Instruction manual
MTL gas analysers & systems

September 2019
INM MTL GIR6000 rev 4

CROUSE-HINDS
SERIES

MTL GIR6000

Biogas analyser

EATON
Powering Business Worldwide

DECLARATION OF CONFORMITY

A printed version of the Declaration of Conformity has been provided separately within the original shipment of goods. However, you can find a copy of the latest version at http://www.mtl-inst.com/certificates

GENERAL SAFETY INFORMATION

Safety instructions for installation and operating personnel

The operating instructions provided here contain essential safety instructions for installation personnel and those engaged in the operation, maintenance and servicing of the equipment. It is essential that the following safety information is read and understood before any work or operation is carried out.

The following methods are used in this manual to alert the user to important information:-

WARNING !

A 'WARNING' marked in this way is provided for operator and plant safety and MUST be followed.

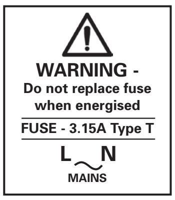
CAUTION

A Caution is provided to prevent damage to the instrument.

NOTE

A Note is used to guide the user in the operation of the instrument.

Instrument warning labels

Warning Label	Warning Information
	In the event of a fault, toxic gas may build up inside the unit. When accessing the unit, always open the outer door slightly and check for H_2S gas using a portable gas alarm before fully opening either the outer or inner doors.
	There are potential electrostatic hazards when cleaning the equipment. Clean only with a damp cloth.
	The equipment must be de-energised before the fuse holder on the mains input terminal is opened or the fuse is changed.
	The enclosure inner door must not be opened when the equipment is energised. Refer to the manual before installing, commissioning, operating or maintaining this equipment.
	Hot surfaces are present in normal operation inside the enclosure. Take care not to touch any heat sinks if the inner door is opened after the analyser has been operating.

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	The sample gas supply must be isolated before removing the Air & Gas Filter Module. The Air & Gas Filter Module must not be inserted or removed unless the equipment has been de-energised.
	The removable gas sensor modules or pump module must not be inserted or removed unless the equipment has been de-energised.

WARNING !

The Site Safety Officer must be consulted before any procedure is carried out which involves any of the above actions. It is the responsibility of the user to ensure all site safety procedures are followed.

Before commencing installation or commissioning:

- Read and understand the contents of these instructions
- Ensure installation and operating personnel have received adequate training for this task
- Ensure that any operating instructions are fully understood by the personnel responsible.
- Observe national and local installation and mounting regulations (e.g. IEC 60079-14).

During operation:

- Make the relevant instructions available at all times to the operating personnel.
- Observe safety instructions.
- Observe national safety and accident prevention regulations.
- Operate the equipment within its published specification.
- Servicing, maintenance work or repairs that are not described in this manual must not be performed without prior agreement with the manufacturer.
- Any damage to this equipment may render its explosion protection null and void.
- Changes to any of the components that might impair their explosion protection are NOT permitted.

If any information provided here is not clear:

Contact Eaton's MTL product line or one of its representatives.

NOTE

Improper installation and operation of the enclosure can result in the invalidation of the guarantee.

Warranty

Eaton warrants its products are free from defects in material and workmanship for a period of 1 year from date of shipment.

A warranty claim will not be valid if defects are not reported within the warranty period or if Eaton or its agents determines that defects or damage are due to normal wear, misapplication, lack of maintenance, abuse, improper installation, alteration or abnormal conditions.

Eaton's obligation under this warranty shall be limited to, at its option, repair or replacement. Under no circumstances will Eaton be liable for any incidental or consequential damages whether to person or property.

Eaton will not be liable for any other loss, damage or expense of any kind including loss of profits, resulting from the installation, use or inability to use this product.

The product must be returned freight prepaid for examination to Eaton or its agent, thoroughly cleaned, and any process chemicals removed before it will be accepted for replacement or repair.

This manual contains Important Health & Safety Information

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MTL GIR6000 Biogas analyser

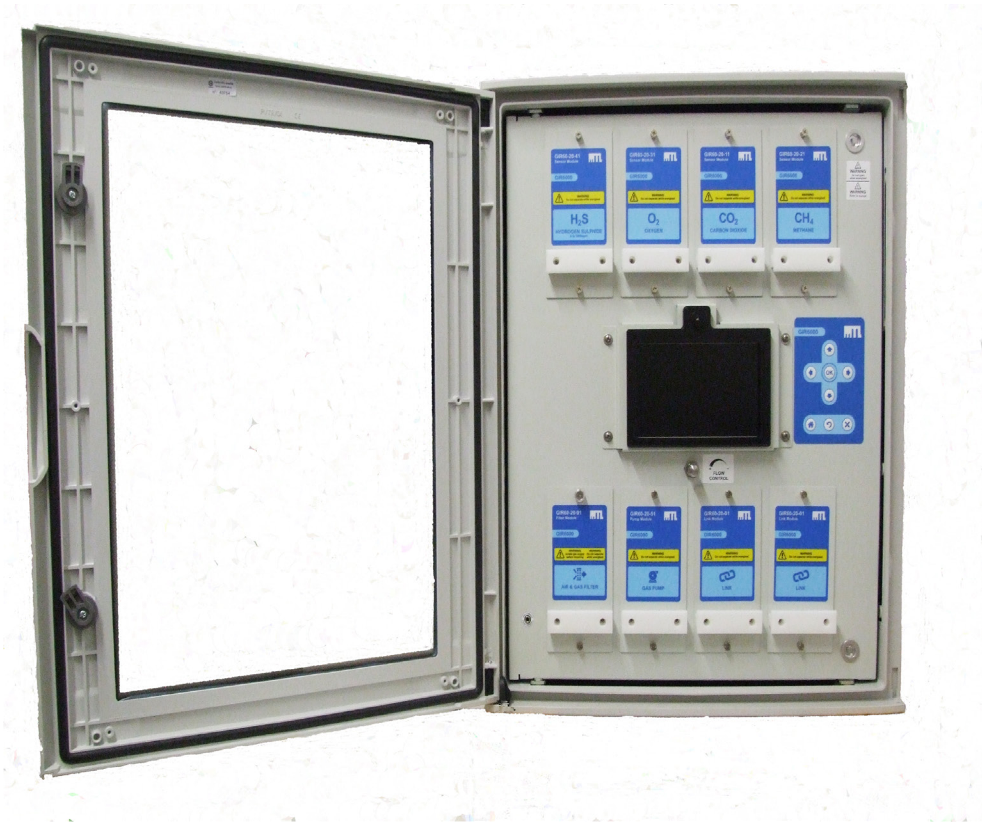


Figure 1.1 - The inner door of the MTL GIR6000 Biogas analyser showing pluggable modules

1 OVERVIEW

This manual explains the safe procedures for installation, operation and maintenance of the MTL GIR6000 Biogas Analyser and must be read in association with the product datasheets that contain electrical data.

Biogas consists chiefly of a mixture of Methane (CH_4) and Carbon Dioxide (CO_2), with Oxygen (O_2) and Hydrogen Sulphide (H_2S) present in lower proportions. Other trace gases are often present in low levels and may require monitoring when appropriate. All of these components can have implications regarding the safety of personnel involved in their production, the quality of gas produced, the efficiency of the production process and the use of the biogas in energy conversion.

The MTL GIR6000 is a field mountable, standalone biogas analyser that can monitor up to 6 individual gases simultaneously, display their relative proportions or levels and create alarms when the gas levels exceed preset upper limits or fall below lower ones. Each monitored gas has a dedicated plug-in module that may be changed by the user, in the field, to meet the current monitoring requirements. This plug-in, field replaceable facility also simplifies maintenance when the active life of a sensor has been reached and a replacement has to be fitted.

The MTL GIR6000 must be mounted in a designated Zone 2 hazardous area because of the potentially explosive nature of the gases flowing through and out of it. It must not be mounted in a Safe Area. All the necessary precautions associated with a hazardous area must be observed in the installation, operation and maintenance procedures concerning the analyser.

2 SPECIFICATION

2.1 Gas sensor options

	Methane (CH_4)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Hydrogen Sulphide (H_2S)	
Range:	0-100%	0-25%	0-100%	0 to 5000ppm	0 to 350ppm
Resolution:	0.2%	0.1%	0.2%	1ppm	0.1ppm
Typical sensor response time:	T90 ≤ 20s	T90 ≤10s	T90 ≤ 20s	T90 ≤ 40s	

2.2 Stability (@STP)

<2% f.s.d./month

2.3 Accuracy (@STP)

H_2S, CH_4, CO_2, O_2: 2% of f.s.
The accuracy specification of CH_4 sensor readings may be reduced from ±2% to ±4% if the GIR6000 is subjected to high levels of RF interference.

2.4 Sample flow

100 to 300ml/min. (operating)
400ml/min. (maximum)

2.5 Sample temperature and humidity range

–20°C to +50°C
15% to 90% RH (non-condensing)

2.6 Sample pressure

Pump-off: Min. 20 mbarg - Max. 1 barg

2.7 Sample and Air connections

Inlet and outlet: bulkhead compression fittings suitable for 0.25inch (or 6mm) o.d. tube
Air inlet is from atmosphere

2.8 Analogue Outputs

Six channels. User assignable. 4-20mA output current.
When assigned to gas sensors the range represents 0% to 100% of span.
Accuracy: ±20μA
Resolution: ±1μA

2.9 Output load range (Analogue Outputs)

0-700 ohms for all outputs

2.10 Digital Communication

RS485 Modbus*
Profibus DP (Option) *
Wireless (Option) *
* Check with Eaton's MTL gas product line for availability

2.11 Alarm Outputs

Two supplied as standard. Optionally up to sixteen in blocks of two. All are volt-free contacts and are user-assignable.
Contact Rating: 30VAC or DC, 0.5A max

2.12 Ambient operating and storage conditions

Operating Temperature	-10°C to +40°C
Operating Humidity	maximum 90% RH non-condensing
Recommended storage conditions	5°C to 20°C, 50% RH non-condensing

2.13 Power (Input Voltage range)

100-240Vac, 335mA, 50-60Hz
Maximum Power = 130VA

2.14 Enclosure details

Vibration: The MTL GIR6000 system is not designed for high vibration environments

Protection: (IP rating) is IP54 with door closed.

Net weight: approx. 30kg

External dimensions: 650mm(H) x 540mm(W) x 260mm(D)

Material: Polyester sheet mould compound (SMC) 25% glass fibre reinforce (manufacturer: Polynt, product code: 3300 RF HUP 17)

2.15 Accessories supplied

Mounting brackets, bushes and screws, inner- and outer-cabinet door keys and 4 - off union compression nuts.

3 MECHANICAL INSTALLATION

WARNING !
The responsibility for planning, installation, commissioning, operation and maintenance, particularly with respect to applications in explosion hazard areas, lies with the plant operator.

3.1 Preliminary information

This section contains important information that must be considered when planning the installation of the equipment.

WARNING !
It is NOT permitted to mount the enclosure in anything other than a Zone 2 hazardous area.

- It is important to recognise that during operation the inside of the enclosure is classified as a Zone 2 hazardous area.
- The gas and pumped air outlets create a Zone 0 hazardous area. See Section 3.3.4 for dealing with this hazard.

WARNING !
Enclosures are IP54 sealed when they leave the factory. All cable entry points are fitted with blanking plugs, and blanking nuts are fitted onto all bulkhead gas/air connectors. It is recommended that these remain in place until connected on site, especially on gas/air lines, to prevent the entry of any dirt, contamination or particles that could cause a blockage.

3.1.1 Mounting overview

Before mounting an enclosure it is important to consider the following points.

a) Choose a location that minimises the chances of excessive vibration and heavy impacts.

b) The MTL GIR6000 is rated for ambient temperatures between –10°C and +40°C. In exposed locations it may be necessary to provide shading from direct solar heating while maintaining adequate air flow around the breather valves on the top and bottom of the enclosure.

c) The enclosure has an Ingress Protection rating of IP54 (to EN60529) when the door is closed, so the mounting location should be chosen to comply with this rating.

d) The enclosure is designed for mounting on a vertical surface (+/- 5°), with the cable entry at the lowest point.

e) An entry for the power cable is provided, additionally two entry holes have been included adjacent to the power cable entry for the installers wiring. Any alternative or additional gland holes made by the installer must be kept within the area indicated on the bottom of the enclosure, please refer to figure 3.1. All holes made by the installer/user must be fitted with either a suitable cable gland or blanking plug. All glands or blanking plugs fitted to the enclosure must be appropriately certified (e.g. ATEX & IECEx) and have an Ingress Protection (IP) rating of at least IP54, and an operating temperature range of at least-10°C to +40°C.

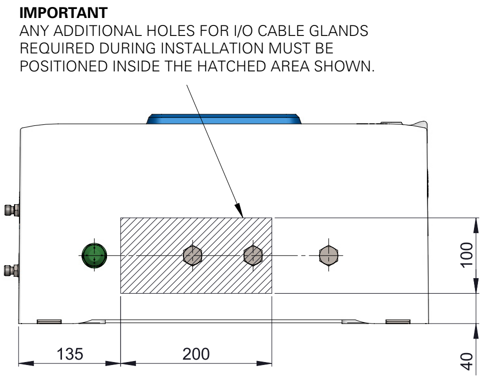


Figure 3.1 - The bottom face view of the MTL GIR6000 enclosure showing area for alternative or additional holes

f) A breather is fitted on the top of the enclosure and a breather/drain is fitted on the underside. Take care when siting the enclosure not to limit the air flow around these valves.

g) Adequate security should be provided against unauthorised interference with the enclosure.

3.2 Preparation

This section contains important information that must be considered when planning the installation of the equipment.

> **WARNING !**
> The MTL GIR6000 weighs approximately 30kg and is regarded as a two-man lift.
> Appropriate manual handling precautions should be observed.

a) Remove any temporary protection or packing materials.
Examine the enclosure for any signs of physical damage. If damage is identified, **DO NOT INSTALL THE ENCLOSURE.** Contact your Eaton representative or the factory for advice on how to proceed.

b) The enclosure can be mounted on any suitable structure using the mounting brackets supplied in the equipment accessories pack. Note: The wall / structure on which the enclosure is to be mounted should be flat, have an even surface and be able to support 4x the weight of the instrument (e.g. 4 x 30 = 120Kg).

c) The fixing bolts must be suitable for the mounting surface and the environmental conditions; M8 Partially threaded stainless steel (A4-70) bolts or imperial equivalents e.g. 5/16" UNC are recommended.

d) Attach the four stainless steel brackets (provided as accessories with the equipment) one in each corner, and secure in place using the M6 screws provided, as shown in fig 3.2.

e) Prepare holes in the mounting surface, on the centres shown in Figure 3.3, to accept suitable screws/bolts for mounting.

f) It is advisable before mounting, to do all necessary drilling of the enclosure and install suitable cable glands. For further details see Section 3.1.1 item e).

g) After mounting the enclosure check that:

- it has not suffered any damage
- the IP rating is not affected; for example, by distortion of the enclosure
- the mounting bolts/nuts have all been tightened to recommended levels

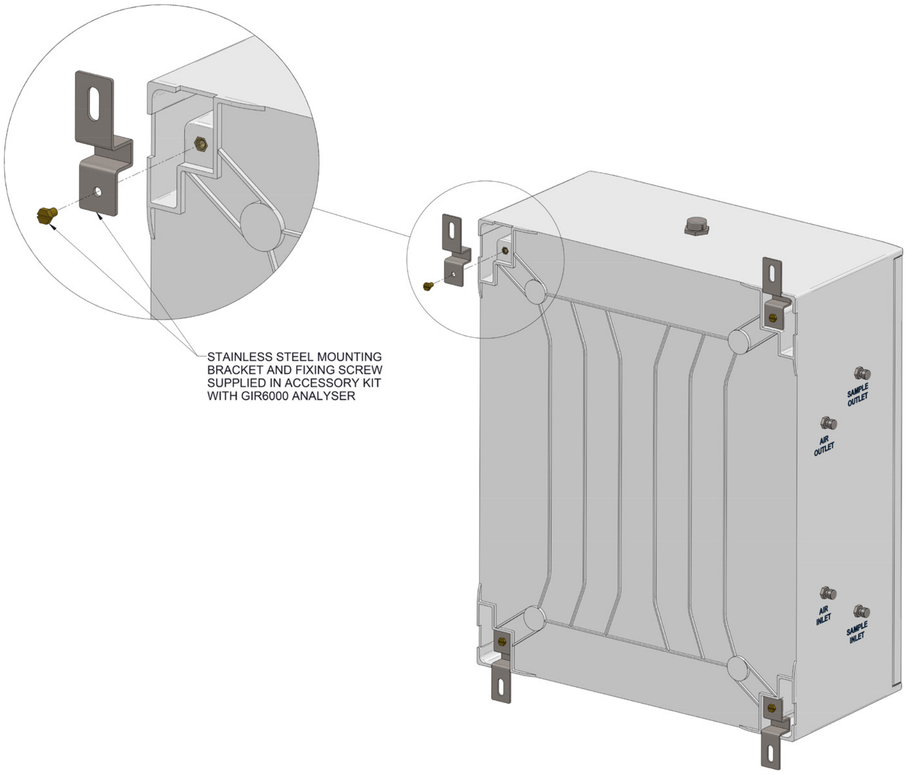


Figure 3.2 - The MTL GIR6000 mounting brackets and assembly procedure

3.3 Mounting the analyser

WARNING !

To minimise the risk of ignition by electrical apparatus in hazardous areas, efficient installation, inspection and maintenance of apparatus and systems is essential, and the work should be carried out by suitably trained personnel in accordance with the prevailing code of practice.

The certification documents specify "Conditions for safe use", which must be adhered to, and any copy certificate supplied should be studied and understood. Additionally it is recommended that a working knowledge of IEC EN 60079-14 be attained, as this standard provides guidance in respect to the installation of electrical equipment in hazardous areas.

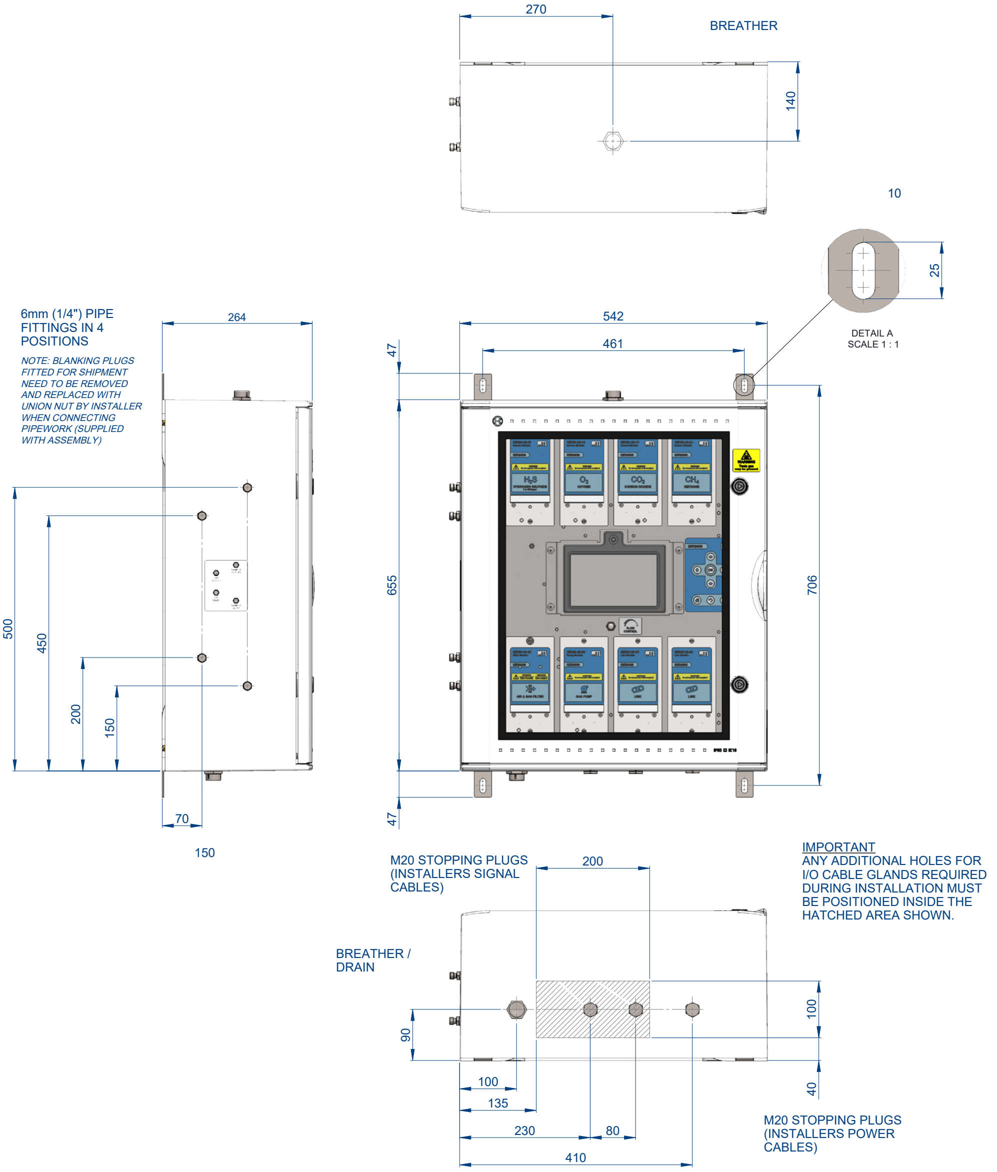


Figure 3.3 - External dimensions including mounting-hole positions

3.3.1 Fixing the enclosure to a surface

The mounting procedure will normally depend upon the mounting surface. The following method is suggested but local rules and guidelines must be followed whenever they are provided.

a) Prepare holes in the mounting surface, on the centres shown in Figure 3.3, to accept suitable screws/bolts for mounting.

b) Fit washers onto two expanding fixing bolts and screw the bolts into the top two prepared holes to a depth that will allow the enclosure to be safely hung on them.

c) Support the enclosure on these top bolts then fit the bottom fixing bolts (and washers) for the lower lugs and secure them.

d) Finally, tighten all fixing bolts to the manufacturers recommended torque value.

After mounting the enclosure check that:

- it has not suffered any damage.
- the IP rating is not affected; for example, by distortion of the enclosure.
- the mounting bolts/nuts have all been tightened to recommended levels.

3.3.2 Isolating gas valve

	WARNING ! A remote isolation valve must be included in the gas inlet flow line.

This valve should be positioned close to the analyser to enable the sample gas to be conveniently isolated for maintenance and leak-testing purposes.

3.3.3 Isolating electrical switch

	WARNING ! This instrument must be installed with a disconnecting switch close to it, within easy reach of the operator and compliant with the relevant parts of IEC 60947-1 and IEC 60947-3. It must be marked that it is the disconnection switch for this instrument and it must show ON and OFF positions. Wiring should conform to local codes.

3.3.4 Gas sample connection

NOTE

Before connecting to any external tubing the factory fitted protective caps need to be removed from the bulkhead fittings and replaced with union compression nuts (supplied as part of an accessory kit included with the instrument).

The enclosure has four bulkhead compression fittings on its left-hand side, suitable for 0.25 inch (or 6mm) o.d. tube; two of these are the input and output connections for the sample gas and the other two are for the pumped air connections (see section 3.3.5). Stainless steel tubing is mandatory for these connections.

	WARNING ! The bulkhead compression fitting may rotate if overtightened from the outside, possibly resulting in damage to the internal pipework. Always use a second spanner on the inside of the MTL GIR6000 when tightening up the compression fitting to prevent any rotation from occurring.

Figure 3.4 illustrates the recommended installation arrangement for obtaining a sample of the biogas for analysis. See also section 3.3.6 for details on venting the outlet pipes.

NOTE

The hydrogen sulphide (H_2S) sensor is cross-sensitive to hydrogen (H2), which can affect its accuracy.

Hydrogen, being the lightest of the component gases, tends to flow along the upper part of the pipe (assuming there is minimal turbulence), so the sample inlet tube should be positioned approximately 2/3 of the way into the pipe- as shown below- to avoid the collection of samples that contain abnormally high levels of H_2.

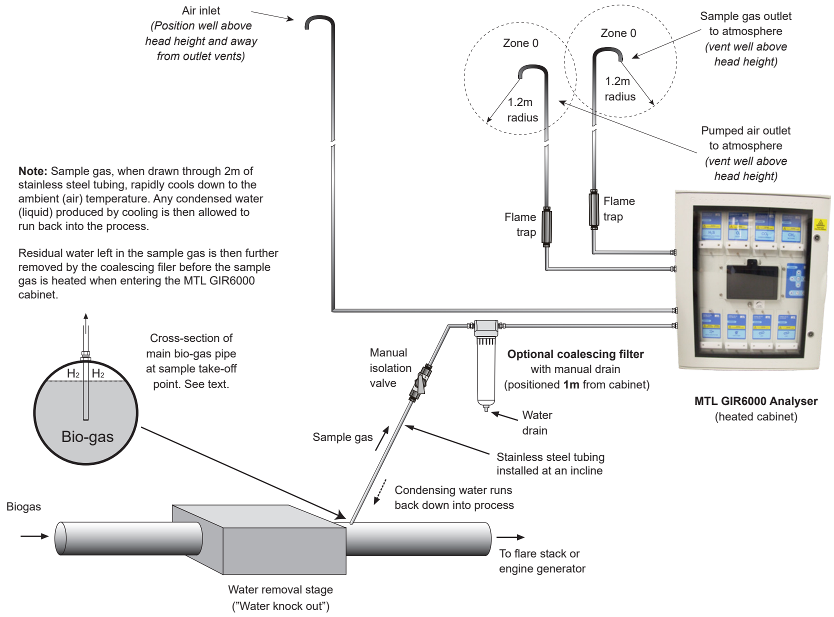


Figure 3.4 - Recommended pipe work configuration for the MTL GIR6000

It is important to ensure that the gas sample that enters the equipment is "Clean and Dry", as stated in the equipment specification. For water-saturated biogas applications, additional sample conditioning equipment can be considered; for example, peltier cooling. In most applications, coalescing filters (MTL part number HIL850-0035) are sufficient when installed as shown in Figures 3.4 & 3.5, the user should ensure that the filter is fitted with a 45 micron particulate element, this filter has two functions: firstly, it removes particulates from the gas stream; secondly, it helps to reduce the temperature of the gas to that of the ambient of the analyser and captures condensate as the temperature falls, which reduces the likelihood of condensation of the sample once it is within the heated analyser enclosure. If the external ambient temperature is 0°C or less, the equipment must be switched on and allowed to warm up (possibly for up to one hour, depending on conditions) before passing gas samples through it. This is to avoid icing in the gas inlet shutoff valve.

Refer to Figure 3.5 for additional details of the filter assembly, which is available on request from Eaton's MTL gas product line.

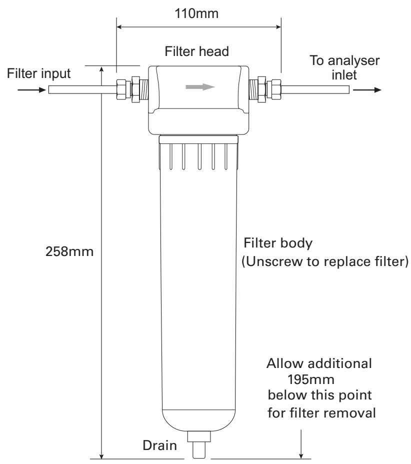


Figure 3.5 - Standard (optional) coalescing filter on gas inlet

CAUTION

a) Ensure there is adequate space below the filter body to permit it to be removed.

b) When replacing the filter element, take special care to avoid cross-threading the filter body in the filter head.

3.3.5 Pumped-Air connection

Both the hydrogen sulphide sensor and the oxygen sensor, when installed, require regular purging with clean air to maintain performance and sensitivity. The system has an intergrated pump which, at timed intervals, will temporarily halt measurement to pass clean air over the sensor(s) to maintain the operational accuracy.

The enclosure is provided with an additional pair of bulkhead compression fittings on the left-hand side, also suitable for 0.25 inch (or 6mm) o.d. tube. Figure 3.4 illustrates the mandatory installation arrangement for providing a source of clean air for the instrument, which should be located above head height and with adequate separation from the output vents to prevent recycling of gas fumes.

NOTE

If the atmosphere surrounding the analyser is liable to high levels of airborne dust or particulates it is recommended that a suitable external filter be fitted to the air inlet. This will help to prolong the lifetime of the analyser's internal air filter.

3.3.6 Outlet pipes - venting

WARNING !

The gas outlet pipe and the pumped air outlet pipe must not be joined together but must be vented independently.

Both outlet pipes must be vented well-above head height.

The two outlet pipes can be vented in the same area but it should be recognised that the gas-air mixture around each outlet will create a Zone 0 hazardous area. This is represented in Figure 3.4 by spherical volumes that extend to a minimum radius of 1.2 metres around each vent.

A flame trap is required in-line with each of these outlet pipes to prevent flame blow-back.

3.4 Plug-in modules

The MTL GIR6000 is designed around the concept of plug-in modules that are simple to remove and replace.

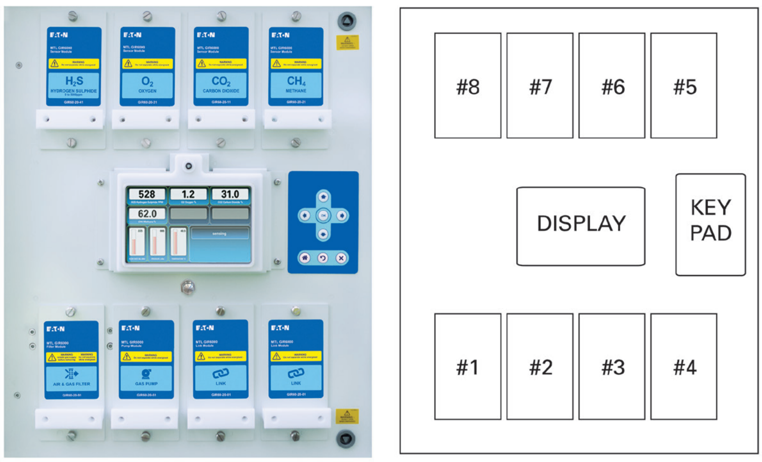


Figure 3.6 - Example of a complete inner door panel showing modules and aperture numbers

3.4.1 Gas modules

Each gas sensor module has a built-in sensor for its own particular gas, e.g. carbon dioxide CO_2, or oxygen O_2, etc. Each sensor module plugs into the gas manifold behind the door panel so that the biogas can flow across its sensor to provide an electrical signal appropriate to the specific gas concentration. The electrical signals are then analysed by the controller board and passed to the front display panel to indicate the proportion of the individual gases present.

3.4.2 Filter module

The FILTER module is a replaceable module that provides filtering for the incoming biogas. The Filter module is always fitted in position number 1 – see Figure 3.6

NOTE

Passive Flow control is also provided and is controlled with a knob positioned below the display panel on the inner door.

3.4.3 Gas Pump module

The GAS PUMP module enables the sample flow to be increased to ensure the optimum flow rates for accurate measurement. The Gas Pump module is always fitted in position number 2 – see Figure 3.6

3.4.4 Module locations in the door

There are three rules regarding the location of modules in the eight door apertures. Refer to Figure 3.6

1. The FILTER module MUST be located in position #1
2. The GAS PUMP module MUST be located in position #2
3. The H_2S gas module MUST be fitted in position #8
4. If fitted, the O_2 gas module MUST be fitted in position #7

Other gas modules may be located in any of the other positions and in any order.

3.4.5 Vacant module positions on the inner door

Any aperture in the door panel that does not have one of the above modules fitted must be fitted with a LINK module to maintain continuity of the gas flow line.

4 ELECTRICAL INSTALLATION

WARNING !

Before starting any electrical installation work, ensure that the incoming trunk connection is isolated from any source of power.

CAUTION

Any person working on the enclosure when the inner door is open MUST wear an ESD grounding wrist strap. If the enclosure is already wired to a suitable ground connection the wrist strap can be plugged into the ESD COMMON GROUND jack socket provided on the lower left corner of the inner door. This may be accessed from the front or back of the door, as appropriate (see images below), otherwise an alternative ground connection must be used.

It is also advised that a user handling a plug-in module uses the same precautions to prevent inadvertent static damage to any of the module's electrical components.

ESD common ground connection points

Outside inner door **Inside inner door**

4.1 Overview

Each gas monitor module has a built-in sensor for its own particular gas, e.g. carbon dioxide CO_2, or oxygen O_2, etc. The gas module plugs into a gas manifold behind the door panel allowing a sample of the biogas to flow across the module's sensor that provides an electrical signal indicating the proportion of that gas present in the sample. The electrical signals from the module are passed through a plug and socket at the back of the module to the controller board where the signal levels are analysed and then passed to the display panel where the individual gas levels can be seen by the user.

WARNING !

There must be an absolute minimum separation of 10mm between AC power cables and the input/output, low-voltage, signal cables, both inside and outside the analyser enclosure.

It is necessary to obtain access to the inner part of the enclosure to perform all the required cabling. This requires both the outer and inner doors to be opened.

4.2 AC Power wiring

As mentioned in Section 3.3.3, the AC power must be supplied from an isolating switch located within easy reach of the equipment and marked as the disconnecting device for the equipment, and MUST be fused at 6A.

The AC power cable should enter the enclosure through a cable gland (minimum IP54) from the underside on the right-hand side. The AC power connection terminals are located on the inner back panel of the enclosure on the lower right-hand side- see Figure 4.1.

Ensure the correct AC power input voltage range has been selected at the switch located on the Power Supply beneath its AC power connections.

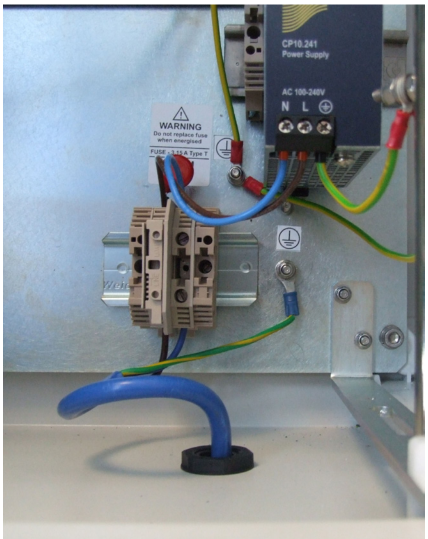


Figure 4.1 - AC power input connections

⚠	**WARNING !** To comply with the ATEX & IECEx requirements for hazardous area safety, the mains power wiring to the equipment must be protected by a protection concept suitable for use in Zone 2 (e.g. Ex e glands and armoured cable).

The incoming AC power wiring terminates on a pair of DIN-rail mounted terminals, see Figure 4.1.
The live (L) terminal contains a replaceable 3.15A 'T' type fuse (20 x Ø5mm).
The terminals can accept wiring/ferrule sizes in the range 1.5mm2 (AWG 20) up to 4.0mm2 (AWG 14).

Screwdriver blade size: 0.8 x 4mm flat-bladed

Stripping length: 12mm

a) Feed the AC power cable through the cable gland and prepare the live (L) and neutral (N) wire ends, preferably with crimped ferrules, for connection to the terminals. Avoid excessive length on these cable ends to avoid the possibility of a loose end touching adjacent surfaces. Tighten terminals to a torque value in the range 0.8- 1.6Nm.

b) The protective ground wire should be fitted with an M4, crimped, ring-terminal and connected securely to the threaded stud marked to the lower right of the DIN terminals- see Figure 4.1. Ensure that the earth wire is always the longest so that it will be the last one to take the strain if the cable should slip in the gland that anchors it.

c) On completion, eliminate any strain on the incoming wiring then tighten the gland to secure the cable and create the appropriate atmospheric seal. Use cable ties where necessary to tidy and secure the wiring.

4.3 Signal cable wiring

Signal cables must enter the enclosure from the underside. Suitable cable glands (see Section 3.1.1 e) must be provided by the installer to suit the Zone 2 location and the IP54 rating of the enclosure.

The temperature rating of any cabling used should be at least –10°C to +80°C, and of a suitable specification for the environment that the instrument is installed in.

Inside the enclosure the signal cables should be connected into the double row of terminals provided on the lower edge of the motherboard – see Figure 4.2.

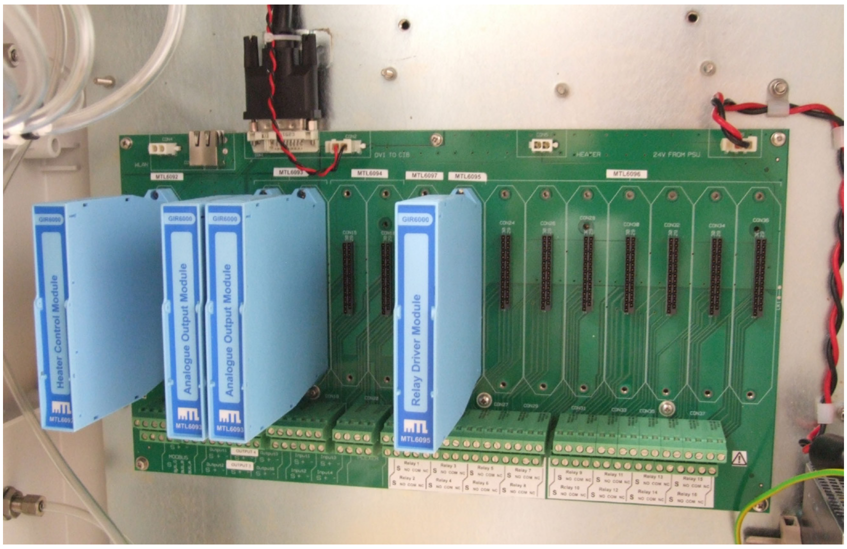


Figure 4.2 - Signal processing motherboard showing connection terminals

WARNING !
To comply with the ATEX & IECEx for hazardous area safety, all signal connections to the equipment must be protected by protection concept(s) suitable for use in Zone 2.

WARNING !
For electrical safety, all signal connections must be fed from either a mains-isolated power supply complying with IEC/EN60950 or IEC/EN61010, or be protected by an Intrinsically Safe isolator with a Um of at least 250V.

The motherboard terminals can accept wiring/ferrule sizes in the following range of sizes.

Solid / stranded 0.2 – 4.0mm2 / 0.2 – 2.5mm2

It is recommended that stranded cables are fitted with ferrules.

Screwdriver blade size: 0.6 x 3.5mm flat-bladed

Stripping length: 7mm

Feed each signal cable through a cable gland and prepare the wire ends as indicated above, preferably with crimped ferrules. Connect the wiring as indicated for each module type then tighten terminals to a torque value in the range 0.5- 0.6Nm.

WARNING !
There must be an absolute minimum separation of 10mm between AC power cables and the input/output, low-voltage, signal cables, both inside and outside the analyser enclosure.

Use suitable cable clamps and ties where necessary to maintain this separation.

4.4 Motherboard connections

The motherboard is located on the rear panel inside the enclosure, behind the inner door, and carries the connection terminals for the input and output control signals. A range of modules is available for the motherboard to provide various functions, but these must be fitted by an MTL approved service engineer; *they must not be fitted or replaced by the user.*

Starting from the left-hand side, the module functions and their connection terminals are as follows.

Analogue Output modules –

These modules are factory fitted as standard and provide analogue output channels, one for each of the gas modules fitted. Each gas output signal is assigned to a channel through the software interface as explained in Section 6.4.4.

These outputs have a conventional 4-20mA current loop that represent 0-100% of the measurement span defined in the software. The outputs are configured as current sources (from '+' to '–') and will work into load resistances of up to 700 ohms. A terminal is also provided for the cable shield wire.

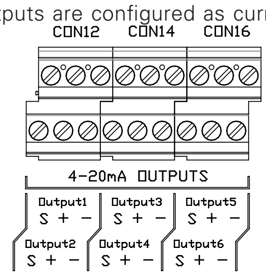


Figure 4.3 - Analogue output connection terminals

Analogue Input modules –

These modules are not fitted as standard but may be added to accept input signals from external sources that require monitoring, or to supplement the data presented by the graphical interface display panel. They operate over the conventional current loop 4-20mA range – driving into the '+' terminal and returning via the '–' terminal. A terminal is also provided for the cable shield wire.

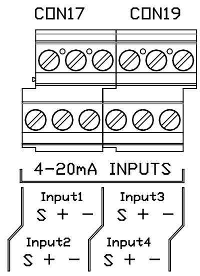


Figure 4.4 - Analogue input connection terminals

External Gas Multiplexer module –

This module is optional and enables signals from other gas sensors to be multiplexed with those from the enclosure for additional signal processing and presentation on the display panel. This facility is scheduled for a later release of the product; check with our MTL gas product line for details.

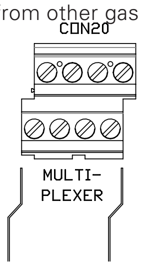


Figure 4.5 - External gas multiplexer connection terminals

Heater Controller module –

This module is factory fitted as standard. Although no internal heater is fitted, this module must be installed for correct operation of the analyser.

Relay Driver module –

This module is factory fitted as standard and controls the relay modules. It also contains two relays which can be operated independently.

Dual Relay modules –

These modules are optional and are fitted as required. Each one contains two relays that can be operated independently and are used to switch auxiliary equipment, such as alarm or fault indicators. Up to seven modules may be fitted to the motherboard which, together with the two relays on the Driver Module, provide a total of sixteen switched digital outputs. The relay modules may be installed in any order and in any of the positions provided. The individual relays are then assigned to any sensor, by the user, using the software interface – see Section 6.4.3.5.

Each relay has a 'normally open' (NO) terminal, a 'normally closed' (NC) terminal and the common (COM) switched terminal, so the user can chose the switching option to suit the system requirements, a terminal is also provided for the cable shield wire.

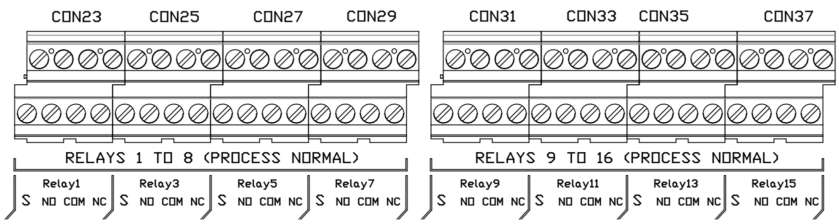


Figure 4.6 - Relay modules connection terminals

Further details of these modules are provided in Section 6 that deals with their configuration.

4.5 Final checks

Before applying power to the analyser, check the following items:

- Has the correct AC power input voltage been selected?
- Have all wire terminal connection screws been tightened?
- Is there a minimum separation of 10mm between power and signal wiring and other adjacent components?
- Have all cable glands and any blanking plugs been tightened to provide a good seal?
- Are there are any loose cable ends that could cause an open or short circuit?
- Have all tools (e.g. screwdrivers) or loose items been removed from inside the enclosure?
- Has the inner door been closed and secured with the key provided?
- Check that all plug-in modules are in their correct positions (see Section 3.4.4), are fully seated and their securing screws are tightened.
- Check the door seal for damage as the ingress of contaminants might affect both safety & performance.

Finally, close the outer door and secure both locks with the key provided.

5 COMMISSIONING

Commissioning of the MTL GIR6000 is necessary to ensure that the instrument is operational but does not include setting of all of the gas measurement parameters or alarm levels, etc. For details on configuring the gas parameters see Section 6 – Graphical User Interface.

The sensors in the MTL GIR6000 analyser are characterized before the instrument leaves the factory, however it is recommended that the system calibration is verified during initial site installation.
The calibration status of the instrument should be monitored by site maintenance staff and schedules established for maintaining measurement accuracy levels within the user-defined standards for the site.
The calibration methods for the individual gas sensors are described in the Maintenance and Calibration section of this manual.

Commissioning consists of the following initial basic set up and checks.

- Leak testing following initial installation
- Initial switch-on to confirm correct start-up and initialisation
- Set or confirm – date and time, user language, Tag Number and display brightness

5.1 Leak testing following initial installation

⚠	**WARNING !** It is essential that the MTL GIR6000 enclosure is tested for potential gas leakage after installation and proven to be leak-free.

The leak tests described in this manual are solely for the purpose of testing for internal gas leaks within the MTL GIR6000 equipment. All other external pipe work and valves must be tested in accordance with established site practice.

NOTE All leak testing operations will be found in the Maintenance and Calibration section of this manual.

DO NOT PROCEED WITH FURTHER EQUIPMENT SETUP AND COMMISSIONING UNTIL THE LEAK TESTING HAS BEEN CARRIED OUT.

5.2 Initial switch-on

Before switch-on, carry out the following visual checks.

- correct AC power connections – especially safety ground connection
- Correct AC power input voltage range is selected
- correct AC power fuse is fitted
- all pipework connections are tightened
- check that all tools have been removed from inside the enclosure- e.g. screwdrivers, etc.
- check there are no loose items- e.g. keys, etc.

⚠	**WARNING !** Ensure that the inner door to the MTL GIR6000 enclosure is closed and locked before power is applied to the instrument.

Switch on the power using the external safety isolation switch.

It is recommended to allow a warm-up period of at least 1 hour when commissioning the equipment in low temperature environments.

5.2.1 Start-up sequence

The instrument should then commence its start-up sequence which takes approximately 60 seconds.

After the initial boot sequence, each gas sensor should be recognised automatically and presented in the upper half of the graphical user display on the instrument panel- see Figure 5.1. Any of the six gas displays that are not currently required will have the readout area 'greyed out'. Confirm that all the fitted sensors have a read-out on the display panel and that each has a green border, which confirms that the sensor is operating within the default performance limits.

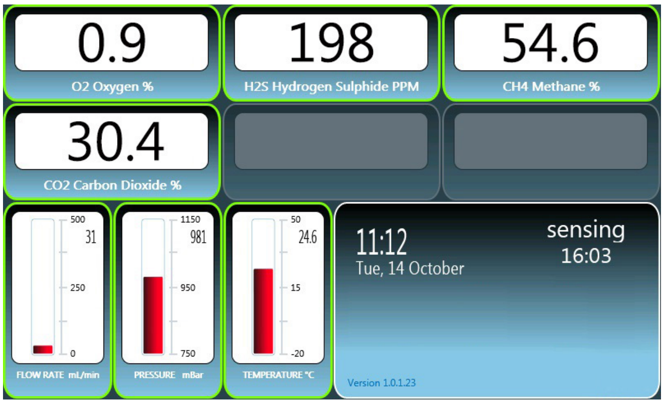


Figure 5.1 - 'Home' display on the graphical user interface

The 'Home' display also provides a graphical representation, with a numerical spot figure, for gas 'Flow Rate', 'Pressure' and 'Temperature' in the bottom left hand corner and finally a 'Status' display in the lower right corner, which will display the message "initialising".

To the right of the display is the control panel- see Figure 5.2- with a set of buttons. The up, down, left and right buttons are used to direct the cursor on the display screen and the 'OK' button is to confirm a menu choice.

Below these buttons are three others defined as:

Home- which takes the user to the 'Home' display screen shown in Figure 5.1

Return- Go back one level on the menu sequence and confirm any settings made at the current level

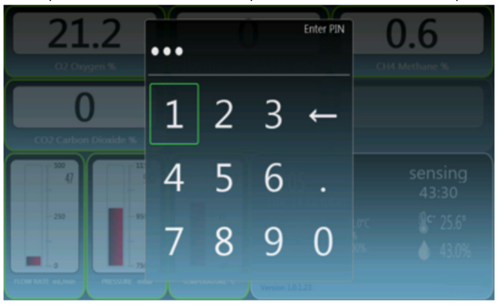
Exit- Go back one level on the menu sequence and discard any settings made at the current level

Figure 5.2 - User control buttons

5.2.2 Setting date and time, Tag Number and language

Press the OK button (see Figure 5.2) to show the side Menu Screen.

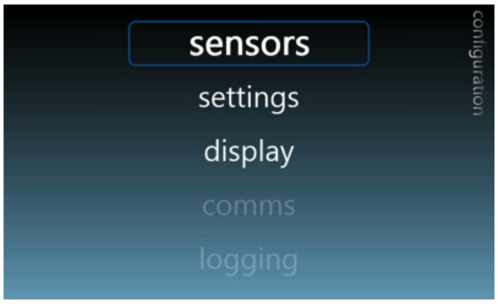
The top icon ⚙ *configuration* should be highlighted. If not use the up and down arrows to position the highlight at the top and press OK. This will open a screen that requires the entry of a PIN number



to proceed further.

Figure 5.2 - PIN entry screen

The factory default PIN number is ‘1111’. To enter this, highlight the first digit using the arrow buttons and press OK. Continue in the same manner through the number sequence in turn. The actual digits used will not be shown on screen but a dot will display how many digits have been entered. The PIN number should be changed from the default PIN before the analyser is put into service. To change the



PIN number see Section 6.4.5.5.)

Figure 5.3 - Configuration screen

Use the down arrow button to highlight ***settings*** (Figure 5.3) and press OK to obtain the ***settings*** screen.

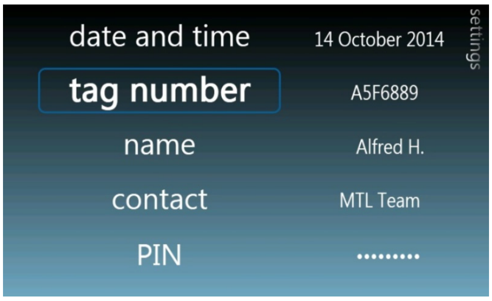


Figure 5.4 - Settings screen

Ensure the time option is highlighted, using the up/down arrow buttons if necessary, and press OK.

Step through the date and time figures shown on screen, using the left and right arrow buttons, and use the up and down arrow buttons to set the correct date and time parameters.

Use the ⟲ button to confirm the new date and time settings and move back to the ***settings*** screen. Move the blue highlight down to the **tag number** option and press OK.

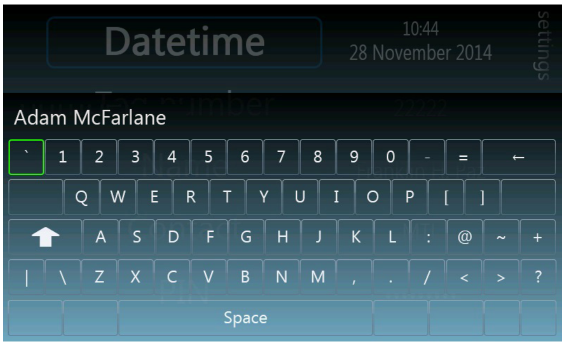


Figure 5.5 - Tag number screen

Use the on-screen keyboard to type the required tag number. Press the up/down and left/right arrow buttons to select individual characters on the screen keyboard, then press OK to confirm each character. Up to 15 characters are permitted for this parameter.

Finally, use the button to confirm the tag number and return to the ***settings*** screen menu.

Press the button again to return to the ***configuration*** screen. Move the blue highlight to the ***display*** option and press OK.

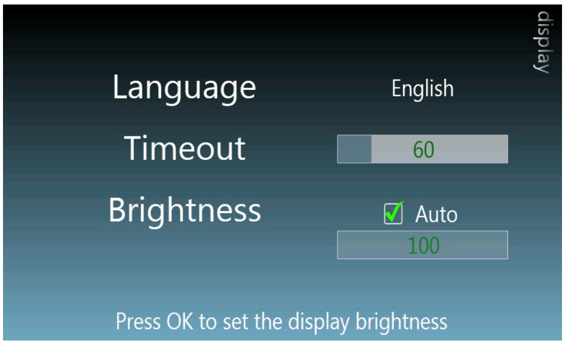


Figure 5.6 - Display screen

The only ***language*** currently available is 'English', so this parameter may be ignored.

Highlight the ***brightness*** parameter and press OK. The ***auto*** choice field becomes highlighted and will show either an empty square or a square with a check mark in it (as shown in Figure 5.6). Use the right or left arrow buttons to display the check mark in the square. The check mark specifies the auto brightness mode. This will ensure that the screen is suitable for most ambient lighting conditions. The brightness can be set to a more specific level when ambient lighting conditions are better known, but for initial setup, the auto brightness option is the most practical. Press OK to confirm the choice.

Press the button until the screen returns to the 'Home' display showing the gas measurements.

The analyser has now received its basic commissioning and is ready for the more detailed setting of alarms.

6 GRAPHICAL USER INTERFACE

The graphical user interface was introduced in Section 5.2, during the initial commissioning of the MTL GIR6000 analyser, in order to set up some of the basic user parameters of the system. However there are a number of additional parameters that should be set up in order to obtain the maximum performance benefits from the analyser when measuring constituent gases.

The following parameters and facilities can be set for each of the gases in order to obtain more meaningful information from the analyser.

- Alarms, both high and low, can be set to predefined threshold levels to alert a user to gas levels outside of desirable limits
- Hysteresis margins can be set to avoid alarms cycling on and off around the level set
- Latching or non-latching responses can be chosen on crossing an alarm threshold
- Specific relays can be chosen to control external alarms or signals
- Alternative communication protocols and methods maybe available on the unit *
- Definition of any required logging features *

** Check with Eaton's MTL product line for current availability of these features*

6.1 The Home Screen

The 'Home' screen is the default screen for the display. If the display is left in any of the sub-menu screens, without any further button presses, for more than 30 seconds it will return to the 'Home' screen display. There are ten specific screen areas that should be identified by the user.

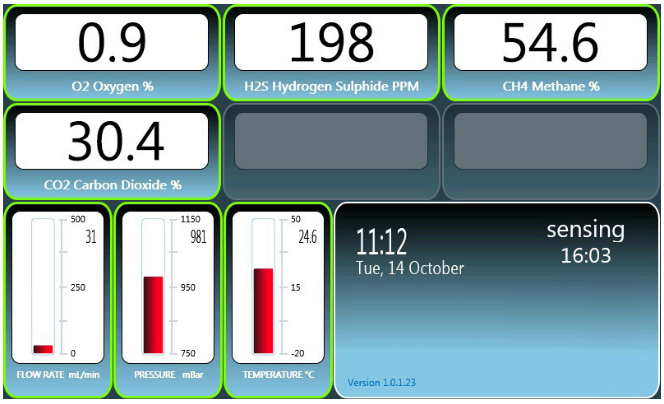


Figure 6.1 - 'Home' display on the graphical user interface

6.1.1 Gas content levels

At the top of the screen there are two rows of three numerical readouts, one for each of the sensors fitted in the instrument. The readout areas will be activated for each of the sensors fitted in the instrument during the start-up period. If there are fewer than six sensors fitted then any remaining readout areas will have a grey appearance – see the second row of sensor readouts in Figure 6.1.

The active readout areas have a bright white background and a numerical readout in black figures and each one will contain the name of a gas being measured together with the associated units, i.e. ppm – parts per million, or a percentage symbol (%). For example, the display shown in Figure 6.1 is indicating that the gas flowing through the analyser has an oxygen content of 0.9%.

6.1.2 Gas flow, pressure and temperature

In the lower left corner of the display there are three graphical indicators showing:

- the rate of flow of the gas through the instrument- in millilitres per minute (ml/min)
- the pressure of the gas in the instrument – in millibars (mBar)
- the temperature of the gas in degrees Celsius (°C)

Each has a scale beside the red level indicator and the current value is provided in larger figures near the upper right corner of each indicator.

6.1.3 Status panel

This rectangular panel in the lower right area of the display provides status information during various stages of operation of the analyser. For example, during start-up it will display "initialising"; during intervals when the hydrogen sulphide and oxygen sensors are being 'refreshed' by passing clean air across them, it will indicate "purging", otherwise the status will indicate "sensing". During any of these activities a countdown timer will indicate the amount of time left for the current activity.

In the lower left corner there is also a revision level for the software, so that the information is readily available when necessary.

6.1.4 Diagnostics messages

The region between the time/date and the Version number is used to display up to four diagnostic messages. Each diagnostic message is displayed as a single line of text in bold yellow.

Diagnostic messages are displayed if any of the following are encountered:

- If a module is Faulty
- If a module should be calibrated
- If a module should be replaced

An example of a diagnostic message is shown below:

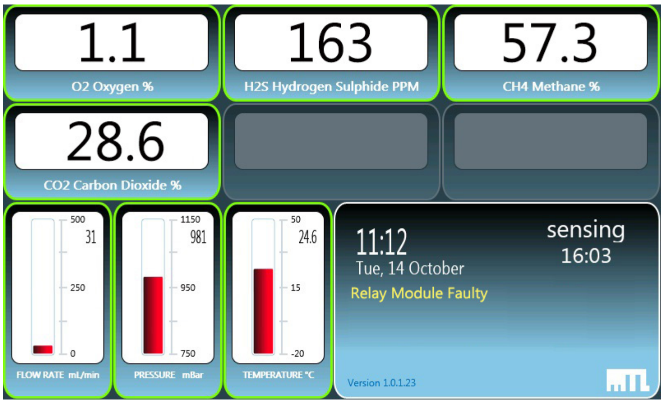


Figure 6.2 - Fault message

In the event of a diagnostic message the diagnostic screen can be viewed for more detailed information, see section 6.6.

6.1.5 Coloured margins around individual panels

The individual readout and graphical areas are surrounded by a coloured margin. The current status of the area concerned is indicated by the colour of this margin.

- **Green** indicates normal operation levels
- **Orange/amber** means system initialising
- **Red** is a **warning** or **alert** – it indicates that the analyser is unable to communicate with the module or that the module has identified a problem with its own operation

6.1.6 Notifications within panels

The individual readout and graphical areas are surrounded by a coloured margin. The current status of the area concerned is indicated by the colour of this margin.

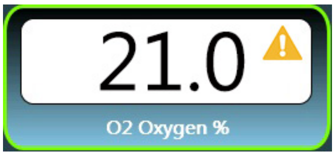


Figure 6.3 - Module error display

An upward pointing red arrow as shown below indicates a high alarm:

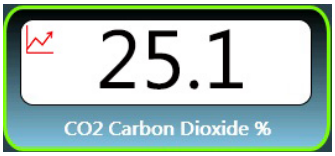


Figure 6.4 - High limit alarm

A downward pointing red arrow as shown below indicates a low alarm:

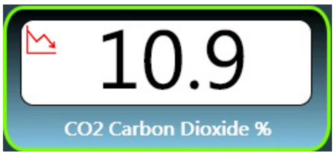


Figure 6.5 - Low limit alarm

For instructions on how to setup alarms see section 6.4.

6.2 Control buttons

To the right of the display is the control panel - see Figure 6.6. This has environmentally-sealed press buttons. The up, down, left and right buttons direct the cursor on the display screen and the **OK** button is to confirm a menu choice.

Below these buttons are three others defined as:

 **Home** - which takes the user to the 'Home' display screen shown in Figure 5.1

 **Return** - Go back one level on the menu sequence and confirm any settings made at the current level

 **Exit** - Go back one level on the menu sequence and discard any settings made at the current level

Figure 6.6 - Control buttons

6.3 Main menu

Press the OK button when in the default ‘Home’ screen to reveal the Main menu on the right of the display as shown in Figure 6.7.

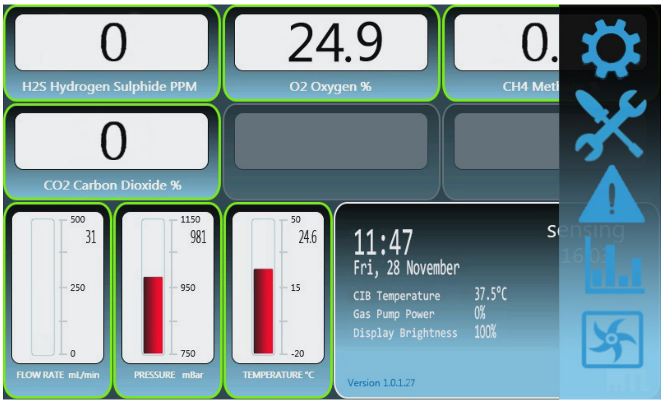


Figure 6.7 - Main menu – see right side of display

The five icons displayed have the following meanings.

- Configuration menu for setting analyser parameters – Section 6.4
- Service- used for calibrating and leak-testing the instrument – Section 6.5
- Diagnostics- for internal status information and for use by Eaton maintenance staff– Section 6.6
- Reports- available in later issues of the interface software – Section 6.7
- Pump- used to toggle the internal flow pump ON or OFF – Section 6.8

Use the up and down arrow buttons to move through the menu choices.

The principle choice for the user will be the Configuration menu option as this provides access to the main user-defined parameters.

NOTE

Any of the selections chosen will require a PIN number to be entered to gain access to the instrument parameters.

To enter the PIN, move through the number sequence in turn using the arrow buttons and then press OK as each number is highlighted.

The factory default number is ‘1111’. To change this refer to Section 6.4.5.5.

6.4 Configuration menu

Move the highlight to the ⚙ option and press **OK** to display the Configuration screen. The options are shown in Figure 6.8.

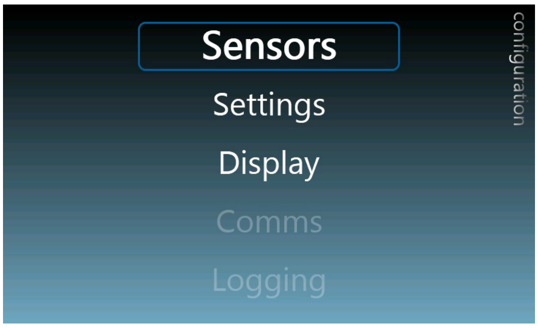


Figure 6.8 - Configuration screen

Use the up and down arrow buttons to move the selection highlight to the required option. The options are described below.

6.4.1 Sensors screen

In the ***configuration*** screen, move the selection to ***sensors*** and press **OK** to show the sensors menu screen. This screen is used to set the alarms and output channels for each sensor. No parameters can be changed until the sensor has been selected.

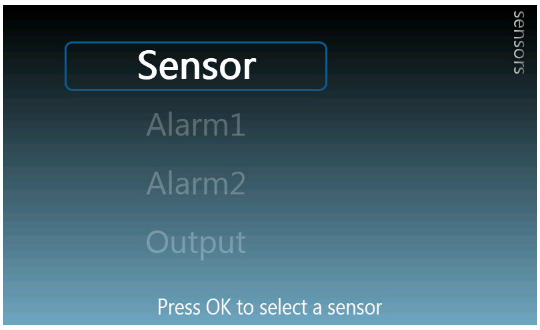


Figure 6.9 - Sensors screen

6.4.2 Selecting a sensor

Move the selection highlight to sensor and press **OK**. A drop-down list of the sensors fitted appears.

Figure 6.10 - Choice of sensors currently fitted

Choose the required sensor and press **OK**.

6.4.3 Alarm settings

Two individual alarm levels can be set for any given sensor- alarm1 and alarm2. Move the highlight to the alarm number you wish to set and press OK to reach the alarm setting screen for that alarm.

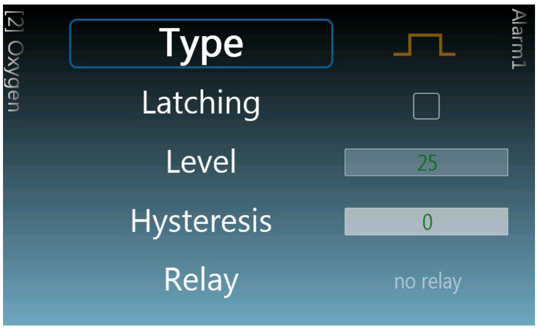


Figure 6.11 - Alarm setting screen

The alarm setting screen is the same for both alarms, so the following process can be applied to the parameters of either alarm.

6.4.4 Alarm type

First it is necessary to define the type of alarm required.

The two types of alarm are:

- an alarm that is generated when a gas level goes above a preset level – high alarm
- an alarm that is generated when a gas level drops below a preset level – low alarm

To choose the type of alarm, move the highlight to *type* and press OK. Use the left and right arrow buttons to select from the following options.

–	Do not generate an alarm
	Generate an alarm when the level exceeds a High threshold
	Generate an alarm when the level drops below a Low threshold

Press OK to confirm selection.

6.4.5 Latching

This will define the response when the chosen alarm level threshold has been crossed. A latch means that the alarm goes to alarm status and stays there, but no latch means that the alarm status will be cleared if the level returns to a non-alarm value.

Press OK to enable a latching choice to be made. Use the left and right arrow buttons to choose between the following options.

	YES- latch the alarm
	NO- do not latch the alarm

6.4.6 Level

Use this option to set the actual level for the chosen high or low alarm.

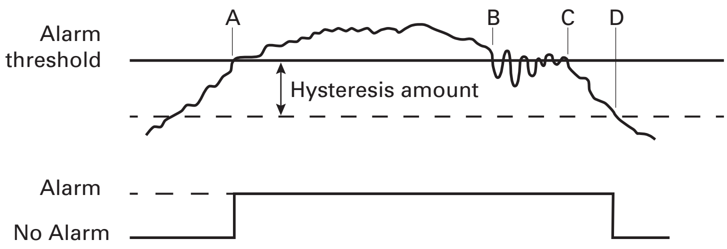
Press OK to start setting a level. Use the left and right arrow buttons to set the required level value then press OK to confirm the value setting.

6.4.7 Hysteresis

Hysteresis is used to prevent unwanted switching between an 'alarm' state and 'no-alarm' as a result of minor electrical variations (noise) on the parameter level. By using hysteresis, the level has to move away from the alarm threshold a specific amount (the hysteresis) before the alarm is cancelled.

The effect is illustrated in Figure 6.12, where an alarm is triggered at point 'A' because the (high) alarm threshold has been crossed. Even when the level drops below the alarm threshold at point 'B', the alarm state remains because a "band of hysteresis" has been defined that extends well below the original alarm level. If there was no hysteresis, the signal variations between 'B' and 'C' would cause the alarm to switch off and on rapidly as a result of short term variations in the parameter level.

Figure 6.12 - The effect of hysteresis



With hysteresis, the level must fall well below the alarm threshold by an amount defined with the hysteresis parameter before the alarm state is 'cancelled' (point 'D').

The hysteresis value can be set between the values of 0% to 20% (which is a percentage of the ***Level*** parameter).

Example

If the (high) alarm level had been set at 1000ppm, and the hysteresis set at 100ppm, the level would have to drop below 900ppm (1000- 100) before the alarm would be cancelled.

The required hysteresis value may need to be established by experiment as it will depend upon the amount of random signal variation (noise) experienced in the system.

To set a hysteresis value, move the highlight to ***hysteresis*** and press OK. Use the left and right arrow buttons to set the required percentage value then press OK to confirm the value setting.

6.4.8 Relay

This parameter is used to switch the state of a relay on the motherboard (as discussed in Section 4.4) when an alarm occurs. It can be used, for example, to complete (or break) a circuit for an alarm indicator or sounder.

Each relay has two possible options - normally open (NO) or normally closed (NC). The ***relay*** parameter, when used, has the effect of switching the relay from one of the states to the other. All relays are energized when the MTL GIR6000 is powered, and this is defined as the 'process normal' state. The required option for process normal, i.e. NO or NC, is decided by the terminal connections to the motherboard. The text adjacent to the connections indicates the process normal state – see Section 4.4.

If relay modules have been installed on the motherboard then a list of the available relays will appear (Relay 1, Relay 2, etc.) when the OK button is pressed – see Figure 6.13.

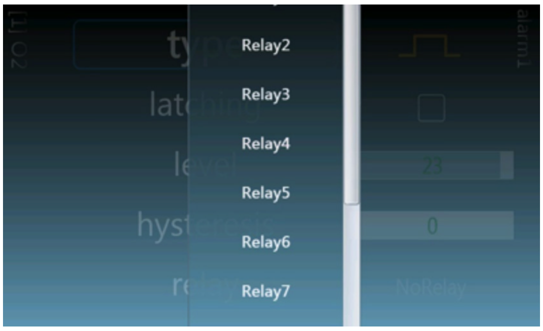


Figure 6.13 - Relay options

Any relay that has not been already been allocated to an alarm circuit can be seen from this list or, if a relay output is not required, the parameter can be set to **"No Relay"**, which is also the factory default setting.

Press the button to accept the alarm values set and return to the sensors screen.

6.4.9 Output

The final parameter in the sensors screen is ***output***, which is used to assign the sensor's output signal to an analogue output channel. The analogue output signals are presented on the terminals of the motherboard as described in Section 4.4 of this manual. A gas sensor output can be assigned to any of the available output channels.

Press OK to view the available channel options. Only channel numbers that are not currently assigned will be displayed. Choose ***"No channel"*** if an analogue output channel is not required for the sensor. Use the up and down arrow buttons to choose an option, then press OK to accept the choice.

Press the button to accept all the sensor values set and return to the ***configuration*** screen.

6.4.10 Settings screen

In the configuration screen, move the selection to settings and press OK to show the settings menu screen.

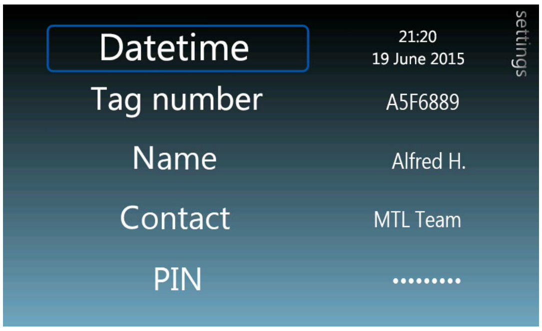


Figure 6.14 - Settings menu screen

This screen is used to set some fundamental parameters for the MTL GIR6000 and is not used much after initial installation and configuration. Each of the options shown is described below.

6.4.11 Date and time

This option is used to set the clock on the MTL GIR6000.

Ensure the highlight is on *Datetime* and then press OK.

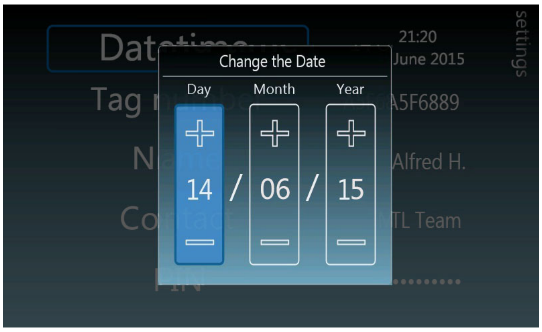


Figure 6.15 - Date change screen

The individual date parameters are shown on screen.

Use the up and down arrow buttons to adjust the values, and the left and right arrow buttons to select the parameter. Additional presses on the right arrow button will step the display into the time parameters.

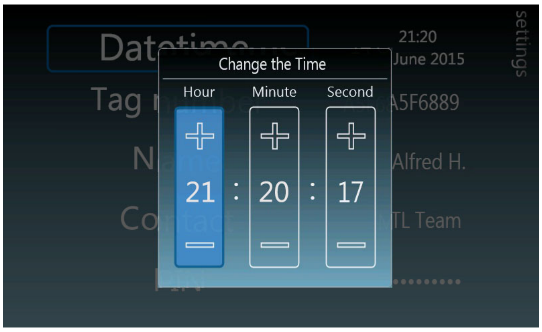


Figure 6.16 - Time change screen

Adjust these values in the same manner as the date parameters. Press OK to confirm the values entered.

6.4.12 Tag number

This is used to define the site tag number for the instrument.

Move the highlight to *Tag number* and press OK, to display a keyboard that can be used to edit the tag number. Any of the characters shown on the screen may be used in the process.

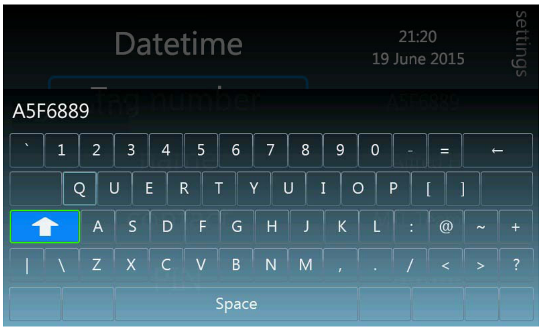


Figure 6.17 - Tag number entry screen

Move the highlight around the keys with the arrow buttons of the control panel and press OK to confirm a character. Uppercase characters can be obtained by moving the highlight to the 'Caps' key and press OK.

Press the button to confirm the tag number entered and return to the ***settings*** menu screen.

6.4.13 Name

This is used to define a name for the instrument in a similar way to the tag number process.

Move the highlight to name and press OK, to display a keyboard (see Tag number) that can be used to edit the name. Any of the characters shown on the screen may be used in the process. A maximum of 15 characters may be entered. Move the highlight around the keys with the arrow buttons of the control panel and press OK to confirm a character. Uppercase characters can be obtained by moving the highlight to the 'Caps' key and press OK.

Press the button to confirm the tag number and return to the ***settings*** menu screen.

6.4.14 Contact

This is used to define a 'contact', i.e. the name of a person or a telephone extension number; that can be referred to if information is needed or who should be contacted if an alert needs to be raised.

Move the highlight to *contact* and press OK, to display a keyboard (see Tag number) that can be used to edit the field. Any of the characters shown on the screen may be used in the process. A maximum of 15 characters may be entered. Move the highlight around the keys with the arrow buttons of the control panel and press OK to confirm a character. Uppercase characters can be obtained by moving the highlight to the 'Caps' key and press OK.

Press the button to confirm the tag number and return to the settings menu screen.

6.4.15 Change PIN

A user is required to enter a PIN number in order to make any changes to the settings of the instrument. A PIN number of '1111' is the factory default. This should be changed as soon as possible, or as soon as the instrument is commissioned for use.

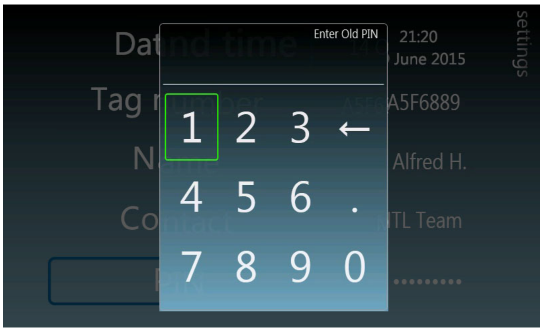


Figure 6.18 - PIN change screen

To change the PIN number the 'old' PIN number must first be entered, then the user is asked to enter a new number. Record the new PIN number in a safe location and make it available to any user with the authority to change instrument parameters.

NOTE
There is only one level of access to the instrument
A user who has the PIN number can change any of the parameters!

Press the button to confirm all the values and return to the ***settings*** menu screen.

6.4.16 Reset PIN

In the event that the entry PIN number is unavailable or forgotten, it can be reset to the factory default.

Press the Home button to return to the Home screen, then press all three buttons simultaneously; this will cause the PIN number to be reset to '1111'.

6.4.17 Display screen

In the ***configuration*** screen, move the selection to ***display*** and press OK to show the display menu screen. This is used to modify the display language, the display timeout and the brightness of the display.

Move the selection to ***display*** and press OK to show the menu screen.

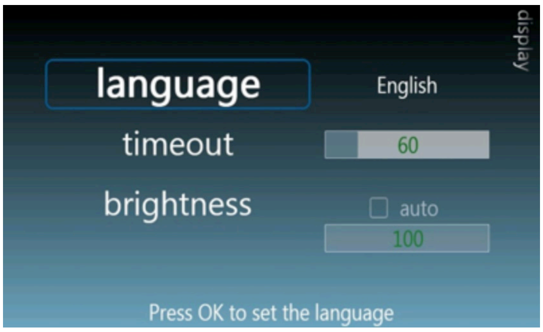


Figure 6.19 - Display menu screen

6.4.18 Language

Use this option to set the display language*.

** The only option currently is English, but other languages will be made available later.*

6.4.19 Timeout

The default screen for the display is the 'Home' screen. If the screen is changed to show some other parameter, it will return to the 'Home' screen after a preset period if no buttons have been pressed during that period. The ***timeout*** parameter is used to set the period before the display defaults back to the 'Home' screen from one of the menu or parameter-setting screens. Highlight the timeout parameter and press **OK**.

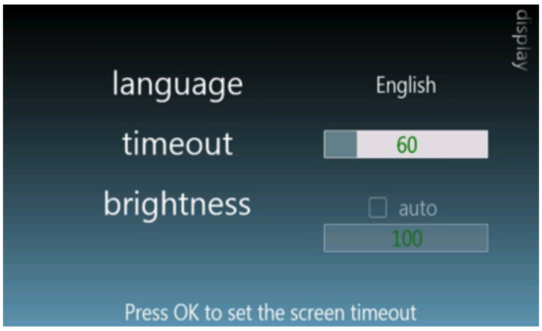


Figure 6.20 - Timeout parameter

Use the left and right arrow buttons to adjust the period to a value between 0 and 300 seconds. A value of 0 (zero) seconds means there will be no **timeout**, and the display will stay in the current screen until changed by the user. Press **OK** to confirm the timeout choice.

NOTE
The display will never timeout during a calibration sequence.

6.4.20 Brightness

There are two key options for setting the brightness of the display:

- auto
- manual

'Auto' allows the display to change its brightness according to current ambient light conditions. A circular sensor window can be seen above the main display window and this obtains a reading of the ambient light and adjusts the display to one of four brightness values. This is **the recommended option** for daily use on site. The display will dim as light levels fall and brighten as the day gets brighter.

'Manual' is the alternative and is probably best used in relatively constant light conditions. A range of values between 0 and 100 are available.

Highlight the **brightness** parameter and press **OK**.

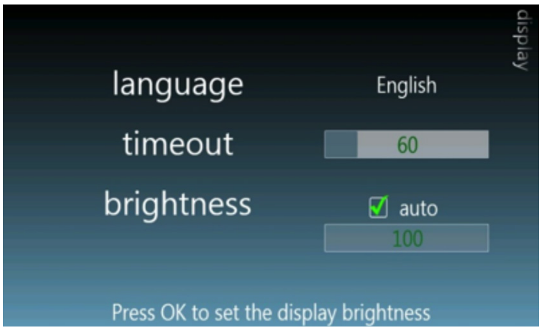


Figure 6.21 - Brightness parameter

The ***auto*** choice field becomes highlighted and will show either an empty square or a square with a check mark in it (as shown in Figure 6.21). The check mark specifies the ***auto*** mode. If that is required, press **OK** to confirm the choice. If manual mode is required, use the right or left arrow button to remove the check mark. The 'bar' field below will now be highlighted. Use the right or left arrow button to adjust the value between 0 and 100.

Press the button to confirm all the values and return to the ***configuration*** menu screen.

6.4.21 Comms

The *comms* menu is used to define the communications protocol and parameters for communication to and from the instrument.

This facility is currently not available but will be made available with a later release of the software.

6.4.22 Logging

The *logging* menu is used to define the parameters and readings that require logging for later reporting.

This facility is currently not available but will be made available with a later release of the software.

6.5 Service

The Service option on the main menu provides a range of facilities for the Technician or Engineer.

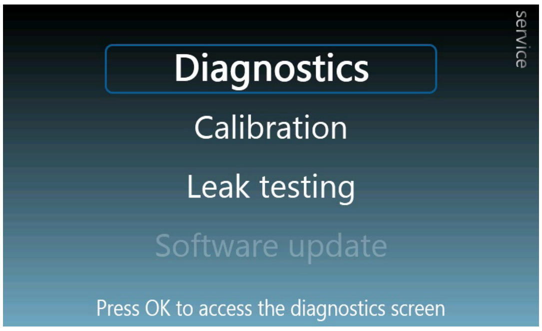


Figure 6.22 - The Service manu

6.5.1 Diagnostics

This option in the Service menu provides an alternative route to the Diagnostic routines that are covered in Section 6.6. See that section for details.

6.5.2 Calibration

The MTL GIR6000 sensors are characterized before leaving the factory and it is recommended the system calibration is verified during installation. In general use the instrument should remain in calibration for a number of months. It is then a matter of the plant maintenance policy to decide when re-calibration is required.

As a guide, the following table suggests calibration check intervals for the individual gas sensors.

Gas Type	Sensor type	Calibration check intervals
Oxygen *	Chemical	3 months
Hydrogen sulphide *	Chemical	3 months
Methane	Infra-red	6 months
Carbon dioxide	Infra-red	6 months

* When recalibration is due, a message will be provided on the Status area of the display.

Calibration is instrument-led because the 'Calibration' option on the menu provides a step-by-step guide to the process for each sensor type. Follow the instructions provided on screen to ensure speedy and effective calibration routine.

WARNING !
Calibration requires the outer door to be opened.
Personnel involved MUST establish whether a gas clearance certificate is necessary to carry out this work.

6.5.3 Equipment

The calibration process can be carried out at the instrument's site location and will require gas samples of each of the measurable gases in the form of "known" mixtures (e.g. a specific percentage of the calibration 'gas' in another) or in a 100% form, as necessary. These are usually available from an industrial gas supplier in convenient 112 litre lightweight aluminium bottles. Depending on the gas bottle used, a pressure or fixed flow regulator must be fitted to the calibration gas bottle. A suitable length of flexible tubing with connectors is required to connect the gases in turn to the instrument. Ideally the calibration gas concentration would reside in a mixture of "background" gas which is representative of the typical gas mixture produced on site. The calibration process involves setting the "zero" and "span" of the respective sensor, and the gas mixtures selected accordingly. The "span" gases can be selected to represent expected site concentrations, or some other convenient value. Two example mixtures and their function are shown in the table below:

		Sensor			
		H_2S	O_2	CH_4	CO_2
Mixture #1 **(350ppm H_2S)**	350ppm H_2S 55% CH_4 30% CO_2 Balance N_2	SPAN	ZERO	SPAN	SPAN
Mixture #2 **(5000ppm H_2S)**	5000ppm H_2S 55% CH_4 30% CO_2 Balance N_2	SPAN	ZERO	SPAN	SPAN
Mixture #3	20.9% O_2 30% CO_2 Balance N_2	ZERO	SPAN	N/A	N/A
Mixture #4	Air	N/A	N/A	ZERO	ZERO

WARNING !

Personnel involved in the calibration process MUST be suitably "gas trained" and must always wear appropriate monitoring equipment when handling any toxic gases.

6.5.4 Calibration Process

As mentioned above, the process is instrument led and the user should follow the instructions provided on the display. To start the process, press OK when in the 'Home' screen to obtain the main menu on the right side of the display. Move the highlight to the icon and press OK. If necessary, enter the PIN number for the instrument to obtain access to the calibration screen.

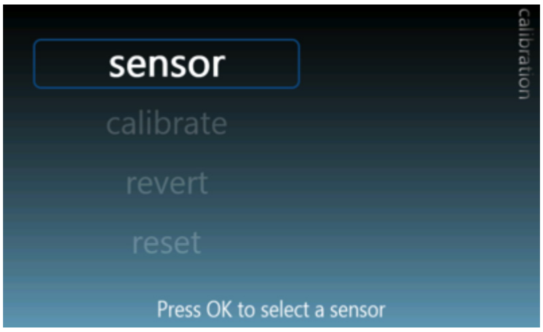


Figure 6.23 - The calibration screen

First, it is necessary to select the particular gas sensor that requires calibration, so with the highlight on sensor, press OK and choose the sensor from the list of gases provided.

Note; When a 350ppm H2S sensor module is fitted, the screen will say 350ppm and not 5000ppm.

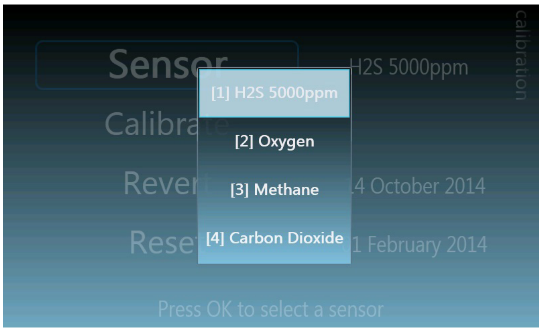


Figure 6.24 - Choose from sensor list

With the gas sensor chosen, move the highlight to ***calibration*** and press OK to start the process.

> **NOTE**
> The display will never timeout during a calibration sequence.

If the H_2S or O_2 gas sensor is chosen, the system will first enter a Purge cycle to remove any traces of the biogas. If using a fixed flow regulator on the gas cylinder, ensure that the MTL GIR6000 Flow Control Valve is fully opened before applying the gas. After the calibration process has completed, disconnect the gas cylinder and adjust the Flow Control Valve back to the required operating flow rate. The calibration sequence will now commence, starting with the instruction to connect the 0% gas concentration bottle. Next the 'span' gas is required and the user is asked to define the concentration level of the 'span' gas sample by entering the value on screen. The analyser will then sample the 'span' gas, compute a new calibration value for the chosen internal sensor and then announce on screen that the process is complete. After applying the required gas sample, allow 60 to 90 seconds for the gas to stabilize in the system before proceeding.

> **NOTE**
> If it is necessary to leave the calibration process at any stage, press the ⊗ button to discard any data and return to the calibration screen. (Figure 6.18)

The user may now chose another sensor and then repeat the process with other appropriate gas samples.

6.5.5 Discard calibration

If, for some reason, it is decided that this recent calibration was unnecessary, unwanted or suspected of being inaccurate, the user is provided with two options on screen.

revert This returns the calibration value to the one previously held on the instrument and ignores the value that has just been computed.

reset This option returns the calibration value to the value provided on the equipment when it left the factory.

Both of these options are accompanied, on screen, with the date when they occurred.
Press the button to return to the default 'Home' screen.

6.5.6 Leak Testing

Leak Testing is an essential facility that must be carried out whenever one of the plug-in modules is changed. Additional, i.e. more "in-depth", leak tests are available when there is a suspicion of a leak, or as part of the annual maintenance routine recommended for the instrument. As this is principally a maintenance facility, details of leak testing and other maintenance issues are provided in the Maintenance section (Section 7) of this manual.

6.6 Diagnostics

The Diagnostic option provides a set of internal checks to assist a service engineer or technician in determining the status of various components within the analyser. They are primarily for MTL engineers but the initial pages contain information that may assist the user.

Go to the *Home* screen, move the highlight to the ⚠ icon and press OK. The first screen to appear is the System diagnostic information.

6.6.1 System Diagnostics

System diagnostics provides information and status of the MTL GIR6000 system

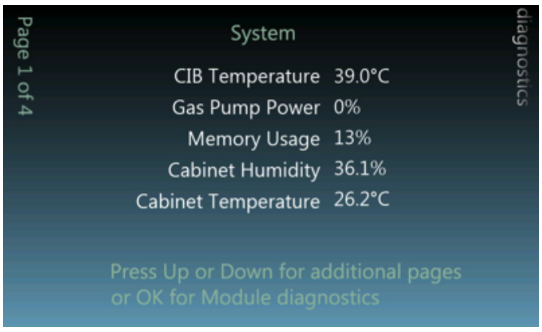


Figure 6.25 - System diagnostics

The initial screen shows basic system parameters. Use the up or down arrow keys to view additional pages.

6.6.2 Module Diagnostics

Module diagnostics provide status information for all of the intelligent modules fitted to the MTL GIR6000 system.

To select a module's diagnostic data press the OK button from within the System diagnostic's screen. A list of all the intelligent modules that are installed will appear.

Note; When a 350ppm H2S sensor module is fitted, the screen will say 350ppm and not 5000ppm.

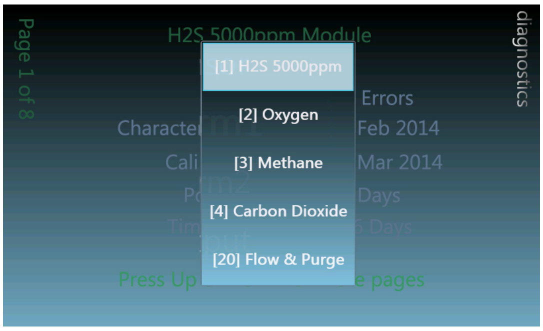


Figure 6.26 - Choosing the module

Move the highlight to the module of choice and press the OK button to view the diagnostic information for that module.

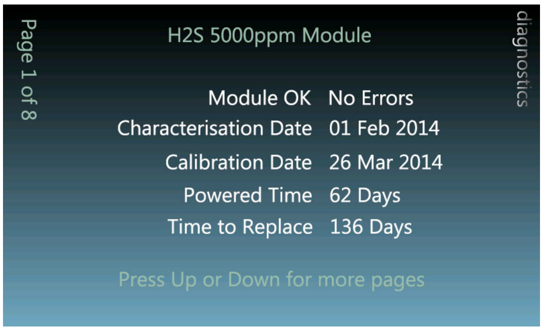


Figure 6.27 - Module diagnostics page

Use the up and down arrow button to move through the other pages. The first page is of most interest to a user It gives the overall health status of the module, calibration date and data that helps to determine when a module should be replaced.

> **NOTE**
> Not all of the modules have calibration information and only the electro-chemical sensor modules (O_2 and H_2S) have a"Time to Replace" field.

The remaining pages are primarily for use by Eaton engineering staff.

Press the OK button to return to the module choice dropdown. From there, choose another module and press OK to view its diagnostic information.

6.7 Reports

The reporting option will be made available in a later release of the software.

6.8 Pump

The pump may be switched on at any time to boost the flow rate through the instrument. If the pressure of the gas sample is low or if it has to pass along a significant length of piping to get to the analyser, the flow rate may not be sufficient to obtain accurate readings. The pump may then be used to create a negative pressure which will pull the sample into the analyser.

To switch on the pump, press OK from the default *Home* screen and move the highlight down to the symbol and press OK. This will toggle the pump from the OFF to the ON state. Repeat this action to toggle the pump from the ON to the OFF state.

The Flow Rate indicator will indicate the increase in flow and the rate may then be adjusted, using the Gas Sample Flow Control knob on the inner door, to a value between 100 and 300ml/min, which is the optimum flow rate for the measurements.

7 MAINTENANCE

7.1 General maintenance

It is recommended that the general condition of the MTL GIR6000 biogas analyser should be checked on a quarterly basis. This may require no more than a simple visual check to assess the general condition of the instrument enclosure, to check that the breather and drain are unobstructed and assess the state of all connecting pipe work.

Further checks should be carried out as part of the site maintenance schedule including an assessment of the calibration status of the sensors.

> **WARNING !**
>
> In the event of a fault, toxic gas may build up inside the unit. When accessing the unit, always open the outer door slightly and check for H_2S gas using a portable gas alarm before fully opening either the outer or inner doors. If gas is detected, shut off the sample gas inlet and take precautions against exposure when opening the doors. Use Personal Protective Equipment as required by site regulations. Where gas has been detected on opening the unit, the unit must be leak tested and any defects rectified before turning on the gas sample supply and returning the unit to service.

> **WARNING !**
>
> Hydrogen sulphide can poison several different systems in the body, although the nervous system is most affected. The toxicity of H_2S is comparable with that of hydrogen cyanide. Inhalation of concentrations of greater than 10ppm should be avoided. Seek immediate medical help for anyone overwhelmed by exposure.

- The operator must perform a ***Full Leak Test*** annually.
- The operator must always perform a ***Module Leak Test*** after any gas, pump or filter modules are changed.

> **CAUTION**
>
> The analyser is rated IP54 with the enclosure door closed. If the door is opened for maintenance purposes, the Ingress Protection level of the equipment is reduced to IP20. Care should be taken to avoid any dust or liquid from entering the interior of the instrument.

> **WARNING !**
>
> **Low Flow Alarm**
>
> In the event of a low flow alarm, indicating a possible gas leak within the unit, the valve on the gas inlet within the analyser will close automatically. The operator must immediately isolate electrical power to the analyser and perform a leak test. The only user serviceable parts inside the analyser that may cause a leak are the replaceable modules (sensors, pump or filter). If changing modules does not resolve the problem, a service engineer must be called. The leak must be eliminated before the analyser is powered up again.

- No user serviceable parts are present other than replaceable modules and power input fuse. Do not attempt repairs to any electrical or mechanical systems within the analyser.

> **WARNING !**
>
> In order to allow continuous airflow through the enclosure, the top breather and bottom drain must not be obstructed or blocked. Any material which may block the breather (e.g. snow) must be cleared away promptly.

Continued on next page

- Inspection and maintenance should be carried out in accordance with European, national and local regulations which may refer to standard IEC60079-17. In addition specific industries or end users may have specific requirements which should also be met.
- If any information provided here is not clear, please contact Eaton's MTL gas product line.

7.2 Plug-in module lifetimes

There are three types of plug-in module and the lifetime of each of these modules will depend to some extent upon the level of usage and the type and concentration of the gases being monitored.

The three module types are 1) the Filter module

2) the Gas Pump module

3) the Gas sensor module

7.2.1 Filter module

The Filter module contains both air and gas filters. The gas is drawn from the bio-digester and, although it passes through a moisture trap, it can sometimes carry unwanted particulates. Similarly, the air drawn from the immediate environment of the analyser may carry dust particles. Any of these impurities may clog the analyser pipe work and/or affect the sensitivity or accuracy of the sensors, consequently ***the filter module should be changed every 12 months.***

7.2.2 Pump module

The internal pump is provided to assist the flow of gas when the regular pressure level of biogas is insufficient to provide the optimum gas flow levels across the sensors. ATEX/IECEx regulations define a replacement period for pumps based upon the manufacturer's specification. On this basis it is determined that the pump should be replaced every ***2 years*** and a warning message will appear in the Status part of the main display when replacement is necessary.

For countries not subject to ATEX/IECEx regulations it is recommended, for safety reasons, that these guide lines are followed and a similar replacement schedule is observed.

7.2.3 Gas sensor module

The gas sensor modules are very much dependent upon the types, compositions and concentrations of the gases flowing over them. The chemical based sensors have the shortest lifetime and so the instrument carries out testing of the sensors on a regular basis so that the user is made aware of when a sensor needs changing.

For general guidance however, the user might expect the following approximate lifetimes from the following sensors.

Gas being monitored	Type of sensor	Approximate lifetime
Hydrogen sulphide *	Chemical	12-24 months
Oxygen *	Chemical	24-36 months
Methane	Infra-red (IR)	> 5 years
Carbon dioxide	Infra-red (IR)	> 5 years

** A message will appear in the Status panel of the display when either of these modules need to be replaced.*

7.3 Module replacement procedure

7.3.1 Initial instrument shutdown

⚠	**WARNING !** The operator must follow the Safe Work Instruction below for changing replaceable modules once the system is in operation.

To add or change any replaceable module, it is important to follow the procedure below.

1. Isolate the sample gas inlet supply- using the local manual isolation valve.
2. Disconnect the sample gas inlet pipe from the analyser.

⚠	**WARNING !** Failure to isolate the sample gas supply pipe before disconnection may result in toxic gas escaping.

3. Leave the analyser running for 5 minutes (to purge air through system)

NOTE Purging the gas analyser will result in gas readings falling to zero and this may generate alarms.

4. Power down the analyser using the external AC power isolation switch.
5. Open the outer door.

7.3.2 Module removal and replacement

CAUTION It is advised that any person handling an unplugged module should wear an ESD grounding wrist strap to prevent inadvertent static damage to any of the module's electrical components. The ESD COMMON GROUND jack socket provided at the lower left corner of the inner door may be used **if the enclosure is provided with a suitable ground connection.**

Figure 7.1 - Module removal

Figure 7.2 - Module replacement

Each module is held in place with two threaded bolts at the top and bottom of its front panel. A flat-bladed screwdriver is required to loosen the bolts after which they can be freed by hand.

The module should be drawn straight out of the panel (see Figure 7.1), which will disconnect both the gas and electrical connections at the rear of the module automatically.

NOTE
Before any module – existing or new- is inserted into a position on the inner door, ALWAYS check the condition of the O-ring seals for any sign of damage and replace any that appear to show signs of damage or wear.
It is also good practice to do a quick visual inspection on the pins of the module's multiway connector to check for any bent or distorted pins.

Remove any packaging from the new module and, before inserting it into the door panel, take care to align it with the guides on each side of the opening. When the guides are engaged, insert the module gently into the door until the connectors are encountered (see Figure 7.2) then press firmly to engage both gas and electrical connectors.

Tighten the two bolts with the fingers and then use a screwdriver to tighten the bolts to a recommended torque of 1.5 Nm – i.e. sufficient to prevent them being unscrewed by hand.

It is then necessary, following any module replacement, to perform a Module Leak-Test. All leak-testing procedures are described in Leak-testing- Section 7.4.

7.4 Leak testing

The leak tests described in this manual are solely for the purpose of ***testing for internal gas leaks*** within the MTL GIR6000 equipment. All other external pipe work and valves must be tested in accordance with established site practice.

WARNING !

The MTL GIR6000 enclosure MUST be tested for potential gas leakage after installation, or replacement of any gas, filter or pump module

Leak testing is required in a number of circumstances, for example:

- as part of the commissioning process
- after the replacement of a plug-in module
- as part of an annual maintenance programme
- or if a leak is suspected in normal operation

Some of these may require a simple form of the test while others are more thorough as the situation requires.

7.5 Leak testing preparation

If the analyser :

- is being installed/commissioned and has never had gas flowing through it
- has been open to the air for at least 1 hour prior to a leak test procedure

the following purging process may be omitted. Otherwise **this procedure must be followed** in preparation for the leak test.

If in doubt about the state of the internal pipe work ***purge the system*** as described below.

WARNING !

Isolate the sample gas supply pipe before disconnection.

Failure to do this will result in the escape of toxic gas.

a) Close the isolating valve that supplies the incoming gas to the analyser

b) Disconnect sample gas inlet pipe from the MTL GIR6000

c) Leave the MTL GIR6000 running for 5 minutes (to enable the pump to purge the internal piping with clean air)

NOTE
Purging the gas analyser will cause gas readings to fall zero. This may cause alarms to be generated!

d) Isolate AC power to the system using the external isolation switch

e) Open the outer door

7.6 Leak-Testing process

The leak-testing process is always managed by the analyser and the user should follow the instructions provided on the display screen. The overall concept of the test is as follows:

- Connect the leak test apparatus
- Pressurise the system to approximately 800mm water gauge
- Close the shut-off valve
- Monitor the system pressure for **4 minutes**

The pressure drop must be no **more than 8mm of water** in order to pass the leak test.

The details of the test procedure, however, depend upon a number of situations and these are discussed below.

7.6.1 Leak Test equipment

Testing for potential leaks within a MTL GIR 6000 enclosure requires the following equipment.

- a "water column" manometer capable of reading at least 1000mm of water head
- an air pump capable of creating a pressure of a minimum of 1000mm of water head
- an effective and reliable isolating valve
- two T-pieces
- two connectors with rigid spigots to attach the tubing to the MTL GIR6000
- some 6mm o.d. (4mm i.d.) flexible tubing

Connect these items as shown in Figure 7.3

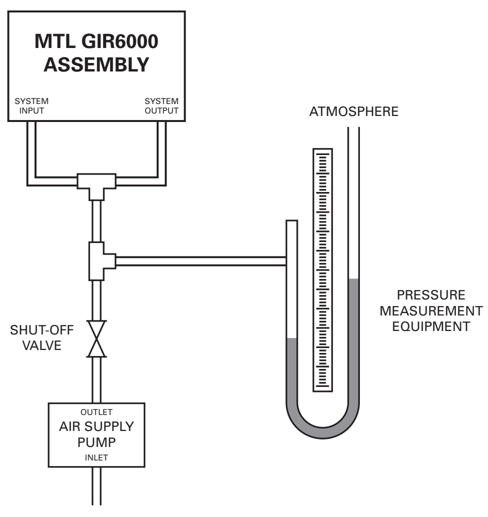


Figure 7.3 - Leak test apparatus

Press **OK** to show the main menu on the right of the screen and select the ***Service*** icon.

From the ***Service*** menu select "leak testing" and press **OK**.

Follow carefully the **step by step** instructions **provided on the display screen to complete the leak test.**

Leak Test – 'Pass'

If the leak test was a 'Pass', follow any instructions for disconnecting the leak testing apparatus then disconnect the AC power.

⚠	**WARNING !** The user must ensure the MTL GIR6000 has exited from the leak test mode before restoring the gas connection.

Restore the gas connections for normal operation and open the isolation valve on the sample gas line. Close the outer door, re-apply AC power to the instrument and allow it to start-up, following which allow 5 minutes for all gas readings to stabilise.

Leak test – 'Fail'

⚠	**WARNING !** If a leak is detected during the tests DO NOT reconnect sample gas supply to the analyser.

If the leak test did not provide a 'Pass' result, the analyser must NOT be returned to active use. If a module had been replaced prior to the leak test, reseat that module by removing it, examining the gas seals around the two spigots at the rear for signs of any foreign bodies or debris, then replacing it. Repeat the leak test. If the result is still a 'Fail' then a service engineer should be called to repair the analyser.

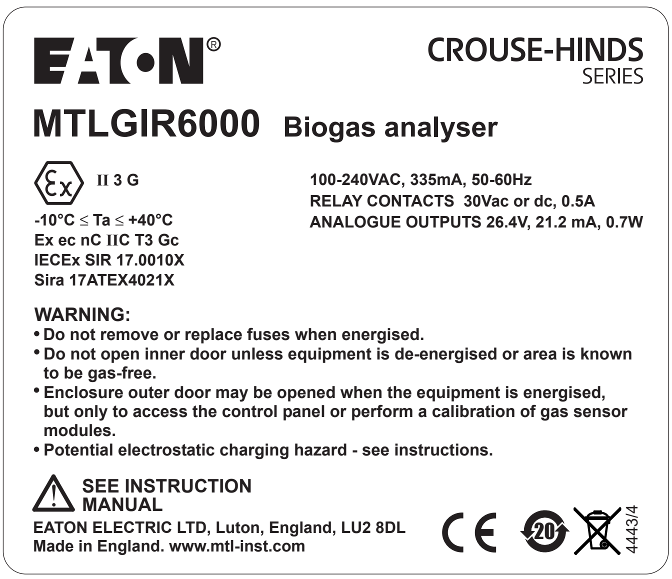
Aside from replacing a module there are no user-serviceable parts on the analyser.

8 ATEX & IECEx INFORMATION

Instructions specific to hazardous area installations (in accordance with IEC 60079-0:2011 clause 30).

The following instructions relevant to safe use in a hazardous area apply to equipment covered by certificate numbers IECEx SIR 17.0010X & Sira 17ATEX4021X.

a) The certification marking is as follows.



b) The equipment may be used in zone 2 with flammable gases and vapours with apparatus groups IIA, IIB & IIC and with temperature classes T1, T2 and T3.

c) The equipment is only certified for use in ambient temperatures in the range -10ºC to +40ºC and should not be used outside this range.

d) Installation shall be carried out in accordance with the applicable code of practice by suitably-trained personnel.

e) There are no special checking or maintenance conditions other than a periodic check.

f) With regard to explosion safety, it is not necessary to check for correct operation.

g) With the exception of the removable modules, the equipment contains no user-replaceable parts and is not intended to be repaired by the user. Repair of the equipment is to be carried out by the manufacturer, or their approved agents, in accordance with the applicable code of practice.

h) Repair of this equipment shall be carried out in accordance with the applicable code of practice.

i) If the equipment is likely to come into contact with aggressive substances, e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected thus ensuring that the type of protection is not compromised.

j) The certificate number has an 'X' suffix which indicates that special conditions of installation and use apply. Those installing or inspecting this equipment must have access to the contents of the certificate or these instructions. The conditions listed in the certificate are reproduced below:

i. All cable entry holes shall be fitted with either a certified cable gland or a certified stopping plug withminimum IP54 that is suitable for the application.

ii. Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

iii. When the equipment is energised the enclosure outer door may be opened, but only to access the control panel or perform a calibration of gas sensor modules in accordance with the instructions in the manual.

iv. The enclosure inner door must not be opened where an explosive atmosphere may be present or when the equipment is energised.

v. Do not open (inner door), maintain or service in an area where an explosive atmosphere may be present.

vi.The area in which the equipment is to be used shall be a minimum of Pollution degree 2 as defined in IEC 60664-1.

vii.The removable modules (gas sensor modules, pump module or filter module) must not be inserted or removed unless the area is known to be non-hazardous or the equipment has been de-energised.

viii.CH_4 and CO_2 IR sensors must not be replaced by the end user.

ix.The terminal blocks shall only be fitted with wires that have cross sectional area falling within the terminal blocks certificates limitations, as reproduced below:

Mains Terminals:	Rigid conductor cross-sectional area: 0.5mm2 to 10mm2
	Flexible conductor wire cross-sectional area: 0.5mm2 to 6mm2
Backplane Terminals:	Solid conductor cross-sectional area: 0.2mm2 to 4mm2
	Stranded conductor cross-sectional area: 0.2mm2 to 2.5mm2

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APPENDIX 1 – OPERATIONAL SECURITY ACCESS LEVELS

The MTL GIR6000 is equipped with a number of access levels for different types of personnel. The range varies from ‘Engineer’ level, providing access to all controls and facilities, to ‘Operator’ level where access is restricted to viewing the measured gas levels only.

Physical access to the inside of the cabinet is controlled by the use of door keys, one key fits the outer door and another opens the inner door.

Access to control parameters and software settings is provided by way of a P.I.N. number. This ensures that access to operating parameters is restricted to qualified and responsible personnel only.

The tables below show how the various security access levels are defined, and what tasks are permitted for each level type, so that the correct level of access may be assigned to the appropriate personnel.

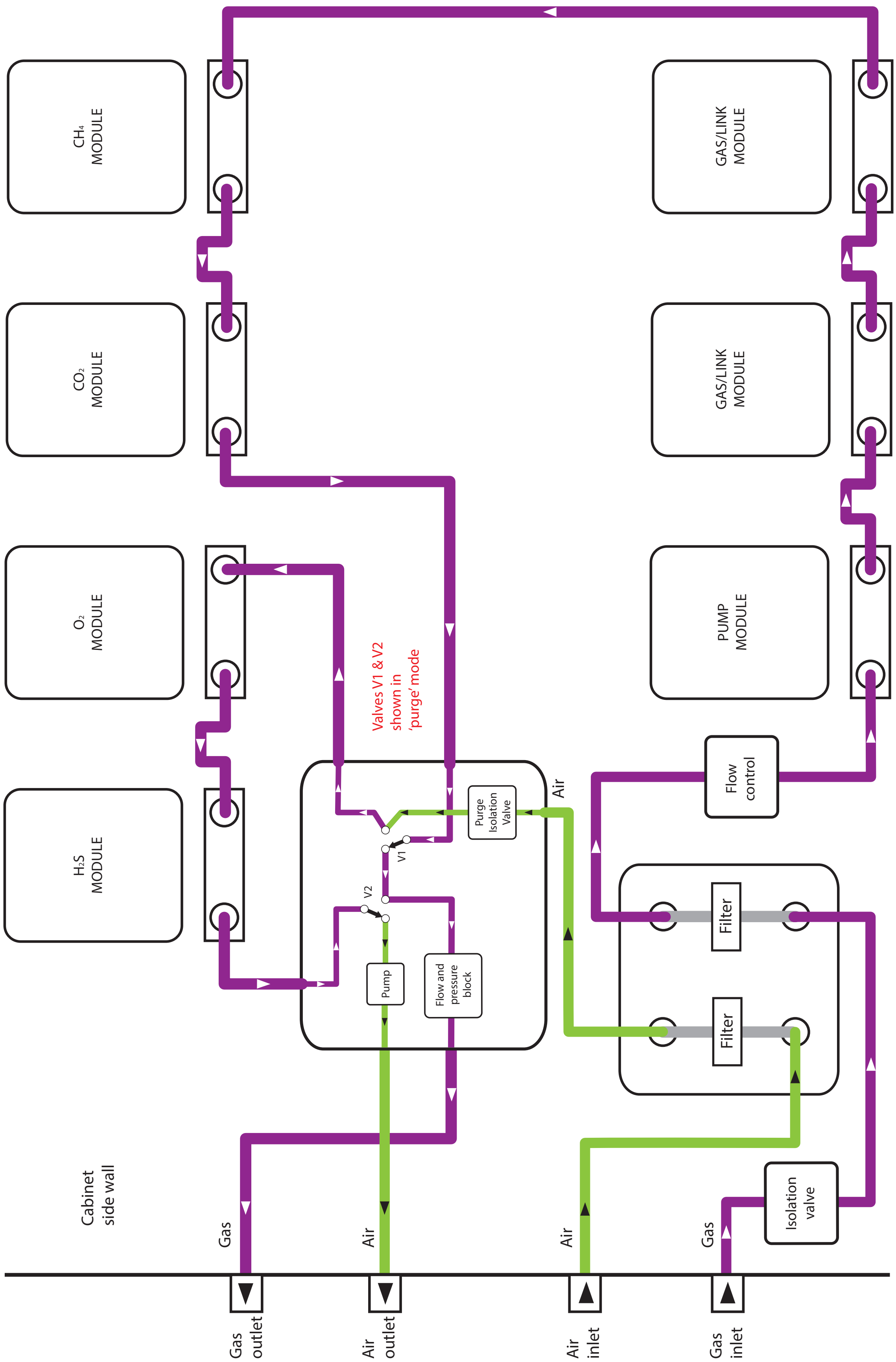
Key/PIN access levels

	Key 1	Key 2	PIN
Operator			
Technician	✓		✓
Engineer	✓	✓	✓
Installer	✓	✓	

Task access levels

	Operator	Technician	Engineer	Installer
Leak test		✓	✓	
Zero/End point calibration		✓	✓	
View configuration & diagnostics		✓	✓	
Change configuration & full diagnostics			✓	
View history & logged data		✓	✓	
Edit history & logged data			✓	
Relay configuration			✓	
Reset all			✓	
Electromechanical access			✓	✓

APPENDIX 2 – GAS FLOW DIAGRAM FOR INSTRUMENT



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