any part of the 2500 user menu, simply press the MEASURE key.

NOTE

The display will also revert automatically to measurement if no key is pressed for one minute.

2 INITIAL CONFIGURATION

2.1 Power up procedure

WARNING

Ensure that the instrument variant is properly installed before proceeding.

Confirm that all electrical and plumbing connections have been correctly made as described in the installation manual.

Follow the Power up procedure as detailed in the installation manual.

The normal measurement display will then appear and the 2500 will be operational.

NOTE

- The measurement will not be valid at this point since process sample is not yet flowing.
- If a heated cell is fitted, it will not yet be up to temperature and the intermittent ‘warming-up’ message will be displayed. Depending on set point and/or environment, this may take several hours to reach temperature and for the message to cease.
- The 2500 chopper box assembly will take up to 2 hours to reach specified temperature and the ‘warming-up’ message will also be displayed until this is accomplished.

While the analyser is warming up, the software configuration to suit the user's particular requirements may now be accomplished. Proceed to Section 3: Configuration. Note that during the ‘warming-up’ period, all outputs and alarms are live and fully operational. All diagnostics are also operational, EXCEPT cell temperature and chopper box temperature. These last two diagnostics only become operational once the temperature set points have been reached or after 2 hours (for chopper box) or 10 hours (for cell) have elapsed from power up.

WARNING

Check for no leaks of sample at full operating pressure and temperature before proceeding. This is especially important for toxic/flammable samples.

At this point, process sample may be turned on and allowed to flow through the 2500 sampling system.

Where the 3rd (sample/inert) solenoid valve is in use (see installation manual), the inert medium will automatically be supplied to the analyser until the cell reaches correct temperature.

2.2 General access to analyser functions

It is recommended that the user refers to the menu map (see Figure B) and locates the function required. Then, using the keypad and display, follow the route as mapped. It

will often be necessary to enter the password.

NOTE

The factory-default password for the 2500 series is ‘2000’ - this must be entered. Alternatively, if a keyswitch has been fitted this should now be closed. Failure to close the keyswitch is interpreted as an invalid password, and this should prompt the user to operate the keyswitch at this point.

NOTE

The ‘up arrow’ (↑) appears at the lower right of the display. This arrow is used throughout the 2500 software to indicate that more information, or further items for selection, are available and can be viewed by pressing the ▲ key. A ‘down arrow’ (↓) means further information in the ▼ direction, and a ‘double headed’ arrow (↕) indicates more information in either direction.

2.3 Setting passwords

NOTE

If the keyswitch facility is to be used, ignore this section.

Several sections of the 2500 menu are password-protected against unauthorised changes by a 2-level password system. A lower-level OPERATOR password protects basic calibration functions, and a high-level SUPERVISOR password protects the essential configuration functions. The factory default password is ‘2000’ in both cases. At this stage, new passwords may be selected.

NOTE

- Be sure to record the chosen passwords in a safe place.
- Three consecutive failed attempts at entering a password will cause a fault to be signalled.
- The numbers can be scrolled round completely using the cursor keys, and the decimal point (.) and minus sign (-) are included in the character set.

Go via MENU/SET UP/UTILITY/UTILITY 1 to NEW PASS - Press ENTER	
At display screen	Operation
SUPERVISOR OPERATOR	Select required password and press ‘ENTER’
NEW SUPERVISOR PASS 00 0 0	Use the cursor keys to set the new password, then press ‘ENTER’
NEW PASS IS NNNN ACCEPT YES/NO	To confirm new password, press ‘ENTER’
SUPERVISOR OPERATOR	Select required password and press ‘ENTER’, or press ‘EXIT’ to finish

2.4 Setting time and date

The 2500 is equipped with a real-time clock and this is capacitor-backed to retain the time setting for up to 2 days without power. At this stage, it should be set to the correct local time and date, and the preferred day/month format, in order that all future-timed operations and historical logs reflect correct local times.

Go via MENU/SET UP/UTILITY/UTILITY 1 to CLOCK - Press ENTER	
At display screen	Operation
TIME = 16:15 DATE = 07/03/00	This display will change after 4 seconds to:
CHANGE DATE/TIME YES/NO	Select ‘YES’ or ‘NO’ and press ‘ENTER’
SET CLOCK SET YEAR 0 0 0 0	Use the cursor keys to set the correct value, then press ‘ENTER’
SET MONTH 0 0	As above
SET DAY 0 0	As above
SET HOUR 0 0	As above
SET MINUTE 0 0	As above
SELECT FORMAT DDMMYY/MMDDYY	Select format required, then press ‘ENTER’

NOTE

Illegal times/dates outside the range of the clock are not accepted.

3 MAIN CONFIGURATION

3.1 Alarms

There are 4 concentration alarms for each measured component on the 2500 series, and these are called ‘AL1’, ‘AL2’, ‘AL3’ and ‘AL4’. These must now be set up to suit the measurement and control needs of the particular installation. Factory default settings are 70%, 80%, 90% and 100% fsd respectively, and HIGH activation.

Each enabled alarm has four parameters which need to be set up:

i) FREEZE to prevent alarms during calibration, or FOLLOW so that alarms may be activated by calibration gases.

ii) HIGH concentration alarm or LOW concentration alarm.

iii) The concentration LEVEL at which the alarm is to occur.

iv) The HYSTERESIS (dead band) of the alarm; this may be used to avoid ‘chatter’ if the typical sample concentration is close to the alarm level.

Go via MENU/SET UP to SET ALARM - Press ENTER	
At display screen	Operation
SELECT COMPONENT CO_2vpm f (if more than 1 component)	select required component using cursor keys, then press ‘ENTER’
[Measurement] SELECT AL 1/2/3/4	select required alarm using cursor keys, then press ‘ENTER’
[Measurement] AL1 ENABLE / DISABLE	select required state, then press ‘ENTER’
[Measurement] AL1 FREEZE / FOLLOW	select required state, then press ‘ENTER’
[Measurement] AL1 HIGH / LOW ALARM	select required state, then press ‘ENTER’
[Measurement] AL1 LEVEL = 00000 [units]	select required value, then press ‘ENTER’
[Measurement] AL1 HYST = 0.0% FSD	select required value, then press ‘ENTER’
[Measurement] SELECT AL1/2/3/4	select next required alarm using cursor keys, then press ‘ENTER’, or press ‘EXIT’ to set up another component

3.2 Allocation of relays

Each standard 2500 series analyser has 3 relay outputs, which can now be assigned to various functions. These relay outputs are given software identity numbers which relate physically to the particular PCB from which they are provided. The hardware locations and terminal strip identifiers are given in the installation manual.

Each relay output may be assigned to *any combination* of the following functions:

i) Any of the concentration alarms for any of the measured components, in any combination.

ii) Calibration in Progress.

iii) Fault.

Any existing relay allocation may be edited or cleared. When cleared, the relays will remain non-functional.

NOTES

- The Calibration in Progress function is active whenever a Manual Calibration or Check, or an Auto calibration or Autocheck routine, is in progress.
- The Fault alarm is active whenever any Fault condition (i.e. parameter out of tolerance) is detected, except for cell or chopper box temperature during warmup.
- Serious Faults (Shutdown/Measurement withdrawn) will also drive all analogue outputs HIGH (or LOW, depending on user setting).
- Factory default settings are:
  - All concentration alarms
  - Calibration in Progress
  - Faults

Go via MENU/SET UP/ASSIGN to RELAYS - Press ENTER	
At display screen	**Operation**
SELECT RELAY 1.3 ASSIGNED ↑ or 1.3 UNASSIGNED ↑	Select required relay using cursor keys, then press 'ENTER'
RELAY ASSIGNMENT 1.3 **EDIT** / CLEAR or 1.3 ASSIGn? **Y**/N	Select 'EDIT' to edit allocation, or re-assign a cleared relay or select 'CLEAR' to clear the relay, then press 'ENTER'
1.3 [**Measurement**] AL1 HI 10.0 % **Y**/N	Select 'Y' to assign this function to this relay or 'N' to clear the function, then press 'ENTER'
1.3 [**Measurement**] AL2 HI 0.0 % **Y**/N	Select 'Y' to assign this function to this relay or 'N' to clear the function, then press 'ENTER'
{Cycle through all the available assignment options, selecting with 'Y' or 'N' as required}	Select 'Y' to assign this function to this relay or 'N' to clear the function, then press 'ENTER'
SELECT RELAY 1.3 ASSIGNED ↑ or 1.3 UNASSIGNED ↑	Select next relay using cursor keys, then press 'ENTER'

3.3 Analogue outputs

Each standard 2500 series analyser has 2 analogue outputs, which can now be assigned to the measurement being made. These analogue outputs are given software identity numbers which relate physically to the particular PCB from which they are provided. The hardware locations and terminal strip identifiers are given in the installation manual for each analogue output.

Each analogue output is supplied configured as current but may be set to voltage. This selection is made as described in the installation manual.

Each analogue output has 2 sets of parameters, one for 'Range 1' (normal state) and one for 'Range 2' (engaged when external 'Range 2' contact is closed, as specified in the installation manual).

Each analogue output can be scaled across the whole measurement range of a component (e.g 0-100% fsd corresponds to 4-20 mA), or a smaller or larger proportion of the calibrated range. Minimum recommended analogue output range is 5% fsd, maximum is 200% fsd (i.e. 2x over-range). Factory default is 0-100% fsd for all outputs.

NOTE

- Above 100% fsd, linearity performance may be degraded.
- At minimum (5% fsd) output scaling, i.e. maximum expansion of output, increased noise may require adjustment of Time Constant (see Section 3.11).
- Upper and lower limits of measurement for each output are entered in actual concentration units. The lower limit can be non-zero, but cannot be higher than the upper limit (i.e. reversed outputs not permitted).

The parameters which can be adjusted on the analogue outputs are:

i) LOWER and UPPER range of the output in the units of the measurement (component).

ii) TRUE or LIVE zero. TRUE zero = 0 to 20 mA and LIVE zero = 4 to 20 mA.

iii) FREEZE to prevent alarms during calibration or FOLLOW so that alarms may be activated by calibration gases.

Each of these parameters can also be independently set for range 2, if required.
LOWER and UPPER example:

2500 First Component Calibrated 0-20% CO_2

Default analogue output range:
(4-20 mA) corresponds to (0-20% CO_2)

Minimum output range:
(4-20 mA) corresponds to (0-1% CO_2)

Maximum output range:
(4-20 mA) corresponds to (0-40% CO_2*)
(* = approx)

The analogue identity (in this case ‘1.1’) appears lower left, and the current status (ASSIGNED OR UNASSIGNED) next to it. All are initially ASSIGNED in the factory to the measurements in logical order, one analogue per measurement.

Go via MENU/SET UP/ASSIGN to ANALOGUE - Press ENTER	
At display screen	**Operation**
SELECT ANALOGUE 1.1 ASSIGNED ↑ OR 1.1 UNASSIGNED ↑	Select required analogue output using cursor keys, then press ‘ENTER’
ANALOGUE ASSIGNMENT 1.3 EDIT / CLEAR OR 1.3 ASSIGN? Y/N	Select ‘EDIT’ to edit allocation, or re-assign a cleared relay OR select ‘CLEAR’ to clear the relay, then press ‘ENTER’
SELECT COMPONENT CO_2vpm t (if more than 1 component)	Select component to be assigned to this analogue output using cursor keys, then press ‘ENTER’
1.1 [Measurement] R1 L=00.0 U=20.0	Select Lower and Upper limits for the output and press ‘ENTER’
1.1 [Measurement] R1 TRUE 0 / LIVE 0	Select required state, then press ‘ENTER’
1.1 [Measurement] R1 FREEZE / FOLLOW	Select required state, then press ‘ENTER’
1.1 [Measurement] R2 L= 00.0 U=20.0	Repeat above process for range R2
SELECT ANALOGUE 1.1 ASSIGNED ↑ OR 1.1 UNASSIGNED ↑	Select another analogue output using cursor keys, then press ‘ENTER’

3.4 Defining and selecting measurement display screen

The window menu enables the user to display the measurement value and measured component in the preferred format for the (default) measurement display.

Go via MENU/SET UP/UTILITY/UTILITY 1 to WINDOW - Press ENTER	
At display screen	**Operation**
SELECT SCRN / UDEF DEFINE SCRN / VARS	Select required function using cursor keys, then press ‘ENTER’

SELECT SCRN is used to display the required measured components on the display.

AUTOSCROLL is used on multi component analysers only, and is used to show all measured components in a continuous circular scroll.

If SINGLE display is selected, the name of a chosen measured component appears on the top line and the measurement value on the bottom line.

The SPLIT display is used on multi component analysers only, and is used to show two measured components at a time.

UDEF is used to select the required displayed chemical name, chemical formula and engineering unit, e.g. carbon dioxide, CO_2, vpm.

DEFINE SCREEN is used on multi component analysers only, and is used to specify the sequence order in which the measured components are displayed.

VARS is used to set the number of displayed digits (DECIMAL POINTS) appearing after the decimal point in the measurement value. This is adjustable between values of 0 to 3.

3.5 Communication Options

A standard 2500 provides RS232 serial communications. If specified, the analyser may be fitted with additional hardware to allow digital communications using either Modbus over RS485 or Modbus TCP over Ethernet. If either option is fitted the RS232 output is no longer available.

The 2500 menu system displays all communication options but for correct operation the selection must match the analyser hardware. The following table lists the options.

Go via COMMS **to** SET COMMS MODE **- Press ENTER**		
At display screen	**Operation**	Analyser Option
NONE **OR**	Select required option using cursor keys, then press 'ENTER'	Any
RS232 **OR**		Standard
MODBUS **OR** ASCII		02500912 Communications Board RS485
MODBUS **OR** RTU		02500912 Communications Board RS485
ETHERNET		02500913 Communications Board Ethernet

NONE disables all digital communications.

RS232 enables the serial output and print functions. See section 3.7 for further details.

Modbus ASCII enables this protocol using the RS485 interface on the 02500912 Communication Board (if fitted).

Modbus RTU enables this protocol using the RS485 interface on the 02500912 Communication Board (if fitted).

Ethernet enables Modbus TCP communication using Ethernet interface on the 02500913 Communication Board (if fitted)

WARNING

Do not use an uncertified DCS, dilatator, printer or other external equipment in a Hazardous Area.

3.6 Communication Setup

When the communication mode has been selected as described in section 3.5, it may be configured using the SET COMMS PARMS menu. Note that this menu is only displayed if the communication mode is not NONE.

The configuration options displayed are specific to the selected communication mode and are described in the following sections.

3.7 RS232

The RS232 option uses the following fixed configuration.
BAUD rate: 2400
PARITY: EVEN
STOP BITS: 1
DATA BITS: 8
HANDSHAKE: HARDWARE

Any device intended for connection to the 2500 must be capable of serial RS232 communication and be configured with these settings.

Entering the RS232 menu displays further options.

SERIAL

This option configures the analyser to transmit serial data frames at user configurable time intervals. For connection details and signal interpretation, refer to the installation manual.

Go via MENU/COMMS/SET COMMS PARMS to SERIAL - Press ENTER	
At display screen	**Operation**
FRAME PERIOD = 00s	Select required value using cursor keys, then press ‘ENTER’. A zero value will disable transmission.

PRINT

The PRINT MENU is only displayed if the FRAME PERIOD under the SERIAL menu is set to zero. It is provided to enable the user to download hard copy records of the 2500’s Identity (ID), current history logs (Alarm, Fault and calibration histories) and complete SET-UP information. Any printer must have at least 80 column width.

Go via MENU/COMMS/SET COMMS PARMS to PRINT - Press ENTER

At display screen	Operation
SYSTEM SET-UP OR IDENTITY OR HISTORY	Select required value then press ‘ENTER’

3.8 MODBUS ASCII

This section details the analyser configuration that is displayed when the communications mode is set to MODBUS ASCII. This should be adjusted as necessary to match the requirements of the Modbus network to which the analyser is connected.

Go via MENU/COMMS to SET COMMS PARMS - Press ENTER	
At display screen	**Operation**
MODBUS ADDRESS =	Select required value from 1 to 247 and press 'ENTER'
SELECT STOP 1 / 1.5 /	Select required value and press 'ENTER'
SELECT DATA BITS 8 /	Select required value and press 'ENTER'
SELECT PARITY EVEN / ODD / NONE	Select required value and press 'ENTER'
SELECT BAUD RATE 9K6 / 4K8 / 2K4 / 19K2	Select required value and press 'ENTER'

3.9 MODBUS RTU

This section details the analyser configuration that is displayed when the communications mode is set to MODBUS RTU. This should be adjusted as necessary to match the requirements of the Modbus network to which the analyser is connected.

3.10 ETHERNET

This section details the analyser configuration that is displayed when the communications mode is set to ETHERNET. This should be adjusted as necessary to match the requirements of the network to which the analyser is connected.

Go via MENU/COMMS to SET COMMS PARMS - Press ENTER	
At display screen	**Operation**
IP ADDRESS = 000.000.000.000	Select required value and press 'ENTER'
SUBNET MASK = 000.000.000.000	Select required value and press 'ENTER'
GATEWAY ADDRESS = 000.000.000.000	Select required value and press 'ENTER'

Note that the SUBNET MASK value is automatically set to the appropriate default value whenever an IP address is entered that falls into a different class. This may be altered as required.

3.11 Functions

The FUNCTIONS menu items are displayed in turn for the selected component, so that they can be locked ON/OFF, or DEFAULT/USER, as required.

i) Pressure Compensation - If the 2500 is fitted with optional Sample Pressure Compensation, this may be turned ON or OFF using this function. This appears only when the option is fitted.

ii) Temperature Compensation - If the 2500 is fitted with optional Sample Temperature Compensation, this may be turned ON or OFF using this Function. This appears only when the option is fitted.Span Constant - To enable user adjustments (manual or automatic) to span, this may be left in 'USER' setting. Reversion to 'DEFAULT' setting returns the 2500 to the factory span and locks out any user adjustments. This is useful for applications where span samples are infrequently available, e.g. moisture in solvents.

iii) Zero Constant - This should normally be left in 'USER' setting to enable user adjustments (manual or automatic) to zero. Reversion to 'DEFAULT' returns the 2500 to factory zero.

NOTE

The zero generally requires more frequent setting than span adjustment on most applications (see Section 4. for further details).

iv) Time Constant - This is used to set the TIME CONSTANT for analogue outputs on the 2500. This is adjustable from 0 seconds to 60 seconds, and there are separate constants available for Range 1 operation and Range 2 operation (see Section 3.3). These are T1 and T2 respectively. For most applications, a setting of 0 seconds is considered normal.

NOTE

- The response time for the measurement display is not variable.
- This time constant is additional to the inherent system response time.
- The T1 and T2 selected must be integers, i.e. a whole number of seconds.

Go via MENU/SETUP/UTILITY/UTILITY 2 - Press ENTER	
At display screen	**Operation**
SELECT COMPONENT CO_2vpm ↑ ***(if more than 1 component)***	Select required component, then press 'ENTER'
ZERO & SPAN TOL FUNCTIONS	Select 'FUNCTIONS', then press 'ENTER'
[Pressure compensation or Temperature compensation controls, where fitted] ON/OFF	Select required state, then press 'ENTER'
SPAN CONST **[Measurement]** **DEFAULT**/USER	Select required state, then press 'ENTER'
ZERO CONST **[Measurement]** **DEFAULT**/USER	Select required state, then press 'ENTER' to select more functions
XI [Learnt cross interference compensation if fitted] ON/OFF	Select the required state, then press 'ENTER'
[Measurement] TC1=00 TC2=00	Select required values, then press 'ENTER'
ZERO & **SPAN TOL** FUNCTIONS	Press 'EXIT', then select another component if required

NOTE

Setting Zero and Span constants to 'DEFAULT' returns the 2500 to its original factory calibration.

3.12 Associate

The ASSOCIATE function is the procedure by which the factory calibration and system information in a 2500 is uploaded from the backup EEPROM on the Transmitter PCB into the 2500's Microprocessor PCB. This routine is normally used if a replacement Microprocessor PCB is being fitted. This operation is only carried out once.

In addition, if a Default System Data corruption Fault is diagnosed, this may be corrected using the Associate routine.

Go via MENU/SETUP/UTILITY/UTILITY 1 to ASSOCIATE - Press ENTER	
At display screen	**Operation**
ASSOCIATE PROCEED? Y/N	Select required action, then press ‘ENTER’
ASSOCIATING IN PROGRESS	This display will change after a few seconds to:
ASSOCIATE OK OR ASSOCIATE FAILED	This display will return after a few seconds to the UTILITY 1 Menu

If association fails, refer to the installation manual.

4 CALIBRATION

4.1 Introduction to calibration

The 2500 series is supplied by Servomex with an accurate factory calibration for the measurement required as specified on the customer's order. This calibration contains a zero constant, a span constant and a linearising function, which are stored in the 2500 and cannot be erased or overwritten by the user.

The user is able to make adjustments to span and zero, however, in order to suit his own site conditions and calibration standards. User adjustments, using the calibration routines in this section, modify the factory values only when the appropriate FUNCTIONS have been ‘unlocked’ (set to ‘USER’) as described in Section 3.7.

Factory values are restored whenever the FUNCTIONS are set back to ‘DEFAULT’.

Two types of calibration operation are available:

i) True CALIBRATIONS, where the zero and span of the 2500 are adjusted.

ii) Sample CHECKS, where the 2500 is tested with zero and span, but no adjustments are made.

In either case, results are logged in the appropriate Calibration History log. Either type of calibration can be performed MANUALLY or AUTOMATICALLY.

NOTE

- It is likely that SPAN adjustments will be required less often than ZERO adjustments on the 2500 series, due to its inherent span stability.
- At this stage, if true CALIBRATIONS are to be required, unlock the necessary FUNCTIONS before proceeding.
- All Calibration Samples must have stable and accurately known concentrations of the measured component in a background representative of the actual process stream, and they must be supplied to the 2500 at typical process temperature, pressure and flow rate.

4.2 Setting low and high calibration tolerances

The Zero and Span Tolerances are the limits, set by the user, on the permissible range of adjustments during manual and auto calibration routines. These warn of incorrect samples or excessive drift.

If a tolerance is about to be exceeded during a manual calibration, a warning is given. This can be ignored if necessary.

If a tolerance is about to be exceeded during an auto calibration, the auto calibration will fail and the Fault alarm will be signalled.

The maximum permissible tolerance is 10% fsd in either case.

Go via MENU/SETUP/UTILITY/UTILITY 2 to Z&S TOL - Press ENTER	
At display screen	**Operation**
ZERO TOLERANCE 10.0 % FSD	Select required value using cursor keys, then press 'ENTER'
SPAN TOLERANCE 10.0 % FSD	Select required value using cursor keys, then press 'ENTER'

4.3 Manual calibration and checking

• Calibration

Manual CALIBRATION of Zero and Span is conducted by entering the MAN function. Individual Calibration Samples for each component must be manually introduced into the 2500's sample cell, either using manually-switched valves or the built-in solenoid valve driver relays. The following example assumes a Z CAL (zero) followed by an S CAL (span).

Go via MENU/CALIBRATE to MANUAL CAL - Press ENTER	
At display screen	**Operation**
SELECT COMPONENT CO_2vpm ↑ ***(if more than 1 component)***	Select required measurement, then press 'ENTER'
Z CAL/S CAL HISTORY/CHK Z&S	Select 'Z CAL', then press 'ENTER'
ZERO TARGET CO_2 = 00.0 vpm	Set to the required zero gas concentration, then press 'ENTER'
TC 0.0 CC 2.1 vpm ACCEPT? Y/N	TC is the target concentration CC is the current concentration **Introduce low cal gas**, when CC has stabilised it may be accepted or rejected
Z CAL/S CAL HISTORY/CHK Z&S	Select 'S CAL', then press 'ENTER'
SPAN TARGET CO_2 = 0100.0 vpm	Set to the required span gas concentration, then press 'ENTER'
TC 100.0 CC 96.2 vpm ACCEPT? Y/N	TC is the target concentration CC is the current concentration **Introduce high cal gas**, when CC has stabilised it may be accepted or rejected

NOTE

For best accuracy, the Zero Calibration Sample concentration should be as close to true zero % fsd as possible, and the Span Calibration Sample should be as close to 100% fsd as possible.

• Checking

Manual Checking of Zero and Span is conducted by entering CHK Z & S routine.

This routine operates the Solenoid Valve Drives 1 and 2. Therefore, if the 2500 is configured and plumbed for AUTOCALIBRATION or AUTOCHECKING, the Zero Calibration Sample and Span Calibration Sample connected for automatic routines will also be used in the Manual Check Zero and Span routine.

If AUTOCALIBRATION or AUTOCHECKING routines are not being used, the user may still wish to utilise the Solenoid Valve Drives 1 and 2 to switch solenoid valves controlling the samples for greater convenience.

Go via MENU/CALIBRATE to MANUAL CAL - Press ENTER	
At display screen	**Operation**
SELECT COMPONENT CO_2vpm ↑ ***(if more than 1 component)***	Select required measurement then press 'ENTER'
Z CAL/S CAL HISTORY/CHK Z&S	Select 'CHK Z&S', then press 'ENTER'
CHECK ZERO CHECK SPAN	Select required function, then press 'ENTER'
CHK ZERO **[Measurement]** CONC = [00.0 vpm]	Wait till the concentration has settled, then press 'EXIT'; the 2500 logs the concentration at this point
CHECK ZERO CHECK SPAN	Select span if required, then press 'ENTER' and repeat the process with the span gas

4.4 Auto calibration and autocheck setup

Either AUTOCALIBRATION or AUTOCHECK can be configured on the 2500 - these are described as 'Auto calibration'. In either case, suitable Zero only, or Zero and Span Calibration Samples must be permanently plumbed via solenoid valves into the sampling system from which the 2500 is fed.

The Auto calibration is configured to the user's requirements in the Set Up Cal Parm function.

Suitable solenoid valves are plumbed and wired to the 2500 as described in the installation manual.

The required Auto calibration can be initiated by any of 4 methods:

i) From the display panel, by the user entering the ONE CYCLE function. This performs one complete Auto calibration operation only. This is also useful for testing the configuration as set up.

ii) From the 2500's real-time clock. The Auto calibration PERIOD (time between each Auto calibration initiation) is adjustable from 1 hour to 59 days and 24 hours. A setting of 00 days, 00 hrs. will prevent timed initiation. The start time for the first cycle is also adjustable.

iii) Remotely, on demand. Remote contact closure by host device or remote user switch will initiate one complete Auto calibration operation (a ‘ONE CYCLE’) only; see installation manual for wiring. Contacts must be closed for at least 2 seconds but no more than 59 seconds.

iv) Remotely using digital communications if either Modbus over RS485 or Modbus over Ethernet option is fitted. See installation manual for details.

The following parameters need to be set:

i) Zero only, or Zero plus Span routine - This choice depends on the nature of the application, the ease of providing plumbed samples, and the degree of autonomy required for the 2500.

ii) Zero sample concentration.

iii) Span sample concentration.

iv) Required Auto calibration period (time between cycles).

v) Start time/date of the first Auto calibration cycle.

vi) DV (dead volume) lag - This is the time to allow full flushing of the 2500's sample cell before Auto calibration action occurs.

vii) Auto calibration mode or Auto checking only mode - This allows full AUTOCALIBRATION (zero and span settings are adjusted) or AUTOCHECK (zero and span settings are NOT adjusted, i.e. the analyser readings for zero and span samples are simply compared with the given values)

viii) Zero and Span adjustment tolerances - This enables limits to be put on an acceptable range of automatic adjustment for zero and span. Outside these limits, an Auto calibration will fail and a Fault will be signalled (see Section 4.2).

ix) Unlock Zero and Span Adjustment Functions - This enables Manual and Auto calibration routines to actually change the 2500's zero and span constants where appropriate (see Section 3.11).

Go via MENU/CALIBRATE to AUTO - Press ENTER	
At display screen	**Operation**
SET UP CAL PARM ONE CYCLE	Select required function, then press ‘ENTER’
SELECT AUTO CAL **LOW** / LOW & HIGH	Select required state, then press ‘ENTER’
[Measurement] LOW = 00.0 %	Set to the required zero gas concentration, then press ‘ENTER’
[Measurement] HIGH = 00.0 %	Set to the required span gas concentration, then press ‘ENTER’
SELECT MODE AUTO **CAL** / CHK	Select required state, then press ‘ENTER’
SELECT DV LAG **0.5** MIN f	Select the required value using the cursor keys, then press ‘ENTER’
ENTER PERIOD DAYS **0** 0	Select required value, then press ‘ENTER’
ENTER PERIOD HOURS **0** 0	Select required value, then press ‘ENTER’
ENTER START TIME SET YEAR **0**000	Select required value, then press ‘ENTER’
ENTER START TIME SET MONTH **0**0	As above
ENTER START TIME SET DAY 00	As above
ENTER START TIME SET HOUR **0**0	As above
ENTER START TIME SET MINUTE **0**0	As above
TIME 12:00:00 DATE 10/12/99	Temporary display of start time and date
SET UP CAL PARM ONE CYCLE	Select required function, then press ‘ENTER’

* note: LOW and HIGH are used to denote ZERO and SPAN respectively.

See Figure C for schematics of the function of the AUTOCALIBRATION and AUTOCHECK cycles.

At Auto calibration initiation, the concentration alarms and analogue outputs may be frozen in their current states until after the end of the ‘POST FLUSH’, which is the final DV Lag time that returns the process stream to the analyser. To configure them to ‘FREEZE’, see Sections 3.1 and 3.3.

NOTE

- If Auto calibrations are to be remotely initiated, it is advisable to prevent internal initiation by setting the auto calibration PERIOD to 00 days, 00 hrs.
- Timed or remotely-initiated Auto calibrations will NOT operate when there is any Fault condition or during the warming-up period, or 15 minutes after the clearance of the last Fault or warm-up.
- An Auto calibration will fail if either the Zero Tolerance or Span Tolerance would be exceeded. Any Auto calibration will fail if a Span Preflush is unsuccessful for any component.
- Any Auto calibration in progress can be manually aborted by pressing any key.
- Some Auto calibration settings may be changed using digital communications where the RS485 or Ethernet option has been fitted. See installation manual for details.
- Any Auto calibration in progress can be manually aborted by pressing any key. It may also be aborted by means of a Modbus command. See installation manual for details.

4.5 Calibration when learnt cross interference is enabled

Where the analyser is fitted with XI (cross interference compensation) and where this is enabled, Manual Span calibrations are required with separated span components.

Auto calibration using a gas mixture is normally unavailable. However if Autocal has been ordered then it may be used with a gas mixture using specially determined Span Target Values. These values are supplied with the instrument documentation and must be used as the Span Target values during span calibration rather than the actual mixture composition.

5 VIEWING CONFIGURATION AND HISTORY FILES

5.1 Displaying 'current' alarms and faults

• Alarms

Go via MENU/ALARMS to DISPLAY ALARMS - Press ENTER	
At display screen	**Operation**
NO ALARMS DETECTED OR [Measurement] AL1 100.0 vpm HIGH ↑	Either 'NO ALARMS DETECTED' OR the first alarm is displayed; if further alarms are present, an arrow will be shown; use the cursor keys to access them

• Faults

Faults on the 2500 series are categorised into 2 types:

i) General Faults

These indicate that a parameter is out of tolerance and user intervention is required as soon as possible to correct any hardware problems arising or deal with any failure of auto calibration, sample flow, etc.

ii) Serious Faults

If any fault arises, or parameter degrades to such an extent that the measurement accuracy is also significantly degraded, the 2500 goes into 'Shutdown state'. The measurement is automatically withdrawn and all analogue outputs are driven HIGH (or LOW, as configured; see installation manual). The display will show a 'Measurement Invalid' message instead of the measured value.

For full details of types of fault and the recommended remedial actions, see the installation manual.

Go via MENU/FAULTS to DISPLAY FAULTS - Press ENTER	
At display screen	**Operation**
NO FAULTS DETECTED OR DET SIG LO ↑	Either 'NO FAULTS DETECTED' OR the first fault is displayed; if further faults are present, an arrow will be shown; use the cursor keys to access them

5.2 Displaying alarm settings

Go via MENU/SET UP/DISPLAY to ALARMS - Press ENTER	
At display screen	**Operation**
SELECT COMPONENT CO_2vpm ↑ (if more than 1 component)	select the desired component for alarm display, then press 'ENTER'
[Measurement] AL1 ENABLE 10.0 % HI ↑	the first screen for each alarm shows whether it is **enabled** or not and the **setpoint** and **type**; use the cursor keys to select the next screen
[Measurement] AL1 ENABLE HYST 1.0% FRZ ;	The second screen for each alarm shows the **hysteresis** and **mode**, use the cursor keys to select the next alarm
[Measurement] AL2 ENABLE 10.0 % HI ↑	repeat above process to view all alarm settings, then press 'EXIT'

5.3 Displaying output configuration

- **Relays**

Go via MENU/SET UP/DISPLAY/OUTPUTS to RELAYS - Press ENTER	
At display screen	**Operation**
DISPLAY RELAY 1.3 ASSIGNED ↑	Select the desired relay for display, then press 'ENTER'
1.3 **[Measurement]** AL1 HI 10.0% ↑	Display the functions assigned to this relay using the cursor keys, then press 'EXIT'

- **Analogue outputs**

Go via MENU/SET UP/DISPLAY/OUTPUTS to ANALOGUE - Press ENTER	
At display screen	**Operation**
DISPLAY ANALOGUE 1.3 ASSIGNED ↑	Select the desired analogue output for display, then press 'ENTER'
1.1 **[Measurement]** R1 L=[**Lower**] U=[**Upper**] ↑	Display the configuration of this output using the cursor keys, then press 'EXIT'

5.4 Displaying analyser histories

The 2500 series retains history entries (up to 20 per category) for the following events. The most recent event is shown first.

Alarms: An entry is made each time an alarm appears ('ON') or is cleared ('OFF'), in the following format:
[Measurement] [Alarm No.] [Event] [Time] [Date]

Go via MENU/ALARMS to ALARM HISTORY - Press ENTER	
At display screen	**Operation**
[**Measurement**] AL1 ON 17:59:00 16/12 ↑	Select the desired alarm entry to display, then press 'EXIT' to finish

Faults: An entry is made each time a fault appears ('ON') or is cleared ('OFF'), in the following format:
[Fault] [State] [Time] [Date]

Go via MENU/FAULTS to FAULT HISTORY - Press ENTER	
At display screen	**Operation**
DET SIG LO ON 17:13:23 23/12 ↑	Select the desired fault entry to display, then press 'EXIT' to finish

NOTE

Sometimes one or two faults may be logged for a moment on power up. This is a normal occurrence.

Calibration: Each measurement has its own calibration history for ZERO and SPAN. An entry is made each time a calibration or calibration check is performed, in the following format:
[Measurement] [Type*] [Difference**] [Time] [Date]

* 'Type' is the type of calibration performed, CHECK or CAL and ZERO or SPAN.

** In the case of CHECK operations, the 'difference' is (2500 reading) - (Calibration Sample Concentration). Any constant value therefore shows NO drift.

In the case of CALIBRATION operations, the 'difference' is (2500 reading before correction) -(Calibration Sample Concentration). Any constant value therefore shows a CONSTANT drift.

Go via MENU/CALIBRATE to MANUAL CAL - Press ENTER	
At display screen	**Operation**
SELECT COMPONENT CO_2vpm ↑ **(if more than 1 component)**	Select the desired measurement history to display, then press 'ENTER'
Z CAL/S CAL HISTORY/CHK Z&S	Select 'HISTORY', then press 'ENTER'
ZERO HISTORY SPAN HISTORY	Select the desired history to display, then press 'ENTER'
[Measurement] CHKMZ - 9.2 13:22:25 31/12 ↑	Select the desired calibration entry to display, then press 'EXIT' to finish

5.5 Displaying analyser identity and diagnostics

• Identity

Go via MENU/SET UP/DISPLAY to ID - Press ENTER	
At display screen	**Operation**
SERVOMEX IR REV [**etc.**]	Displays the power up sequence of the 2500's identity and calibration

• Diagnostics

Go via MENU/SET UP/DISPLAY to DIAGNOSTICS - Press ENTER	
At display screen	**Operation**
CHOPPER TEMP NN.N °C ↑	Use the cursor keys to display the list of diagnostic parameters and their current status; press 'EXIT' to finish

For more information, please refer to the Installation/Service Manuals.