OPERATING INSTRUCTIONS FOR

Model 7600

NDIR Infrared Gas Analyzer

P/N M7600

ECO:

	DANGER

Toxic gases and or flammable liquids may be present in this monitoring system.

Personal protective equipment may be required when servicing this instrument.

Hazardous voltages exist on certain components internally which may persist for a time even after the power is turned off and disconnected.

Only authorized personnel should conduct maintenance and/or servicing. Before conducting any maintenance or servicing, consult with authorized supervisor/manager.

Warranty

This equipment is sold subject to the mutual agreement that it is warranted by us free from defects of material and of construction, and that our liability shall be limited to replacing or repairing at our factory (without charge, except for transportation), or at customer plant at our option, any material or construction in which defects become apparent within one year from the date of shipment, except in cases where quotations or acknowledgements provide for a shorter period. Components manufactured by others bear the warranty of their manufacturer. This warranty does not cover defects caused by wear, accident, misuse, neglect or repairs other than those performed by TI/AI or an authorized service center. We assume no liability for direct or indirect damages of any kind and the purchaser by the acceptance of the equipment will assume all liability for any damage which may result from its use or misuse.

We reserve the right to employ any suitable material in the manufacture of our apparatus, and to make any alterations in the dimensions, shape or weight of any parts, in so far as such alterations do not adversely affect our warranty.

Important Notice

This instrument provides measurement readings to its user, and serves as a tool by which valuable data can be gathered. The information provided by the instrument may assist the user in eliminating potential hazards caused by his process; however, it is essential that all personnel involved in the use of the instrument or its interface, with the process being measured, be properly trained in the process itself, as well as all instrumentation related to it.

The safety of personnel is ultimately the responsibility of those who control process conditions. While this instrument may be able to provide early warning of imminent danger, it has no control over process conditions, and it can be misused. In particular, any alarm or control systems installed must be tested and understood, both as to how they operate and as to how they can be defeated. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of TI/AI at the time the order is placed.

Therefore, the purchaser must be aware of the hazardous process conditions. The purchaser is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that hazard warning devices and instrumentation are maintained and operated properly.

Teledyne Instruments/ Analytical Instruments, the manufacturer of this instrument, cannot accept responsibility for conditions beyond its knowledge and control. No statement expressed or implied by this document or any information disseminated by the manufacturer or its agents, is to be construed as a warranty of adequate safety control under the user's process conditions.

Specific Model Information

Instrument Serial Number: _____

Instrument Range: _____

Calibrated for: _____

Background Gas: _____

Zero Gas: _____

Span Gas: _____

Safety Messages

Your safety and the safety of others is very important. We have provided many important safety messages in this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:

GENERAL WARNING/CAUTION: Refer to the instructions for details on the specific danger. These cautions warn of specific procedures which if not followed could cause bodily Injury and/or damage the instrument.

CAUTION: HOT SURFACE WARNING: This warning is specific to heated components within the instrument. Failure to heed the warning could result in serious burns to skin and underlying tissue.

WARNING: ELECTRICAL SHOCK HAZARD: Dangerous voltages appear within this instrument. This warning is specific to an electrical hazard existing at or nearby the component or procedure under discussion. Failure to heed this warning could result in injury and/or death from electrocution.

Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

No Symbol

NOTE: Additional information and comments regarding a specific component or procedure are highlighted in the form of a note.

CAUTION: **THE ANALYZER SHOULD ONLY BE USED FOR THE PURPOSE AND IN THE MANNER DESCRIBED IN THIS MANUAL.**

IF YOU USE THE ANALYZER IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, UNPREDICTABLE BEHAVIOR COULD RESULT POSSIBLY ACCOMPANIED WITH HAZARDOUS CONSEQUENCES.

This manual provides information designed to guide you through the installation, calibration operation and maintenance of your new analyzer. Please read this manual and keep it available.

Occasionally, some instruments are customized for a particular application or features and/or options added per customer requests. Please check the front of this manual for any additional information in the form of an Addendum which discusses specific information, procedures, cautions and warnings that may be peculiar to your instrument.

Manuals do get lost. Additional manuals can be obtained from TI/AI at the address given in the Appendix. Some of our manuals are available in electronic form via the internet. Please visit our website at: www.teledyne-ai.com.

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DANGER
COMBUSTIBLE GAS USAGE WARNING

This is a general purpose instrument designed for use in a non-hazardous area. It is the customer's responsibility to ensure safety especially when combustible gases are being analyzed since the potential of gas leaks always exist.

The customer should ensure that the principles of operating this equipment are well understood by the user. Misuse of this product in any manner, tampering with its components, or unauthorized substitution of any component may adversely affect the safety of this instrument.

Since the use of this instrument is beyond the control of Teledyne Instruments/ Analytical Instruments, referred as TI/AI, no responsibility by TI/AI, its affiliates, and agents for damage or injury from misuse or neglect of this equipment is implied or assumed.

Introduction

1.1 Overview

The Model 7600 Infrared Gas Analyzer is a microprocessor based infrared gas analyzer used to measure the concentration of NO, SO_2, CO_2, CO and CH_4 contained in sample gas. It is based on the principle that different molecular species have unique absorption spectrum in the infrared, and the intensity of absorption is determined by the Lambert-Beer law.

In addition to the infrared analyzer, the Model 7600 can also be equipped with a built-in compact paramagnetic O_2 sensor or employ an external zirconia oxygen sensor to increase to 5 the number of simultaneous component species the unit can analyze.

Teledyne's Series 7600 Infrared (IR) Gas Analyzer is conveniently packaged in either a 19" rack mount or NEMA-4 wall mount enclosure. The NEMA-4 enclosure can be X or Z-purged to satisfy hazardous area installation requirements.

A high-sensitivity mass flow type twin detector is used for infrared measurements. By utilizing a single beam, double path design in conjunction with a serial dual-layer transmission detector, the Series 7600 delivers long term, drift-free performance.

The concentration of the desired gases is displayed on a large, easy-to-read back-lit LCD. Figure 1-1 shows the standard rack mountable Model 7600. The user interface is very intuitive and the menu / mode selection buttons, which are readily accessible, provide the operator with dynamic control and extensive diagnostic capabilities.

1.2 Main Features of the Analyzer

The Model 7600 Infrared Gas Analyzer is designed for accurate and reliable gas analysis and is easy to operate. The following features are standard on the 7600 instrument:

Figure 1-1: Model 7600A Infrared Gas Analyzer

- Simultaneous measurement of up to five components
- Excellent long-term stability
- Large, easy to read LCD display showing all simultaneous measurements and computations
- Slide-out, chassis design to facilitate any optical or maintenance adjustments required to fine tune analyzer performance (7600A)
- Multiple, in-depth on-screen analyzer functions easily accessible using the front-panel user interface buttons
- Follow & Hold output signal control (during calibration)
- Remote range change control
- Low / Hi limit alarms
- Range ID signals
- Auto-calibration with user adjustable frequency and gas flow time setting programming capabilities
- Remote auto-calibration initiation
- Auto-calibration status contacts

- Instrument or calibration error contact outputs
- Extra functions included such as average value computation, O_2 conversion
- Pump ON/OFF contact

1.3 Options Available

- Percent O_2 detector — Paramagnetic (built-in) or ZrO_2 (externally installed), user preference
- O_2 correction (the conversion of measured CO and SO_2 readings into values at standard O_2 concentration). Consult factory for more detail for this function.
- Communication functions:
  - RS-232C (9 pins D-Sub connector)
  - Half-duplex bit serial
  - Modbus protocol

1.4 Applications

The Model 7600 Infrared Gas Analyzer is a versatile analytical instrument tool and is ideally suited for multi-parameter gas analysis requirements for applications such as:

- Combustion control within the power, pulp and paper, steel, and cement industries
- Heat treating / Inert gas blanketing atmosphere control
- Bulk-gas impurity analysis within the air separation industry
- Anaerobic digester / Bio-gas / Land-fill gas analysis
- Vent gas analysis of oxyhydrochlorination reactors (EDC)
- Off-gas analysis on PTA and Maleic Anhydride reactors
- Fluid Catalytic Cracker (FCC) regeneration gas analysis
- Ammonia / Fertilizer process gas stream analysis
- Continuous Emissions Monitoring Systems (CEMS)

- Biochemistry and fermentation,
- Automotive emission analysis
- Explosive and toxic gas analysis
- Chemical analysis
- Refinery operation
- Research applications

1.5 Description of the Main Unit

Teledyne's Series 7600 Infrared Gas Analyzer measures the concentration of NO, SO_2, CO_2, CO, and CH_4 in a gas mixture on a continuous basis. The Series 7600 can also be supplied with an oxygen sensor, which allows the simultaneous measurement of oxygen concentration as well. The NEMA-4 enclosure can be X or Z-purged to satisfy hazardous area installation requirements.

The system uses a high-sensitivity mass flow type twin detector for infrared measurements. A single beam, double path optical bench is installed in conjunction with a serial dual-layer transmission detector.

The concentration of the desired gases is displayed on a large, easy-to-read backlit LCD. The user interface is very intuitive and the menu / mode selection buttons, which are readily accessible, provide the operator with dynamic control and extensive diagnostic capabilities. See Figure 1-2.

The front panel mounted power switch turns the instrument on and off while the display switch controls power to the display.

Front panel mounted handles make sliding the instrument out of the panel rack or enclosure a simple task for easy maintenance.

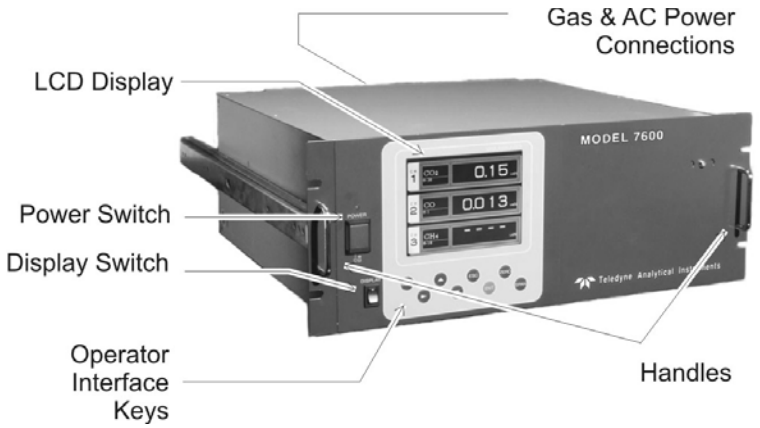


Figure 1-2: Model 7600 Description

Gas connections for the 7600 instrument are made on the rear panel of the instrument using the ¼" NPT fittings installed. The standard instrument has two measuring units and a pair of inlet/outlet gas connections exist for each unit. See Section 2.5 *Gas Connections*.

A power receptacle on the rear panel accepts the three-prong power cable supplied with the instrument. The Model 7600 operates on 100-240 VAC 50/60 Hz power. The power inlet conforms to EN60320 Protection Class 1 specifications.

Installation

Installation of the analyzer includes:

1. Unpacking the system.
2. Choosing a suitable location
3. Mounting the analyzer
4. Mounting the terminal module
5. Installing gas connections
6. Making electrical connections
7. Testing the installation.

CAUTION: READ THIS CHAPTER IN ITS ENTIRETY BEFORE INSTALLING THE SYSTEM.

FOR INDOOR USE ONLY.

2.1 Unpacking the Analyzer

The Model 7600 Infrared Gas Analyzer is shipped with the following components:

- 7600 Analyzer
- Input/Output terminal module set
- Connection cable
- Power cable
- Fuse (2)
- Cell window mounting tool
- Slide rail (2)*
- Relay board for auto calibration*
- Relay board connection cable*
- Instruction manual

* These optional items are included if specified at the time of purchase

As soon as you receive the instrument, carefully unpack and inspect the analyzer and components for damage. Immediately report any damage to the shipping agent. The analyzer is shipped with all the materials you need to install and prepare the system for operation.

2.2 Choosing a Location

CAUTION: THIS UNIT IS NOT EXPLOSION-PROOF. DO NOT INSTALL IT IN A LOCATION WHERE EXPLOSIVE OR FLAMMABLE GASES ARE PRESENT.

Select an installation location that meets the following criteria:

- This instrument should be rack mounted, or mounted in a steel enclosure.
- Indoor location.
- Vibration-free.
- Not exposed to direct sunlight.
- Clean and non-cluttered space.
- Depending on the options selected at the time of purchase, the model 7600 requires an AC power source of 100V to 240V AC.

- Operating voltage: 85V to 264V AC
- Rated frequency: 50/60 Hz
- Power consumption: 250 VA max.
- Plug: Comformity to EN60320 class I type 3-pin inlet
    - Operation conditions:
        - Ambient temperature: -5° to 45°C
        - Ambient humidity: 90 % RH or less, no condensation

2.3 Mounting the Analyzer

The 19” rack mountable 7600 analyzer is designed for either a guide rail or slide rail mounting within a rack or cabinet. The guide rail method supports the weight of the instrument from the bottom and can be used when there is adequate space for removing the top cover for maintenance. The slide rail mount supports the instrument from sliders mounted on the side of the instrument as shown in Figure 2-1. The instrument is then able to slide out of the rack or enclosure for required access during maintenance.

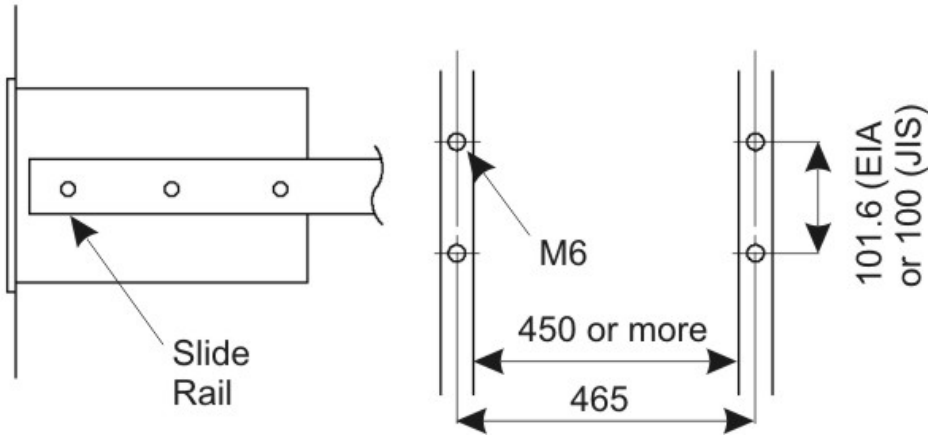


Figure 2-1: Slide Rail Mounting Dimensions

2.4 Mounting the Input/Output Terminal Module

The input/output module is the electronic interface that handles the various signals to and from the analyzer. It consists of up to five terminal blocks, a communications connector, a cable connector, and a solenoid drive output connector mounted together on a single mounting plate. See Figure 2-2.

Mount the input/output terminal module to the rack or cabinet panel using the six M4 screws supplied. For grounding, see Figure 2-3.

Note: To avoid noise generated from external units, mount the I/O terminal module mounting plate to the panel making sure there is adequate metal contact for continuity at the

mounting surface. Connect the panel to the same ground as the analyzer main unit.

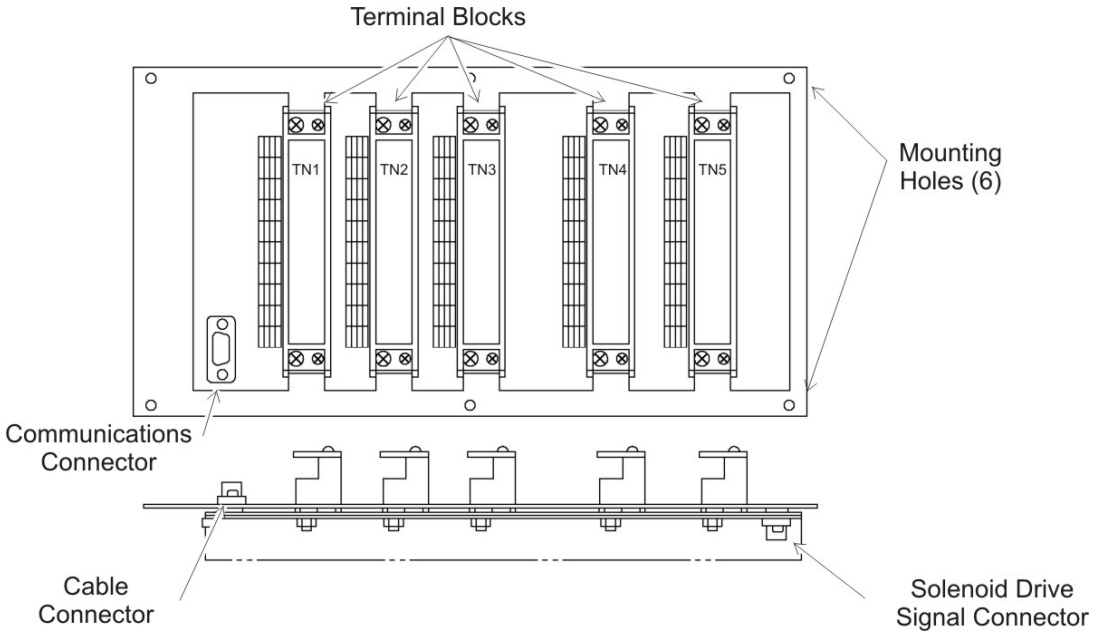


Figure 2-2: Input/Output Terminal Module

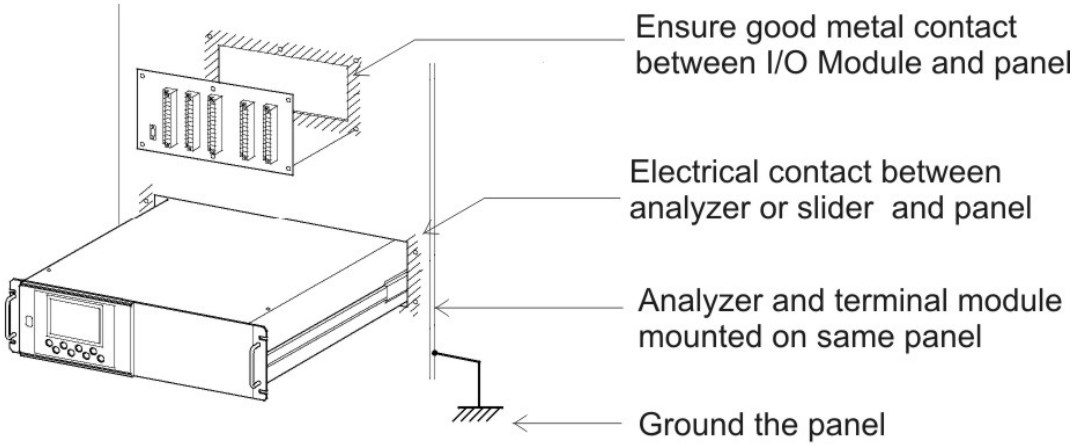


Figure 2-3: Mounting the I/O Module

2.5 Gas Connections

Gas connections are made on the rear panel of the analyzer. Adhere to the following guidelines when making gas connections:

- Use a corrosion resistant tube such as Teflon, stainless or polyethylene to connect the instrument to a sampling system. Even if there is a danger of corrosion, refrain from using rubber or soft vinyl tubing. This would result in instrument inaccuracies due to gas absorption by the piping materials.
- Pipe connection port is Rc1/4 female thread (or NPT1/4). Piping should be cut as short as possible for quicker response. About 4 mm inner diameter is recommended.
- Keep out dust and debris from the tubing and connections . Always use clean tubing and fittings.

Connect the gas tube as follows:

- **Sample gas inlet:** Attach the sample gas tube to the inlet fitting. The sample gas should be filtered and dehumidified before passing into the analyzer. This port is also used to connect the zero and span calibration gases.
- The gas flow should be constant within the range of 0.5 L/min ±0.2 L/min.
- **Sample gas outlet:** Sample gas exits the analyzer through the gas out port at atmospheric pressure. Exhaust gases must be vented safely.
- **Purge gas inlet:** This connection is used for purging the inside of the analyzer. Purging is not always required. See Section 2.5.6 *Purging the Analyzer*. When required, use dry N_2 or instrumentation air for the purge gas. Use a flow rate of 1L/min or greater).

2.5.1 Internal Piping Diagram

Note: When the purge gas inlet is provided, an internal connection to measuring unit 2 is installed.

An internal piping diagram for an instrument with one or two measuring units is shown in Figure 2-4. When there are two measuring units, if a built-in oxygen sensor is used, it must be installed in measuring unit 2. The diagram shows the combination of two cells used in measuring unit #2. This is possible by combining ranges. When a single measuring unit is used, there is only a single inlet and outlet gas connection.

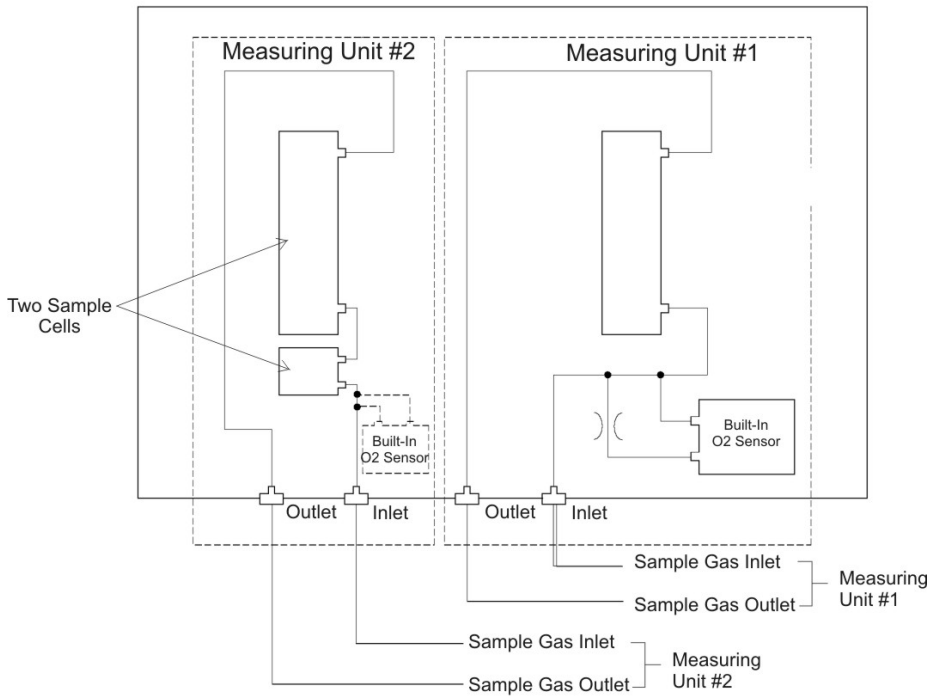


Figure 2-4: Internal Piping with Single or Dual Measuring Units

Depending on the options chosen, the analyzer can be configured in several ways. Table 2-1 lists the possible configurations for single and dual measuring units with 1 to 4 component meters.

Table 2-1: Correspondence of Measured Components and Measuring Units

Measuring components	Measuring unit 1	Measuring unit 2
1-component meter for NO, SO_2, CO_2, CO and CH_4	Each component	None
2-component meter for NO/SO_2 and CO_2/CO	NO/SO_2 CO_2/CO	None
2-component meter for NO/CO	NO	CO
3-component meter for NO/SO_2/CO	NO/SO_2	CO
4-component meter for NO/SO_2/CO_2/CO	NO/SO_2	CO_2/CO

2.5.2 External Piping Diagram

There are several ways to bring sample gas to the analyzer depending on the number of inlet/outlet gas connections on your instrument Recommended piping diagrams are shown in Figures 2-5, 2-6 and 2-7. Figure 2-5 is a schematic for an instrument with a single pair of inlet/outlet gas connections. Figures 2-6 and 2-7 are used when there are two pair of inlet/outlet connections. Note that a NO_2/NO converter is used when NO measurement is used for NOx analysis.

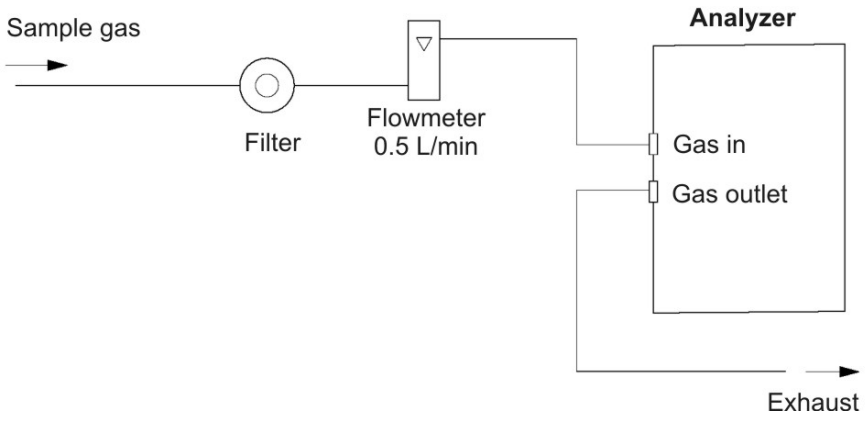


Figure 2-5: External Piping with Single Inlet and Outlet

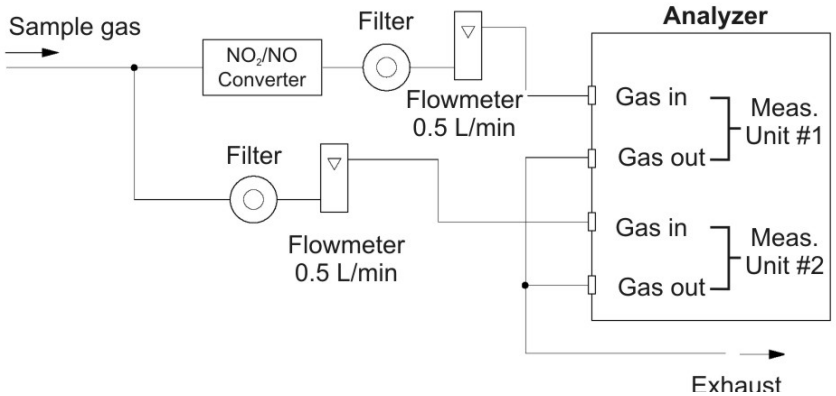


Figure 2-6: External Piping with Two Pair of Inlet/Outlet (1)

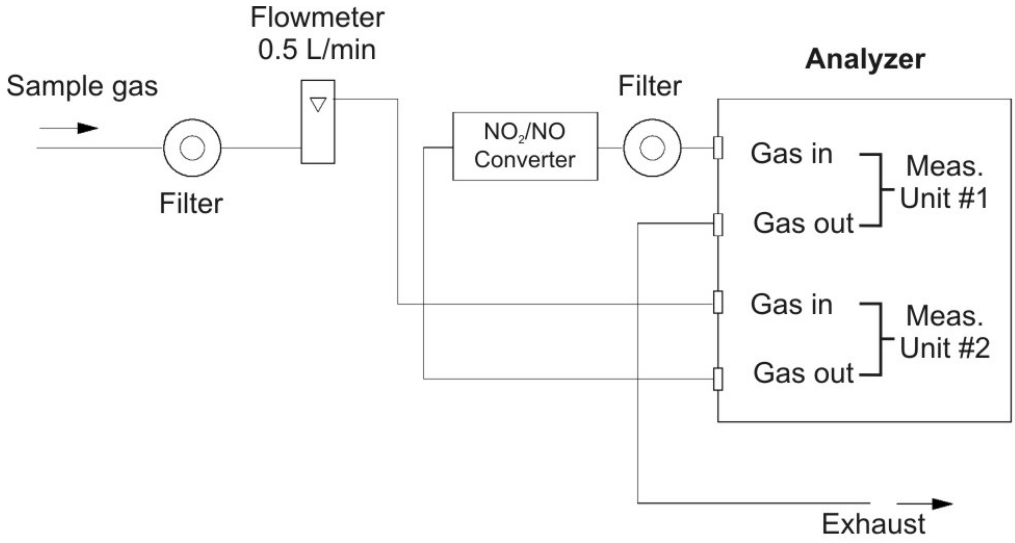


Figure 2-7: External Piping with Two Pair of Inlet/Outlet (2)

2.5.3 Gas Conditioning

For optimum performance, the sample gas should be treated as follows:

- A filter should be installed to remove any dust or particles in the sample gas. For a final stage filter, use a filter that can remove dust particles of 0.3 μm.

- The dew point of the sample gas must be lower than the ambient temperature to avoid condensation in the analyzer. If vapor is contained in the sampling gas, the dew point should be lowered to 0°C by using a dehumidifier.
- If SO_2 mist is contained in the sample gas, use a mist filter or cooler to remove the SO_2 mist. Other mists should be removed by using an appropriate mist filter or cooler.
- Corrosive gases such as Cl_2, F_2 and HCl, if contained in the sample gas in considerable amounts, will shorten the life of the instrument.
- Sample gas temperature should be within 0 to 50°C. Hot gas should not be fed directly into the instrument.

2.5.4 Flowrate

Use a flowrate of 0.5L/min ±0.2L/min. The sample system should be designed to avoid any flow fluctuation during measurement.

Use a flowmeter to observe the flow reading as shown in the external piping diagrams of Figures 2.5, 2.6 and 2.7.

2.5.5 Preparation of Calibration Gas

Routine calibration using calibration gases is required for optimizing the performance of this instrument. Once a week is a suggested calibration frequency. Table 2-2 indicates the zero and span gas required for calibration.

Table 2-2: Zero and Span Gas

	Analyzer without O_2	**Analyzer with built-in O_2**	**Analyzer with external zirconia O_2 sensor**
Zero gas	N_2 gas	N_2 gas	Dry air
Span gas other than for O_2	Gas concentration of 90% or more of full scale	Gas concentration of 90% or more of full scale	Gas concentration of 90% or more of full scale
Span gas for O_2 analysis	NA	Gas concentration of 90% or more of full scale	1 to 2% O_2

2.5.6 Purging the Analyzer

In general, purging the analyzer is not required unless one of the following cases apply:

- A combustible gas component is contained in sample gas.
- Corrosive gas is contained in the atmospheric air at the installation site.
- The same gas as the sample gas component is contained in the atmospheric air at the installation site.

In the above situations, the inside of analyzer should be purged with instrument air or N_2. Use a purge flow rate of about 1 L/min.

Use a filter to remove dust or mist from the purge gas.

2.5.7 Sample Gas Pressure

The sample gas pressure at the outlet should be atmospheric pressure.

2.5.8 Example configuration of gas sampling system

A typical system configuration with five component gas analysis for monitoring combustion exhaust gas from boiler, refuse incinerator, etc. is shown in Figure 2-8. Contact Teledyne for specific application system configuration or further information.

The system shown is comprised of:

- Model 7600—with dual measuring unit option and external zirconia oxygen sensor.
- Gas Extractor—with stainless steel filter of standard mesh 40 μm equipped with integral heater.
- Mist Filter—to remove condensate, mist and dust from the sample before it enters the analyzer.
- Safety Drain Trap—with two compartments for positive and negative pressure. It monitors and adjusts the sample gas pressure.
- Gas Aspirator—to aspirate the sample gas.
- Electronic Gas Cooler—used to dry the sample gas to a dew point of approximately 2°C (35.6°F).

- Solenoid Valve—for introducing calibration gas and OFF/ON flow of sample gas.
- Membrane Filter—PTFE filter for rempval of fine dust particles.
- Flowmeter—adjusts and monitors the sample gas flowrate.
- Standard Gas—a bank of calibration gases used for setting zero and span of the analyzer for each species monitored.
- Zirconia Sensor— an external zirconia sensor is used for measuring the oxygen concentration in the sample gas. Some instruments use a built-in paramagnetic oxygen sensor instead aof an external zirconia sensor.
- NO_2/NO Converter—added to the NO analysis circuit which uses an efficient catalyst for converting NO_2 to NO for analysis.

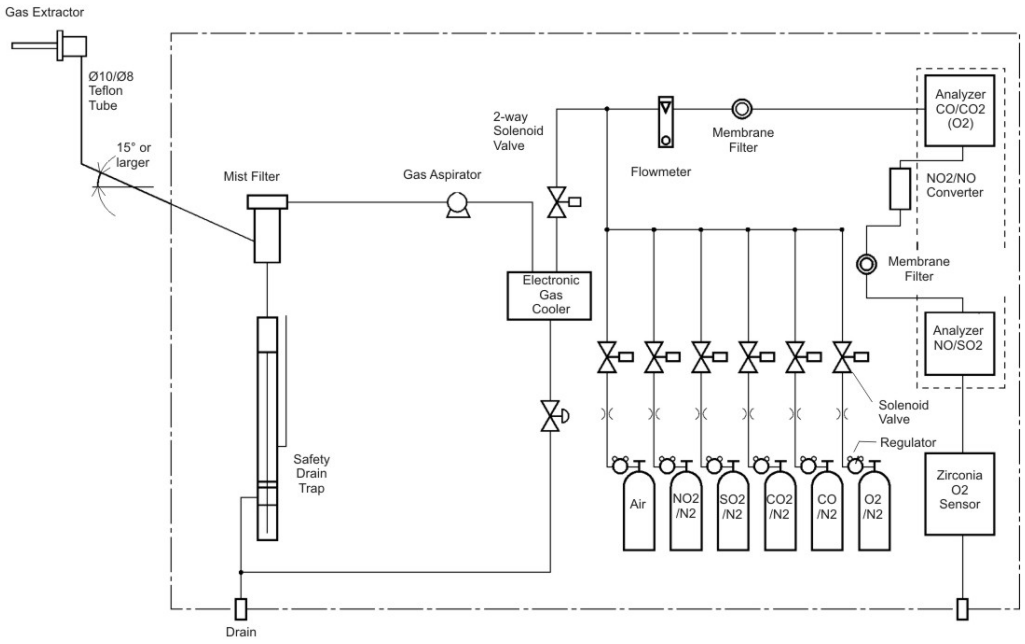


Figure 2-8: Five-Component Analysis System

2.6 Electrical Connections

2.6.1 Power Inlet

The power inlet for the Model 7600 is located on the rear panel as shown in Figure 2-9. The proper 3-prong power cord has been supplied with your instrument. Connect the power cable to the power inlet.

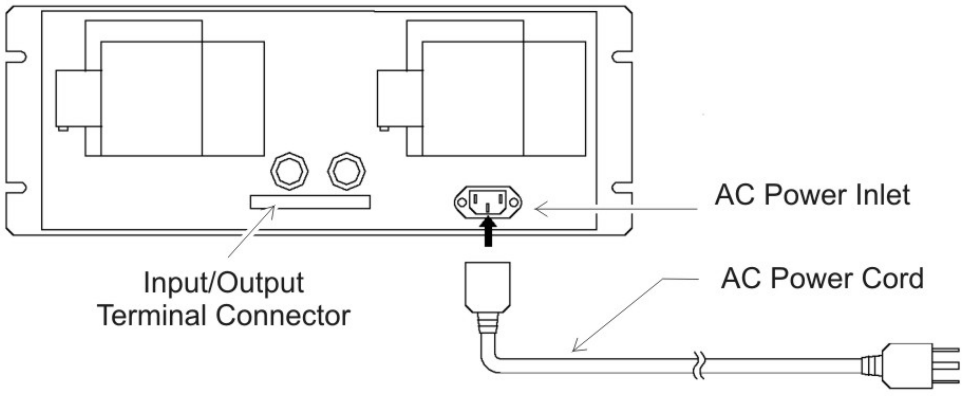


Figure 2-9: Model 7600 Electrical Connections

The Model 7600 requires 100-240 VAC 50/60 Hz power.

Avoid installing this instrument near an electrical unit that generates electrical noise such as a high frequency furnace or electric welder. If using the instrument near such a noise-generating unit is unavoidable, use a separate power line to avoid noise.

Mount a noise suppressor such as varister or spark killer as shown in Figure 2-10 to the noise generating unit when noise is generated from relays or solenoid valves. The suppressor must be mounted near the noise generating source, or it will have no effect.

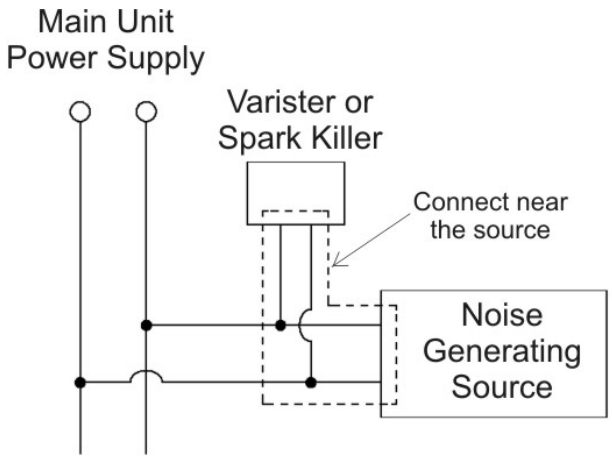


Figure 2-10: Noise Suppression

2.6.2 Input/Output Terminal Module

Use the supplied cable to interface the I/O Module to the analyzer.

Plug the cable connector into the receptacle at the rear panel of the analyzer and the receptacle on the PC board of the input/output module.

Make sure that the ferrite core attached to the I/O cable goes to the analyzer. See Figures 2-9 and 2-11.

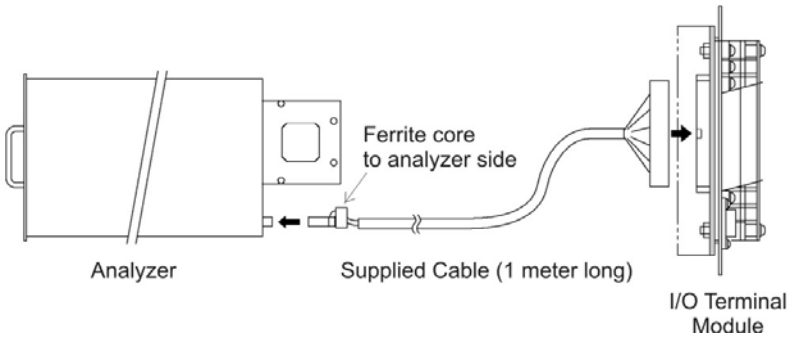


Figure 2-11: I/O Cable Connection

The I/O Module carries various input and output signals. A detailed list of these signals and pinout information is given in the Appendix.

2.7 Testing the System

After the analyzer has been installed with gas and electrical connections but prior to powering up the unit make sure you have:

- Installed the unit correctly
- Checked the gas connections for leaks

Once the above checks have been made, you can connect the power source and turn the analyzer on using the power switch on the front panel. Allow the analyzer to warm up for four hours.

When the instrument is first turned on, you will see the measurement screen. While in the warm up stage, the readings are inaccurate. They may even be above the upper limit of range, however, this is not an error.

After the analyzer has come to equilibrium (approximately four hours after first powering up) the instrument is ready to be configured and calibrated for your process. This is described in Section 3.

Operation

3.1 General Information

This section describes the front panel interface of the analyzer.

Figure 3-1 Shows the Model 7600 Infrared Gas Analyzer front panel. The user interface consists of 8 membrane switch buttons or keys, a power ON/OFF switch and a display ON/OFF switch. The 8 user keys are shown in Figure 3-2 and described below.

Figure 3-1: Front Panel of the Model 7600

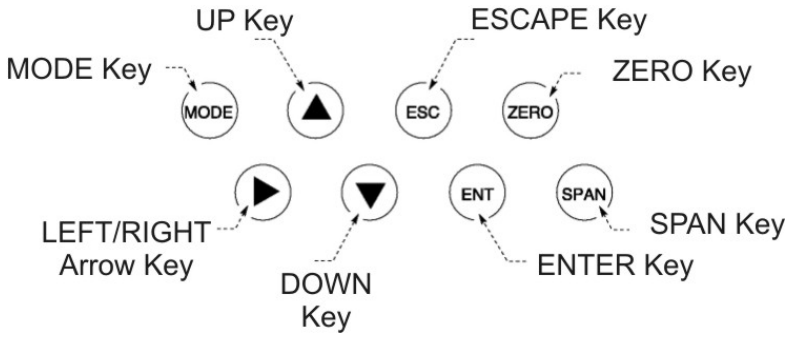


Figure 3-2: Interface Keys on the Front Panel

MODE key:	Used to switch the mode.
LEFT/RIGHT Arrow key:	Used to change the selected item by moving the cursor and numeral digit.
UP key:	Used to change the selected item by moving the cursor and to increase a numeric value.
DOWN key:	Used to change the selected item by moving the cursor and to decrease a numeric value.
ESC key:	Used to return to a previous screen or cancel the setting midway.
ENT key:	Used for confirmation of selected item or value, and for performing a calibration.
ZERO key:	Used for zero calibration.
SPAN key:	Used for spancalibration.

3.2 Display and Available Menus

The display on the Model 7600 has two modes: measurement mode and user mode. To change between modes, press the MODE key.

In the measurement mode, the display indicates the composition of the sample gas. Up to 12 channels of output are available although the screen only shows 5 channels at a time. To see additional channels, scroll down or up using the UP or DOWN keys.

Calibration is performed from the measurement mode by pressing ZERO or SPAN. See Section 3.7 *Calibration*.

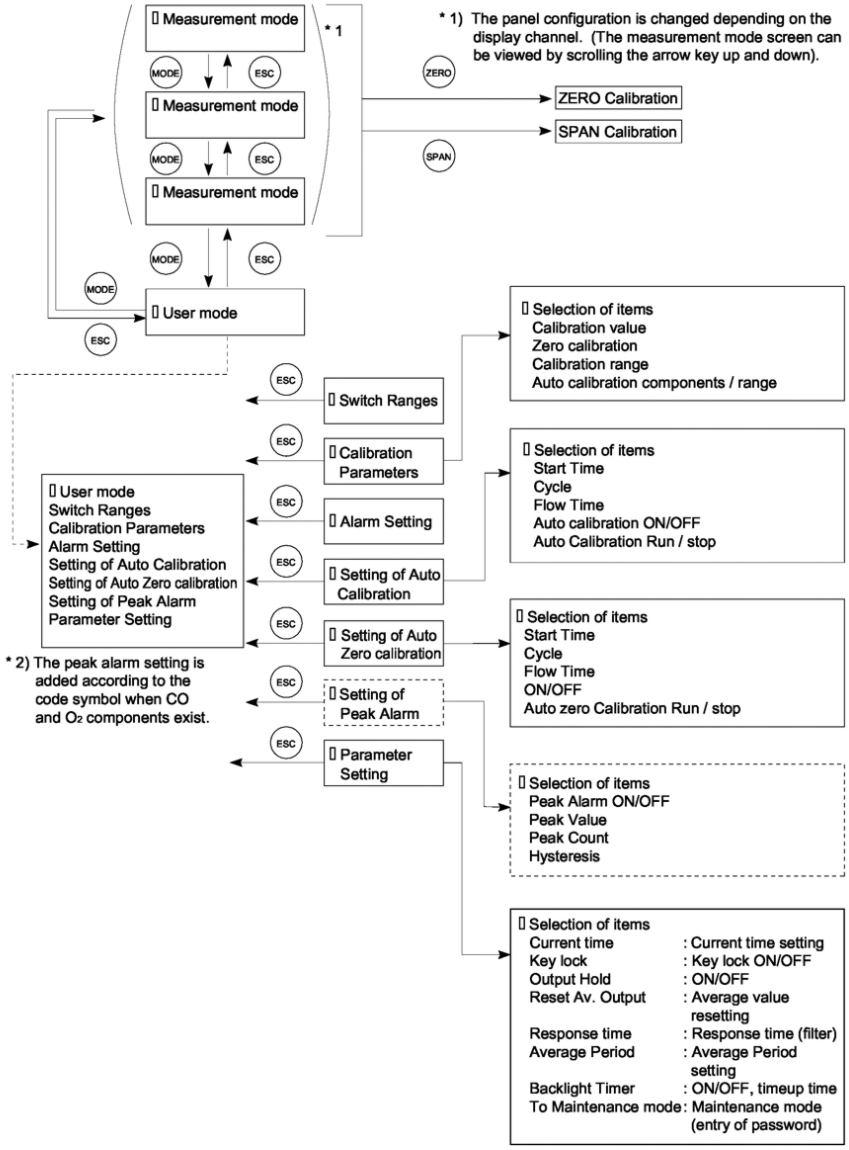


Figure 3-3: Display Modes and Menu Hierarchy

The user mode is where the operator configures the instrument and sets up various parameters for the intended application. From the user mode the following menus are available:

- Switch Ranges
- Calibration Parameters
- Alarm Setting
- Setting of Auto Calibration
- Setting of Auto Zero Calibration
- Setting of Peak Alarm
- Parameter Setting

Figure 3-3 shows the overall structure of the Model 7600 display and menu hierarchy.

3.3 The Display Screen

3.3.1 Measurement Mode

The measurement mode screen is the default mode when the power is turned on. It displays component and concentration information about the process. The screen depends on the number of components. Figure 3-4 is an example of a measurement mode screen for an instrument configured for NO, SO_2, CO_2, CO and O_2 analysis with a 12 channel output.

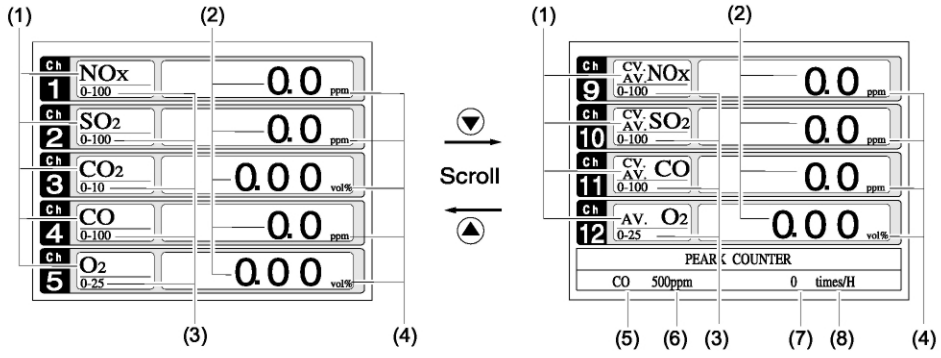


Figure 3-4: Example Screen—5 Component Analysis 12 Channels

The numbered call outs in Figure 3-4 refer to:

No.	Name	Function
(1)	Component display	Displays component of instantaneous value, corrected instantaneous value, corrected average value, etc.
(2)	Concentration display	Displays measured value of concentration.
(3)	Range display	Displays range values.
(4)	Unit display	Displays unit with ppm and vol %.
(5)	Peak alarm component	Displays peak alarm component.
(6)	Peak alarm concentration	Displays peak alarm concentration display. (Upper limit value)
(7)	Peak alarm times	Displays the alarm times exceeding the peak value.
(8)	Peak alarm unit display	Displays units of peak alarm with times/H.

Instantaneous value and concentration value:

The concentration display of Ch (component) where sampling components such as "CO_2", "CO" or "O_2 are displayed in the component display, indicates current concentration values of the measured components contained in gas that is now under measurement.

O_2 correction concentration values:

Ch components where "cv**" is displayed as "cv CO" in the component display are calculated values. They are obtained from the following equation by setting sampling components, O_2 instantaneous/ concentration values and O_2 correction reference value (see item 6.8).

$$\text{Correction output} = \left(\frac{21 - \text{On}}{21 - \text{Os}}\right) \times \text{Cs}$$

Where:

On: The value of the O_2 correction reference value (Value set by application)

Os: Oxygen concentration (%)

Cs: Concentration of relevant measured component. Note that Os does not exceed the O_2 limit value set in "Other Parameter" See Section 3.6 *Maintenance Mode.*

The corrected sampling components are NO_X, SO_2 and CO only.

O_2 correction concentration average value:

In the Ch (component) and O_2 average value where "CV/AV **" is displayed as " AV CO" in the component display, a value obtained by averaging O_2 correction concentration value or O_2 average value in a fixed time is output every 30 seconds.

Averaging time can be changed between 1 minute and 59 minutes or 1 hour and 4 hours according to the average time settings (See Section 3.5.7 *Parameter Setting*).

The set time is displayed as "1h" , for instance, in the range display.

* The measurement ranges of O_2 correction concentration value and O_2 correction concentration average value are the same as that of the measuring components. Also, the measurement range of O_2 average value is the same as that of O_2.

3.3.2 Setting/Selection Screen

The setting/selection screen is configured as shown in Figure 3-5:

- In the status display area, the current status is displayed.
- In the message display area, messages associated with operation are displayed.
- In the setting item and selection item display area, items or values to be set are displayed, as required. To work in a particular area, move the cursor to any item by using the UP, DOWN and LEFT/RIGHT keys.

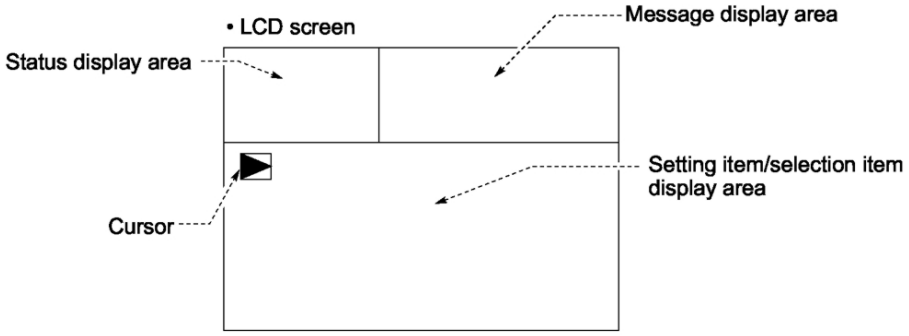
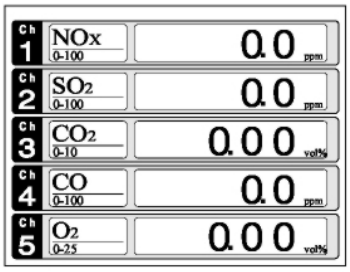


Figure 3-5: Setting/Selection Screen Areas

3.4 Basic Operation

Measurement mode

The measurement mode is the default mode of the instrument and appears when the unit is first turned on. It displays information about the process being analyzed such as: channel number, component species analyzed, concentration or calculated value, etc. In this mode, the display can show up to 5 channels on a single screen. To view additional channels, scroll down by pressing the DOWN key or back up using the UP key. Each press scrolls the screen by one channel. You can also calibrate the instrument from this mode by pressing the appropriate ZERO or SPAN button. See Section 3.7 *Calibration*.



User mode displays:

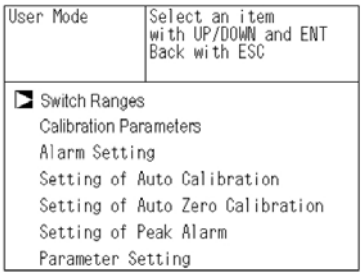
In the user mode you can:

- Switch ranges
- Set calibration parameters
- Adjust alarm settings

- Set up the Auto Calibration feature
- Setup an auto zero calibration
- Adjust the peak alarm parameter Setting.

These settings are described in Section 3.5.

To enter the user mode from the measurement mode, press the MODE key. To return to the measurement mode, press the MODE key again or ESC.



3.5 Setting Up the Analyzer in the User Mode

3.5.1 Switch Ranges

From the Switch Ranges menu you can:

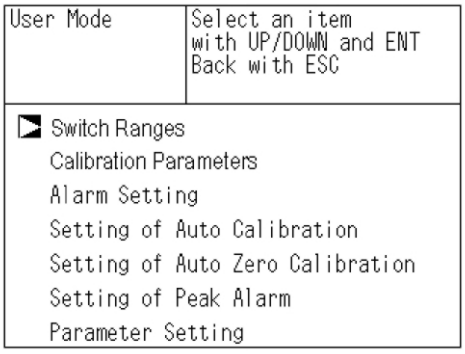
a. Manually select a desired range for any channel.

b. Use the remote range switch contacts to select a range.

c. Select autoranging.

To enter the Switch Ranges menu:

1. Press the MODE key to enter the user mode.



2. Move the cursor to the “Switch Ranges” option and press ENT. The “Channel Selection” screen appears.

Switch Range		Select Ch No. with UP / DOWN and ENT Back with ESC
Ch1 NO_x	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO_2	AR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch3 CO_2	RR	▶ Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O_2	MR	▶ Range1 0-10 vol% Range2 0-25 vol%

3. Move the cursor by pressing the UP/DOWN keys to the desired channel and press ENT.

There are 3 range switch modes in the second column to select from:

MR: Manual selection

RR: Remote range switch

AR: Autoranging

The selected range switch mode is highlighted for the channel you selected.

4. Press the UP/DOWN keys to toggle between the available switch modes.
5. Then press the ENT key to confirm the selection.

3.5.1.1 MANUAL RANGE SWITCHING

To manually switch between analysis ranges:

1. Select the MR option from the Switch Range screen and press the ENT key.

Switch Range		Select method of Switch ranges with UP / DOWN and ENT Back with ESC
Ch1 NO_X	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch2 SO_2	AR	Range1 0-100 ppm ▶ Range2 0-2000 ppm
Ch3 CO_2	RR	▶ Range1 0-10 vol% Range2 0-20 vol%
Ch4 CO	MR	▶ Range1 0-100 ppm Range2 0-2000 ppm
Ch5 O_2	MR	▶ Range1 0-10 vol% Range2 0-25 vol%

2. Move the highlight of the cursor to range selection and select the desired range using the UP/DOWN keys. The highlighted arrow indicates the currently selected range.
3. Press ENT to accept the selection. Measurement is now carried out using the selected range.

Note: If "RR" or "AR" is selected as range switch mode, manual range selection as described above is not possible

The range for O_2 correction value, O_2 correction average value, and O_2 average value is automatically switched if the corresponding instantaneous value range is switched.

To abort the range selection, press the ESC key and the setting operation is made invalid and the previous screen appears.

3.5.1.2 RANGE IDENTIFICATION CONTACT OPERATION

In all of the range switch modes (MR, RR, AR), the status of the range identification relay contact corresponding to each Ch (component) is closed when Range 1 is selected, and open when Range 2 is selected.

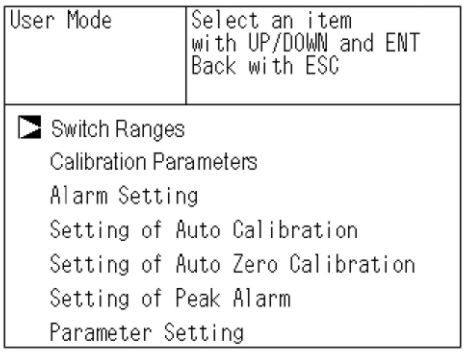
Note that even if the range is switched while a hold of measurement is in place, for instance, by a remote hold contact input or the hold of measurement value during calibration, the range identification contact maintains the contact state immediately before the hold. After stop of the hold, the contact state of the current range is resumed.

3.5.1.3 REMOTE RANGE SELECTION

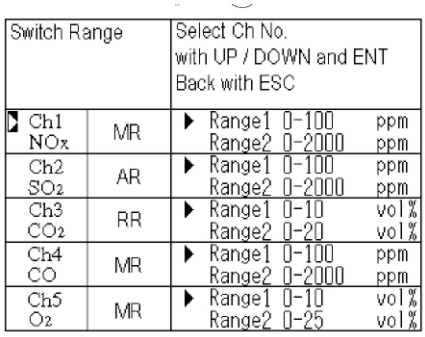
The range can be selected remotely if a remote switch has been installed. To use this feature, the range mode must be switched in the display to RR (Remote Range) .

To configure the instrument for remote range selection:

1. Press the MODE key to enter the user mode.



2. Move the cursor to the “Switch Ranges” option and press ENT. The “Channel Selection” screen appears.



3. Move the cursor by pressing the UP/DOWN keys to the desired channel and press ENT.

The selected range switch mode is highlighted for the channel you selected.

4. Press the UP/DOWN keys to toggle between the available switch modes until RR is displayed.
5. Press the ENT key to accept the selection.

3.5.1.4 AUTORANGING

The Model 7600 can be set to autorange where the instrument will select the analysis range automatically. To use the autorange feature, AR must be selected for the switch mode. Note that each channel is independent so that autoranging can be used for some or all of the available channels. the remaining channels can be configured to manual or remote switching.

To setup autoranging use the same procedure as Section 3.5.1.1 except you must select AR for the switch mode on the channel or channels you want to autorange.

3.5.2 Calibration Parameters

The next menu choice from the user screen is the Calibration Parameters menu. Here calibration settings can be configured for your particular application. There are 4 submenus in the Calibration Parameters menu. They are:

- Calibration Value—set the concentration of calibration gas
- About ZERO Calibration—set each or all components to be zero calibrated during a manual zero calibration.
- About Calibration Range—sets whether each component during a zero or span calibration should be calibrated with a single or dual range.
- Auto Calibration Components/Range— select the component and range with which auto calibration is to be performed.

3.5.2.1 CALIBRATION VALUE

This submenu allows you to set the concentration of the standard gas (zero and span) for each channel used for calibration.

To enter the Calibration Value submenu:

1. From measurement mode, press the MODE key to display the user mode.
2. Point the cursor to “Calibration Parameters” by pressing the UP or DOWN key.
3. Press the ENT key to enter the Calibration Parameters menu.

4. In the "Calibration Parameters" screen that appears, point the cursor to "Calibration Value" by pressing the UP or DOWN key. Press the ENT key.

Cal. Settings Cal. Value	Select Ch No. for setting calibration value		
CH	RANGE	ZERO	SPAN
Ch1 NOx	0-100ppm 0-2000ppm	+0000.0 +00000	0100.0 02000
Ch2 SO_2	0-100ppm 0-2000ppm	+0000.0 +00000	0100.0 02000
Ch3 CO_2	0-10vol% 0-20vol%	+000.00 +000.00	010.00 020.00
Ch4 CO	0-100ppm 0-2000ppm	+0000.0 +00000	0100.0 02000
Ch5 O_2	0-10vol% 0-25vol%	21.00 21.00	01.00 01.00

To change the concentration of a calibration gas:

1. Point the cursor to the channel you want to set by using the UP or DOWN key. Press the ENT key.
2. Select the concentration item you want to set by pressing the UP or DOWN or SIDE key. Press the ENT key, and the selected value is highlighted.

Cal. Settings Cal. Value	Select setting value		
CH	RANGE	ZERO	SPAN
Ch1 NOx	0-100ppm 0-2000ppm	+0000.0 +00000	0100.0 02000
Ch2 SO_2	0-100ppm 0-2000ppm	+0000.0 +00000	0100.0 02000
Ch3 CO_2	0-10vol% 0-20vol%	+000.00 +000.00	010.00 020.00
Ch4 CO	0-100ppm 0-2000ppm	+0000.0 +00000	0100.0 02000
Ch5 O_2	0-10vol% 0-25vol%	21.00 21.00	01.00 01.00

3. Enter the calibration gas concentration values (zero and span). For any numerical value entry, press the UP or DOWN key to increase or decrease a single digit. Select the next digit by pressing the SIDE key.
4. When the concentration is correct, save the entry by pressing the ENT key. The saved value becomes valid from the next calibration process.

Note: Enter settings that correspond to each range. If a zirconia type O_2 sensor is used, select 21.00 for the field of Zero (when air is used), and select the concentration listed on the cylinder if the air contained in a cylinder is used.

To close the calibration concentration value setting process or cancel this mode midway, press the ESC key. The previous screen will return.

Setting range of values:

For NO_x, SO_2, CO_2, CO, CH_4, external O_2 measurement and built-in paramagnetic O_2 sensors, the setting range for span gas is 1 to 105% of full scale. The instrument will not accept values outside of this range.

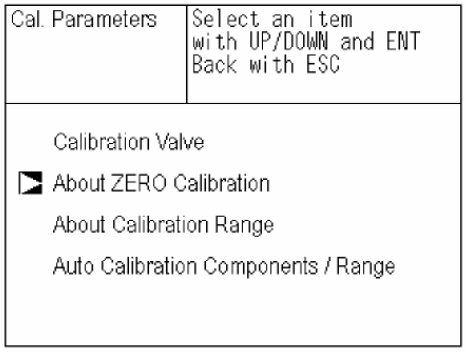
For external Zirconia O_2 sensors, the setting range for zero gas is 5 to 25 vol % and span from 0/01 to 5 vol %

3.5.2.2 SETTING OF MANUAL ZERO CALIBRATION

When zero calibration is performed manually, you can choose whether all components are to be calibrated simultaneously or each component calibrated while selecting one by one.

This is configured from the About Zero submenu of the Calibration Parameters menu. To get to the About Zero submenu:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to “Calibration Parameters” by pressing the UP or DOWN key and press the ENT key.
3. In the “Calibration Parameters” screen that appears, point the cursor to “About ZERO Calibration” by pressing the UP or DOWN key. Press the ENT key.



This brings up the Cal. Settings ZERO Cal. screen where you can set whether all components or individually selected components are zeroed during a manual zero calibration. The choices are:

- at once—these components will be zeroed simultaneously during a manual zero.
- each—these components will be zeroed individually during a manual zero.

Cal. Settings ZERO Cal.	Select Ch No.	
▶ Ch1 NO_x	Range1 0-100 ppm Range2 0-2000 ppm	at once
Ch2 SO_2	Range1 0-100 ppm Range2 0-2000 ppm	at once
Ch3 CO_2	Range1 0-10 vol% Range2 0-20 vol%	at once
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	at once
Ch5 O_2	Range1 0-10 vol% Range2 0-25 vol%	each

To change the manual zero setting:

1. In the "Cal. Settings ZERO Cal." screen, point the cursor to the channel you want to set by using the UP or DOWN key. Press the ENT key.
2. Select "at once" or "each" by pressing the UP or DOWN key to toggle between the two options. Press the ENT key when the desired option is displayed.

To close the Cal. Settings ZERO Cal. screen or cancel this mode midway, press the ESC key. The previous screen will return.

Example:

The options "each" or "at once" can be determined for each channel.

- When the setting is "each", select the channel on the manual zero calibration screen (see Section 3.7) and perform a zero calibration. Only that component is zeroed.
- When the setting is "at once", performing a manual calibration (see Section 3.7) will zero calibrate all components tagged "at once". You will notice on the manual

zero calibration screen that all there are cursors on all components where “at once” is set.

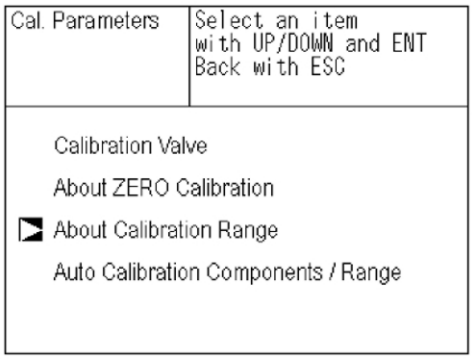
Note: When the cylinder air or atmospheric air is used for the zero gas, select “at once.”

3.5.2.3 SETTING OF CALIBRATION RANGE

Use the “About Calibration Range” submenu to configure the instrument for calibration on one or two ranges for a channel.

To set calibration one or both ranges:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to “Calibration Parameters” by pressing the UP or DOWN key and press the ENT key.
3. In the “Calibration Parameters” screen that appears, point the cursor to “About Calibration Range” by pressing the UP or DOWN key. Press the ENT key.



4. In the next screen that appears, point the cursor to the channel you want to set by pressing the UP or DOWN key then press the ENT key.
5. On the “calibration range selection” screen that appears, select “both” or “current” by pressing the UP or DOWN key.

   If “both” is selected, zero or span calibration is performed with Range 1 and Range 2 of the selected channel.

   If “current” is selected, zero or span calibration is

performed only for the range displayed when calibration of the selected channel is performed.

Cal. Settings Cal. Range	Select Ch No.	
▶ Ch1 NOx	Range1 0-100 ppm Range2 0-2000 ppm	both
Ch2 SO_2	Range1 0-100 ppm Range2 0-2000 ppm	current
Ch3 CO_2	Range1 0-10 vol% Range2 0-20 vol%	current
Ch4 CO	Range1 0-100 ppm Range2 0-2000 ppm	both
Ch5 O_2	Range1 0-10 vol% Range2 0-25 vol%	current

6. Press the ENT key after the selection, and the specified calibration is set.

To close the calibration range selection screen or cancel this mode midway, press the ESC key. The previous screen will return.

Note: To perform calibration for "both," set the same calibration gas concentration for both ranges.

After setting the calibration range to "both", you will notice in the Manual Calibration screen (see Section 3.7), that there are cursors next to both ranges whereas there would only be a single cursor next to the range for calibration if "current" was set. For example, if channel 1 and channel 4 were set to "both" then cursors will appear in both ranges of Ch1 and Ch4 in the Manual Calibration screen shown below.

ZERO Cal.	ENT : Go on calibration of selected Ch ESC : Not calibration	
Ch1 NOx	▶Range1 0-100 ppm Range2 0-2000 ppm	-0.6
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	0.4
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	-0.1
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	21.00

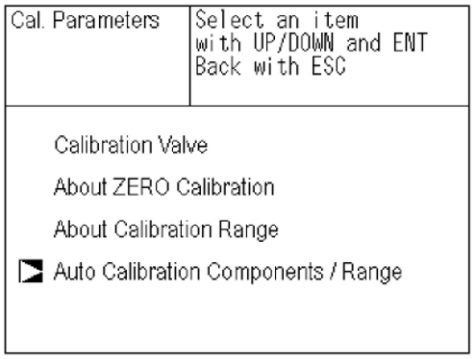
3.5.2.4 SETTING OF AUTO CALIBRATION COMPONENT/RANGE

This menu is used to select the channel and the range in which auto calibration is to be performed. If a channel has been set to autoranging

(AR), it will be calibrated in the range set in this menu when auto calibration is performed. From this menu you can enable or disable the auto calibration feature.

To navigate to the Auto Calibration Components/Range menu:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to “Calibration Parameters” by pressing the UP or DOWN key and press the ENT key.
3. In the “Calibration Parameters” screen that appears, point the cursor to “Auto Calibration Components/Range” by pressing the UP or DOWN key. Press the ENT key.
4. In the “Calibration Parameters” screen that appears, point the cursor to “Auto Calibration Components / Range” by pressing the UP or DOWN key. Then press the ENT key.



Cal. Settings Auto Cal.	Select Ch No.	
Ch1 NO_x	▶Range1 0-100 ppm Range2 0-2000 ppm	enable
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	enable
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	enable
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	enable
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	enable

To set the range used for auto calibration:

1. In the “Auto Calibration Components / Range” selection screen that appears, point the cursor to the channel whose

range you want to set using the UP or DOWN key. Then press the ENT.

2. The cursor next to the range of the selected channel is highlighted. Select the range to be calibrated using the UP or DOWN key. Then press the ENT key. The auto calibration will be performed on the selected range.

Channels which have been set for autoranging (AR) will undergo the auto calibration and manual calibration on the range selected here. Once the calibration has started, the range will automatically switch and on completion of the calibration, the original range is resumed.

The range identification contact is interlocked with the range after the switch. However if the hold setting is set to "ON" the contact status before calibration is maintained.

To ENABLE/DISABLE the auto calibration feature:

1. With the cursor next to the range of the selected channel you want to enable or disable for autocalibration (see steps 1 and 2 above), use the SIDE key to highlight the "enable" or "disable" option.
2. Use the UP or DOWN keys to toggle between the two options then select the desired status by pressing ENT.

To close the Auto Calibration Components/Range screen or cancel this mode midway, press the ESC key. The previous screen will return.

Note: The order in which the Zero and Span calibrations are performed in the auto calibration routine are different. For the zero calibration, the calibration is performed according to the order in which the channels were set to "enable". For Span, the calibration begins with the lowest channel number first and proceeds sequentially to the highest channel number set to "enable".

3.5.3 Alarm Setting

The Model 7600 is equipped with 6 alarms (5 or 6 concentration and a power failure alarm). The alarm configuration and settings can be assigned to any channel and adjusted at any time by entering the user mode and navigating to the Alarm Setting submenu. Arbitrary 6 alarm contact outputs are used which can be configured as:

- High Limit: sets the upper value (concentration) above which the alarm will trigger. Has an on-screen display.
- Low Limit: sets a lower value (concentration) below which the alarm will trigger. Has an on-screen display
- High or Low Limit: triggers an alarm when the concentration is above the high limit or below the low limit.
- High-High: sets the upper value (concentration) above which the alarm will trigger.
- Low-Low: sets a lower value (concentration) below which the alarm will trigger.
- Power Failure: (Alarm 6 only) normally closed contacts open when power is removed.

Configuring the alarms involves:

- Selecting the alarm type
- Assigning it to a channel
- Establishing setpoints (concentration alarms only)
- Enabling or disabling it

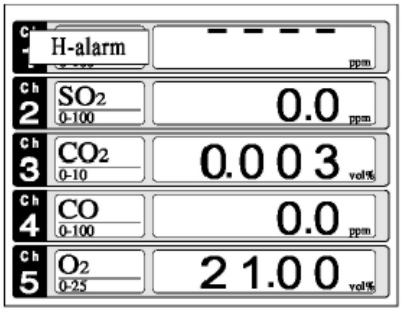
A channel can be configured for multiple alarms.

ON/OFF enables the alarm function if set at ON, or disables the alarm function if set at OFF. The H-limit value cannot be set below the L-limit value, and the L-limit value cannot be set above the H-limit value.

If it is desired to set the H-limit value below the L-limit value already stored in the memory, reduce the L-limit value beforehand, and vice versa.

A typical on-screen display for a High alarm is shown below.

When the H-limit alarm occurs, the “H-alarm” message comes on in the field of relevant channel. Similarly for L-alarm. There is no screen display for the HH-alarm”, and “LL-alarm” but otherwise, they function like the H and L limit alarms.

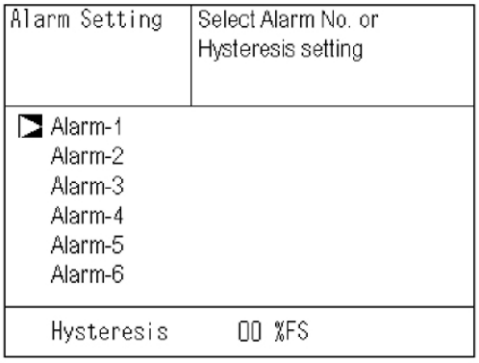


CAUTION: ALARMS ARE INACTIVE FOR 10 MINUTES AFTER TURNING ON POWER.

3.5.3.1 CONFIGURING THE ALARMS

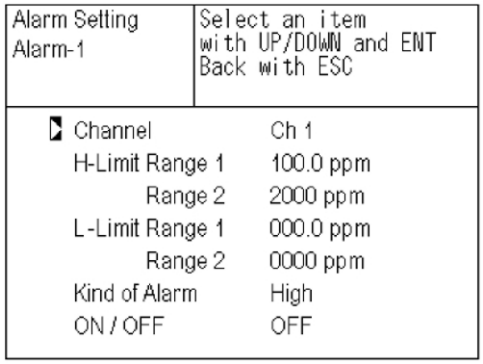
Note: To change an alarm setting, first set the alarm ON/OFF setting to OFF, and then change the value.

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to "Alarm Setting" by pressing the UP or DOWN key and press the ENT key.
3. In the "Alarm Setting" screen that appears, point the cursor to the alarm number you want to set (1 through 6) using the UP or DOWN key. Press the ENT key when the cursor is on the alarm number you desire.



4. The alarm item selection screen will appear where you can select the alarm type, assign it to a channel, define setpoints, and enable or disable the alarm. Use the UP or DOWN keys until the cursor is aligned with the desired function and press the ENT key.

Note: Setpoints are adjustable form 0 to 100% of fullscale however they must be defined so that H-limit value > L-limit value and that (H-limit value- L-limit value) > hysteresis.



5. After setting the last feature, store the values by pressing ENT again.

To close the Alarm Setting screen or cancel this mode midway, press the ESC key. The previous screen will return.

3.5.3.2 HYSTERESIS SETTING

The hysteresis setting is used prevent chattering of an alarm output near the alarm setpoint. The hysteresis value range is 0-20% of fullscale on any analysis range. Figure 3-6 shows the hysteresis width (in % fullscale) set for a high limit alarm.

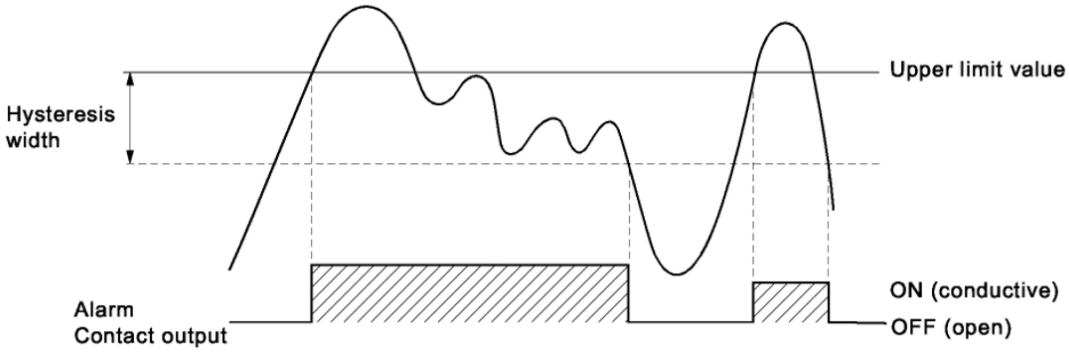


Figure 3-6: Hysteresis Example for a High Limit Alarm

An alarm output is turned ON if measurement value exceeds the upper limit value as shown in Figure 3-6. Once the alarm output has been turned ON, it is not turned OFF until the process value falls below the hysteresis width.

Note: The hysteresis setting is common to all alarms.

To set the hysteresis value:

1. From the "Alarm No. Selection" screen, point the cursor to "Hysteresis" by pressing the UP or DOWN key then press ENT.

Alarm Setting	Select Alarm No. or Hysteresis setting
Alarm-1 Alarm-2 Alarm-3 Alarm-4 Alarm-5 Alarm-6	
▶ Hysteresis 00 %FS	

2. In the "Hysteresis Value Setting" screen that appears, enter hysteresis values using the UP or DOWN keys to increment or decrement a digit. Use the SIDE key to move to the next digit. When finished, press ENT.

To close the “Hysteresis Setting” or cancel the mode midway, press the ESC key. A previous screen will return.

3.5.4 Setting of Auto Calibration

3.5.4.1 AUTO CALIBRATION

Auto calibration is automatically carried out when zero and span calibrations are set.

In this menu you can set when and how frequent the auto calibration is performed. You also enable or disable the auto calibration feature here.

Description of setting items:

Start Time: Setting at the first calibration (day of the week, hour, minute)

Cycle: A period between the start time of one calibration and another (unit: hour/day)

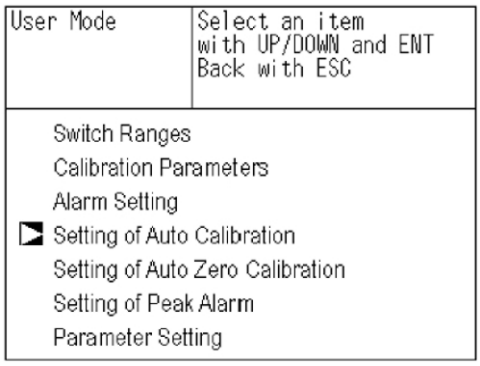
Flow Time: The time required for replacement by calibration gas. Time required for replacement of sample gas after the calibration is completed (Set by calibration gas.)

ON/OFF: Enable/disable the auto calibration feature.

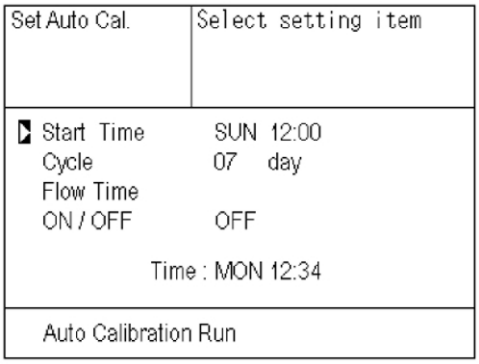
Note: Before changing the settings of auto calibration, set the ON/OFF to OFF.

To change the settings:

3. From the measurement mode, press the MODE key to display the user mode.
4. Point the cursor to “Setting of Auto Calibration” by pressing the UP or DOWN key and press the ENT key.



5. In the "Setting of Auto Calibration" screen that appears, point the cursor to any item you want to set by pressing the UP or DOWN key. Press the ENT key.
6. In the "Auto Calibration Parameter Setting" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the UP or DOWN key. To change the setting, use the SIDE key to move the cursor to the right.



7. After changing the setting, press the ENT key to accept the change. Auto calibration will now be carried out using the entered setting value.

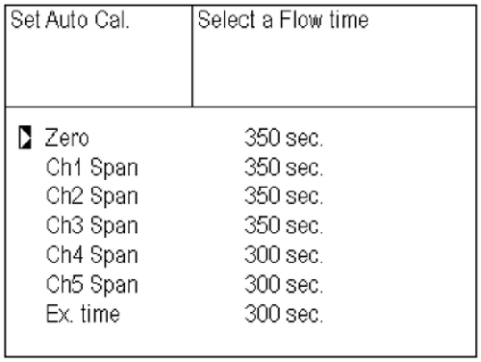
To close the "Setting of Auto Calibration" or cancel the mode midway, press the ESC key. A previous screen will return.

3.5.4.2 GAS FLOW TIME SETTING

In this submenu you select the gas whose flow time is to be changed. The flow time range is from 60 to 900 seconds. The initial value is set for 300 seconds.

To set the flow time:

1. Place the cursor next to "Flow Time," then press the ENT key.
2. On the flow time setting screen that appears, use the UP and DOWN keys to move the cursor to the gas whose settings you want to change, then press ENT.



3. The highlighted value can be changed. Change the value by pressing the UP or DOWN key, and then move the cursor to the right by pressing the SIDE key.
4. After changing the value, press the ENT key.
5. Press the ESC key to return to the automatic calibration setting screen.

Note: Only the channels used are displayed on this screen. The Ex. time is the output signal hold extension time after the completion of calibration. It is valid only when the hold setting is set to "ON." The Ex. time set here is also used in a manual calibration.

The auto calibration contacts are closed during an auto calibration event.

3.5.4.3 CYCLE SETTING RANGE

The cycle range is settable from 1 to 99 hours or 1 to 40 days. The initial value is set at 7days.

Note: When an auto calibration starts, the measurement screen automatically appears.

Any operation other than "Stop Auto Calibration" (see Section 3.5.4.5) is not permitted during auto calibration.

"Stop Auto Calibration" cannot be performed when the key lock is ON.

To cancel auto calibration, set the key lock to OFF and then execute "Stop Auto Calibration".

Auto Calibration Example

Start Time	SUN	12:00
Cycle	1	day
Flow Time	Zero	350 sec
	Ch1 Span	350 sec
	Ch1 Span	350 sec
	Ch1 Span	350 sec
	Ch1 Span	300 sec
	Ch1 Span	300 sec
	EX. time	300 sec
ON/OFF	ON	

Figure 3-7 shows the auto calibration with the above settings.

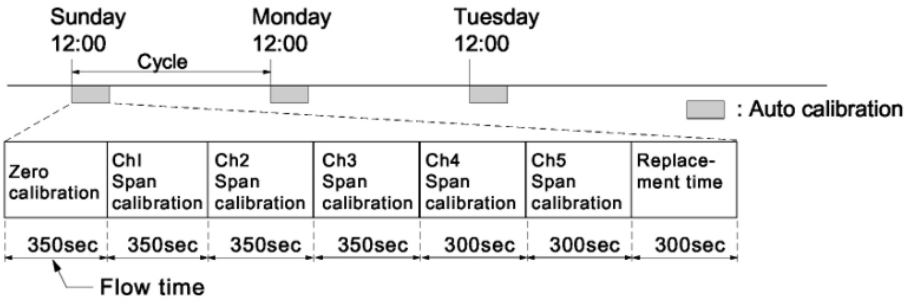
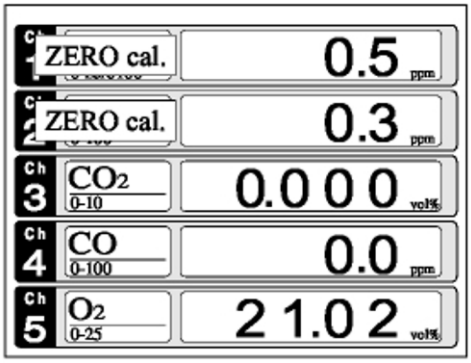
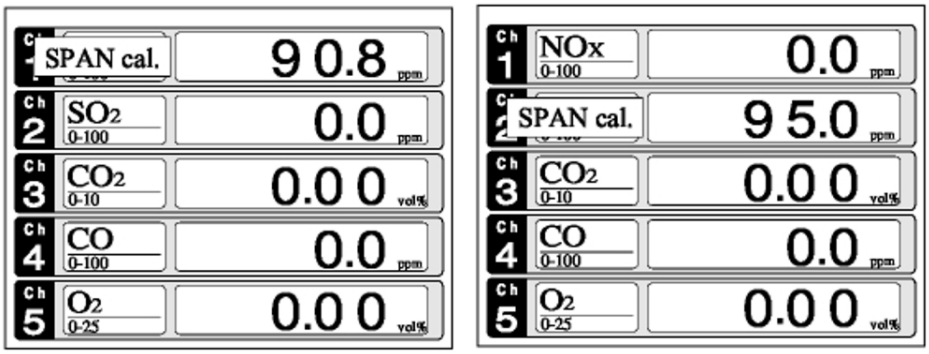


Figure 3-7: Example Auto Calibration

When a channel enabled for auto calibration is in the calibration mode, a message indicating ZERO cal. or SPAN cal. will appear on the measurement screen. For example, if channels 1 and 2 have the auto calibration setting enabled, when the calibration event takes place, both channels 1 and 2 will indicate ZERO cal. when the zero calibration is being performed. Zero calibrations are performed first and all enabled channels will zero simultaneously.



When the zero calibrations are finished, channel 1 will enter the span calibration followed by channel 2.



3.5.4.4 REMOTE START

An auto calibration is always available by keeping the remote start input closed for at least 1.5 seconds. The remote start can initiate an auto calibration whether the parameter setting is ON or OFF.

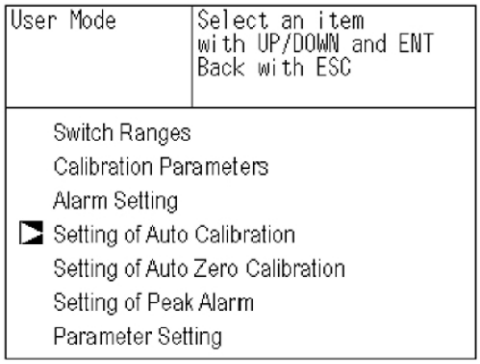
3.5.4.5 FORCED RUN/STOP OF AUTO CALIBRATION

Auto calibration can be performed manually or forcibly stopped while the calibration is performed.

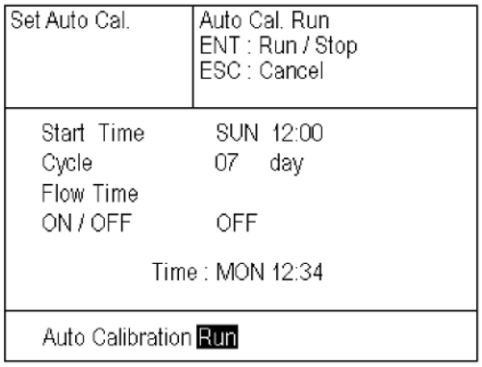
3.5.4.5.1 MANUAL EXECUTION OF AUTO CALIBRATION

To perform the auto calibration cycle manually:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to "Setting of Auto Calibration" by pressing the UP or DOWN key and press the ENT key.
3. In the "Setting of Auto Calibration" item selection screen that appears, point the cursor to "Auto Calibration Run" by pressing the UP or DOWN keys. Press the ENT key.



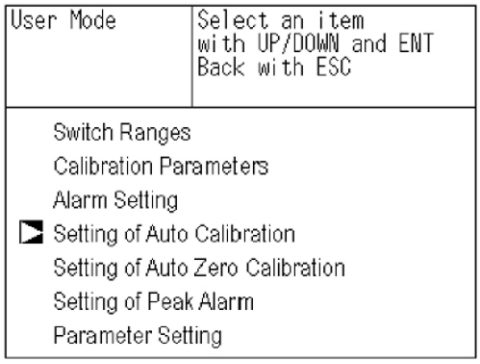
4. "Run" is highlighted, displaying a message to confirm the execution of auto calibration. Press the ENT key to execute the auto calibration, or press the ESC key to cancel.



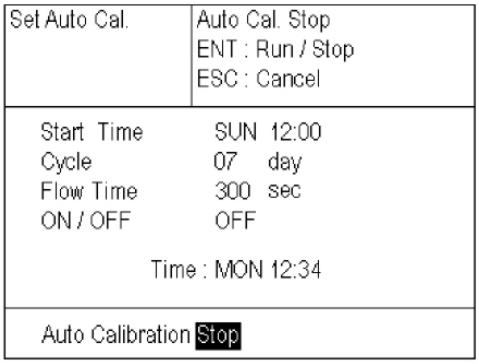
3.5.4.5.2 FORCIBLY END AN AUTO CALIBRATION

To abort an auto calibration event:

5. From the measurement mode, press the MODE key to display the user mode.
6. Point the cursor to "Setting of Auto Calibration" by pressing the UP or DOWN key and press the ENT key.
7. In the "Setting of Auto Calibration" item selection screen that appears, point the cursor to "Auto Calibration Run" by pressing the UP or DOWN keys. Press the ENT key.



8. "Stop" is highlighted, displaying a message to confirm the stop of auto calibration. Press the ENT key to stop the auto calibration, or press the ESC key to cancel the abort.



Note: During auto calibration, the keys are inoperable other than key lock ON/OFF and "Stop Auto Calibration."

When the key lock is set to ON, even the "Auto Calibration Stop" is locked out. To stop "Auto Calibration" forcedly, set the key lock to OFF and then execute "Auto Calibration Stop" as detailed above.

3.5.5 Setting of Auto Zero Calibration

3.5.5.1 AUTO ZERO CALIBRATION

Auto zero calibration is automatically carried out when the zero calibration is set. Components for which a calibration is to be made are determined by setting of auto calibration component in Section 3.5.3.

Similar to the menu choices and operation of the auto calibration, in this menu you can set when and how frequent the auto zero calibration is performed. You also enable or disable the auto zero calibration feature here.

Description of setting items:

Start Time: Setting at the first calibration (day of the week, hour, minute)

Cycle: A period between the start time of one calibration and another (unit: hour/day)

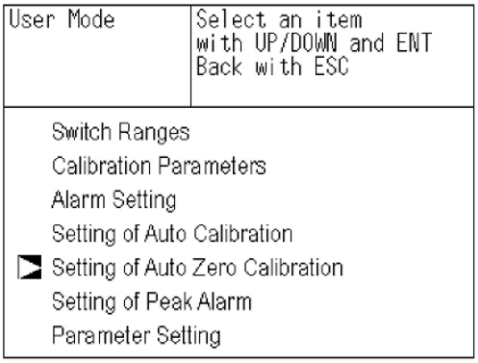
Flow Time: The time required for replacement by calibration gas. Time required for replacement of sample gas after the calibration is completed (Set by calibration gas.)

ON/OFF: Enable/disable the auto calibration feature.

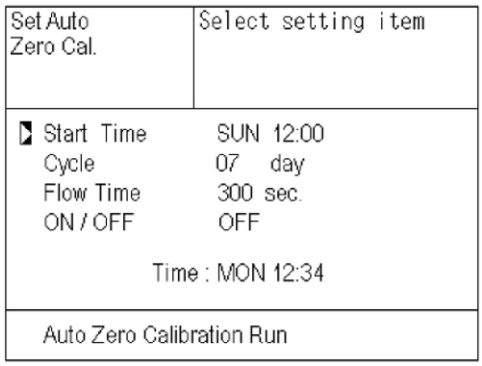
Note: Before changing the settings of auto calibration, set the ON/OFF to OFF.

To change the settings:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to “Setting of Auto Zero Calibration” by pressing the UP or DOWN key and press the ENT key.



3. In the "Setting of Auto Zero Calibration" screen that appears, point the cursor to any item you want to set by pressing the UP or DOWN key. Press the ENT key.
4. In the "Auto Zero Calibration Parameter Setting" screen that appears, perform the value entry or the setting. For the value entry or setting change, use the UP or DOWN key. To change the setting, use the SIDE key to move the cursor to the right.



5. After changing the setting, press the ENT key to accept the change. Auto zero calibration will now be carried out using the entered setting value.

To close the "Setting of Auto Calibration" or cancel the mode midway, press the ESC key. A previous screen will return.

The contacts for the auto zero calibration are closed during auto zero calibration.

Auto Zero Calibration Example

Start Time	SUN	12:00
Cycle	12	hour
Flow Time	300	sec
ON/OFF	ON	

Figure 3-8 shows the auto zero calibration with the above settings.

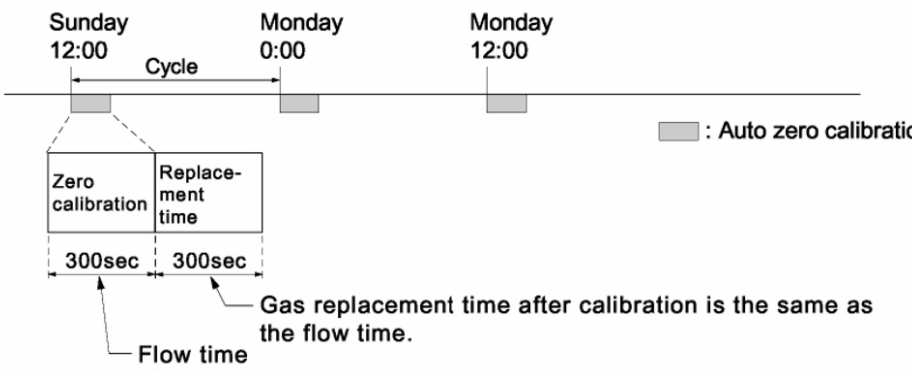


Figure 3-8: Example Auto Zero Calibration

Note: When an auto zero calibration starts, the measurement screen automatically appears.

Any operation other than "Stop Auto Zero Calibration" (see Section 3.5.4.5 is not permitted during auto calibration.

"Stop Auto Zero Calibration" cannot be performed when the key lock is ON.

To cancel auto zero calibration, set the key lock to OFF and then execute "Stop Auto zero Calibration". 0 If the auto calibration period and auto zero calibration period have overlapped, the auto calibration is retained, ignoring the auto zero calibration of that period.

If the auto calibration and the auto zero calibration periods overlap, the auto calibration setting is retained. The instrument ignores the auto zero calibration period.

When the hold setting is set to ON, the hold time of auto calibration contact and measurement value output signal is extended after calibration for gas replacement time.

Turn on the power again after it is turned off (including the case of power failure) at the time set as the next start time in auto zero calibration, and then repeat it in the set cycle.

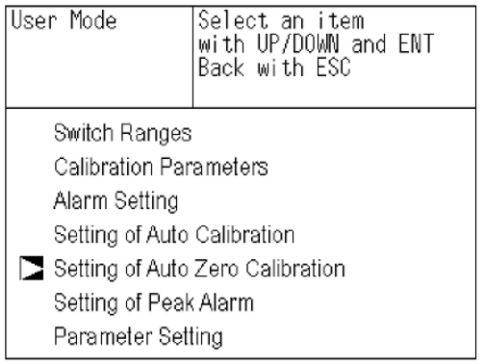
3.5.5.2 FORCED RUN/STOP OF AUTO ZERO CALIBRATION

Like the auto calibration, the auto zero calibration can be performed manually or forcibly stopped while the calibration is performed.

3.5.5.2.1 MANUAL EXECUTION OF AUTO ZERO CALIBRATION

To perform the auto calibration cycle manually:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to "Setting of Auto Zero Calibration" by pressing the UP or DOWN key and press the ENT key.



3. In the "Setting of Auto Zero Calibration" item selection screen that appears, point the cursor to "Auto zero Calibration Run" by pressing the UP or DOWN keys. Press the ENT key.
4. "Run" is highlighted, displaying a message to confirm the execution of auto calibration. Press the ENT key to execute the auto calibration, or press the ESC key to cancel.

Set Auto Zero Cal.	Auto zero Run ENT : Run / Stop ESC : Cancel
Start Time Cycle Flow Time ON / OFF	SUN 12:00 07 day 300 sec. OFF
Time : MON 12:34	
Auto Zero Calibration Run	

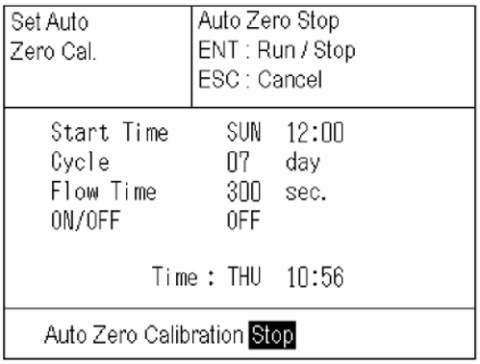
3.5.5.2.2 FORCIBLY END AN AUTO ZERO CALIBRATION

To abort an auto zero calibration event:

1. From the measurement mode, press the MODE key to display the user mode.
2. Point the cursor to "Setting of Auto Calibration" by pressing the UP or DOWN key and press the ENT key.

User Mode	Select an item with UP/DOWN and ENT Back with ESC
Switch Ranges Calibration Parameters Alarm Setting Setting of Auto Calibration ▶ Setting of Auto Zero Calibration Setting of Peak Alarm Parameter Setting	

3. In the "Setting of Auto Calibration" item selection screen that appears, point the cursor to "Auto Calibration Run" by pressing the UP or DOWN keys. Press the ENT key.
4. "Stop" is highlighted, displaying a message to confirm the stop of auto calibration. Press the ENT key to stop the auto calibration, or press the ESC key to cancel the abort.



Note: During auto zero calibration, the keys are inoperable other than key lock ON/OFF and "Stop Auto Zero Calibration."

When the key lock is set to ON, even the "Auto Zero Calibration Stop" is locked out. To stop "Auto Zero Calibration" forcedly, set the key lock to OFF and then execute "Auto Zero Calibration Stop" as detailed above.

3.5.6 Peak Alarm Setting

The optional peak alarm is triggered whenever the CO concentration exceeds the upper limit value for a preset number of times. The peak number is set from within the Peak Alarm Setting menu.

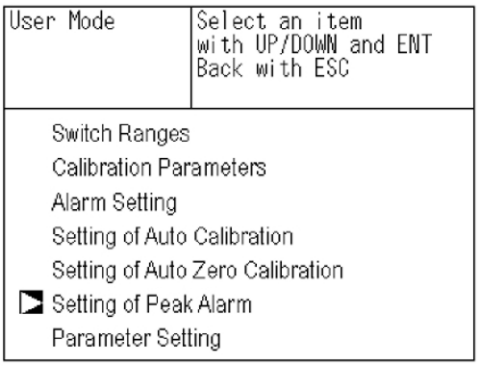
Note: Only instruments with the peak alarm option installed will have this menu.

The following items are set within the peak alarm menu:

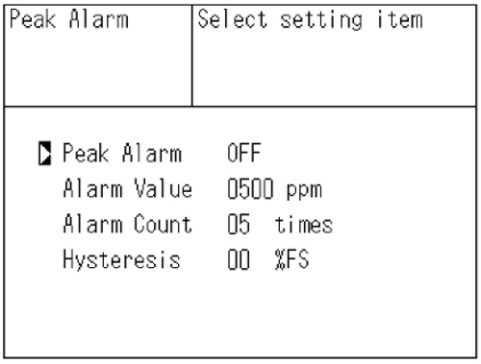
- OFF/ON status of peak alarm
- Alarm setpoint value
- Alarm count (number of peaks)
- Hysteresis

To adjust the peak alarm settings:

1. From the measurement mode, enter the user mode by pressing the MODE key.
2. Point the cursor to "Setting of Peak Alarm" by pressing the UP or DOWN key.



3. Press the ENT key.
4. In the "Peak Alarm Setting" item selection screen that appears, point the cursor to any item you want to set by pressing the UP or DOWN key. Then press the ENT key.



5. Enter numeric values by using the UP or DOWN keys. Use the SIDE key to move the cursor to the right. Press the ENT key to save the change.

To close the "Peak Alarm Setting" or cancel the mode midway, press the ESC key. A previous screen will return.

Description of setting items:

Peak Alarm:	ON/OFF of peak alarm
Alarm Value:	If measuring value exceeds the set alarm value in ppm, a peak counter increments by 1.
Alarm Count:	When a peak in excess of the alarm value occurs, a peak count is incremented. The alarm count is

the numerical value which upon reaching will trigger the peak alarm.

Hysteresis: To prevent possible chattering when the measuring value may exceed the set peak concentration by only 1 time, the peak count has an allowance in the hysteresis width.

Setting range:

Alarm value: 10 to 1000 ppm, 5 ppm step (initial value: 500 ppm)

Alarm count: 1 to 99 times (initial value: 5 times)

Hysteresis: 0 to 20 % of full scale (initial value: 0% of full scale).

Action of peak alarm:

If CO concentration exceeds the alarm value, counting will begin. If the number of peaks is over the set times per hour, the peak alarm contact closes (ON). If it is less than the set times per hour, it is open (OFF).

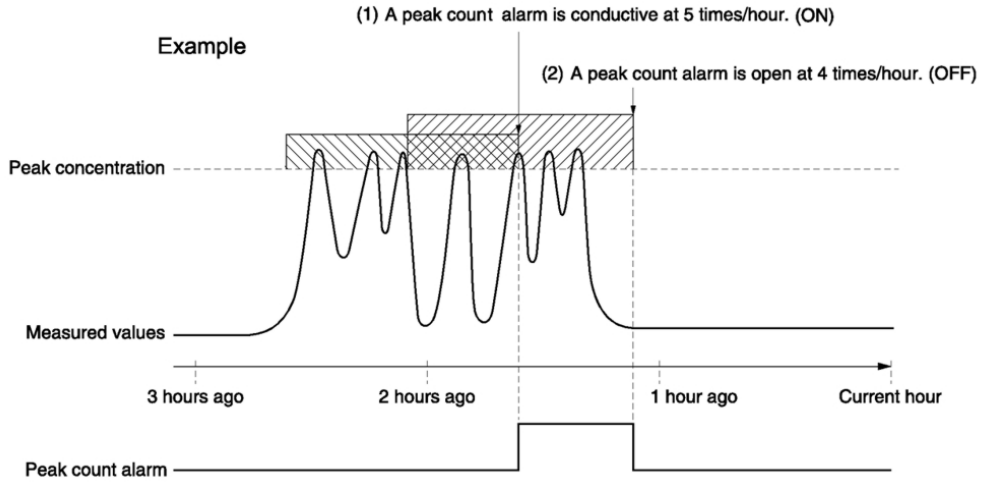


Figure 3-9: Peak Alarm Example

Figure 3-9 depicts the behavior of the Peak alarm where the alarm count has been set to 5. At the point labeled (1), the peak count alarm is turned ON since the alarm count has reached the threshold of 5 per hour. Since peaks of more than 5 times within an hour occur between the

interval (1) and (2), the peak count alarm remains ON. At (2), the peak count has fallen to 4 per hour so the peak alarm is turned OFF.

Like the hysteresis of the alarm setting , the hysteresis prevents possible chattering when measured gas is fluctuated near the alarm value.

CAUTION: **FOR 10 MINUTES AFTER THE POWER IS TURNED ON, A PEAK ALARM COUNTING IS NOT PERFORMED.**

Releasing peak count alarm:

To release the peak count alarm, set the peak alarm to OFF. Turning the peak alarm back ON again resets the count to 0.

3.5.7 Parameter Setting

This menu allows you to adjust parameter settings such as:

- Time
- Key lock
- Output hold
- Reset average output
- Response time
- Average period
- Backlight timer
- Enter maintenance mode

Description of setting items:

Current Time: Current year, month, date, day of the week, hour, and minute setting in this order.

Note: The clock backup time is 2 days. If power is off for 2 days or longer, the time setting will need to be set again.

Key Lock:	Sets with ON/OFF. When set to ON, all key operations except key lock OFF are disabled.
Output Hold:	Sets whether calibration output is held or not, and the holding value setting.

Reset Av. Output: Resets the average value.

Response time: Sets the response time of the electrical system.

Average Period: Sets the moving average time.

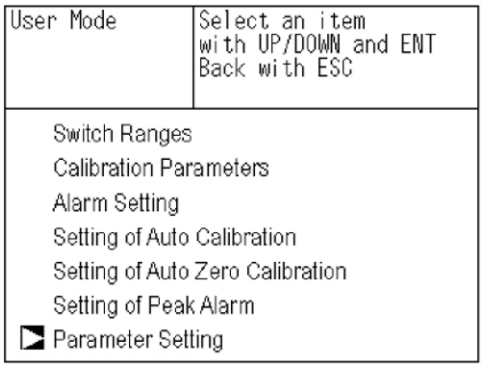
Backlight Timer: Sets an automatic OFF of the backlight of display unit and the time until the backlight is turned OFF.

Maintenance mode: Enters passwords to switch to the Maintenance mode.

For the maintenance mode, see Section 3.6.

To make parameter changes:

1. From the measurement mode, enter the user mode by pressing the MODE key.
2. Point the cursor to "Parameter Setting" by pressing the UP and DOWN keys. Then press ENT.



3. In the "Parameter Setting" screen that appears, point the cursor to any item you want to set by pressing the UP or DOWN key. Then Press ENT.
4. Enter numeric values by using the UP or DOWN keys. Use the SIDE key to move the cursor to the right. After setting, press the ENT key to save the parameter setting.

Parameter	Select setting item
Current Time	05/01/27 THU 13:50
Key Lock	OFF
Output Hold	OFF Current
Reset Av. Output	Reset
Response Time	
Average Period	
Backlight Timer	ON 5 min
To Maintenance Mode	0000

To close the "Setting of Auto Calibration" or cancel the mode midway, press the ESC key. A previous screen will return.

Settings range:

Hold setting: 0 to 100% FS

Response time: 1 to 60 sec. (Initial value: 15 sec)

Average period: 1 to 59 min or 1 to 4 hours (Initial value: 1 hour)

Backlight Timer: 1 to 60 min (Initial value: OFF)

Maintenance mode: 0000 to 9999 (Initial value: 0000)

3.5.7.1 OUTPUT HOLD

By setting an output hold to ON, the output signal of each channel is held during the calibration (manual calibration and auto calibration) plus the gas flow time as shown in Figures 3-10 through 3-12. Refer to Section 3.5.4, *Setting of Auto Calibration* for a description of the gas flow time. Regardless of Hold ON/OFF setting, an output signal can always be held via an external input.

Manual calibration

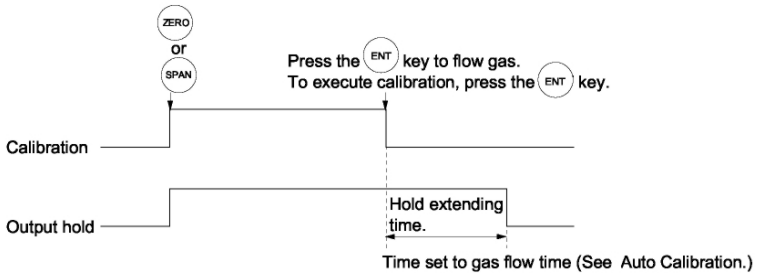


Figure 3-10: Output Hold for Manual Calibration

Auto calibration

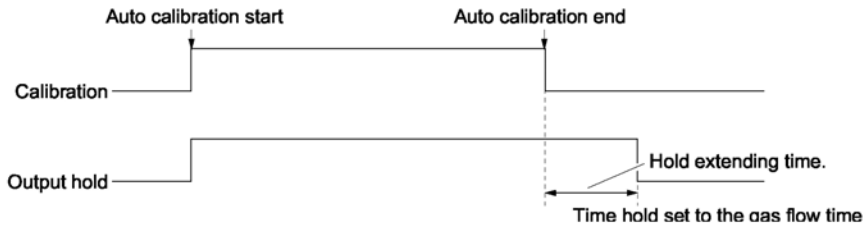


Figure 3-11: Output Hold for Auto Calibration

External hold

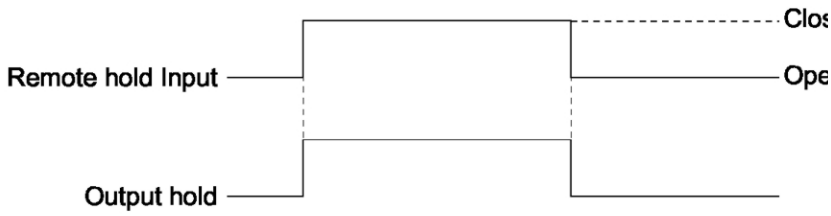


Figure 3-12: Output Hold for External Hold

Screen display during hold

For Auto calibration and external holds, the "on Hold" message will be shown blinking on the measurement screen.

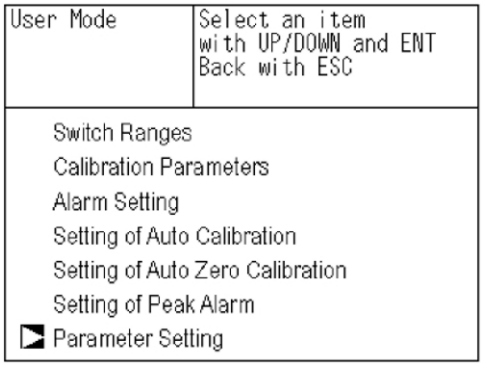
In a manual calibration, the screen displays the process of calibration so the "on Hold" message is not displayed even if the output signal is held. However, "on Hold" message is displayed during the hold extending time shown in Figure 3-10.

For both manual and auto calibration, if the calibration is cancelled after the calibration gas has been directed to the analyzer, the hold extending time will be performed.

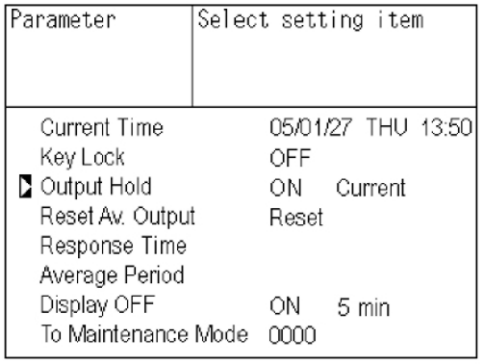
There are two types of hold values that you can use: "current" or "setting". Current uses the existing value immediately before entering output hold, while "setting" uses an arbitrary value that you set before initiating the hold.

To change or set the value for a hold:

1. From the measurement screen, press the MODE key to enter the user mode then navigate to the Parameter Setting option. Press the ENT key to bring up the parameter setting screen.

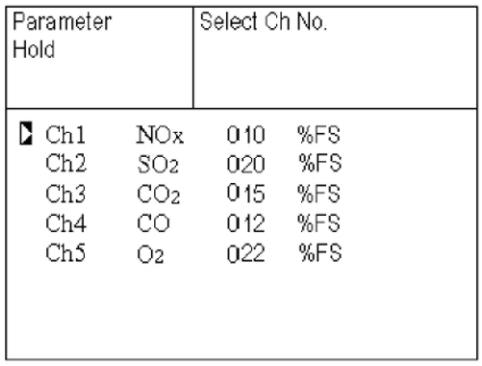


2. Select the Output Hold option by moving the cursor to it using the UP and Down keys. Select it by pressing ENT.



3. "ON" or "OFF" is highlighted. If you desire to change the state, press the UP or DOWN key to toggle between ON and OFF. Press the ENT key to select the desired state.

4. To change the hold value, use the SIDE key to highlight "Current" or "Setting". Select "Setting" by pressing the UP or DOWN key until that option appears then press ENT. The screen changes to the hold setting screen where you can select the channel and hold value for that channel.



5. On the parameter hold screen that appears, move the cursor next to the channel you want to make the setting by pressing the UP or DOWN key, and then press ENT.
6. The value is highlighted, indicating that the value can be changed. Change the numerical value by pressing the UP or DOWN key, and then move the cursor to the right by pressing the SIDE key.
7. After the value is changed, press the ENT key to save.
8. Press the ESC key to return to the parameter setting screen.

The setting is expressed in % against the range for both ranges. For example, when 0 to 1000 ppm is selected as the range, and 10% FS is selected as hold setting, the output equivalent of 100 ppm is output and held irrespective of the measurement value at that time.

Description of setting:

Instantaneous value display of the measurement cannot be held. Only the output can be held.

If set value is selected for hold, instantaneous O_2 correction value is calculated and held based on the set value.

Range identification contact output cannot be switched even if the range is switched during the hold.

3.5.7.2 AVERAGE VALUE RESET:

This mode is used to clear all average values O_2 correction average and O_2 average, and restarts averaging. All average values are reset at the same time. The indication value and output value is 0 ppm, vol % etc. at the time of the reset input (Refer to the average period). To

perform a reset, the contacts must close for at least 1.5 seconds. See Figure 3-13. Resetting occurs as the contacts reopen.

Figure 3-13: Average Value Reset

3.5.7.3 RESPONSE TIME

The response time of the electrical system can be changed. Individual settings are available for each component.

Note: Response time does not provide exact seconds for the setting time, but rather it is a guide to the overall response.

Parameter Response Time		Select Ch No.	
Ch1	NOx	10	sec.
Ch2	SO_2	20	sec.
Ch3	CO_2	15	sec.
Ch4	CO	12	sec.
Ch5	O_2	22	sec.

3.5.7.4 AVERAGE PERIOD

This submenu allows you to set an averaging period over which the average value of O_2 correction and O_2 average are sampled.

Parameter Average Period		Select Ch No.	
Ch9	%/ppm NOx	01	hour
Ch10	%/ppm SO_2	01	hour
Ch11	%/ppm CO_2	01	hour
Ch12	%/ppm O_2	01	hour

To modify the average period:

1. Choose the channel or channels you want to modify. You can set an average time from 1 to 59 minutes in 1-minute steps or 1 to 4 hours in 1-hour steps.
2. The UP and DOWN keys will increment or decrement the numerical values while the SIDE key will move the cursor to the right to the next digit. Press ENT when the desired value is displayed.

Changing this parameter resets the average value of O_2 correction and O_2 average value. Pressing the ENT key validates the resetting only for components whose setting was changed.

Example of average action:

In the example shown in Figure 3-14, the average period was set to 1 hour.

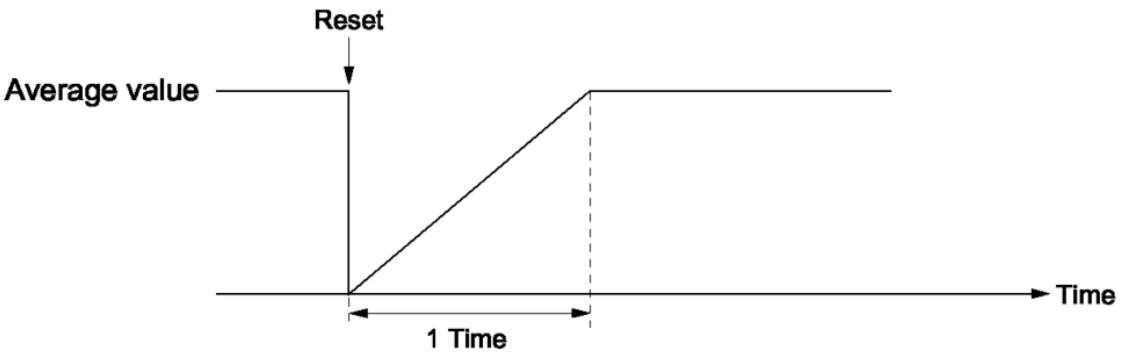


Figure 3-14: Example Average Period

Sampling occurs every 30 seconds so every 30 seconds the average for the last 1 hour (time setting) is output.

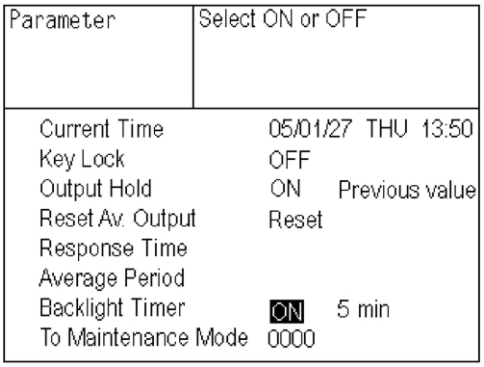
At the instant of resetting, zero is assumed for all past values. This means that the average value will be incorrect for 1 hour (1 time period) after resetting.

3.5.7.5 BACKLIGHT TIMER

Automatic OFF setting of the backlight of the LCD unit can be adjusted from this menu.

Upon returning to the measurement screen, when the specified time elapses, the backlight is automatically turned off. During operation,

pressing any key will turn the backlight back ON for the specified duration.



When ON is selected, the time until auto OFF is displayed. To change the backlight automatic shut off time:

1. Select Parameter Setting from the user screen.
2. With the UP or DOWN key, select Backlight Timer. and press ENT.
3. If the timer is not set to ON, change its state by pressing the ENT key when OFF is highlighted.
4. Press the SIDE key to move the cursor to the time value and the time setting can be changed using the UP and DOWN keys. Press the ENT key to confirm the selection.

Note: When OFF is selected, the backlight remains ON and is not turned off automatically.

3.5.7.6 MAINTENANCE MODE

The maintenance mode is covered in section 3.6. It is a detailed password protected set of screens that allows you to check sensor input values, review error logs, set passwords and more.

The default password setting for entering this mode is "0000." Use this password to initially enter the maintenance mode and then change it to one you can easily remember.

To enter the maintenance mode:

1. From the measurement screen press the MODE key to open the user mode screen.

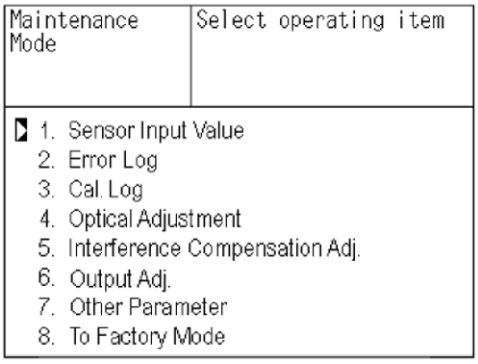
2. Select Parameter Setting from the user screen.
3. With the UP or DOWN key, select Maintenance Mode and press ENT.

3.6 Maintenance Mode

This mode is used for checking sensor input values, error log file display, or setting of passwords, etc. A password is required to enter this mode.

To get to the maintenance mode screen, select Maintenance Mode from the Parameter Setting menu. See Section 3.5.7 Parameter Setting." This brings up a screen for entering the password. Enter the 4 digit password using the UP and DOWN keys and the SIDE key to move to the next digit. Press ENT when complete. If the password is entered correctly, the maintenance mode screen will appear on the display offering a range of submenus.

Note: The default password installed in new instruments is "0000".



The following submenus are accessed from the maintenance mode screen:

1. Sensor Input
2. Error Log
3. Calibration Log
4. Optical Adjustment
5. Interference Compensation Adjustment
6. Output Adjustment

7. Additional Parameters
   a. Password Set
   b. O_2 Reference Value
   c. Limit
   d. MODBUS Communication Station No.
   e. Range Setting
8. Factory Mode

In the maintenance mode screen, point the cursor to the item you want to set by pressing the UP or DOWN key and press the ENT key. The appropriate screen will automatically display.

Note: "To Factory Mode" is used for factory service engineers. Do not use this mode.

3.6.1 Sensor Input Value

Upon selecting Sensor Input Value, the following screen will appear. It lists the installed sensors along with the input value from the measuring sensor (M) and the compensating detector (C).

Maintenance
Sensor Input

sensor	input	sensor	input
NOx M	648	02	20785
C	499	TEMP	15785
SO2 M	1518		
C	425		
CO2 M	1120		
C	80		
CO M	39		
C	80		

Where:

NOx M: NOx sensor input value

NOx C: NOx interference compensation sensor input value

SO_2 M: SO_2 sensor input value

SO_2 C: SO_2 interference compensation sensor input value

CO_2 M: CO_2 sensor input value

CO_2 C: CO_2 interference compensation sensor input value

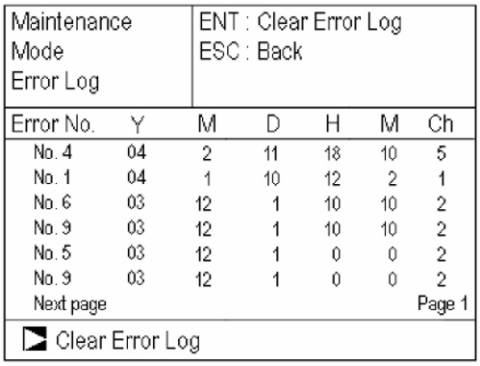
CO M: CO sensor input value

CO C: CO interference compensation sensor input value

Temperature: temperature sensor input value O_2: O_2 sensor input value

3.6.2 Error Log

This screen gives the error history for the last fourteen logged errors. It also shows the date and time of occurrence (year, month day, hour, minute) and the channel the error occurred on. For error number, date and time of occurrence, channel and other details of error, refer to Section 4.6 *Error Messages*.

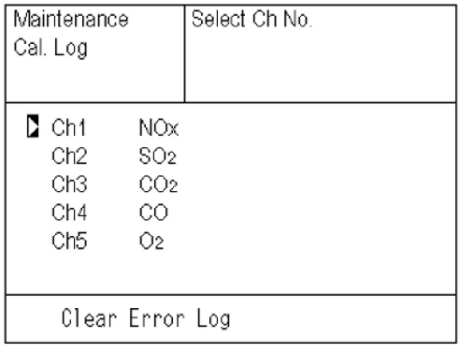


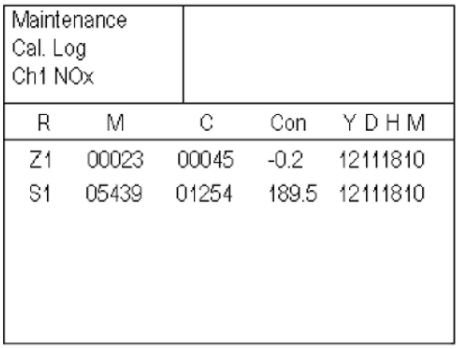
To clear the error log, select Clear Error Log and press the ENT key.

3.6.3 Calibration Log

The next screens detail the past calibration history on the analyzer. The first screen allows you to choose the channel whose information you want displayed. The next screen displays logged information on sensor input value, concentration value, and the dates when zero/span calibration were performed for that channel. The last 10 calibration events are logged for each channel.

The first screen also gives you the opportunity to clear the log. To erase the log, move the cursor to Clear Calibration Log and press the ENT key. The calibration log is cleared completely.





Z1: Zero calibration (Z) of Range 1

S1: Span calibration (S) of Range 1

M: Value of measuring detector at the time of calibration

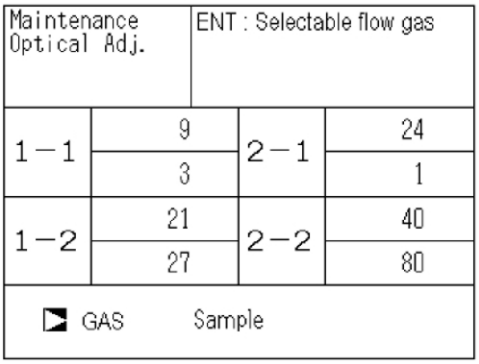
C: Value of the interference compensation detector at the time of calibration

Con: Concentration value displayed before calibration

3.6.4 Optical Adjustment

CAUTION: IF THE OPTICAL ADJUSTMENT IS MADE INCORRECTLY, ANALYSIS MAY BE ADVERSELY AFFECTED. CARRY OUT THE OPERATION WITH UTMOST ATTENTION.

For details of this item, refer to Section4.4 Optical Zero Adjustment.



Press ENT key and then turn ON the solenoid valve signal for each calibration gas by using the UP or DOWN keys.

3.6.5 Moisture Interference Adjustment

This item is described in Section 4.5 *Moisture Interference Adjustment*.

Maintenance		Select Ch No. with UP / DOWN and ENT Back with ESC	
▶ Ch1	NOx	10	1.252
Ch2	SO_2	-33	0.983
Ch3	CO_2	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			

For the values listed in the middle column of the screen, the moisture interference for each component is already offset. The values in the right column are the interference compensation coefficients used.

To change the coefficient:

1. Move the cursor to a desired channel by pressing the UP or DOWN key, and then press the ENT key. The selected interference compensation coefficient at the right is highlighted.
2. Check that the gas for moisture interference compensation is flowing. Change the moisture interference compensation coefficient using the UP or DOWN key. Adjust the value until the value in the left column is near zero. Then press the ENT key to log moisture interference compensation value.

Note: An interference compensation detector is not provided so if the 1st range is beyond 0 to 10 vol %, no interference adjustment can be performed (no need).

3.6.6 Output Adjustment Screen

In this menu you can adjust the analog output. First, connect a digital multi meter to the output terminal corresponding to the output to be adjusted. See the Appendix for terminal identification on the terminal blocks. Adjust the value so that 4 mA or 0 V is output at zero and 20 mA or 1 V is output at span.

1. From the output adjustment screen which accessible from the maintenance mode menu, move the cursor with the UP or DOWN key to the output (OUT No. and zero/ span) to be adjusted, and then press the ENT key.

Maintenance Mode Output Adj.			Adjust OUTPUT ZERO and SPAN		
OUT	Zero	Span	OUT	Zero	Span
1	01245	11845	7	01900	12500
2	01245	11845	8	01900	12500
3	01245	11845	9	01900	12500
4	01245	11845	10	01900	12500
5	01245	11845	11	01900	12500
6	01245	11845	12	01900	12500

2. The selected value is highlighted. Adjust the value using the UP or DOWN key while watching the output on the digital multi-meter. Press the SIDE key to select the next digit.
3. On completion of the adjustment, press the ENT key.

3.6.7 Other Parameters

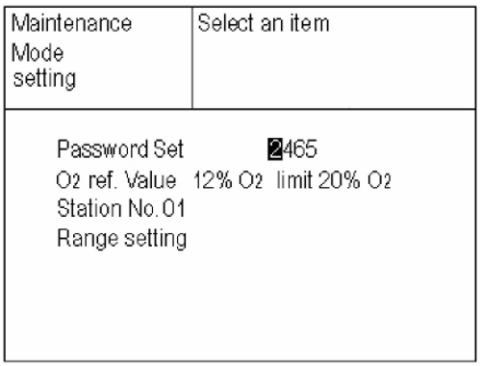
The last submenu of the maintenance mode menu contains a group of parameters that may be modified by the user. These include:

- Password Set: Set the password used to enter the maintenance mode. An arbitrary 4-digit number can be selected.
- O_2 Ref. Value: Set the oxygen concentration reference value at the time of oxygen correction calculation. Settable in the range from 00 to 19%.
- Limit: Set the oxygen concentration limit at the time of oxygen correction calculation. Settable in the range from 01 to 20%. See O_2 correction concentration value in Section 3.3.1 *Measurement Mode* for oxygen correction calculation procedure.

- Station No.: Set the station No. for MODBUS communication. Settable in the range from 00 to 32.
- Range setting: Moves to the screen on which measuring range is changed.

To adjust or make changes to these parameters:

1. Press the UP or DOWN key to move the cursor to the item whose setting is to be changed.
2. The values for password, oxygen correction, limit, and station no. are highlighted.



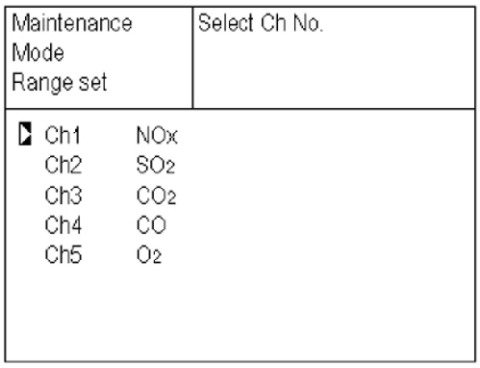
3. Press the UP or DOWN key to change the value and then press the ENT key.

Note: If you forget the password you will be locked out from the maintenance mode. Keep a record of the password in a secure place. Contact the factory for instruction on reclaiming forgotten or lost passwords.

To set or change the range:

The measuring range can be arbitrarily selected in the minimum and the maximum range specified at the time of purchase. The range to be used can be selected as 1 or 2.

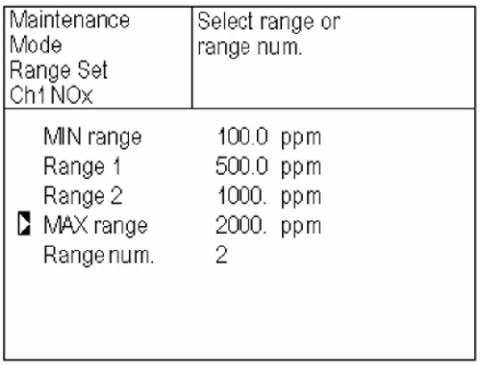
1. Move the cursor to the Range Setting option using the UP or DOWN key, and then press the ENT key.
2. This brings up another screen that lists the channels and components. Move the cursor to the channel whose setting is to be changed by pressing the UP or DOWN key, and then press the ENT key.



3. Another screen appears which displays the current MIN and MAX ranges established for that component. To change the existing range move the cursor to the range you want to modify using the UP or DOWN key, and then press the ENT key.

Note: The value for range 1 and range 2 must fall within or be equal to the MIN the MAX range and range 1 must be less than range 2.

The number of ranges (Range num.) is 1 or 2.



4. Press the UP or DOWN key to change the value. Press the SIDE key to select the next digit. When the decimal point is highlighted, press the UP or DOWN key, and the decimal point position can be changed.
5. When complete, press the ENT key to save the change.

3.7 Calibration

3.7.1 Zero Calibration

The zero calibration is used for zero point adjustment. A suitable zero calibration gas is described in Section 2.5.5 *Preparation of Calibration Gas*.

To zero calibrate the analyzer:

1. Press the ZERO key on the Measurement screen to display the Manual Zero Calibration screen.

ZERO Cal.	Select Ch No. with UP / DOWN and ENT Back with ESC	
Ch1 NOx	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	20.09

2. Select the channel to be calibrated by pressing the UP or DOWN key. After selection, press the ENT key, and zero gas will be supplied.

Note: For channels that are set to "both" in the "Zero Calibration" of the Calibration Setting mode, the zero calibrations are carried out at the same time.

3. Wait until the display has stabilized with the zero gas flowing. After stabilization, press the ENT key. At this point, the zero calibration on the range indicated by the cursor is carried out.

Note: If the selected channel was set for autoranging "AR" (see Section 3.5.1 Switch Ranges*. the cursor automatically moves to the range selected in "*Setting of Auto Calibration Component/ Range*" (Section 3.5.2.4), and calibration is carried out within that range.*

To close the "Zero Calibration" screen or cancel this mode midway, press the ESC key. A previous screen will return.

3.7.2 Span Calibration

Span calibration is used to perform a span point adjustment. It requires a span gas with a known concentration, preferably 90% or more of the range value of the component being calibrated. For oxygen, when measuring with the built-in O_2 use a standard gas containing 90% or more of the range value. Use a standard gas of about 2 vol % when measuring with an external zirconia O_2 sensor.

To span calibrate the analyzer:

1. From the measurement screen press the SPAN key to display the Manual Span Calibration screen.

SPAN Cal.	Select Ch No. with UP / DOWN and ENT Back with ESC	
Ch1 NOx	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch2 SO_2	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch3 CO_2	▶Range1 0-10 vol% Range2 0-20 vol%	0.00
Ch4 CO	▶Range1 0-100 ppm Range2 0-2000 ppm	0.0
Ch5 O_2	Range1 0-10 vol% ▶Range2 0-25 vol%	20.09

2. Select the channel to be calibrated by pressing the UP or DOWN key. Then press the ENT key and the calibration gas will be supplied.

Note: For channels that are set to "both" in the "Span Calibration" of the Calibration Setting mode, the span calibrations will be carried out for each component.

3. Wait until the display has stabilized with the span gas flowing. After stabilization, press the ENT key. Span calibration on the range selected by the cursor is performed.

Note: If the selected channel was set for autoranging "AR" (see Section 3.5.1 Switch Ranges*. the cursor automatically moves to the range selected in "*Setting of Auto Calibration Component/ Range*" (Section 3.5.2.4), and calibration is carried out within that range.*

To close "Span Calibration"

To close the “Span Calibration” screen or cancel this mode midway, press the ESC key. A previous screen will return.

Maintenance

4.1 Routine Maintenance

Aside from normal cleaning of the instrument and making sure connections are tight and secure, the following maintenance items should be carried out on a daily basis.

1. Zero and Span Calibration:
   Perform a zero calibration. For the calibration procedures, refer to Section 3.7.1 *Zero Calibration*.

   Then, perform span calibration. For the calibration procedures, refer to Section 3.7.2 *Span Calibration.*
2. Flowrate Check:
   Sampling and purge gas flowrates are as follows:

   Sampling gas flow: 0.5L/min 0.2 L/min
   Purge gas flow: About 1 L/min

Check and adjust if necessary every day.

4.2 Daily Check and Maintenance Procedures

Table 4.1 Troubleshooting and Maintenance

Item to be checked	Phenomena	Cause	Remedy
Display value	Display values are low. Display values are high.	(1) Dust is mixed in sampling cell.	(1) Clean the sampling cell. Check sampling system especially gas filter.

Item to be checked	Phenomena	Cause	Remedy
		(2) Air is absorbed midway in the sampling pipe.	(2) Find cause of leak and repair.
Purge gas flow is included when purge gas in sampling gas flow rate.	Standard flow is beyond the specified flow rate of 0.5 L/min, 0.3 to 0.7 L/min.		Adjust using needle valve on flowmeter.
Zero point of gas analyzer	It is deflected.		Adjust.
Span point of gas analyzer	It is deflected.		Adjust.

4.3 Analyzer Maintenance

4.3.1 Sample Cell Cleaning

In rare circumstances will the sample cell require cleaning. The procedure for dismantling and cleaning the sample cell should be handled by qualified personnel only. In general, if it is absolutely required, contact the factory.

The recommended procedure for cleaning the sample cell is as follows:

1. Turn off the power switch, stop the sample gas, and allow the zero gas to flow for several minutes to purge the cell interior.
2. Loosen the setscrew (2 pieces) from the top cover and remove it as shown in Figure 4-1.
3. Remove the internal gas inlet tube.
4. Loosen both right and left screws for cell holding plate and remove only the sample cell. See Figure 4-2.
5. Turn the sample cell window to the left and remove it from the sample cell. See Figures 4-3 and 4-4.

6. For cleaning the window and inside surface of the cell, first eliminate coarse dust using a soft brush and then wipe with a soft rag.

CAUTION: THE WINDOW IS EASILY SCRATCHED. USE EXTREME CARE WHEN PERFORMING THIS OPERATION SO AS NOT TO DAMAGE IT.

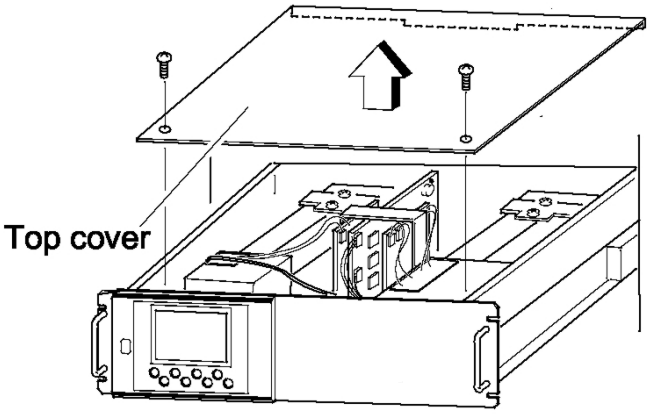


Figure 4-1: Top Cover Removal

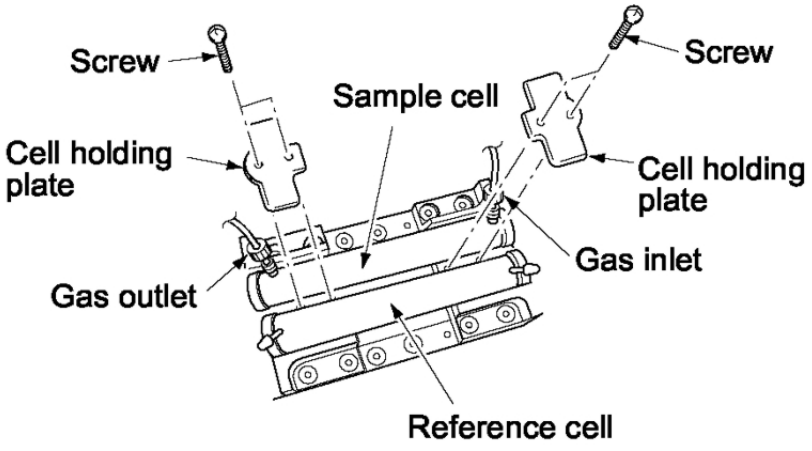


Figure 4-2: Sample Cell Removal

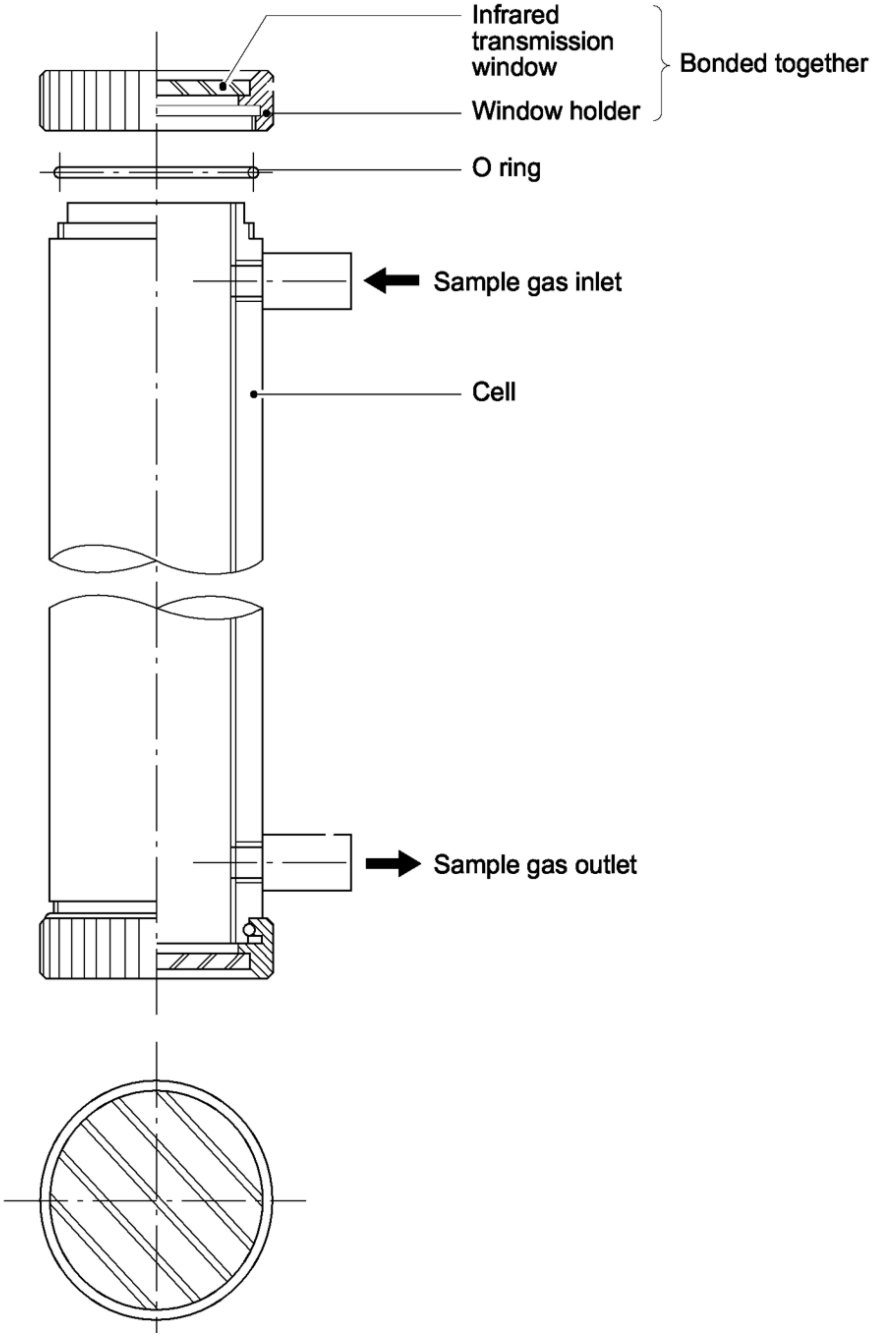


Figure 4-3: Sample Cell

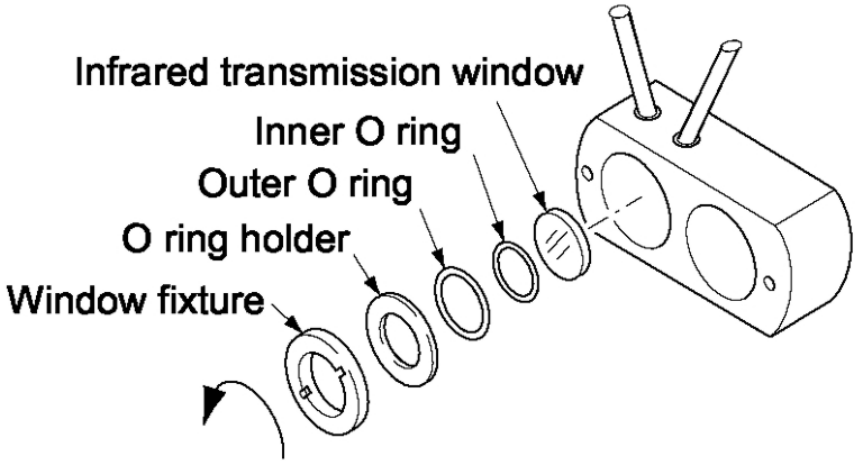


Figure 4-4: IR Window Assembly

Note: If the window or the cell interior is very dirty, gently wipe it using a soft cloth moistened with absolute alcohol. A slightly corroded infrared transmission window/sample cell can be remedied by gentle rubbing with chromium oxide powder on a cleani cloth but if excessively corroded, it must be replaced. Do not use excessive force when cleaning the window.

Reinstall the cell after cleaning. Be sure to perform an optical zero adjustment (Section 4.4) and moisture interference compensation adjustment (Section 4.5) prior to analysis.

4.3.2 Cleaning the Cell Block

1. Turn off the power switch, stop the sample gas, and allow the zero gas to flow for several minutes to purge the cell interior.
2. Loosen the 2 setscrews that secure the top cover and remove it.
3. Remove the internal gas inlet tube.
4. Loosen the 2 detector set bolts. See Figure 4-5.

Note: The gas distribution block, cell block, and detector are fastened by the same bolts.

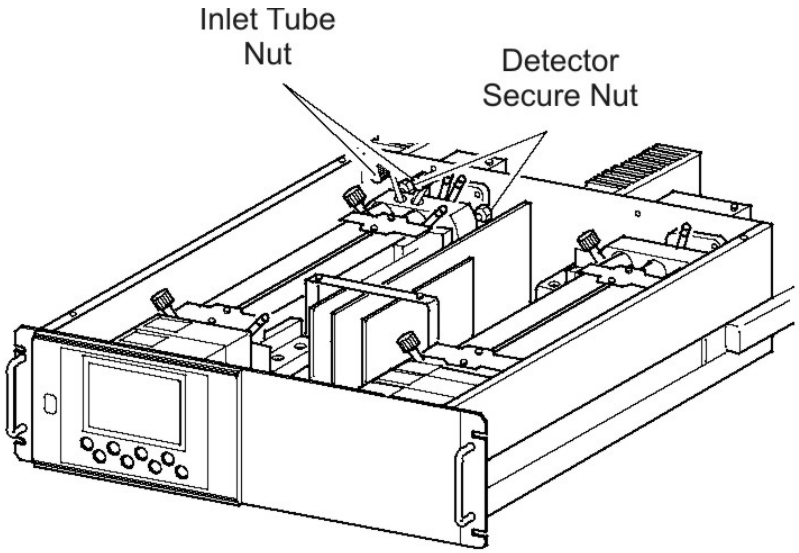


Figure 4-5: Detector Secure Nut

5. Using the furnished cell mounting tool, turn the window fixture to the left and remove it from the cell. See Figure 4-6.
6. For cleaning the infrared transmission window and cell inside surface, first eliminate coarse dust using a soft brush and then wipe clean with a soft rag.

CAUTION: **THE WINDOW IS EASILY SCRATCHED. USE EXTREME CARE WHEN PERFORMING THIS OPERATION SO AS NOT TO DAMAGE IT.**

7. After cleaning, reinstall the sample cell and perform an optical zero adjustment (see Section 4.4) and moisture interference compensation adjustment (see Section 4.5).

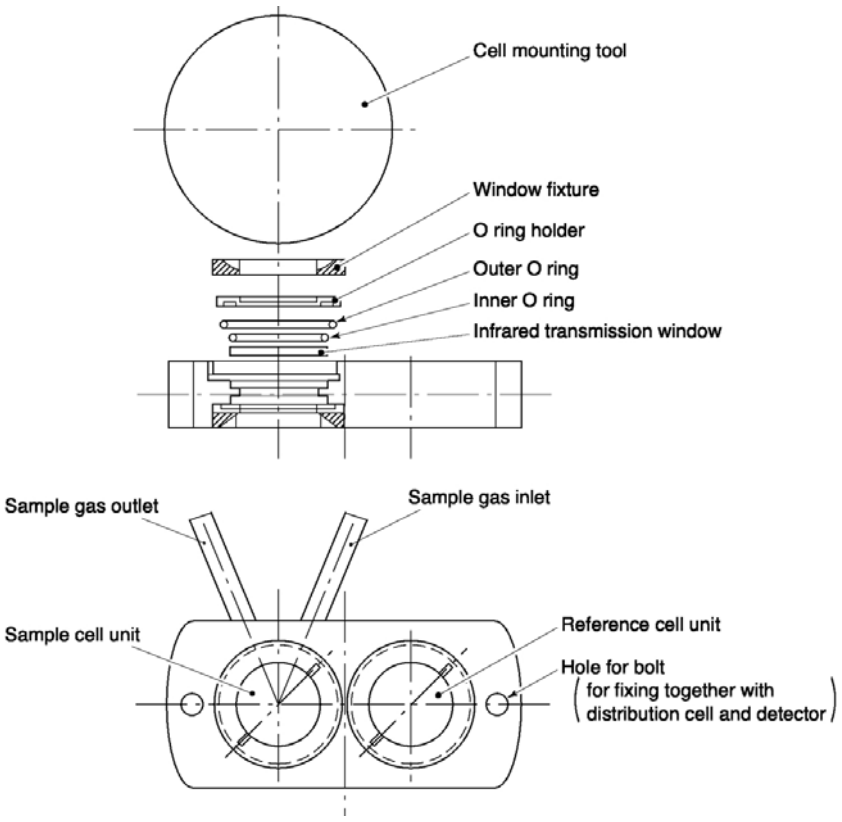


Figure 4-6: Cell Block Assembly

4.4 Optical Zero Adjustment

If the following operation is not performed correctly, subsequent analysis may adversely be affected. This operation should be performed by a trained technician or the unit sent back to the factory for service.

The following adjustment is performed at reassembly after removing and cleaning the sample cell.

1. Remove the top cover.
2. Allow dry N_2 or air to flow through the analyzer sample gas inlet until the reading stabilizes. The sample gas is

introduced directly to the inlet of analyzer unit through the gas cylinder.

3. Proceed to an optical adjustment as described in the maintenance mode. The display on the operation panel of the main unit is illustrated in Figure 4-7. Balance adjustment is not required if the display falls within ±100.

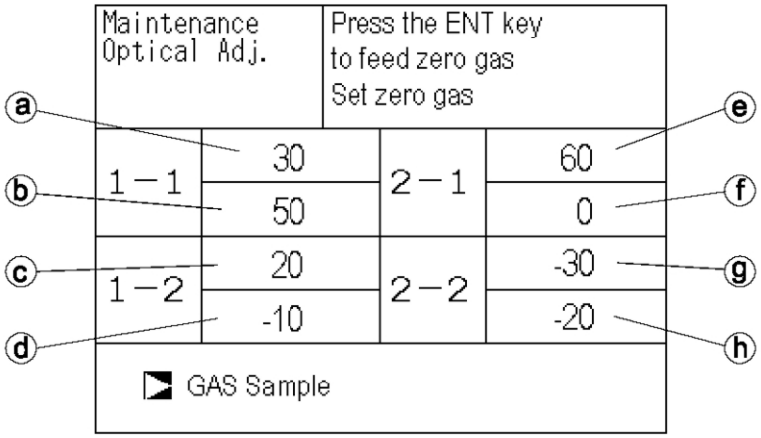


Figure 4-7: Optical Adjustment Display for Dual Optical System Option

Table 4-2: Components of Optical Adjustment Screen

No. Of Components to be measured		a	b	c	d	e	f	g	h
1-component meter		Main	Comp	–	–	–	–	–	–
2-component meter	NO/SO2	NO Main	NO Comp	SO2 Main	SO2 Comp	–	–	–	–
	CO2/CO	CO2 Main	CO2 Comp	CO Main	CO Comp				–
	NO/CO	NO Main	NO Comp	–	–	CO Main	CO Comp	–	–
3-component meter NO/SO2/CO		NO Main	NO Comp	SO2 Main	SO2 Comp	CO Main	CO Comp	–	–
4-component meter NO/SO2/CO2/CO		NO Main	NO Comp	SO2 Main	SO2 Comp	CO2 Main	–	CO Main	CO Comp

Where:

"Main" is signal input value from the main detector of each component.

"Comp" is signal input value from interference compensation detector of each component. If low range exceeds the range of 0 to 10 vol %, detector signal of "comp" is not usable.

In the above table, O_2 is excluded from the number of components.

Sensor values which are not included in measuring components should be ignored.

4. Adjust the primary side of the optical system (if instrument is equipped with more than 1 measuring unit) so that the onscreen values for (a) to (d) in 1-1 and 1-2 of become as close to 0 as possible within ±100 range.
5. Adjust on the secondary side of the optical system so that the values for (e) to (h) in 2-1 and 2-2 become as close to 0 as possible within ±100 range.
6. Operate the optical zero adjustment knob to change the value displayed at (a) or (e). See Figure 4-8

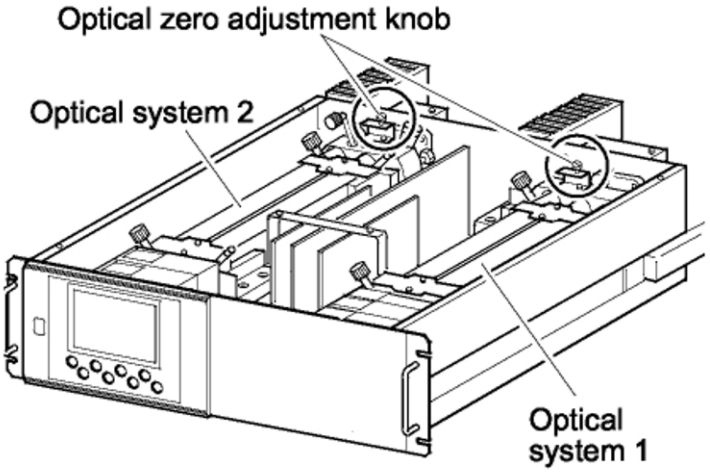


Figure 4-8: Optical Zero Adjustment

7. Move the beam adjustment plate sideways to change the value displayed at (b) or (f). See Figure 4-9.

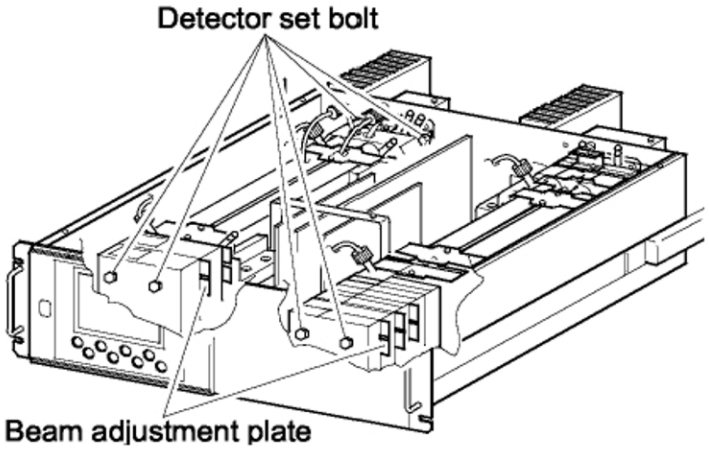


Figure 4-9: Beam Adjustment Plate

8. Move the beam adjustment plate sidewise to change the value displayed at (c) or (g).
9. Move the beam adjustment plate sidewise to change the value displayed at (d) or (h).
10. Repeat the procedures in (6) to 9) to make all the displayed values come close to 0 as possible within ±100 range.

Note: Adjust the beam adjustment plate which is the nearest to the zero adjustment knob first, and sequentially.

11. After the optical balance adjustment, remount the top cover of the analyzer unit, then carry out a moisture interference compensation adjustment, and perform zero and span calibrations.

Note: Before moving the beam adjustment plate, loosen the detector set bolts (just enough to make the plate movable for snug adjustment.

4.5 Moisture Interference Compensation Adjustment

If the following operation is not performed correctly, subsequent analysis may adversely be affected. This

operation should be performed by a trained technician or the unit sent back to the factory for service.

Perform an adjustment if excessively (beyond ±2% FS) affected by moisture inteference.

It is also necessary to adjust moisture interference compensation after making an optical balance adjustment or whenever the cell structure is opened to moist air.

1. After warm-up, select the low range and allow dry gas (N_2 or air) to flow at 0.5 L/min and zero calibrate the analyzer.
2. Display the moisture interference compensation screen of the analyzer unit (see Section 3.6.5 Moisture Interference Adjustment). Set the dew point to 2°C by using an electronic cooler, and introduce bubbled N_2 or air to the analyzer (shown in the Figure 4-10).

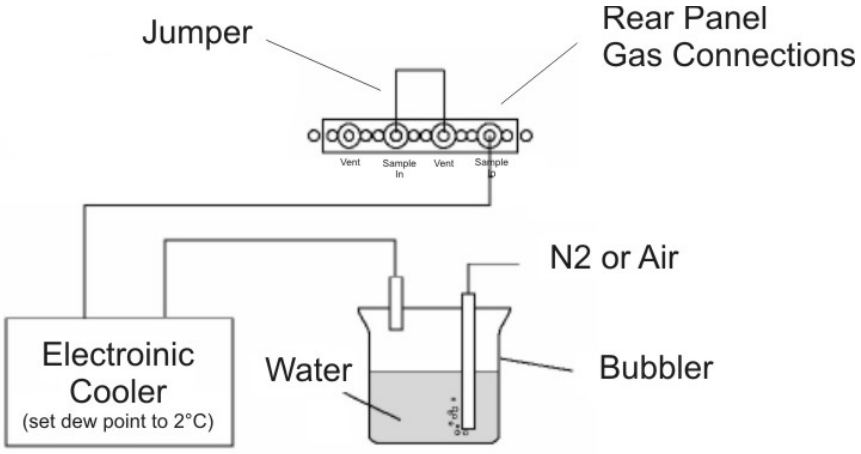


Figure 4-10: Bubbler Apparatus

3. On the screen, select a desired channel by using the UP and DOWN keys then pressing ENT when the cursor is on the desired channel.
4. Use the SIDE key to move the cursor to the numerical value in the right column. Adjust the value by the UP or DOWN key so that the value at left falls within ±10 (or as

close to 0 as possible), and then press the ENT key to save the value. Alternatively, by selecting the "ALL"option and pressing the " ENT " key, you can zero all components at once. You can abort the process at any time by pressing the " ESC " key.

Maintenance		Select Ch No. with UP / DOWN and ENT Back with ESC	
▶ Ch1	NOx	10	1.252
Ch2	SO_2	-33	0.983
Ch3	CO_2	13	0.000
Ch4	CO	20	1.922
ALL			
Valve OFF			

5. It is sometimes easier to adjust all components by selecting ALL and then perform fine adjustment for components one by one using UP and DOWN keys.

Note: If any components exceed the range of 0 to 10 vol %, no adjustment can be performed (No interference compensation is required).

4.6 Error Messages

You may encounter an onscreen error message depending on the process state or operational error. The following table describes typical error messages and their cause.

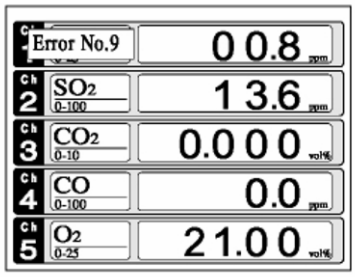
Table 4-3: Error Messages

Error Display	Error Contents	Probable Cause
Error No.1	Motor rotation detection signal faulty.	• Motor rotation is faulty or stopped. • Motor rotation detector circuit is faulty. *Note: Sector motor is a consumable item. It is recommended to exchange the motor once every two years.*
Error No.4	Zero gas not flowing	• Zero gas is not supplied.

Error Display	Error Contents	Probable Cause
Error No.5	Amount of zero calibration (indication value) is over 50% of full scale.	• Zero is deflected much due to dirty cell. • Detector is faulty. • Optical balance is out of adjustment.
Error No.6	Span calibration is not within the allowable range.	• Span gas is not supplied. • Calibrated concentration setting does not match cylinder concentration. • Zero calibration was performed incorrectly. • Dirty cell. • Detector sensitivity has deteriorated.
Error No.7	Amount of span calibration (difference between indication value and calibrated concentration) is over 50% of full scale.	
Error No.8	Measured values fluctuate too much during zero and span calibration.	• Calibration gas is not supplied. • Time for flowing calibration gas is too short.
Error No.9	Calibration is abnormal during auto calibration.	• No. 4 to No. 8 Error occurred during
Error No.10	Output cable connection is improper.	• Wiring is detached between analyzer and interface module. • Wiring is disconnected between analyzer and interface module.

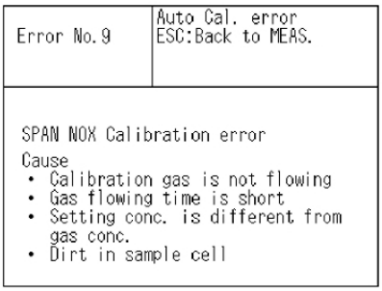
When errors No. 1 and No. 10 occur, the analyzing block error contact is closed. When errors No. 4 to No. 9 occur, calibration error contact is closed.

When an error occurs, the error number message will appear at the offending channel. The screen below shows that error No. 9 has occurred on Channel 1.



Pressing ENT displays the error contents screen which describes the error, indicates what channel or component is affected and suggests probable causes for the error.

If the ESC key is pressed without removing the cause of an error, the error will be displayed again. When more than one error occurs, pressing the SIDE key moves to another error display.



4.6.1 Error Log File

If error occurs, the history is saved in an error log file. The error log file exists in the maintenance mode.

4.6.2 Error Log Screen

Up to 14 errors can be saved in the error history; the oldest error will be deleted one by one each time a new error occurs. Figure 4-11 shows the Error Log screen and identifies the fields.

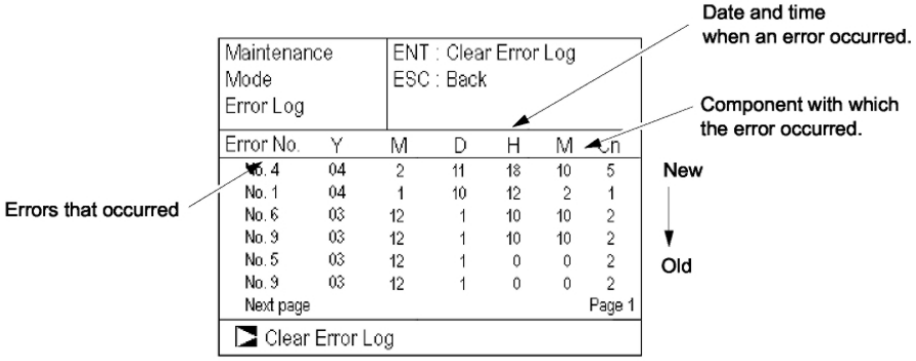


Figure 4-11: The Error Log Screen

If the power supply is turned OFF, the contents in the error log file will not be lost or damaged.

4.6.3 ***Deleting Error Hstory***

Press the ENT key on the above screen, and the “Error Log Clear” will be inverted. Pressing the ENT key again will clear the error history.

Appendix

A.1 SPECIFICATIONS

General Specifications

Standard specifications

Measurable components: Max. 5 components including O_2.

	Minimum range	Maximam range
NO	0 – 50ppm	0 – 5000ppm
SO_2	0 – 50ppm	0 – 10vol %
CO_2	0 – 20ppm	0 – 100vol %
CO	0 – 50ppm	0 – 100vol %
CH_4	0 – 200ppm	0 – 100vol %
O_2 (built in)	0 – 5vol %	0 – 25vol %
O_2 (Ext. Zirconia)	0 – 5vol %	0 – 25vol %

Ranges: 2 each channel, user settable between Max. and Min.

Measuring Range Ratio: ≤ 1:5 (O_2)

≤ 1:25 (other than O_2)

Principle of measurement:

(NO, SO_2, CO_2, CO): Non-dispersion infrared-ray absorption Single light source and double beam (double-beam system)

O_2: Paramagnetic O2 sensor (built in) or zir conia O2 sensor (externally installed)

Display: 4-digit digital LCD display with back light

Analog Output:	12 points max. 4 to 20 mA DC or 0 to 1V DC, non-isolated output max.load 550Ω for 4 to 20 mA DC min.load 100kΩ for 0 to 1VDC
Analog Input:	0 to 1V DC non-isolated input from externally installed Zirconia type O_2 sensor.
Relay Contact Output:	1a contact (250V AC/2A, resistive load) Instrument error, calibration error, range identification, auto calibration status, pump ON/OFF, peak alarm. 1c contact (250V AC/2A, resistive load selectable 6 outputs). High/Low limit alarm contact output. Power disconnection alarm.
Contact Input:	No-voltage contact (ON/0V, OFF/5V DC, 5mA flowing at ON) Remote range switch, auto calibration remote start, remote holding, average value resetting, pump ON/OFF Isolated from the internal circuit with photocoupler. Contact inputs are not isolated from one another.
Other Output:	Solenoid valve drive signal for automatic calibration. Transistor output (100mA or less)
Power Supply:	Voltage rating: 100V to 240V AC Allowable range: 85V to 264V AC Frequency: 50Hz/60Hz
Power consumption:	250VA max.
Inlet:	Conforms to EN60320 Protection Class 1

Operating conditions:	Ambient temperature: -5°C to 45°C Ambient humidity: 90% RH max., non-condensing
Storage Conditions:	Ambient temperature: -20°C to 60°C Ambient humidity: 100% RH max., non-condensing
Dimensions:	Analyzer main unit: 177 x 483 x 600mm
	Input/output module: 164 x 318 x 55mm
Weight:	Approx. 22 kg (Analyzer only)

Internal Sample System

Wetted Parts:	Gas inlet/outlet: SUS304 Sample cell: SUS304,chloroprene rubber IR window: CaF_2 O_2 sensor sample cell: SUS316 Internal piping: Toaron, Teflon
Gas Inlet/Outlet:	Rc1/4 or NPT1/4 internal thread
Purge Gas Flowrate:	1L/min (when required)

A.2 Standard Functions

Output signal holding: Output signals are held during manual and auto calibrations by activation of holding (turning "ON" its setting).

The values to be held are the ones just before start calibration mode or setting value. Selectable.

Indication of instantaneous values will not be held.

Remote output holding: Output signal is held at the latest value or setting value by short-circuiting the remote output holding input terminals. Holding is maintained while the terminals

are short-circuited. Indication of instantaneous values will not be held.

Range switching: Range switching is available in manual, auto, and remote modes. Only preset switch method is effective.

Manual: Allows range to switch by key operation.

Auto: Allows range to switch from low to high range when 90%FS or more is available in the low range.

Allows range to switch from high to low range when 80%FS or less is available in the low range.

Remote: No-voltage contact input (for measurable components)

Allows range to switch via an external signal when remote range switch input is received.

When the contact input terminals for each component are short-circuited, the first range is selected, and it is switched to the second range when the terminals are open.

Range identification signal: The present measuring range is identified by a contact signal.

The contact output terminals for each component are short-circuited when the first range is selected, and when the second range is selected, the terminals are open.

Auto calibration: Auto calibration is carried out periodically at the preset cycle.

When a standard gas cylinder for calibration and a solenoid valve for opening/closing the gas flow line are prepared externally by the customer, calibration

will be carried out with the solenoid valve drive contacts for zero calibration and each span calibration turned on/off sequentially at the set auto calibration timing.

Auto calibration cycle setting:
Auto calibration cycle is set.

Setting is variable within 1 to 99 hours (in increments of 1 hour) or 1 to 40 days (in increments of 1 day).

Gas flow time setting:
The time for flowing each calibration gas in auto calibration is set. Settable within 60 to 900 seconds (in increments of 1 second)

Auto calibration remote start: Auto calibration is carried out only once according to an external input signal. Calibration sequence is settable in the same way as the general auto calibration. Auto calibration is started by opening the auto calibration remote start input terminals after short-circuiting for 1.5 seconds or longer.

Auto zero calibration: Auto zero calibration is carried out periodically at the preset cycle.

This cycle is independent of "Auto calibration" cycle.

When zero calibration gas and solenoid valve for opening/closing the calibration gas flow line are prepared externally by the customer, zero calibration will be carried out with the solenoid valve drive contact for zero calibration turned on/off at the set auto zero calibration timing.

Auto zero calibration cycle setting:
Auto zero calibration cycle is set.

Setting is variable within 1 to 99 hours (in increments of 1 hour) or Setting is variable within 1 to 40 days (in increments of 1 day)

Gas flow time setting:
The timing for flowing zero gas in auto zero calibration is set.

Settable 60 to 900 seconds (in increments of 1 second)

Upper/lower limit alarm: Alarm contact output turns on when measurement value reach to the preset high or low limit alarm value.

Contacts close when the channel value of each channel becomes larger than the high alarm limit value or smaller than the low alarm limit value.

Instrument error contact output:

Contacts close at occurrence of analyzer error No. 1, 3 or 10.

Calibration error contact output:

Contacts close at occurrence of manual or auto calibration error (any of errors No. 4 to 9).

Auto calibration status contact outputs:

Contacts close during auto calibration.

Pump ON/OFF contact output:

During measurement, this contact close. While calibration gas is flowing, this contact open. This contact is connected in power supply of pump, and stop the sample gas while calibration gas flowing.

A.3 Optional Functions

O_2 correction: Correction of measured NO, SO_2 and CO gas concentrations into values at reference O_2 concentration

Correction formula: $C = \frac{21 - On}{21 - Os} \times Cs$

C: Sample gas concentration after O_2 correction

Cs: Measured concentration of sample gas

Os: Measured O_2 concentration (Limit setting: 1 to 20% O_2)

On: Reference O_2 concentration (value changeable by setting. 0 to 19% O_2)

Average value after O_2 correction and O_2 average value calculation:
The result of O_2 correction or instantaneous O_2 value can be output as an average value in the preset period of time. The moving average method is used for averaging in which sampling is carried out at intervals of 30 seconds.

Output is updated every 30 seconds. It is the average value in the determined period of time just before the latest update. Averaging time is settable within 1 to 59 minutes (in increments of 1 minute) or 1 to 4 hours (in increments of 1 hour).

Average value resetting: The above-mentioned output of average value is started from the initial state by opening the average value resetting input terminals after short-circuiting for 1.5 seconds or longer.

Output is reset by short-circuiting and restarted by opening

CO concentration peak count alarm: (added only for CO/O_2 measurement) Alarm output turns on according to the pre-set concentration and count.

Whenever the instantaneous value of CO exceeds the preset concentration value, count increments. If the count exceeds the preset value in one hour, the alarm contacts close.

Communication function: RS-232C (9 pin D-sub)
Half-duplex bit serial
Start-stop synchronization
Modbus TM protocol

Contents:

Read/Wright parameters
Read measurement concentration and instrument status

Remark:
When connecting via RS-485 interface, a RS-232C↔RS-485 converter should be used.

A.4 Performance:

Repeatability: ±0.5% of full scale

Linearity: ±1% of full scale

Zero drift: ±1% of full scale/week
(±2% of full scale/week; range between 0 to 50ppm and 0 to 200ppm)
(±2% of full scale/day; below 0 to 50 ppm range)

Span drift: ±2% of full scale/week
(±2% of full scale/day; below 0 to 50 ppm range)

Response time (90%):	15 sec electrical response. Within 60 seconds including replacement time of sampling gas (with 0.5L/min gas flow rate). Gas replacement time depends on the number of components,and measuring range.

A.5 Standard Requirements for Sample Gas

Flowrate:	0.5L / min ±0.2 L/ min
Temperature:	0 to 50°C
Pressure:	10 kPa (1.45 psi) or less (Gas outlet side should be open to the atmospheric air.)
Dust:	100 g/Nm^3 in particle size of 1μm or less
Mist:	Unallowable
Moisture:	Below saturation at 2°C (condensation un-allowable).
Corrosive component:	1 ppm or less
Standard gas for calibration:	Zero gas: Dry N_2
	Span gas: Each sample gas having concentration 90 to 100% of its measuring range (recommended). Concentration above 100% FS is unusable.
	If an external zirconia O_2 sensor is installed and calibration is carried out on the same calibration gas line:
	Zero gas: Dry air or atmospheric air (provided without CO_2 sensor).
	Span gas: For other than O_2 measurement, each sample gas having concentration 90 to 100% of its measuring range.
	For O_2 measurement: O_2 gas of 1 to 2 vol %.

A.6 Installation Requirements

- Indoor use. Select a place where the equipment does not receive direct sunshine, draft/rain or radiation from hot substances. If such a place cannot be found, a roof or cover should be prepared for protection.
- Avoid a location that is subject to heavy vibration.
- Select a location where atmospheric air is clean.

A.7 EC Directive Compliance

The product conforms to the requirements of the Low Voltage Directive 73/23/EEC and EMC directive 89/336/EEC (as amended by Directive 92/31/EEC), both as amended by Directive 93/68/EEC.

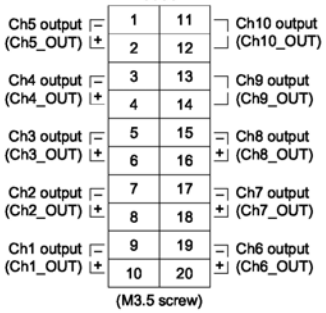
It conforms to following standards for product safety and electromagnetic compatibility;

- EN61010-1: 2001 Safety requirements for electrical equipment for measurement, control and laboratory use. “Installation Category II” “Pollution Degree 2”
- EN61326-1: 1997, AI: 1998, A2: 2001 Electrical equipment for measurement, control and laboratory use — EMC requirements.

* The product mounted in a steel enclosure conforms to the requirements of EMC directive.

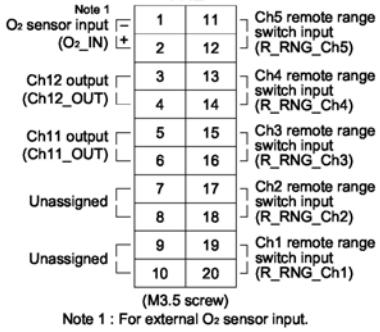
A.8 Terminal Block Connections

Terminal block 1
<TN1>



(M3.5 screw)

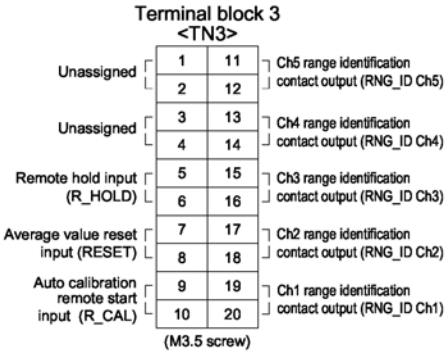
Terminal block 2
<TN2>



(M3.5 screw)

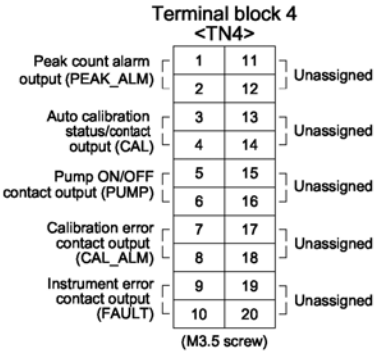
Note 1 : For external O_2 sensor input.

Terminal block 3
<TN3>



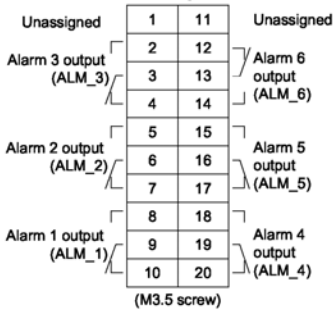
(M3.5 screw)

Terminal block 4
<TN4>



(M3.5 screw)

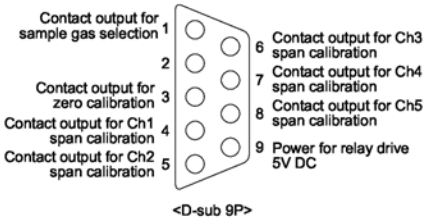
Terminal block 5
<TN5>



(M3.5 screw)

Connector
<CN3>

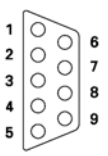
Solenoid valve drive signal output for calibration (Transister output)



<D-sub 9P>

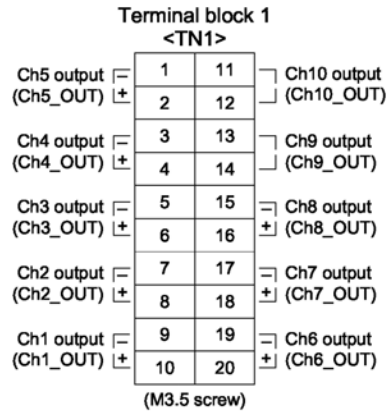
Connector
<CN2>

For serial communication (D-Sub9pin)



For details, refer to another manual about communication function.

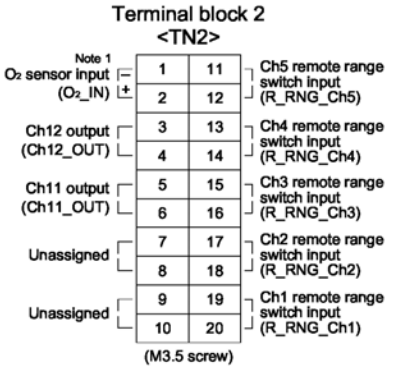
A.9 Description on Terminal Block



Terminal block 1 <TN1>

Terminal block for analog output (non-isolated output)

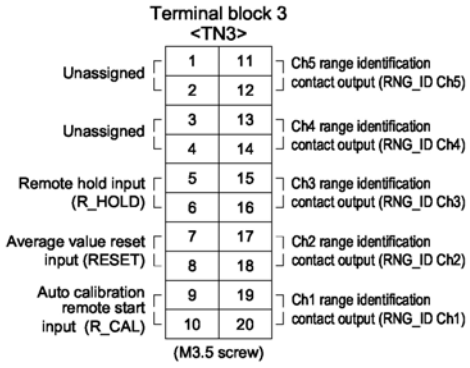
Between 1–2:	Ch5 output
Between 3–4:	Ch4 output
Between 5–6:	Ch3output
Between 7–8:	Ch2 output
Between 9–10:	Ch1 output
Between 11–12:	Ch10 output
Between 13–14:	Ch9 output
Between 15–16:	Ch8 output
Between 17–18:	Ch7 output
Between 19–20:	Ch6 output



Terminal block 2 <TN2>

Between 1–2:	O_2 sensor input (For input of Fuji's zirconia oxygen sensor or externally oxygen sensor. Must not be used unless external O_2 sensor is provided.)
Between 3–4:	Ch12 output
Between 5–6:	Ch11 output
Between 7–10	For internal connection. Must not be wired. (Must not be used as junction terminal).
Between 11–12:	Ch5 remote range switch input
Between 13–14:	Ch4 remote range switch input
Between 15–16:	Ch3 remote range switch input
Between 17–18:	Ch2 remote range switch input
Between 19–20:	Ch1 remote range switch input

Note 1: For external O_2 sensor input.



Terminal block 3 <TN3>

Between 1–4: For internal connection. Must not be wired. (Must not be used as junction terminal.)

Between 5–6: Remote hold input. No hold when open. Output hold when short-circuited.

For details, refer to "Item 6.7 Parameter setting, Output Hold".

Between 7–8: Average value reset input. short-circuitting the contact input (for at 1.5 sec min.) resets O_2 average and O_2 corrected average simultaneously. Opening it restarts the average value.

For details, refer to "Item 6.7 Parameter setting, Average Value Resetting"

Between 9–10: Automatic calibration remote start input

After shorting for 1.5 sec. or more, automatic calibration is started by the opening input whether the automatic calibration setting is ON/OFF.

For details, refer to "Item 6.4 Setting of auto calibration"

Between 11–12: Ch5 range identification contact output

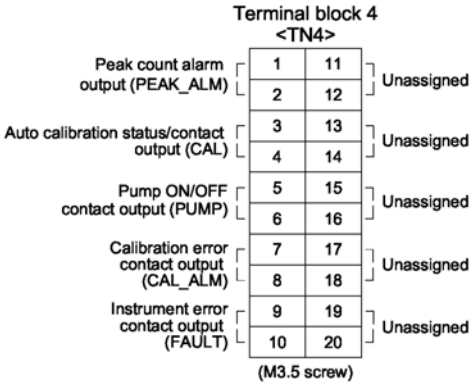
Between 13–14: Ch4 range identification contact output

Between 15–16 Ch3 range identification contact output

Between 17–18: Ch2 range identification contact output

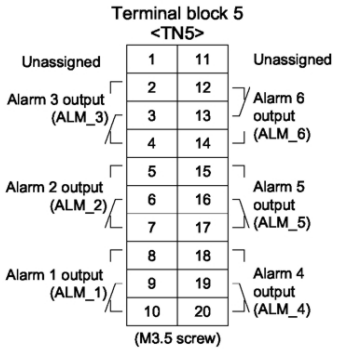
Between 19–20: Ch1 range identification contact output

Action of range identification signal
Range identification contact is conductive at low range and open at high range.



Terminal 4 <TN4>

Between 1–2:	Peak count alarm contact output It is conductive when peak count exceeds the setting time. It remains open below the setting time. For setting and operation, refer to "Item 6.6 Peak alarm setting".
Between 3–4:	Contact output of auto calibration status When the auto calibration is carried out , it is conductive. Remains open otherwise.
Between 5–6:	Pump ON/OFF contact output Used when turning ON/OFF the pump. It is open during auto and manual calibration status and conductive during measurement.
Between 7–8:	Calibration error contact output It is conductive when an error occurs during zero calibration or span calibration. It is normally open.
Between 9–10:	It is conductive when an error occurs to the analyzer unit. It is normally open.
Between 11–20:	For internal connection, wiring is not allowed. (Do not use it as junction terminal).



Terminal 5 <TN5>

Between 2, 3 and 4: Alarm 3 output

When the output exceeds the set value, it is conductive between2 and 3, and open between 3 and 4. Otherwise, it is open between 2 and 3 and conductive between 3 and 4.

Between 5, 6 and 7: Alarm 2 output

When the output exceeds the set value, it is conductive between 5 and 6, and open between 6 and 7. Otherwise, it is open between 5 and 6, and conductive between 6 and 7.

Between 8, 9 and 10: Alarm 1 output

When the output exceeds the set value, it is conductive between 8 and 9, and open between 9 and 10. Otherwise, it is open between 8 and 9.

Between 12, 13 and 14: Alarm 6 output

When the analyzer unit is turned ON, it is conductive between 12 and 13, and open between 13 and 14. When the analyzer unit is turned OFF, it is open between 12 and 13, and conductive between 13 and 14.

Between 15, 16 and 17: Alarm 5 output

When the output exceeds the set value, it is conductive between 15 and 16, and open between 16 and 17. Otherwise, it is open between 15 and 16, and conductive between 16 and 17.

Between 18, 19 and 20: Alarm 4 output

When the output exceeds the set value, it is conductive between 18 and 19, and open between 19 and 20. Otherwise, it is open between 18 and 19, and conductive between 19 and 20.

For detailed action of the alarm contact, refer to “Item 6.3 Alarm setting”.

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