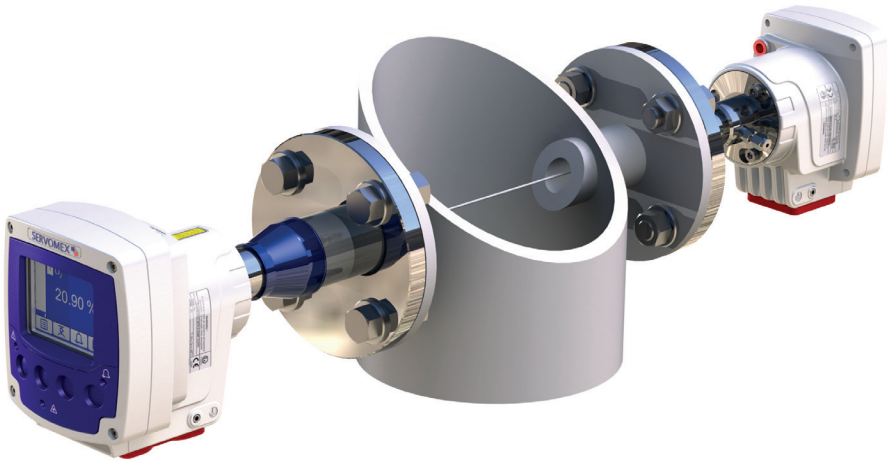
SERVOMEX
ANALYZERS
HIGH-PERFORMANCE GAS ANALYSIS



SERVOTOUGH LaserSPII mini
OPERATOR MANUAL

Part Number: **07931001A**
Revision: **1**
Language: **UK English**

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IMPORTANT INFORMATION

Continued safe and reliable operation of this equipment is conditional on all installation, operation and maintenance procedures being carried out in accordance with the appropriate manuals and by personnel having appropriate qualifications, experience and training.

Failure to observe the requirements of the manual may result in the user being held responsible for the consequences and may invalidate any warranty.

Servomex will accept no liability for unauthorised modifications to Servomex supplied equipment.

Servomex has paid particular attention to Health and Safety throughout this manual. Where special precautions need to be taken due to the nature of the equipment or product, an appropriate safety icon and warning message is shown. Special attention should be made to Section 1 – Safety, where all such messages are summarized.

In line with our continuous policy of research and development, we reserve the right to amend models and specifications without prior notice.

This handbook is accurate at the date of printing, but will be superseded and should be disregarded if specifications or appearance are changed.

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About this manual

Safety information

The following icons are used throughout this manual to identify any potential hazards that could cause serious injury to people or damage to the equipment:

This symbol warns of specific hazards which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards from laser radiation.

This symbol warns of specific hazards from high temperatures.

Other information provided by the manual

This symbol highlights where you must take special care to ensure the analyser or other equipment or property is not damaged.

Note: *Notes give extra information about the equipment.*

Hint: *Hints give helpful tips.*

Scope of the manual

This manual covers the basic software set up, configuration and operation for the 07931-Series Laser.

Other documents for the 07931-Series Laser are listed below:

Document	Description	Document number
Service Manual	This manual is for use by qualified personnel and provides detailed servicing instructions.	07930002A

1 Safety

1.1 General warnings and cautions

If the 07931-Series Laser is used in a manner not specified within this manual, the protection provided by the equipment may be impaired.

Failure to observe the requirements of the manual may result in the user being held responsible for the consequences and may invalidate any warranty.

Before you attempt to install, commission or use the 07931-Series Laser, read this manual carefully.

Do not attempt to install, commission, maintain or use the 07931-Series Laser unless you are trained and competent.

The 07931-Series Laser does not include any user-serviceable parts.

The 07931-Series Laser does not include any user replaceable fuses.

Do not use the 07931-Series Laser as Personal Protective Equipment (PPE).

If you do not install and use the 07931-Series Laser in accordance with the instructions in this manual, you may risk exposure to hazardous laser radiation.

The 07931-Series Laser may be attached to equipment that is hot. Always wear the appropriate PPE to minimize the risk of burns.

Where there is a risk associated with the release of potentially harmful gases into the operating environment, always use suitable monitoring equipment.

The gases included in the process being monitored may be toxic, asphyxiant or flammable.

Before you use the 07931-Series Laser, make sure that all connections are leak-free at full operating pressure to prevent exposure of personnel and the environment to the hazardous gases.

The analyser may fail if it is used with sample streams that contain substances not compatible with those listed in Section 2.8.

Make sure that you install the instrument to conform to all relevant safety requirements, National Electrical Code and any local regulations. The installation must be safe for any extremes of operating conditions which may occur in the operating environment of the 07931-Series Laser.

Do not install the analyser on a surface which is subject to high levels of vibration or sudden jolts. Sample measurements may not be accurate and the analyser may be damaged.

1.2 Laser safety

CLASS 3R LASER PRODUCT.

LASER RADIATION. The 07931-Series Laser is a Class 3R laser product. The laser light is not visible. Do not look into the laser beam. Avoid direct eye contact with the laser radiation.

The transmitter and receiver units both have a Laser On indicator. This is ON when the transmitter emits laser radiation from the optical window.

CLASS 3R LASER PRODUCT.

LASER RADIATION. Changes to settings or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

1.3 Certification

1.3.1 Hazardous area installations

Do not modify the unit, either mechanically or electrically, or the certification of the instrument will be invalidated and it may not operate safely.

Exposure to some chemicals may degrade the sealing properties of materials used in the following devices (North America only):

K1:	**Relay from Analyser Main Board**	**Sealed Device**
K1:	**Relay from Option Board**	**Sealed Device**
K2:	**Relay from Option Board**	**Sealed Device**

Substitution of the following components may impair suitability for Division 2 (North America only):

K1:	**Relay from Analyser Main Board**	**Sealed Device**
K1:	**Relay from Option Board**	**Sealed Device**
K2:	**Relay from Option Board**	**Sealed Device**

EXPLOSION HAZARD - Substitution of components may impair suitability for CL I, Div 2. (North America only).

Make sure that the operating environment is within the limits specified in the product data (section 2.6.5).

Do not install the 07931-Series Laser in a high-velocity dust-laden atmosphere.

Do not open the enclosure if an explosive atmosphere is present.

Do not open the enclosure if the 07931-Series Laser is energized.

It is a condition of certification that the unit must be installed following the appropriate national or international legislation or codes of practice. In particular, you must make sure that the correct glands are fitted to cable entries and that you do not compromise the weatherproofing of the enclosure.

All of the analyser electrical connections are considered to be incendive and therefore must only be connected to safe area equipment.

The equipment is incapable of passing the dielectric strength test prescribed by the standards, and so this must be taken into account during installation.

1.3.2 Hazardous area variants

Do not use hazardous area variants with a process atmosphere that requires EPL Ga. (e.g. Zone 0). If they are used within this process atmosphere, the hazardous area certification may be invalidated.

Do not use hazardous area variants for oxygen enriched flammable samples; that is gases over 21% O_2. If they are used with gases containing over 21% O_2 the hazardous area certification may be invalidated.

Hazardous area variants are certified for use with a flammable process atmosphere at a pressure of 0.8 to 1.1 bar absolute (11.6 to 15.95 psi). If used with a flammable process atmosphere beyond these limits, the hazardous area certification may be invalidated.

1.4 Markings

The 07931-Series Laser includes these external markings. Their locations are shown in section 1.4.1.

Follow the appropriate safety instructions and be aware of any warnings about potential hazards.

1.4.1 Label locations

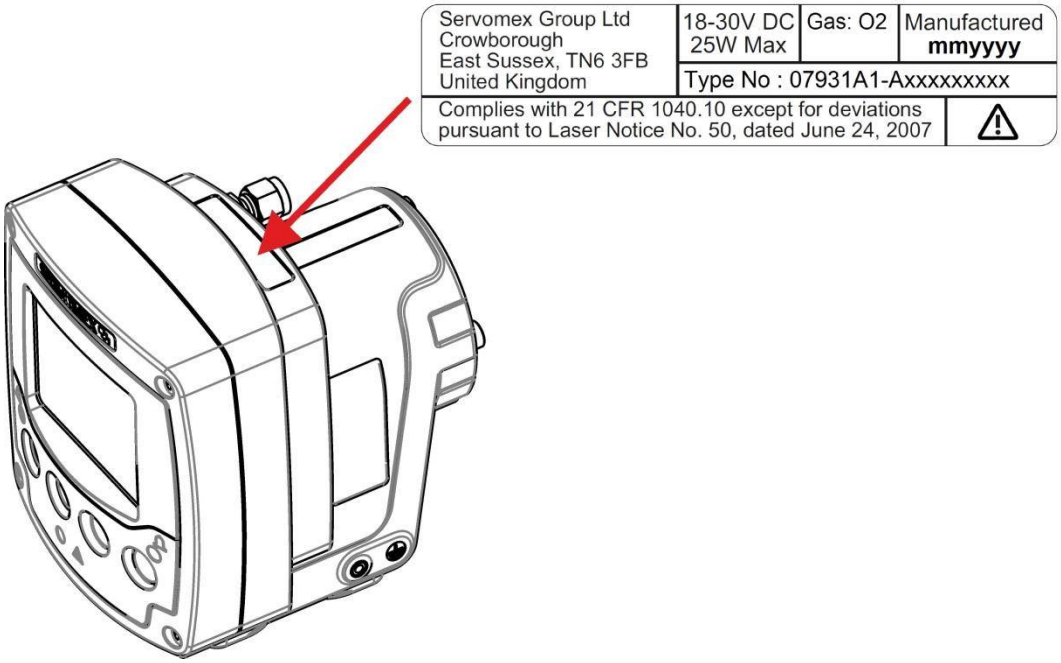


Figure 1-1: 07931-Series Laser transmitter unit rating label location

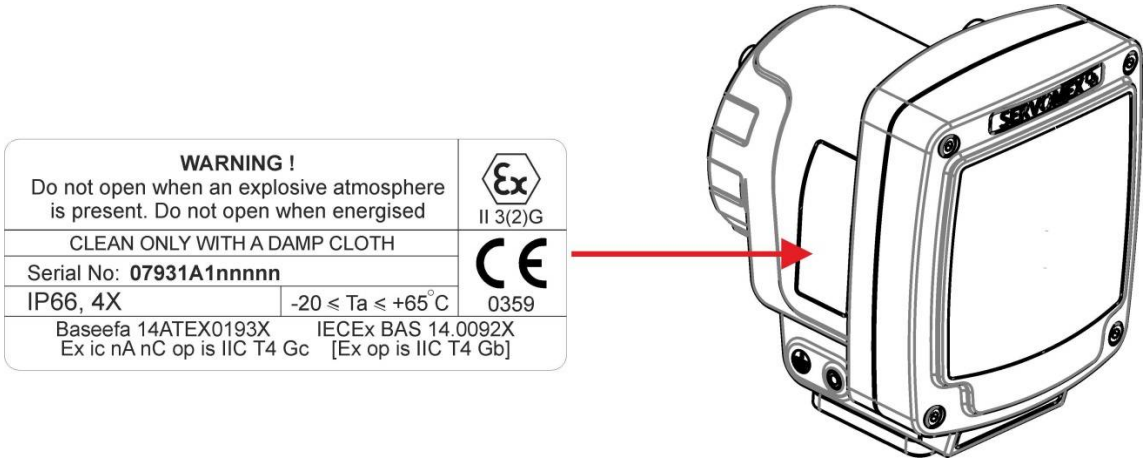


Figure 1-2: 07931-Series Laser receiver unit certification label location

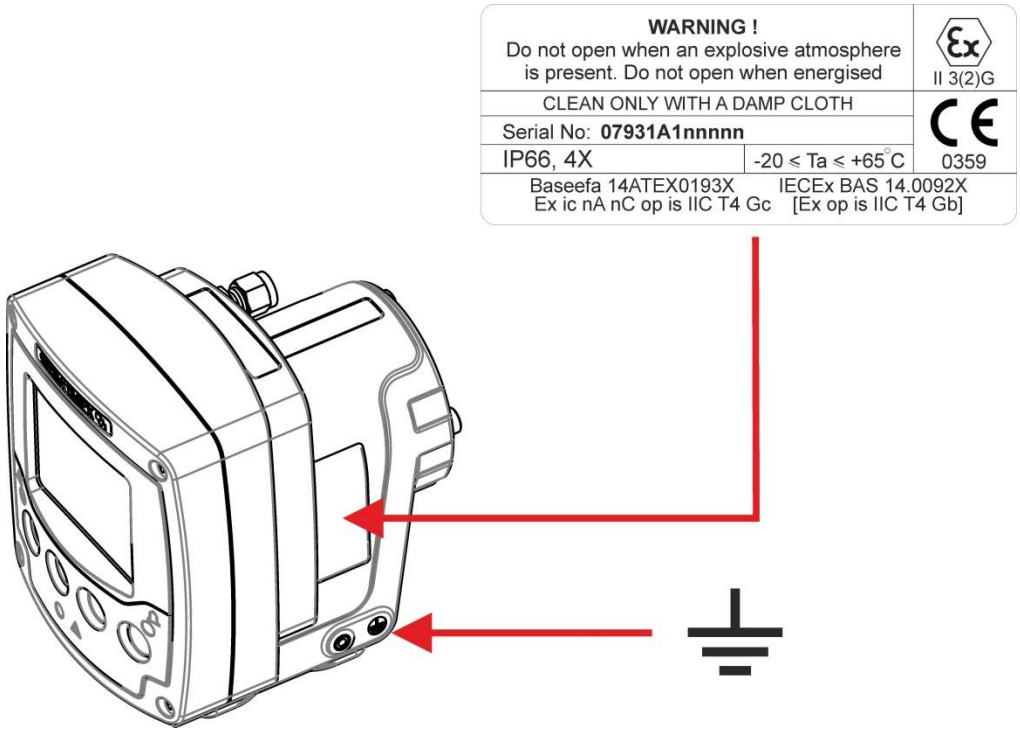


Figure 1-3: 07931-Series Laser transmitter unit certification label and EMC / function earth label location

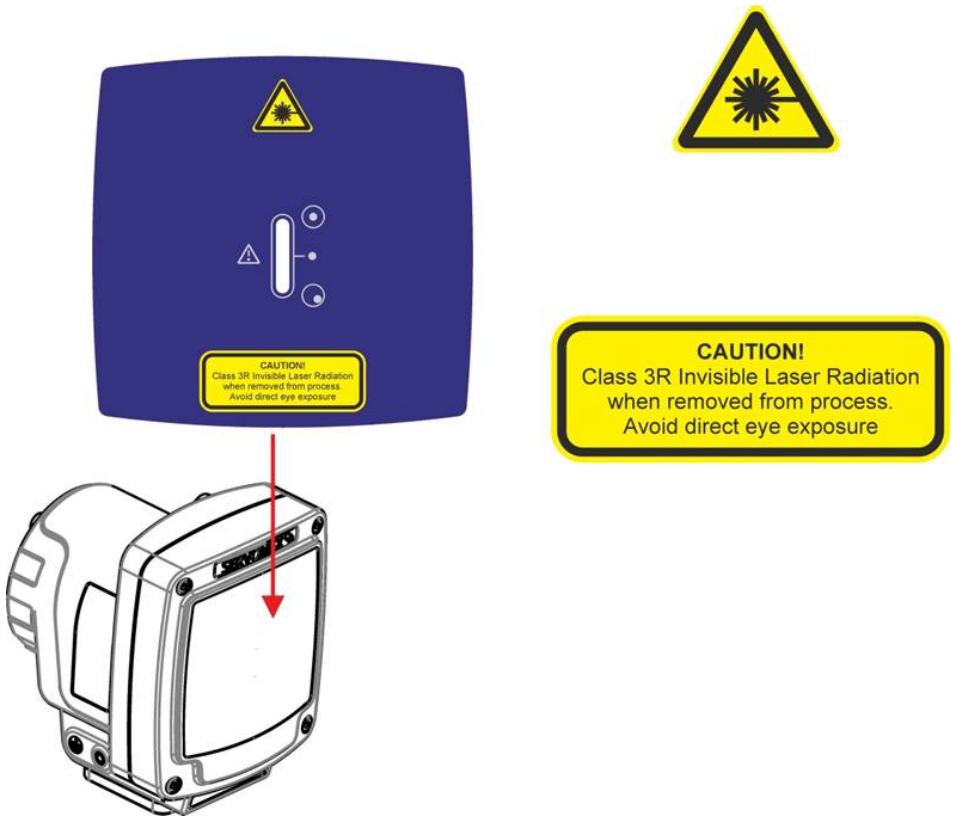


Figure 1-4: 07931-Series Laser receiver unit laser label location

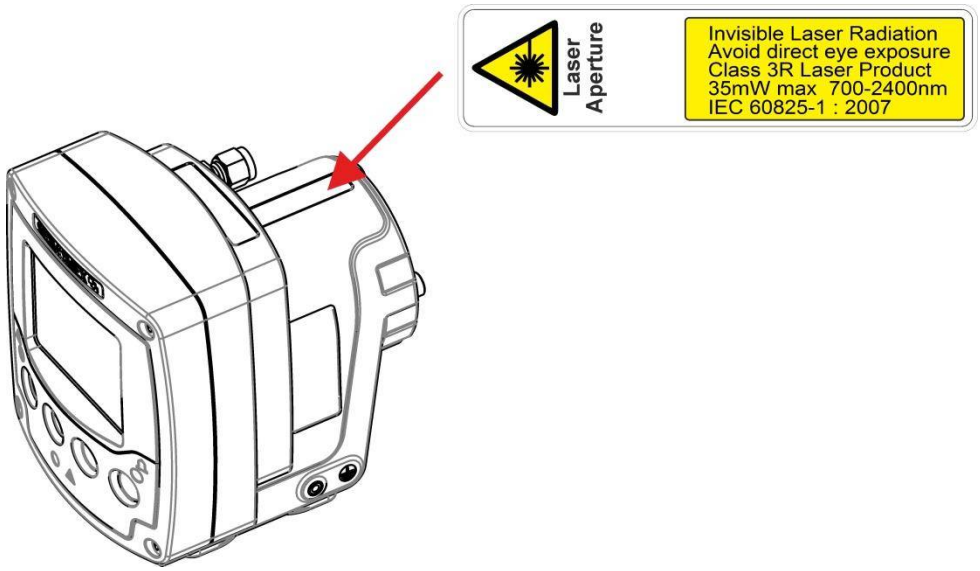


Figure 1-5: 07931-Series Laser transmitter unit laser label location

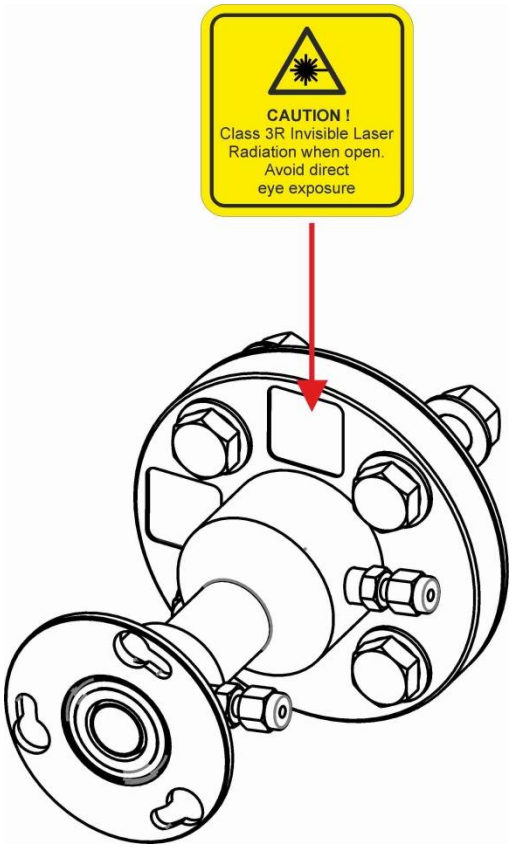


Figure 1-6: 07931-Series Laser mount laser label location

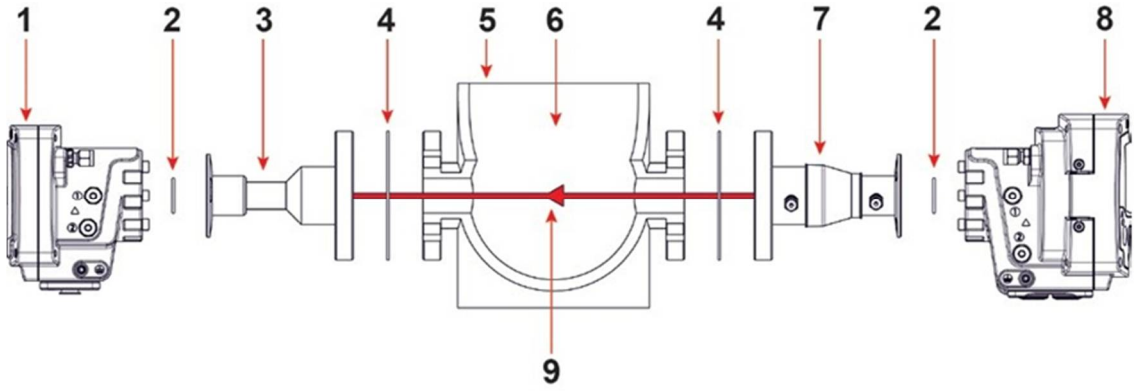
2 Introduction

2.1 Product description

The 07931-Series Laser is an advanced gas analyser. It comprises a transmitter unit (TU) and a receiver unit (RU), with an optional AC to DC power supply, ancillary equipment and sample cell.

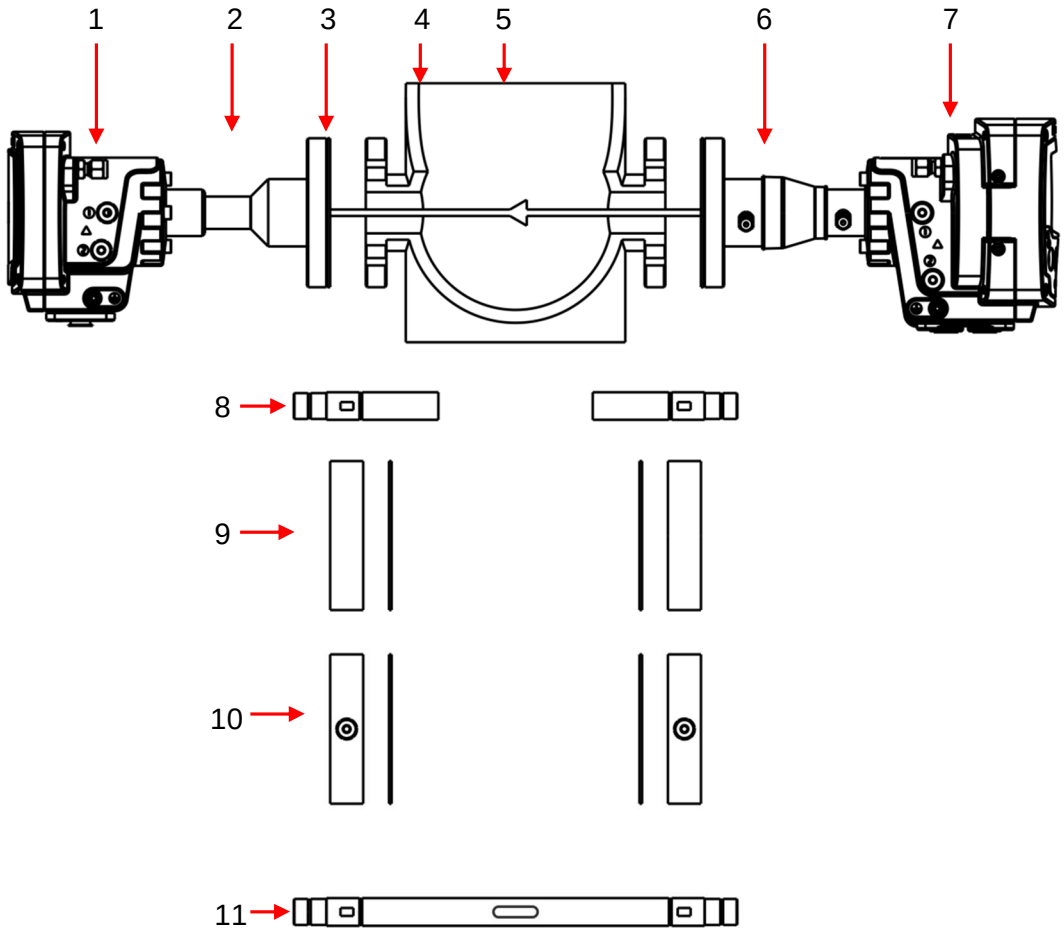
The laser radiation detected by the photo-detector is amplified and transferred to the transmitter unit through a multi-core cable which connects the receiver and transmitter electronics. The same cable transfers the required power from the TU to the RU. Pluggable connectors at each end of the cable, and a removable gland plate, allow you to easily remove the TU and RU for calibration or maintenance.

For continuous in-situ applications, the 07931-Series Laser is installed directly across stacks, ducts and reactors typically employing path lengths of 0.1 to 40 m (3.94" - 131 ft.).



1	Laser receiver	6	Process gas
2	O-ring	7	Adjustable mount (2 variants)
3	Fixed mount	8	Laser transmitter
4	Gasket	9	Non-visible laser beam path
5	Process pipe, stack, duct, etc.		

Figure 2-1: 07931-Series Laser example installation (exploded view)

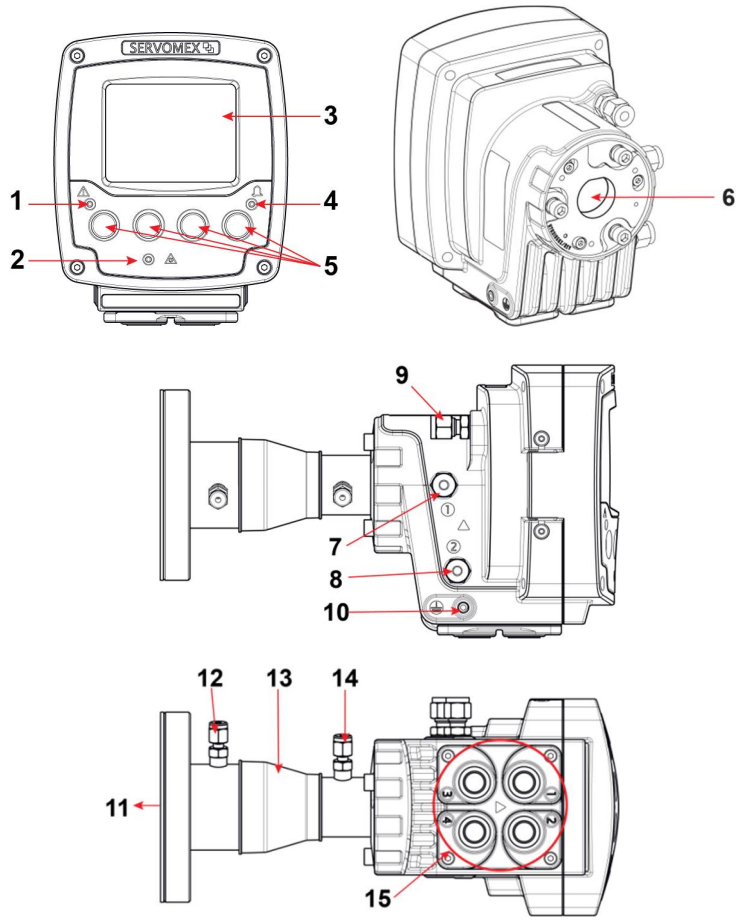


1	Laser receiver	**6**	Adjustable mount (2 variants)
2	Fixed mount	**7**	Laser transmitter
3	Gasket	**8**	Insertion tube (multiple variants)
4	Process pipe, stack, duct, etc.	**9**	Thermal spacer
5	Process gas	**10**	Isolation flange
		11	Fixed pipe

Note: *Installation may vary depending on specific application and system requirements as items 3 and 7 are selectable options. If item 7 is required it must be fitted to the TU side. Items 8, 9 and 10 are optional, additional gaskets and adaptors may be required.*

Figure 2-2: 07931-Series Laser installation: showing insertion tube, thermal spacer and isolation flange options

2.2 Transmitter unit



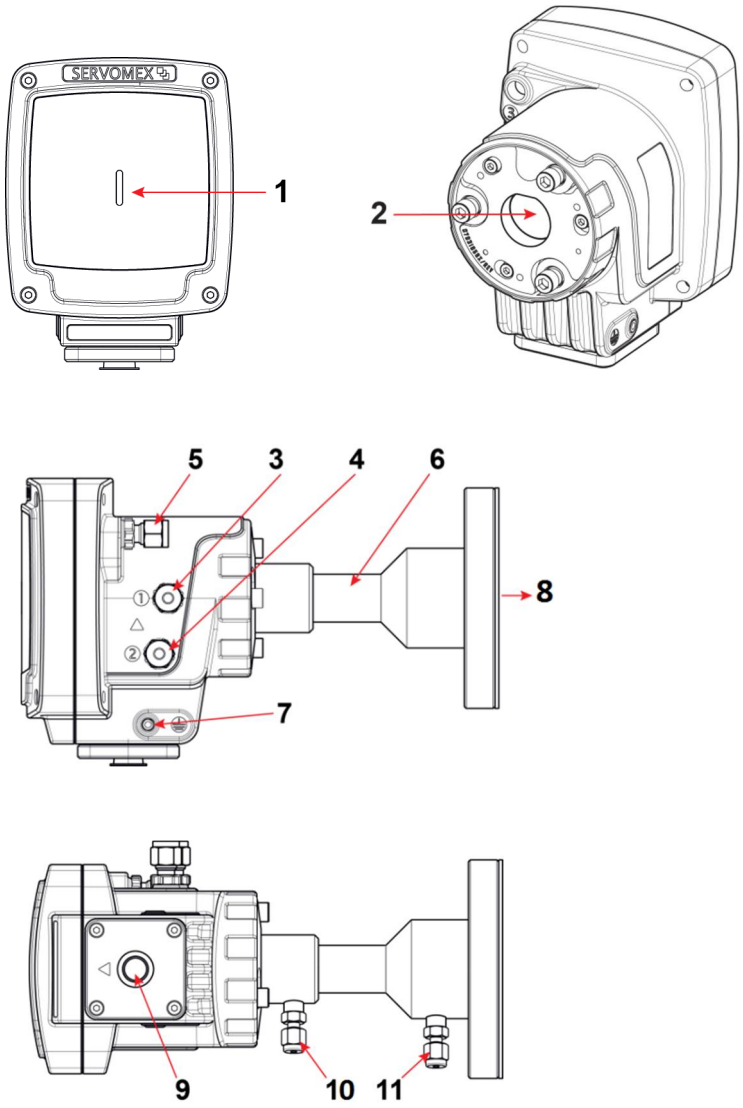
1	Fault LED (Fault status - amber)	**9**	Purge 3: enclosure environmental out or breather *(option)*
2	Laser light ON indicator (Status ON - green)	**10**	Functional / EMC earth (ground)
3	Display	**11**	Window purge out *(standard)*
4	Alarm LED (Alarm status - red)	**12**	Window purge out *(option: isolation flange only)*
5	Pushbuttons	**13**	Adjustable mount (illustrated) may alternatively be configured with a fixed mount
6	Optical window / transmitter aperture		
7	Purge 1: measurement in	**14**	Window purge in
8	Purge 2: enclosure environmental in *(option)*	**15**	Cable entry glands: 2 x M16 x 1.5 mm (ports 2 and 3) 2 x M20 x 1.5 mm (ports 1 and 4)

Figure 2-3: Transmitter unit: front, rear, side and under-side views

2.2.1 Transmitter enclosure contents

Laser transducer CPU board Main board	Provides the standard connectivity including: 24 V DC power feed 0 / 4 to 20 mA output A status relay output Ethernet connectivity SD Card
Colour display with key inputs	A colour display (LCD)
Option of an additional I/O board	Provides: A second 0 / 4 to 20 mA output Two 0 / 4 to 20 mA inputs Two additional status relay outputs
Customer connection terminals	Accessible terminals are provided for: 24 V DC power feed Analog inputs (1 or 2) Analog outputs (0, 1 or 2) Relays (1 or 3) Ethernet

2.3 Receiver unit



1	Laser light ON indicator (green)	**7**	Functional / EMC earth (ground)
2	Optical window / receiver aperture	**8**	Window purge out *(standard)*
3	Purge 1: measurement in	**9**	Cable entry gland (1 off M20 x 1.5 mm)
4	Purge 2: enclosure environmental in *(option)*	**10**	Window purge in
5	Purge 3: enclosure environmental out or breather *(option)*	**11**	Window purge out *(option: isolation flange only)*
6	Fixed mount (illustrated) may alternatively be configured with an adjustable mount		

Figure 2-4: Receiver unit: front, rear, side and under-side views

2.3.1 Receiver enclosure contents

Detector board

Aspherical lens

Transmitter connection board

LEDs

Two flange mounts and window purge assemblies are provided to mount the transmitter and receiver to the process flanges. The quick-connect connection between the instrument and mounting assembly allows easy removal of the transmitter and receiver for calibration or maintenance.

2.3.2 Receiver unit indicator LEDs

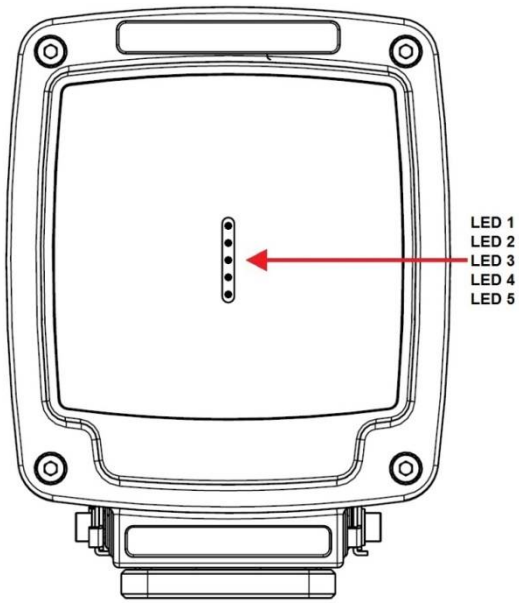


Figure 2-5: Receiver unit indicators

The receiver unit front panel contains the following indicator LEDs:

LED	Function	Colour
1	Laser adjustment (usually OFF)	Illuminated Amber during alignment
2	Laser adjustment (usually OFF)	Illuminated Amber during alignment
3	Laser light ON	Illuminated Green when laser beam is on
4	Laser adjustment (usually OFF)	Illuminated Amber during alignment
5	Laser adjustment (usually OFF)	Illuminated Amber during alignment

2.4 Mounting assembly (flange and window purge)

The mounting assembly comprises a stainless steel tube with two circular flanges at either end.

The larger process flange has 4 or more circular holes; the smaller instrument flange has 3 axial keyhole slots.

Two purge ports are located on the side of the tube, one at either end.

There are two variants of the assembly:

- Fixed assembly
- Adjustable ball joint

2.5 Power supply (optional)

The optional power supply is a third party* universal input, 24 VDC (nom) / 5 A (max) power supply in a die cast aluminium housing and is supplied with input and output connectors.

- Input connector: 3+PE, Cable outlet (mm): 12-14, wire gauge (max AWG): 14
- Output connector: 6+PE, Cable outlet (mm): 12-14, wire gauge (max AWG): 16

*For further details refer to www.tracopower.com/products/tex120.pdf

2.6 Product specifications

2.6.1 Physical dimensions

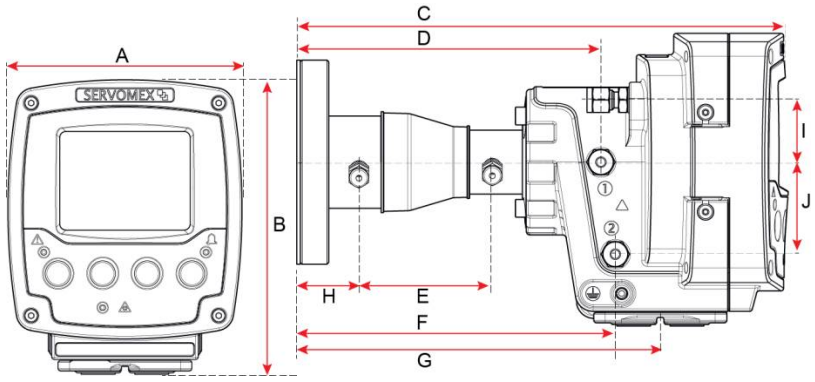


Figure 2-6: Transmitter unit dimensions

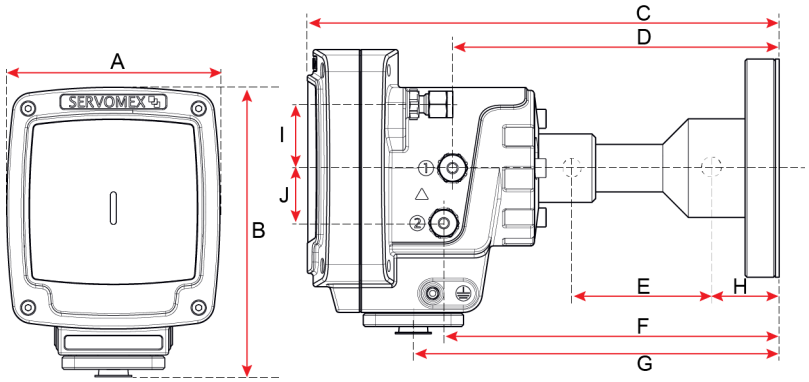


Figure 2-7: Receiver unit dimensions

Dimension	Transmitter unit	Receiver unit
	mm (inches)	Mm (inches)
A	131 (5.157)	110 (4.331)
B	165 (6.496)	150 (5.905)
C	277 (10.905)	249 (9.803)
D	171 (6.732)	173 (6.811)
E	75 (2.953)	75 (2.953)
F	180 (7.087)	177 (6.969)
G	205 (8.071)	193 (7.598)
H	35 (1.378)	35 (1.378)
I	35 (1.378)	34 (1.339)
J	52 (2.047)	29 (1.142)
Weight	2.0 kg (4.4 lbs)	1.6 kg (3.52 lbs)

2.6.2 Electrical specifications

Input power supply:	18 – 30 VDC; 25 W maximum

2.6.3 Connection details

Connection	Transmitter unit	Receiver unit
Cable glands	2 x M16 x 1.5 mm 2 x M20 x 1.5 mm	1 x M20 x 1.5 mm
Purge 1 (measurement In)	Female 1/8” NPT pipe connector	Female 1/8” NPT pipe connector
Purge 2 (enclosure environmental in)	Female 1/8” NPT pipe connector	Female 1/8” NPT pipe connector
Purge 3 (enclosure environmental out)	Female 1/8” NPT pipe connector	Female 1/8” NPT pipe connector

2.6.4 Laser specification

Laser class:	Class 3R (according to IEC 60825-1)
Laser range:	Near-infrared (NIR) range: 700 to 2400 mm (depending on the gas to be measured)
Laser power:	35 mW (max)

CLASS 3R LASER PRODUCT.

LASER RADIATION. The 07931-Series Laser is a Class 3R laser product. The Laser light is not visible. Do not look into the laser beam. Avoid direct eye contact with the laser radiation. Figure 2-1 shows the laser beam path.

The transmitter and receiver units both have a Laser On indicator. This is ON when the transmitter emits laser radiation from the optical window.

2.6.5 Environmental operating conditions

Operating and storage temperatures:	-20 °C to +65 °C (-4 °F to 41 °F) (standard)
Operating ambient pressure range:	80 to 110 kPa (11.6 to 16 psi) (hazardous areas)
Operating humidities:	0 to 80% RH (non-condensing)
Maximum operating altitude:	4000 m (13,120 ft.) 2000 m (6,560 ft.) for hazardous area variants
Ingress Protection classification:	IP66

2.6.6 Performance specifications

Technology:	Tunable laser diode absorption spectroscopy	
Optical path:	0.1 – 40 m (3.94" - 131 ft.)	
Maximum process pressures:	Unclassified process:	150 kPa a (22 psi)
	Classified process:	110 kPa a (16 psi)
Maximum process flange temperature (classified process):	135 °C (275 °F)	
In-situ response time:	Application dependent	
Drift:	Application dependent	
Repeatability:	± detection limit or ± 1% of reading, whichever is greater	
Linearity:	<1% FSR	

Averaging time:	Rolling average up to 24 hours (exponential decay).

For general commissioning activities the analyser will be functional within 10 minutes, however Servomex recommend allowing 3 hours for the analyser to stabilise.

2.7 Additional information

The following specifications are dependent on the configuration of the 07931-Series Laser that you originally purchased.

Equipment classification:	ATEX Cat 3 (Gases) ATEX Cat 2 (Dusts) IECEx EPL Gc (Gases) IECEx EPL Db (Dusts)
Area classification:	Safe area ATEX, IECEx & North America Zone 2 (Gases) ATEX & IECEx (Dusts) North American Class I, Div 2 (Gases) North American Class II, Div 2 (Dusts)
Optical path length:	0.1 m to 40 m (4" to 130 ft)
Optical window purging:	None (low dust clean process) Instrument air N_2, inert gas
Beam:	Configuration dependant
Supply voltage:	24 VDC (standard) 110 Vac 50/60 Hz (external power supply) 220 Vac 50/60 Hz (external power supply))
High process gas temperature applications:	High temperature O_2 / CO_2 / CO applications (>500 °C / >932 °F)
Mounting flange:	DN25 / PN10 DN50 / PN10 ANSI 1” / 150 lbs, pair ANSI 2” / 150 lbs, pair ANSI 3” / 150 lbs, pair
Isolation flanges:	DN50 / PN10 (pair) ANSI 2” / 150 lbs, pair
BASF pressure isolating flanges:	DN50 / PN10 (pair)

	ANSI 2” / 150 lbs, pair
Insertion tubes for high dust / water:	316SS insertion tubes, 19.5 mm to 35 mm dia, pair
Calibration cell:	316SS for corrosive gases (except HF)
4 to 20 mA outputs, isolated current loop, 500 Ω maximum:	One 4 to 20 mA output (standard) Two 4 to 20 mA outputs
4 to 20 mA inputs for process temperature and pressure:	None (standard) Two 4 to 20 mA inputs Maximum current: Input impedance:
Alarm outputs relay, 1A at 30 VDC/VAC:	One relay alarm output (standard) 22 mA 50 Ω Three alarm outputs
Ethernet output:	Ethernet and MODBUS TCP
Instrument purging:	None (blanked) Transmitter unit and receiver unit instrument purge
Alignment tools:	Temperature range: Alignment jig with target -20 °C to +65 °C (-4 °F to 149 °F)
Purge gas filtration:	Dry and oil-free air (ISO 8573.1 Class 2-3) or N_2
Flange and window purging:	Purge flow (application dependent) Transmitter and receiver window must be purged for proper operation.

2.8 Materials in contact with the sample

Item:	Material:
Flange:	316 stainless steel
Insertion tube:	316 stainless steel
O-rings:	Fluorocarbon Chemras 505 *(optional)*
Process flange gasket:	Stainless steel and graphite composite
Optical window:	Fused silica (optical coating)
Optical window seal:	Loctite 595

2.9 Unpacking

Remove the 07931-Series Laser and its accessories from the packaging and inspect

Wetted materials must be compatible or clean for oxygen service at concentrations above 21% or equivalent at elevated pressure.

everything for any damage that may have occurred during transit.

If any item has been damaged, contact Servomex or its agent straight away.

Keep all packaging and shipping information.

Check that the parts supplied agree with your purchase specification.

3 Transmitter user interface

3.1 Keypad

In all operating modes, the function of each pushbutton key is indicated by one of four corresponding icons on the transmitter unit display. The icons change dynamically. Pressing the appropriate keys navigates the operator through the various menus during setup, installation, calibration, etc.

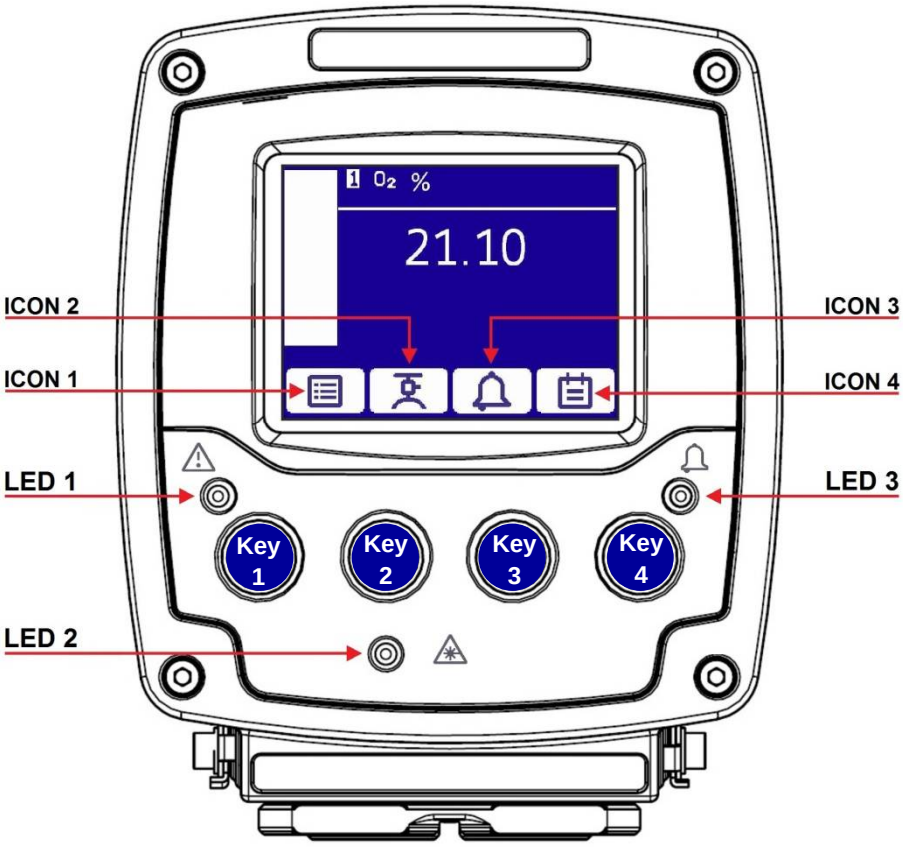


Figure 3-1: Transmitter pushbutton keys, screen icons and indicator LEDs

3.2 Transmitter Unit Indicator LEDs

Refer to Figure 3-1: Transmitter pushbutton keys, screen icons and indicator LEDs. The transmitter unit front panel contains the following indicator LEDs:

LED	Function	Colour
1	Fault	Illuminated amber when a fault is raised
2	Laser light ON	Illuminated green when laser beam is on
3	Alarm	Illuminated red when an alarm is raised

3.3 Start-up screen

The start-up screen is displayed when you first switch on the unit as it carries out a self-test. The start-up screen shows the progress of the self-test and also displays the main analyser software release and transducer software release codes.

Figure 3-2: Start up screen

3.4 Measurement screen

When initialisation is complete the display will default to the ‘live’ measurement screen. The measurement screen displays 2 measurements.

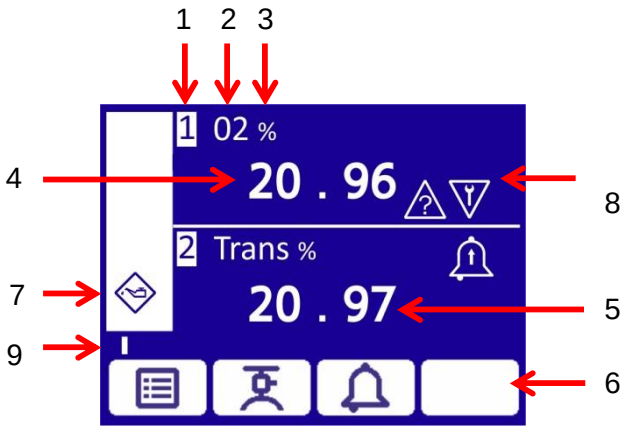


Figure 3-3: Example of a ‘live’ measurement screen

Item			
1	Measurement number	6	Soft key navigation icons
2	Measurement designation	7	System status icon
3	Measurement units	8	Measurement status icons
4	Live measurement reading	9	Software health indicator
5	Live transmission reading		

Note: *In the event of a fault that impacts the integrity of the transmitted laser beam; the transmission signal will 'freeze' at the last known reliable reading. Such a condition will be reflected in analyser status messages.*

Note: *During normal operation the software health indicator (8) moves continuously across the screen below the status icon column. If the indicator stops moving the analyser is not working correctly.*

Note: *If no soft-key is pressed for 10 minutes, the measurement screen will be displayed. You then have to re-enter the password to access any password protected screens.*

Note: *Holding down the*  *soft-key will clear the current security level and return the display to the measurement screen.*

3.5 Soft key legends

Four soft key navigation icons at the bottom of the screen correspond to the four soft keys on the front of the analyser.

The icons that appear are:

Icon	Meaning	Function (when soft key is pressed)
	Menu	Displays the menu screen
	Calibrate	Displays the calibrate screen
	Alarm	Illuminated red when an alarm is raised
	Back	Cancels current screen and displays previous screen
	Accept	Accepts the data or option selected. A new screen may appear
	Edit	Allows highlighted data to be edited
	Up	Moves cursor up the list
	Down	Moves cursor down the list
	Left	Moves cursor to the left
	Right	Moves cursor to the right
	Blank	No effect

3.6 System and measurement status icons

The system status is displayed on the status icon column on the left of the screen. The measurement status is displayed on the right hand side of each measurement reading. The status is shown with one of the following icons:

Icon	Meaning	System status	Measurement status
	Check function	Indicates that the analyser is in a Service In Progress (S.I.P) state	Indicates a specific measurement is in a Service In Progress (S.I.P) state
	Failure	Indicates that a fault has been detected that affects the analyser	Indicates that a fault has been detected that affects a specific measurement
	Maintenance	Analyser requires maintenance	
	Out of specification	Indicates the analyser is operating out of specification	Indicates a specific measurement is operating out of specification
	Warming	N/A	Indicates the TU is warming up
	High alarm	N/A	A high alarm for a specific measurement is activated
	Low alarm	N/A	A low alarm for a specific measurement is activated

3.7 Navigation and selecting on-screen options

To select an option on any screen:

1. Press the up arrow  and down arrow  soft-keys to move highlighted option up or down the screen to highlight the screen option you want.
2. Press the accept soft-key  to select the option or display the screen you selected.

If more options are available than can be shown on the screen, a scroll bar is displayed on the right hand side of the screen. To scroll up and down the list, use the up arrow  and down arrow  soft-keys.

The scroll bar shows where you are in the list of options.

3.8 Edit on-screen data

You can edit data on any screen in the same way.

Press the edit soft-key  to edit a data item.

The screen changes to the appropriate screen, with the first digit highlighted.

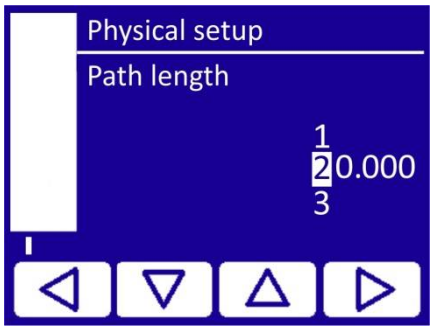


Figure 3-4: Example of a typical edit screen

Soft-key	Function
	This soft key is available when the first digit is highlighted. Press this soft-key to exit the menu without changing any data
	Increases highlighted digit by 1
	Decreases highlighted digit by 1
	Moves cursor left to previous digit
	Moves cursor right to next digit

When the last digit is highlighted and you have changed it press the accept soft-key  to accept the new data.

3.9 Password protection

Passwords for all levels should be changed in order to protect the analyser system from unauthorised operation.

To change the passwords see section 4.3.2.

Passwords should be kept in a secure place.

It is strongly recommended that the highest level password is only used in emergencies to reset 'forgotten' lower level passwords.

Note: *If the highest level password is lost, it will be necessary to contact Servomex for recovery details.*

You must enter a password to access some options and screens.

The factory security settings are:

Operator password: **001000**

Supervisor password: **002000**

When you first try to access a password protected option or screen, the system prompts you to enter the password. You must enter the correct password before the option or screen is displayed.

If you have already entered the password, you do not have to re-enter the password, you will automatically have access to all the relevant options or screens.

Note: *Passwords are displayed as asterisks (*) when entered, for security purposes.*

Note: *The password remains active until 10 minutes after the last time you press a soft-key. If you do not press any soft-key within that time, you must re-enter the password.*

Note: *Present within the software are a number of maintenance / development and diagnostic facilities that are not further documented due to the intended user of such facilities being Servomex staff only.*

Note: *Holding down the [X] soft-key will clear the current security level and return the display to the measurement screen.*

3.10 Configuration setting types

There are a number of settings that can be saved / loaded to the instrument by different security password levels of users.

3.10.1 Measurement (sensor) configuration

There are two forms of this file; the sensor factory settings and users environmental settings.

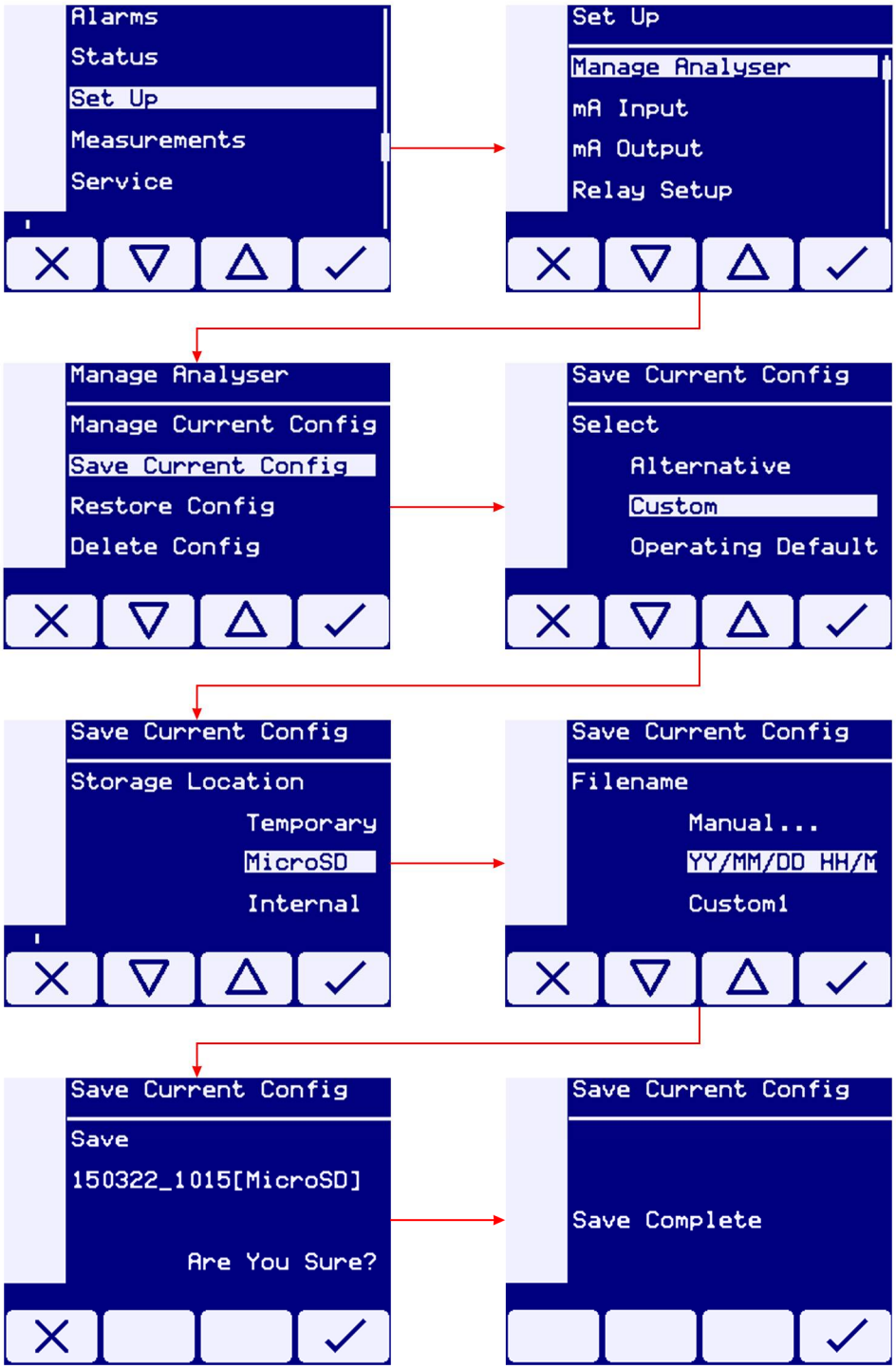
The Configuration can be managed through “Manage Analyser” menu.

The sensor factory settings

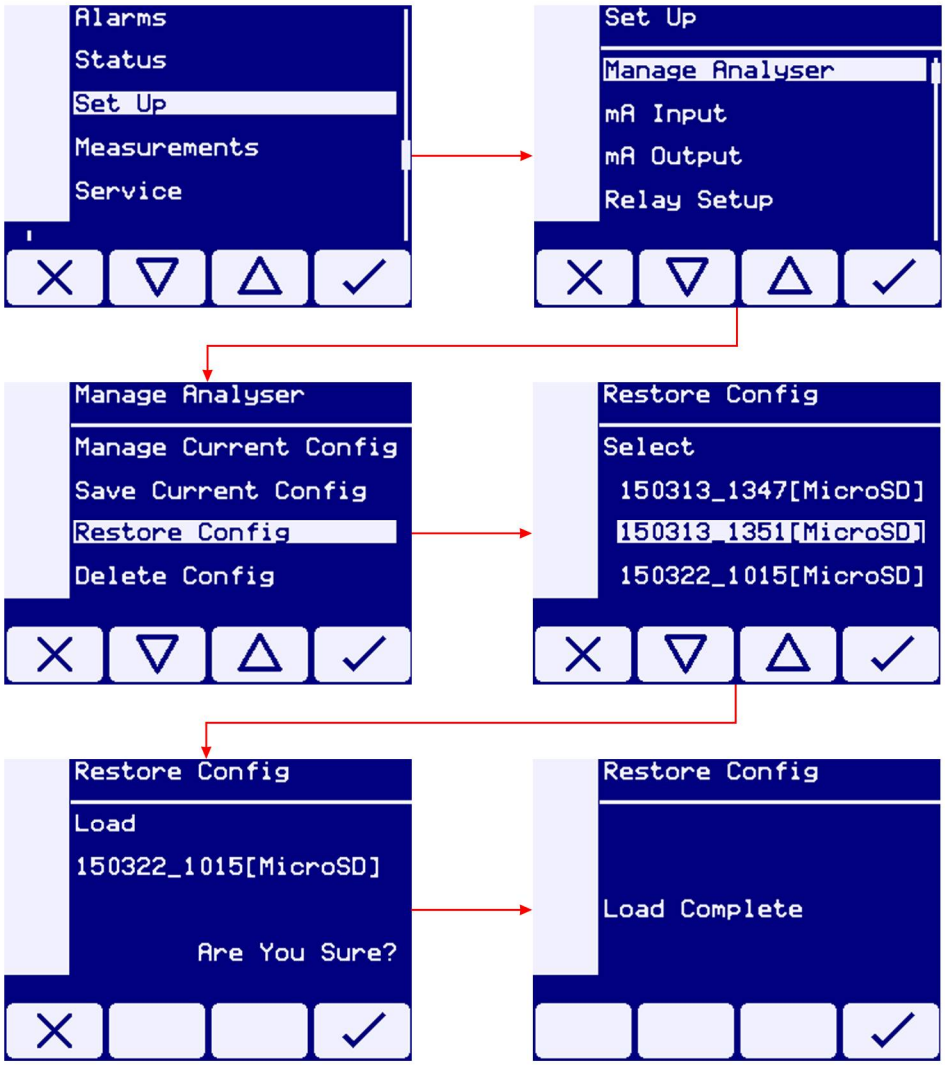
This includes all sensor settings including laser diode characterisation data, factory limits, application tuning data, calibration details, etc.

Note: This file can only be saved / loaded in internally memory via the built-in user interface.

This file will only be saveable by Technical users. It can be loaded by a Supervisor level user or above to facilitate recovery of an instrument that cannot be fixed by other means.



To restore a date and time stamped measurement backup from the microSD card.



Users environmental setting

This file contains sensor and analyser settings intended to support environmental change e.g. moving the instrument from process to calibration jig.

The file contains everything except laser diode characterisation data and calibration data.

The file can be saved / restored from internal memory or via the MicroSD card (or shortly loaded via the web interface). The file can be saved in pre-named configurations for specific purposes or in user named files.

Hint: *The file may be transferable between different instruments but some parameters may need tweaking to fit with laser diode / tuning specifics.*

This file can be saved and restored by Supervisor level users.

Measurement (sensor) calibration

This file contains only sensor data that changes as a result of customer gas calibration. Managed under the “Calibrate” menu.

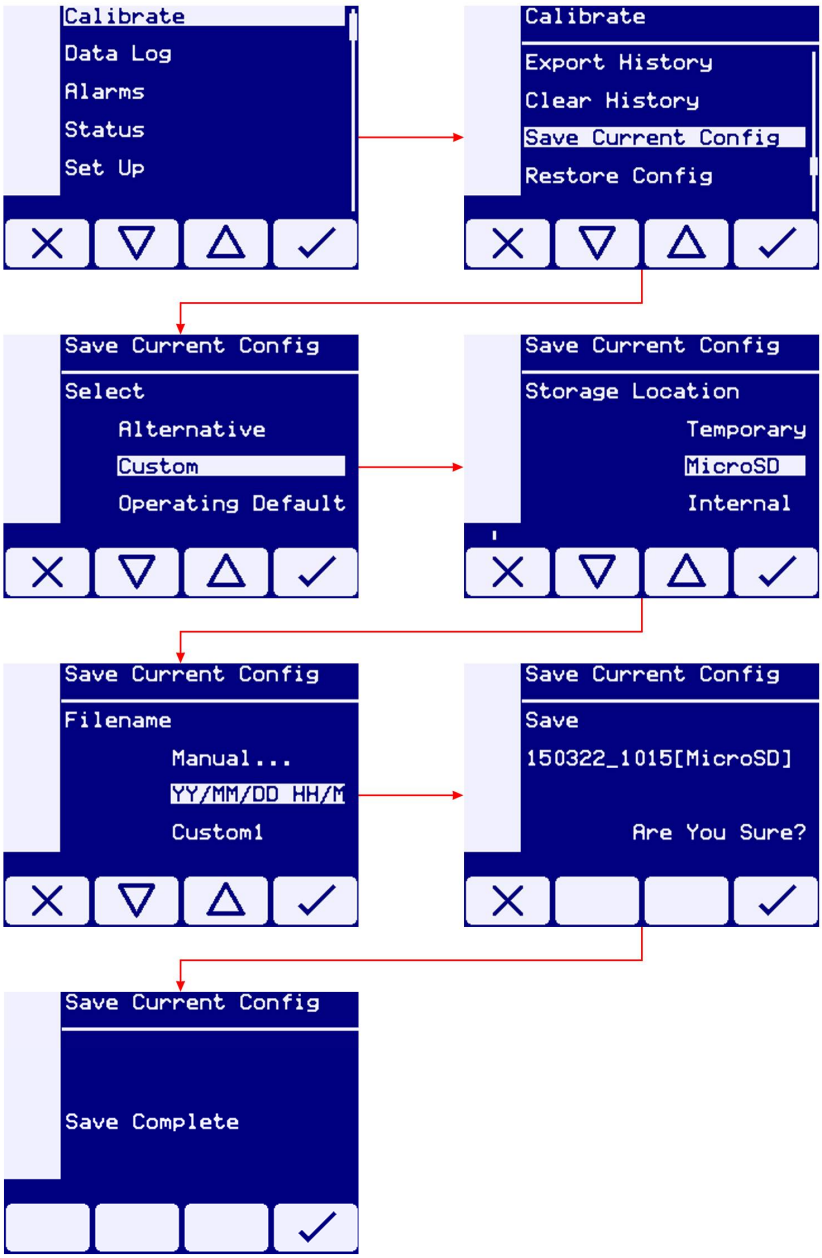
The file can be saved / restored from internal memory or via the MicroSD card. The file can be saved in pre-named configurations for specific purposes or in user named files.

This file can be saved and restored by supervisor level users.

Note: *This feature saves and restores the istrumentcalibration as well as the calibration configuration. By restoring, it will revert the analyser calibration to the one stored in the backup.*

Note: *This feature is able save all of the following options to internal memory located on the Main PCB.*

The custom option can only be saved to a suitable microSD card.



Save current config options

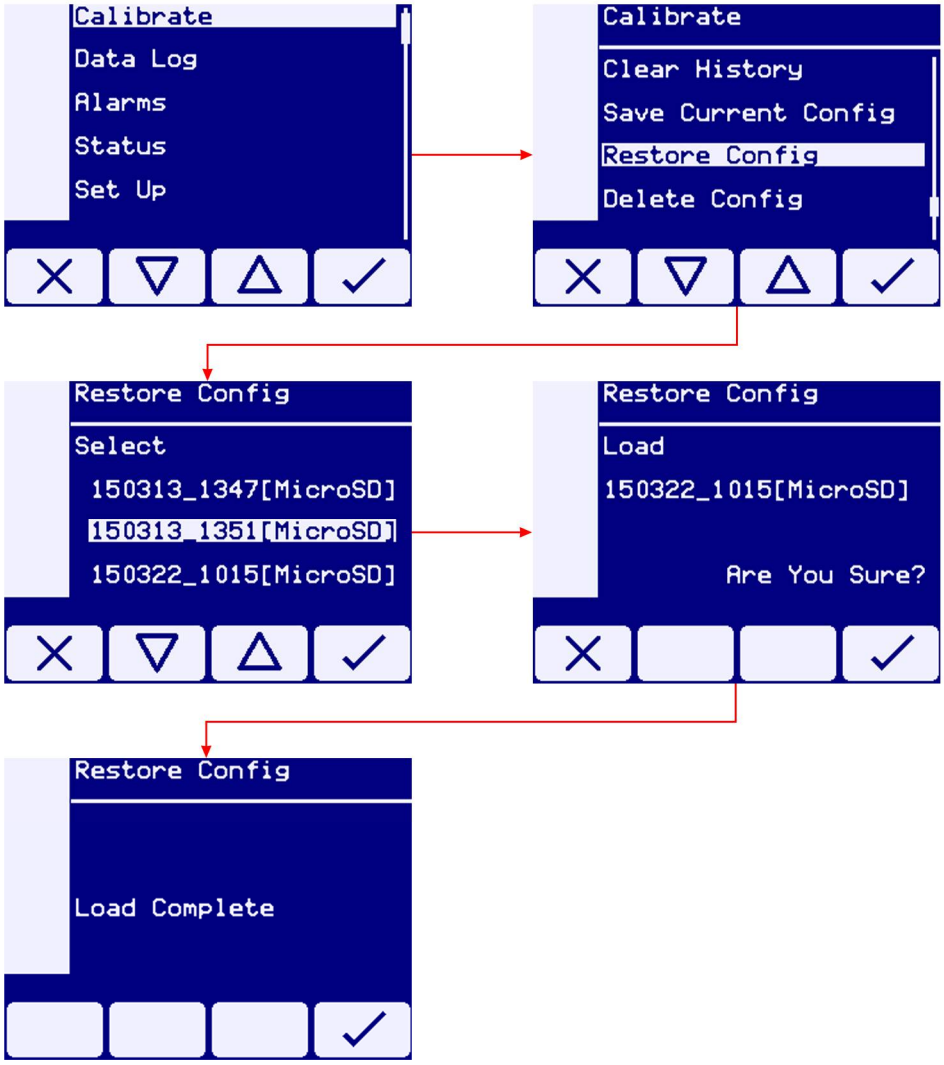
The Save Current Config menu will present 3 options:

Operating default - to be used during normal operation

Alternative – not normally required

Custom – use to create exportable or multiple configurations during servicing and maintenance.

To restore a date and time stamped calibration backup from the microSD card.



3.10.2 Analyser (non-sensor) configuration

This information tells the unit “What product am I?” “What facilities are enabled?” and also stores user settings (alarm levels, mA output config, network etc.).

The configuration can be managed through the “User settings” menu

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Set Up
Manage Analyser
mA input
mA output
Relay set up
Filtering
Unit Select
X-Interfere
Clipping
User settings

User settings
Network settings
Password
Clock
Regional
Display setup
Backlight
Brightness
Save Current Config
Restore Config
Delete Config
Save Support Package
Information

Note: *This file can be saved / restored only to / from MicroSD card by Supervisor level user.*

Note: *It is advisable to leave a backup copy on an SD card present in the instrument. Although this file will not normally be used, if the instrument should lose its configuration at re-boot re-load it will automatically reload its configuration from the file on the SD card.*

Hint: *The configuration file can be transferred between instruments to minimise multiple analyser setup time.*

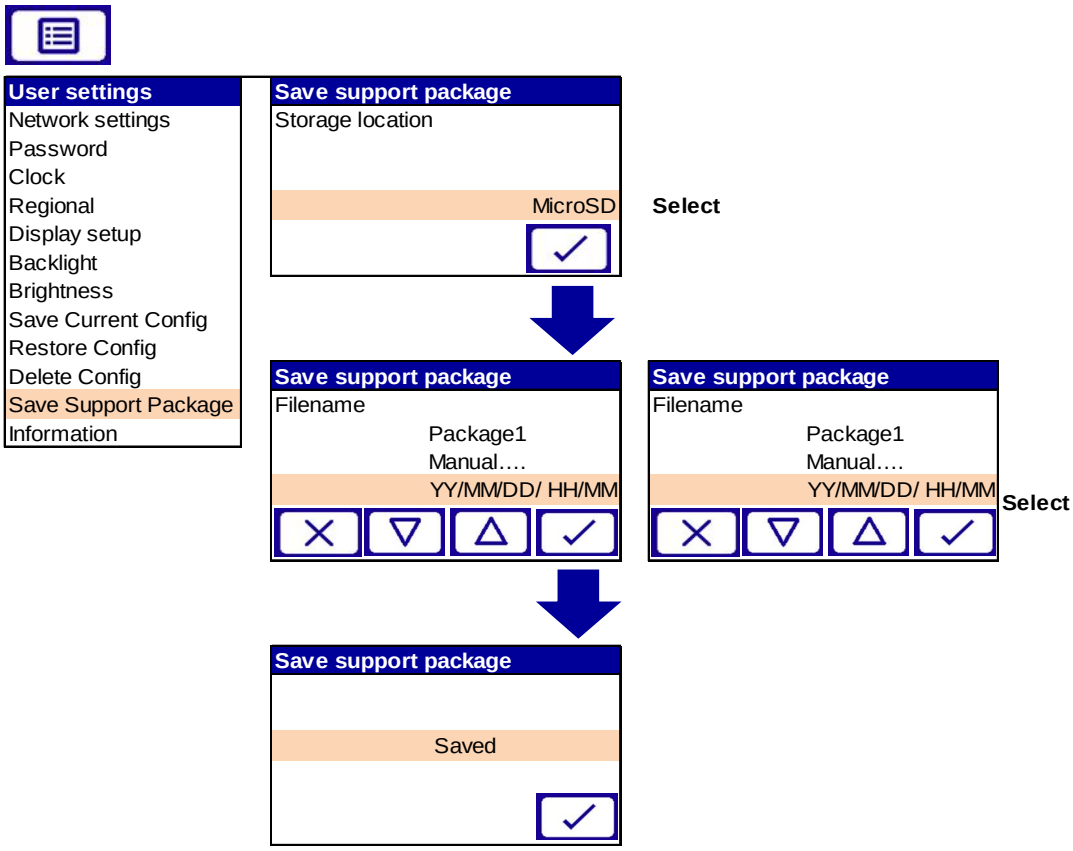
3.10.3 Support Package

A support package can be exported as a .zip file to the SD card which contains information to aid application optimisation of diagnostics. The package contains:

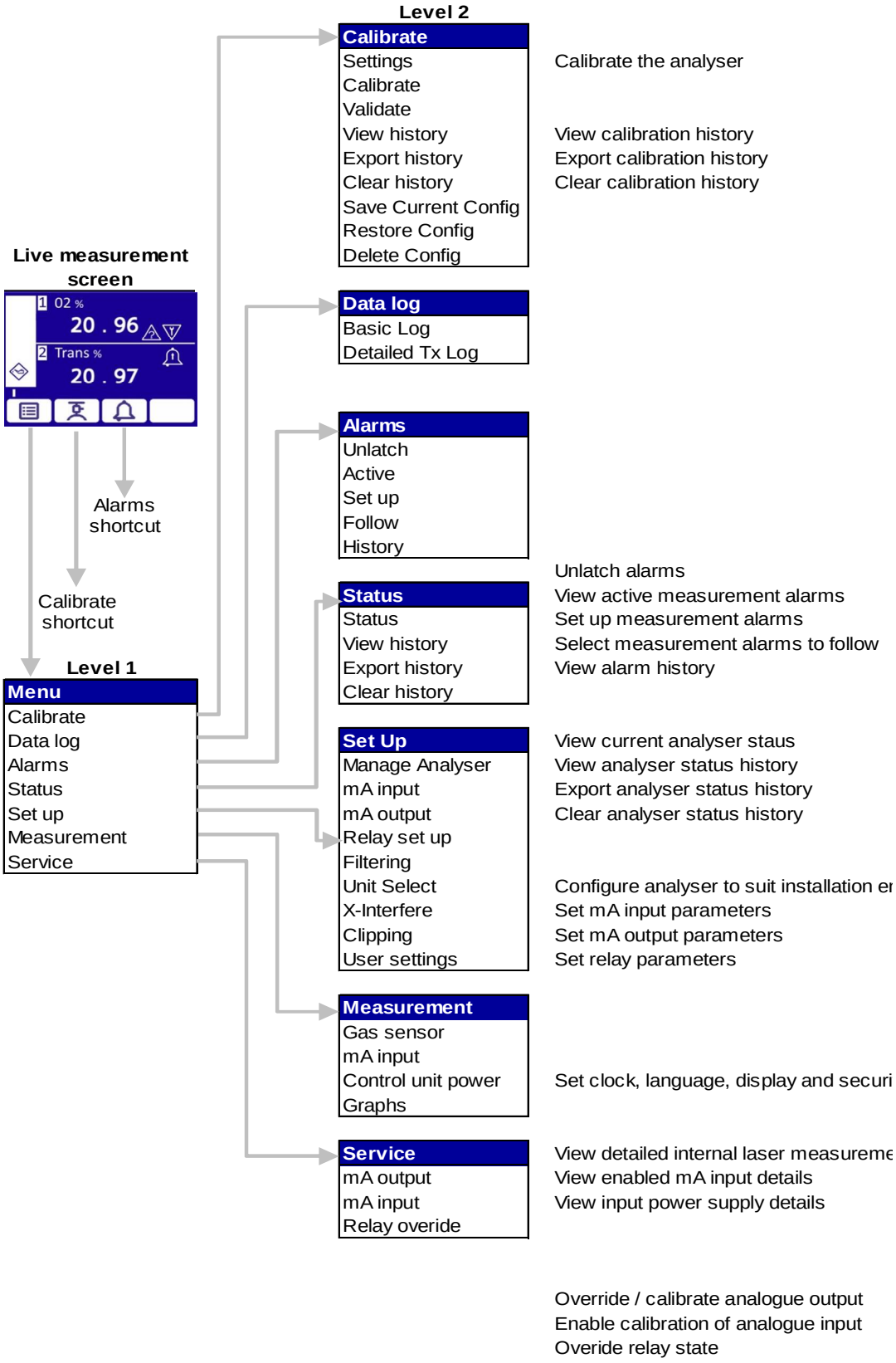
- Alarm history
- Calibration history
- Data log (if enabled)
- Firmware version information
- A snap shot of measurement data values at time of export
- Origin file (information on analyser to log was exported from)
- Status log
- Analyser configuration parameters
- Transducer configuration parameters
- Graphical spectral data
- System log (Servomex access only)

3.10.4 Saving a support package

To save a support package:



3.11 Menu structure



4 Configuration

4.1 Configure mA inputs

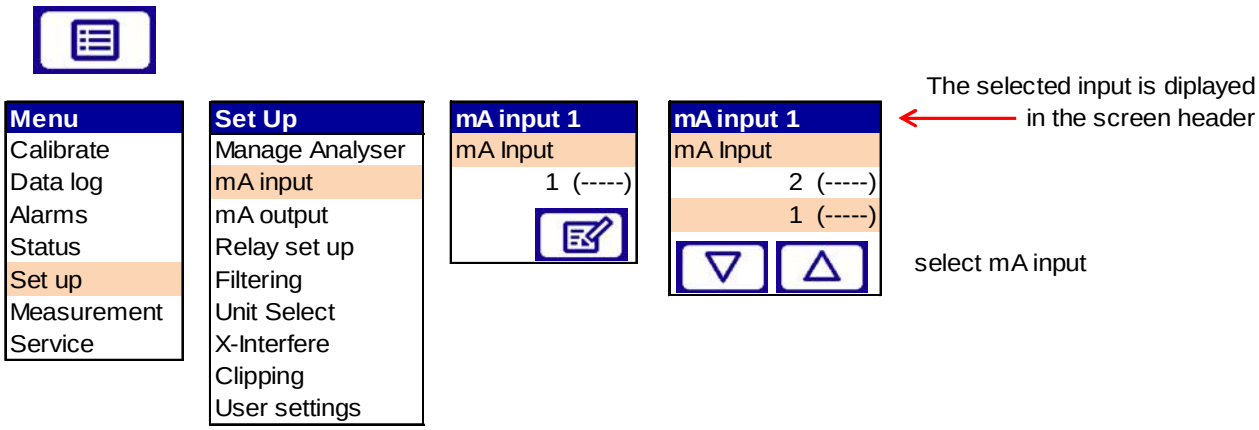
mA inputs are provided to allow the analyser to make measurement corrections when there are external influences in the process such as sample gas temperature and pressure.

The analyser can be supplied with an ‘Options PCB’ that provides an additional mA input. A peripheral measurement device can be connected to 1 or both of these inputs.

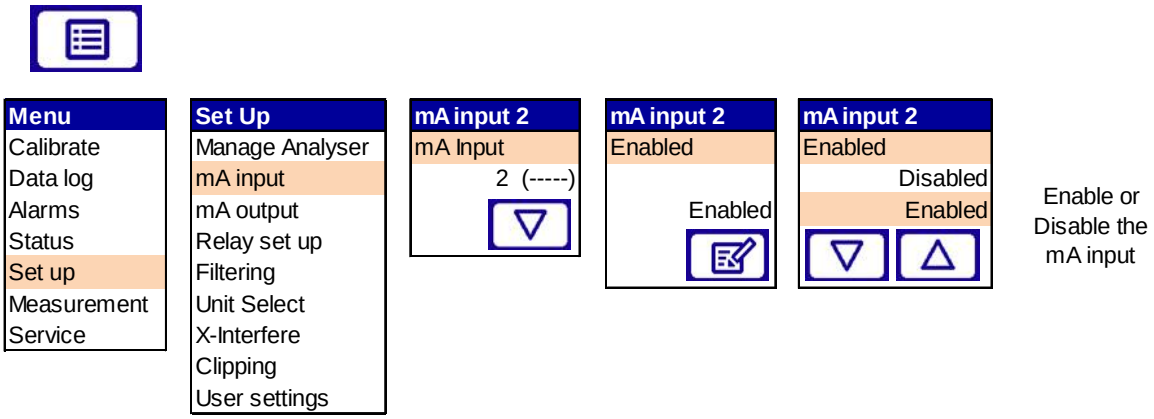
Each input can be assigned to one of 5 measurement properties (gas, pressure, temperature, flow or moisture) depending on the peripheral measurement device being connected to it.

The mA input provides a constantly updated input to the analyser, in which the current represents the value being measured by the peripheral device.

4.1.1 To select either mA input 1 or 2



4.1.2 To enable or disable the selected mA input



Once the mA input has been enabled it will need to be configured. The mA input parameters that must be set up are illustrated in Figure 4-1: mA input sequential menu.

4.1.3 To set the mA input parameters

mA input 1 0r 2						
Enabled	▽					
	Physical property	✎	Pressure Temperature Gas concentration Flow Moisture	✓		*select option*
	Units	✎	Pressure	Pa kPa hPA MPa psi mm Hg ubar mbar bar mPa	✓	*select option*
			Temperature	ºK ºC ºF	✓	*select option*
			Gas concentration	XxXX	✎	*type in formula*
			Gas concentration	% ppt ppb ppm vpm	✓	*select option*
			Flow	m3/s ft3/s cm3/min ml/min ml/s l/s l/hr	✓	*select*
			Moisture	dew pt °C ppm	✓	*select*
	Label	✎	Xxxxxx	✓		*name the input*
	Current 1 (low set)	✎	4.000 mA	✓		*edit value*
	Current 2 (high set)	✎	20.000 mA	✓		*edit value*
	Measurement 1 (low)	✎	0.000	✓		*edit value*
	Measurement 2 (high)	✎	0.000	✓		*edit value*
	Under range	✎	0.000 mA	✓		*edit value*
	Overr ange	✎	0.000 mA	✓		*edit value*
	Out of range state		None Message Maintenance required Out of spec Service in progress Fault	✓		*select option*
	Filter time	✎	0.000 sec	✓		*edit time*
	Reset threshold	✎	100 Pa	✓		*edit*

Figure 4-1: mA input sequential menu

4.1.4 Explanation summary of the mA Input parameter settings

Parameter	Function
Physical property	The option selected determines the mA input measurement type
Units	Assigns a measurement unit to the mA input. The options presented on the screen will be dependent on the physical property selected
Label	Assign an appropriate name to the mA input. For example: ‘Temp’ for temperature, ‘Press’ for pressure
Current 1 (low set)	This is the minimum measurement current for the connected mA input device. Typically 0 – 4 mA
Current 2 (high set)	This is the highest measurement current for the connected mA input device. Typically 20 mA
Measurement 1 (low)	Corresponding minimum measurement at Current 1 (low set) for the connected mA Input device
Measurement 2 (high)	Corresponding maximum measurement at Current 2 (high set) for the connected mA Input device
Under range	A tolerance value set below the current 1 (low set) value. It sets the lowest input current during normal operation
Over range	A tolerance value set above the current 2 (high set) value. It sets the highest input current during normal operation
Out of range state	This is the action you want the analyser to take when the mA input values fall outside of the under range / over range values
Filter time	Filters the input over a given time period. This is used to ‘smooth-out’ the measurement values being displayed on screen
Reset threshold	Sets the threshold where you want the filter to ‘collapse’ and revert to a non-filtered state until the change in reading falls back below the reset threshold (currently selected units apply)

4.2 Process environment settings “physical set up”

The analyser needs to be configured to suit the process environment.

Configuration includes setting the laser path length, process pressure and process temperature.

Note: *When the laser, measurement signals have been optimised and the process environment set up have been completed Servomex recommend saving the configuration.*

The physical parameters that must be set up are illustrated in the following sequential menu table:

Manage analyser							
Level 3	**Level 4**	**Level 5**	**Level 6**	**Level 7**	**Level 8**	**Level 9**	
Manage current config	Service mode						
	Phase/gain Settings						
	Measurement Signal						
	Physical setup	Measurement Selection	Purge Compensation	✎	Enable Disabled	✓	
			Path length	✎	0.000	✓	*edit value*
			Pressure source	✎	External User defined 0-4 Internal	✓	*select option*
			Pressure source Offset or value	✎	Edit	✓	
			Temp source	✎	External User defined 0-4 Internal	✓	*select option*
			Temp source Offset or value	✎	Edit	✓	
	Detailed set up		***For Servomex trained Service operators only***				
Save Current Config	✓		✓				
Restore Config	✓						
Delete Config	✓						

Figure 4-2: Physical setup sequential menu

4.2.1 Purge compensation

Purge compensation (disabled)

Note: *Purge compensation "disabled" should only be used when using a purge gas that does not contain any target gas.*

When purge compensation is "disabled" the measurement path length is simply defined as the total distance between laser diode and receiver photodiode minus the total purged length; the examples shown describe 2 common installation configurations**.**

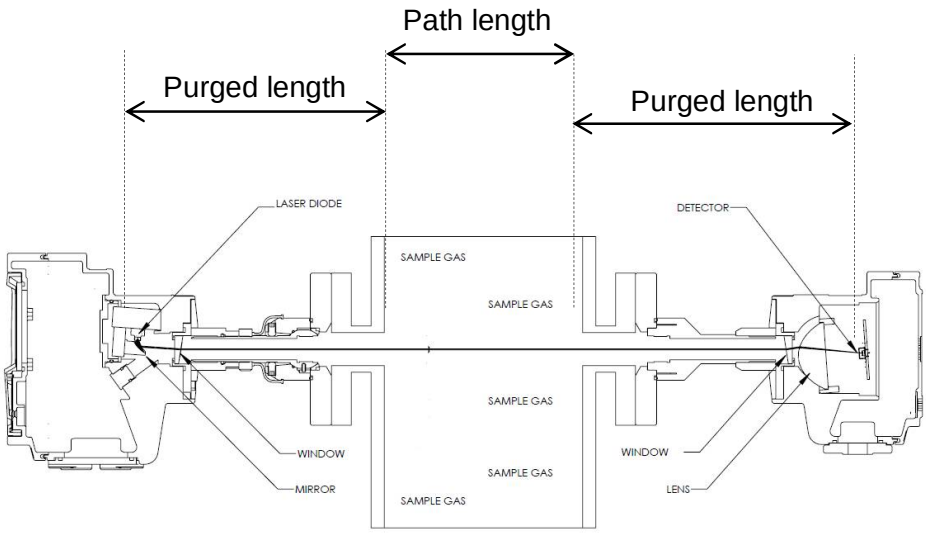


Figure 4-3: Purged cross stack path length example

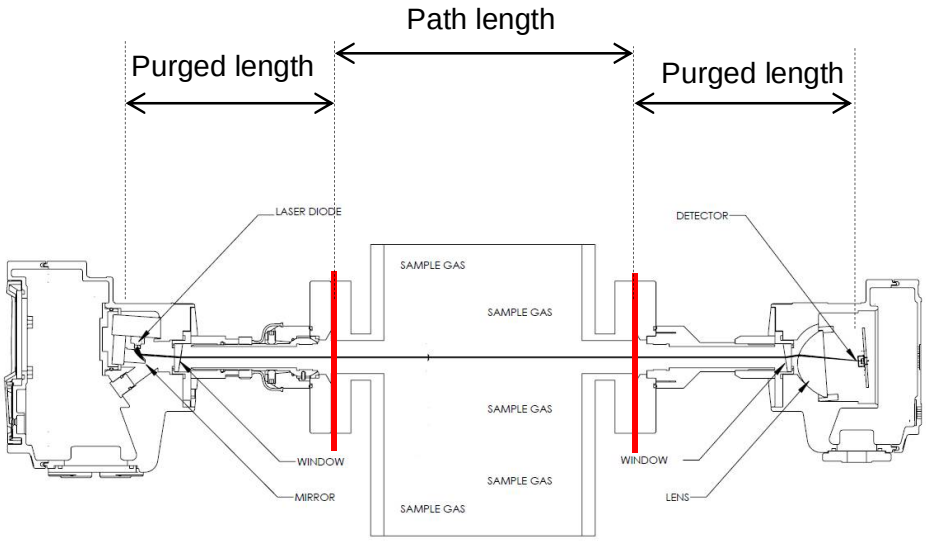
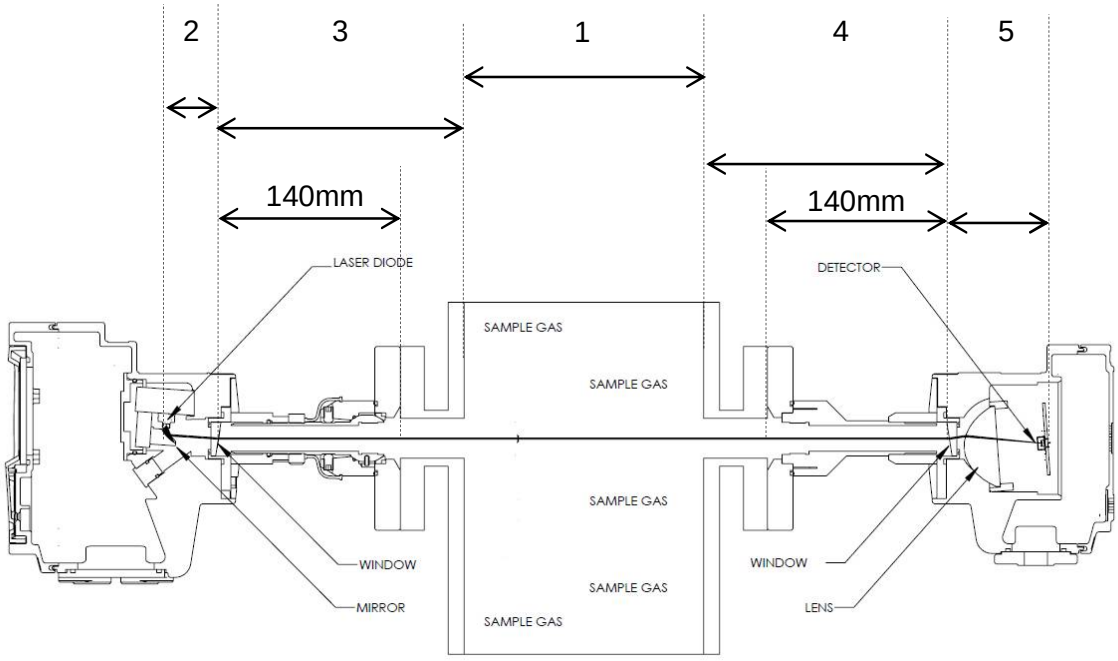


Figure 4-4: Non purged isolation flange cross stack path length example

Purge compensation (enabled)

Purge compensation should be enabled when using a purge gas that contains the target gas. E.g. using instrument air to purge an O_2 measurement.

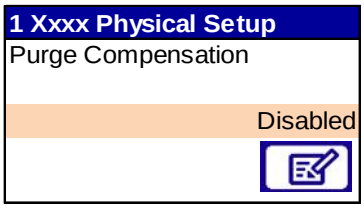
When purge compensation is “enabled” an additional 4 path length segments can be defined between the laser diode and detector.

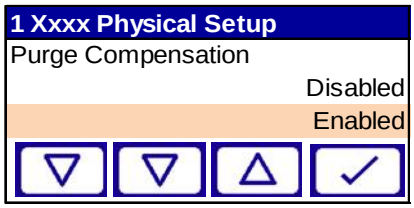


1	Measurement path length	Application dependent
2	Transmitter enclosure (TxEnc)	31- 33 mm configuration depended
3	Transmitter purge (TxPur)	140 mm +
4	Receiver purge (RxPur)	140 mm +
5	Receiver enclosure (RxEnc)	39 mm

Figure 4-5: Purge compensation segments

To enable purge compensation





Enable

To configure purge compensation

The example sequence below show settings options for 1 of the additional 4 segments, the sequence needs to be complete for all segments. A concentration level is required for all 4 segments. E.g. if purging with instrument air and measuring O_2 the concentration in purged segments will be that of the instrument air. If purging with N_2 concentration will be zero.

Note: *Any errors associated with approximated or inaccurate figures in the segments will contribute to errors in the measurement.*

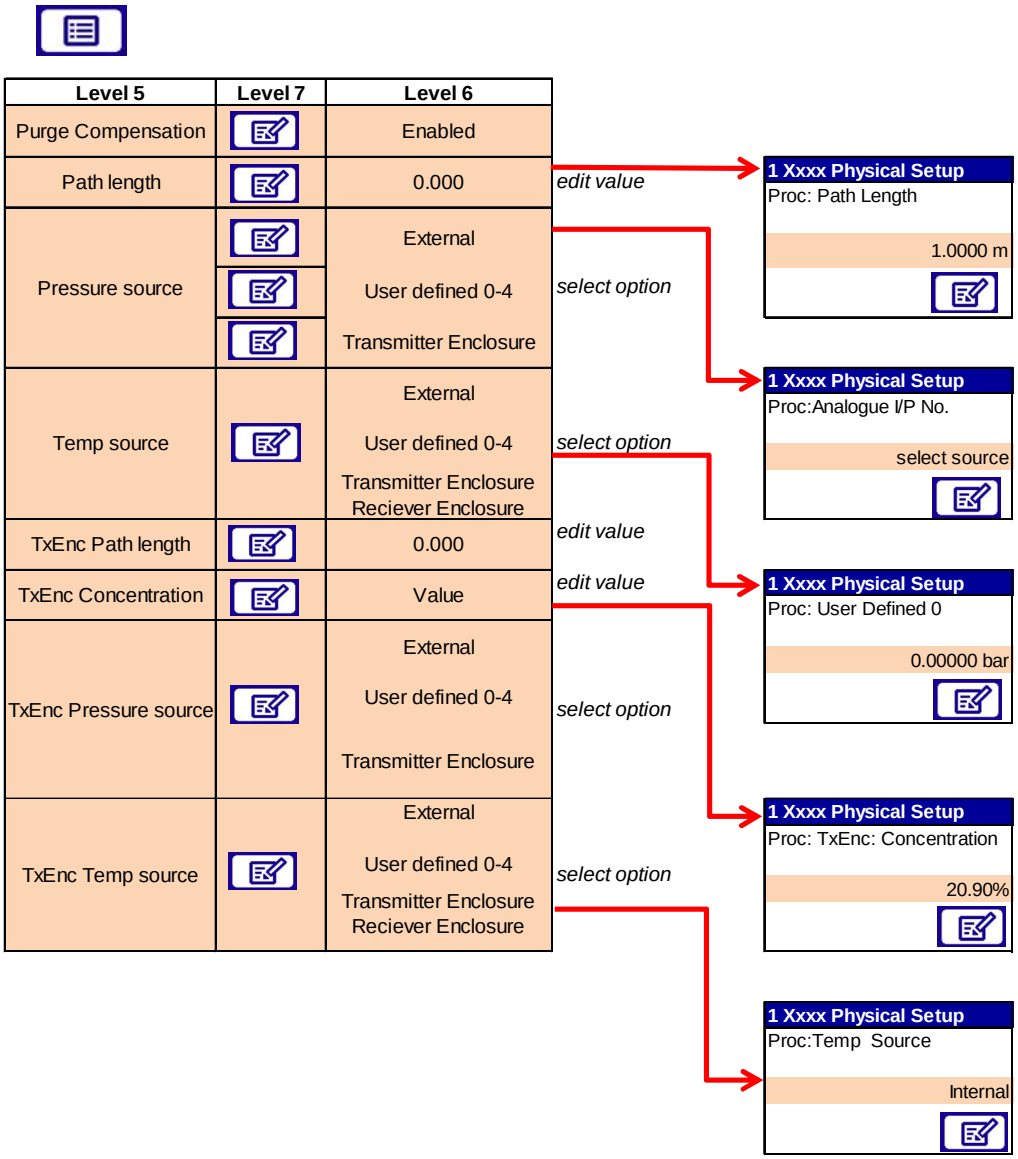


Figure 4-6: Purge compensation sequential menu

4.2.2 Pressure source selection

3 options are available for each segment

Option 1: External

External should be selected when the required pressure source is a mA input device.

Option 2: User defined 0-4

User defined fixed pressures can be entered and saved to be used when purge compensation is enabled.

Note: User defined pressures should only be used when the pressure of the measured gas is constant and stable. Incorrect use will result in reported concentration errors if the measured / purge gas pressure changes while in this mode.

Option 3: Transmitter enclosure

The analyser is fitted with a pressure transducer mounted on the main process PCB inside the transmitter enclosure. The transducer will measure the pressure inside the enclosure. An offset can be applied to correct for differences in measurement gas pressure and the internal enclosure pressure.

Note: *If an environmental purge is fitted, the value reported may be higher than the atmospheric pressure, and an addition to the calculated offset should be applied.*

4.2.3 Temp source selection

4 options are available for each segment

Option 1: External

External should be selected when the required temperature source is a mA input device.

Option 2: User defined 0-4

User defined fixed pressures can be entered and saved to be used when purge compensation is enabled.

Note: User defined temperatures should only be used when the temperature of the measured gas / purge gas is constant and stable as the measurement compensation will also be fixed. Changes in measured gas temperature will result in reported concentration errors.

Option 3: Transmitter Enclosure

The transmitter enclosure is fitted with a thermistor mounted on the main process PCB. The thermistor will measure the temperature inside the enclosure.

Option 4: Receiver enclosure

The receiver enclosure is fitted with a thermistor mounted on the main process PCB. The thermistor will measure the temperature inside the enclosure.

An offset can be applied to correct for differences in measurement gas temperature and the internal enclosure temperature.

> ***Hint:*** *Under normal operating conditions the enclosure internal temperature is approximately 15 to 20°C above ambient.*

Note: *If an environmental purge is fitted, the value reported may be lower than the ambient temperature, and an addition to the calculated offset should be applied.*

Note: *When the physical or user settings have been completed Servomex recommend saving the configuration. See section 3.10*

4.3 User settings

4.3.1 Network settings

You must configure the network settings to suit the requirements of the network you have connected the analyser to.

The values are supervisor password protected. The analyser supports IPv4 Mode and IPv6 Mode. See your network administrator to confirm which mode and the parameters to be entered.

To configure network settings

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Set Up
Manage Analyser
mA input
mA output
Relay set up
Filtering
Unit Select
X-Interfere
Clipping
User settings

User settings
Network settings
Password
Clock
Regional
Display setup
Backlight
Brightness
Save Current Config
Restore Config
Delete Config
Save Support Package
Information

Network settings			
IPv4 Mode		DHCP (Dynamic) + static Static DHCP (Dynamic)	select mode
IPv6 Mode		Default	
IPv4 Address		192.168.240.101	edit address
IPv4 Subnet mask		255.255.255.000	edit address
IPv4 Gateway		000.000.000.000	
IPv6 Address		fe80:0000:0000:0000 021e:c0FF:fead:d4dc	
Hostname		Servomex_000	edit

Figure 4-7: Network settings sequential menu

Note: *The IPv4 or IPv6 address must be set to a unique value in the network*

4.3.2 Change the passwords

Passwords for all levels should be changed in order to protect the analyser system from unauthorised operation.

Passwords should be kept in a secure place.

It is strongly recommended that the highest level password is only used in emergencies to reset 'forgotten' lower level passwords.

Note: *If the highest level password is lost, it will be necessary to contact Servomex for recovery details.*

Note: *Passwords can only be changed for the currently selected security level or lower.*

Note: *Holding down the [X] soft-key will clear the current security level and return the display to the measurement screen.*

To change the password

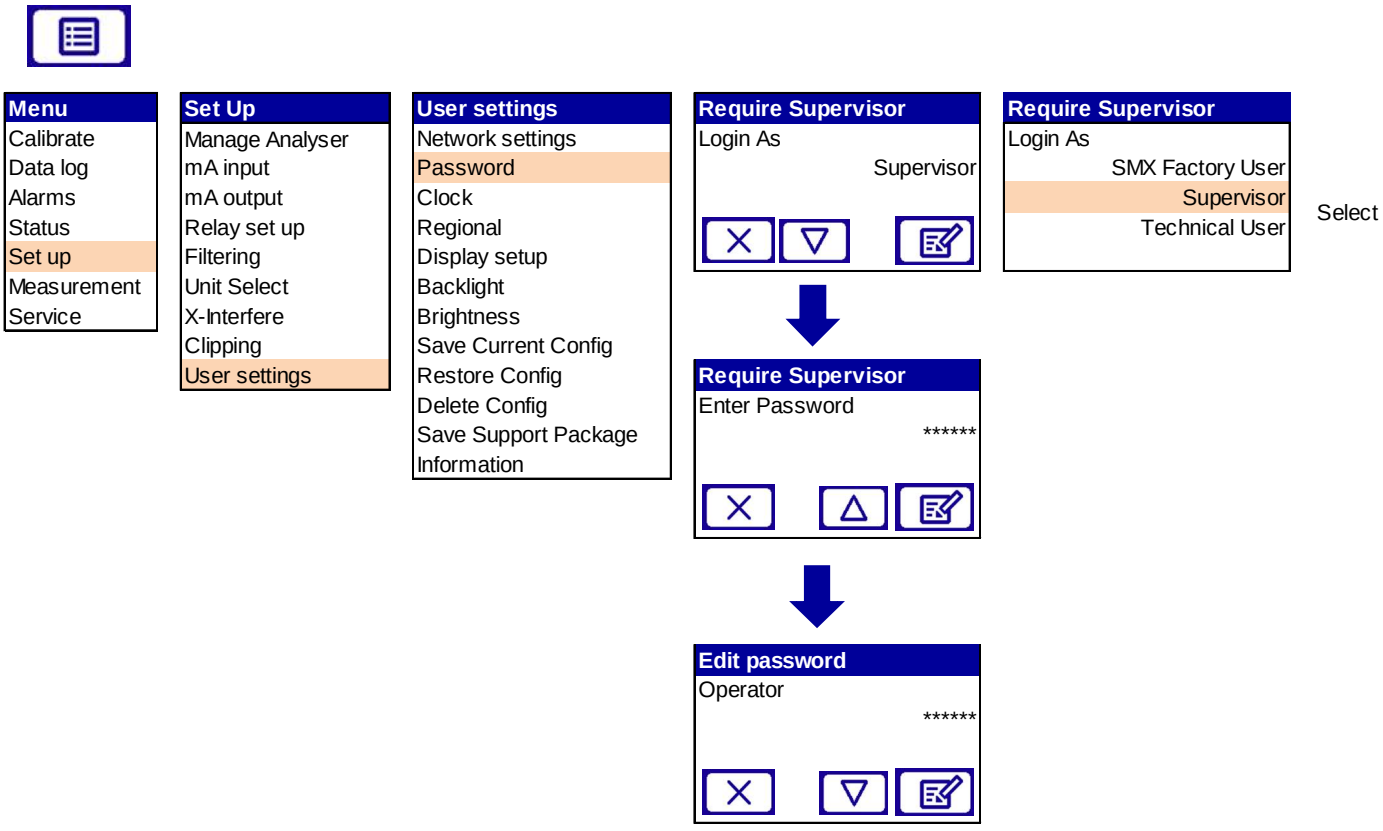
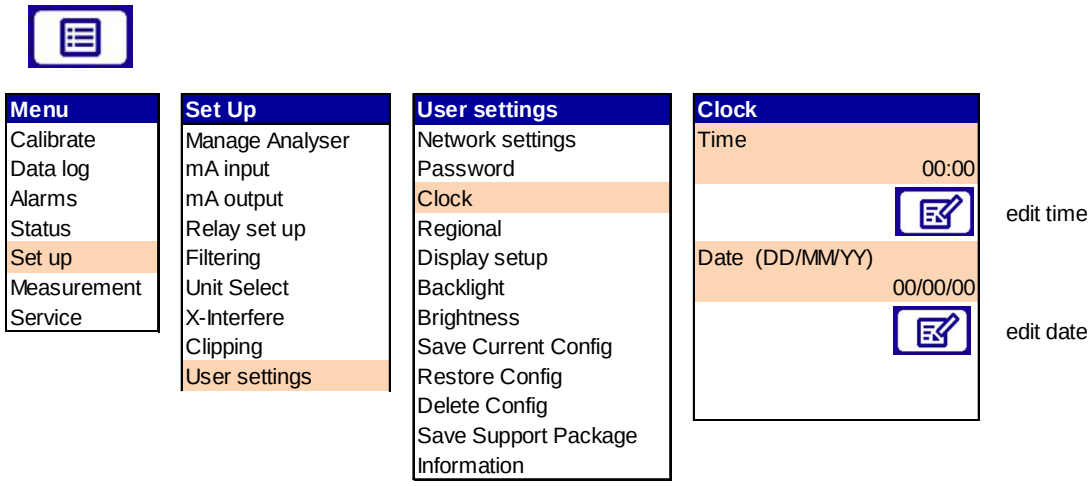


Figure 4-8: Password sequential menu

4.3.3 Set time and date

To set time and date



> ***Hint:*** *You can set the date format to dd/mm/yy or mm/dd/yy in the regional settings (section 4.3.4).*

Note: *After power cycle, review system time and date.to ensure consistency with your own system time.*

4.3.4 Regional settings

The regional settings enable the menu language, date format and measurement units to be changed.

To adjust regional settings

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Set Up
Manage Analyser
mA input
mA output
Relay set up
Filtering
Unit Select
X-Interfere
Clipping
User settings

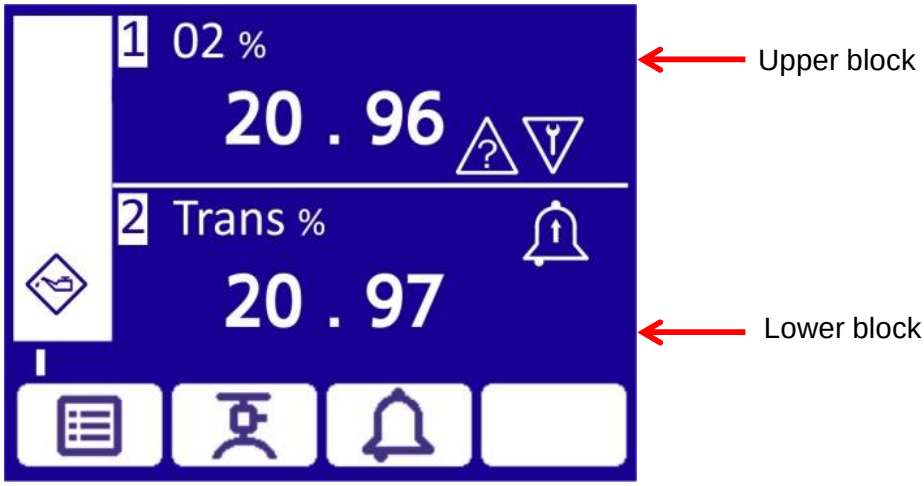
User settings
Network settings
Password
Clock
Regional
Display setup
Backlight
Brightness
Save Current Config
Restore Config
Delete Config
Save Support Package
Information

Regional				
Language		English Francais Deutsch		select language
Date format		MM/DD/YY DD/MM/YY		select format
Decimal format		, .		select format
Distance		cm m inches feet		select units
Pressure		mPa Pa kPa hpa MPa psi mm Hg ubar mbar bar		select units
Temperature		K °C °F		select units
Flow		l / hr m^3 / s ft^3 / s cm^3 / min ml / min ml / s l / s		select units
Current		A uA mA		select units
Voltage		V mV		select units
Resistance		Ohm kOhm		select units
Angle		Rad °		select units
Wavelength		nm		select units
Moisture		dew pt °C ppm		select units

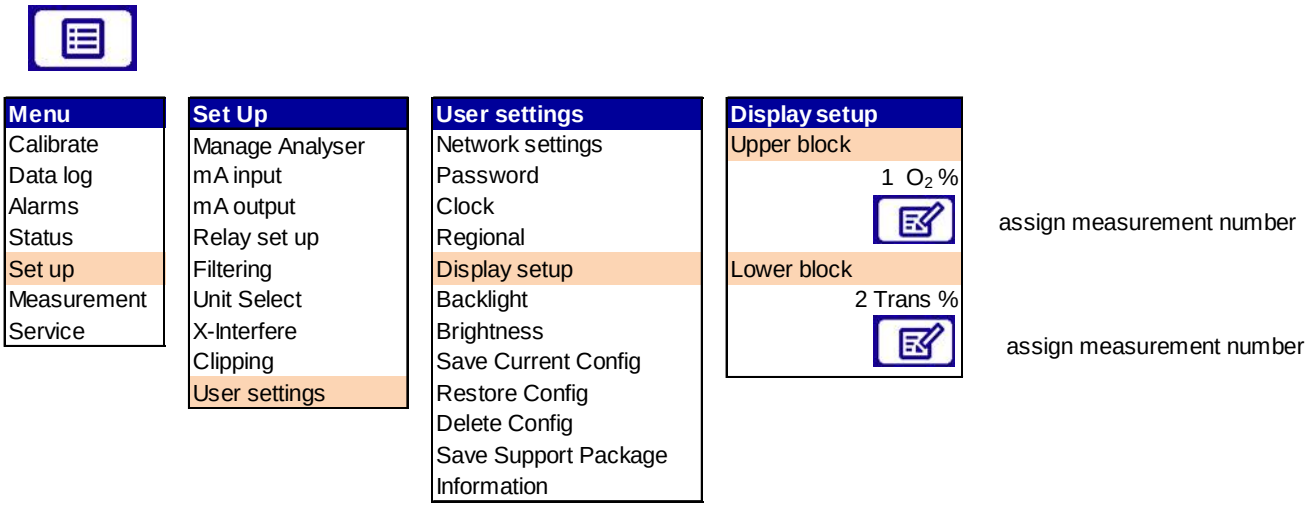
Figure 4-9: Regional settings sequential menu

4.3.5 Display set up

The live measurement screen is divided into 2 blocks, an upper block and a lower block. You can select which block will display a measurement reading.



To assign a measurement reading to upper and lower display blocks



Note: *There is facility to assign up to 5 measurements although only 2 may be displayed on screen at any one time.*

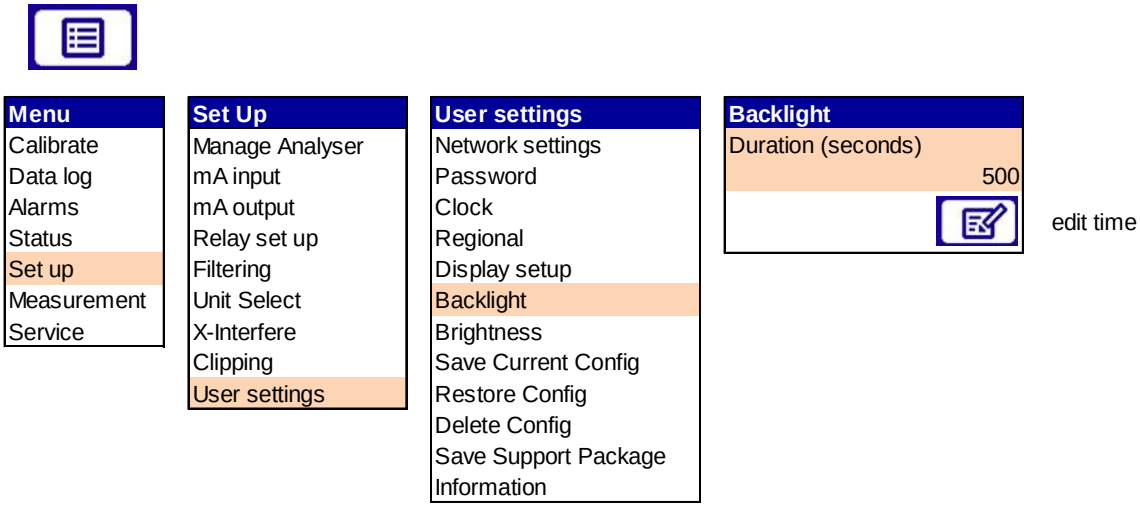
4.3.6 Adjust screen backlight timer

The screen is backlit. If you do not press a soft-key the backlight stays lit for the pre-set 'back light time' it will then switch off.

Note: *The timer is reset each time you press a soft-key, so the backlight remains on for the set time after the last soft-key press.*

To adjust screen backlight time

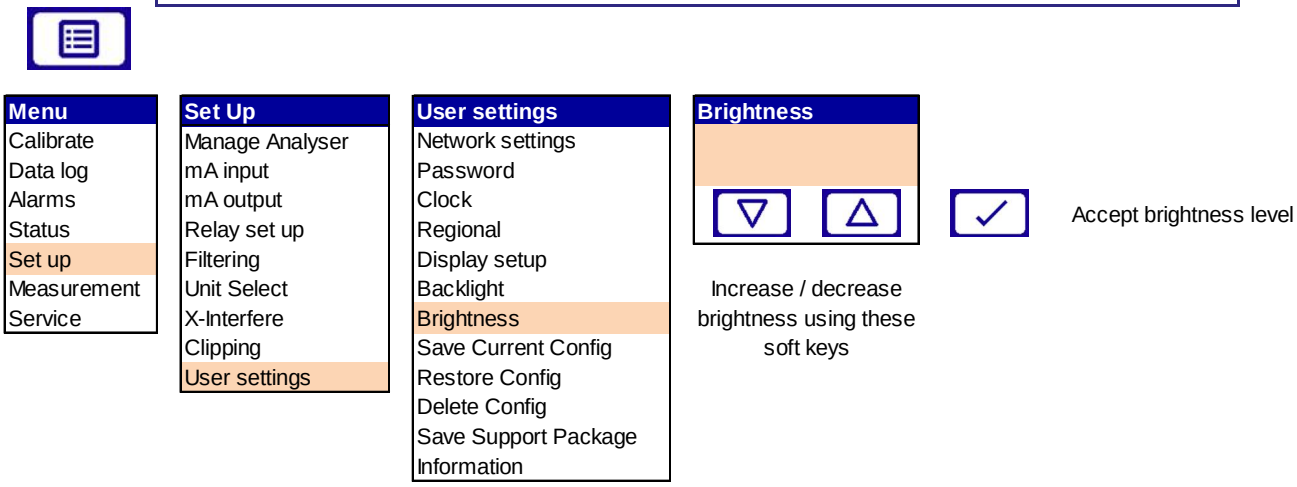
> ***Hint:*** *You can set the backlight duration from 0 to 999 seconds. If you want to leave the backlight permanently ON, set the backlight duration to 0 seconds.*



4.3.7 Adjust screen brightness

To adjust screen brightness

> ***Hint:*** *Press and hold the ▽ or △ soft-keys to quickly adjust the brightness settings.*



> ***Note:*** *When you select the brightness setting the screen displays a non-editable alpha / numeric screen pattern.*

4.3.8 Save / Load

Analyser (non-sensor) configuration

This information tells the unit “What product am I?” “What facilities are enabled?” and also stores user settings (alarm levels, mA output config, Network etc.).

The Configuration can be managed through the “User setting” menu

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Set Up
Manage Analyser
mA input
mA output
Relay set up
Filtering
Unit Select
X-Interfere
Clipping
User settings

User settings
Network settings
Password
Clock
Regional
Display setup
Backlight
Brightness
Save Current Config
Restore Config
Delete Config
Save Support Package
Information

Note: *This file can be saved / restored only to / from MicroSD card by Supervisor level user.*

Note: *It is advisable to leave a backup copy on an SD Card present in the Instrument. Although this file will not normally be used, if the instrument should lose its configuration at re-boot re-load it will automatically reload its configuration from the file on the SD card.*

Hint: *The configuration file can be transferred between instruments to minimise multiple analyser setup time.*

4.3.9 Information

The information page provides key data for the analyser:

- Instrument serial no.
- Control unit firmware
- Display adaptor firmware
- Analog output firmware
- Option board firmware (if fitted)
- Transmitter firmware
- Receiver firmware

4.4 Configure mA outputs

4.4.1 mA outputs

There is 1 mA output provided on the standard analyser configuration. An additional mA output is available if the analyser is supplied with an ‘options PCB’.

Each output can be assigned to one of 4 measurement properties or the transmission.

The mA output provides a constantly updated output, in which the current represents the value of the measurement.

The analyser allows you to specify two separate range configurations for the mA outputs, range 1 and range 2.

The mA output range can be selected as:

0 – 20 mA	0 mA represents the lowest sample measurement and 20 mA represents the highest sample measurement in the range specified
4 – 20 mA	4 mA represents the lowest sample measurement and 20 mA represents the highest sample measurement in the range specified

You can also specify how the mA output operates during calibration, a fault condition and under-range conditions.

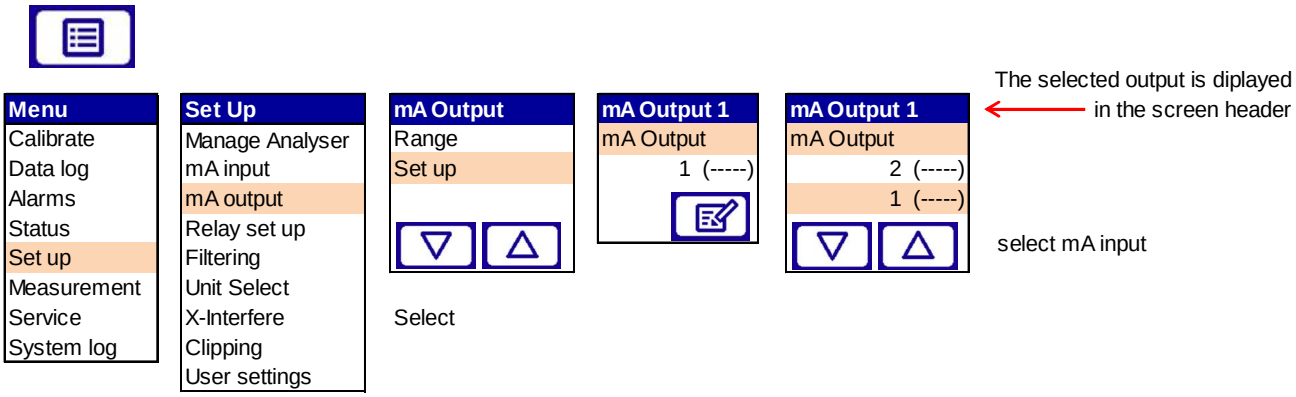
Note: *For safety critical applications or applications where the fault relay is not being used, configure the mA output to 4 -20 mA and jam low (default setting) for safety and to prevent any analyser faults going undiagnosed. This is the safest mode of operation.*

The mA output parameters that you must set up are illustrated in the sequential menu table below:

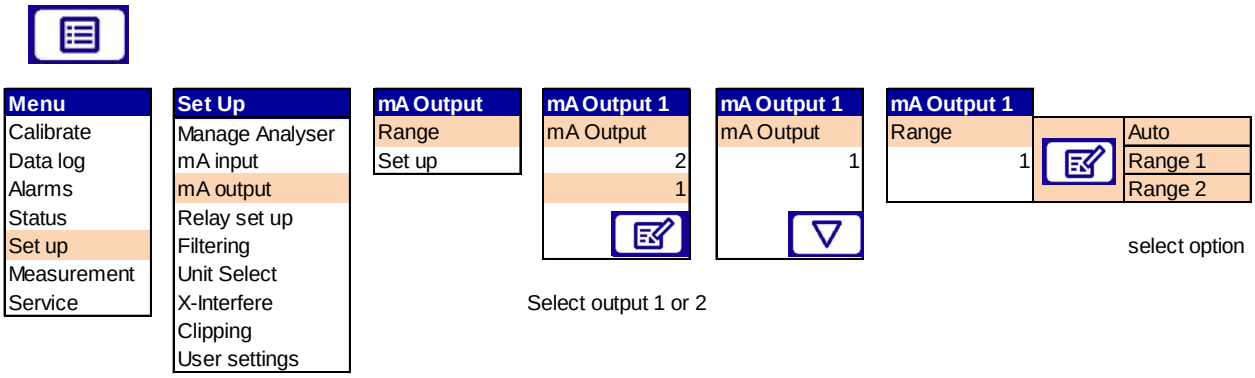
mA Output						
Level 3	**Level 4**	**Level 5**	**Level 6**	**Level 7**	**Level 8**	
mA Output	Range	mA Output		mA Output 1 mA Output 2		*select Output channel*
		Range		Auto Range 1 Range 2		
	Setup	mA Output		mA Output 1 mA Output 2		*select Output channel*
		Measurement (1 or 2)		1. O2 2. Temp 3.- 4.-		*select option*
		Lower Transition		0		*edit value*
		Upper Transition		0		*edit value*
		Range 1 low level		0.000		*edit value*
		Range 1 high level		0.000		*edit value*
		Range 2 low level		0.000		*edit value*
		Range 2 high level		0.000		*edit value*
		During calibration		Follow Freeze		*select option*
		Jam condition		None High Low		*select option*
		mA output range		0-20 mA 4-20 mA		*select option*
		Under range		4.000 mA		*edit value*
		Range change point		0.000		*edit value*
		Hysteresis		0.000		*edit value*

Figure 4-10: mA output sequential menu

To select either mA output 1 or 2



To select the range for either mA output 1 or 2



Note: *The option you select determines the mA output range associated with a measurement.*

Range	Function
Auto	The output automatically switches between range 1 and range 2 depending on sample measurements
Range 1	The output is set to use range 1
Range 2	The output is set to use range 2

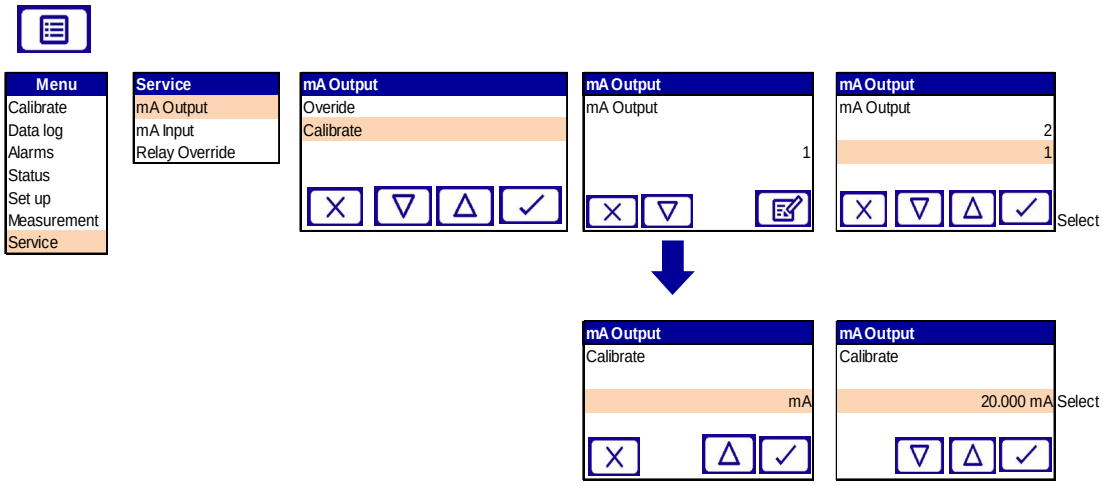
Note: *When more than one range is used, range 2 needs to be set to the higher range.*

Once the mA Output channel and range has been selected the final configuration parameters will need to be set.

Explanation summary of the mA output parameter settingsParameter	Function
Measurement	Selects 1 of 4 measurements properties to assign
Hot Measurement	Select the measurement which is to be reported above upper transition set point
Lower Transition	Lower set point temperature for a linear averaging transition switch between 2 measurement outputs
Upper Transition	Upper set point temperature for a linear averaging transition switch between 2 measurement outputs
Range 1 low level	Range 1 lowest sample measurement
Range 1 high level	Range 1 highest sample measurement (span)
Range 2 low level	Range 2 lowest sample measurement
Range 2 high level	Range 2 highest sample measurement
During calibration	The option you select determines how the mA output operates during calibration
	Freeze the mA output freezes at its last output level as soon as the calibration screen is displayed The output only updates to reflect subsequent measurements when you exit the calibration screen
	Follow the mA output value reflects the measurement value during calibration
mA Output range	0 – 20 mA 4 – 20 mA ***Default setting. Fail safe operation***
Under range	Any value below 4 mA This is only available if the 4 to 20 mA output range is selected. It sets the lowest output current during normal operation and allows negative gas concentrations to be monitored through the mA output For example, with an under range setting of 3.8 mA, the mA output can be less than 4 mA (indicating a zero gas concentration), down to a minimum of 3.8 mA, where an output between 3.8 mA and 4 mA indicates a negative gas concentration
Range change point	The range change-point This is only available when auto range is selected
Hysteresis	The range change hysteresis This is only available when auto range is selected

4.4.2 Calibrate the mA outputs

To calibrate the mA outputs



Select the mA output to be calibrated 1 or 2 and scroll down to calibrate screen. As soon as the mA output calibrate screen is shown, the nominal mA output value is set to 20 mA:

Use your control/monitoring equipment (connected to the analyser) to analyse the actual output value.

Use the soft keys to increase or decrease the actual output value until your control / monitoring equipment indicates 20 mA output.

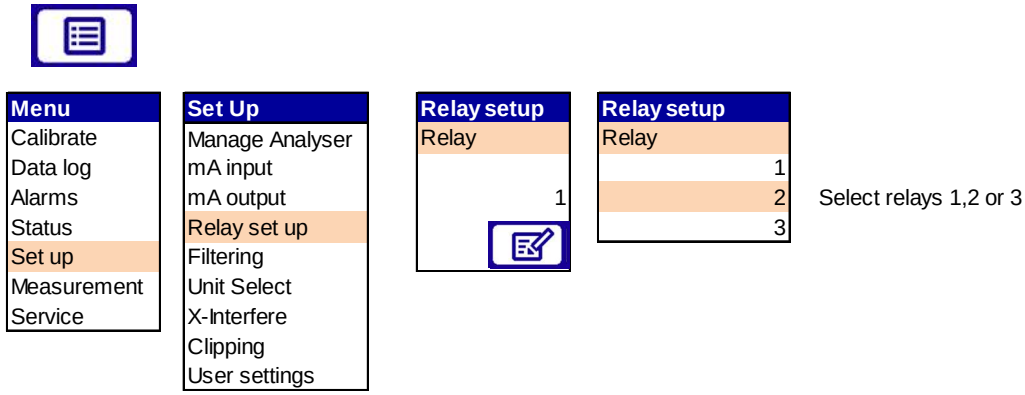
When the mA output has been correctly calibrated, press the soft key, the mA output service screen will then be displayed again.

Note: *The actual mA output value is controlled from the mA output calibrate screen as long as the screen is displayed. As soon as the mA service screen is no longer displayed, the mA output value will be updated to reflect the corresponding measurement.*

4.5 Configure relay outputs

There is 1 relay provided on the standard analyser configuration. 2 additional relays are available if the analyser is supplied with an 'Options PCB'.

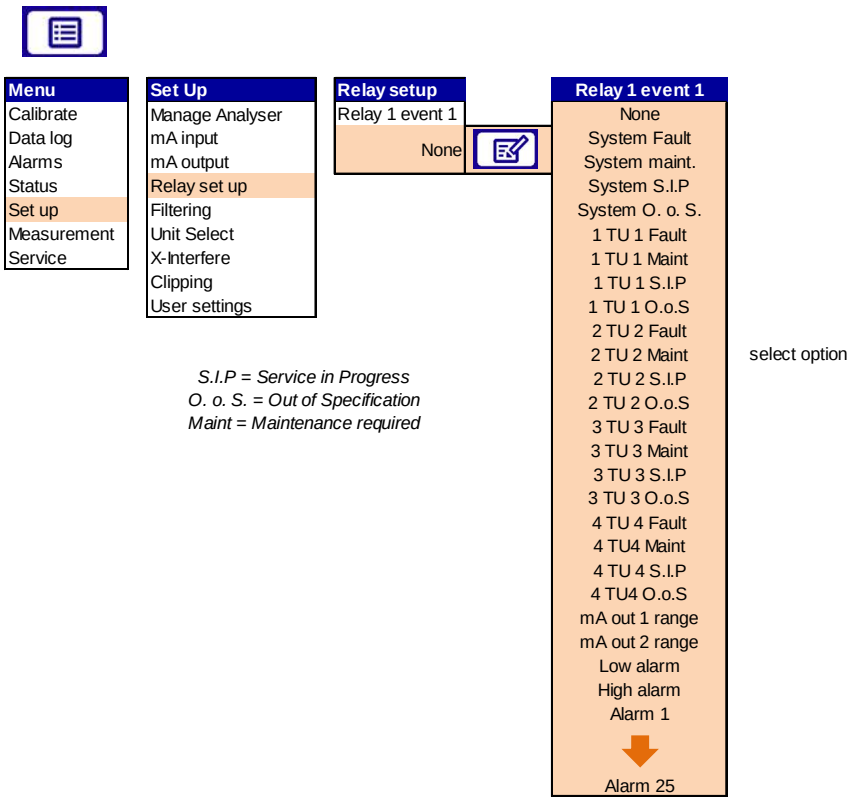
To select relay 1, 2 or 3



Once the relay has been selected it will need to be configured.

Relay event options

The relay event options that you can set are illustrated in the menu table below:

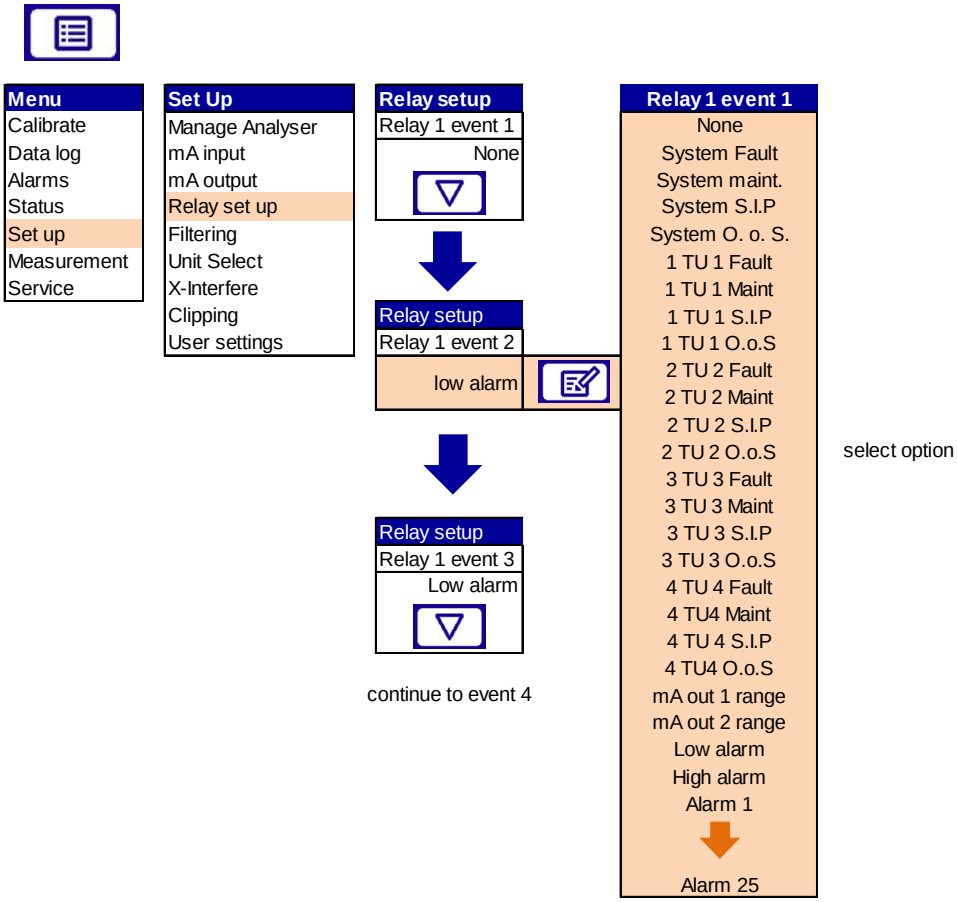


S.I.P = Service in Progress
O. o. S. = Out of Specification
Maint = Maintenance required

Explanation summary of the relay event options settings

Option	Meaning
None	None
System Fault	Generic – Non specific Analyser in Fault
System Main	Generic – Non specific Analyser requires maintenance
System S. I. P	Generic – Non specific Service in Progress
System O o S	Generic - Non specific System out of specification
1 TU 1 Fault	Measurement 1 – Fault specific to measurement 1
1 TU 1 S. I. P	Measurement 1 – Service in progress specific to measurement 1
1 TU 1 O o S	Measurement 1 – Measurement 1 out of specification
	Note: *There are up to 4 measurements available.* *1 TU to 4 TU.*
mA out 1 Range	Indicates which scaling range the Range 1 mA output uses
mA out 2 Range	Indicates which scaling range the Range 2 mA output uses
Low Alarm	1 or more Low Alarm thresholds have been exceeded
High Alarm	1 or more High Alarm thresholds have been exceeded
Alarm 1 to 25	User configurable alarms that can be assigned to a relay event

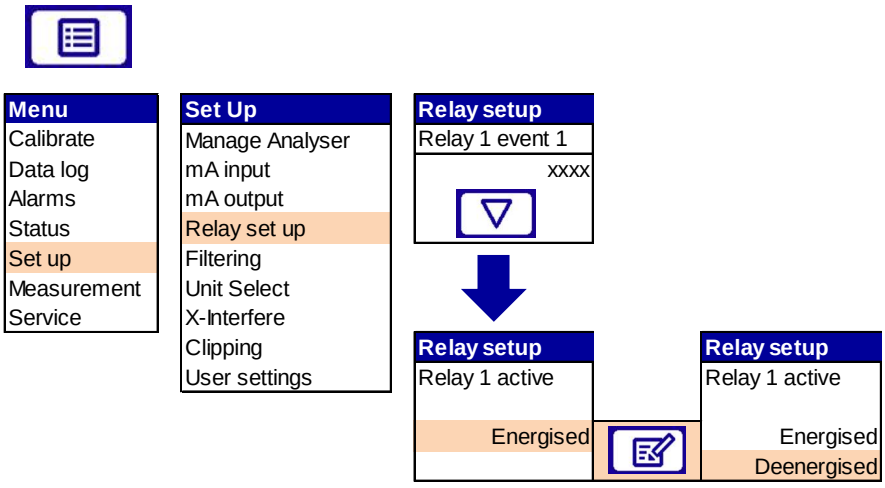
Repeat this option selection process for each of the 4 available events.



Note: *If you have more than 1 relay this process will need to be repeated for each.*

When the 4 events have been assigned the relay coil state will need to be set.

To set the relay coil state

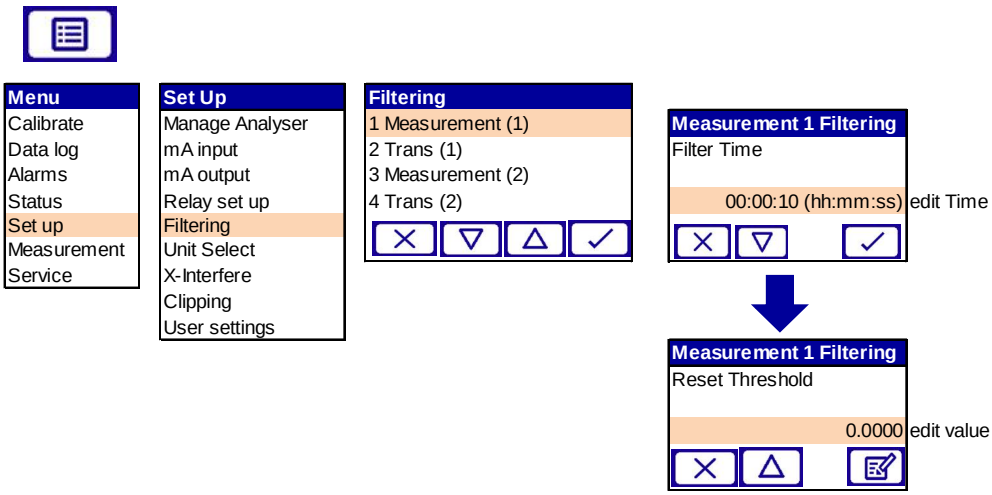


Note: *You can specify the relay coil state (energised or de-energised) to meet any particular application requirement. For example, Relay 1 coil is de-energised during an active status when a measurement or analyser fault is detected. Therefore if the power to the analyser fails, or the relay cable is disconnected, a fault is raised because this is electrically the same as if Relay 1 is de-energised. This is a 'fail-safe' situation.*
In some applications it is preferable that the relay is energised in an active status.

4.6 Filtering

A rolling average filter can be applied up to 24 hours for measurements and transmission values.

To set filter times

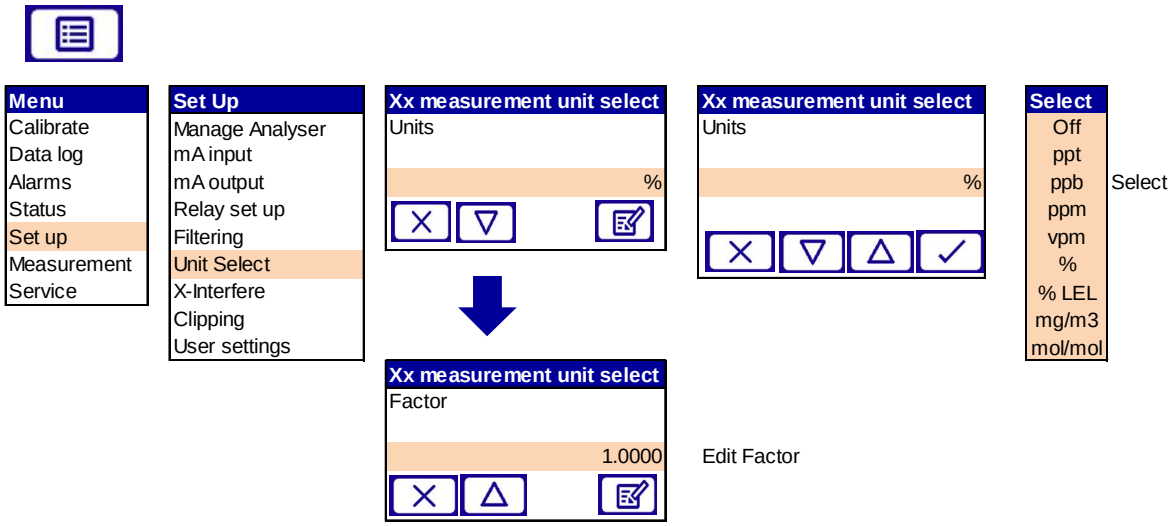


4.7 Unit select

You can change the measurement units shown on the display (and output). The following display units are supported:

Units	Meaning
%	volume %
ppt	parts per trillion
ppm	parts per million
vpm	volume parts per million
%	volume %
mg/m3	mg m-3 (milligrams per normal cubic metre)
mol/mol	mols per mol (or moles per mole)
% LEL	volume % of the Lower Explosive Limit

To set measurement units



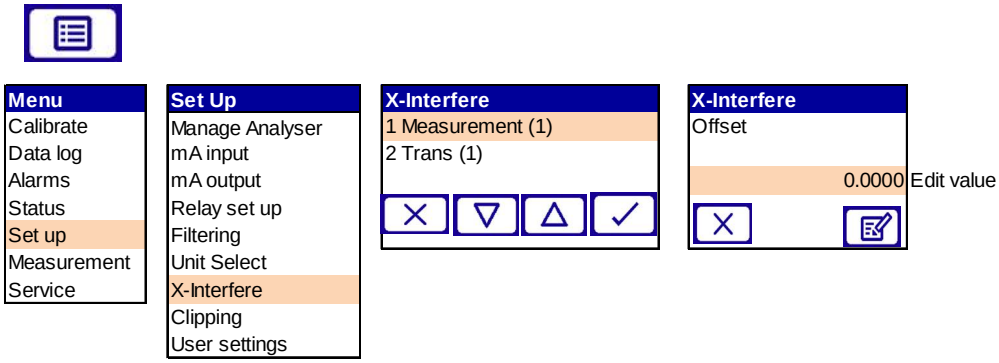
Note: *Selecting the Units ONLY changes the displayed units, the correct "Factor" should be entered to convert the value to the correct figure.*

A list of conversion factors is listed in Section 12.

4.8 X-Interference offset

When set the measurement value is offset by the specified value.

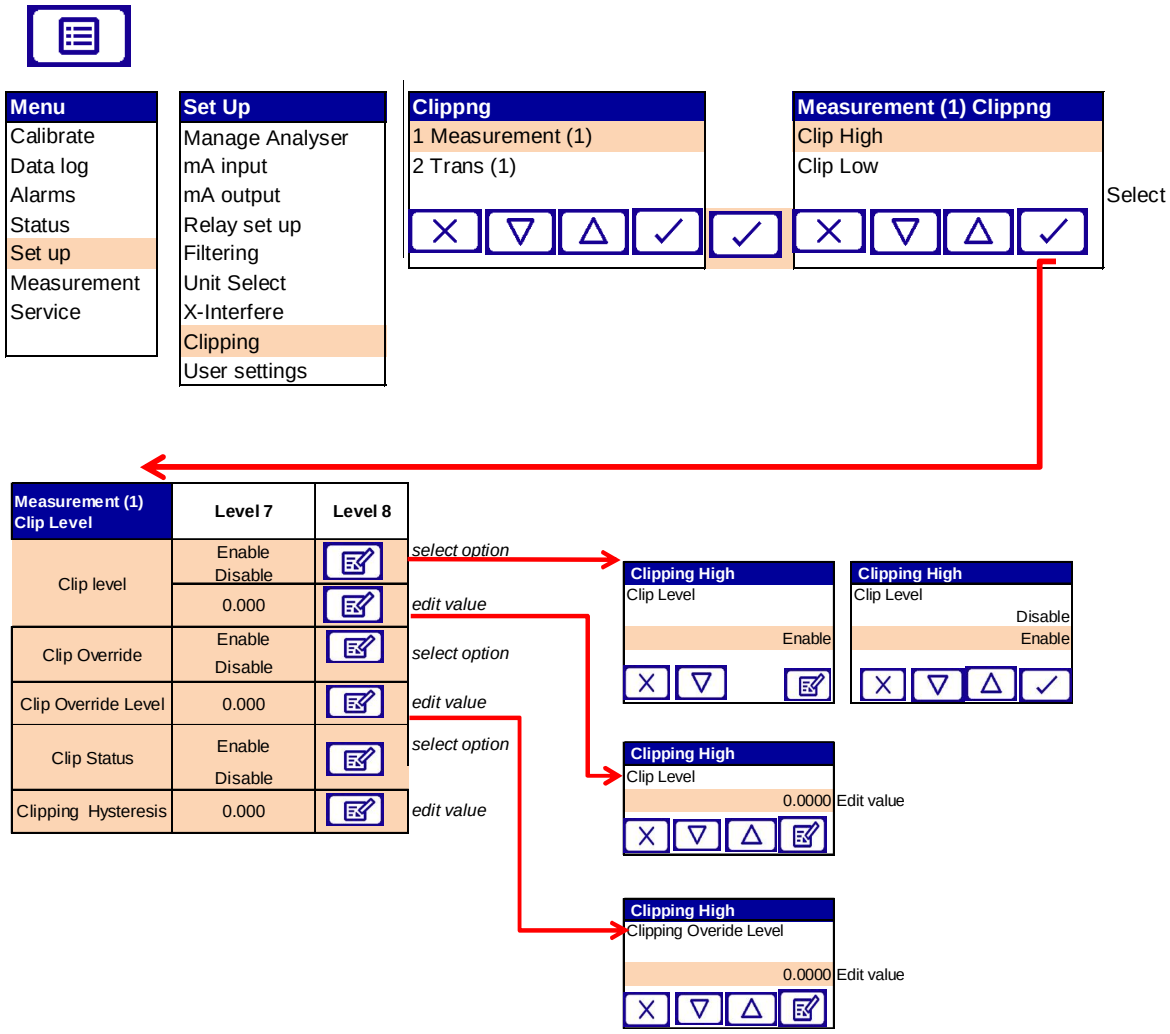
To set the X-interference offset



4.9 Clipping

When enabled, clipping is applied to all instances of a measurement, including displayed values, mA output values and values accessible through digital communications.

4.9.1 To set up clipping



4.9.2 Clip level

Clip level is the threshold at which measurements are clipped enter the clipping levels in measurement units.

4.9.3 Clip override

It is possible for the user to specify levels beyond which the measurement shall cease to be clipped. The default levels are 0.

4.9.4 Clip status

When enabled the facility is provided to raise an “Operation Out of Specification” status condition whenever the measurement value exceeds an enabled clipping level. This status shall persist if a clipping override level is exceeded.

4.9.5 Clipping Status Hysteresis

The user is able to enter a hysteresis value, in measurement units. This value is applied to the clipping level such that the measurement must move out of the clipping region by more than the hysteresis amount before the status indication is cleared. The hysteresis value default level is 0.

4.10 Configure measurement alarms

To view active measurement alarm status:

Alarms
Unlatch
Active
Set up
Follow
History

Active Alarm
None

4.10.1 Alarm modes and levels

25 alarms are available to be allocated for the gas measurements or transmission.

You can configure each alarm to operate in one of three modes:

Alarm mode	Operation
None	An alarm is raised when a sample measurement is lower than the pre-set alarm level
Low alarm	An alarm is raised when a sample measurement is lower than the pre-set alarm level ***Note:*** *An alarm is only activated during calibration if you have set the alarm 'Follow' option to Yes*
High alarm	An alarm is raised when a sample measurement is higher than the pre-set alarm level ***Note:*** *An alarm is only activated during calibration if you have set the alarm 'Follow' option to Yes*

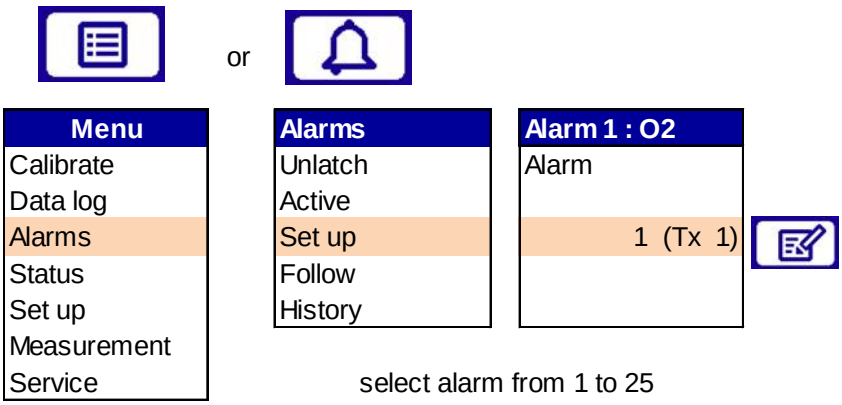
When an alarm is raised, the following things occur:

- An alarm icon is shown on the measurement screen. The number (1 or 2) in the icon identifies the alarm that has been triggered.
- The alarm LED on the front of the analyser flashes on and off.
- If the alarm is assigned to a relay, the appropriate alarm relay is triggered.

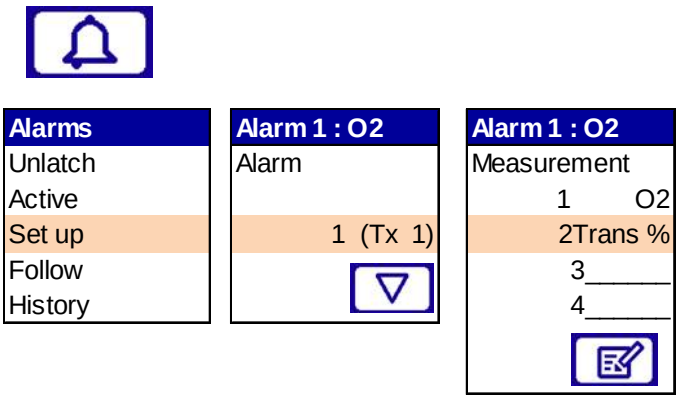
4.10.2 Configure the measurement alarms

To select an alarm

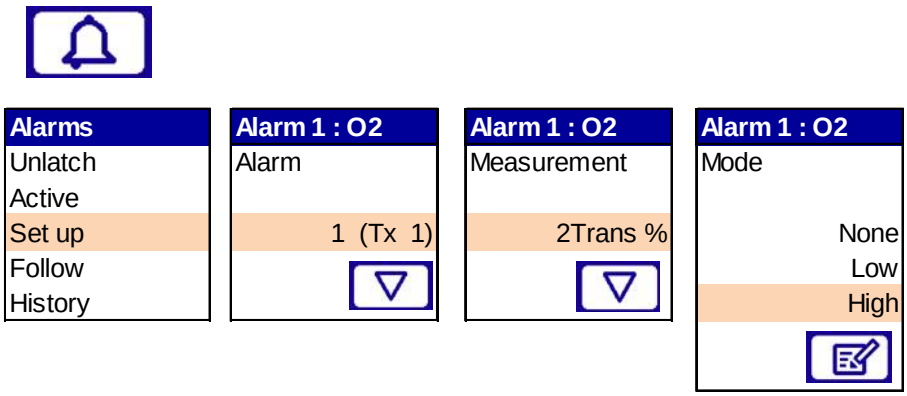
(There are 25 alarms to select from)



To assign alarm to a measurement



To select alarm mode



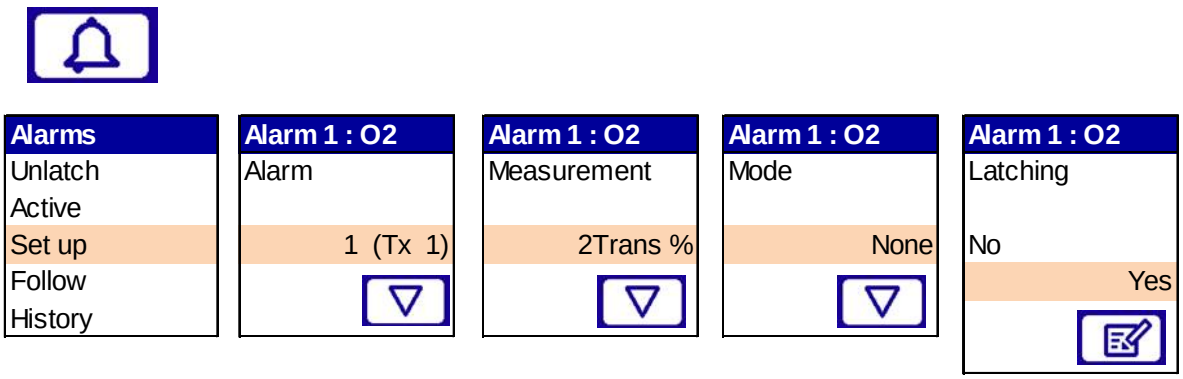
Select mode

4.10.3 Latching and non-latching alarms

You can configure the two measurement alarms to be either latching or non-latching:

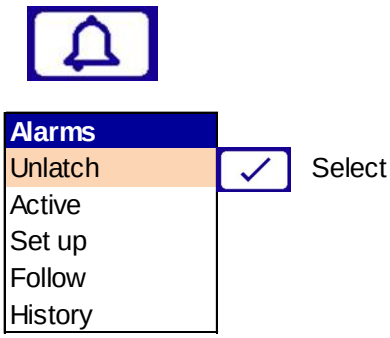
Alarm setting	Meaning
Latching	Once an alarm is raised, it remains activated until the alarm is manually unlatched
Non Latching	Once an alarm is raised, it remains activated only until a subsequent 'good' sample measurement is made (i.e. one that would not trigger an alarm). The alarm condition is then reset

To select a latching mode



select mode

4.10.4 Unlatching



On selecting the currently latched alarms are unlatched

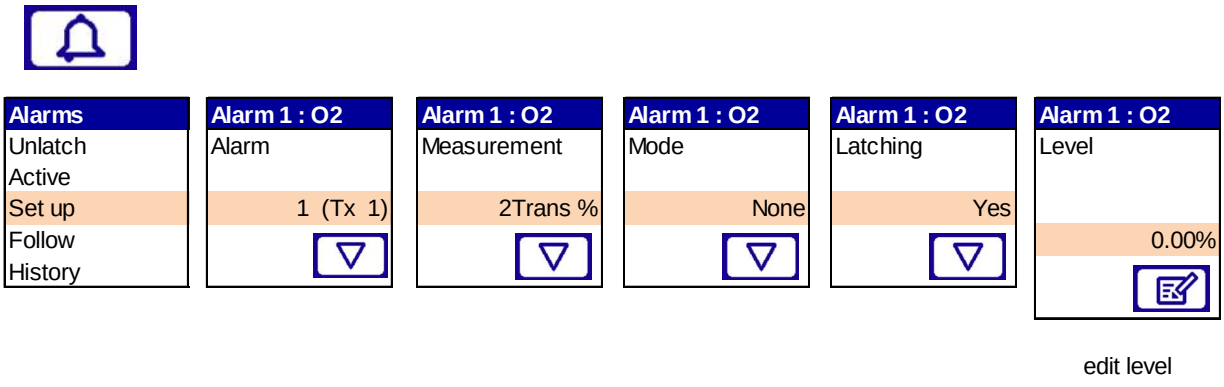
4.10.5 Hysteresis levels

The hysteresis level associated with a measurement alarm determines when an activated condition is deactivated. This depends on the alarm mode:

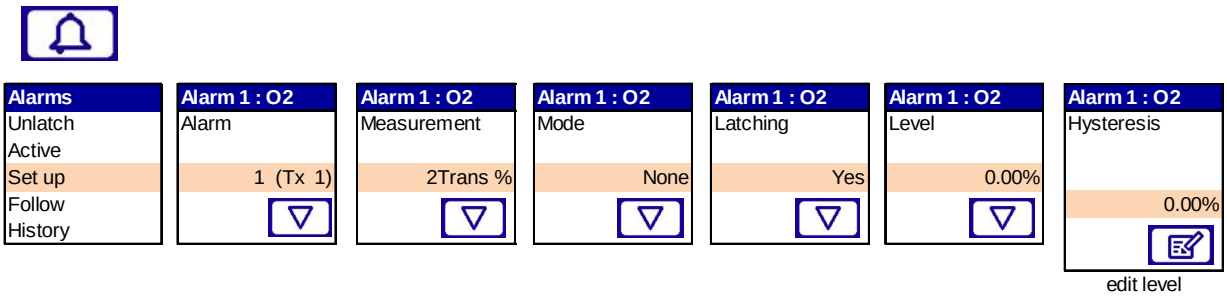
Alarm mode	Hysteresis effect
Low alarm	Once a low alarm condition is activated, the alarm condition is not deactivated until a sample measurement is above: Alarm level + hysteresis level
High alarm	Once a high alarm condition is activated, the alarm condition is not deactivated until a sample measurement is below: Alarm level - hysteresis level

Example: If a low alarm has an alarm level of 18% and a hysteresis level of 1%, the alarm is activated when a sample measurement is <18% and the alarm is not deactivated until a sample measurement is >19%.

To set alarm level



To set hysteresis



Hint:	*If you configure one measurement alarm as low and the other as high, make sure that the high alarm and hysteresis levels are higher than the low alarm and hysteresis levels. If you do not, the analyser can be permanently in an alarm condition until you correct the levels.*

Hint:	*Make sure that the measurement alarm and hysteresis levels are not too close to the expected sample measurements. If your sample gas concentrations contain minor variations that are acceptable, spurious alarms will be reduced.*

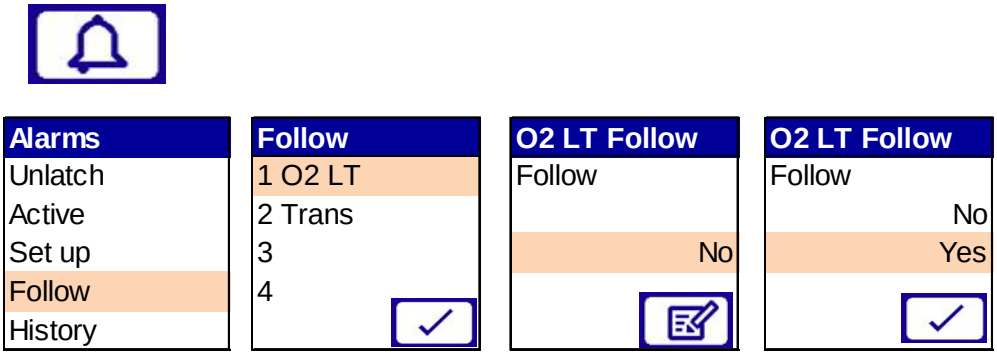
4.10.6 Follow option

Each measurement has a 'Follow' option:

If the 'Follow' option is set to 'No', the alarm will be inhibited during calibration.

If the 'Follow' option is set to 'Yes', the alarm will not be inhibited during calibration.

To set follow option



4.10.7 History (alarm)

Alarms
Unlatch
Active
Set up
Follow
History

History						
Level 2	**Level 3**	**Level4**	**Level 5**	**Level 6**	**Level7**	
Veiw History	✓					*scroll*
Export History	✓	Erase Existing	✓	Start Export	✓	*export*
Clear History	✓	Yes No	✓			*select option*

View history

The View history page enables the current log to be scrolled through to see each event in the alarm history.

Export history

The current alarm history log will be exported to the selected log media.

Clear history

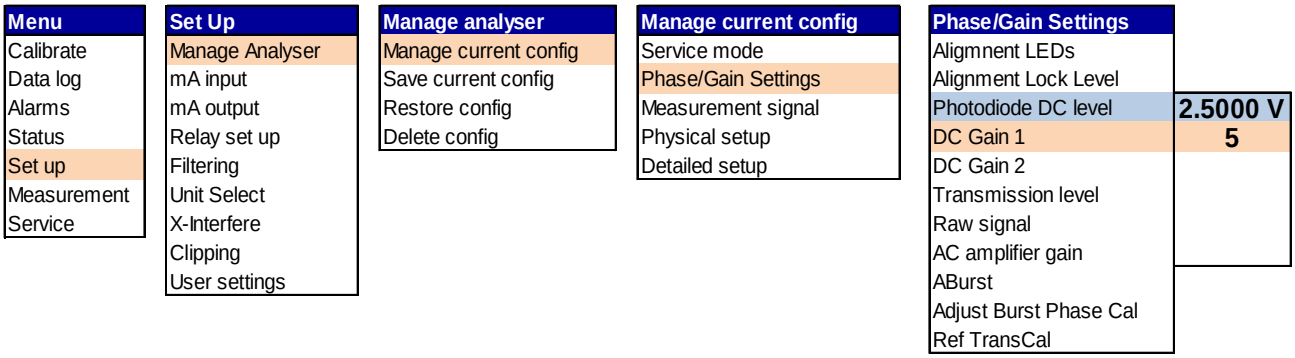
Clear history will clear the current alarm history log stored in the selected media.

Note: *You will be asked to confirm the action before clearing.*

4.11 Gain and phase settings

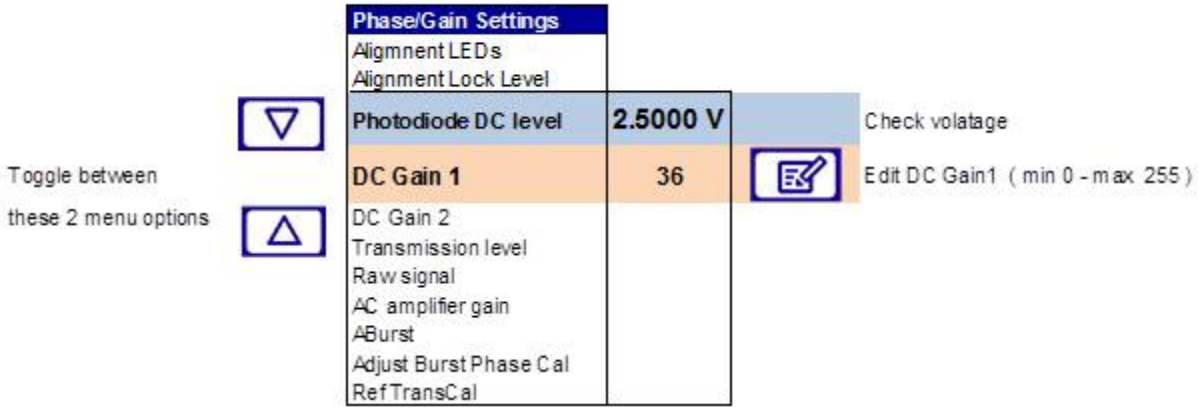
DC gains 1 and 2 enable the signal to be optimised for the specific application; in addition the phase of the measurement signal and reference burst must also be optimised.

4.11.1 To change photodiode DC Level

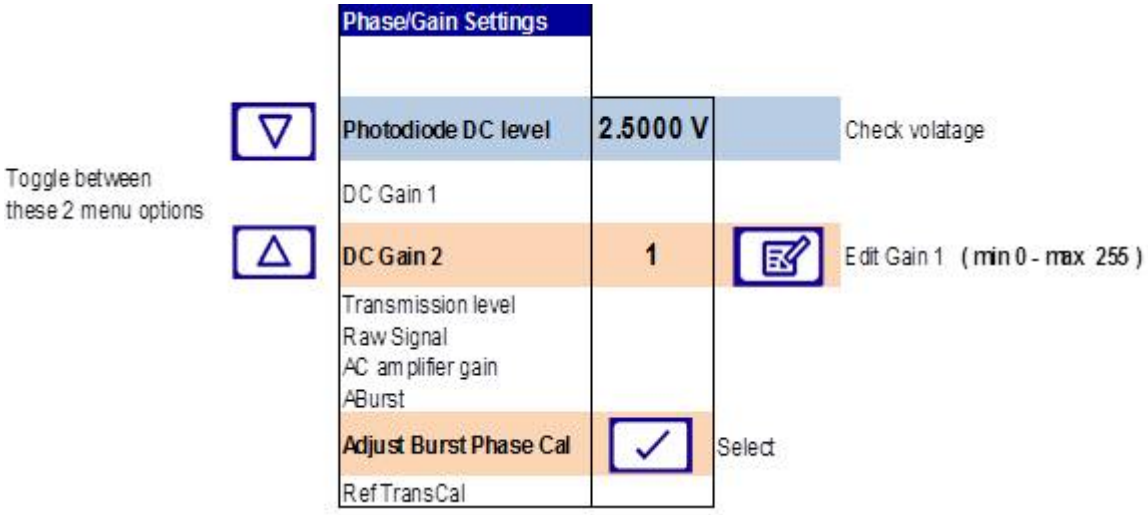


DC Gain 1 and DC Gain 2 is set during manufacturing and should only be changed by a Servomex trained engineer.

4.11.2 To adjust DC Gain 1 settings

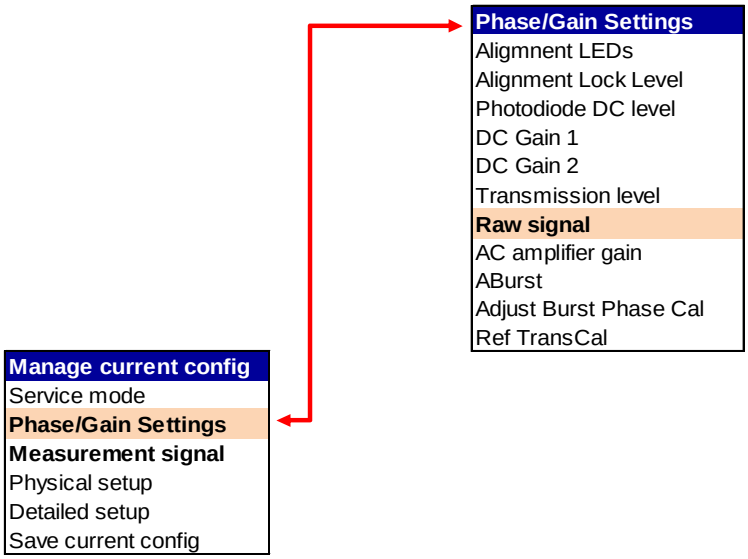


4.11.3 To adjust gain 2 settings



4.11.4 Raw signal graph

To view the raw signal graph which shows the raw gas and ABurst signal and to check that both signals are not above 100,000 counts or the shape has a flat top.



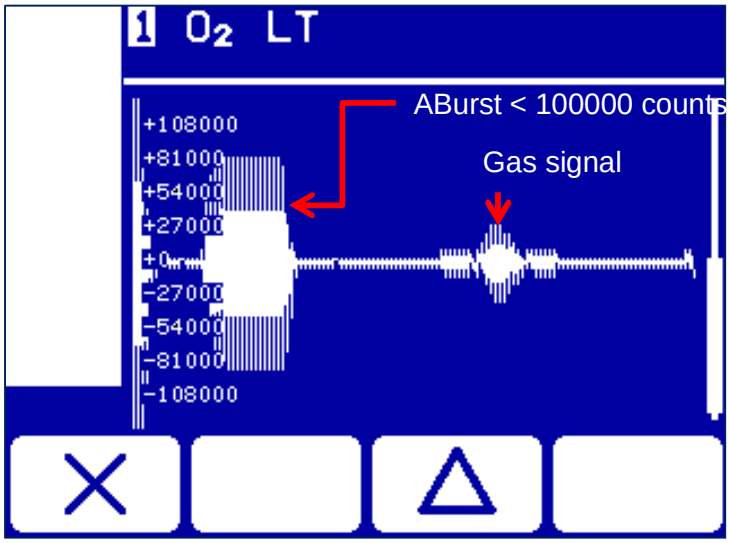


Figure 4-11: Raw signal graph example

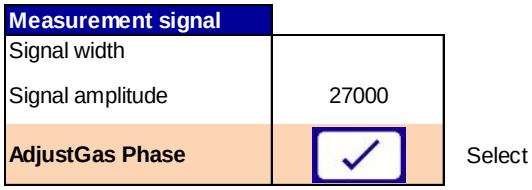
When the gain adjustment and laser alignment have been optimised no further adjustments should be required.

4.11.5 Adjust burst phase cal

When the correct DC Voltage is achieved it is possible to synchronise the phase timing of the reference burst signal ref Figure 4-11(ABurst) by selecting ‘Adjust Burst Phase Cal’.

4.11.6 Adjust gas phase

Synchronise the phase timing of the measurement signal by selecting ‘Adjust Gas Phase ’



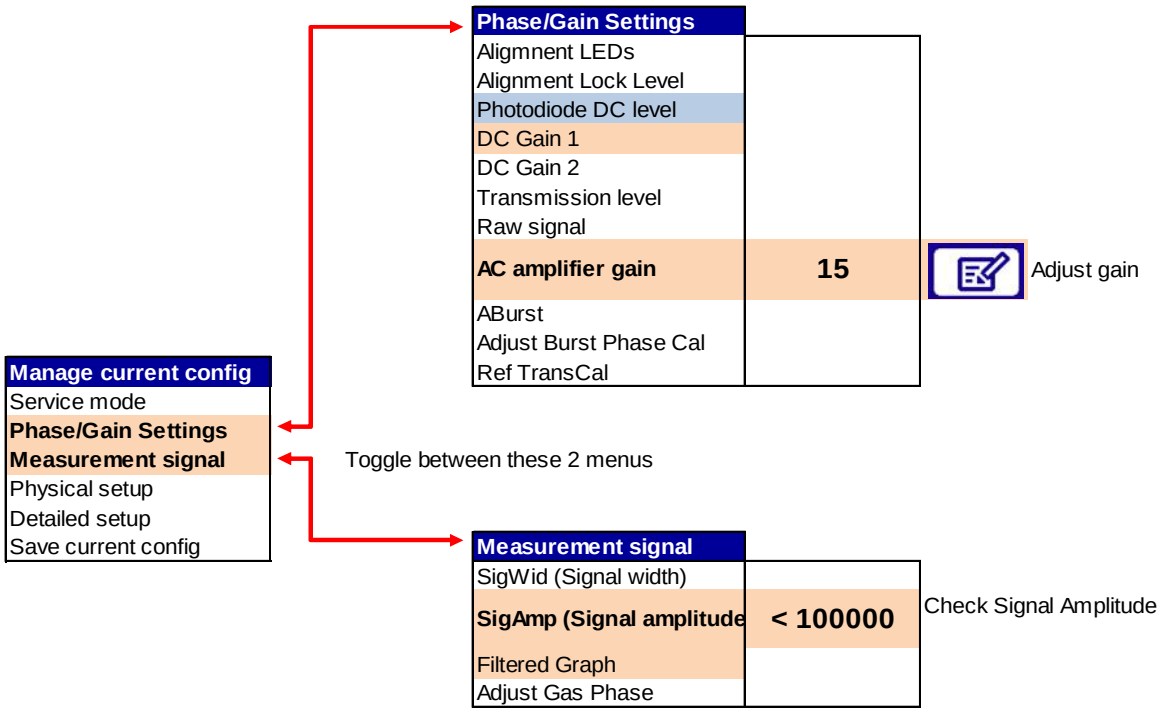
In the event the application has a particularly high gas absorption level it may be required to adjust the AC amplifier gain.

4.11.7 To adjust AC amplifier gain (if required)

You need to adjust the AC amplifier gain (up or down) to achieve signal amplitude below 100000 counts and graph a clear signal peak.

Do not attempt to adjust AC amplifier gain unless you are trained and competent.

Adjustment should only be done while the target gas is present at span concentration level.



When an adiquate signal amplitude is achieved check the signal filtered graph shape. The measurement signal must then be optimised by selecting ‘Adjust Gas Phase ref.4.11.5

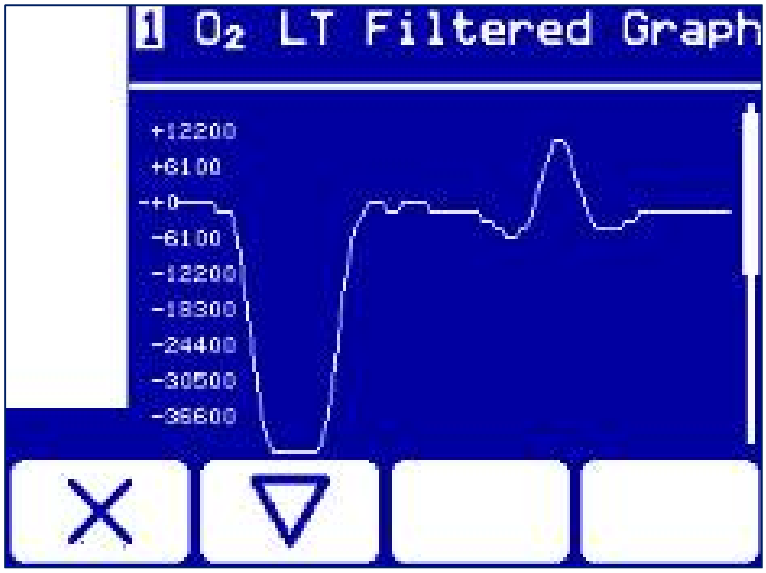


Figure 4-12: Filtered Graph example

Note: *For trace level applications the peak may appear as a flat line.*

5 General analyser information

5.1 Status

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Status						
Level 2	**Level 3**	**Level4**	**Level 5**	**Level 6**	**Level7**	
Status	✓					*veiw*
Veiw History	✓					*scroll*
Export History	✓	Erase Existing	✓	Start Export	✓	*export*
Clear History	✓	Yes No	✓			*select option*

Figure 5-1: Status sequential menu

5.1.1 Status

Allows you to view the current status of the analyser.

Each message status screen shows:

Date and time of message

The message type ("Fault", "Maintenance rqd" or "Service in Progress")

The message itself

5.1.2 View history

The View history page enables the current log to be scrolled through to see each event in the history.

Each message shows:

Date and time of message

The message type ("Fault", "Maintenance rqd" or "Service in Progress")

The message itself

The status of the entry "ON" or "OFF"

5.1.3 Export history

The current stored history log will be exported to the selected log media.

5.1.4 Clear history

Clear history will clear the current history log stored in the selected media. You will be asked to confirm the action before clearing.

5.2 Measurement

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Status				
Level 2	**Level 3**	**Level4**	**Level 5**	
Gas Sensor	✓	Measurement XX Transmission XX	✓	*scroll*
mA Input	✓			*srcoll*
Control Unit Power	✓			*srcoll*
Graphs	✓			*srcoll*

5.2.1 Gas sensor

Allows you to view the current status of the analyser's gas sensor, measurements for any mA input devices and transmission level.

Note: *Parameters cannot be changed only viewed*

5.2.2 mA input

Provides information on mA input devices:

Measurement and units

Calibrated current

Filtered current

Unfiltered current

5.2.3 Control unit power

Provides information on Input supply power and 12 V rail.

5.2.4 Graphs

Shows raw data and filtered graphs for each measurement.

6 Data Log

6.1 Basic data log

The Basic data log function enables the measurement value and transmission value to be recorded and stored for future recall. The log can be exported to internal memory or SD card.

An exported data log contains a limited set of measurements, useful to monitor stability over a period of time.

> ***Hint:*** *Values are separated by semicolons for ease of plotting and analysis.*

> ***Hint:*** *Data log filename is 'datalog.txt' on microSD card*

Example Data log:

```
Servomex 07931A1/000051 ; O2 LT ; Trans ; Temperature ; Pressure

1.7 ; 24/04/15 ; 11:50:07 ; O2 LT ; 20.76 ; % ;  ;  ; Trans ; 101.08 ; % ;  ;
; Temperature ; 0.00 ; degC ;  ;  ; Pressure ; 0.00 ; bar ;  ;

1.8 ; 24/04/15 ; 11:50:08 ; O2 LT ; 20.76 ; % ;  ;  ; Trans ; 101.08 ; % ;  ;
; Temperature ; 0.00 ; degC ;  ;  ; Pressure ; 0.00 ; bar ;  ;

1.9 ; 24/04/15 ; 11:50:09 ; O2 LT ; 20.76 ; % ;  ;  ; Trans ; 101.08 ; % ;  ;
; Temperature ; 0.00 ; degC ;  ;  ; Pressure ; 0.00 ; bar ;  ;
```

6.2 Detailed data log

The Detailed data log function enables the transducer communications for a given time period to be recorded and stored. The log can be exported to internal memory or SD card and used to examine detailed transducer communications.

Note: *The detailed log is not enabled by default*

Note: *The detailed log is not interval based - it is real time, therefore data sets can get very large and therefore overwrite option is best*

Note: If logging cannot start or continue due to a MicroSD card issue a Maintenance Required status, Data Logging error will be raised.

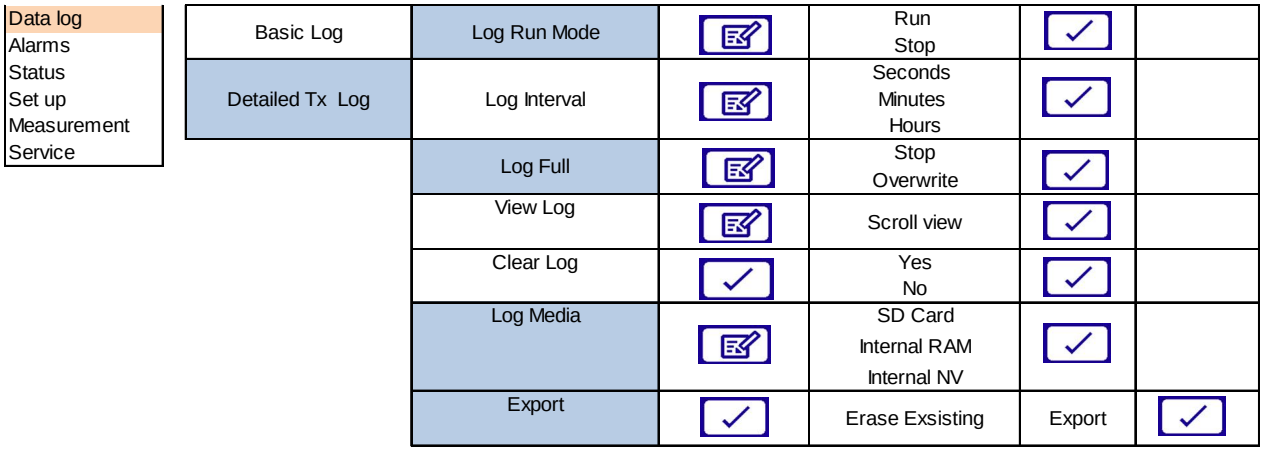


Figure 6-1: Data log sequential menu

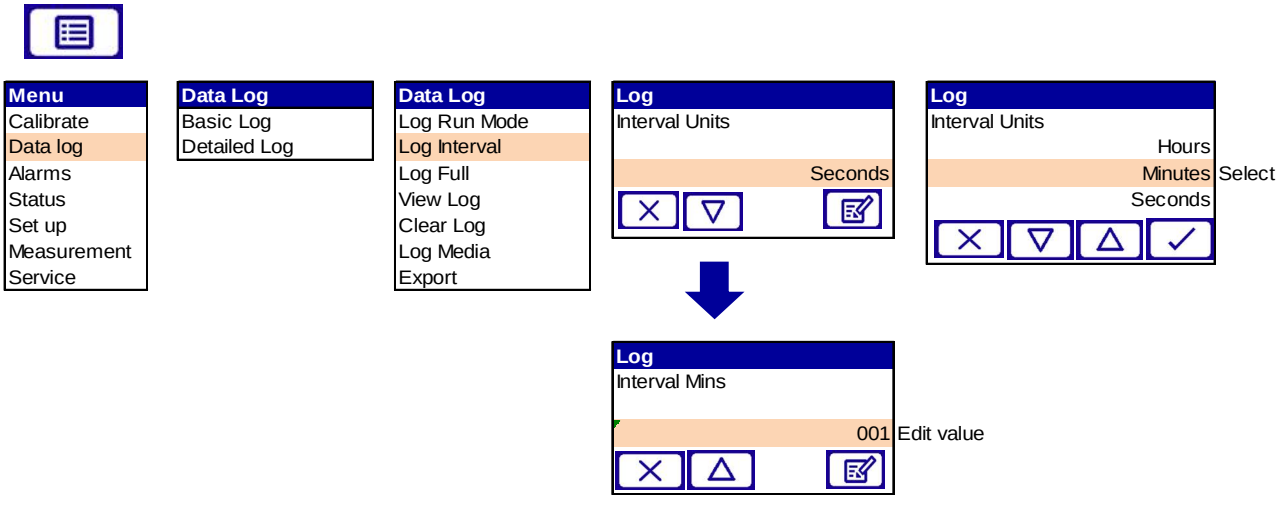
6.3 Log run mode

The log can be set to run or stop. Operator password is required to change status.

Note: *When in "Run" mode it is not possible to view, clear, export or change the log media.*

6.4 Log intervals

The log interval sets the rate at which the data is logged.



6.5 Log full

When the internal log memory is full there are 2 options available:

Log full	Effect
Stop	The data in the log will be saved and no further data recorded
Overwrite	The data in the log will be progressively overwritten (oldest entry overwritten first) until the log is stopped

6.6 View log

The view log page enables the current log to be scrolled through so each data point can be viewed.

6.7 Clear log

Clear log will clear the current log stored in the selected media. You will be asked to confirm the action before clearing.

6.8 Log media

3 options available:

Log Media	Effect	Approx. Log time (1s interval)
SD Card	The data will be stored to the SD card 2GB if present	14 days
Internal RAM	The data will be stored to the internal RAM (Data will be lost in the event of a power down of the analyser)	24 Hours
Internal NV	The data is stored to the non-volatile internal memory	2 minutes

6.9 Export

Note: *If Internal RAM is selected, data log is at risk and will be lost in the event of a power down of the analyser.*

The current log will be exported to the selected log media.

SD card connector

Only remove the transmitter enclosure cover to access the SD card if there is a negligible risk of pollution of the electronic circuits due to moisture, liquids, dirt, dust or other contamination.

Before you refit the covers, make sure that the sealing gaskets are clean, dry and undamaged. Replace and secure all covers as soon as possible after you complete your task within the enclosure.

When you use an SD card to transfer data logs from the analyser, make sure that the transmitter enclosure cover is closed and secured, otherwise the EMC protection measures will be invalidated and the results recorded may not be valid.

When inserting or removing the SD card take care not to accidentally remove the metal card holder as, when open, the holder can slide backwards / out and be disconnected from the PCB. Before closing the enclosure ensure the holder is secure.

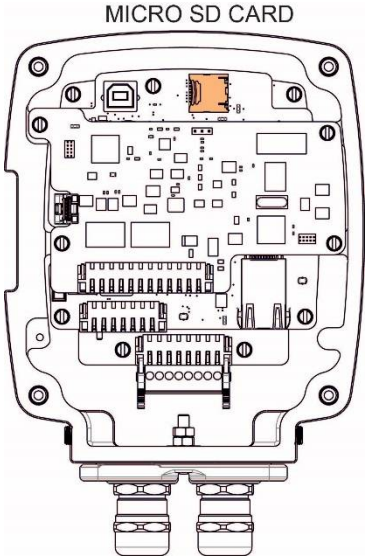


Figure 6-2: Micro SD connector

The 07931-Series Laser will support memory cards with capacity between 128Mb to 32Gb.

Note: the Analyser software will only use up to a maximum of 2Gb of storage memory.

Large datalogs (> 200000 records) can take extended periods of time (> 10 minutes) to export to the micro SD Card

The largest number of log records that can be stored on 2Gb SD Card is 775507 records taking approximately 30 minutes to export.

Note: *MicroSD Card speeds do vary and can have a significant effect on export timings.*

Note: *Unformatted Micro SD cards are not supported by the analyser. MicroSD cards should be formatted as* ***FAT32*** *format prior to insertion. If an unformatted card is inserted an error would be given only when a user attempt to use the card by turning logging on or saving settings.*

Note: *If a formatted micro SD card is inserted in the unit which does not contain an existing data log file it can take up to 30 minutes to prepare the card for logging.*

Note: *When inserting or removing the SD card take care not to remove the metal card holder as, when open, the holder can slide backwards and out. And be disconnected from the PCB.*

To open the cover, slide the latch to the left.

Insert the micro SD card into the slots in the cover.

Close the cover and push the latch to the right to secure it.

The SD card connector is used for:

- Data logging
- Software updates
- Settings (save / restore)

7 Calibration

Item	Ref	Checked
Save the configuration settings	7.1	
Remove the transmitter and receiver units from the process	7.2	
Connect transmitter and receiver units to the calibration cell	7.3	
Reconfigure settings for off line calibration	7.4.1	
Save the calibration configuration settings	7.4.2	
Calibration settings	7.4.3	
Calibrate and verify correct concentration is displayed	7.4.4	
Saving calibration configuration	7.4.5	
Restore configuration settings	7.4.6	

Table 7-1: Calibration check list

The analyser is factory calibrated using a certified gas mixture and is supplied with a calibration test report.

Servomex recommend that you verify the calibration of the instrument annually, using a certified test gas and the supplied calibration gas cell.

7.1 Save the configuration settings

Save all configuration data as described in 3.10.

7.2 Removing the transmitter and receiver units from the process

Note: *The calibration cell is supplied with a TU / RU connection cable loom fitted with terminal connectors. Therefore, when the TU / RU units are unplugged and un-coupled from the process, the connectors, cables and gland plates can remain with the process while the analyser is being calibrated. Cover / protect cables during this time.*

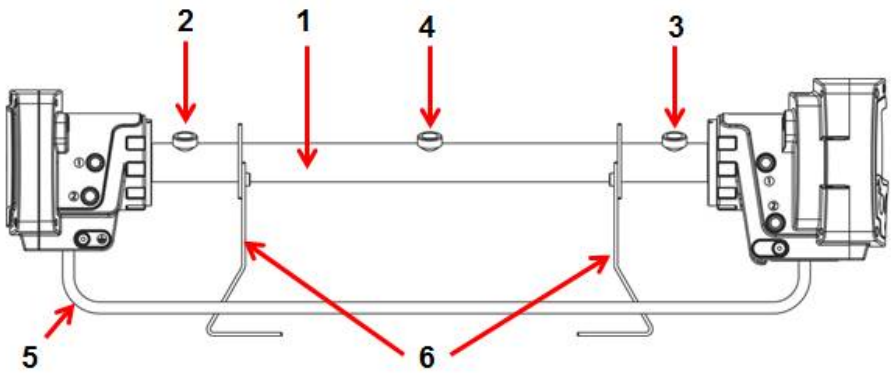
Hint:	*When physically un-coupling and removing the transmitter and receiver units care should be taken to avoid disturbing, and potentially misaligning, the balljoint flange.*

Before disconnecting the TU and RU from the process ensure there is no risk from exposure to potentially harmful gases.

Ensure the analyser is powered off before disconnecting the TU and RU from the process.

Item
Remove purge connections from TU and RU (if required)
Loosen gland plates
Open covers of TU and RU, unclip electrical connectors and remove from enclosure
Dismount TU and RU by loosening the 3 mounting bolts
Place window cover on TU and RU
Mount blanking plates on mounting / alignment assembly
Move to calibration area

7.3 Connecting transmitter and receiver units to the calibration cell



Ident.	Description
1	Calibration cell
2	Calibration gas IN
3	Calibration gas OUT
4	Pressure port (sensor)
5	Cable
6	Supporting brackets

Figure 7-1: Offline calibration view

Before fitting the analyser to the calibration cell check the windows are clear of process residuals. If required clean the windows.

Only use a soft, clean cloth moistened with water to wipe clean the outside of the enclosure.

Optical glass window must be cleaned with isopropanol only.

Ensure the cables and pipes connected to the analyser and calibration cell are routed so that they do not present a trip hazard.

The pressure in the calibration cell shall not exceed 1.5 bar absolute.

Before using the calibration cell, ensure all connections are leak free at operating pressure.

Calibration gases are potentially harmful ensure adequate ventilation is provided.

Purging gases are potentially harmful ensure adequate ventilation is provided.

Before disconnecting the TU and RU from the calibration cell ensure there is no risk from exposure to potentially harmful gases.

Ensure the laser beam is switched off before disconnecting the TU and RU from the calibration cell.

Note: *We recommend that you use an **absolute pressure sensor** to measure the gas pressure in the cell to provide the instrument with correct gas pressure during the verification and calibration procedure.*

Note: *If you only know the ambient pressure or the pressure sensor is located far away from the cell, switch off the gas flow before calibration, wait for 1 minute for the readings to stabilise and then perform calibration. In this case the gas pressure is equal to the ambient pressure.*

7.4 Calibration

7.4.1 Reconfigure settings for off line calibration

Adjust the ‘physical set up’ to suit the calibration cell environment. Path length, pressure source, temp source, analogue I/P. In addition reset the measurement filters to 1 seconds.

Manage analyser							
Level 3	**Level 4**	**Level 5**	**Level 6**	**Level 7**	**Level 8**	**Level 9**	
Manage current config	Service mode						
	Phase/gain Settings						
	Measurement Signal						
	Physical setup	Measurement Selection	Purge Compensation	✎	Enable Disabled	✓	
			Path length	✎	0.000	✓	*edit value*
			Pressure source	✎	External User defined 0-4 Internal	✓	*select option*
			Pressure source Offset or value	✎	Edit	✓	
			Temp source	✎	External User defined 0-4 Internal	✓	*select option*
			Temp source Offset or value	✎	Edit	✓	
	Detailed set up		***For Servomex trained Service operators only***				
Save Current Config	✓		✓				
Restore Config	✓						
Delete Config	✓						

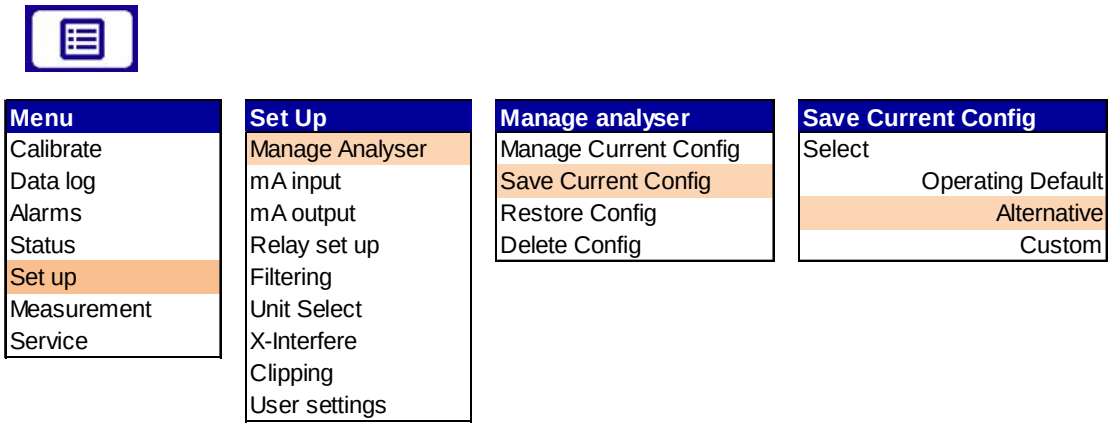
Figure 7-2: Physical setup sequential menu

Check photodiode DC voltage and signal amplitude. Adjust if required.

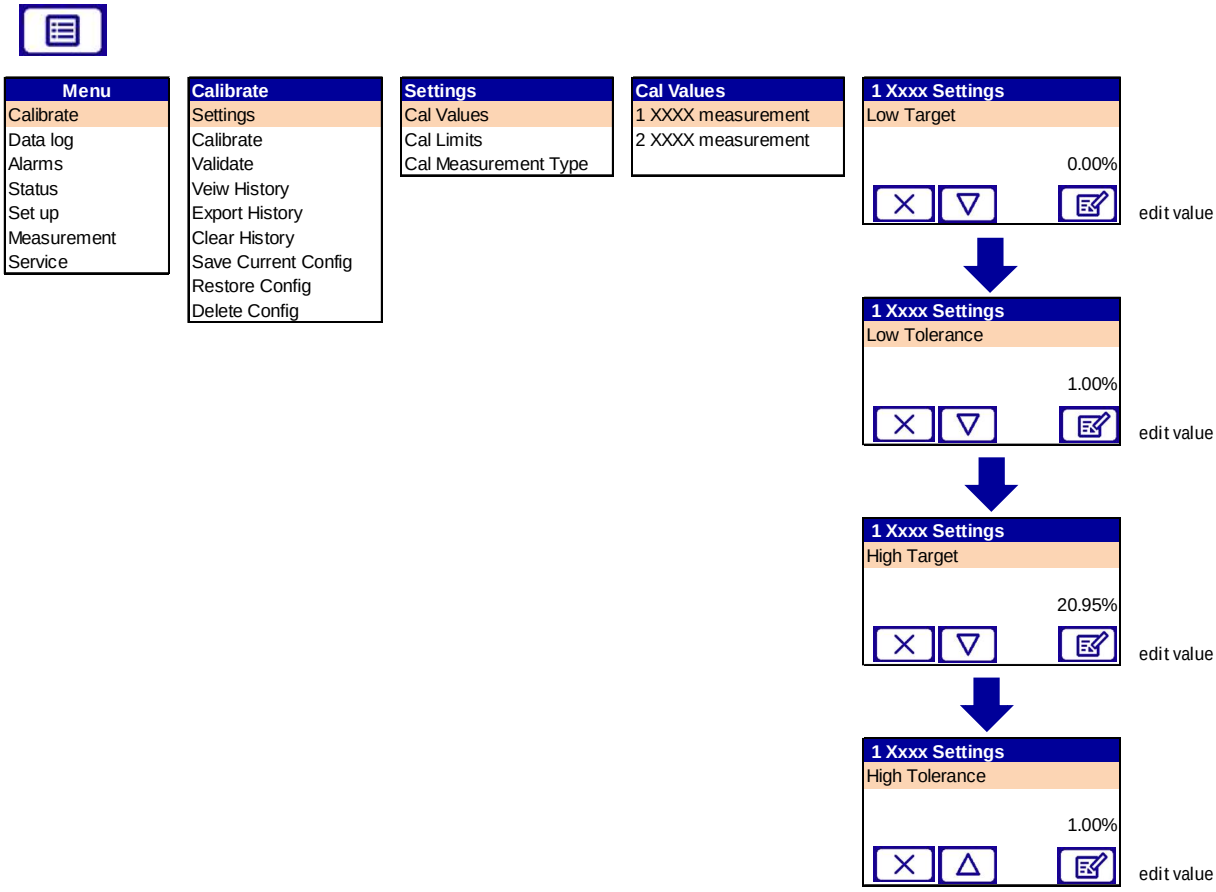
Calibration cell path length to be entered

07910/934B (cell: 07910/929B) 250mm
07910/934C (cell: 07910/929C) 500mm
07910/934D (cell: 07910/929D) 750mm
07910/934E (cell: 07910/929E) 1000mm

7.4.2 Saving the physical calibration configuration settings



7.4.3 Calibration Settings

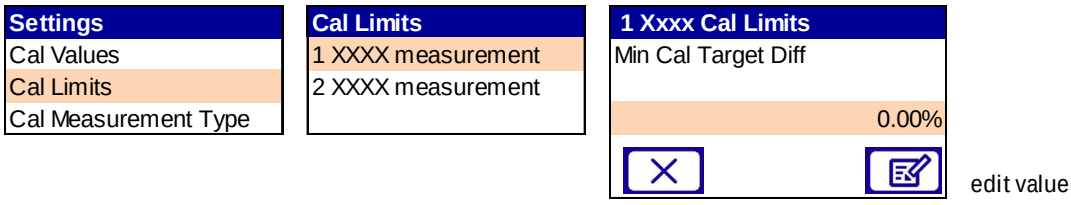


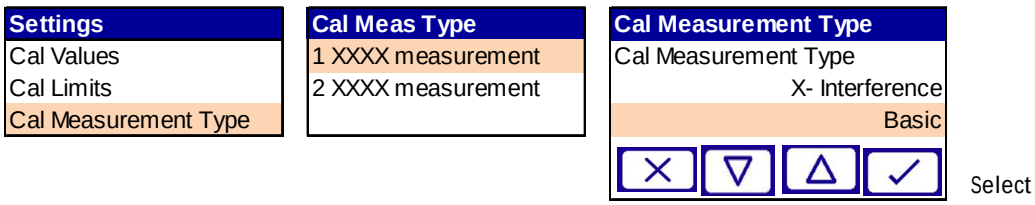
Note: *"Target" refers to the target concentration of the calibration gas.*

Note: *"Tolerance" refers to the tolerance of the measured reading against the "Target" concentration. A warning will be indicated if the measured*

concentration value is outside the "Tolerance" when asked to confirm calibration.

Hint:	*You may wish to check the raw signal and filtered graphs to check correct location of second harmonic signal and 2F burst*





Basic cal measurement type: Uses raw transducer measurement, prior to any X-interference compensation or measurement filtering.

X- interference cal measurement type: Uses the X-interference compensated measurement prior to any measurement filtering.

Note: *X- interference must be enabled in set-up.*

Note: *X- interference requires "Supervisor" password or above.*

7.4.4 Calibrate

Note: *Before you attempt to calibrate the system, let the instrument operate for at least 3 hours.*

Note: *Before calibration proceeds clipping function should be disabled if active.*

Calibration general sequence

If required, connect and start purging of dead volumes in TU and RU Purge 1 – Measurement or Environmental IN e.g. for O_2

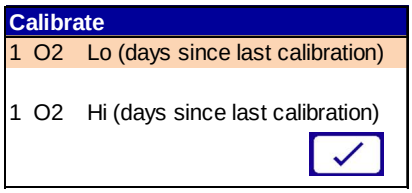
Connect calibration gas and flush system for a minimum of 15 minutes, (30 minutes recommended). Typical flows between 500 to 1000 ml/min

Note: *Measurement purge requires ventilation*

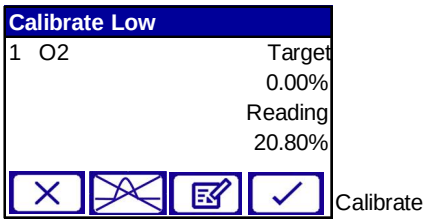
Note: *Ensure zero readings for zero gas concentration*

Wait for the system to reach stable (approximately 3 hours)

Check that the reading agrees with the concentration of certified gas within specified tolerance, then press calibrate



Select Lo or Hi



accept or edit target value

Flush calibration cell with inert gas before removal of analyser

Remove analyser and reinstall as per section 5.4 of the installation manual

Hint: *When re-mounting the transmitter and receiver units care should be taken to avoid disturbing, and potentially misaligning, the mounting assembly.*

Note: *For the following gases O_2, CO_2, and H_2O present in the atmosphere, all the dead volumes inside and outside the instrument enclosure must be purged with N_2 during a calibration.*

There are two distinct calibrations for the instrument to be performed in correct sequence:

LO or zero calibration

During this process, you must flush the cal cell and all the dead volumes inside the analyser with nitrogen for a duration of at least 15 minutes at flows between 500 ml to1000 ml/min. The customer must enter 0 in the box called CAL1C and enter all the

parameters such as Pressure, temperature and pathlength before performing a LOW CAL.

> ***Hint:*** *The graph page should show a flat line in the gas line location.*

HI calibration

During this process, you must flush the cal cell with the gas from the calibration bottle for a duration of at least 15 minutes to 30 minutes (longer for adsorbing gases such as NH_3) at flows between 500 ml/min to 1000 ml/min.

The customer needs to enter their precise cal bottle concentration in pp,% or other units they have previously selected in the box called CAL2C in addition to ensure all the parameters such as Pressure, temperature and pathlength are set correctly before performing a HIGH CAL.

Note: *Ensure that measured gas concentrations reach maximum and stabilized with no oscillations, and that 2f harmonic spectra are correct and as expected, only calibrate if 2f spectra and line positions are in correct locations, the 2f burst has correct amplitude and the 2f signals are correct and of sufficient amplitude.*

Note: *After flush ensure that readings are zero.*

Note: *In the special case of NH_3, the customer must ensure that sufficient background moisture is present in the rest of the dead volumes of the system for a successful line lock to occur.*

Note: *Calibration in the absence of a surrogate gas line lock must not be attempted.*

Note: *When restoring a previous calibration, the time since last calibration will not be updated.*

7.4.5 Saving calibration configuration

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Calibrate
Settings
Calibrate
Validate
Veiw History
Export History
Clear History
Save Current Config
Restore Config
Delete Config

The file can be saved / restored from internal memory or via the MicroSD card. The file can be saved in pre-named configurations for specific purposes or in user named files.

This file can be saved and restored by supervisor level users.

7.4.6 Restore physical configuration settings

Menu
Calibrate
Data log
Alarms
Status
Set up
Measurement
Service

Set Up
Manage Analyser
mA input
mA output
Relay set up
Filtering
Unit Select
X-Interfere
Clipping
User settings

Manage analyser
Manage Current Config
Save Current Config
Restore Config
Delete Config

Save Current Config
Select
Operating Default
Alternative
Custom

Once configuration is restored ensure the analyser is functioning within specified limits.

7.5 In situ validation (in-line span or zero check)

7.5.1 Overview

To allow validation checks of the 07931-Series Laser analyser when attached to the process, the optional validation cell (100 mm) must be fitted between the RU mounting and RU. Suitable O-ring and sealing materials must be specified for the specific application gasses.

The Analyser may fail if you use materials to connect the 07931-Series Laser to the process that are not compatible with the application gasses.

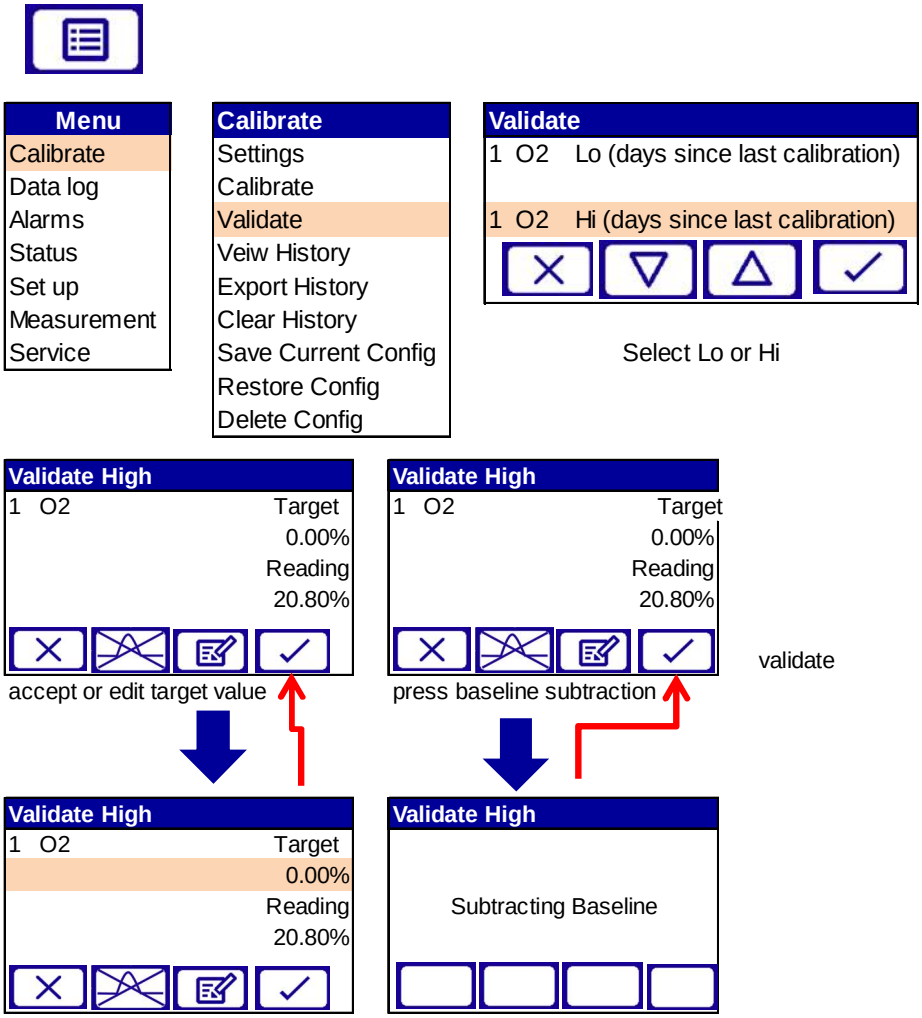
Note: *As the test is performed swiftly, it is assumed that the process conditions will be reasonably stable during this procedure.*

Note: *Filters must be turned off before validation ref section 4.6.*

Note: *Check the validation gas is connected.*

Switch on zero gas to purge in-line span cell for a minimum of 5 minutes.

The baseline subtraction function should then be used to zero out the analyser before validation gas is introduced to the in-line span cell.



Once the baseline subtraction has finished the reading value will be zero.

Allow validation gas to flow into the cell at a constant rate.

Observe change in concentration and record maximum once stable.

Note: The reported gas concentration will be proportional to the 100 mm path length against the set path length and the concentration of the validation gas.

$$\frac{0.1(cell\ length)}{Set\ path\ length} \times Span\ gas\ concentration = Span\ gas\ reading$$

E.g. for a 4 m path length and 20% O_2 span gas concentration will read 0.5%

Note: *Reading must be allowed to stabilize for a minimum of 5 minutes.*

Purge the cell with zero gas and confirm zero reading again and remove baseline subtraction.

8 Installation

8.1 Installation preparations

Before you can use your 07931-Series Laser, you must make a few preparations first. It saves time if you do this before you receive the 07931-Series Laser.

8.1.1 Required tools and equipment

You will need the following tools and equipment to install and commission the 07931-Series Laser:

Tool or equipment	Quantity	Used for
18 mm open-ended wrenches	2	M12 bolts and nuts
24 mm open-ended wrenches	2	M16 bolts and nuts and M16 blanking plugs
M4 socket driver or 7 mm open-ended wrench	1	M4 internal screen nuts
30 mm open-ended wrench	1	Ball joint locking nut on adjustable alignment flange
5 mm Allen key	1	M6 instrument / quick connect locking bolts
3 mm Allen key	1	Lid and gland plate screws transmitter and receiver units and external earth screws Alignment screws on adjustable alignment flange
2.5 mm flat head screwdriver	1	Electrical connections
Anti-Seizure paste Copperslip or equivalent		Mounting hardware
Fittings or blanks		Purge connections
Alignment tool		May be used for flange alignment and analyser mounting
RJ45 connectors and crimping tool		Cable connections
Micro SD card		Backing up post commissioning

Note: *Other wrenches required as appropriate for M16 and M20 cable glands, adaptors and/or conduit being fitted.*

Table 8-1: Required tools and equipment

8.1.2 Installation location

Make sure that you mount the 07931-Series Laser on a structure that is able to support its mass (refer to 2.6.1 for the transmitter unit and for the receiver unit).

The environmental operating conditions for the 07931-Series Laser are listed in Section 2.6.5.

Make sure that all floors and platforms are clear and free from obstructions, and that the engineer has sufficient space to move freely and change posture.

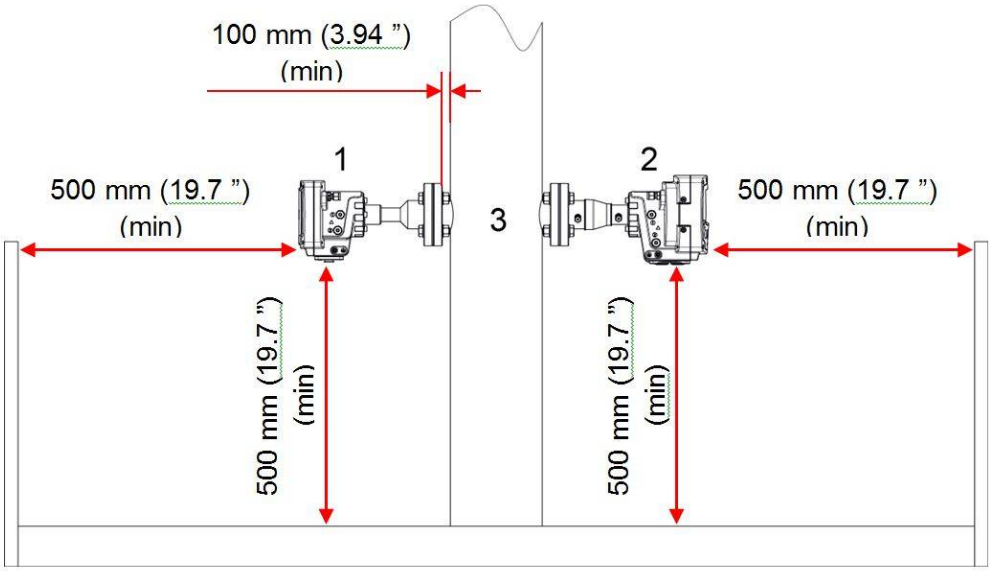
The Analyser may fail if you use materials to connect the 07931-Series Laser to the process that are not compatible with the process environment.

When you decide where to place the 07931-Series Laser in the process, we recommend a minimum of 5 stack diameters of straight duct before and 2 stack diameters of straight duct after the measurement point. Recommended distance from the process wall, duct or pipe to the welded flange is a minimum of 100 mm. This will need to be increased, or thermal break added, for process temperatures above 135 °C.

8.1.3 Analyser placement

You should place the transmitter and receiver units so they are easily accessible. A person should be able to stand in front of the transmitter to view the display and access the alignment mounting to make adjustments. Cabling exiting the Analyser should also be considered.

Each unit requires at least 500 mm (19.7 ") of free space (measured from flange to the stack and outwards).



1 Laser receiver unit

2 Laser transmitter unit

3 Process gas

Figure 8-2: 07931-Series Laser installation distances

8.1.4 Process flanges

The 07931-Series Laser attaches to process flanges that you must weld either to the relevant process pipework, duct or furnace wall or, for pipework up to 150 mm (6 ") in diameter, to a spool piece supplied by Servomex.

You can attach the laser analyser mounting assemblies (fixed or adjustable) to the process flange either directly with appropriate gaskets, or via an isolation valve or an isolation window, depending on your application. If your process is corrosive, toxic or flammable, you must use isolation valves that are mechanically and chemically compatible with the process. When these valves are closed, you can easily remove the analyser from the installation for maintenance procedures without stopping the process.

Always wear the appropriate PPE to minimize the risk of burns.

The maximum process pressures for the 07931-Series Laser are listed in Section 2.6.6. For installations based in the European Union, in all applications operating above the maximum process pressures, the Pressure Equipment Directive (PED) applies and an appropriate isolation flange must be fitted.

Install and use the isolation flanges in accordance with their manufacturer's instructions.

If the process gas temperature is greater than 135 °C (275 °F), make sure that you provide adequate thermal isolation to ensure that the maximum temperature reached by the process flange to which the 07931-Series Laser is fixed does not exceed 135 °C (275 °F).

Hint:	*Servomex can provide thermal spacers for a range of flange sizes.*

It is important that the process flanges are aligned correctly as they are critical to ensuring the successful alignment and maximum transmission of the 07931-Series Laser.

The 07931-Series Laser requires 2 holes of at least 25 mm (1") in diameter to be cut diametrically opposite to each other in order to enable the laser beam to pass through the process gas.

Note: *The size of the hole depends on the process flange that you are using.*

The flange dimensions are listed in and the following tables.

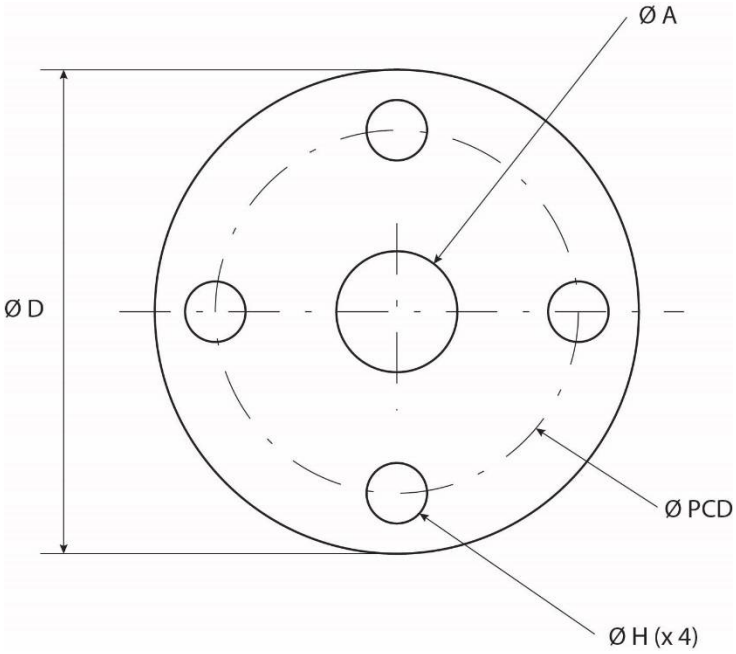


Figure 8-3: 07931-Series Laser flange dimensions

Process flange dimensions

DIN PN10 flange dimensions (dimensions in mm (inches))

Overall diameter, ØD	Hole pitch circle diameter, ØPCD	Hole diameter, ØH (equi-spaced)	Hole diameter, ØA	Flange designation
115.0 (4.528)	85.0 (3.346)	14.0 (0.551)	25.0 (0.984)	DN25
165.0 (6.496)	125.0 (4.921)	18.0 (0.709)	50.0 (1.968)	DN50

ANSI Class 150 and 300 Flange Dimensions

(dimensions in mm (inches))

Overall diameter, ØD	Hole pitch circle diameter, ØPCD	Hole diameter, ØH (equi-spaced)	Hole diameter, ØA	Flange designation
108.0 (4.252)	79.4 (3.126)	15.9 (0.626)	34.4 (1.354)	ANSI 1” 150 #
152.4 (6)	120.7 (4.752)	19.1 (0.752)	61.1 (2.405)	ANSI 2” 150 #
190.5 (7.5)	152.4 (6)	19.1 (0.752)	90.3 (3.555)	ANSI 3” 150 #

Process flange alignment tolerances

The transmitter and / or receiver instrument flanges are provided with an alignment mechanism that allows limited manual adjustment of the laser beam direction in 2 planes.

So that this operates correctly after the instrument is installed, use the following tolerances for positioning and attaching the process flanges.

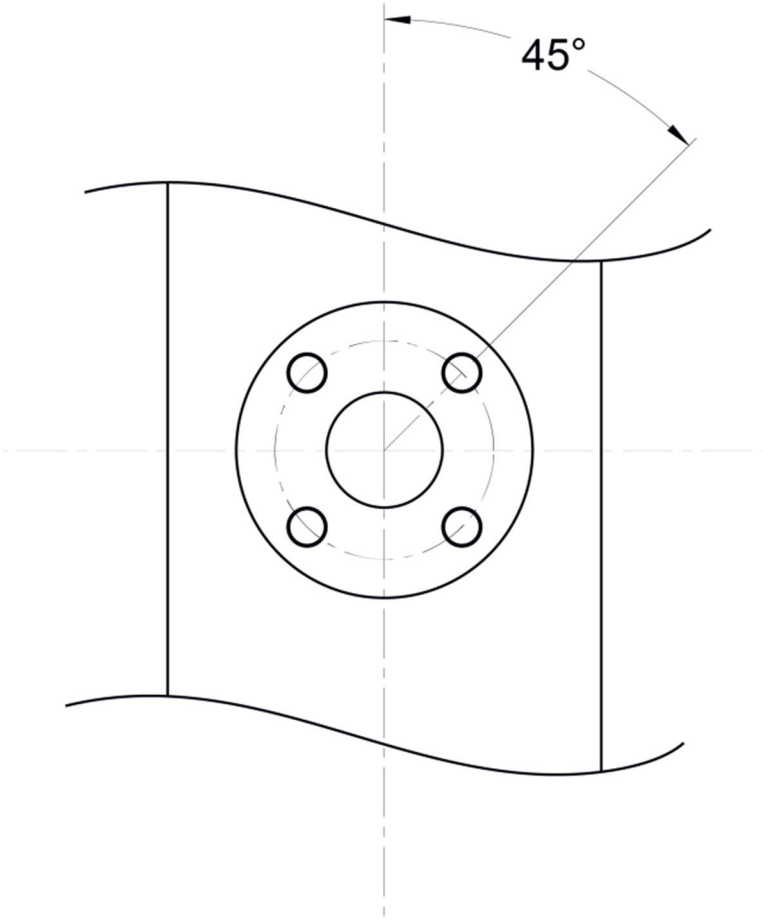


Figure 8-4: Process flange bolt arrangement (4 bolt pattern)

The flange bolt pattern must be:

4 bolt pattern	45 °
8 bolt pattern	22.5 ° (not shown)

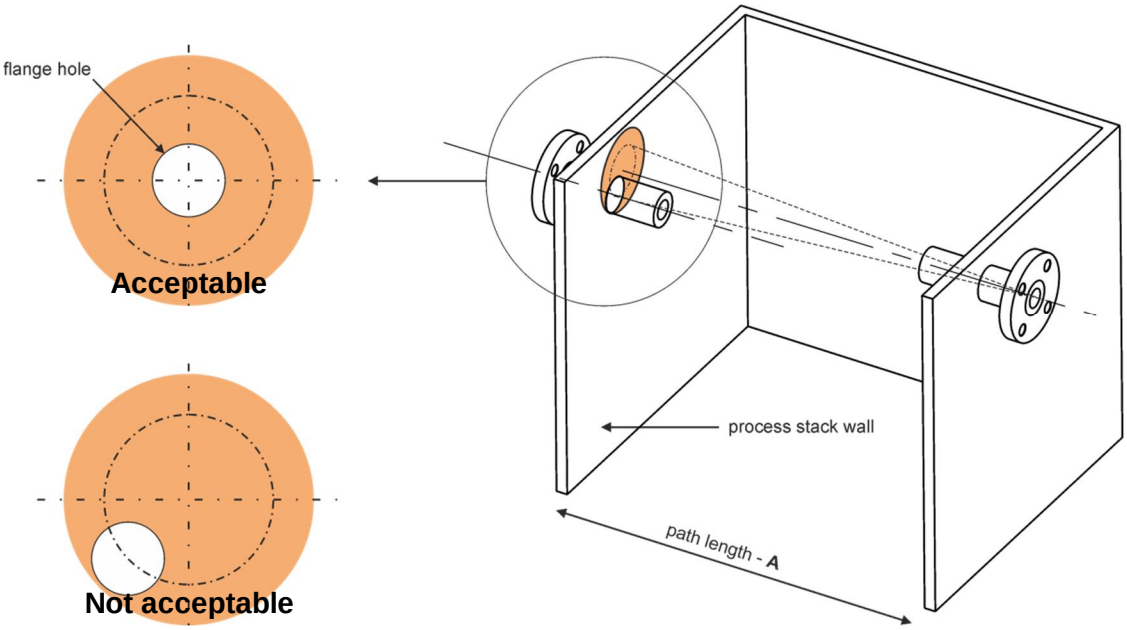


Figure 8-5: Process flange positioning tolerance

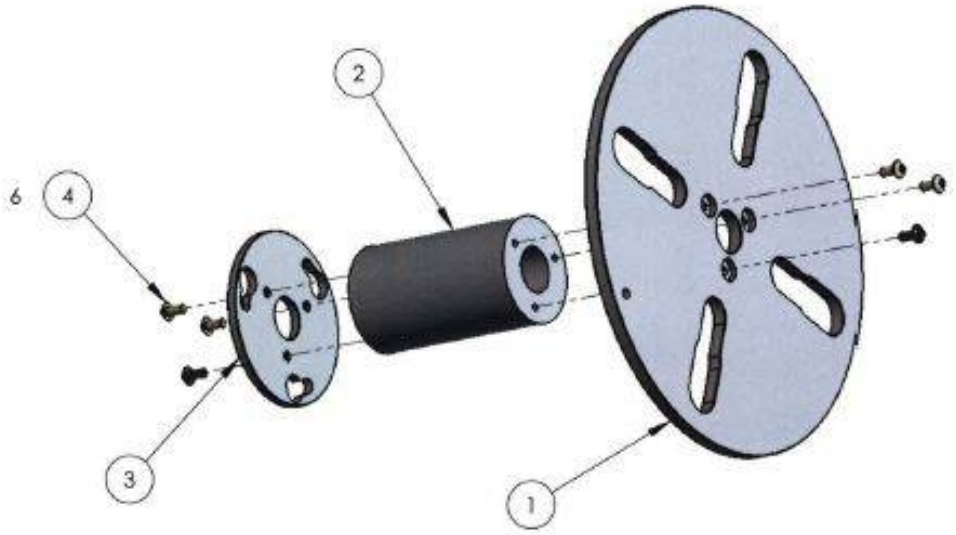
Note: *Failure to align the transmitter and receiver flanges may adversely affect the performance. Tolerance to misalignment is dependent on divergence, path length and measurement. For further advice contact Servomex or local representative.*

8.1.5 Optional flange alignment jig

Never look into a live process through the eye piece as this may result in hazardous radiation exposure and permanent eye damage.

The optional flange alignment adaptor is available to simplify the process of aligning the process flanges before it is fixed in place.

The adaptor simply bolts to the process flanges and enables the alignment jig to be used to align the flanges as they are welded to the process stack.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	07910/411	PROCESS FLANGE ALIGNMENT PLATE	1
2	07910/409	PROCESS FLANGE EXTENSION TUBE	1
3	07910/410	ANALYSER FLANGE, PROCESS ALIGNMENT	1
4	214952	SCREW M4 X 8 HEX SCK BUTTON HD SS	6

Figure 8-6 Flange alignment adaptor

1) Cut 2 holes diametrically opposite each other in the process wall as accurately as possible. The diameter of the holes will be determined by the nominal flange size.

   Note: Any misalignment in these holes may impact the maximum achievable performance of the 07931-series laser.

2) Fully weld a stub pipe, this must protrude by a minimum of 100 mm, normal to the process wall at each side. The diameter of the pipe will be determined by the nominal flange size.

3) Place a flat faced slip-on flange over the end of each stub pipe. The flange bolt holes must straddle the vertical and horizontal centre lines, as per standard industry practice. Secure each flange with **one** tack weld. The clearance should enable an adjustment of at least ± 2º in each direction for all flange sizes.

4) Fit one process flange alignment adaptor onto each process flange, using 4 sets of bolts / studs, nuts and washers of the appropriate size.

5) Fit the alignment tool light source assembly to the adaptor on one process flange using 3 off M6 x 16 screws. Switch the light source on.

6) Fit the alignment tool eyepiece or scope assembly to the adaptor on the other process flange using 3 off M6 x 16 screws. The elevation adjuster should be uppermost to ensure the cross hairs are vertical and horizontal (if applicable).

7) The scope (if used) has been factory set. The windage and elevation adjusters must **not** be tampered with.

8) The process flange with the scope fitted is the flange to be checked / adjusted. Look through the eyepiece or scope and adjust the focus if required: both the light source and eyepiece centre (or cross hairs) should be in sharp focus.

9) The light source must be in the centre of the eyepiece or scope cross hairs. If the eyepiece or scope is off target, **gently** tap the back face of the process flange in the appropriate positions to correct the error. If it is easier to tap the front face of the alignment plate, only tap the parts of the plate that are supported by the flange behind it, to avoid distorting the alignment plate. Repeat until the eyepiece or scope is on target.

10) **Remove** the process flange alignment adaptor and eyepiece or scope assembly, then fully weld the process flange to the stub pipe in such a manner as to minimise distortion.

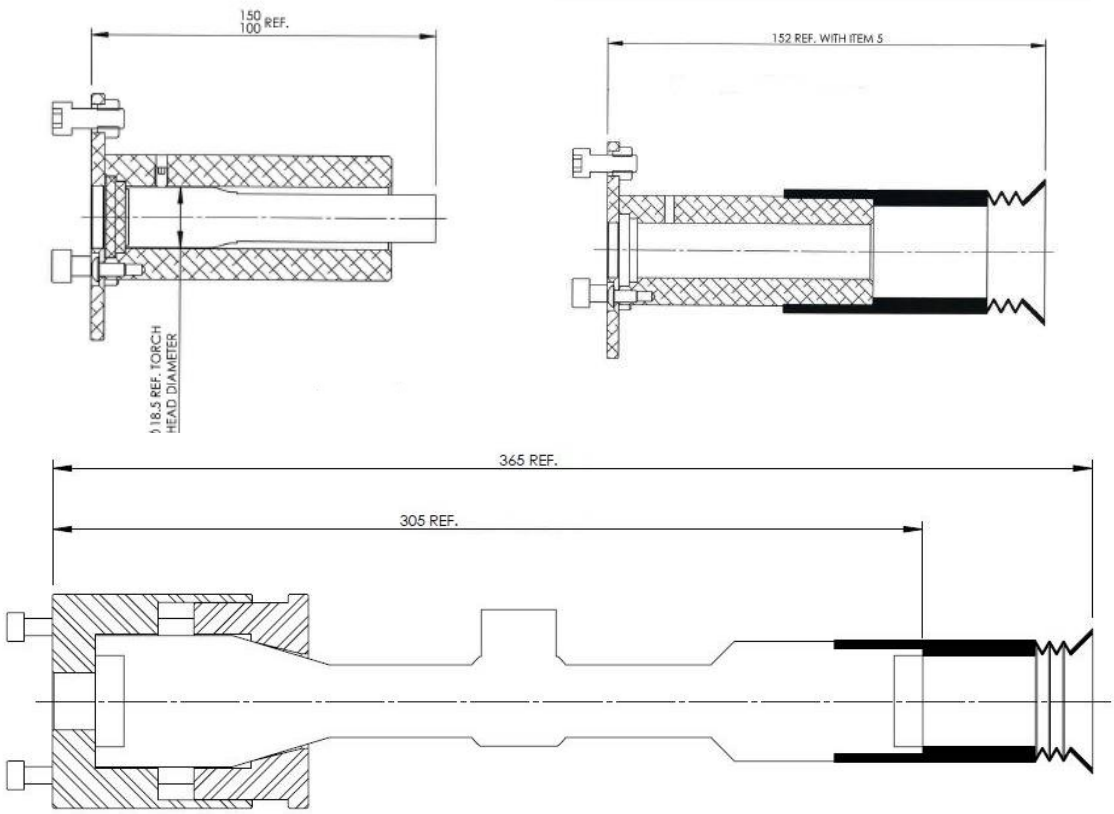
11) When the process flange has cooled down, re-fit the process flange alignment adaptor.

12) Switch off the alignment tool light source assembly (if applicable) and remove it. Fit the eyepiece or scope assembly in its place as described in point 6).

13) Fit the alignment tool light source assembly to the adaptor on the other process flange as described in point 5), if applicable.

14) Repeat steps 8) and 9) to align and secure the second process flange.

15) Switch off the alignment tool light source assembly (if applicable) and remove it. Remove the process flange alignment adaptor. The process flanges should now be coaxial with each other.



FiFigure 8-7 Alignment jig

The alignment jig comprises a LED light source and eye pieces which are fitted to an adaptor on each opposing flange. Align in accordance with tolerances in section 8.1.4 by lining up the eye piece with the light source until the LED source is concentric to the relative bores and eye piece.

For extended path lengths (over 5 meters) an eye piece with integrated scope is available with an optical magnification factor of 4X and crosshair target.

The flange alignment jig is NOT Ex certified.

It CANNOT be used where a FLAMMABLE atmosphere is present in the 'Outside atmosphere' or the 'process atmosphere'.

It MUST NOT be used where an EXPLOSIVE atmosphere is present in the 'outside atmosphere' or the 'Process atmosphere'.

The alignment tool shall not be used where there is a risk of exposure to hazardous gases contained in the process.

8.1.6 Mounting rigidity

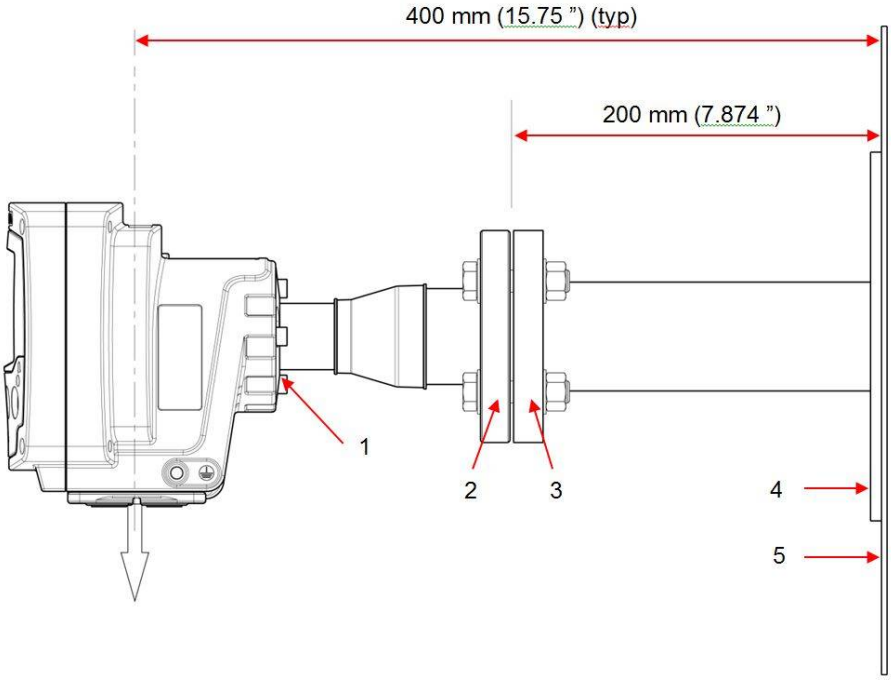
Make sure that the flue wall is strong enough to support the weight of the 07931-Series Laser transmitter and receiver units, including the mounting flanges and unsupported cables.

Install the 07931-Series Laser on a structure that is capable of supporting the weight of the transmitter unit (TU) and receiver unit (RU). If the structure is not strong enough, you will experience alignment problems during commissioning and operation.

The following illustrations of a high temperature mounting arrangement for the TU and RU, where the units have been mounted 200 mm (7.87 ”) from the process wall. Particular attention is required on the TU as the extra weight may require reinforcement of the process wall to counter the moment produced by the distance from the process wall.

Always allow for the weight of the cable in addition to the weight of the TU and RU.

The 'free-hanging' un-supported weight of cables should not exceed the weight of the unit.



1	Analyser mounting flange
2	Adjustable mount flange
3	Process flange
4	Process flange reinforcement plate
5	Process wall

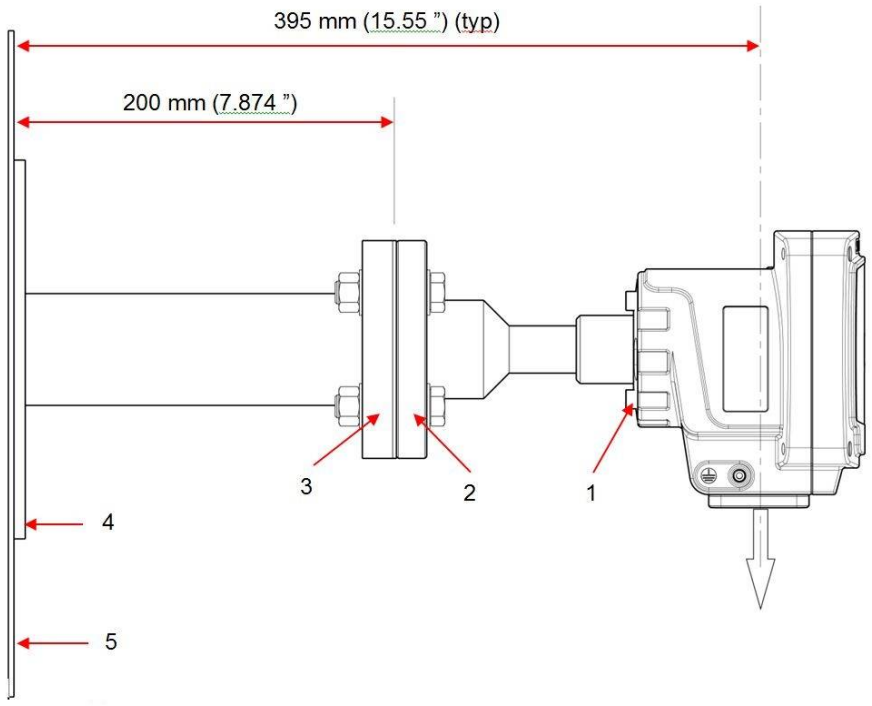
Transmitter Unit =	2.0 kg (4.4 lb)
Flange =	3.5 kg (7.7 lb)
Unsupported cable weight =	3.5 kg (7.7 lb)
Total =	9.0 kg (19.8 lb)

Figure 8-8: Transmitter unit mounting arrangement (example shown with adjustable mount)

If the process wall is not strong enough to support the TU or RU, Servomex recommend that you use a reinforcement plate.

Note: *It is your responsibility to assess and design the reinforcement plate that you will use in your installation, subject to local conditions.*

This reinforcement plate could be part of the process flange (as shown in diagrams) or a separate reinforced section of the process wall.



1	Analyser mounting flange
2	Fixed mount flange
3	Process flange
4	Process flange reinforcement plate
5	Process wall
Receiver Unit =	1.6 kg (3.5 lb)
Flange =	2.5 kg (5.5 lb)
Unsupported cable weight =	2.0 kg (4.4 lb)
Total =	6.1 kg (13.4 lb)

Figure 8-9: Receiver unit mounting arrangement (example shown with fixed mount)

As the TU weighs considerably more than the RU, support for the RU is less of an issue. However, you should use a similar mounting arrangement for consistency.

Note: An alternative to the reinforcement plate is to provide ceiling or floor supports to hold the weight of the TU or RU, although these may impact on the ease of alignment and adjustments.

8.2 Installation overview

This section gives an overview of the installation procedures. It details the signal inputs and outputs available in the 07931-Series Laser transmitter and receiver units, and outlines any conditions of use that you should consider before you install the instrument.

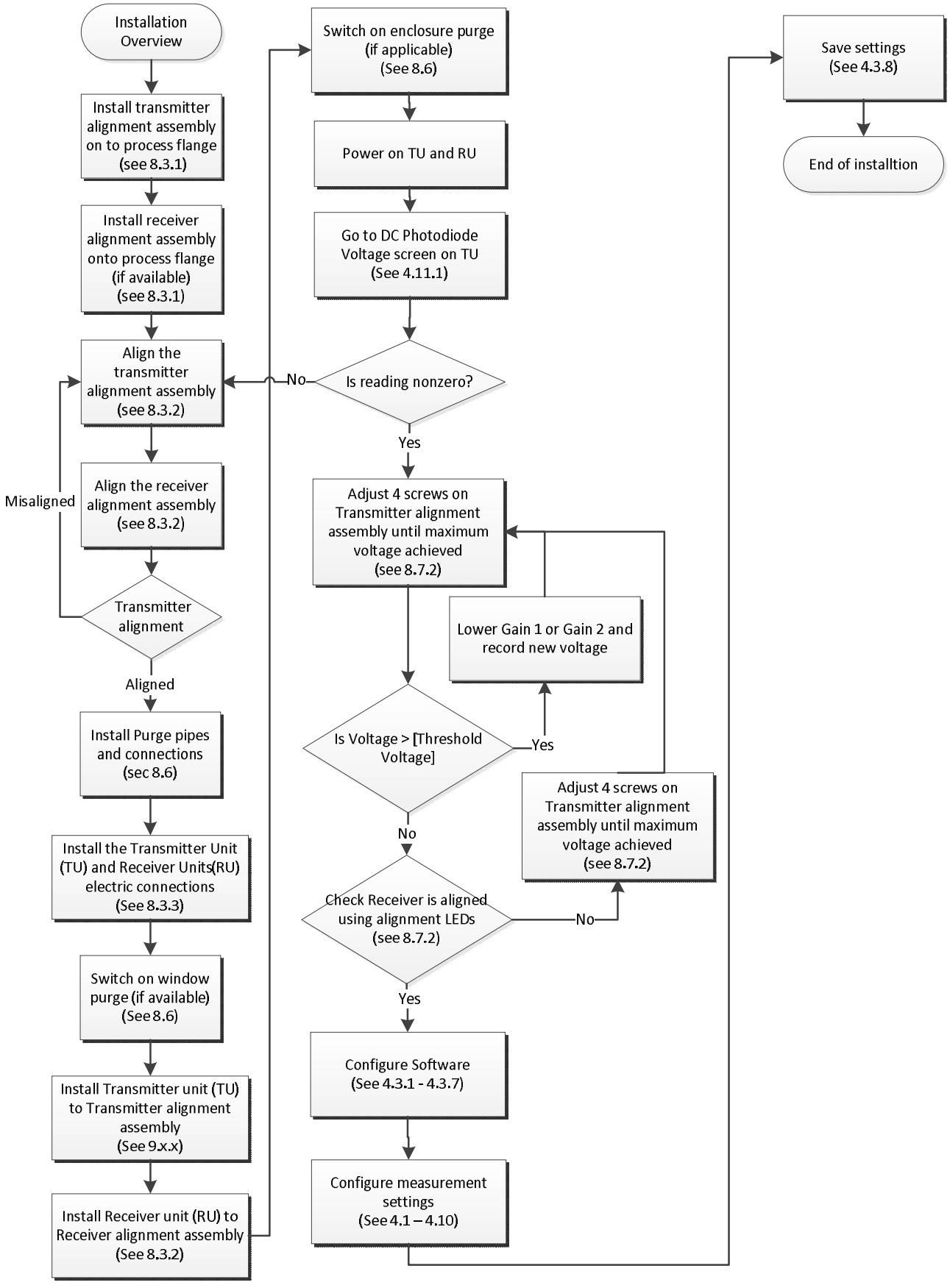


Figure 8-10: Installation overview

8.2.1 Safety

Do not install the 07931-Series Laser in a high velocity dust-laden atmosphere.

You are responsible for ensuring that:

- **The instrument is installed correctly and safely**
- **The laser beam is enclosed during operation**
- **The sampling system is leak free (if being used in bypass extractive configuration)**
- **The venting system is appropriate for the gases you are sampling**
- **The installation does not introduce trip hazards**
- **Appropriate PPE is used for installation, servicing and decommissioning**

Lubricate all threads with suitable grease before you install the 07931-Series Laser.

The optical windows in the receiver and transmitter units are installed in the factory. Do not touch the optical windows as any contamination will adversely affect the performance of the 07931-Series Laser. For cleaning guidance see section 9.3.

Regularly inspect, test and replace seals to ensure that all external connections are always leak-free at full operating pressure.

The equipment is incapable of passing the dielectric strength test prescribed by the standards, and so this must be taken into account during installation.

8.2.2 Pre-installation checks

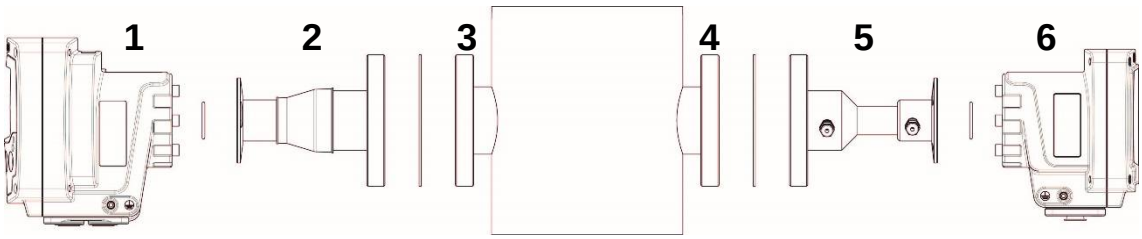
Use this checklist to ensure that all the pre requisites have been set up before you start to install the system:

Item	Checked
Check the services are installed (purge panel, power)	
Check the process flanges are fitted correctly	
Check the cable lengths are correct	
Check the cables are stripped correctly	
Unpack and check the components	
Check the tools list	
Mount the PSU or check the availability of a local 24 V supply	

Table 8-1: Pre-installation check list

8.2.3 Installation

Make sure that the flanges on the process walls are mounted and aligned correctly (Section 8.1).



1	Transmitter unit
2	Transmitter alignment assembly
3	Process flange
4	Process flange
5	Receiver mounting / alignment assembly
6	Receiver unit

Figure 8-11: 07931-Series Laser in-situ installation

8.3 Process connections

8.3.1 Fitting the transmitter and receiver alignment assemblies

Before you fit the transmitter and receiver alignment assembly to the process:

Make sure that there are no dangers from the release of potentially hazardous gases, for example, toxic, flammable, asphyxiant or hot gases.

Always use adequate eye protection to prevent injury from ejected dust or dirt and high levels of IR radiation that may be present.

Make sure that the exposed metal parts of the process are at the same potential as that of its surroundings. If not, use suitable protective equipment to provide protection against the risk of electric shock.

Make sure that the 07931-Series Laser is switched off.

***Note**: The mounting / alignment assemblies are adjustable; the receiver alignment / purging flange may be fixed for shorter path lengths.*

Bolt the transmitter and receiver instrument flanges to the process flanges using the standard bolts, nuts and washers provided.

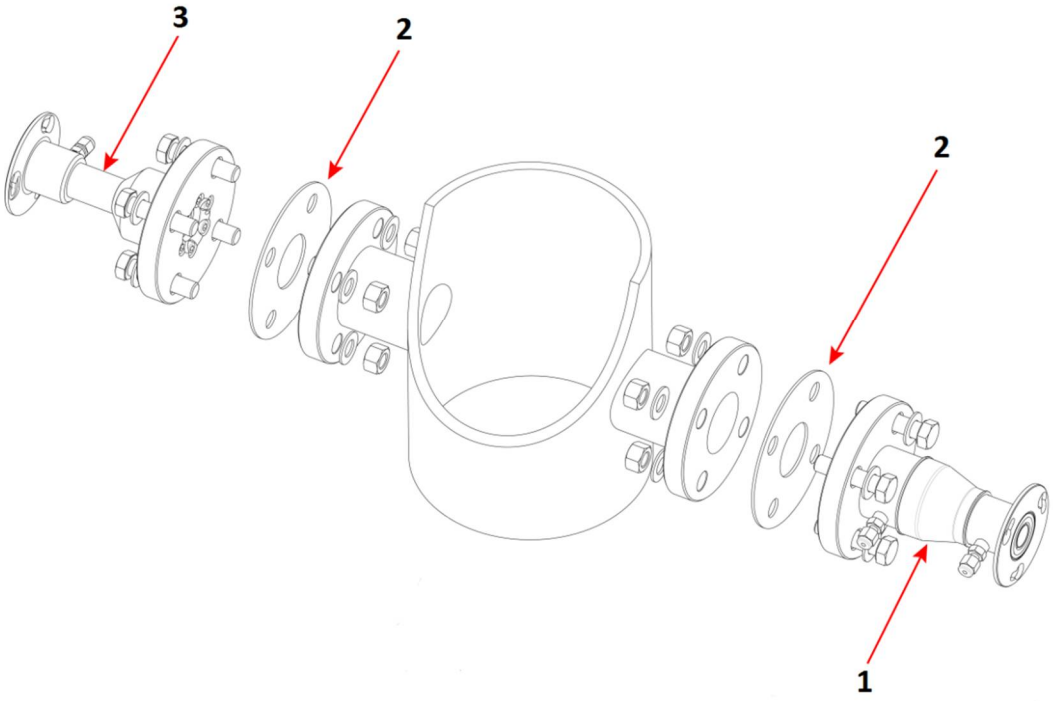
***Note**: Use an anti-seize paste on the threads.*

The tolerances of the standard flanges, bolts and holes allow them to be misaligned from concentric. Therefore when you fasten the flanges, make sure that the two flanges are concentric to aid laser beam alignment.

***Note:** If the process flange temperature is in excess of 135 °C, use a thermal spacer insulating flange gasket to minimise heat transfer to the instrument flanges.*

Ensure flange o-rings are fitted to the analyser mounting flanges.

***Note:** Orientate the mounting assembly so that the purge connections are pointing to the left (as viewed looking at the process wall) to ensure the TU and RU mount vertically.*



1	Transmitter alignment assembly
2	Gasket
3	Receiver alignment assembly

Figure 8-12: Example of mounting / alignment assembly fitting exploded view

8.3.2 Alignment of the transmitter and receiver alignment assemblies

Do not use the alignment tool if the process flange is hot (> 60 °C), or if the process contains potentially hazardous gases.

Only use the light source supplied by Servomex with the alignment tool.

Make sure that there are no dangers from the release of potentially hazardous gases, for example, toxic, flammable, asphyxiant or hot gases.

Always use adequate eye protection to prevent injury from ejected dust or dirt and high levels of IR radiation that may be present.

Refer to	
Step 1	Switch on to light source in order to check operation before fitting then fit the alignment tool light source assembly to the Analyser flange (fixed or adjustable) on the RU side of the process using 3 off M6 x 16 screws. Switch the light source on
Step 2	Fit the alignment tool eye piece assembly to the Analyser flange (adjustable) on the TU side of the process using 3 off M6x16 screws. Peel back the protective boot on the ball joint assembly to reveal the adjusting screws (**FiFigure 8-7**)
Note:	*Ensure all the M6 x 16 screws are tight before beginning the alignment process.*
Hint:	*Remove the O-rings in the RU and TU mounting assemblies for less variation*
Step 3	Loosen the adjustment screws by turning anti-clockwise. Ref (**Figure 8-28**)
Step 4	For correct alignment the light source must be in the centre of the eye piece. If the eye piece is off target adjust the TU/RU alignment assembly tighten the adjustment screws to lock the assembly in position. This is easiest to do with two hex keys, one to loose and the other to tighten.
Note:	*All adjusting screws have a right hand M6 thread, and give an angular resolution of 1.8º per screw turn. The ball joint may be adjusted by ±4º in each direction*
Step 5	When all adjustments are complete, ensure all screws are locked in place
Hint:	*Taking care not to change the position of the assembly during step 5 and 6.*
Step 6	Remove the alignment tool scope assembly and replace the boot immediately
Step 7	Switch off the alignment tool light source assembly and remove it from the RU

Step 8	If the analyser has been supplied with an adjustable, rather than fixed mounting assembly at the receiver end, fit the alignment tool light source assembly to the analyser flange on the TU side of the process as described in step 1). Fit the alignment tool scope assembly to the RU side of the process as described in step 2) and repeat steps 4) and 5), and steps 7) to 9), to align and secure the second analyser mounting assembly

8.3.3 Fitting the transmitter and receiver on the flange

Inspect all joints when you have connected the 07931-Series Laser to the process.

Do not apply power to the transmitter unit before both the transmitter and receiver units are fitted to the Analyser flanges and front panels have been closed. This ensures that there is no risk of exposure to laser light.

Make sure that there is enough space at the base and sides of the enclosure to open the covers and to route cables and pipework without tight bends.

Note: *Although the following diagrams show the TU, use the same technique for the RU.*

Check the o-ring is in place on the transmitter / receiver flange before installation.

Loosen the 3 x M6 screws and align them with the corresponding keyhole slots on the flange joint (Figure 8-13).

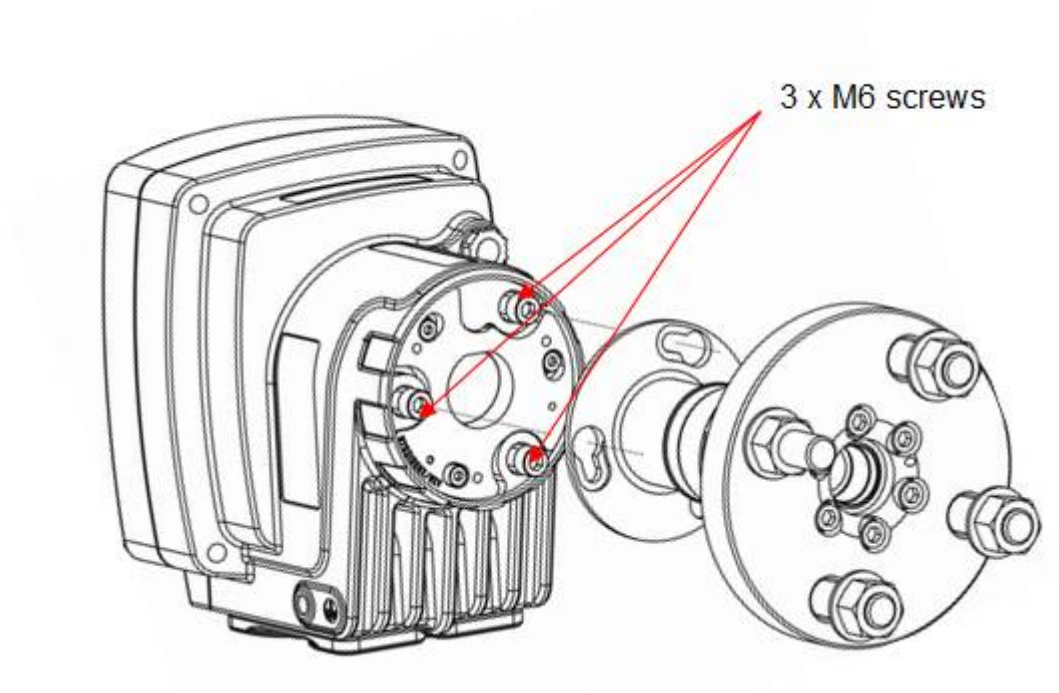


Figure 8-13: Align M6 screws with the flange joint

Rotate the enclosure until it stops at the end of the keyhole slots.

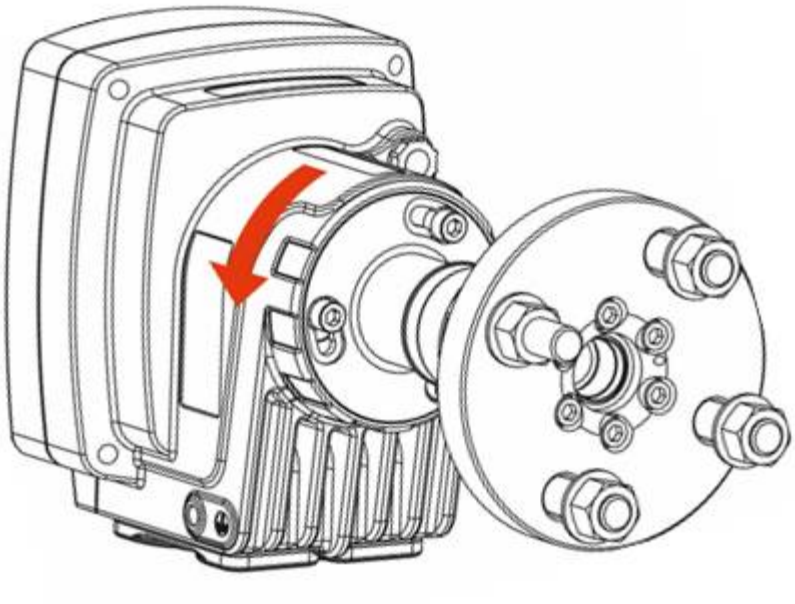


Figure 8-14: Rotate the enclosure

Tighten the 3x M6 screws to secure the flange.

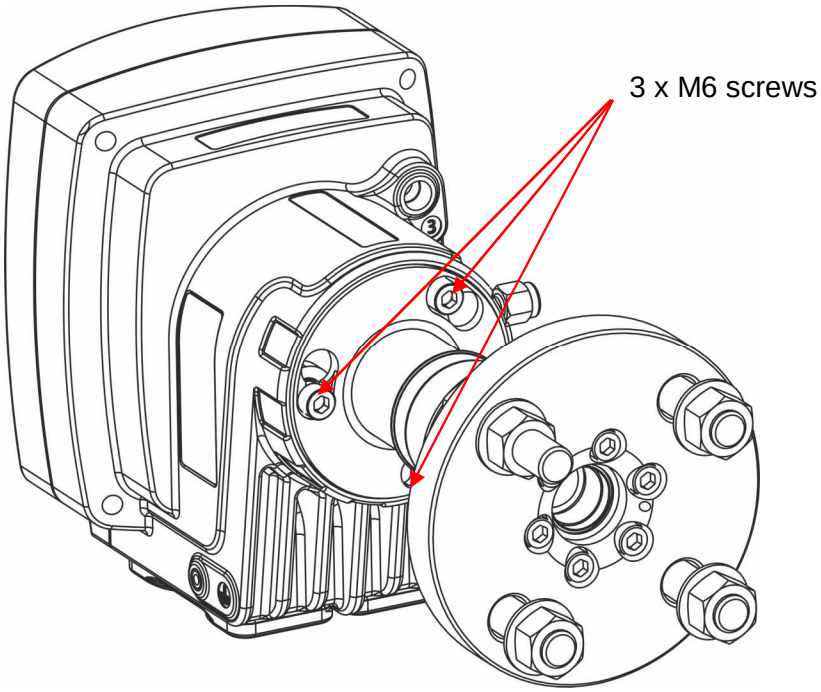


Figure 8-15: Tighten the M6 screws

8.4 Electrical connections

8.4.1 General safety

Make sure you read and understand the warnings and cautions in this section before you proceed

Make sure that you install the instrument to conform to all relevant safety requirements, National Electrical Code and any local regulations. The installation must be safe for any extremes of operating conditions which may occur in the operating environment of the 07931-Series Laser.

It is a condition of certification that the unit must be installed following the appropriate national or international legislation or codes of practice. In particular, you must make sure that the correct glands are fitted to cable entries and that you do not compromise the weatherproofing of the enclosure.

The 07931-Series Laser does not incorporate an integral on/off switch. You must provide a means of externally isolating the electrical supply from the Laser Analyser. Use a suitable switch or circuit breaker located close to the Laser Analyser clearly marked as the disconnecting device for the Laser Analyser. This must also incorporate a suitable fuse or over-current protection device, set to or rated at no more than 3 A. To comply with the relevant safety requirements this power disconnection device must be approved to:

- **UL 489 for equipment used in the USA**
- **CSA C22.2 No. 5.1 for equipment used in Canada**
- **IEC 60497 for equipment used in the EU and the rest of the world**

Equipment connected to the DC power input, mA and Ethernet outputs, relay terminals and mA input terminals must be separated from AC mains voltages by at least reinforced insulation or equivalent.

All of the electrical connections to the 07931-Series Laser are considered to be incendive and must only be connected to safe area equipment.

Only remove enclosure covers (that is gland plates and enclosure doors) if there is a negligible risk of pollution of the electronic circuits due to moisture, liquids, dirt, dust or other contamination.

Before you refit the covers, make sure that the sealing gaskets are clean, dry and undamaged. Replace and secure all covers as soon as possible after you complete your task within the enclosure.

Disconnect all cables from the 07931-Series Laser when you carry out insulation testing on them.

Make sure your electrical supply can provide the necessary maximum power consumption of 25 W.

8.4.2 Glands and cable entries

The following instructions apply to installations that must comply with electrical safety requirements of IEC 61010 and Local Hazardous Area requirements.

To meet IEC61010 and Hazardous Area requirements, the cables glands used with the 07931-Series Laser must:

- Be made of metal or have a flammability rating of V-1 or better
- Be rated for temperatures from -20 °C to +75 °C (-4 to 167 °F)
- Be selected to provide cable strain relief. The effectiveness of the strain relief must withstand pulling and twisting as specified in the relevant safety standard applicable to the installation
- Be UL or CSA approved if you are installing the 07931-Series Laser in the USA or Canada. Blanking plugs must also be UL or CSA approved
- Maintain the IP66 level of environmental protection classification specified for the 07931-Series Laser

Fit suitable blanking plugs to any unused cable entries. These must be made of metal or have a flammability rating of V-1 or better.

Hint: *As the gland plates are completely removable, feeding cable through glands, cutting, trimming and connector fitting may be completed in advance while the gland plate is not fitted to the analyser and pre installation.*

Cable screens

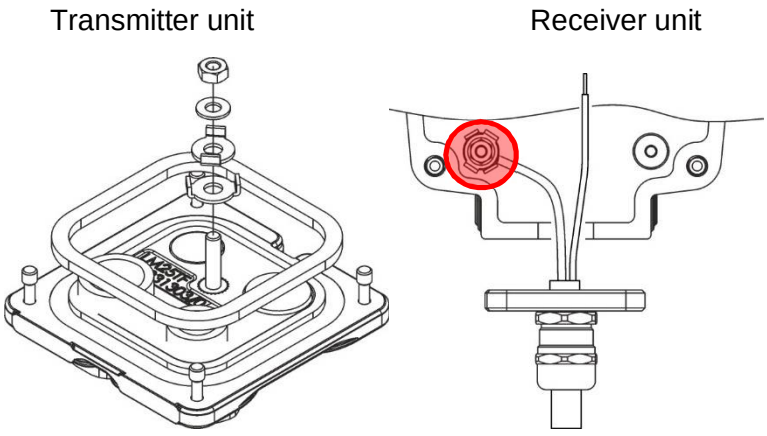


Figure 8-16: Cable screen terminations

Terminate cable screens at the local earth studs for TU and RU

Cable strip lengths

Strip all cables to the dimensions shown in.

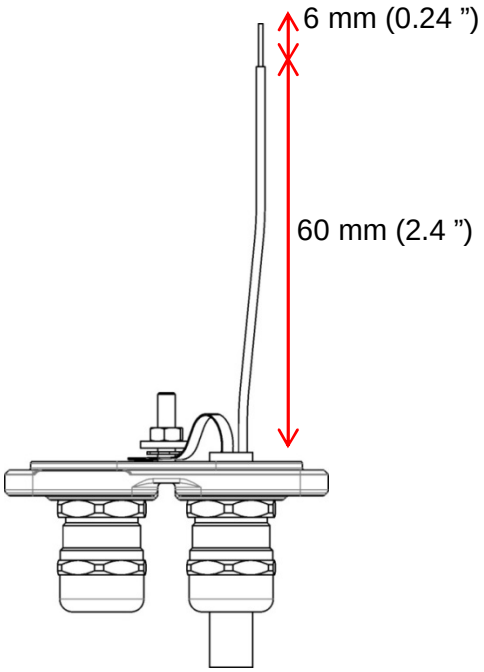


Figure 8-17: Cable strip lengths

Cable gland and blanking plug sizes

Receiver unit

Use one M20 x 1.5 mm cable gland in the receiver unit.

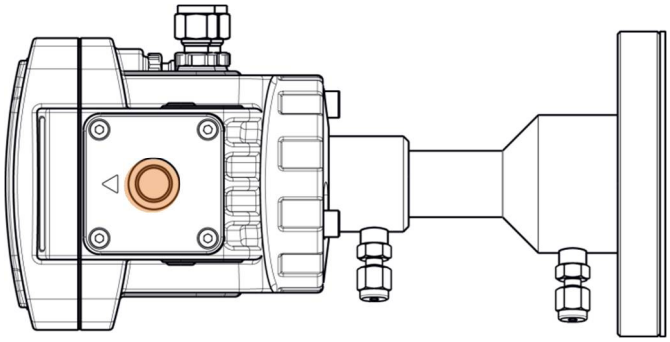


Figure 8-18: Receiver unit cable gland position

Transmitter unit

Use the following cable glands or blanking plugs in the transmitter unit:

Ports 2 and 3	2 x M16 x 1.5 mm
Ports 1 and 4	2 x M20 x 1.5 mm

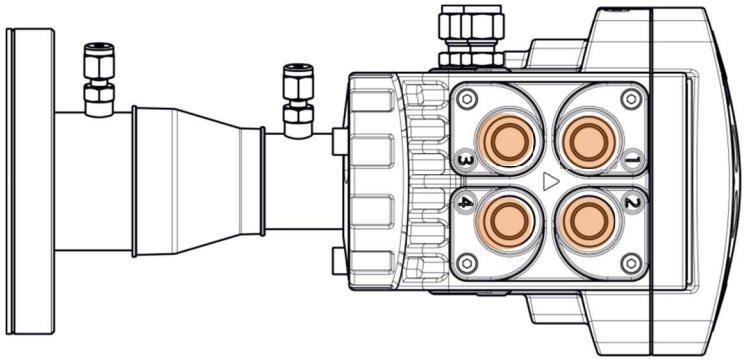


Figure 8-19: Transmitter unit cable gland positions

Note: *The cable glands and blanking plugs must be certified to IP66.*

8.5 Functional earth / ground requirements

Use a suitable conductor to connect the Analyser external earth (ground) terminal to a local equipotential earth (ground) point. You can use flexible or solid conductors, up to 10 mm^2 (0.34 $"^2$) up to a maximum length of 2 m (3.3 ft).

To comply with EMC requirements

- Always connect the functional earth (ground) terminal on the base of the receiver unit (item 7 in Figure 2-4) and transmitter enclosures (item 10 in Figure 2-7) to a local EMC earth (ground). You can use flexible or solid conductors up to 10 mm^2 (0.34 $"^2$). Make sure that the conductor is no longer than 2 m (3.3 ft).
- Make sure that all input and output cables (DC power, mA output, mA input, Ethernet, relay output) and the cable that connects the transmitter and receiver units are screened. Terminate the screens at the cable glands or local earth studs that are in the transmitter and receiver units (denoted by the symbol : ⏚)

Power cable connections

You can connect the 07931-Series Laser to a 24 VDC supply on site (voltage range of 18 to 30 VDC).

Make sure that the electrical supply voltage shown on the rating label is correct for the available electrical supply. Do not install the equipment if the incorrect voltage is shown and contact Servomex or your local Servomex agent immediately.

Make sure that the DC power for the 07931-Series Laser is not derived directly from an AC supply that is rated at more than 300 VAC.

Make sure that the DC power for the 07931-Series Laser is suitably approved for the environment in which it is to be installed and used.

To comply with EMC requirements

To comply with EMC requirements, make sure that the power supply for the 07931-Series Laser:

- meets the immunity and emission requirements of the environment in which it is being operated
- is not a DC supply network that powers other equipment without the application of suitable protection against surges or fast transient bursts

To connect the DC supply cable to the 07931-Series Laser:

1. With the power OFF, pass the DC electrical supply cable through a suitable cable gland fitted to the base of the power / interface compartment of the TU.
2. Connect the DC supply directly to the 7-way main connector.

The DC power cable must have the following specification:

Cable type	Screened
Number of cores	2
Rating (temperature)	-20 to +75 °C (-4 to 167 °F)
Cable conductors	0.2 to 1.5 mm^2 (28 to 14 AWG)
Approvals	Relevant to local requirements
Cable external diameter	Within the range specified for the selected cable gland (opt. power supply selected, 14mm (Max))

Note: *Under certain conditions of high ambient temperature a higher temperature rated cable may be required.*

8.5.2 Identification and location of electrical terminals

To open the transmitter unit, loosen the 4x M4 captive screws on the front panel (A in). The front panel hinges open (B in) to show the electronics and connectors.

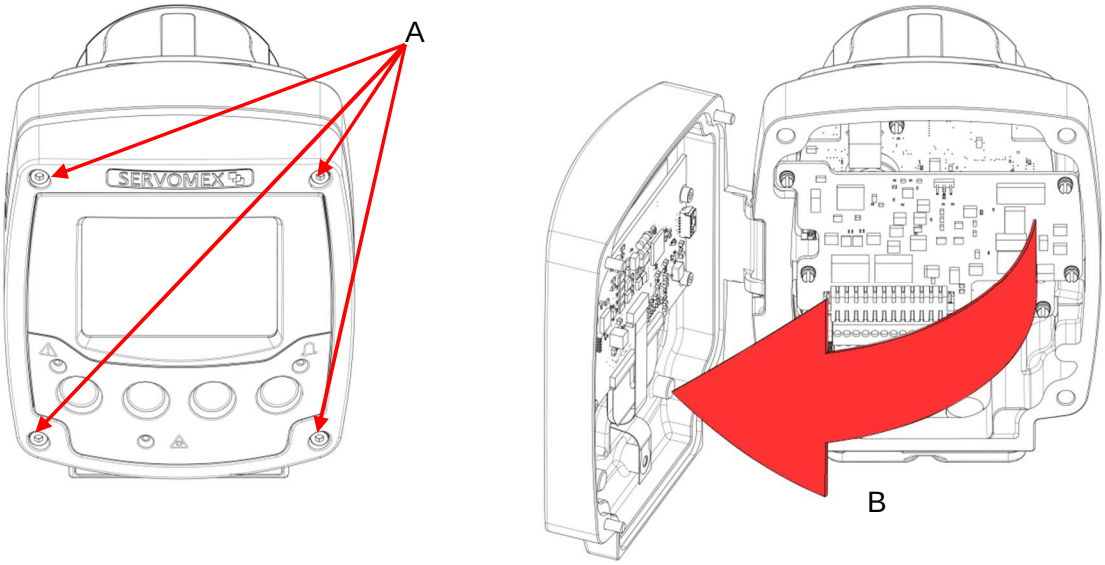
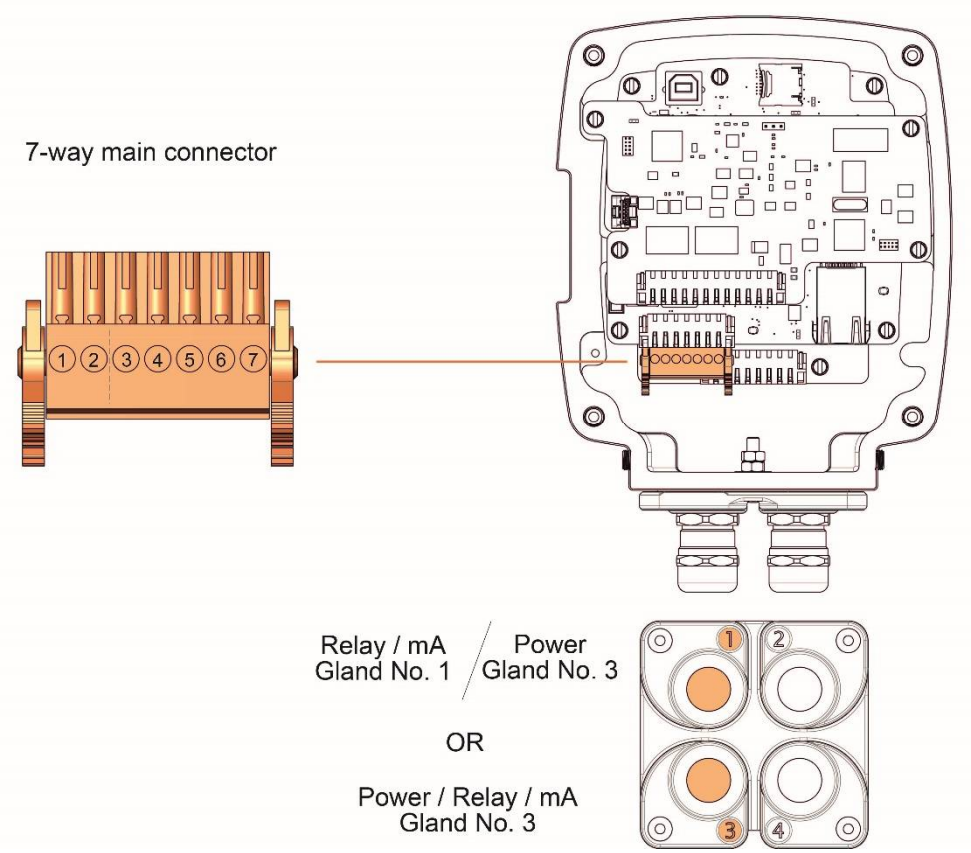


Figure 8-20: Opening the transmitter unit

7-way main connector



Terminal	Signal
1	18 to 30 V DC (nominally 24 V DC)
2	0 V
3	Relay N/O
4	Relay COM
5	Relay N/C
6	mA Output +
7	mA Output -

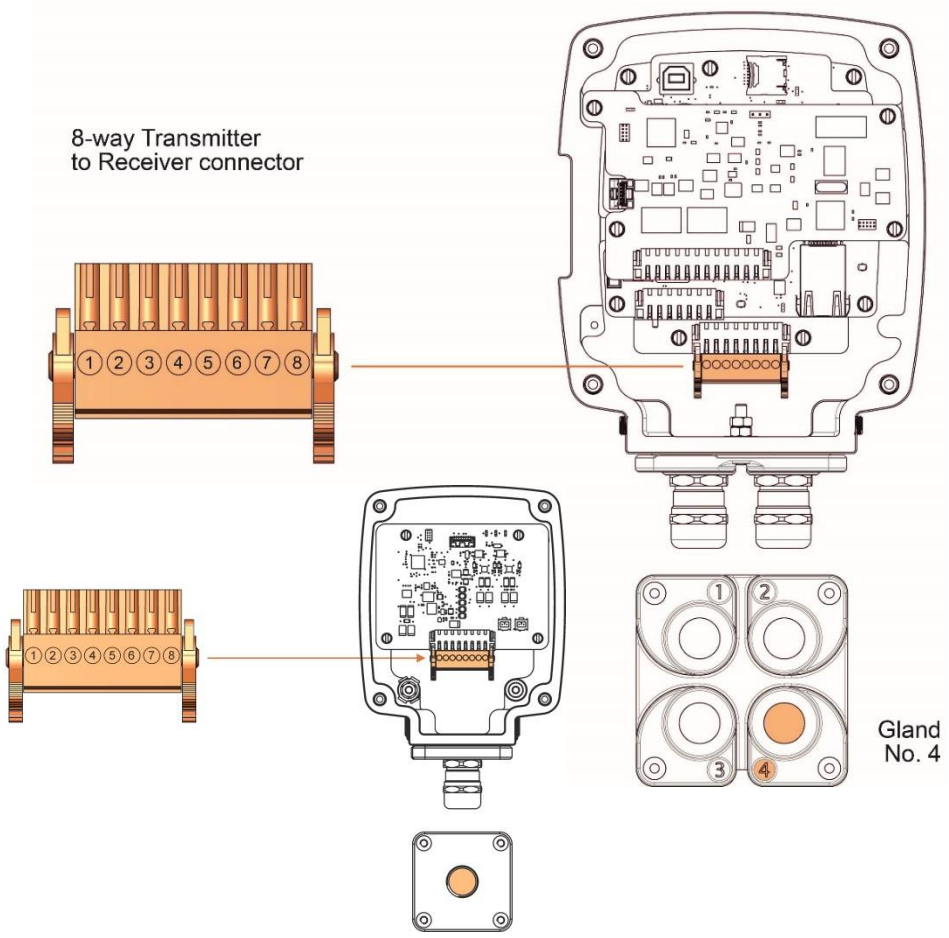
Screw terminal torque 0.2-0.25 Nm

Figure 8-21: 7-way main terminal and entry glands

All unused screw terminals must be tightened.

Ensure connector latches “click” into place and are engaged fully.

8-way transmitter and receiver unit connector



1	RS-485 A		(Twisted Pair 1)
2	RS-485 B		(Twisted Pair 1)
3	+12 V DC		(Twisted Pair 2)
4	0 V		(Twisted Pair 2)
5	Signal 1 +	(Measurement)	(Twisted Pair 3)
6	Signal 1 -	(Measurement)	(Twisted Pair 3)
7	Signal 2 +		(Twisted Pair 4)
8	Signal 2 -		(Twisted Pair 4)

Screw terminal torque 0.2-0.25 Nm

Figure 8-22: 8-way transmitter to receiver connector

Ensure connector latches “click” and are engaged fully.

Before you remove the receiver unit cover, turn off the power to the transmitter unit to ensure that there is no risk of exposure to the laser beam.

The connection cable must have the following specification:

Cable type	Screened
Number of cores	8
Configuration of cores	Twisted pairs
Rating (current / voltage)	300 V_{RMS}
Characteristic impedance	100 Ω
Rating (temperature)	-20 to +75 °C (-4 to 167 °F)
Cable conductors	0.2 to 1.5 mm^2 (28 to 14 AWG)
Flammability	VW-1
Approvals	Relevant to local requirements
Cable external diameter	Within the range specified for the selected cable gland
Maximum length	100 m

Note: *Under certain conditions of high ambient temperature a higher temperature rated cable may be required.*

Ethernet connector

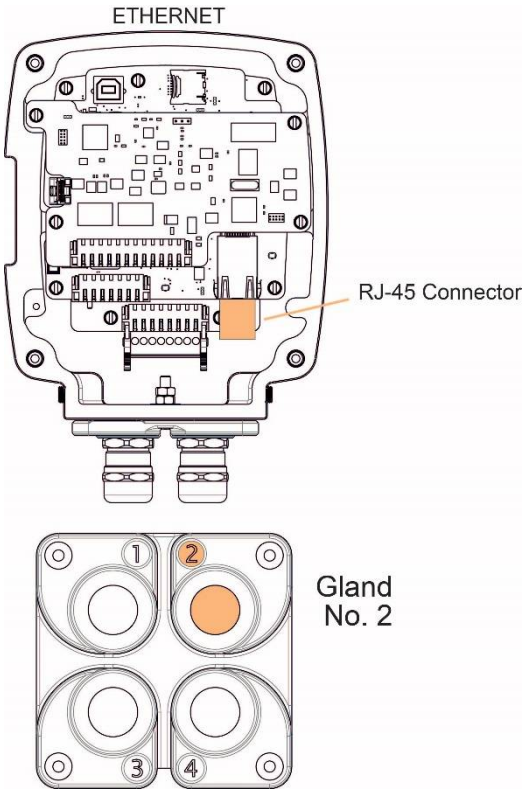


Figure 8-23: Ethernet connections

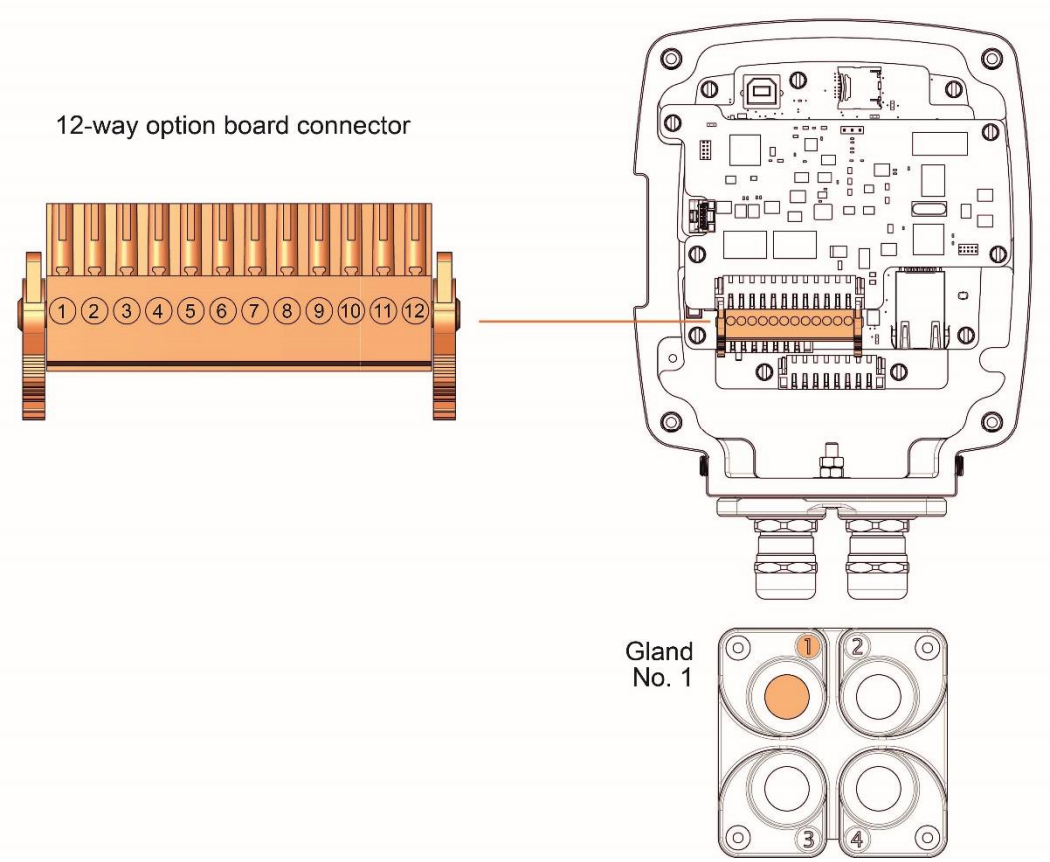
Wire the RJ-45 connector in accordance with to IEC 60603 and TIA / EIA-568-A or TIA / EIA-568-B.

Note: *The instrument supports Auto-MDIX (auto cross-over) so you can use either a straight or cross-over cable.*

Hint: *RJ-45 connector will require to be crimped post insertion through the gland plate. Short connector covers are recommended as internal space is limited and large or long covers may be difficult to fit.*

Hint: *Installation of an Ethernet cable to a designated area suitable for remote connection to a PC is recommended.*

12-way option board connector



Terminal	Signal	Terminal	Signal
1	mA Input 1 +	7	Relay 1 N/C
2	mA Input 1 -	8	Relay 2 N/O
3	mA Input 2 +	9	Relay 2 COM
4	mA Input 2 -	10	Relay 2 N/C
5	Relay 1 N/O	11	mA Output +
6	Relay 1 COM	12	mA Output -

Screw terminal torque 0.2-0.25 Nm

Figure 8-24: 12-way options board connections

All unused screw clamps must be tightened.

Ensure connector latches “click” and are engaged fully.

Note: *These connections are included on an optional PCB.*

8.6 Purge connections

Note: *Purge connections are listed in section 2.6.3.*

8.6.1 Alignment / purging assemblies

Make sure the purge gas pressure is above that of the process being monitored to avoid exposure to hazardous gases leaking from the process.

Make sure that the flange purges are connected and operational before you connect the transmitter and receiver units to the process. If you do not do this, the 07931-Series Laser optics could be damaged by the hot process.

> ***Hint:*** *Servomex recommend that the purge gas is supplied using flexible piping to minimise strain on the alignment assembly.*

The instrument windows are kept clean by setting up a positive flow of air through the alignment / purging flanges and into the stack. This purging prevents particles settling on the optical windows and contaminating them.

Use non-hazardous gas for purging. The purge gas must be dry and clean. Specific gas selected is application dependent.

Hint: *For Fixed pipe installations a typical flow rate is between 20 and 30l min^{-1}. For all other configurations, set an initial purge flow in the flange to approximately 1/10 of the gas velocity in the duct.*

After you have completed the installation, optimise the purge flow for your specific application.

Note: *Purge flows that are too low may cause blockage or contamination of the 07931-series laser.*

Note: *Purge flows that are too high may cause dilution of the measurement gas. If in doubt connect Servomex, or local representative, for further advice.*

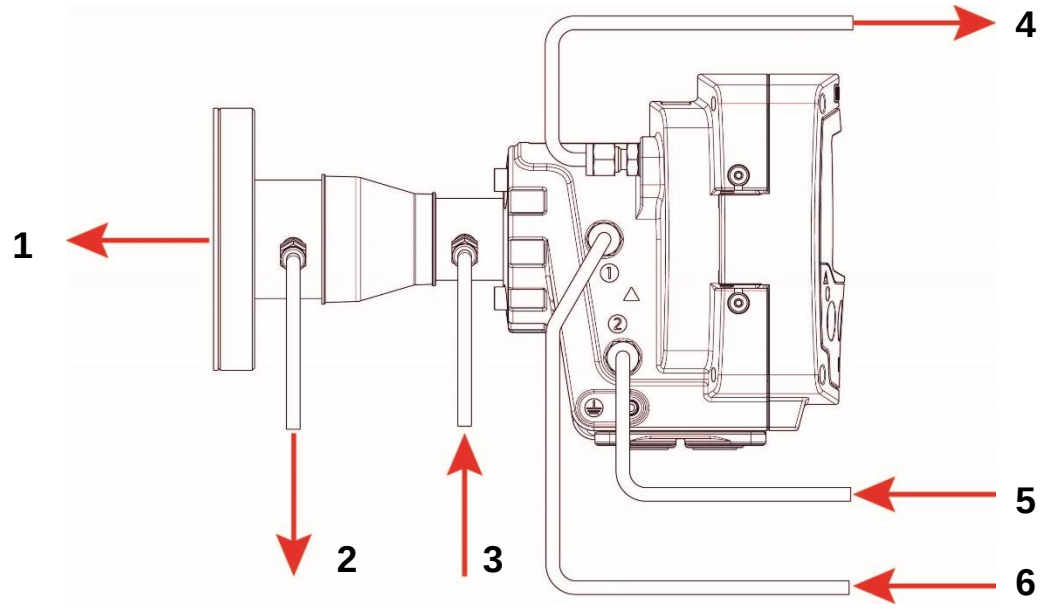
If in doubt, please contact Servomex or local representative for further advice

Note: *The air quality should conform to the standard set by ISO 8573.1, Class 2-3: particles down to 1 micron should be removed, including coalesced liquid water and oil, and a maximum allowed remaining oil aerosol content of 0.5 mg/m^3 (4.99423685 × 10-4 oz/cubic foot) at 21 °C (70 °F) (instrument air).*

Note: *Some instruments require nitrogen purging grade 3.0 or higher, for example, O_2 instruments for temperatures below 500 °C (932 °F).*

If in doubt, please contact Servomex or local representative for further advice

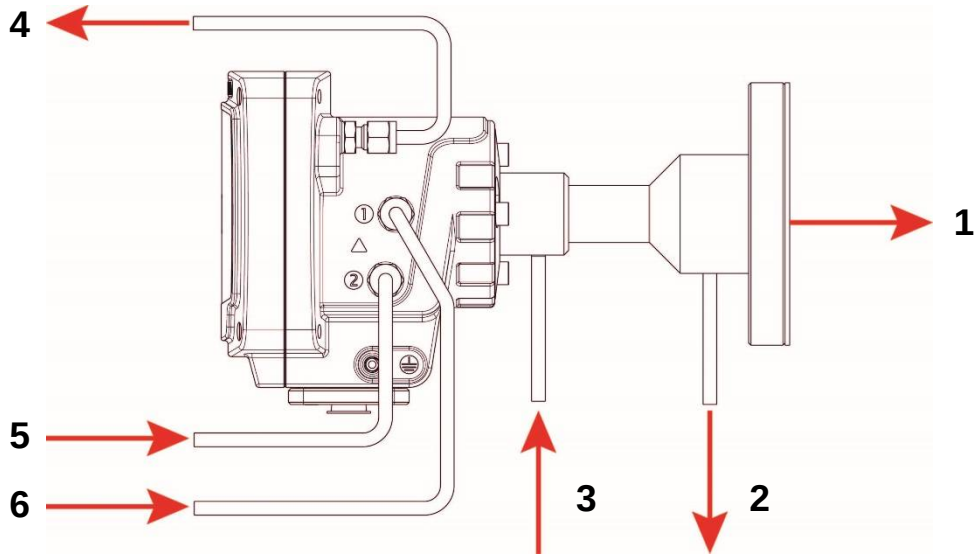
Transmitter purge connections



Ident.	Description
1	Window purge OUT *(standard)*
2	Window purge OUT *(option for isolation flange only, cap if not required)*
3	Window purge IN – Max flow of 10 $lmin^{-1}$
4	Purge 3 – Enclosure environmental / measurement OUT or Breather, includes weather seal - **DO NOT BLANK**
5	Purge 2 – Enclosure environmental IN (only if a measurement purge is also required) or blanking plug
6	Purge 1 – Measurement or environmental IN (max 100ml min^{-1}), or blanking plug

Figure 8-25: Transmitter purge

Receiver purge connections



Ident.	Description
1	Window purge OUT *(standard)*
2	Window purge OUT *(option for isolation flange only, cap if not required)*
3	Window purge IN - Max flow of 10 $lmin^{-1}$
4	Purge 3 – Enclosure environmental / measurement OUT or Breather - **DO NOT BLANK**
5	Purge 2 – Enclosure environmental IN (only if a measurement purge is also required) or blanking plug
6	Purge 1 – Measurement or environmental IN, or blanking plug

Figure 8-26: Receiver purge

8.6.2 Enclosure environmental / measurement (instrument) purge

Make sure that you vent purge gases carefully to avoid creating a hazard.

If using toxic, asphyxiant or flammable sample or calibration gases, always purge the enclosures with non-hazardous gas during operation to reduce the risk of hazardous concentrations accumulating within the analyser. Purge the enclosures for a suitable time before opening to ensure any concentrations are reduced to safe levels. Open transmitter or receiver enclosures in a force ventilated open area, or in another appropriate environment in which any hazardous gases are directed away from the user.

Make sure that the vent for environmental / measurement (Instrument) purge gas is clear and unobstructed so that the 07931-Series Laser enclosure does not become pressurized or its IP rating compromised.

Ensure the pressure of the measurement purge exceeds the pressure of the environmental purge gas to avoid backflow.

For applications where purging of the transmitter and receiver units is required for measurement or cooling, you must make sure that the direction of flow is as shown in **Figure 8-25: Transmitter purge** and **Figure 8-26: Receiver purge**

The transmitter and receiver units have internal optical surfaces. The purge gas must be clean and you may need to add additional filtering. Use Nitrogen or other non-hazardous gas as a purge gas. Make sure that the purge flow is less than 0.1 litres/minute (0.004 cubic ft/min) to avoid pressure build up inside the units.

Note: *Some instrument air may contain some oil and water which will quickly damage the optical windows, mirrors and lens in the receiver and transmitter units.*

8.7 Commissioning

8.7.1 Installation checklist

Item	Checked
The transmitter and receiver units are secure and firmly mounted	
The supply voltage is the same as the unit supplied	
The units are correctly earthed / grounded	
Connection is made from the transmitter to the receiver unit	
Connections are made to the mA outputs (as required)	
Connections are made to the mA inputs (as required)	
Connections are made to the alarm relays (as required)	
Network connection is made (as required)	
PCB connector latches are secure and engaged fully	
All wiring terminations are secure and tight	
All screws in unused terminals are secure and tight	
Cable glands are secured and made weather-tight	
Cables are dressed neatly within the transmitter and receiver units	
Hazardous area safety requirements are complied with	
External electrical connections are correctly labelled	
The transmitter and receiver unit covers are secured and weatherproof	
Gas fittings and connections are tightened and labelled	
Purge panel flow meters are set to recommended flow rates for the specific application and recorded (Flows should be verified at the Analyser to ensure there are no leaks or splits in the lines.	

Table 8-2: Mechanical installation check list

When the Mechanical installation check list is complete, switch on the power.

To confirm the TU and RU are working correctly:

- Check the laser LED light on the transmitter and receiver front panels are **ON**
- Check the transmitter unit display is working

8.7.2 Alignment for optimum measurement

Overview

Note: *The 07931-Series Laser is factory calibrated however Servomex recommend the Analyser is locally calibrated before installation.*

The transmission optimisation process is an iterative process required to be completed when the unit is in situ and should be completed before final measurement commissioning steps and software configuration.

Item		Section	Checked
	Physical Alignment	8.3.2	
	Alginment of the TU (Laser gain adjustment process)	8.7.2	
	Receiver unit alignment	8.7.2	

Table 8-3: Alignment check list

Alignment of the TU (Laser gain adjustment process)

Before the Analyser can be used it must be set up and the laser adjusted and aligned correctly so that the receiver diode is receiving the optimum laser intensity

The following steps describe the process.

Note: Servomex recommend saving current settings before starting the gain adjustment.

The physical alignment of the ‘ball joint’ flange will need to be adjusted to ensure the output is within this range.

Step 1	Peel back the boot on the transmitter mounting assembly to show the ball-joint alignment screws **Figure 8-27**
Step 2	Adjust the 4x screws to change alignment unit maximum Photodiode DC voltage achieved.
Note:	*Only small adjustments should be made (half turn maximum per iteration).*
Step 3	If signal greater than ***1.5*** V, Lower Gain 1 or Gain 2 and note new level of signal.

Step 4	Repeat Steps 2 -3 until the maximium Photodiode DC voltage achieved is between ***1.2V*** and ***1.5V***
Step 5	When all adjustments are complete, gradually tighten all adjusting M6 screws A, B, C and D (

Figure 8-28), taking care not to change the position of the assembly.

Step 6	Adjust Phase busrt cal See section 4.11.5

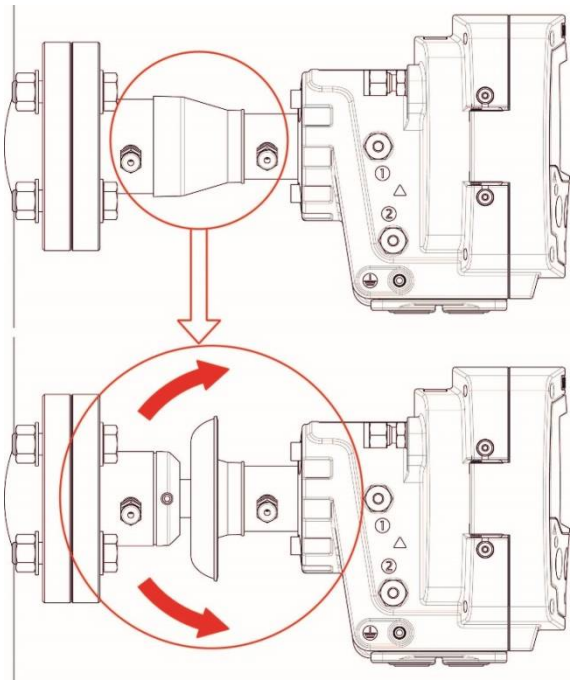


Figure 8-27: Peel back the boot

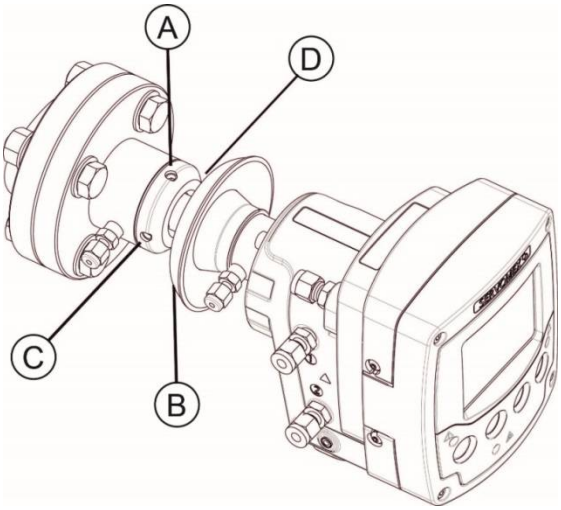


Figure 8-28: Installation: ball-joint adjustment screws

Receiver unit alignment

Assuming the alignment procedure has been followed correctly then adjustment to the receiver alignment should not be required. However, this can be verified using the “Tuning mode”. Tuning mode is switched on by default in the factory settings and the “tuning target” is set to 2.5V.

Note: *The pre-set voltage threshold in the “tuning target” is a configurable setting at the “Technical user” level and can be accessed in the “detailed set-up” menu under the “gain” menu.*

To align using the LEDs

Watch the receiver alignment LEDs on the receiver unit screen as you adjust the ball-joint alignment screws. The LEDs flash according to the direction of the adjustment.

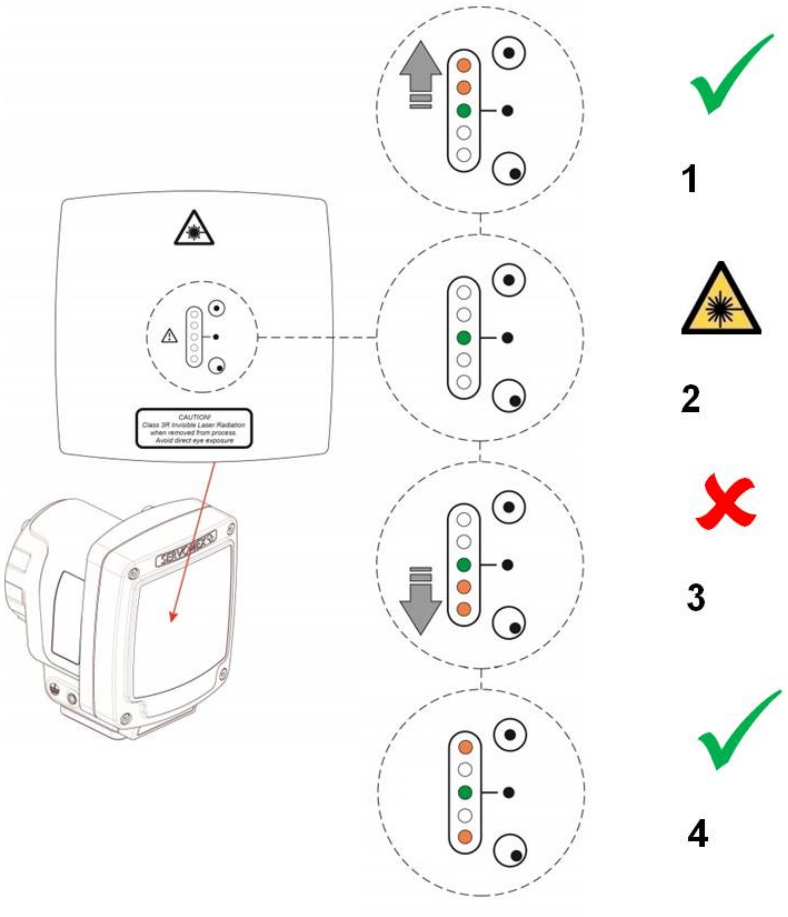
The first and fifth LEDs will illuminate when a large change in alignment has occurred, whereas, the second and fourth LEDs will illuminate when a small change in alignment has occurred.

The first and fifth LEDs will remain illuminated when the photodiode DC level has exceeded a pre-set voltage threshold and adequate alignment is achieved.

Note: *Depending on application details it may be required to readjust the photodiode DC level several times to ensure the target DC voltage level does not exceed 2.7 volts. To check the DC voltage level refer to 4.11.1.*

When all adjustments are complete, gradually tighten all adjusting M6 screws A, B, C and D, taking care not to change the position of the assembly.

Note: *The receiver alignment LEDs can only be used when the receiver is fitted with an adjustable mount (not a fixed mount), and you are adjusting the ball joint at the receiver end.*



1	Increasing laser intensity on the photodiode. Adjustment in the correct direction.	**3**	Decreasing laser intensity on the photodiode. Adjustment in the wrong direction.
2	Shows power ON. Possible laser hazard.	**4**	Tuning target voltage met.

Figure 8-29: Installation: adjust laser intensity on the photodiode

8.7.3 Software configuration

Note: *Settings should be saved on arrival of the Analyser.*

Item	Ref	Checked
Configure the password settings	4.3.2	
Configure the time and date to your region	4.3.3	
Configure the regional settings	4.3.4	
Configure the network settings	4.3.1	

Table 8-4: Software configuration check list

8.7.4 Measurement configuration

Item	Ref	Checked
Configure path length	4.2	
Configure segment details (e.g. for Air purge or N_2 purge for low O_2 application)	4.2.1	
Configure the mA inputs	4.1	
Configure the process pressure settings	4.2.2	
Configure the process temperature settings	4.2.3	
Configure the mA outputs	4.4	
Configure the relays	4.5	
Configure filtering options	4.6	
Configure measurement alarms	4.10	
Save settings	3.10.4 4.3.8, 7.4.5	

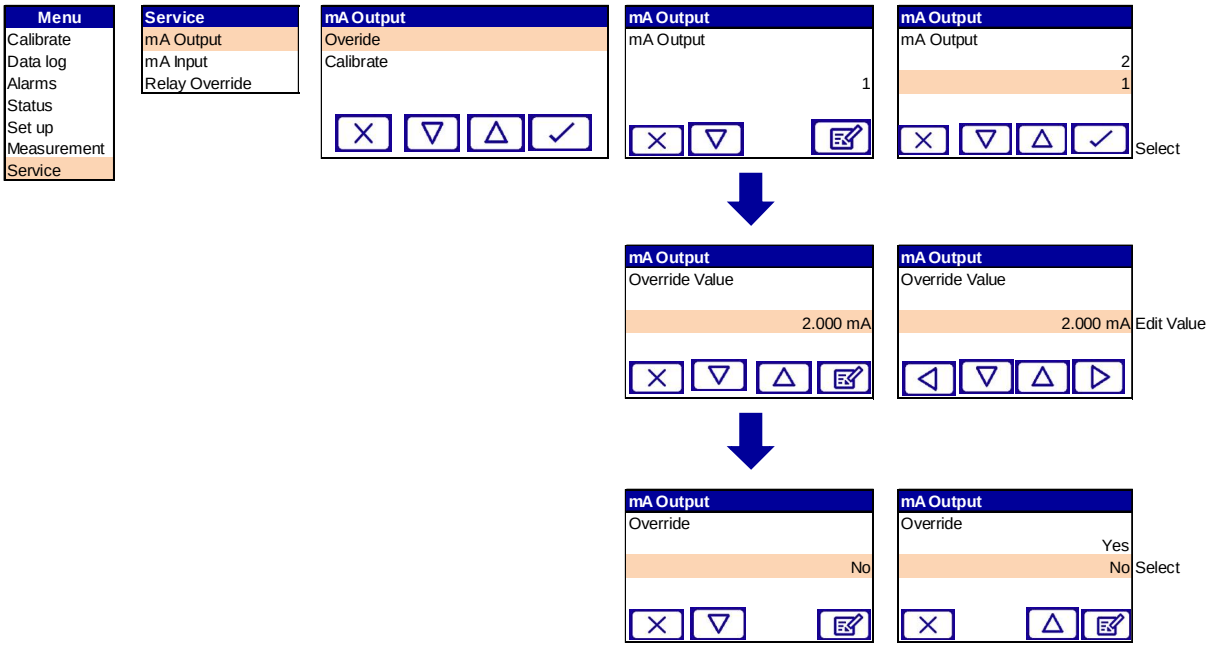
Table 8-5: Measurement configuration check list

9 Service

9.1 Service functions

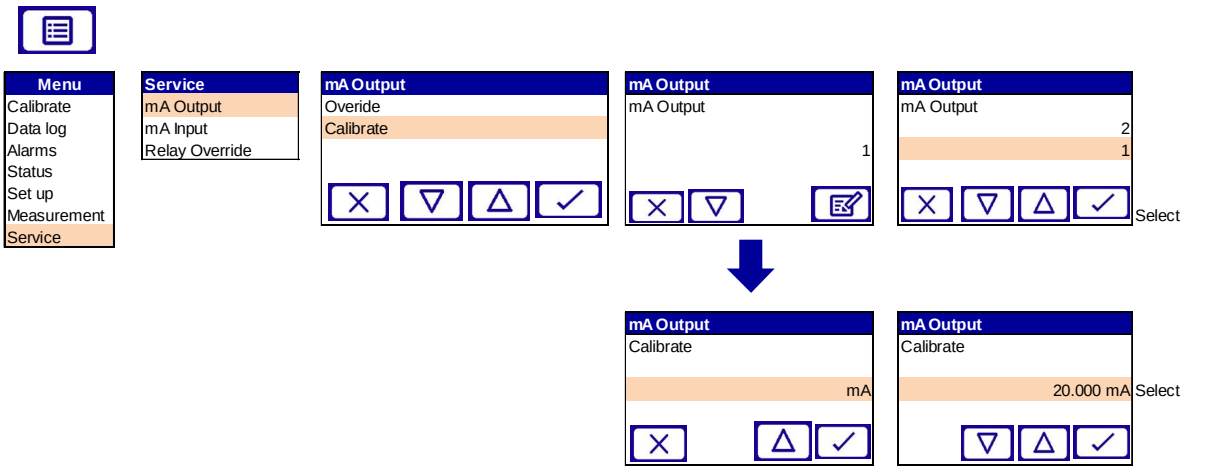
9.1.1 mA output override

To set the mA output override levels and activate override.



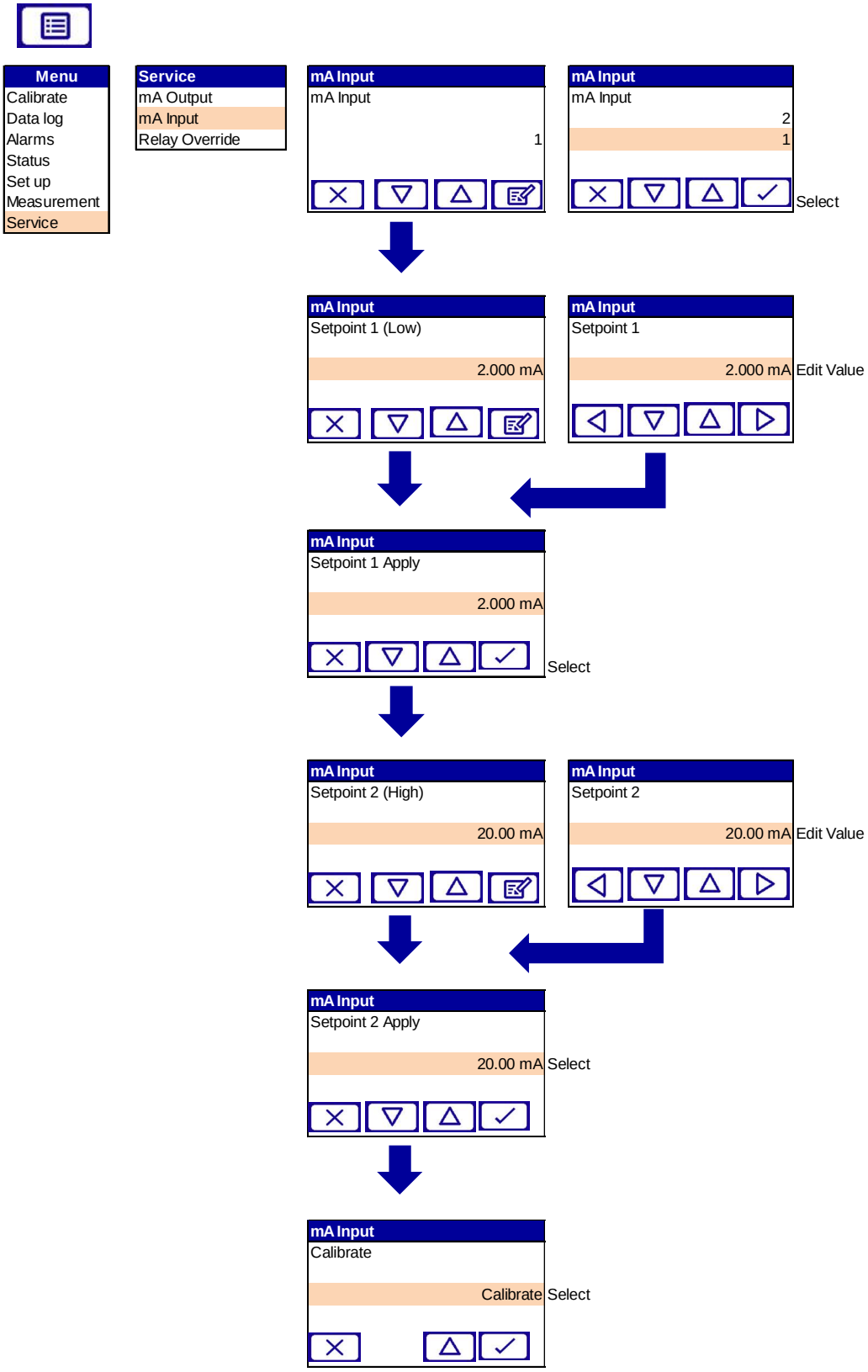
9.1.2 mA output calibrate

To select and calibrate mA outputs



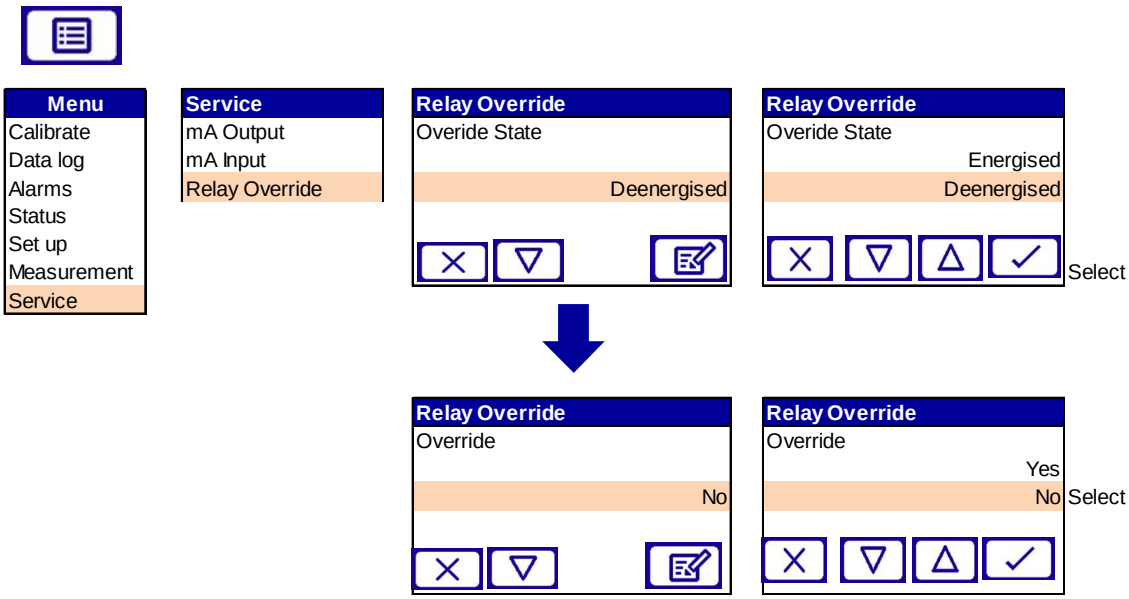
9.1.3 mA input

To set and calibrate mA input



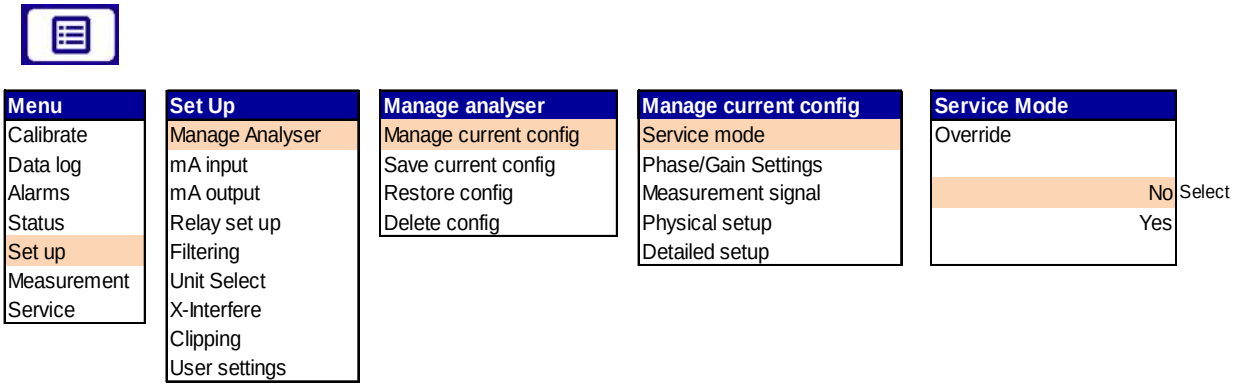
9.1.4 Relay Override

To set and calibrate mA input



9.1.5 Service Mode

To activate service override



9.2 Routine maintenance

Make sure that all gas connections to the process are regularly tested for leaks. If you find any, do not use the equipment until you have corrected the faults.

Do not attempt to maintain or service the 07931-Series Laser unless you are trained and competent.

Service personnel must verify the safe state of the equipment after all repairs. If you do not:

- **people may be injured**
- **the protective facilities incorporated into the design of the instrument may not operate as intended**
- **sample gas measurements may not be accurate, or**
- **the instrument may be damaged**

The 07931-Series Laser may be attached to equipment that is hot. Always wear the appropriate PPE to minimize the risk of burns.

Turn off the power to the 07931-Series Laser before you attempt to remove the transmitter and receiver units from the process, remove the receiver unit enclosure cover for any other maintenance work. This ensures that the laser beam is switched off and there is no risk of exposure to hazardous laser radiation.

Sample gases may be toxic, asphyxiant or flammable.

Before you remove the 07931-Series Laser from the process, make sure that it does not contain any potentially hazardous or heated gases, or is at a pressure below atmospheric pressure.

9.3 Cleaning

Only use a soft, clean cloth moistened with water to wipe clean the outside of the enclosure.

Optical glass window must be cleaned with isopropanol only.

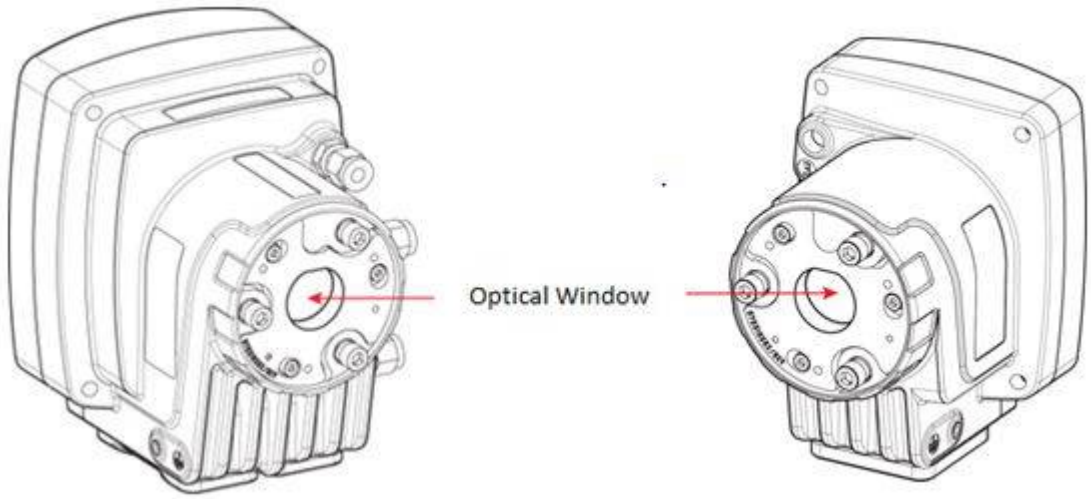


Figure 9-1: Optical windows

9.4 Routine checks

The 07931-Series Laser contains no moving parts and does not need to be fitted with any consumables. You only need to carry out simple maintenance procedures every 3 to 4 months. Carry out the following regular checks to ensure continuous and safe operation of the analyser.

9.4.1 Daily

Check optical transmission	The frequency of checking depends on the level of process condensates, particulates and vibration. You can do this automatically if you use instrument output (option), or via a warning relay.

9.4.2 Weekly

Check purge flow rates	Use a flow meter on the purge panel to check the purge flow rates are the same as at the time of commissioning.

.

9.4.3 Monthly

Check LEDs and display	Check the LEDs and displays are legible on the receiver and transmitter units. Clean them if necessary.

9.4.4 Three-monthly

Check purge flow rates	User the flow meters on the purge panel to check the purge flow rates are the same as at the time of commissioning. Leak check the purge fittings.

9.5 Alignment / purging flanges

Do not disconnect the pipes from the alignment / purging flanges if there is a risk to personnel or the environment from exposure to the potentially hazardous gases contained in the process being monitored.

Failure of the purge will severely damage the optical surfaces of the 07931-Series Laser.

Test the alignment / purging flanges for leaks at regular intervals as required for the specific process and installation conditions.

Inspect the pressure of the flange and window purge at regular intervals to ensure it is higher than that of the process as required for the specific process and installation conditions.

9.6 Enclosure purge and breather (if fitted)

Check the flow rates of the purge panel at regular intervals to ensure it is operating correctly.

Inspect the breather (if fitted) at regular intervals to ensure it has not become blocked or otherwise damaged.

9.7 User replaceable spare parts

There are no user replaceable spare parts.

All 07931-Series Lasers returned to Servomex or one of its appointed agents for servicing, disposal, or any other purpose must be accompanied by a completed decontamination certificate.

10 Certification information

10.1 Hazardous area approval and certification

10.1.1 Equipment certification standards

The standards to which the equipment has been certified are listed below:

ATEX
EN 60079-0:2012
EN 60079-11:2012
EN 60079-15:2010
EN 60079-28:2007
EN 60079-31:2014

IECEx
IEC 60079-0:2011 Edition 6
IEC 60079-11:2011 Edition 6
IEC 60079-15:2010 Edition 4
IEC 60079-28:2006 Edition 1
IEC 60079-31:2013 Edition 2

10.1.2 Europe and IECEx

ATEX	 II 3(2)G
	 II 3G(1D)
	 II 2(1)D
	 II 2D(2G)
	 II 3G
	 II 2D
Coding (ATEX and IECEx)	Ex ic nA nC op is IIC T4 Gc [Ex op is IIC T4 Gb]
	Ex ic nA nC op is IIC T4 Gc [IIIB T135°C Da]
	Ex tb IIIB T135°C IP66 Db [IIIB T135°C Da]
	Ex tb IIIB T135°C IP66 Db [Ex op is IIC T4 Gb]
	Ex ic nA nC op is IIC T4 Gc
	Ex tb IIIB T135°C IP66 Db
Ambient Temperature range	-20 °C to +65 °C
Certification number (ATEX)	Baseefa14ATEX0193X
Certification number (IECEx)	IECEx BAS 14.0092X

10.1.3 North America

SGS	
Non-incendive (USA and Canada)	Class I, Div 2, Groups A,B,C & D T4 Class II, Div 2, Groups F & G T4 Class III, Div 1 T4 Class I, Zone 2, Group IIC T4
Enclosure	IP66, 4X
Ambient Temperature range	-20 °C to +65 °C
SGS Contract number	710216

10.2 Label Information

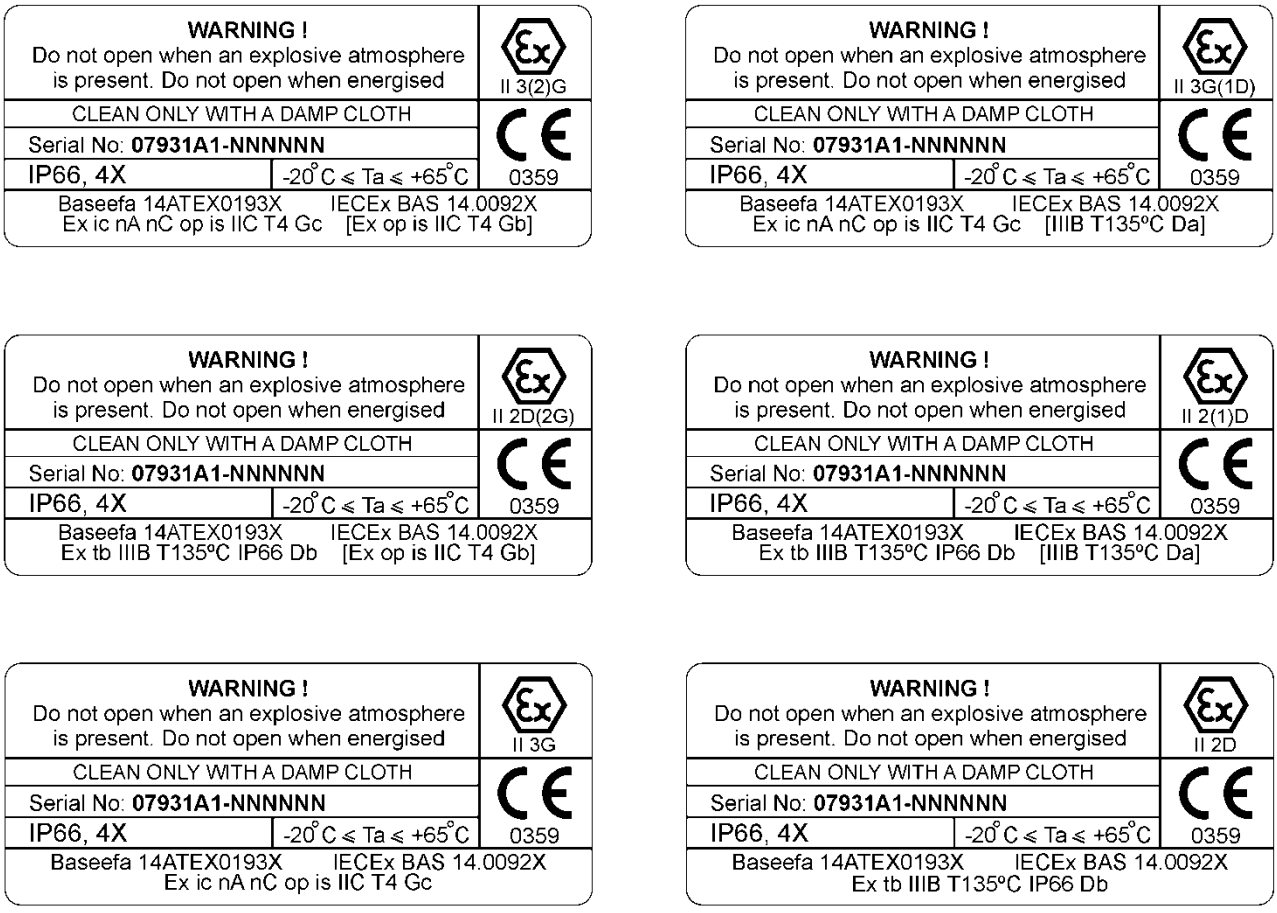


Figure 10-1: ATEX / IECEx labels

Figure 10-2: SGS North American label

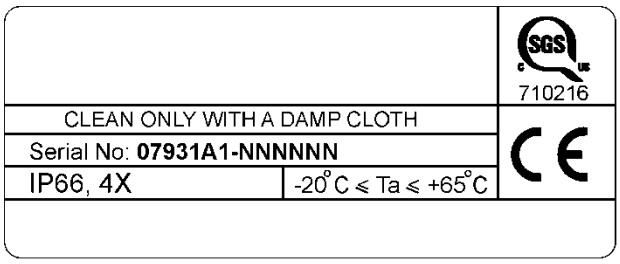


Figure 10-3: General Purpose label

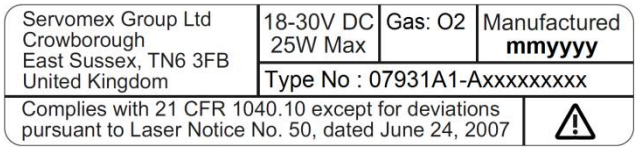


Figure 10-4: Rating label

10.3 EMC

Europe	The 07931-Series Laser complies with the European Community Electromagnetic Compatibility Directive: Emissions Class A: Equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. Immunity: Industrial.
Canada	This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.
US	The 07931-Series Laser complies with Part 15 of the FCC Rules for Class A equipment. It is not suitable for operation when connected to a public utility

power supply that also supplies residential environments.

10.4 Electrical Safety

The 07931-Series Laser has been assessed to IEC61010-1 for electrical safety including any additional requirements for US and Canadian national differences.

Overvoltage Category: Category II.

Pollution Degree: 2.

Servomex Group Limited is a BS EN ISO 9001 and BS EN ISO 14001 certified organisation.

10.5 Product Disposal

This product is not considered to be within the scope of the Waste Electrical and Electronic Equipment (WEEE) Directive.

This product is not intended for disposal in a municipal waste stream, but shall be submitted for material recovery and recycling in accordance with any appropriate local regulations.

Note: *All label certification markings (SGS or ATEX / IECEx) must be permanently defaced to ensure marking is not identifiable before the disposal of the product.*

Additional advice and information on the disposal of this product in accordance with the requirements of the WEEE Directive can be obtained from:

Servomex Group Limited,
Jarvis Brook,
Crowborough,
East Sussex,
TN6 3FB,
England
+44 (0)1892 652181
Fax: +44 (0)1892 662253
www.servomex.com

All 07931-Series Lasers returned to Servomex or one of its appointed agents for servicing, disposal, or any other purpose must be accompanied by a completed decontamination certificate.

10.6 EU REACH regulations

EU REACH Regulations (1907/2006 (as amended)):

For information on Substances of Very High Concern (SVHCs) included in Servomex products see: www.servomex.com

11 Index

12 Appendix Display unit conversion factors

When you select display units as described in Section 4.7, you must ensure that you also enter the correct unit conversion factor, as shown in the table below:

To convert from *	to †	use the units conversion factor	applicable gas(es)
%	ppm	10000	any
ppm	%	0.0001	any
ppm	vpm	1	any
ppm	mg/m3	1.4277	O2
"	"	0.750	NH3
"	"	1.2492	CO
"	"	1.9631	CO2
%	mg/m3	14277	O2
"	"	7500	NH3
"	"	12492	CO
"	"	19631	CO2
ppm	%LEL	0.0008	CO
%	%LEL	8	CO
%	mol/mol	0.01	any
ppm	mol/mol	#	#

* Measurement default units † Selected display units # This conversion is not supported

Note: *To return to the measurement default units, select the "off" units selection option and set the units conversion factor to "1": see Section 4.7*

13 Appendix Modbus setup

13.1 Implementation guide for Modbus communications

13.1.1 Introduction

This appendix details the implementation and use of the Modbus protocol in the analyser.

13.1.2 Supported function codes

For simplicity, only the following function codes will be supported.

Function	Description	Usage
01	Read coils	Read calibration status, pump state, etc.
02	Read discrete inputs	Read faults and alarm states.
03	Read holding registers	Read settings.
04	Read input registers	Read measurements, units, etc.
05	Write single coil	Change modes, perform calibration etc.
06	Write single register	Change single setting.
08	Sub Function 00 = Return query data	Diagnostic to test communications.
16	Write multiple registers	Change multiple settings.

13.1.3 Exception codes

If an error should occur while processing a message one of the following exception codes will be returned by the instrument.

Code	Condition	Meaning
01	Illegal function	Requested function code is not supported.

02	Illegal data address	The combination of data address and transfer length is invalid for this function.
03	Illegal data value	A value contained in the query data field is not an allowable value. This indicates a fault in the structure of the remainder of a complex request. This does NOT mean that a value to be stored in a register is incorrect as Modbus has no means of determining what is legal for any particular register.
04	Slave device failure	An unrecoverable error occurred while the unit was attempting to perform the requested action.

13.1.4 Addressing

Addresses in Modbus ADU (application data unit), run from 1 – N, whereas addresses in the Modbus PDU (protocol data unit) run from 0 – N. This appendix gives addresses in the ADU model. Depending on the particular Modbus master, addresses may have to be entered as they are given or have 1 subtracted from them. For example to read register 101 an address of 100 may be needed.

Note: *Slave ID: 247*

13.1.5 Floating point numbers

Floating point numbers (e.g. 12.34, –1012.32, etc.), are digitally represented using the IEEE–754 format. Single precision floating point numbers are used throughout and they require 32 bits of data. Since a Modbus register holds 16 bits it takes 2 registers to represent a floating point number. We default to having the most significant word of the float, bits 16 – 31, in the first register, and the least significant word, bits 0 – 15, in the next register. This order can be reversed by setting a coil in the system control mapping.

13.1.6 System data

				Supports Function Code							
Base Address	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
3001	0	0-9	Instrument Serial Number			Yes					
		10-19	Control Unit Firmware			Yes					
3021	1	0-9	Display Adapter Firmware			Yes					
		10-19	Analog Output Firmware			Yes					
3041	2	0-9	Option Board Firmware			Yes					
		10-19	Transmitter Firmware			Yes					
3061	3	0-9	Receiver Firmware			Yes					
		10-19	Bootloader Firmware			Yes					
3981	49	0	NumberOfInternalTransducers			Yes					
		1	Reserved			Yes					
		2	NumberOfTransducers			Yes					
		3	NumberOfMeasurements			Yes					
		4	NumberOfAins			Yes					
		5	NumberOfAouts			Yes					
		6	NumberOfAlarms			Yes					
		7	NumberOfRelays			Yes					
		8	NumberOfDins			Yes					
		9	Reserved			Yes					
		10	Number of legacy flow alarms			Yes					
		11	Number of Legacy Heaters			Yes					
		12	Number of Legacy Sample Heater			Yes					
		13	Number of Field Buses			Yes					
		14	Number Of Ovens			Yes					
		15	Number Of Network Cards			Yes					
		16	NumberOfResources			Yes					

13.1.7 System Settings

				Supports Function Code							
Base Address	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
2001	0	0	Floating point order	Yes				Yes			
		1	User interface busy	Yes							
		2	Disable user interface	Yes				Yes			
		3	Audible alarm	Yes				Yes			
		4	ResponseDelay			Yes			Yes		Yes
		5	Language			Yes			Yes		Yes

		6	Date format			Yes			Yes		Yes
		7	Decimal format			Yes			Yes		Yes
		8	Backlight Time			Yes			Yes		Yes
		9	clock: Hrs			Yes			Yes		Yes
				Supports Function Code							
Base Address	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
		10	clock: Mins			Yes			Yes		Yes
		11	clock: Seconds			Yes			Yes		Yes
		12	date: Year			Yes			Yes		Yes
		13	date: Month			Yes			Yes		Yes
		14	date: Day			Yes			Yes		Yes
		15	CalLink			Yes			Yes		Yes
2021	1	0	Temperature Units			Yes			Yes		Yes
		1	Pressure Units			Yes			Yes		Yes
		2	Flow Units			Yes			Yes		Yes
		3	Moisture Units			Yes			Yes		Yes
		4	Distance Units			Yes			Yes		Yes
		5	Current Units			Yes			Yes		Yes
		6	Voltage Units			Yes			Yes		Yes
		7	Resistance Units			Yes			Yes		Yes
		8	Angle Units			Yes			Yes		Yes
		9	Wavelength Units			Yes			Yes		Yes

13.1.8 System control

				Supports Function Code							
Base Address	**Block**	**Base Address Offset**	**Parameter**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**16**
1	0	0	Service in Progress			No			Yes		Yes
0=Not in Service Mode, 1=Service Mode. Instrument MUST be set to Service in Progress before any calibration or override actions are performed											

13.1.9 Measurements

				Supports Function Code							
Base Address	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
1001	0	0	Number Of Measurements			Yes					
	0	1	Repeat (safeguard)			Yes					
	0-49	2(n-1) + 2	Measurement n			Yes					

13.1.10 TU Calibration Data

					Supports Function Code							
Base Address	First Block Number	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
16241	0	Tx (n)	0	Reserved			Yes			No		No
			1	Reserved			Yes			No		No
			2	AVFinishing			Yes			No		No
			3	AVFailState			Yes			No		No
			4	Number of Cal / Val Points			Yes			No		No
			5	Select Cal/val point			Yes			Yes		Yes
			6	LastCal/val Point n Reading			Yes			No		No
			8	LastCalPoint n Target			Yes			No		No
			10	LastCalPoint n Delta			Yes			No		No
			12	Last Cal point n Time			Yes			No		No
			13	Last Cal point n Date			Yes			No		No
			15	Cal point passed/failed			Yes			No		No
AVFinishing 0=Not Finishing, 1=Finishing												
AVFailState 0=Not in Fail State, 1=In Fail State												

13.1.11 TU Live info

					Supports Function Code							
Base Address	First Block Number	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
6961	0	Tx (4n-1)	0	Transducer Type			Yes					
			1	Tag Number			Yes					
			2	Name			Yes					
			11	Measurement			Yes					
			13	Pressure Compensated Measurement			Yes					
			15	Filtered Measurement			Yes					

6981	1	Tx (4n)	0	Alarm Active	Yes
			1	Fault	Yes
			2	Service in progress	Yes
			3	Out of Specification	Yes
			4	Maintenance required	Yes
			5	Transducer maintenance fault	Yes
			6	Transducer error	Yes
			7	Transducer fatal fault	Yes
			8	WarmingOn	Yes
			9	Reserved	Yes
			10	Reserved	Yes
			11	Calibration fault	Yes
			12	Communication fail	Yes
			13	Transducer not detected	Yes
			14	Reserved	Yes
			15	Remote calibration/val denied	Yes
7001	2	Tx (4n+1)	0	Clipping Active	Yes
			1	Remote service in progress	Yes
			2	Transducer calibration mode	Yes
			3	Reserved	Yes
			4	Incorrect transducer type	Yes

13.1.12 TU Settings

					Supports Function Code							
Base Address	First Block Number	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
12881	0	Tx (n)	0	Name			Yes			No		No
			9	Units			Yes			No		No
14001	56		0	Filter Time			Yes			Yes		Yes
			2	Filter Reset Threshold			Yes			Yes		Yes
			4	Unit selection (scaling Factor)			Yes			Yes		Yes
			6	PMR			Yes			No		No

		8	Cross Interference correction	Yes	Yes	Yes
15121	112	0	Clip Low Enabled	Yes	Yes	Yes
		1	Clip Low Level	Yes	Yes	Yes
		3	Clip Low Override Enable	Yes	Yes	Yes
		4	Clip Low Override Level	Yes	Yes	Yes
		6	Clip Low Hysteresis Enable	Yes	Yes	Yes
		7	Clip Low Hysteresis Level	Yes	Yes	Yes
		9	Clip High Enabled	Yes	Yes	Yes
		10	Clip High Level	Yes	Yes	Yes
		12	Clip High Override Enable	Yes	Yes	Yes
		13	Clip High Override Level	Yes	Yes	Yes
		15	Clip High Hysteresis Enable	Yes	Yes	Yes
		16	Clip High Hysteresis Level	Yes	Yes	Yes

13.1.13 TU Control

				Supports Function Code							
Base Address	Block	Base Address Offset	Parameter	1	2	3	4	5	6	8	16
4001	0	0	Calibration mode on/off	Yes				Yes			
		1	Reserved	No				Yes			
		2	Reserved	No				Yes			
		3	Capture and enable baseline subtraction	Yes				Yes			
4021	1	0	Invoke calibration n			Yes			Yes		Yes
		1	Calibration point n gas			Yes			No		No
		2	Reserved			Yes			Yes		Yes