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**MICROPROCESSOR
CONTROLLED
DUAL BEAM NDIR
ANALYSER
MODELS 414/5/6/7**

Serial No.:

Customer:

Order No.:

Tag No.:

Job No.:

SAFETY WARNING

THIS INSTRUMENT INCLUDES APPARATUS USING VOLTAGES THAT CAN ENDANGER LIFE. IT IS THE DUTY OF ALL PERSONS WHO MAY BE CONCERNED WITH OPERATION OR WORK UPON THE APPARATUS TO COMPLY WITH CURRENT ELECTRICITY SAFETY REGULATIONS AND TO BE THOROUGHLY CONVERSANT WITH ALL REGULATIONS GOVERNING THE WORK THEY UNDERTAKE.

DISCONNECTION OF THE PROTECTIVE EARTH INSIDE OR OUTSIDE THE APPARATUS WILL MAKE IT DANGEROUS. INTENTIONAL DISCONNECTION IS PROHIBITED.

DO NOT USE FUSES OF A TYPE OR RATING DIFFERING FROM THOSE SPECIFIED.

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SECTION 1

INTRODUCTION

1.1 OUTLINE

This is a multi-function, easy-to-operate non-dispersion type infrared gas analyser for measuring the concentration of gases such as NO, SO₂, CO₂ and CO. It utilises a highly reputed mass flow type detector featuring high sensitivity and reliability, plus a microprocessor for easy operation.

1.2 THEORY OF OPERATION

The infra red light beam emitted from the IR source is split by a distribution cell into two beams which pass to the sample cell and reference cell respectively. The distribution cell contains interference gas to prevent any effect on the instrument reading by interference gas in the sample. In the sample cell, the infra red light beam is partially absorbed by the sample gas, attenuating the transmitted light. The reference cell is filled with a gas that will not absorb infra red light and therefore allows it to pass without attenuation. A chopper is rotating at approximately 9 Hz between the infra red light source and the distribution cell. Therefore two infra red light beams, one attenuated and the other not attenuated, simultaneously fall on the detector at a frequency of 9 Hz. The Model 41X NDIR's unique high sensitivity mass flow detector converts the intensity difference into a resistance change and then transmits AC signals at a frequency of 9 Hz to an amplifier. The detector is designed to compensate for interference from other infra red absorbing gases. The AC output is amplified by an IC; it is then rectified by an electronic synchronous rectifier system in synchronisation with rotation of the chopper. The DC output thus obtained is smoothed and amplified to give an output signal of 0-1 VDC and 4-20 mA which is obtained through voltage-current conversion of the voltage output.

The instrument has a second higher range which is linearised. This measuring range may be selected from the front panel or by remote control.

SECTION 2

INSTRUMENT DESCRIPTION

2.1 SPECIFICATION

Analyser Performance

Ranges Available	Models 414/5: Lowest 0-50 ppm, highest 0-100%. Dual range maximum ratio 20:1. Available ranges and ratio dependent on gas and application. Model 416: Any two from 0-1-/25/50/100 ppm Model 417 (atmospheric CO ₂): Low 350 ± 50 ppm/High 0-500 ppm or Low 350 ± 100 ppm/High 0-1000 ppm Model 417 (ambient level CO): any two selected from 0-50/100/250/500 ppm
Measurement Resolution	1% FS
Repeatability	± 0.5% FS
Linearity	± 2% FS; both ranges normally linear
Noise	< 1% FS
Minimum Detectable Concentration	1% FS
Zero Drift	± 2% FS/week
Span Drift	± 1% FS/week
Response Time	Typically 90% to step change at inlet 15 secs.; max. 20 sec dependent on gas and application

Output Signals

0-1V DC or 4-20mA negative ground

Output Hold

Last output can be held during calibration. This function can be toggled on or off.

Interference

Dependent upon application. Specifications based on 0°C dew point sample

Sample Requirements

Models 414/5: 0.5 ± 0.25 L/min., clean, dry 0°C dew point sample gas. Sample temperature 0-50°C

Model 416/7: 0.5 ± 0.25 L/min., clean, dry 0°C dew point sample gas; sample and reference gas combined. Sample temperature 0-50°C

Power Supply

Voltage	110V or 220/240V, 50Hz or 110V, 60Hz. All -10%, +6% VA
Consumption	125 VA

Local Displays

Digital LED concentration display (red), digital LED range selected (green)
Optional Sample flow meter

Standard Connections

0.25" O/D compression fittings used for:	Sample In Sample Out Purge (when applicable, flow 1 ± 0.5 L/min.)
------------------------------------------	-----------------------------------------------------------------------------

Environmental Operating Conditions

The analyser is designed for rack or bench mounting in a non-hazardous area	
Temperature	+15°C to +30°C
Humidity	95% max. RH.

Storage Temperature

The analyser should be stored at a temperature between 0 and 45°C

Dimensions and Weight (rack mounted)

	Unpacked	Packed
Height	222 mm	380 mm
Width	483 mm	670 mm
Depth	463 mm	570 mm
Weight	20 kg	25 kg

Add 30 mm height for bench mount rubber feet

Options

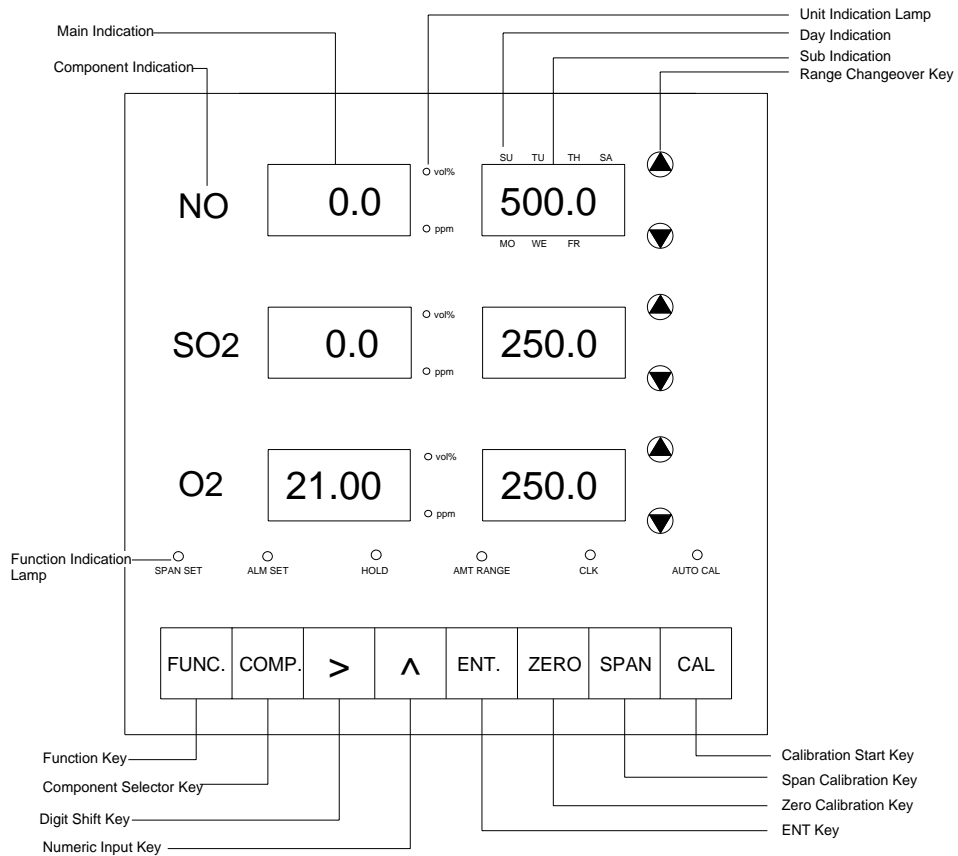
Built-in sample pump with sample filter/flow meter, for non-corrosive applications
Zero/span switching valves
Differential flow analyser
Sample needle valve/flow meter (for pressurised samples only)

2.2 CASE COMPONENTS

Part Name	Description
1.) Grip	Used to pull out the interior (base).
2.) Knurled Knob	Used to fasten the instrument case.
3.) Power Switch	Turn ON to supply power to the internal components (excluding the pump). After 3 or 4 seconds the LED indicator lights up. Refer to pump power supply.
4.) Indication/operation panel	Indicates gas concentration, measuring range, etc., and contains keys necessary for routine operation and settings. Refer to section 5 for operating method.
5.) Flowmeter (option)	Used to check sample gas flow rate. Float rises when sample gas flows.
6.) Sample gas inlet	Connect gas to be measured here.

Part Name	Description
7). Sample gas outlet	Connect pipe for discharging measured gas here.
8). Reference gas inlet	Connect reference gas here in case of differential flow system.
9). Reference gas outlet	Connect pipe here for discharging reference gas.
10). Purge gas inlet	Connect pipe for purge gas here.
11). COMP1 (1st component) input/output terminal	Used for 1st component of standard type and sample switching type or flow differential type.
12). COMP2 (2nd component) input/output terminal	Input/output terminal for 2nd component of two-component analyser.
13). O ₂ input/output terminal (option)	Input/output terminal for O ₂ analyser
14). AUTO CAL input/output terminal (option)	Input/output terminal for auto calibration function.
15). Power terminals	Supply power to the analyser

2.3 OPERATION PANEL



Part Name	Description
1). Component indication	Indicates kind of gas measured.
2). Main indication	Indicates measured concentration. Also indicates various setpoints for alarm function, auto calibration function (option), etc.
3). Unit indication lamp	Indicates unit of measured gas concentration.
4). Day indication	Indicates current day or day of starting by means of bar in auto calibration (option) setting mode. Indication SU MO TU WE TH FR SA Day Sun Mon Tue Wed Thu Fri Sat
5). Sub indication	Indicates measuring range, error code, various setpoints, etc.
6). Range changeover key	Used when changing the range. High range is set when pressing [Δ] and low range is set when pressing [∇].
7). Function indicator lamp	Relevant lamp lights up when following functions are set. MEAS: Lights up in measuring status. SPAN SET: Flashes in calibration concentration setting mode. ALM SET: Flashes in alarm setting mode. HOLD: Flashes in hold setting mode or lights steadily while hold function is activated. RMT RANGE: Flashes in remote range setting mode or lights steadily while remote range function is activated. AUTO CAL: Flashes in auto calibration setting mode or lights steadily while auto calibration function is activated.
8). Function key	Setting mode is changed at each press of this key. (Refer to Section 5.)
9). Component selector key	Set component is changed for each setting mode or span adjustment.
10). Digit shift key	Shift is made from highest toward lowest digit at each press of this key.
11). Numeric input key	Selected digit is incremented at each press of this key.
12). ENT key	By pressing this key after setting, the set contents are memorised and become valid.

Part Name	Description
13). Zero calibration key	Used for zero point calibration. (Lamp flashes in zero calibration mode.)
14). Span calibration key	Used for span calibration. (Lamp flashes in span calibration mode.)
15). Calibration start key	Start key for manual calibration. Zero is calibrated by pressing [ZERO] and [CAL] keys. Span is calibrated by pressing [SPAN] and [CAL] keys. (CAL lamp lights steadily during calibration.)

SECTION 3

INSTALLATION

3.1 MOUNTING METHOD

The following three methods are usable for mounting the analyser.

3.1.1 Mounting Method

Mount so that the front panel is vertical.

3.1.2 Caution on Installation

70% or more of the instrument weight should be supported by the case bottom. (When mounting on a panel or 19 inch rack, attach a support under the rear of the case.)

3.2 SAMPLE TUBING

3.2.1 Tubing Connections

Connect pipes to the gas inlets and outlets located at the top left on the analyser rear.

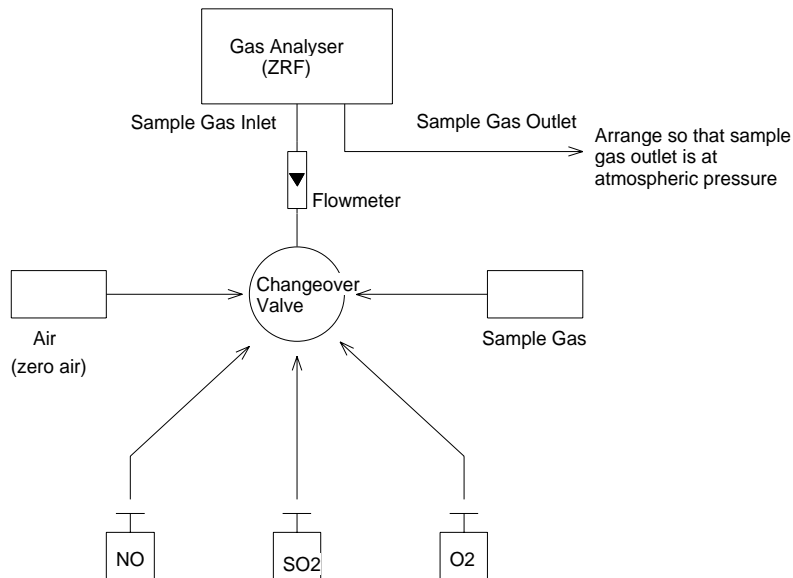
Use corrosion resistant tubes made of teflon, stainless steel, polyethylene or the like for connecting the analyser and sampling system. Avoid using rubber or soft vinyl tubes even if there is no worry about corrosion. Improper piping material may cause inaccurate indication due to adsorption of gas. The pipes should be kept as short as possible to quicken the response. A suitable inner diameter is about 4 mm. Note that dust entering the analyser may cause a malfunction, so be sure to use clean pipes and joints.

Connect the tubing as follows:

Connection	Tubing
Sample Gas Inlet	Connect gas to be analysed
Sample Gas Outlet	Connect tubing for disposal of analysed gas
Reference Gas Inlet	Connect reference gas here for differential flow analysers
Reference Gas Outlet	Connect tubing for disposal of used reference gas
Purge Gas Inlet	Connect purge gas pipe here

3.2.2 Tubing Schematic

Shown next is an example of the configuration for measuring three components (when using Zirconia O₂ analyser).



3.3 SAMPLING

3.3.1 Sample Gas Conditions

- (1) Remove all dust included in sample gas by means of a filter. Use a filter capable of eliminating dust particles of 0.3 μ at the final stage.
- (2) The dew point of sample gas must be lower than the ambient temperature to prevent accumulation of drain inside the analyser. If water vapour is included in the sample gas, then feed the gas through a dehumidifier to lower the dew point to around 0°C.
- (3) If SO₃ mist is included in sample gas, then use a mist filter, cooler etc. to exclude the mist. The same applies if other kinds of mist are included.
- (4) Note that if strongly corrosive gas such as Cl₂, F₂ or HCl is included in sample gas in a large amount it will shorten the service life of the analyser.
- (5) The sample gas temperature should range from 0 to 50°C. Be careful not to introduce a high temperature gas directly into the analyser.

3.3.2 Sample Gas Flow Rate

The sample gas flow rate should be as follows. Provide a flowmeter as shown in the preceding diagram to measure the flow rate.

Analyser Type	Gas Flows
Standard Type	0.5 \pm 0.25 L/min
Sample Switching Type	(1 L/min + 1 L/min) \pm 0.1 L/min (sample gas + reference gas)
Flow Differential Type	(0.5 L/min + 0.5 L/min) \pm 0.25 L/min (sample gas + reference gas)

3.3.3 Calibration Gases

Prepare calibration gases for zero point and span point calibration.

Gas	Comment
Zero Gas	Nitrogen or Zero Air
Span Gas	Gas with concentration of 80% or more of full scale for each component

When using a zirconia O₂ Analyser, use air for zero gas.

Gas	Comment
Zero Gas	Zero Air
Span Gas	1 to 2% O ₂ Gas of 80% or more of full scale for other than Zirconia O ₂ Analyser

3.3.4 Analyser Interior Purging

Although purging of the analyser interior is normally unnecessary, it should be considered in the following cases.

- (1) When combustible gas is included in the measured gas.
- (2) When corrosive gas is included in the atmosphere at the installation site.
- (3) When the same gas as the measured component is included in the atmosphere at the installation site. In such cases, purge the analyser Interior with instrumentation air or N₂. The flow rate for purging should be about 1 L/min.

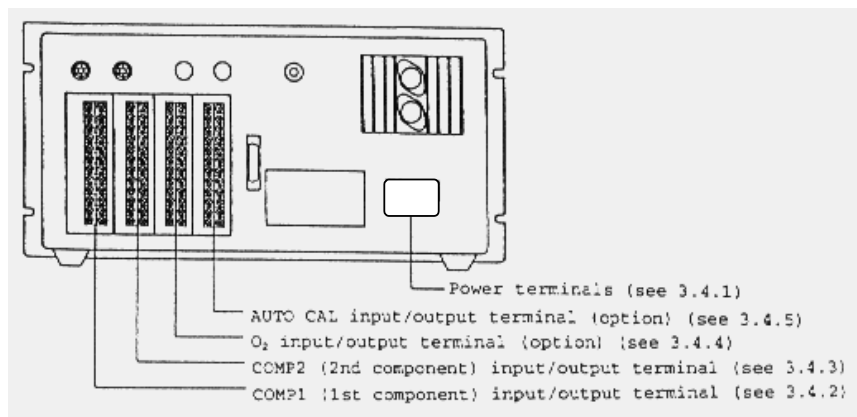
Dust or mist should be completely eliminated from the gas for purging.

3.3.5 Pressure at Sample Gas Outlet

Arrange so that the sample gas outlet is at atmospheric pressure.

3.4 WIRING METHOD

The external terminals are provided on the rear of the instrument. Carry out wiring to each terminal according to the figure. Terminal screws are M3.5 (but power terminals are M4). figure. Use shielded wires for the output signals to suppress the influence of external noise.



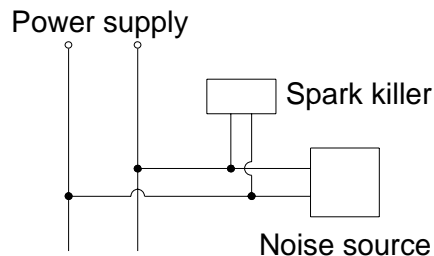
3.4.1 Power Input

The power terminals are arranged as shown in the figure. Connect the specified power supply via the IEEC ac connector on the rear panel. Ensure the unit is earthed.

NOTE: when a noise-generating source is located nearby - avoid installing this analyser near an electrical apparatus which produces power source noise. (Such as high frequency furnace, electric welder, etc.) If use of the analyser near such an apparatus is unavoidable, then keep the power lines separate to avoid noise.

If noise from a relay, solenoid valve or the like enters the power source, then attach a varistor or a spark killer to the noise source as shown in the figure.

Note that attaching the varistor or spark killer away from the noise source will be ineffective.

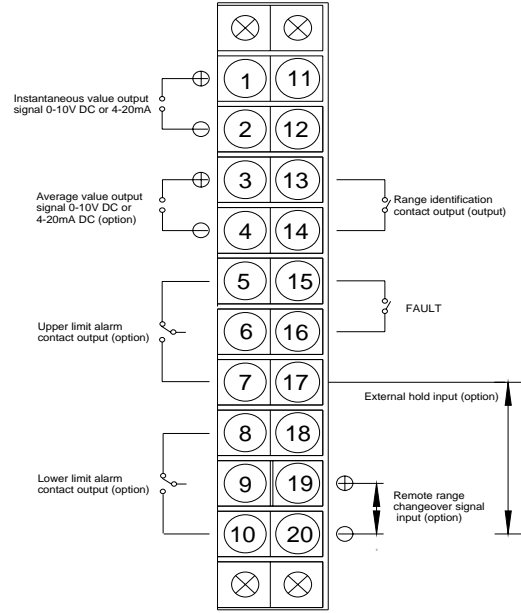


Note: On some units it is possible to initiate a zero and span remotely. This allows you to apply a relevant gas and calibrate against the analyser output (eg when the unit is in a system). Selection of the gas is achieved by connecting the common terminal of the remote control terminal block to either the span or zero terminal. These terminals should remain isolated from external equipment and switched using clean contacts (eg like those on a relay). It will still be necessary to calibrate the unit periodically as described in subsequent sections.

3.4.2 COMP1 (1st component) Input/Output Terminal

This output terminal is used with the standard single-component type, sample switching type or flow differential type.

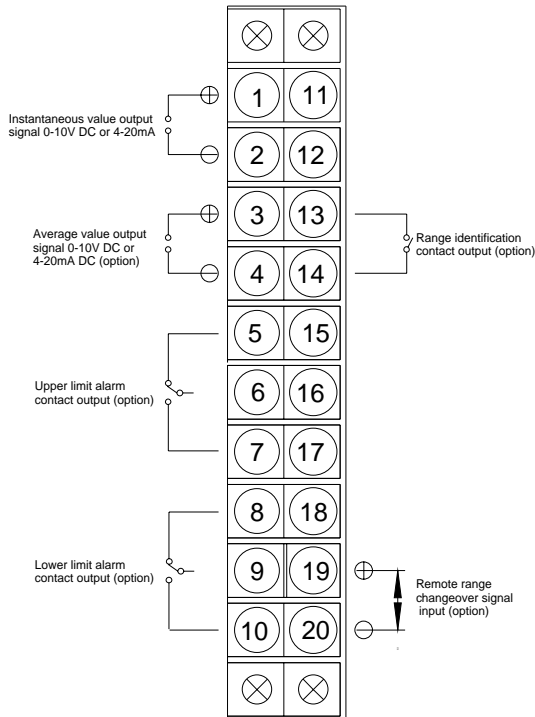
The wiring method is as follows:



3.4.3 COMP2 (2nd component) Input/Output Terminal

This output terminal is for the 2nd component of the standard type.

The wiring method is as follows:



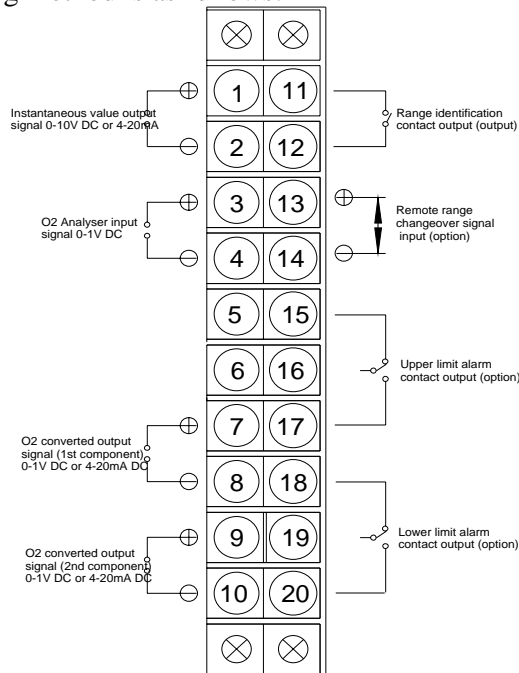
COMP1, COMP2 terminal block

- 1). Instantaneous value output - Instantaneous value of 0-1V DC or 4-20mA DC is outputted.
- 2). Rolling average output (option) - rolling average of 0-1V DC or 4-20mA DC is outputted.
- 3). Upper limit alarm contact output (option) - when signal exceeds upper limit, terminals 5 and 6 turn from on to off and 6 and 7 turn from off to on. Change-over contact 250V AC, 2A (resistive load)
- 4). Lower Limit Alarms Output (option) - when signal is below lower limit, terminals 8 and 9 turn from on to off and 9 and 10 turn from off to on. Change-over contact 250v AC, 2A (resistive load)
- 5). Range identification signal output (option) - terminals 13 and 14 are conductive when 1st range is selected: 13 and 14 are open when 2nd range is selected. Open/closed contact 250V AC, 2A (resistive load)
- 6). Remote range input (option) - 1st range is selected when 5V DC is input to terminals 19 and 20; 2nd range is selected when there is no input to terminals 19 and 20.
- 7). External hold input (output to COMP1 terminal) (option) - hold setting component is outputted and held with 5V DC inputted between 17 and 20.
- 8). Fault (output to COMP1 terminal) - contact output when analyser incurs an abnormality. Open/closed contact 250V AC, 2A (resistive load)

3.4.4 O₂ Input/Output Terminals (option)

This is the input/output terminal for the standard type O₂ analyser.

The wiring method is as follows:



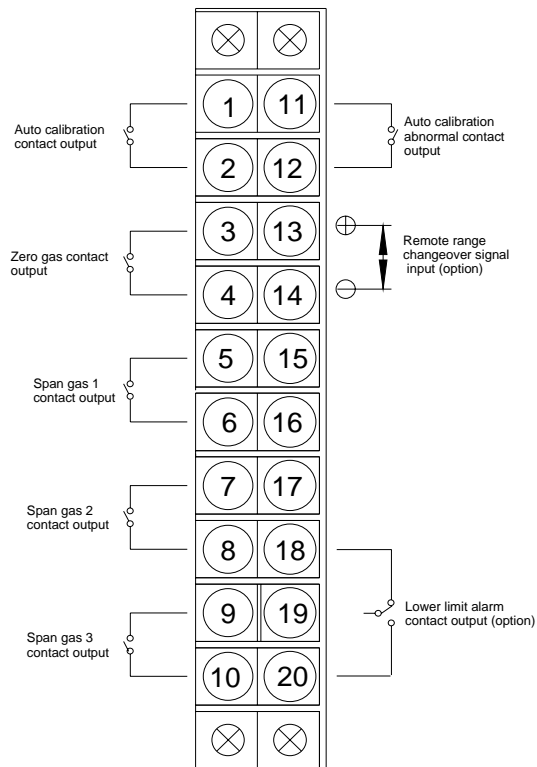
O₂ TERMINAL BLOCK

- 1). Instantaneous value output - instantaneous value of 0-1V DC or 4-20mA DC is outputted.
- 2). O₂ analyser input terminal - O₂ analyser signal of 0-1V DC is inputted.
- 3). O₂ conversion output - O₂ conversion instantaneous value is outputted with pre-set conversion reference value.
- 4). Lower limit alarm contact output (option) - when signal is below lower limit, terminals 15 and 16 turn from on to off and 16 and 17 turn from off to on. Change-over contact 250V AC, 2A (resistive load)
- 5). Range identification contact output (option) - terminals 11 and 12 are conductive when 1st range is selected: 11 and 12 are open when 2nd range is selected. Open/closed contact 250V AC, 2A (resistive load)
- 6). Remote range input (option) - 1st range is selected when 5V DC is input to terminals 13 and 14; 2nd range is selected when there is no input to terminals 13 and 14.

3.4.5 AUTO CAL Input/Output Terminal (option)

This is the output terminal for the auto calibration function.

The wiring method is as follows:



AUTO CAL Terminal Block (option)

- 1). Contact output during auto calibration - contact between 1 and 2 is ON during auto calibration. Open/closed contact, 250V AC, 2A (resistive load)

- 2). Zero gas contact output - contact output for driving solenoid valve for flowing zero gas. Open/closed contact 250v AC, 2A (resistive load)
- 3). Span gas 1 contact output - contact output for driving solenoid valve for flowing 1st component span gas.
- 4). Span gas 2 contact output - contact output for driving solenoid valve for flowing 2nd component span gas. Open/closed contact 250v AC, 2A (resistive load)
- 5). Span gas 3 contact output - contact output for driving solenoid valve for flowing O₂ analyser span gas. Open/closed contact 250V AC, 2A (resistive load)
- 6). Auto calibration abnormal contact output - contact output when abnormality occurs during auto calibration.
- 7). Remote Start Input - input for starting auto calibration via external signal. Calibration started by inputting 5V DC between terminals 13 and 14.

SECTION 4

OPERATION

4.1 OPERATION PROCEDURE

Set up the operational status by the following procedure. Operation is started by using the keys on the front panel of the analyser. Before use, please read through the instruction manual for the analyser.

	Mounting	Section 3.1
	Piping	Section 3.2
	Wiring	Section 3.4
	Tubing Check	Section 4.2
	Purging of Analyser Interior	Section 4.2
	Turning on Power	Section 4.2
Routine Operation	Alarm Setting Value	Section 5.2
	Hold Setting	Section 5.2
	Remote Range Setting	Section 5.2
	Auto Calibration Setting	Section 5.2
	Concentration Setting for zero air and span gas	Section 5.2
	Zero and span calibration	Section 5.2
	Key Lock Setting	Section 5.2
	Sample Gas Introduction	Section 4.3

4.2 PREPARATION FOR OPERATION

4.2.1 Checking Tubing

Check that tubing has been connected correctly.

4.2.2 Purging of Analyser Interior

When purging is necessary, flow purge gas for about 3 hours before turning on power.

4.2.3 Turning on Power

Turn on the power switch and indication will appear in a few seconds.

4.2.4 Turn on Pump Power Supply

When the optional pump is provided, then pull out the base and turn on the pump power supply.

4.2.5 Warm-up

Flow the zero gas and warm up the instrument. The warm-up is completed when the zero point stabilises (about 4 hours).

4.2.6 Concentration Setting for Calibration Gas

Next set the concentration for the calibration gas. Refer to Section 5.2.1 and Section 5.2.2 for the procedure.

4.2.7 Zero Calibration

Flow zero calibration gas and calibrate the zero point. Refer to Section 5.2.8 for the key operation for zero calibration.

4.2.8 Span Calibration

Flow span calibration gas and calibrate the span. Refer to Section 5.2.9 for the key operation for span calibration.

4.3 START OF MEASUREMENT

Flow the sample gas to start measurement.

4.4 SHUTDOWN

Stop the flow of sample gas, and flow zero gas for 10 minutes to purge the interior of the measuring cell. Then turn off the power switch of the instrument. When a pump is fitted, also turn off the pump power supply.

* The set values are retained in the memory even when power is turned off. But note that with the clock function of the auto calibration function, the backup fails to work after 48 hours has elapsed, so when the power is turned on again, the correct time must be re-input.

SECTION 5

OPERATION OF INDICATION/OPERATION PANEL

5.1 OUTLINE OF INDICATION/OPERATION PANEL

This panel consists of the following functions.

Function & Key Operation	Main Indication	Sub Indication	Function Lamp	Page
	<p>Measured Value</p> <p>Zero point calibration density (with zirconia O₂)</p> <p>Span point calibration density</p> <p>O. CAL (with O₂ meter)</p> <p>S. CAL</p> <p>Lo 2P Hi 2P</p> <p>His</p> <p>Hold</p> <p>r. rAG</p>	<p>Range</p> <p>Range</p> <p>Range</p> <p>Set Value</p> <p>Set Value</p> <p>Alarm Value</p> <p>Hysteresis Value</p> <p>ON or OFF</p> <p>ON or OFF</p>	<p>MEAS lamp ON</p>	

When the setting mode is assumed, the analogue output signal is held at the value just before entering this mode.

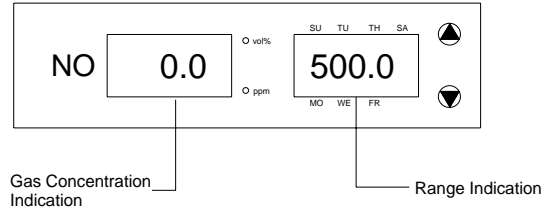
When optional functions are not provided, the contents of these functions are not indicated.

SECTION 6

OPERATION

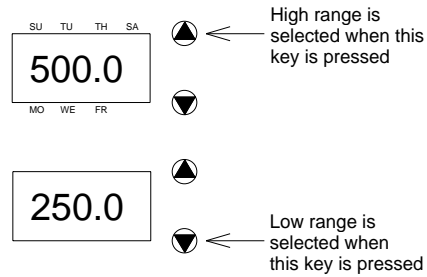
6.1 GENERAL OPERATION

The measuring mode is assumed when power is turned ON. The gas concentration appears on the main indication, while the range being used appears on the range indicate sub indication.



6.1.1 Advice on Operation

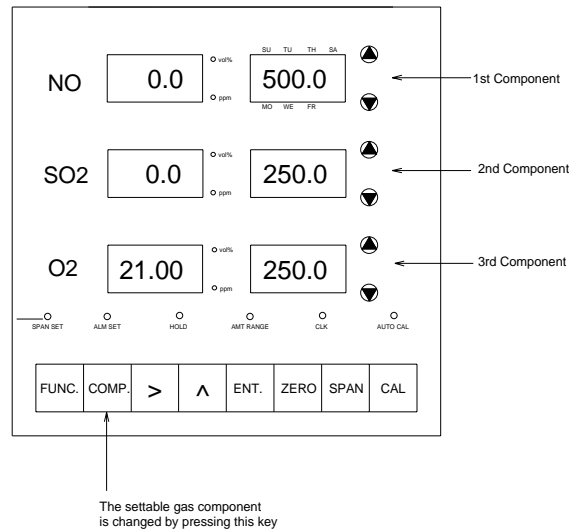
When selecting the range in the setting status, as shown in the figure at the right, the high range is selected when key is pressed, while the low range is selected when [Δ] key is pressed.



When selecting the gas component in the setting status, as shown in the figure at the right, the gas component can be set by pressing [COMP] key.

Example: When [COMP] key is pressed while the 1st component is flashing, the flashing moves to the 2nd component (figure at right). The setting for the 2nd component is now changeable.

* [COMP] key is not provided for single-component analyser.



* For releasing zero or span

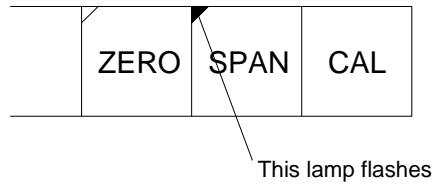
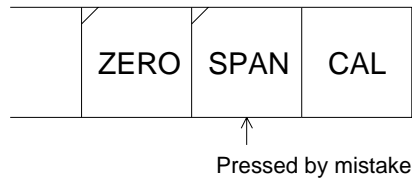
If a mistake has been made in zero or span calibration. then perform a reset in the following way.

The figure at the right shows an example.

If [SPAN] key has been pressed mistakenly instead of [ZERO] key, then press [SPAN] key again. Calibration is cleared.

If [ZERO] key has been pressed mistakenly instead of [SPAN] key, then press [ZERO] key again. Calibration is cleared.

* To clear moving average, press the [^] key 3 times while pressing the [>] key in measurement mode. The data of each moving average is cleared.



Press again and the lamp will go out. the resetting is now finished, so press the [ZERO] key.

6.2 CALIBRATION (WHEN NOT USING ZIRCONIA O₂ ANALYSER)

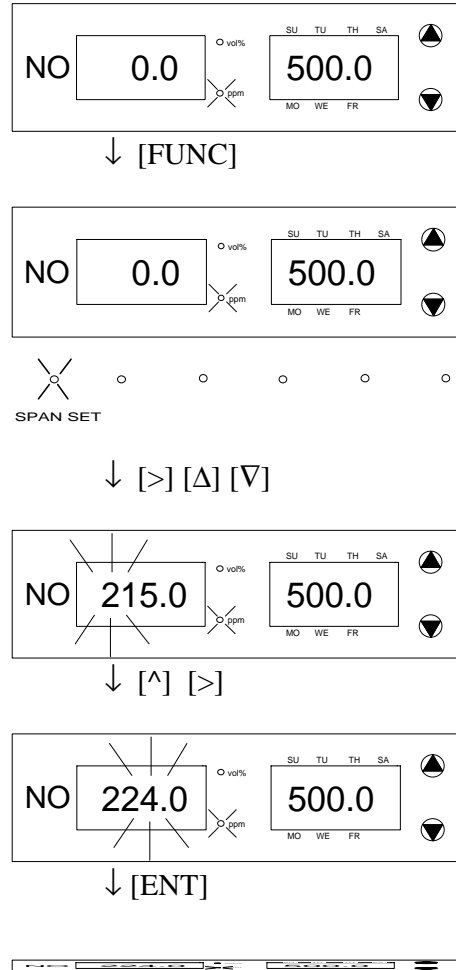
When not using a Zirconia O₂ analyser, then set a span value for the calibration concentration setting. (Zero point calibration concentration is fixed at zero.) Set the calibration gas concentration (span value). When [FUNC] key is pressed in the measuring status, the previously set span value will appear on the main indication.

The SPAN SET LED of the function indicating lamps will flash. By pressing the [>] key, the highest digit of the main indication for the 1st component will flash, and the span value can now be set.

Select a range with the [Δ] [∇] keys. After selecting the range, set a span value in this status. The numeric value will be incremented by pressing [^] key. The digit to be set can be selected by pressing [>] key.

For selecting the 2nd and subsequent components and the range. Press the [>] key and while the main indication for the 1st component is flashing, press the [COMP] key and then the main indication for the component to be set will flash. Now press the [Δ] [∇] keys to select the range to be set.

When the span value has been set, press the [ENT] key. Setting operation is now completed.



6.2.1 Setting of Single Zero Calibration

This setting operation is used to select a zero calibration component. This function is invalid when O₂ component is not included.

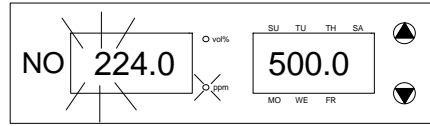
Press the [>] key in span setting mode.
The first digit in the main indication flickers.

Press the [CAL] key. "O.CAL" appears in the main indication and "O" appears in the sub indication.

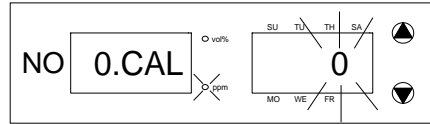
At each press of the [^] key, the setting is changed in the order of 0 - 1 - 2 - 0.

After selecting, press the [ENT] key. The data is stored in memory.

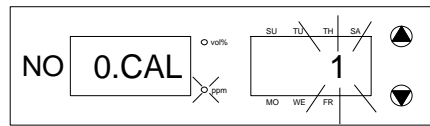
↓ [>]



↓ [CAL]



↓ [^]



Select Code	Zero Calibration	
	Manual Calibration	Auto Calibration
0	Calibration of all components	Calibration of all components
1	Calibration of components other than O ₂	Calibration of components other than O ₂
2	Calibration of O ₂	Calibration of components other than O ₂

Note 1. This mode is invalid when O₂ component is not included.

Note 2. The main indication flickers when zero calibration ([ZERO] + [CAL]) is made on selected components.

6.2.2 Setting of Single Calibration of all or each range

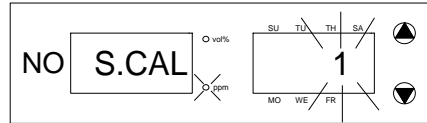
This setting operation is used for calibration of all or each range during zero/span calibration.

Perform setting in the following way. By pressing E key while the highest digit of the main indication for the 1st component is flashing, then ' S.CAL ' will appear on the main indication and '1' will appear on the sub indication. Press [^] key and '1' will change to '0'.

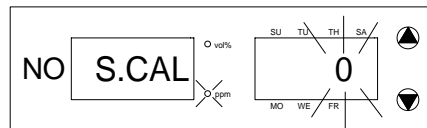
= Meaning of set values =

- 0: The calibration is valid only for the selected range, and zero and span calibration can be made independently for each range.
- 1: By conducting zero and span calibration for one range, the calibration will be done automatically for the other ranges as well.

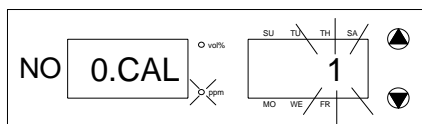
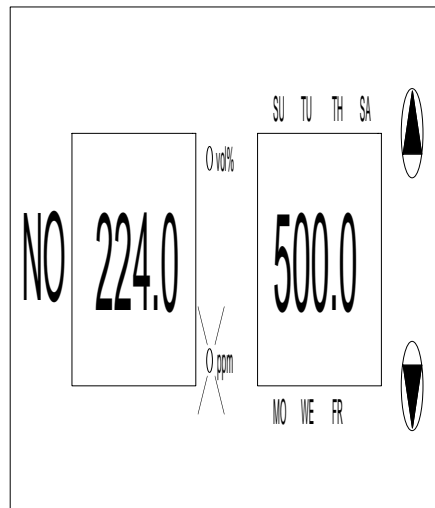
When the selection has been finished, press the K key.



↓ [^]



↓ [ENT]



↓ [CAL]

6.3 CALIBRATION (WHEN USING ZIRCONIA O₂ ANALYSER)

When a zirconia O₂ analyser is provided, set the zero (air) point and the span calibration concentration for each component of the O₂ analyser.

* Setting of calibration concentration for zero (air) point

The zero (air) point calibration concentration is settable for the O₂ analyser alone. The zero point calibration concentration for components other than for the O₂ analyser is fixed at zero. By pressing the E key in the measuring status, the calibration concentration previously set for the zero (air) point will appear on the main indication. The SPAN SET LED of the function indicating lamps will flash.

Press the [Δ] [∇] keys to select a range.

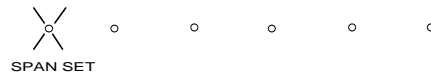
By pressing the [>] key, the 2nd highest digit of the main indication of the O₂ analyser will flash, and zero point setting is enabled.

The numeric value will be incremented by pressing [^] key.

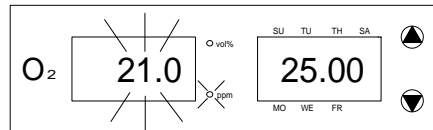
The digit to be set is selected by pressing [>] key.

Setting ranges are 20.0 to 21.9 vol. % for high range and 7.0 to 21.9 vol % for low range.
Set the same air concentration for both high and low range.

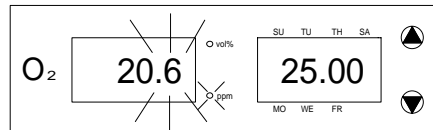
Press the [ENT] key after setting the zero point. Setting operation is now completed.



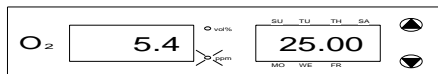
↓ [>]



↓ [^] [>]

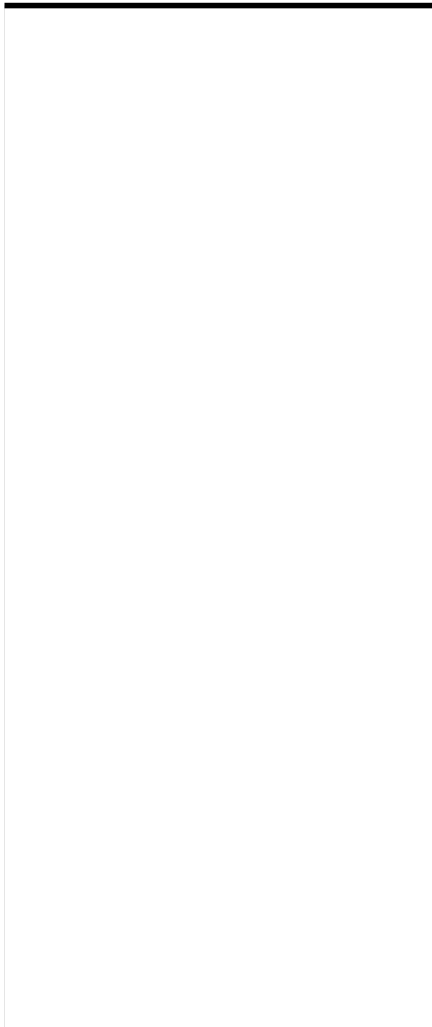


↓ [ENT]



↓ [FUNC]





6.3.1 Setting of Span Calibration Concentration

Press the [CAL] key in the status where the digit of the O₂ analyser main indication is flashing via the zero (air) point calibration concentration setting. The previously set span value will now appear on the main indication.

The SPAN SET LED of the function indicating lamps will flash.

The highest digit of the 1st component main indication will flash and the span value is now settable.

Press the [Δ] [∇] keys to select a range.

When the range has been selected, set a span value in this status.

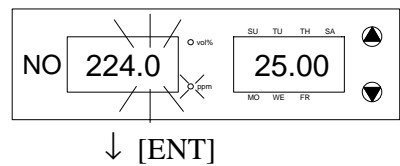
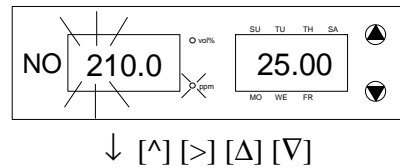
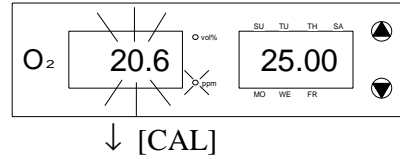
The numeric value will be incremented by pressing [^] key.

Press the [>] key and the digit to be set can be selected.

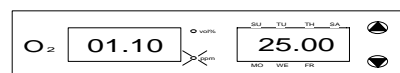
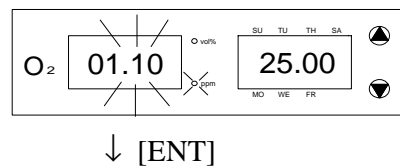
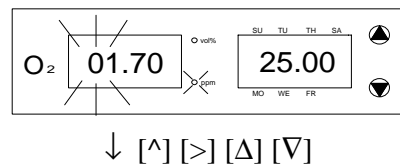
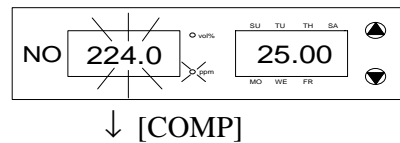
For selecting the 2nd and subsequent components and the range, press the [>] key and in the status where the 1st component main indication is flashing, press the [COMP] key and the main indication for the component to be set will flash. Press the [Δ] [∇] keys to select the range to be set.

Press the [ENT] key after setting the span value. Setting operation is now completed.

Setting for each component



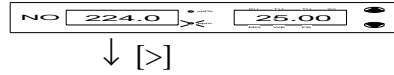
Setting of O₂ Analyser



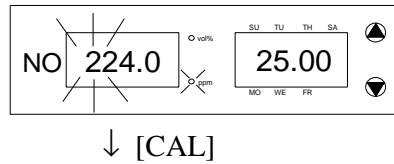
6.3.2 Setting of Single Zero Calibration

This setting operation is used to select a zero calibration component. This function is invalid when O₂ component is not included.

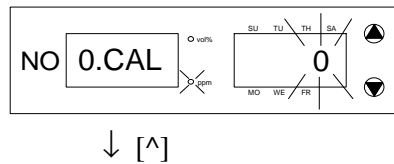
Press the [>] key in span setting mode. The first digit in the main indication flickers.



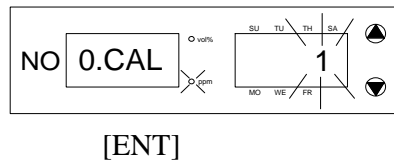
Press the [CAL] key. 'O.CAL' appears in the main indication and 'O' appears in the sub indication.



At each press of the [^] key, the setting is changed in the order of 0 - 1 - 2 - 0.



After selecting, press the [ENT] key. The data is stored in memory.



Meaning of set value

Select Code	Zero Calibration	
	Manual Calibration	Auto Calibration
0	Calibration of all components	Calibration of all components
1	Calibration of components other than O ₂	Calibration of components other than O ₂
2	Calibration of O ₂	

Note 1) This mode is invalid when O₂ component is not included.

Note 2) The main indication flickers when zero calibration ([ZERO] + [CAL]) is made on selected components.

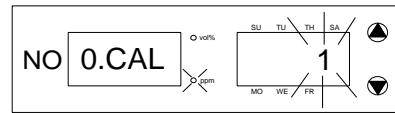
6.3.3 Setting of Single Calibration of all or each Range

This setting operation is used for calibration of all or each range during zero/span Calibration.

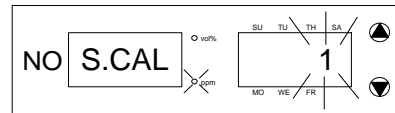
Carry out the setting as follows.

By pressing [CAL] key while the highest digit of the 1st component main indication is flashing, 'S.CAL' will appear on the main indication and '1' will appear on the sub indication.

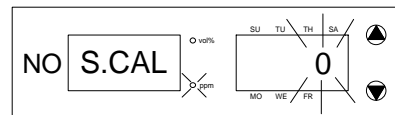
Press [^] key and '1' will change to '0'.



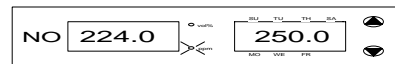
↓ [CAL]



↓ [^]



↓ [ENT]



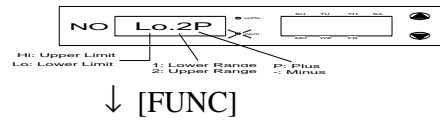
Meaning of set values

- | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>0: The calibration is valid only for the selected range, and zero and span calibration can be made independently for each range.</p> <p>1: By conducting zero and span calibration for one range, the calibration will be done automatically for the other ranges as well.</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Press the [ENT] key when the selection is finished.

6.4 ALARM VALUE SETTING (option)

Set the upper and lower limit alarms and output an alarm. Setting can be made for each component and each range.



Press [FUNC] key in the measuring status and 'Lo.XX' will be indicated. The ALM SET LED of the function indicating lamps will flash.

Press the [>] key and then alarm values are settable. The highest two digits of the main indication will flash.

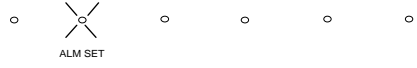
Press the [COMP] key and select the gas component for which alarms will be set. Press [Δ] [∇] keys and select the range.)

Press the [^] key and select either the upper or lower limit alarm.

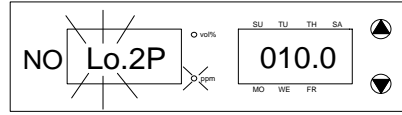
'Lo ' indication appears when lower limit alarm is to be set and 'H ,' indication appears when upper limit alarm is to be set.

Press the [>] key and the lowest digit flashes, so press the [^] key to select either plus ('P ') or minus ('-') for the set value. Press the [>] key and the highest digit of the main indication flashes, so set an alarm value. The numeric value is incremented by pressing [^] key. Press the [>] key and the digit can be selected. The setting operation is now complete.

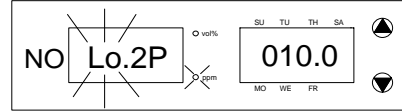
When the alarm setting is finished, press the [ENT] key. Setting is now completed.



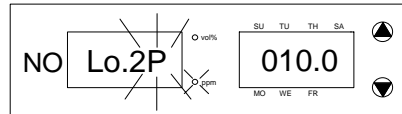
↓ [>] ([COMP] [Δ] [∇])



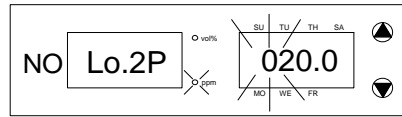
↓ [^]



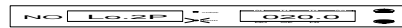
↓ [>] [^]



↓ [>] ([^] [>])



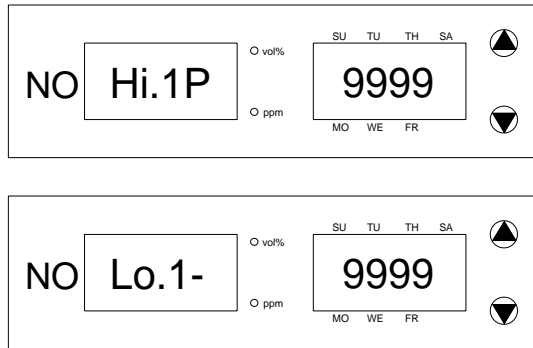
↓ [ENT]



CAUTION

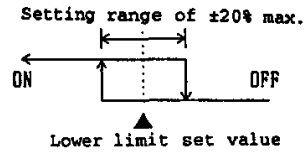
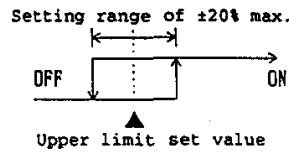
ALARM VALUES ARE SETTABLE WITHIN THE SELECTED RANGE. NOTE THAT THE UPPER LIMIT ALARM CANNOT BE SET BELOW THE LOWER LIMIT ALARM. IF THE LOWER LIMIT ALARM IS SET ABOVE THE ALREADY MEMORISED UPPER LIMIT ALARM, THEN THE UPPER LIMIT ALARM WILL BECOME THE SAME VALUE AS THE NEWLY SET LOWER LIMIT ALARM.

To make the alarm function invalid then set the upper limit alarm value to '9999' and the lower limit alarm value to '-9999' for each component and each range.



6.4.1 Hysteresis Setting

Set a hysteresis versus the alarm value.



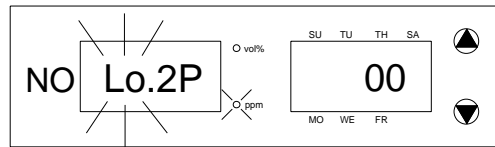
When [CAL] key is pressed in the alarm setting status, 'H ,S' will appear on the main indication.

This is the mode for setting the hysteresis for the alarm value.

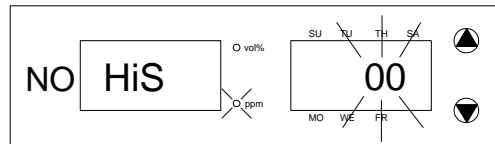
Change the hysteresis value on the sub indication by pressing the [^] key.

The hysteresis is settable in 1% steps in a range of ± 0 to $\pm 20\%$ versus the measuring range. The indication changes from 0 → 1 → 2.....10 → 20 → 0 →.....

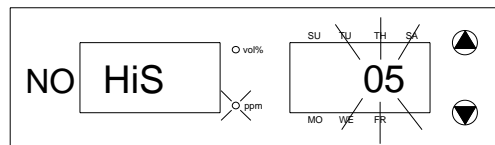
Press the [ENT] key when the setting is finished.



↓ [CAL]



↓ [^]



↓ [ENT]



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6.5 HOLD SETTING

This is used when calibrating for holding the output signal at the value just before entering calibration. (The indication is not held.) The hold function is settable for each component.

↓ [FUNC]

Set to OFF when not using.

Press the [FUNC] key in the measuring status and 'Hold' will be indicated.

The HOLD LED of the function indicating lamps will flash.

Press the [>] key and the hold function will be settable.

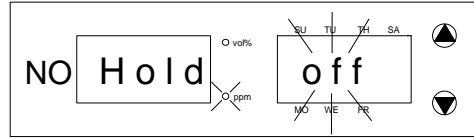
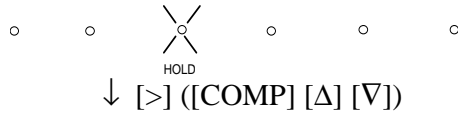
The sub indication will flash.

Press the [COMP] keys and select a setting component.

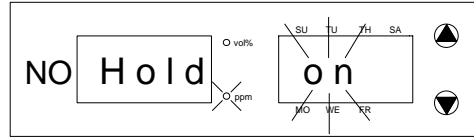
Select hold 'on' or 'off' by pressing the [^] key.

Press the [ENT] key after setting the hold function. The setting operation is now completed.

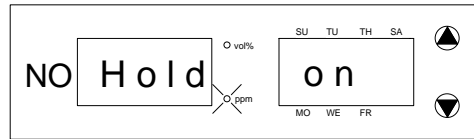
At hold ON, the HOLD of the function indicating lamp will light steadily while the hold function is activated. The unit indicating lamp flickers only for components which have been set. This lamp goes off at hold OFF.



↓ [^]



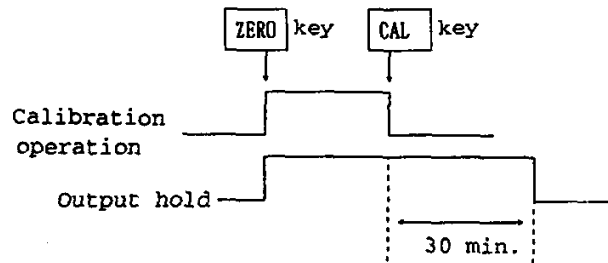
↓ [ENT]



6.5.1 Output Hold Functions after Manual Calibration

The following shows the output hold function after manual calibration zero or span). The hold function is cleared automatically after 30 minutes or it can be cleared by key operation (manual).

1. Operation



2). Clear Operation

a). Auto clear

Press the [ZERO] key or [SPAN] key after hold setting (ON/OFF). Output hold is started and calibration is completed with [CAL] key. Then, the hold function is automatically cleared after 30 minutes.

b). Manual clear

The hold function is cleared manually by pressing the [ENT] key and [CAL] key at the same time.

Note 1) During auto calibration, the Contact output between terminals 1 and 2 does not operate when it is under manual calibration.

Note 2) Output hold is effective only for pre-set components.

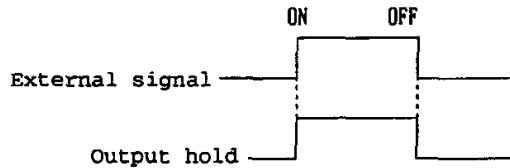
6.5.2 Output Hold Function under Auto Calibration

Output hold function under auto calibration and replacement time. For operation, refer to Item 6.

6.5.3 External Hold Function (option)

The following operation is used for output hold with external signals.

1. Operation



2. Operation method

By putting 5V DC between the 1st component input/output terminals 17 and 20 ('+' and '-'), only the component pre-set by the front key will be operated..

Note 1) The indication during operation is the same as that of hold calibration.

Note 2) This function is effective only when alarm, remote range or range detect function is used as an option. (When using the supplied function, be sure to contact Rotork Analysis because the hardware is different.)

Note 3) This function is effective only for the standard type No. 1 and 2 range analysers and flow differential type.

6.6 REMOTE RANGE SETTING (option)

This is used for selecting the range via an external signal. This setting should be OFF when remote range is not used. Press the [FUNC] key in the measuring status and 'rrAG' will be indicated. The RMT RANGE LED of the function indicating lamps will flash.

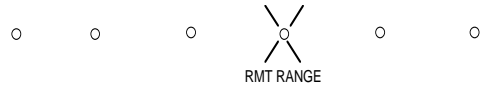
↓ [FUNC]

Press the S key and the remote range function is settable. The sub indication will flash.

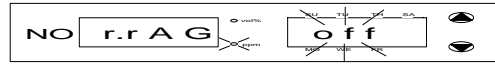
Select the remote range 'on' or 'off' by pressing the [^] key. The setting is valid for all the components. Press the [ENT] key when the remote range setting is finished. The setting operation is now completed.

When the remote range function is set ON, the RMT RANGE LED of the function indicating lamps will remain lit, and the [Δ] [∇] keys will be unusable for range selection.

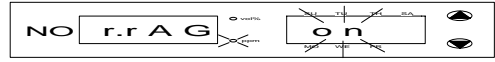
By inputting 5V DC between the remote in terminals 13 and 14, the No. 1 range selected. No. 2 range is selected when 5V DC input applied to the remote input terminals 13 and 14.



↓ [>]

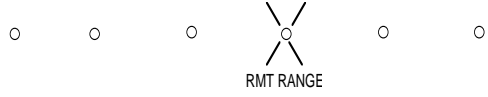


↓ [^]



↓ [ENT]





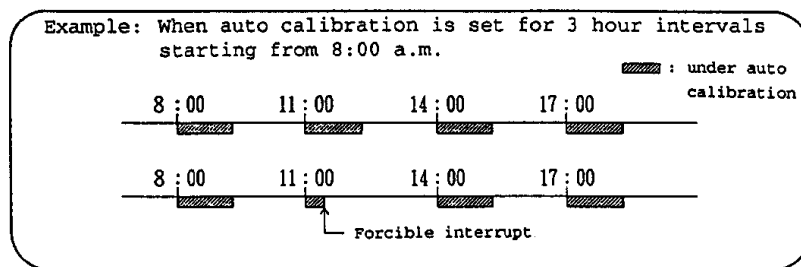
6.7 AUTO CALIBRATION (option)

As an option with this analyser, the signals from the input/output terminals on the rear panel can be used for driving an external solenoid valve and introducing standard gas, whereby zero point and span can be calibrated automatically.

The auto calibration is done according to Section 6.1 Current Time Setting, Section 6.2 Auto Calibration Start Time, Section 6.3 Auto Calibration Cycle, Section 6.4 Calibration Gas Flow Time, Section 6.5 Calibration Gas Flow Mode and Section 6.6 Auto calibration ON/OFF setting.

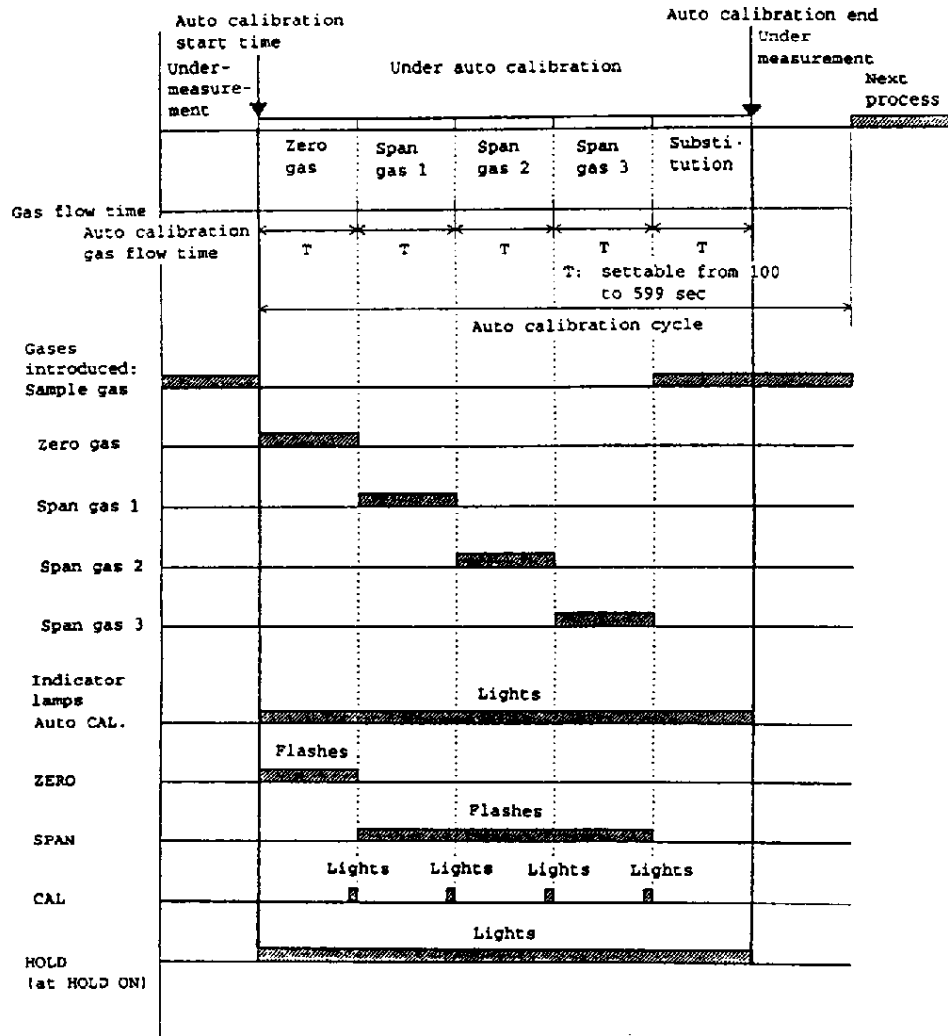
CAUTION ON OPERATION

1. When the auto calibration start time is reached during key operation, the auto calibration is given priority and is started. All key operation will be invalid until the auto calibration is finished.
2. To forcibly interrupt the auto calibration in progress, press both the [ENT] and [CAL] keys simultaneously. After the forcible interrupt, the measuring mode is resumed and all the keys are operable. Although the current auto calibration will be passed over, it will be started from the initially set cycle from the next time onward.



3. Key operation is possible while calibration is not under way with the auto calibration function set. Therefore all settings (of span, hold, remote range, time, etc.) including manual calibration can be made. Out note that if the wrong time is set on the clock, the auto calibration will not be started at the correct time.
4. Auto calibration is able to start by applying remote start signal, 5V DC longer than 100 msec, to remote start input terminals. In this case, auto calibration will start independent to its ON/OFF setting.

Example where Auto Calibration gas flow mode 5 is set



Auto calibration abnormality: if an abnormality occurs during auto calibration, a contact signal for auto calibration abnormality will be output from the input/output terminals on the rear of the analyser. The gas which incurred the abnormality will not be calibrated, and instead the next component will be calibrated.

6.7.1 Current Time Setting

Set the current time and day of the week.

Press the [FUNC] key in the measuring status. The AUTO CAL LED of the function indicating lamps will flash.

↓ [FUNC]

The main indication shows the hour and minute via a 24-hour indication and the decimal point flashes. A ' - ' bar lights up at the relevant on the sub indication.

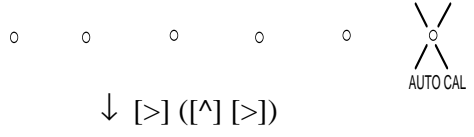
Indication	SU MO TU WE TH FR SA
Day	Sun Mon Tue Wed Thu Fri Sat

Press the [>] key and the time is now settable. The highest two digits of the main indication will flash. The numeric value is incremented by pressing the [^] key. Press the [>] key and the digit can be selected.

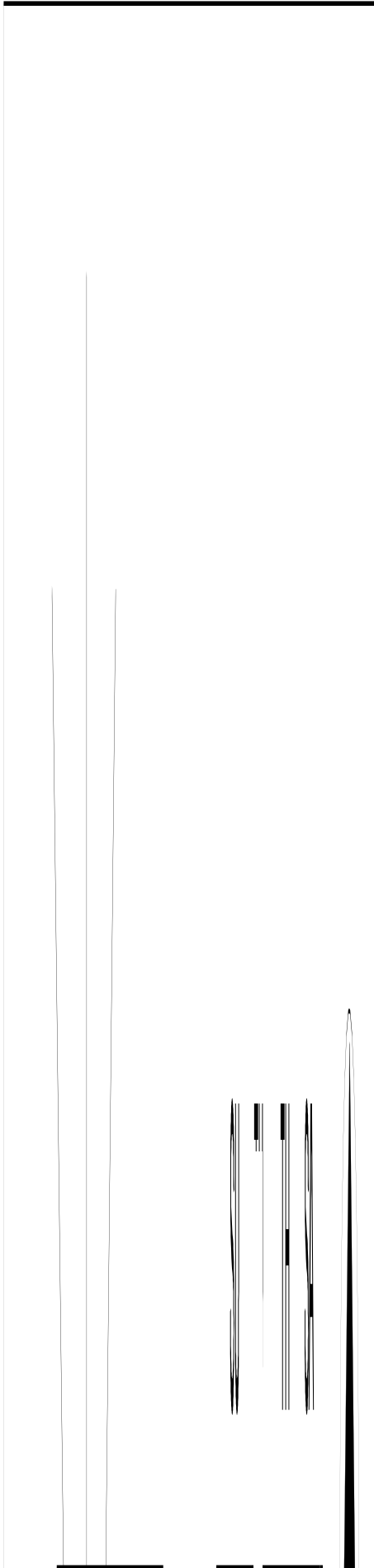
After the time setting, press [>] key and the day is settable on the sub indication. The bar indication will flash.

Press the [^] key and the bar will shift. Press the [ENT] key when the time and day setting is finished. The data is stored in memory.

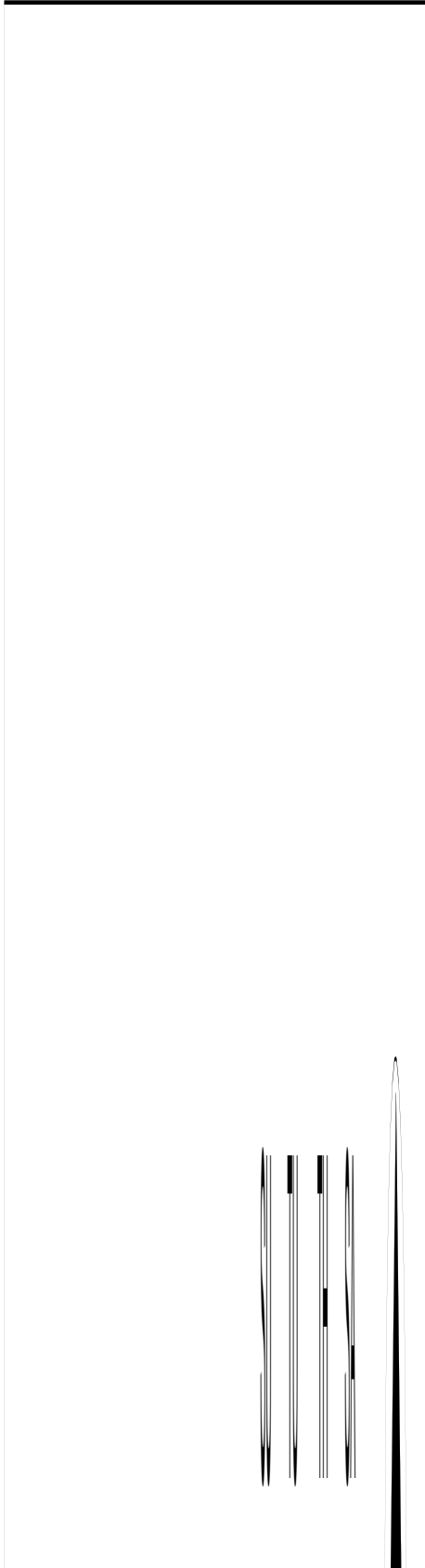
Time starts from the point where [ENT] key is pressed.

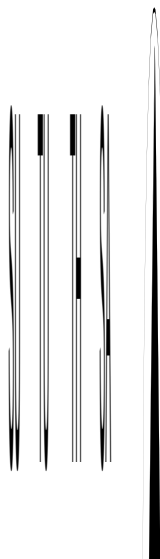
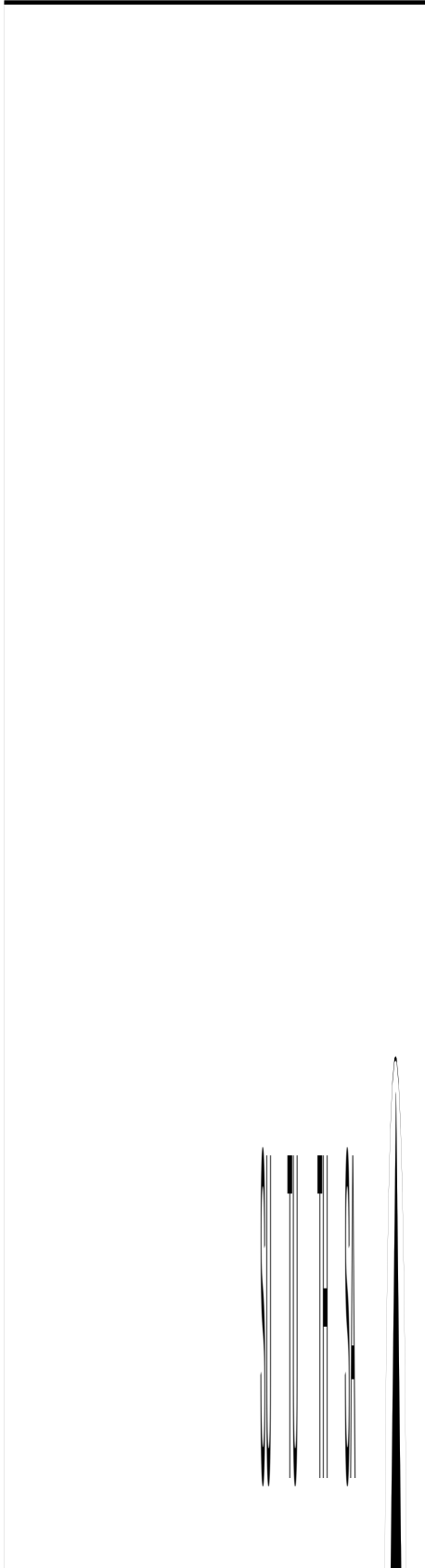


↓ [>] ([^])



↓ [ENT]





6.7.2 Auto Calibration Start Time Setting

When [FUNC] key is pressed at the current time indication, the auto calibration start time and day will appear on the main and sub indications. The AUTO CAL LED of the function indicating lamps will flash. In the case of start time, the decimal point on the main indication will light steadily.

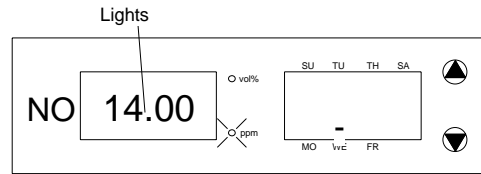
Press the [>] key and the auto calibration start time is settable, so set a start time on the main indication. The numeric value is incremented by pressing the [^] key. Press the [>] key and the digit can be selected.

After setting the calibration start time, press the [>] key and the calibration start day can be set on the sub indication. The bar indication will flash. Press the [^] key and the bar will shift.

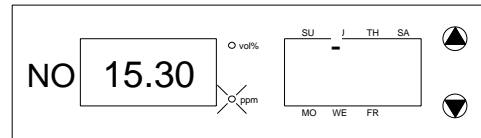
The auto calibration start time is to one week ahead.

When the auto calibration start time and day have been set, press the [ENT] key. The data is stored in memory.

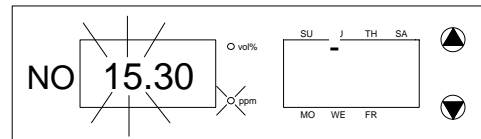
When the auto calibration at the set time is finished, the next auto calibration start time will be set automatically. To confirm the next auto calibration start time, then carry out this operation and check the indication.



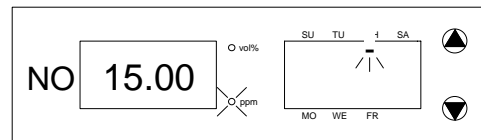
↓ [FUNC]



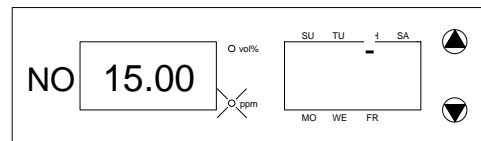
↓ [>] ([^] [>])



↓ [>] ([^])



↓ [ENT]



6.7.3 Auto Calibration Cycle Setting

The calibration cycle is settable in either 'days' or 'hours'. Press the [FUNC] key at the calibration start time indication and 'CYCL' will appear. The AUTO CAL LED of the function indicating lamps will flash.

Press the [>] key and the auto calibration cycle is settable. The highest digit on the sub indication will flash. Select either 'days' or 'hours' by pressing the [^] key.

'd' appears on the sub indication when selecting 'days' and 'H' appears when selecting 'hours'.

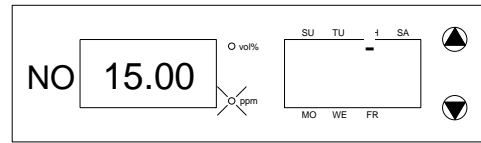
Press the [>] key and the calibration cycle can be set in the lower digits of the sub indication.

The numeric value is incremented by pressing the [^] key. Press the [>] key and the digit can be selected.

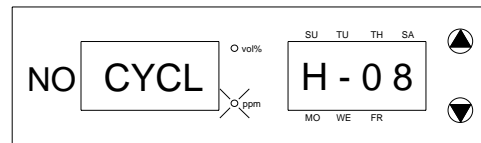
Day is settable in a range of 1 to 7 days. Hour is settable in a range of 1 to 99 hours.

NOTE: If '00' (hours) is set, it will be automatically set to '1' (hour).

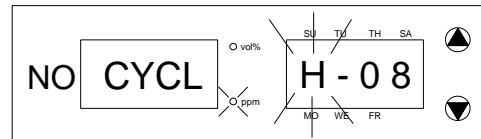
Press the [ENT] key when the calibration cycle has been set. The data is stored in memory.



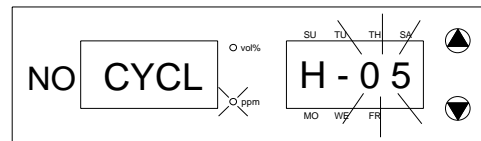
↓ [FUNC]



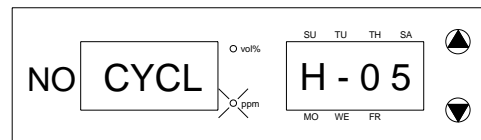
↓ [>] ([^])



↓ [>] ([^] [>])



↓ [ENT]



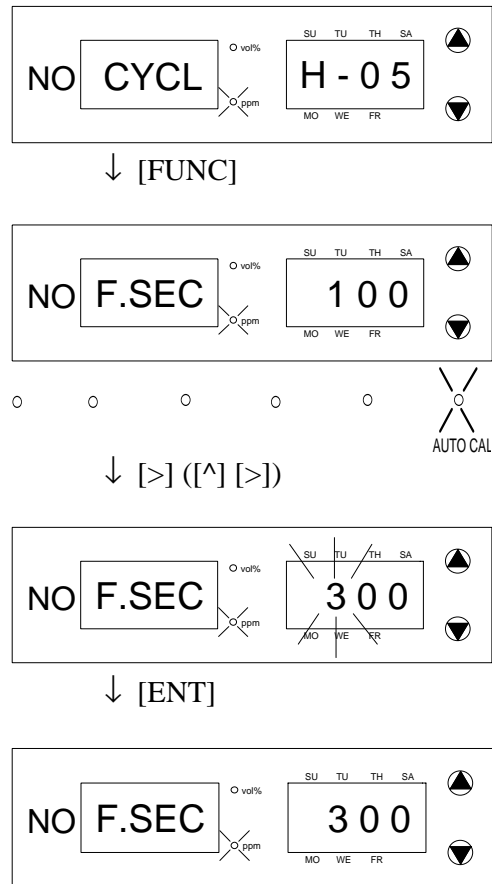
6.7.4 Calibration Gas Flow Time Setting

Press the [FUNC] key at the calibration cycle indication and ' F.SECOND ' will appear. The AUTO CAL LED of the function indicating lamps will flash. Press the [>] key and the auto calibration gas flow time is settable. Set the flow time on the sub indication. The numeric value is incremented by pressing the [^] key. Press the [>] key and the digit can be selected.

The setting range is 100 to seconds.

Press the [ENT] key when the calibration gas flow time has been set. The data is stored in memory.

The time set in this mode is common to all the calibration gas flow time including replacement time.



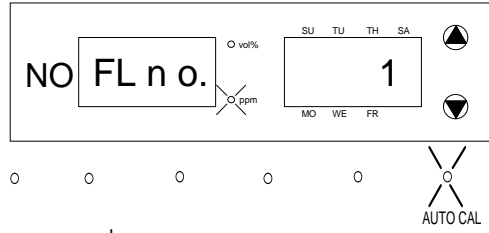
6.7.5 Calibration Gas Flow Mode Setting

Select a calibration gas flow mode according to the number of components to be calibrated. Press the [FUNC] key at the calibration gas flow time indication and 'Fl no ' will appear.

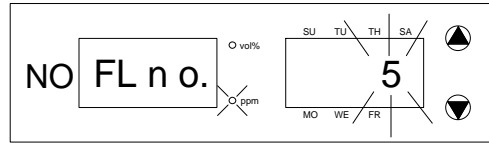
The AUTO CAL LED of the function indicating lamps will flash. Press the [>] key and the auto calibration gas flow time is settable. Set the flow mode no. by pressing the [^] key. (See the table below for the meaning of the flow mode no.)

Press the [ENT] key when the calibration gas flow mode has been set. The data is stored in memory.

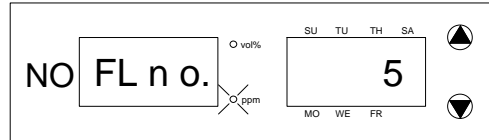
↓ [FUNC]



↓ [>] ([^])



↓ [ENT]



Meaning of flow modes

Mode	Sequence
1	Zero gas
2	Zero gas 1st component span gas
3	Zero gas 1st component span gas 2 component span gas
4	Zero gas 1st component span gas 2nd components span gas (O ₂)
5	Zero gas 1st component 2nd component span gas 3rd component span gas (O ₂)

6.7.6 Auto Calibration ON/OFF Setting

Select whether or not to carry out auto calibration. Set to ' o f f ' when calibration will not be made. Press the [FUNC] key at the calibration gas flow mode indication and ' A.CAL ' will be appear.

The AUTO CAL LED of the function indicating lamps will flash.

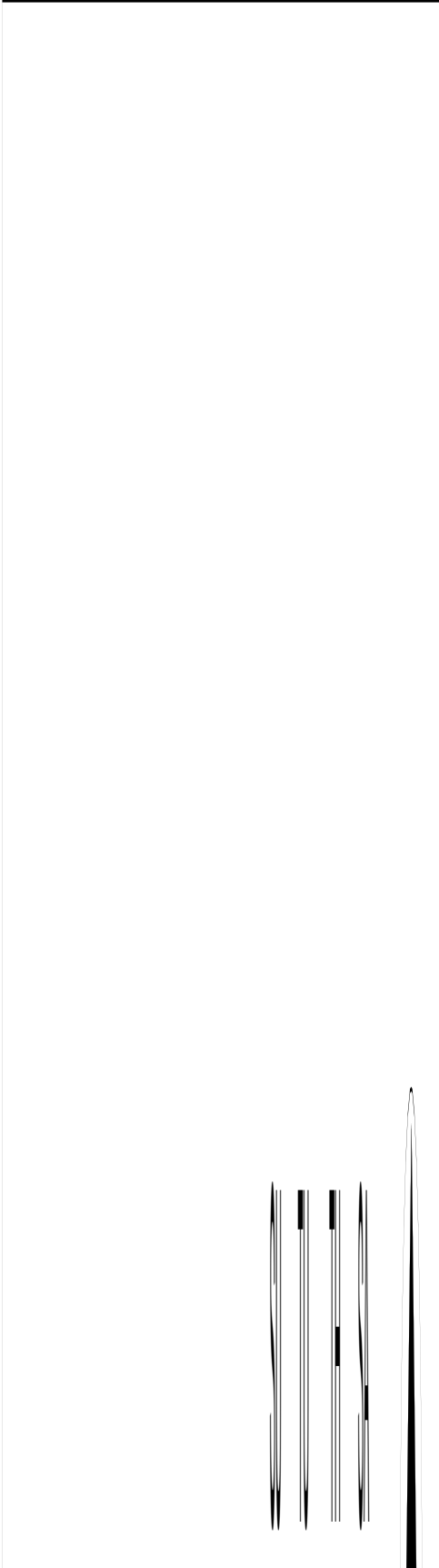
Press the [>] key and auto calibration ON or OFF can be set.

Select either ' on ' or ' off ' on the sub indication by pressing the [^] key.

When the auto calibration ON/OFF setting is finished, press the [ENT] key.

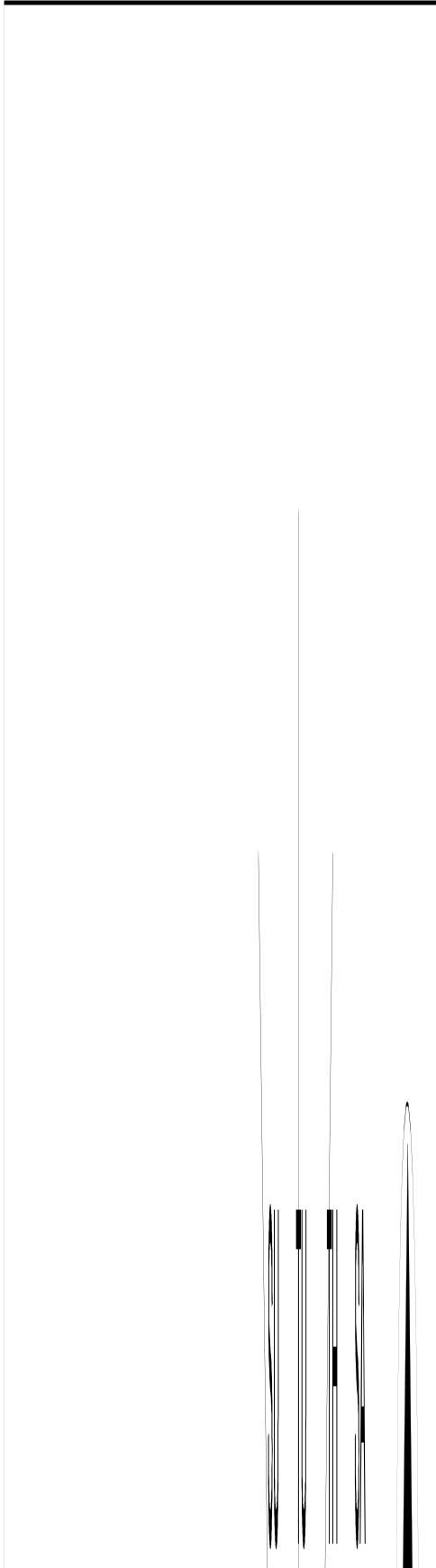
The setting operation is now completed.

↓ [FUNC]

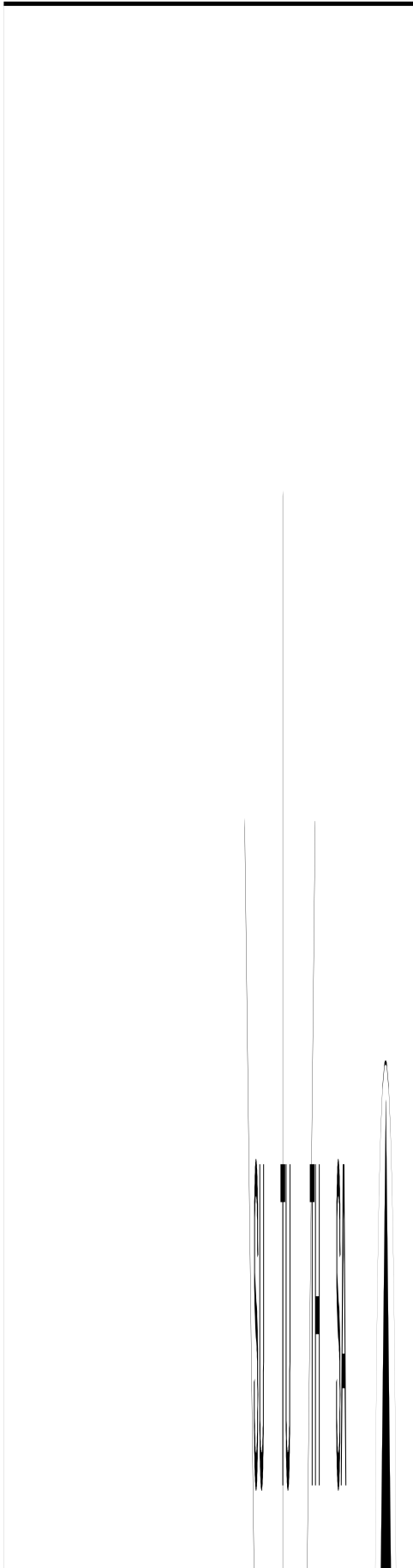




↓ [^]



↓ [ENT]





6.8 KEY LOCK ON/OFF SETTING

This function is intended to prevent erroneous operation.

By pressing the key lock at ' o n ', keys other than the [FUNC] key will be inoperable.

To release the function, set at ' o f f '.

Press the [FUNC] key in the measuring status and ' LOC ' will be indicated. Now press the [>] key and the key lock can be set.

The sub indication will flash.

Set the key lock ON or OFF by pressing the [^] key. Press the [ENT] key when the key lock setting is finished.

Setting operation is now completed.

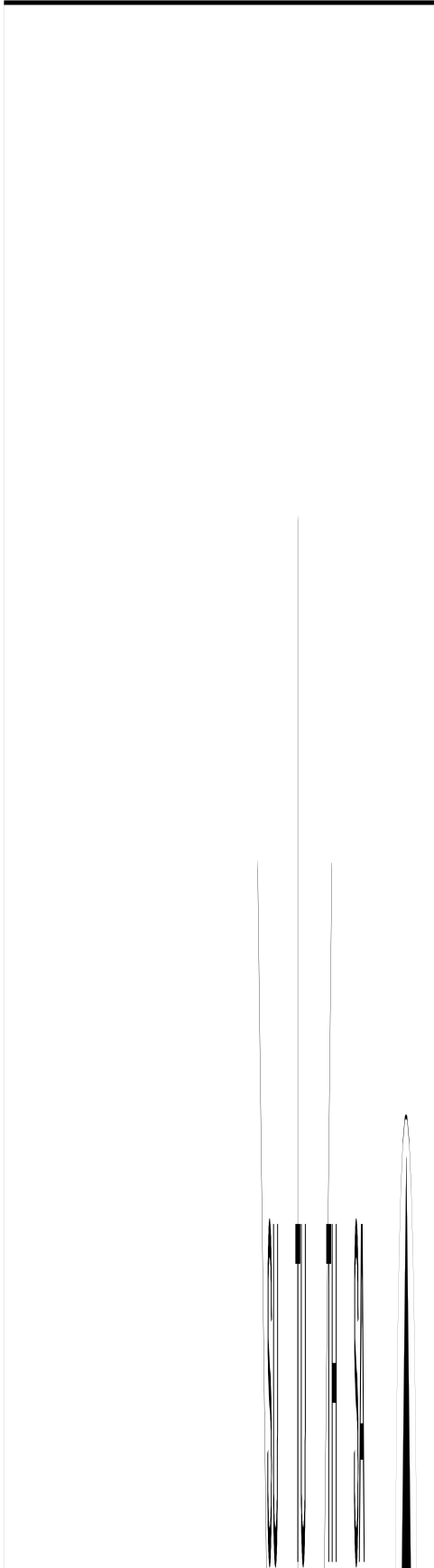
↓ [FUNC]



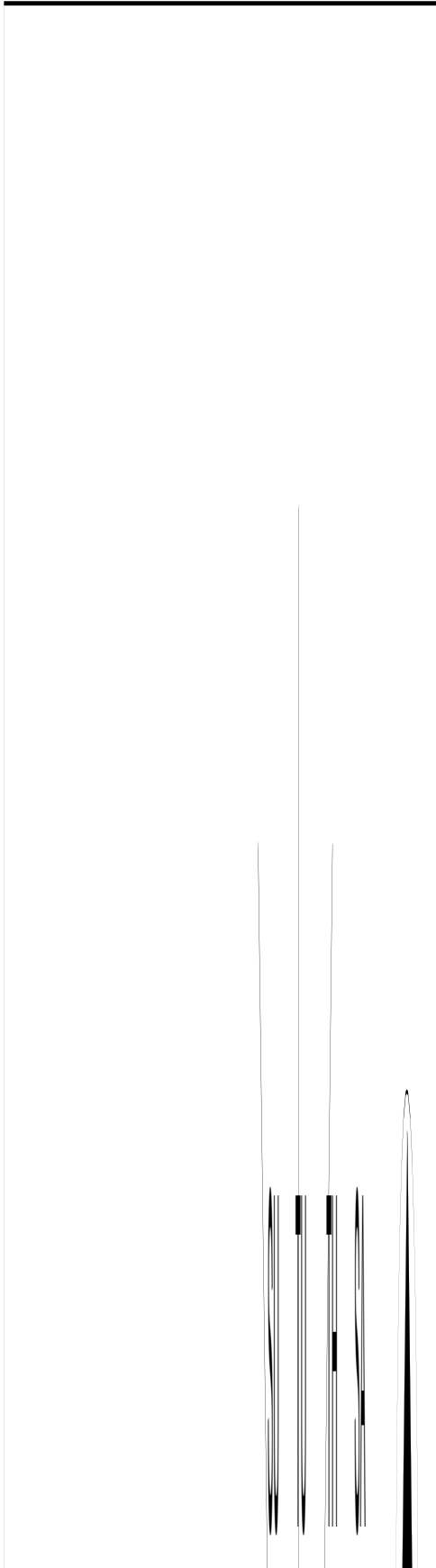
↓ [>]



↓ [^]



↓ [ENT]





6.9 ZERO CALIBRATION

This is used for adjusting the zero point. Flow the zero gas and wait until the indication stabilises. When the Zirconia O₂ analyser is used, use air as the zero gas. (Refer to note 1)

When the indication has stabilised, select the measuring range to be calibrated by using the [Δ] [V] keys.

When using a multi-component analyser, undergo zero calibration at the selected range and component. (Note 2)

Since the measuring status is resumed after the calibration, carry out the calibration for other ranges if necessary.

Press the [ZERO] key, and [ZERO] key lamp will flash. After the indication is stabilised, press the [CAL] key and conduct zero calibration.

The [CAL] key lamp lights steadily during calibration.

↓ [ZERO]





↓ [CAL]

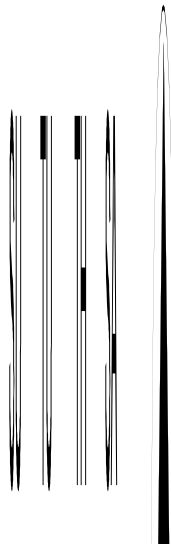




Lights steadily



(The lamp goes out after calibration)



The calibration is completed when the key lamp goes off. After the calibration, it is reset in measurement mode. Calibrate other ranges as necessary.

Note 1) When using gas separately for low and high ranges, apply 9 to 10 vol % O₂/N₂ which has been set for low range.

Note 2) Calibration component should be set in zero calibration select mode.

6.10 SPAN CALIBRATION

Carry out span calibration by flowing calibration gas at the concentration set as a span value. Flow the calibration gas at 0.5 L/minute. Wait until the indication stabilises, then conduct span calibration. Press the [SPAN] key and the [SPAN] key lamp flashes.

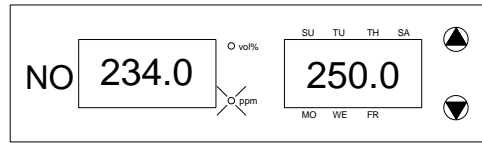
In the case of multi-component analyser, the main indication will flash for the components which can be calibrated. Press the E key and the calibratable gas component will change. When the gas component has been determined, press the [Δ] [▽] keys and select a range.

Note) The lamp will not flash in the case of a single-component analyser.

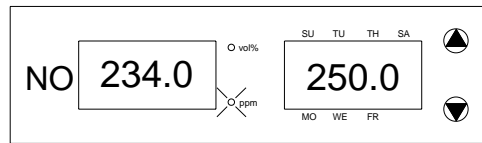
After the indication is stabilised, press the [CAL] key and conduct span calibration.

The [CAL] key is lit during calibration.

The calibration is completed when key lamp goes off. Since the measuring status is resumed after calibration, continue the calibration for each component and each range.

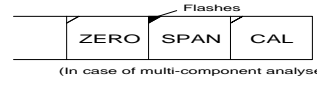


↓ [SPAN]

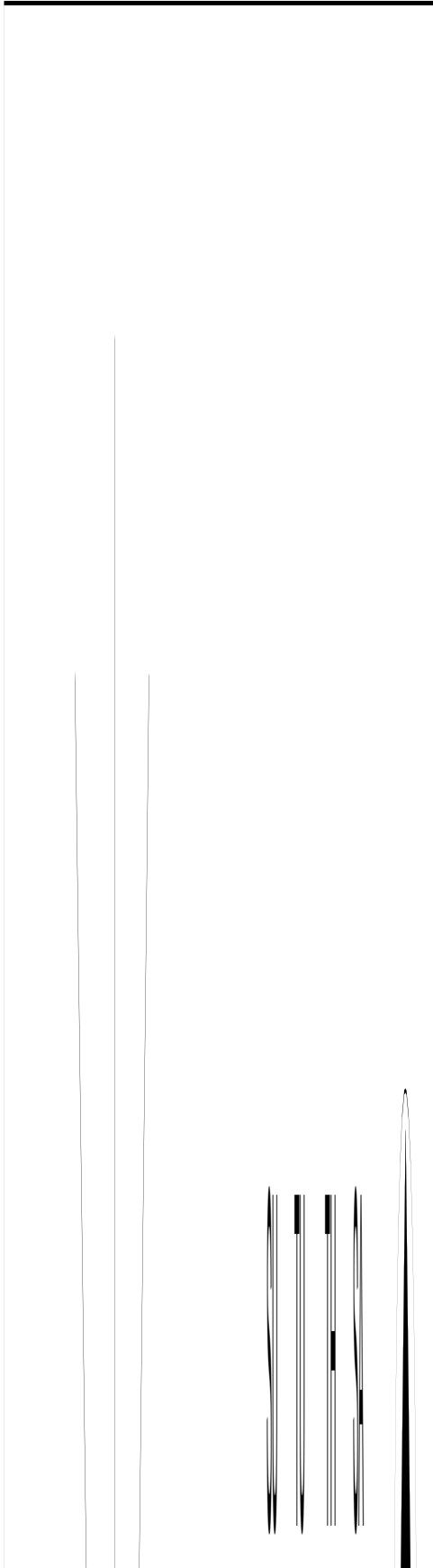


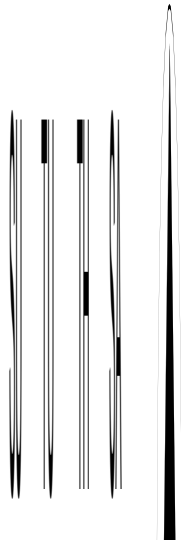
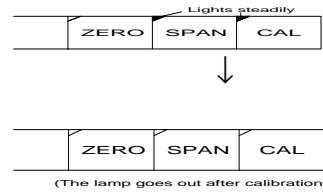
Flashes

↓ ([COMP]) [Δ] [▽]



↓ [CAL]



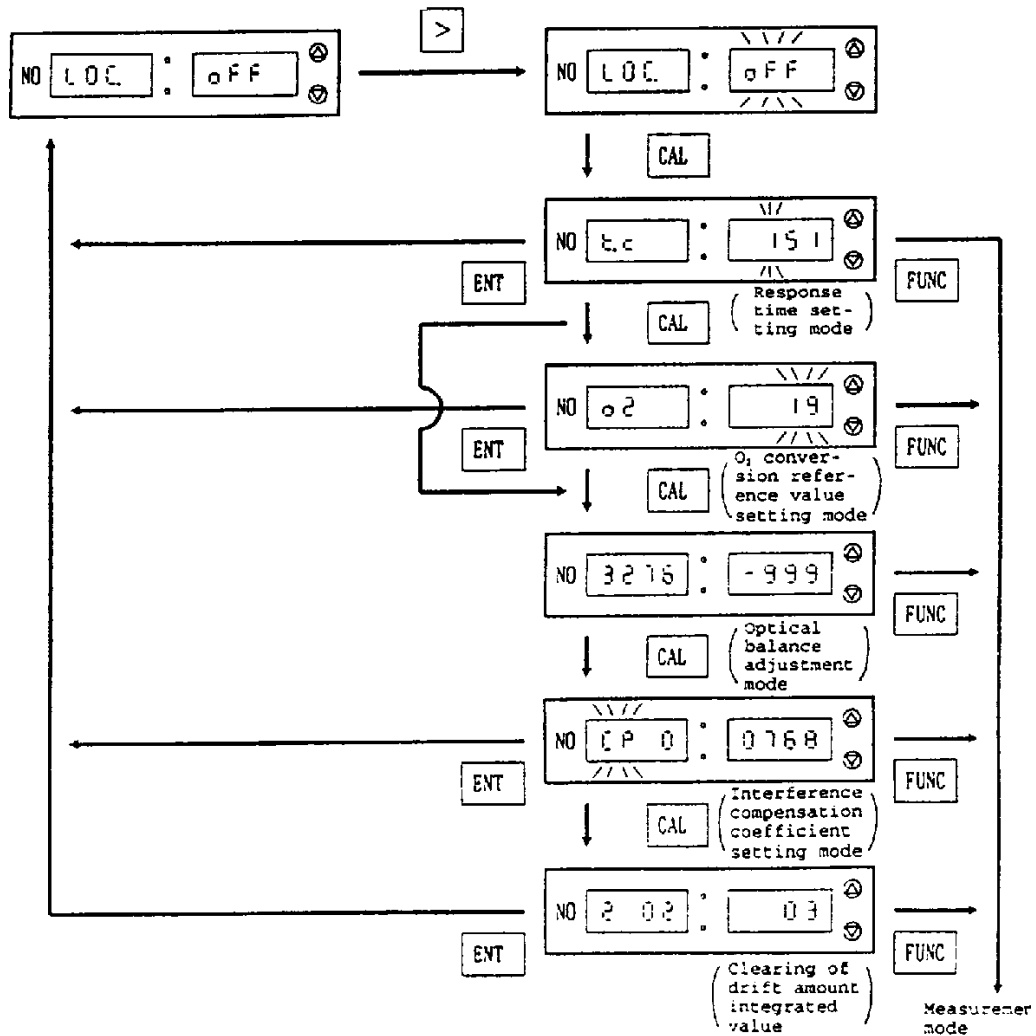


SECTION 7

MAINTENANCE MODE

The maintenance mode refers to settings and adjustment in the following five modes.

Mode	Section
Response time setting mode	Refer to Section 7.1
O ₂ conversion reference value setting mode (option)	Refer to Section 7.2
Optical balance adjustment mode	Refer to Section 7.3
Interference compensation coefficient setting mode	Refer to Section 7.4
Indication and clearing of drift amount integrated value	Refer to Section 7.5



Caution on Operation

1. Note that there is no O₂ conversion reference value setting mode when an O₂ indication and conversion function is not provided. If [CAL] key is pressed in the response time setting mode, then optical balance adjustment will be indicated.
2. Be sure to press the [ENT] key when each setting is finished. If another key is pressed without pressing [ENT], then the set numerics will not be registered.
3. After pressing [ENT] key, "LOC" indication will light up.

7.1 RESPONSE TIME SETTING

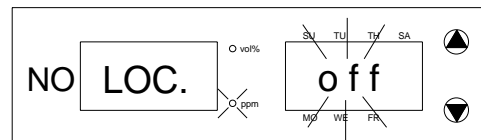
With the " LOC. " indication flashing, press the [CAL] key and ' t.c ' will be indicated. The sub indication will now flash.

Press [COMP] key and select the desired component.

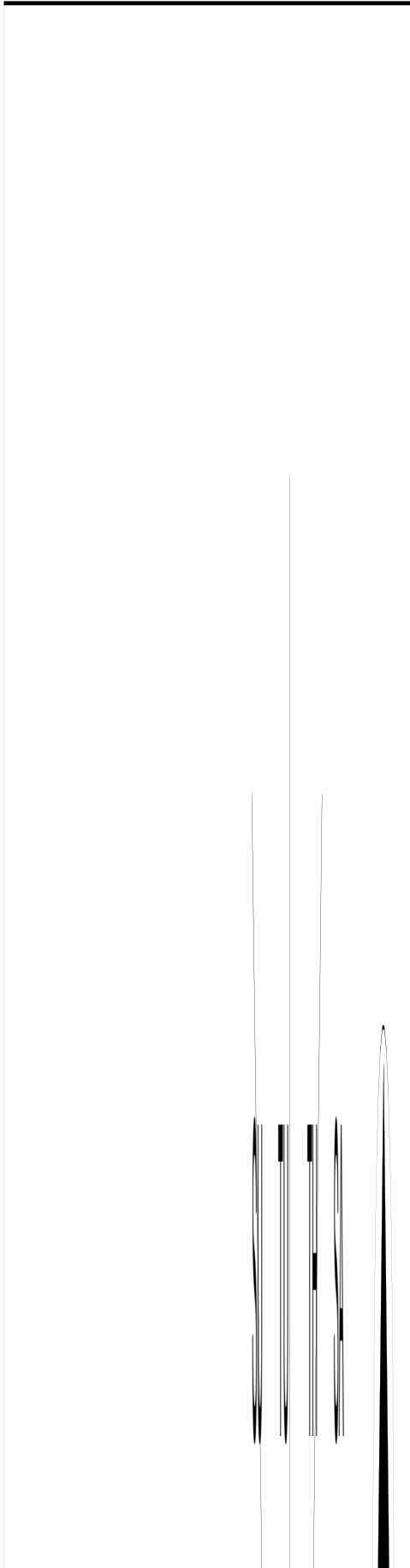
Set the response time of the electrical system. Set numerics (1 to 199) from the highest digit which is flashing on the sub indication. The settable range is 1 to 49 for O₂.

90% response time (electrical system) = 0.22 x (1 to 199) sec.

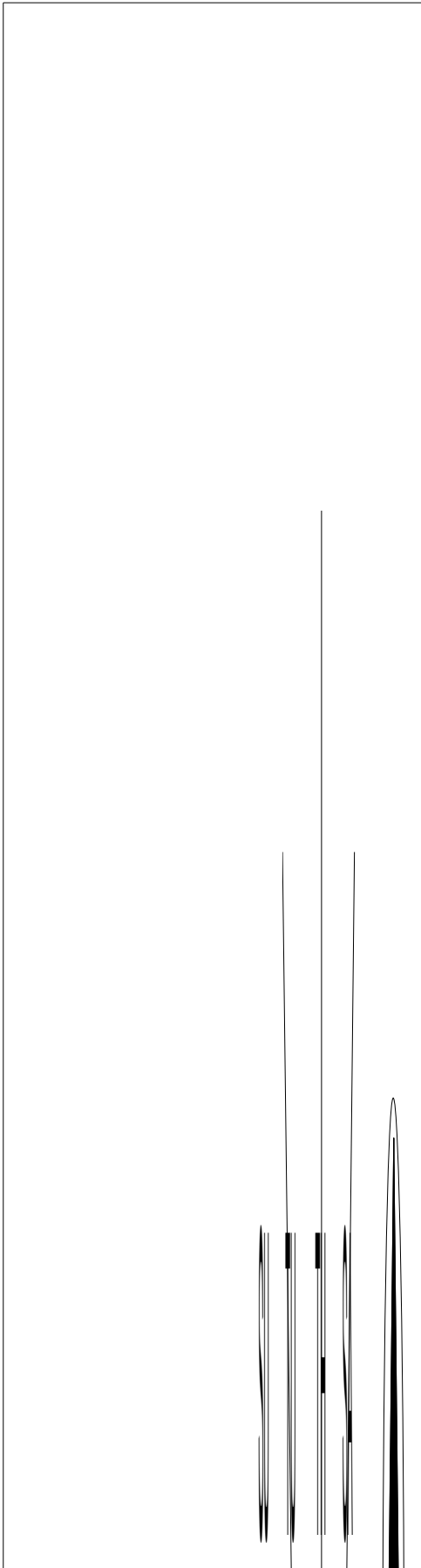
Press the [^] key and the numeric will be incremented. The digit can be selected by pressing the [>] key. Press the [ENT] key after setting the response time.



↓ ([^] [>])



↓ [ENT]



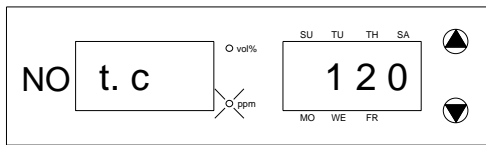


7.2 O₂ CONVERSION REFERENCE VALUE SETTING

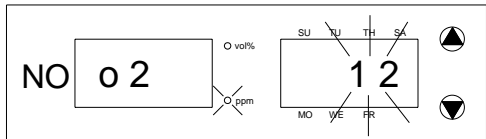
With the " LOC " indication flashing, press the [CAL] key will be indicated. The sub indication now flashes. Set a reference value (1 to 19) %O₂. Press the [^] key and the numeric will be incremented. Press [ENT] key after setting a reference value.

O₂ converted concentration

$$= \frac{21 - \text{Set Value} \times \text{NO}_x \text{ concentration}}{21 - \text{O}_2 \text{ concentration}}$$

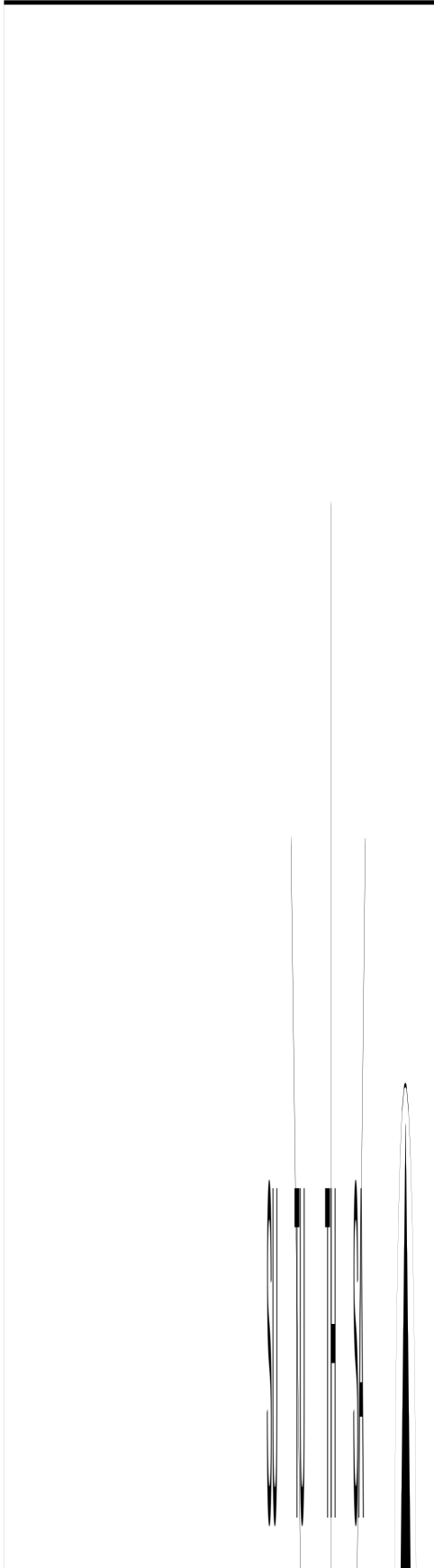


↓ [CAL]



↓ ([^])

↓ [ENT]

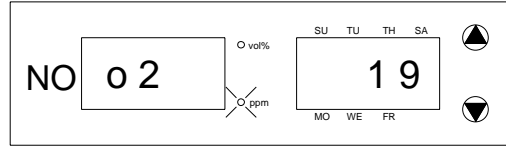




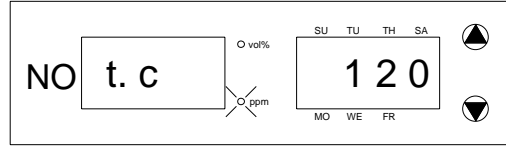
7.3 OPTICAL BALANCE ADJUSTMENT

When the sample cell is reassembled after having been detached for cleaning or the like, this optical zero adjustment should be performed before use. When this mode is assumed, the input signal from the measurement detector is displayed on the main indicator while the input signal from the interference compensating detector is displayed on the sub indicator. The numerics vary in a range of -999 to 3200. This adjustment is made so that the readings on both indicators approach zero. Refer to Section 8 Maintenance for details.

With the " LOC " indication flashing, press the [CAL] key and the input signal from the measurement detector will appear on the main indicator while the input signal from the interference compensating detector will appear on the sub indicator. Press the [CAL] key after the optical balance adjustment.



or



↓ [CAL]

↓ [CAL]





7.4 INTERFERENCE COMPENSATION COEFFICIENT SETTING

This is used for adjusting the interference compensation when there is much interference. In this mode, the indication is adjusted, while flowing interference gas (0 or 2°C saturated H₂O), so that it is nearly zero or within 2% of the value obtained by dividing 30,000 by the range ratio. Refer to Section 7 Maintenance for details.

With the " LOC " indication flashing, press the [CAL] key and " CP " will be indicated. Main display lamp " CP " flickers. (The compensation coefficient is the lower two digits on the main indicator and a value within -32768 to 32768 on the sub indicator.) (The lower 2nd digit of main display is negative symbol.)

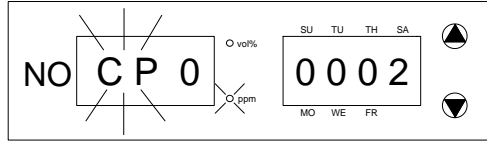
Press the [COMP] key and select the desired component.

Set the compensation coefficient. Press the [^] key and the numeric will be incremented. Press the [>] key and the numeric will be decremented. Press [ENT] key after setting the compensation coefficient.

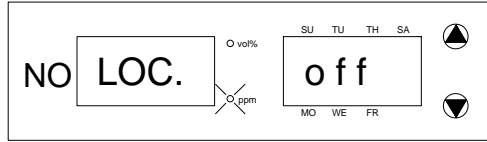
↓ [CAL]



↓ ([^] [>])



↓ [ENT]



7.5 INDICATION AND CLEARING OF INTEGRATED DRIFT VALUE

With the " LOC. " indication flashing, press the [CAL] key and indicate the zero point drift amount on the main indicator and the span point drift amount on the sub indicator for each component. Select the range with the [Δ] [▽] keys and the integrated zero point and span point drift values will be indicated for that range.

When the integrated drift value appears, press the [FUNC] key and the measurement mode will be resumed.

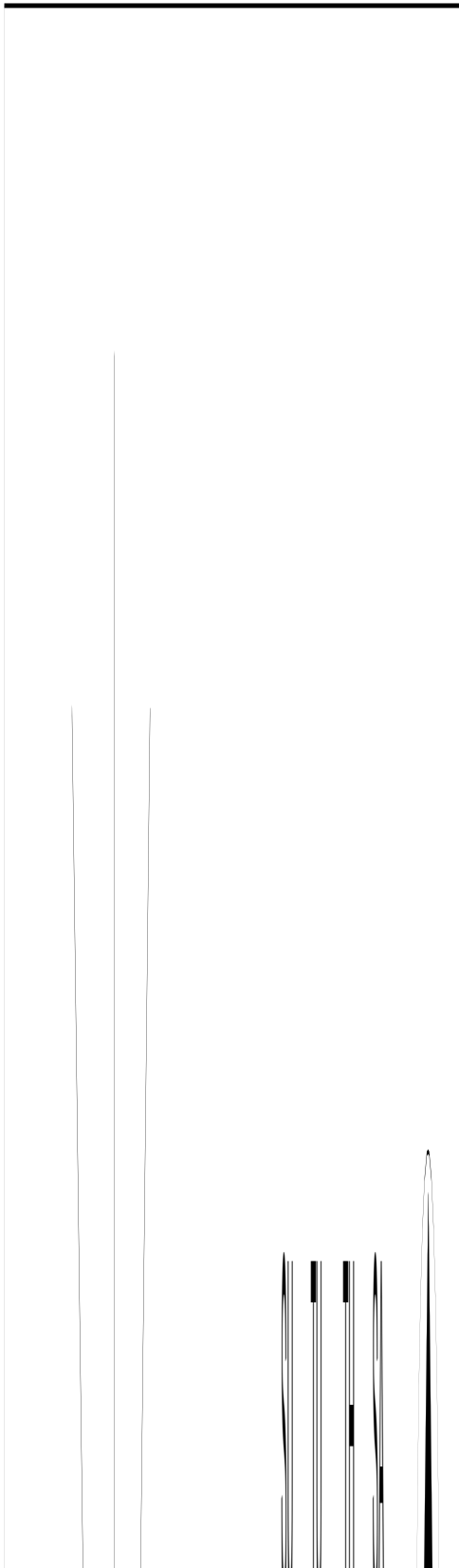
[ENT] ←

↓

Zero Clearing

Carry out zero clearing after cleaning the sample cell when the integrated drift value appears on the indicator, press the [ENT] key and the integrated zero point and span point drift values will be cleared to zero for each component and each range. The indicator will then display " LOC ".

↓ [CAL]



↓ ([Δ] [▽])



↓ [FUNC]





SECTION 8

MAINTENANCE

8.1 ROUTINE MAINTENANCE

8.1.1 Zero and Span Calibration

- 1). Carry out zero calibration with reference to the method in Section 5.2.
- 2). Next carry out span calibration with reference to the method in Section 5.2
- 3). Zero and span calibration should be made about once a week or when necessary.

8.1.2 Check of Flow Rate

- 1). The flow rates for sample gas, standard gas and purge gas are as follows.

Sample gas	Standard gas flow rates
Standard type analyser	0.5 ± 0.25 L/min (sample gas)
Sample switching type	$(1 + 1) \pm 0.1$ L/min (sample gas + reference gas)
Flow differential type	$(0.5 + 0.5) \pm 0.25$ L/min (sample gas + reference gas)

Purge gas flow rate: about 1 L/min.

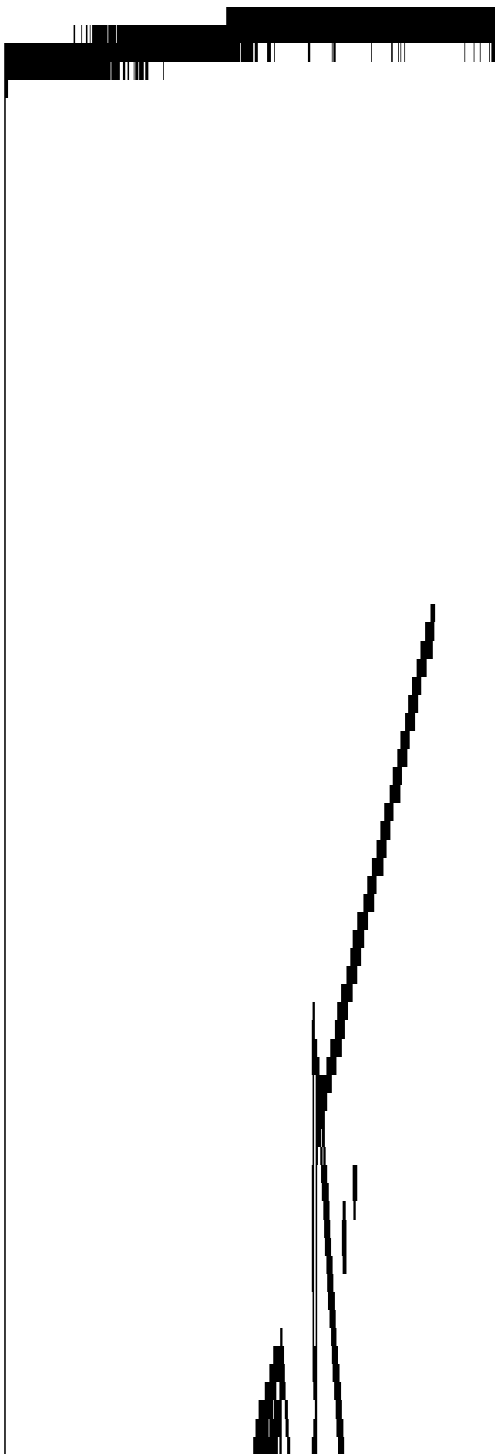
- 2). Inspection and maintenance should be carried out about once a day or as necessary.

8.2 PERIODICAL INSPECTION

8.2.1 Cleaning Sample Cell (Pipe Cell)

This instrument has been carefully adjusted before shipment from the factory. If it should require readjustment, then please contact Rotork Analysis.

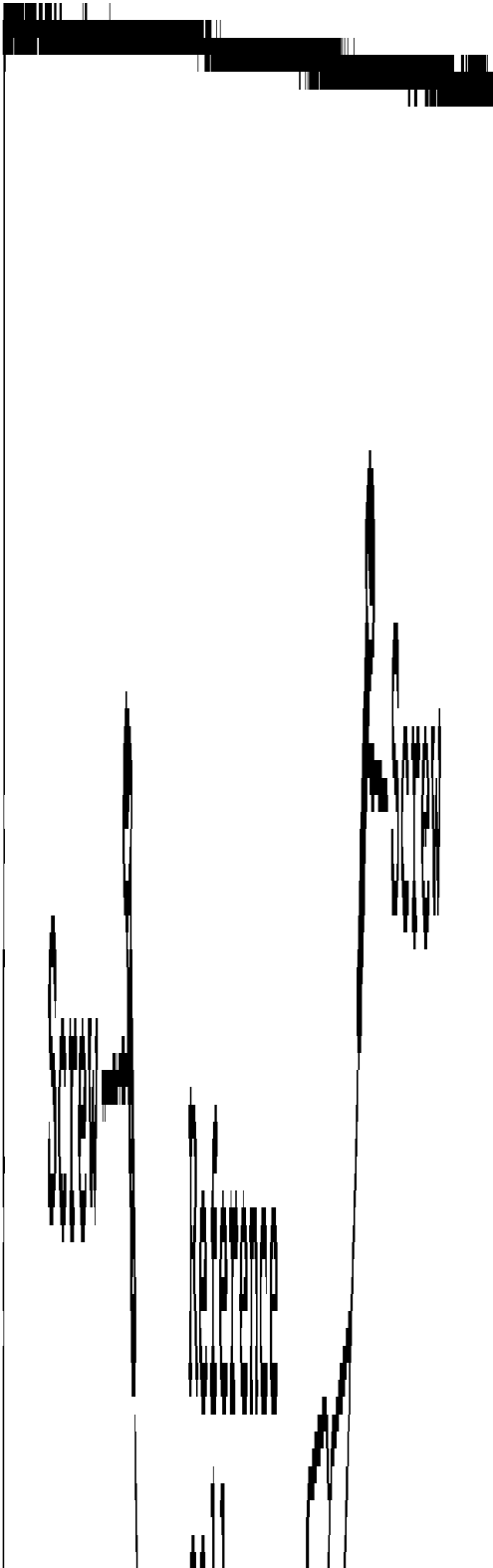
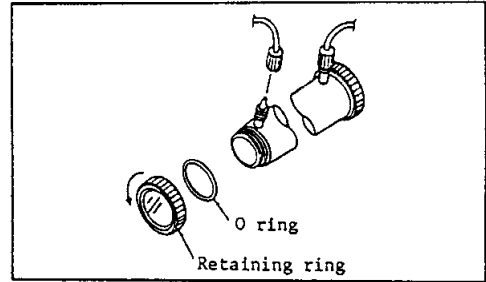
- (1) Turn off the power switch, stop the flow of sample gas and flow zero gas for a few minutes. Loosen the knurled knobs on the front panel and pull out the analyser interior by means of the grips.



- (2) Loosen the cap nuts fixing the gas inlet pipe, and detach the internal gas inlet pipe.

- (3) Remove the screws from the left and right cell retaining plates. In the case of the sample switching type, remove both the sample and reference cells. With the standard type, remove only the sample cell.

- (4) Turn the retaining ring (with transparent window) to the left and remove it from the cell. Refer to Fig. 3A.



- (5) For cleaning the infrared-ray transmitting window and cell interior, first remove heavy contamination with a soft brush or the like, then wipe lightly with the furnished cleaning cloth for sample cell. Be especially careful when cleaning the window since it is easily scratched.

NOTE: If the infrared-ray transmitting window is only lightly contaminated, it can be cleaned by wiping lightly with the cleaning cloth for sample cell to which chrome oxide powder is added. But if heavily contaminated, then the window must be replaced. Be careful not to apply unreasonable force when cleaning.

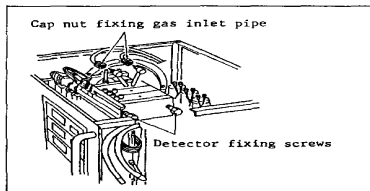
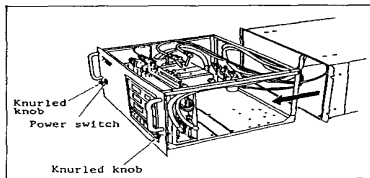
- (6) When cleaning of the sample cell is finished, then reassemble the cell in its original position. If the zero point has deviated considerably when operating again, select a low range and carry out optical zero adjustment (refer to item 8.2.3).

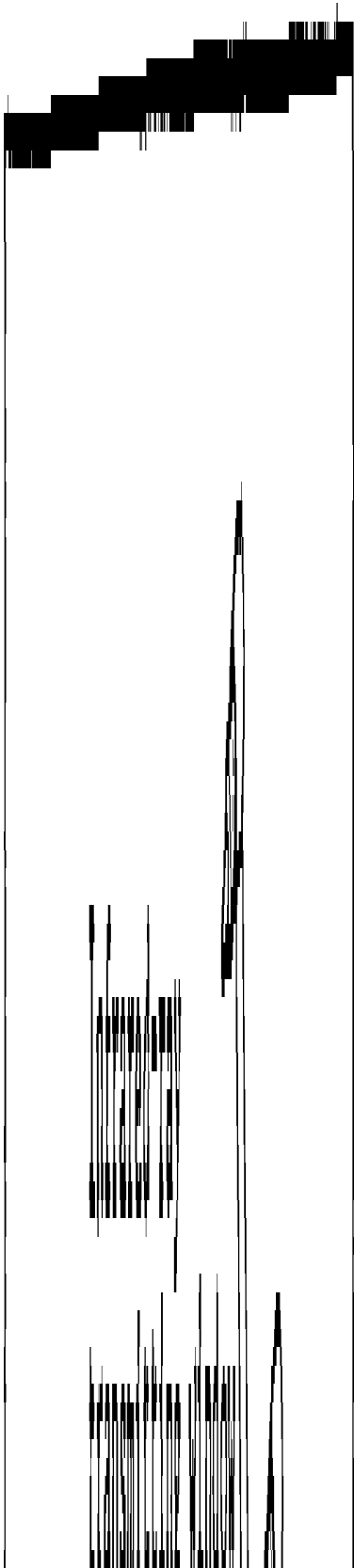
8.2.2 Cleaning Sample Cell (Block Cell)

- 1) Turn off the power switch, stop the flow of sample gas and flow zero gas for a few minutes. Loosen the knurled knobs on the front panel and pull out the analyser interior by means of the grips.
- (2) Loosen the cap nuts fixing the gas inlet pipe and remove the internal gas inlet pipe.
- (3) Remove two detector

NOTE: Be careful since the distribution and block cells are fixed together with the detector.

- (4) Using the furnished cell assembly tool, turn the retaining ring leftward and detach it from the cell.





- (5) For cleaning the infrared-ray transmitting window and cell interior, first remove heavy contamination with a soft brush or the like, then wipe lightly with the furnished cleaning cloth for sample cell. Be especially careful when cleaning the window since it is easily scratched.

NOTE: If the infrared-ray transmitting window is only lightly contaminated, it can be cleaned by wiping lightly with the cleaning cloth for sample cell to which chrome oxide powder is added. But if heavily contaminated, then the window must be replaced. Be careful not to apply unreasonable force when cleaning.

- (6) When cleaning of the sample cell is finished, then reassemble the cell in its original position. If the zero point has deviated considerably when operating again, select a low range and carry out optical zero adjustment.

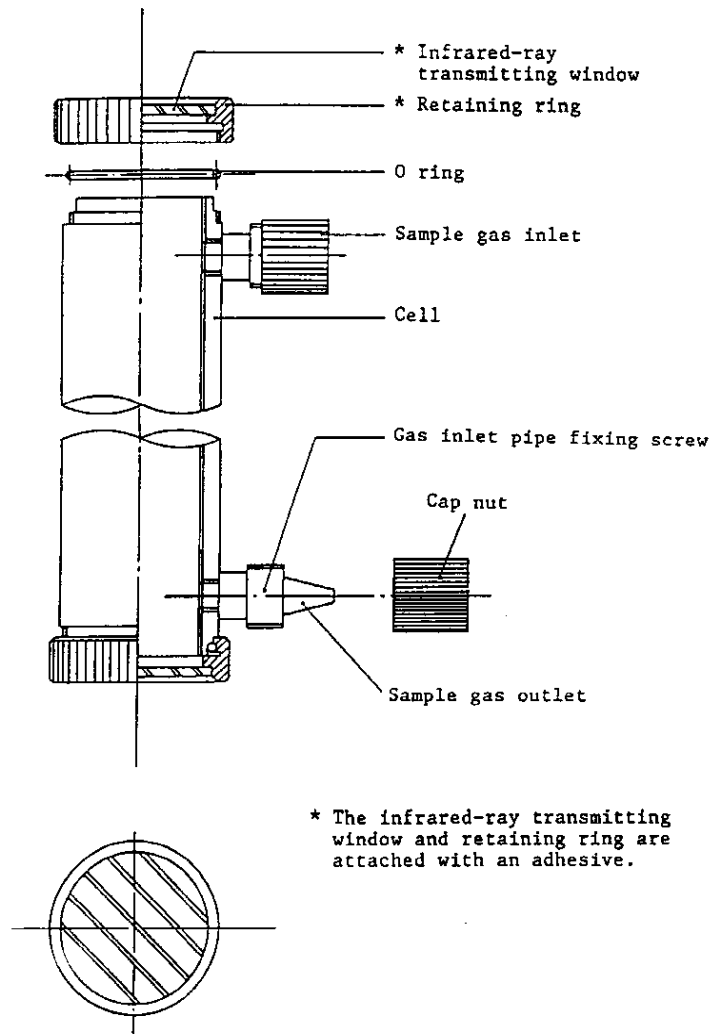


Fig 3A Sample Cell Structure (Pipe Cell)

Use the supplied cell assembling tool.

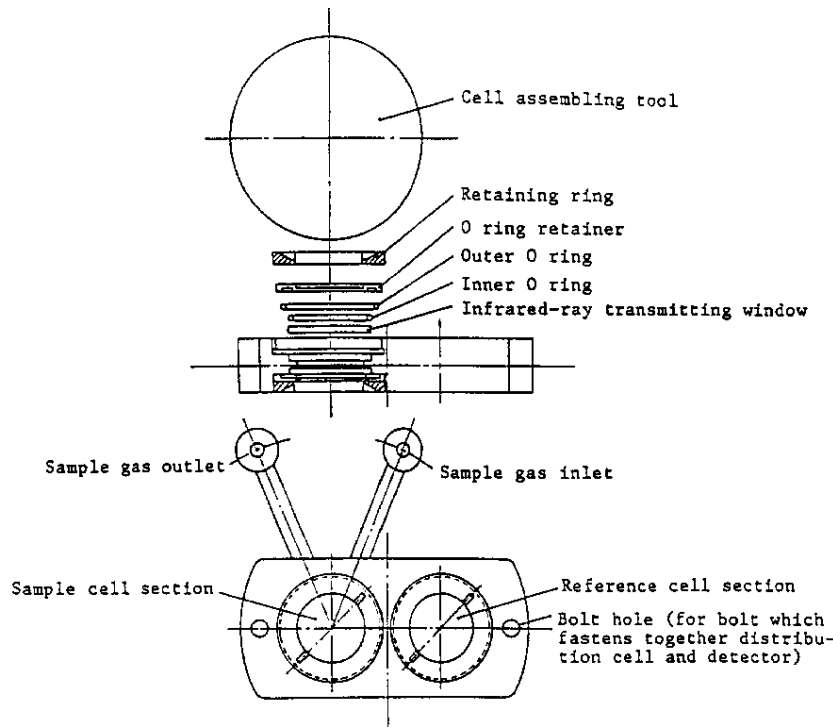
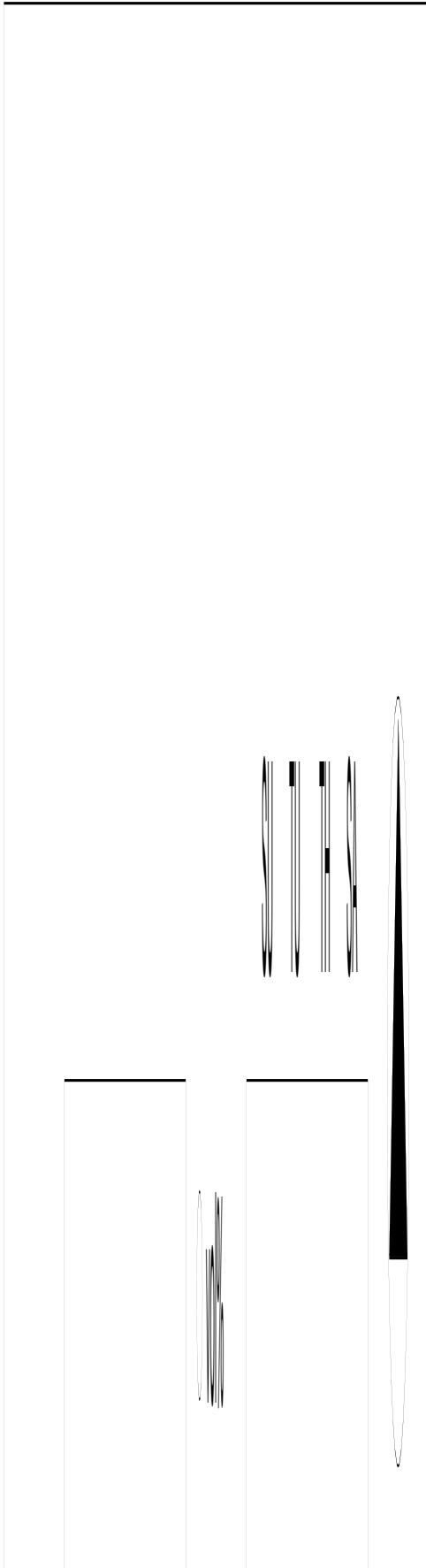


Fig. 3B Sample Cell Structure (Block Cell). The sample and reference cells are integral.

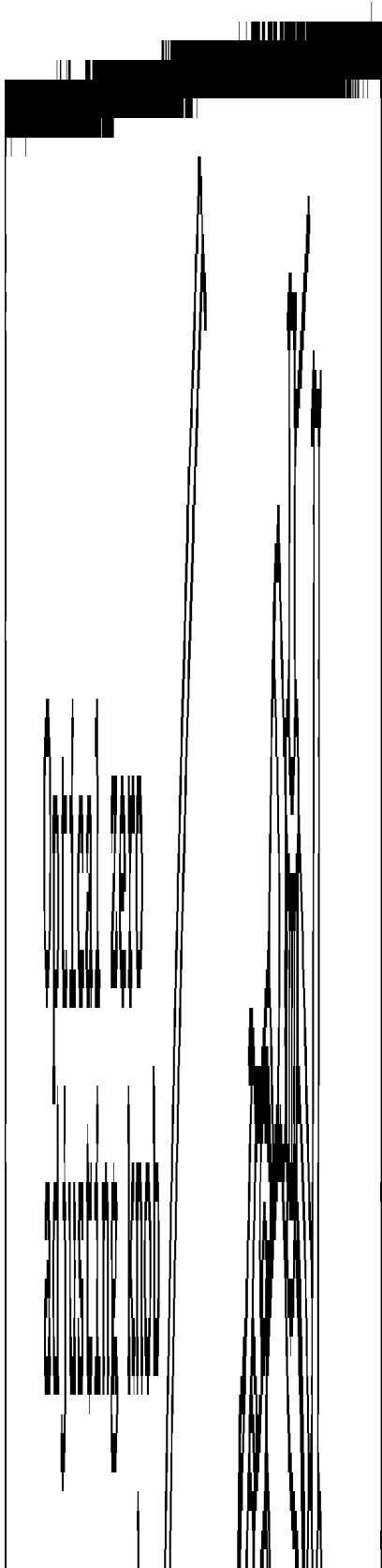
8.2.3 Optical Zero Adjustment Method

When the sample cell is reassembled after having been removed for cleaning or the like, this adjustment should be carried out before use. Following is the adjustment procedure.

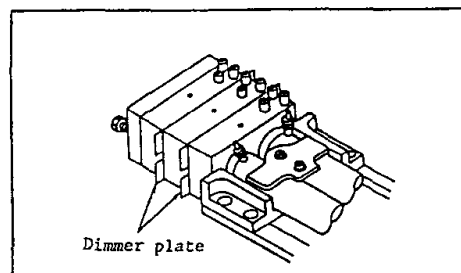
- (1) First carry out electrical zero adjustment. With the power turned off, detach the connectors CN2 and 3 (for 1st component) and CN4 and 5 (for 2nd component) leading from the detector which are connected with the main PCB (2). Next, turn on the power and calibrate the zero point using [ZERO] and [CAL] keys.
- (2) Turn off power, connect the connectors CN2 and 3 (1st component) and CN4 and 5 (2nd component), and turn on power again. Supply dry nitrogen from the sample gas inlet and wait until the indication stabilises.
- (3) Set up the optical zero adjustment mode as in 7-3. The following indications will appear on the main and sub indicators of the analyser front panel.



- (4) Operate the optical zero adjusting knob so that the numeric value on the main indicator approaches zero (within ± 10).



- (5) Operate the dimmer plate so that the numeric value on the sub indicator approaches zero (within +10).



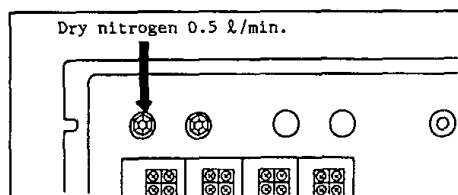
- (6) Repeat steps (4) and (5) to bring the numeric values on the main and sub indicators as close to zero as possible.

8.2.4 Interference Compensation Adjusting Method for Standard and Flow Differential Analysers

Since this adjustment is difficult, please contact Rotork Analysis if it becomes necessary.

Adjust the interference compensation if the effect of interference is large (more than +2% of full scale).

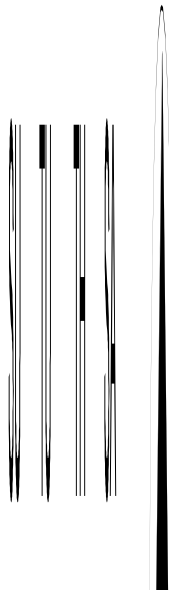
- 1). After warming up the instrument, supply dry nitrogen at a rate of 0.5 l /minute from the sample gas inlet. (With the flow differential system, supply dry nitrogen continually to the reference cell.)



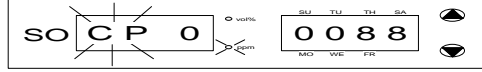
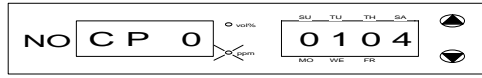
- 2). Carry out zero calibration using the [ZERO] and [CAL] keys.
- 3). Set up the interference compensation setting mode as in Section 7-4.

" CP " a will appear in the upper two digits of the main indicator on the front panel while a total of 5 numerals will appear in the lower digit of the main indicator plus the four digits of the sub indicator. (A negative sign appears in the second lowest digit of the main indicator.).

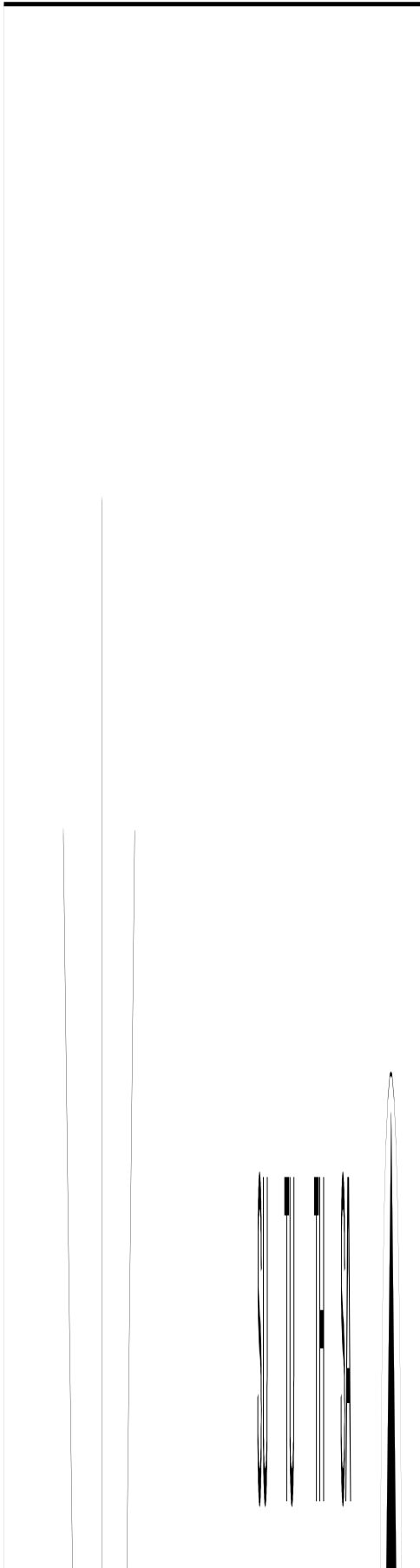
↓ [CAL]



↓ [COMP]



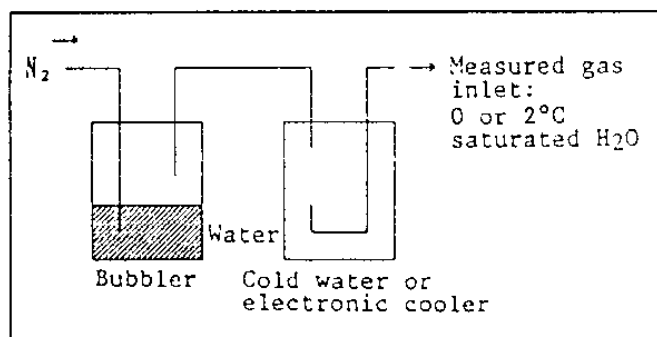
↓ [>] [^]



- (4) Supply interference gas (N_2 saturated with water at 0 or 2°C) as shown in the figure. When the indication has stabilised, press the [COMP] key and select the component to be adjusted, then adjust by using the [>] and [^] keys so that the indicated value approaches zero or within 2% of the value obtained by dividing 30,000 by the range ratio.

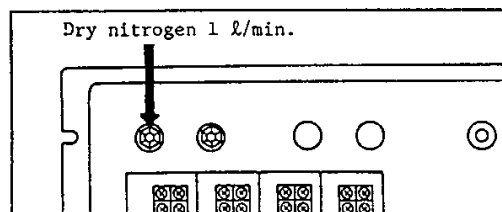
When range ratio is 1 : 5 (low range: high range) $30,000 \times 1/5 \times 0.02 = 120$

Adjust to obtain a value of nearly zero within ± 120 .



8.2.5 Interference Compensation Adjusting Method for Sample Switching Analysers

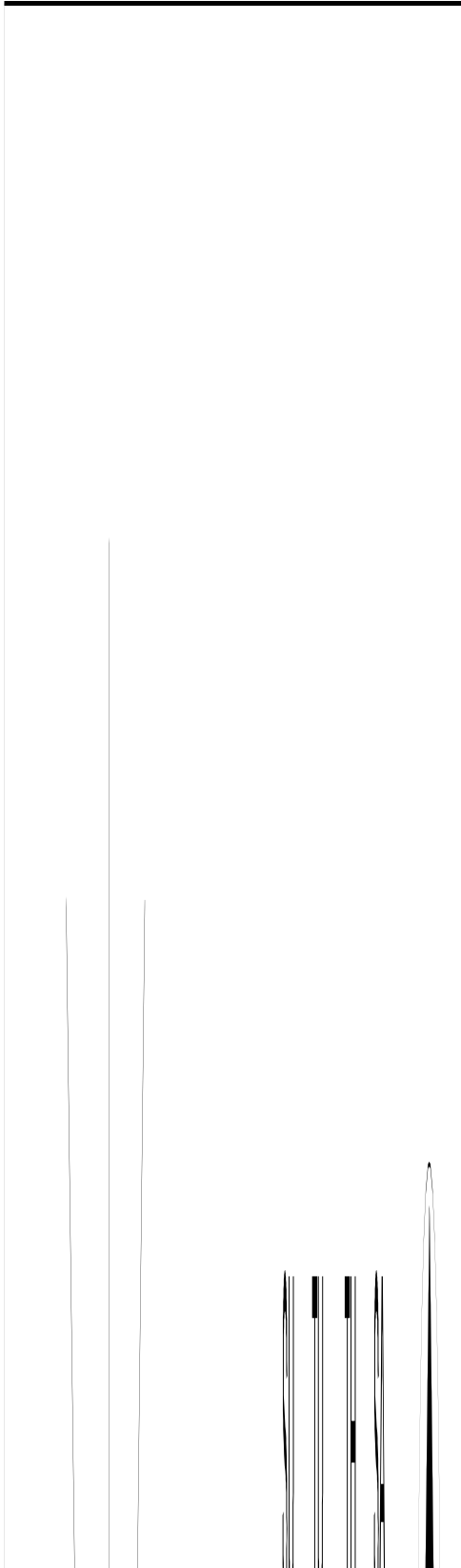
- (1) After warming up the instrument, supply dry nitrogen at a rate of 1 L/min. from the measured gas inlet. Detach the pipe from the reference cell gas inlet (light source side) and flow dry nitrogen at 1 L/min.
- (2) Carry out zero calibration using the [ZERO] and [CAL] keys.

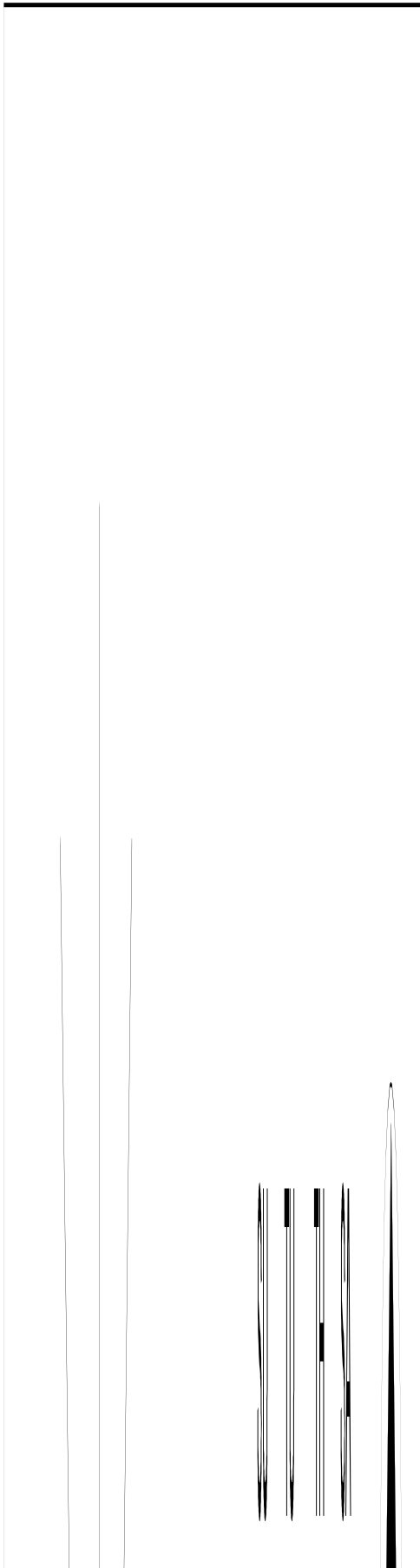


↓ [CAL]



↓ [>] [^]



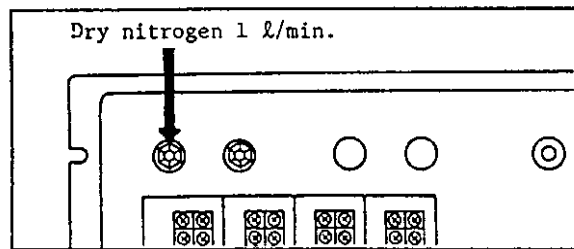


- (3) Set up the interference compensation setting mode as in Section 7-4. " CP " will appear in the upper two digits of the main indicator on the front panel while a total of 5 numerals will appear in the lower digit of the main indicator plus the four digits of the sub indicator. (A negative sign appears in the second lowest digit of the main indicator.)
- (4) Supply interference gas (0 or 2°C saturated H₂O) as shown in the figure. When the indication has stabilized, press the [COMP] key and select the component to be adjusted, then adjust by using the [>] and [^] keys so that the indicated value approaches zero or within 2% of the value obtained by dividing 30,000 by the range ratio.

When range ratio is 1 : 5 (low range: high range)

$$30,000 \times 1/5 \times 0.02 = 120$$

Adjust to obtain a value of nearly zero within ± 120 .



- (5) Return the reference cell pipe to its original position.

SECTION 9

ERROR CODES AND REMEDIES

This analyser is provided with self-diagnosis functions, and an error code is displayed if an abnormality occurs in the instrument.

Carry out the following remedies when an error code appears.

When an error code appears, first check for an abnormality in the power supply or gas piping.

The analyser will not operate correctly unless the cause of the error is removed. But, the error indication remains as it is as a history until the [ENT] key is pressed.

1. Error code appears at the sub indication in the case of a single-component analyser and at the 2nd component sub indication in the case of a multi-component analyser.
2. When multiple errors have occurred, the error codes appear successively starting from the lowest numbered one upon pressing [ENT] key. After displaying all the error codes, press [ENT] key again and the error display disappears, but they will reappear if the fault is not removed.
3. Turn ON the power supply. When the analyser operates correctly, it is considered normal.
4. When an error occurs, the FAULT contact output is closed.

Error Code	Contents of Error Code	State of Analyser	Cause	Cause and Countermeasure
E-0	Trouble with digital circuit (memory read/write impossible)	Not operated until trouble is removed.	Malfunction due to noise Digital circuit is defective.	Turn ON the power supply. When the analyser operates correctly, it is considered normal. Replace the main printed circuit board.
E-1	Trouble with digital circuit (output IC read/write impossible)			
E-3	Synchronising signal has stopped	Both the indicated value and output value have stopped. LED stops flickering at each setting.	Improper adjustment of synchronising signal Improper rotation of motor and chopper Synchronising signal process circuit is defective. Instantaneous power failure	Adjust synchronising signal on main printed circuit board 2. (CP1 - CS. VRI) Check motor and chopper for proper rotation. Check connector for proper connection. Replace main printed circuit board 2.
E-4	Zero point calibration is out of the calibration range.	Measurement is possible but zero calibration is impossible.	Improper zero gas Unbalance of optical system Optical system parts are defective.	Check gas components and dew point. Check sampling system. Check the inside of cell for contamination. Adjust the balance of optical system. Replace light source. Replace sensor.
E-6	Integrated drift of zero point exceeds 50%/FS of each measurement range.			
E-8	One-time zero point calibration exceeds 50%/FS of measurement range.			

Error Code	Contents of error code	State of analyser	Cause	Check and countermeasure
E-5	Span point calibration Is out of calibration range	Measurement is possible but zero calibration is impossible.	Improper setting of calibration set value and cylinder Unbalance of optical system Optical system parts are defective.	Check calibration set value and cylinder. Check sampling system. Check the inside of cell for contamination. Adjust the balance of optical system. Replace light source. Replace sensor.
E-7	Integrated drift of span point exceeds 50% FS of each measurement			
E-9	One-time span point calibration exceeds 50%/FS of measurement range.			
E-10	Zero calibration is impossible due to unstable input	Measurement is possible but calibration is impossible.	Abnormal sampling system (improper gas flow) Defective sensor	Check piping connection and gas flow. Replace sensor. Check wiring and connector.
E-11	Span calibration is impossible due to unstable input.	Measurement is possible but span calibration is impossible.	Effect of vibration	Check operating conditions and carry out vibration-proofing.
E-16	O ₂ input signal is low.	Measured value of O ₂ analyser is different from density.	O ₂ sensor is defective. Input circuit is defective.	Check O ₂ sensor output voltage. Check wiring and Connector
E-23	O ₂ input signal is over.			
E-17	Temperature sensor input signal is low.	Measurement error due to ambient temperature may become large.	Temperature sensor is defective. Temperature circuit is defective.	Check resistance of TMP1 on printed circuit board 2.
E-24	Temperature sensor input signal is over.			