CERTIFICATE OF CONFORMANCE

This certificate is issued to certify the instrument(s) listed below have been checked, tested, where necessary, calibrated and found to comply with the manufacturer's specification at the measured points.

EQUIPMENT DESCRIPTION:	**INFRARED MEASURING EQUIPMENT**
MANUFACTURER :	**NDC INFRARED ENGINEERING LTD**
MODEL :	**CM710E 417390**
PO NUMBER :	**PO 121264**
OUR REF :	**402295**
REMARKS :	**Electronic Moisture Measuring Gauge**

Test equipment used in the testing of the above item(s) is subject to regular calibration and traceable to a national standard.

Due allowance has been made for the uncertainty of measurements.

Calibration is carried out in accordance with the general requirements of ISO 9001:2008

Name : **Vivienne Hayward**

Signed :

Date : 24th August 2012

The Measure of Quality

NDC Infrared Engineering Ltd, Bates Road, Maldon, Essex, CM9 5FA, United Kingdom. Registered in England. No 6630998
Tel +44 (0)1621 852244 Fax +44(0) 856180 www.ndcinfrared.com sales@ndcinfrared.co.uk

NDC Infrared Engineering
710e Series
User Guide

Gauge Types: CM710e, PH710e

Publication Reference: 105/14560-01SA
Issue 8

COPYRIGHT

NDC
Offices in the USA, UK and China. Visit www.ndcinfrared.com for office details.

A Spectris Company

Contents

1 Introduction

1.1 About this manual

This manual describes the installation, operation, calibration and maintenance of the 710 Series gauges and peripheral equipment. It is intended for use by installation personnel, suitably-qualified maintenance staff and trained operators.

As an aid to using the manual for installing and setting up the system, we have provided the following Quick Setup Guide, which gives the essential steps and takes you quickly to the sections that describe them.

1.2 Quick setup guide

The 710e gauge system is designed for ease of installation and setup. Just perform the key steps in the order given below.

Note: The procedure here assumes that your system includes an HMI. If it does not, you can still follow the procedure, but you will need to perform the setup steps using the GaugeToolsXL software and its user instructions.

1. Install the gauge system (Page 4-1).
   You might need to read the Overview (Page 5-1) and Data entry (Page 5-5) information in the Operation section before performing the following setup actions on the HMI.
2. Select the user language. (Page 5-20)
3. Set up the home page as desired from the factory defaults. (Page 5-14)
4. Check no error messages are displayed on the HMI. (Page 5-30)
5. Name the gauge(s) and measurement channels from the factory defaults as desired. (Page 5-26)
6. Reference the gauge (allowing the gauge to warm up for 1 hour first). (Page 6-4)
7. Create a Product recipe based on factory settings sheet with the desired response time. (Page 5-16)
8. Select the Product recipe. (Page 5-17)
9. Auto-trim the gauge to the desired reading. (Page 6-2)
10. Check and if necessary adjust the gauge trim value against laboratory reference values. (Page 6-3)
11. If there is a wide measurement range, perform a full-range calibration. (Page 6-6)
12. If the 4-20mA analogue outputs are being used, set the scaling over the full measurement range. (Page 5-26)

1.3 Associated documentation

The following documents are associated with this manual.

- Packaging Sheet - detailing all despatched items, for use as a delivery check list
- Factory Settings Sheet. This provides:
  - a system diagram showing the components supplied
  - serial numbers of all major components
  - factory settings for each component
- GaugeToolsXL User's Guide : 105/14033-01SA
- GaugeToolsXL Installation Guide and Quick Start : 105/14020-SA

1.4 Contact information

For enquiries relating to the operation and use of the equipment described in this manual please refer to www.ndc.com for company contact details.

2 Safety information

2.1 Warnings

- To avoid the risk of electric shock, isolate the mains supply to the equipment before carrying out any installation, maintenance or repair work.
- The gauge contains items that rotate at high speed and which could cause injury. Do not operate the gauge unless it is fully assembled.
- Compressed air can be dangerous. Where this is used, observe all relevant local regulations and follow normal operational good practice for handling compressed air.
- If the gauge is not installed and used in the manner prescribed in this manual, the safety protection afforded by the equipment may be impaired.

2.2 Cautions

- The gauge and associated equipment contain static-sensitive devices. During installation, maintenance or repair, observe standard electrostatic precautions to avoid damaging the equipment.
- Clean the gauge windows and external equipment surfaces with clean non-abrasive materials only, in accordance with the cleaning instructions (Page 7-1). If in doubt, contact NDC.

3 System Overview

Each 710e gauge installation is optimised specifically for a particular application, to suit the environment in which it will operate and to provide the appropriate process measurements.

The CM710e gauge is designed for industrial processing applications, covering a wide range of products and often involving aggressive environments. It is most commonly used for the measurement of moisture, but its measurement channels may be used to analyse various product constituents, according to requirements.

The PH710e is optimised for Pharmaceutical applications, typically for endpoint moisture determination, but also for measurement of other constituents. The gauge outputs can be used to control drying and other production processes by interfacing with relevant factory systems.

Both gauges are available in cast alloy and stainless steel enclosures.

3.1 System components

The 710e gauge system has the following key components, which may be configured in a wide range of stand-alone and multi-gauge configurations.

- Gauge
- Human Machine Interface (HMI)
- Operator Work Station (OWS)
- User Port (UP)
- Switched Hub

The gauges and peripheral unit enclosures are available in various formats and materials for use in different environments. Each component may be supplied in some or all of the following.

Gauges	▪ Cast alloy, IP65
	▪ Stainless steel, IP65
	▪ Stainless steel, IP67, Atex certified
Peripherals	▪ Molded ABS enclosed
	▪ Stainless steel enclosed
	▪ Aluminium panel-mounted

Gauge

710e gauges are intelligent devices that perform all of the measurement and processing functions of the system internally, and provide direct outputs of the calibrated measurement values. They also generate the displays shown on the HMI and OWS, which allows, for example, gauge firmware updates to be automatically reflected in all operator displays.

The gauges work on the principle that different product constituents absorb Near Infra-red Light (NIR) at specific wavelengths. The gauges emit NIR light at these wavelengths and then accurately measure the amount reflected from the product. From this they generate outputs that are directly proportional to the amount of each measured constituent in the product.

Depending on the application and environment, the gauges may have cast alloy or stainless steel enclosures. They may be fitted with options including water or vortex air cooling, and an air purge unit to keep the gauge window free from contamination. Versions of the stainless steel gauges are available for use in harsh and hazardous environments.

By default, the gauges communicate with other system devices via ethernet. They are powered from a 24V supply, and connect to the system by means of a single cable carrying both data and, where required, DC power to associated devices such as the OWS and HMI.

HMI

The HMI (Human Machine Interface) provides supervisor-level access to up to 16 gauges within the same network.

The operating and display interface is a colour touch screen. Each connected gauge has its own home page, normally configured to display the real-time measurement outputs.

Other pages allow for direct interaction with the gauges for functions such as taking sample measurements and performing calibration, and for performing supervisor functions such as maintaining user passwords.

Product definitions can be created through the HMI, each of which is a collection of settings for a specific gauge and measurement application. These are stored in the gauges and can be recalled remotely or manually from the HMI.

In addition to ethernet connection, it provides four scalable analogue outputs, eight opto-isolated digital inputs and eight digital outputs.

OWS

The OWS (Operator Workstation) is dedicated to one individual gauge and is located near to it in the process.

It enables the operator to carry out process-related tasks such as viewing measurement and product sampling.

It cannot change any process-critical gauge settings or perform any supervisory tasks.

UP

The function of the UP (User Port) is to provide connectivity at any required point in the system. It can be used, for example for interconnection between the NDC gauge network and a factory network.

In addition to ethernet connection, it provides four scalable analogue outputs, eight opto-isolated digital inputs and eight digital outputs.

Switched Hub

The switched hub serves as a sealed 8-port switched ethernet hub for the gauges in multi-gauge systems. It can also provide the interface for communication between the 710e network and a factory network, allowing only the required data to pass between the two.

The hub has seven screw-terminal ports for connection to the 710e system. The eighth port is RJ45 and intended mainly for temporary connection of a laptop running GaugeTools XL software.

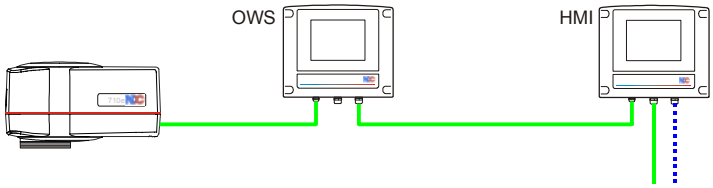
3.2 Configuration examples

The following examples show typical configurations of 710e gauges to illustrate the application of the system components. Your configuration will be shown on the Factory Settings sheet supplied with the equipment.

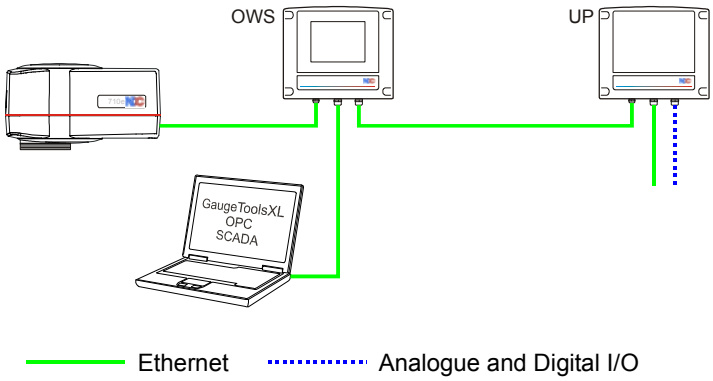
3.2.1 Single gauge systems

These are two basic stand-alone system configurations, using a single gauge with its own OWS.

In the first example, an HMI is used to provide supervisory functions and remote measurement display. It also provides the facility to interface with factory systems for remote measurement or control purposes via ethernet and its analogue and digital I/O.



Alternative arrangements may use NDC GaugeToolsXL software for supervisory functions and remote measurement, and a User Port (UP) for the interfacing facilities.



The gauge may be powered from a dedicated power supply unit or from a factory 24V supply. Depending on the distance between units, the OWS and User Port or HMI may be powered from the gauge, or they can have their own independent 24V supplies (Page 3-6).

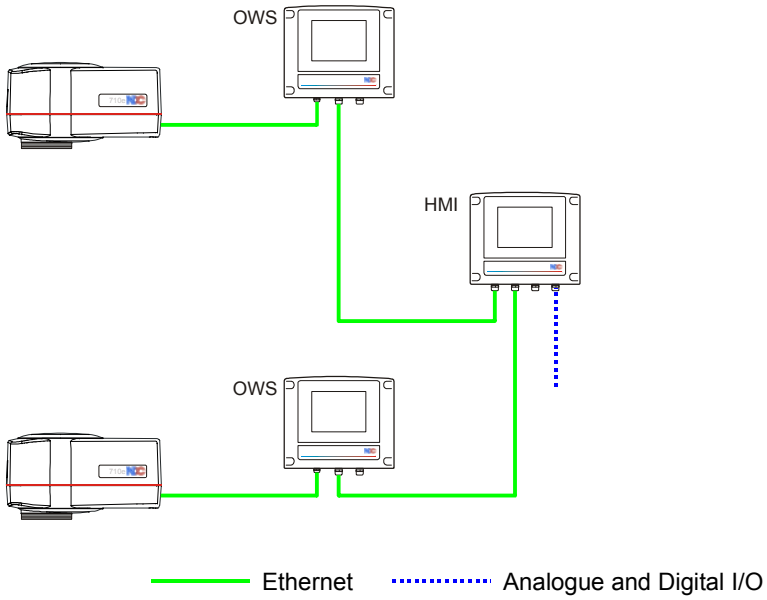
3.2.2 Dual-gauge system with HMI

In this configuration, the two gauges each have their own OWS for local monitoring and sampling.

A single HMI provides the supervisory functions and remote measurement display for both gauges, with each gauge having a separate configurable home page available through the display. Extensive I/O facilities in the HMI enable the gauges to be interfaced with other equipment via discrete analogue and digital channels.

The switched hub provides an intelligent interface between the 710e network and the factory network, passing only specifically addressed communications between the two.

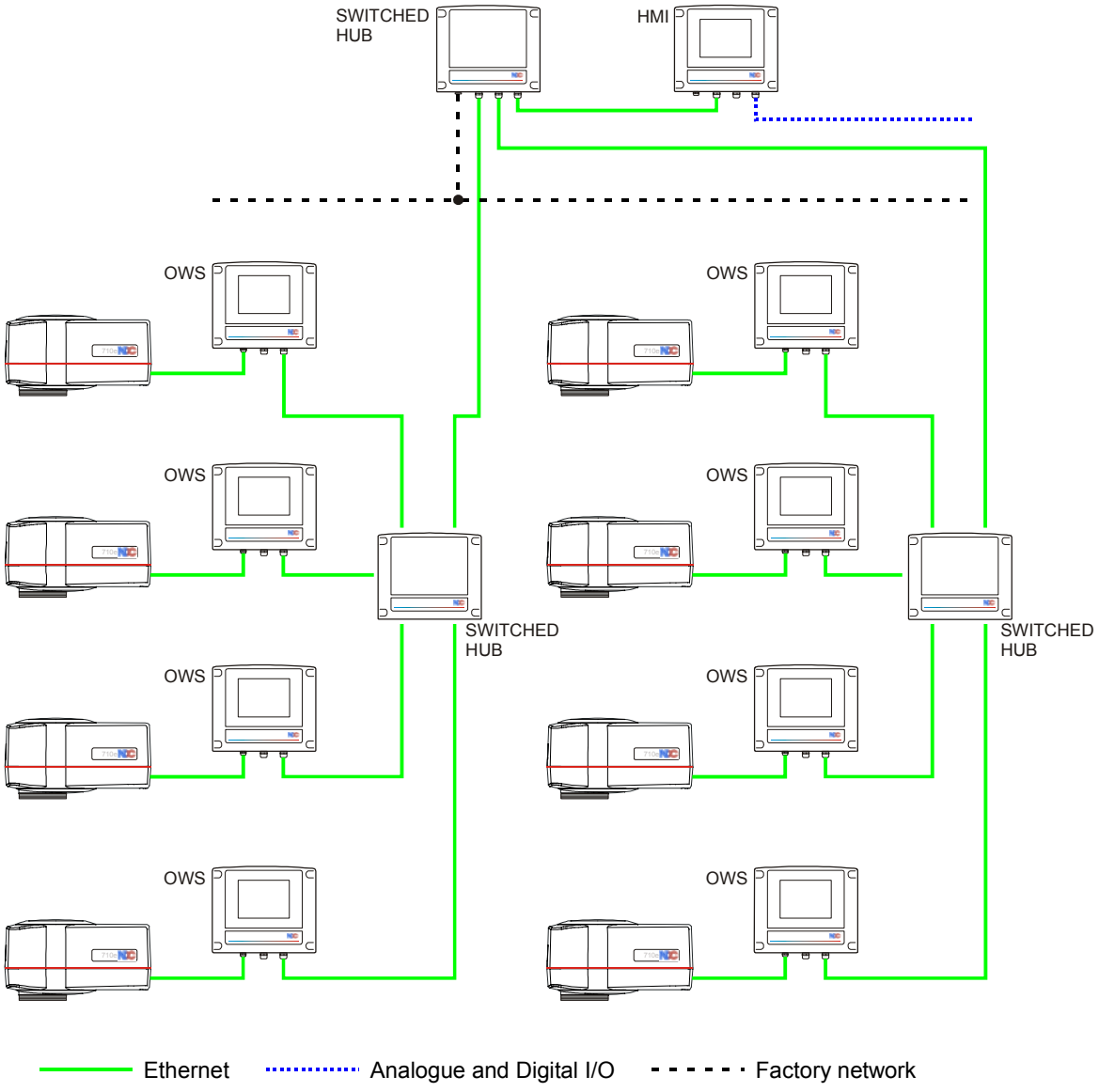
The gauges may be powered from a dedicated power supply unit or from a factory 24V supply. Depending on the distance between units, the OWS units and HMI may be powered from the gauges, or they can have their own independent 24V supplies.



3.2.3 Multi-gauge system

Using ethernet connectivity, it is easy to configure multi-gauge systems of almost any complexity from the 710e components without complex wiring. As just one example the illustration below shows how gauges on different production lines may be grouped into a local switched hub and then connected to a central switched hub.

In this case, the central hub also provides the interface between the gauge network and a factory network, using the RJ45 port, and connection to the HMI. The hub ensures that only the required information is passed between two networks. The configuration of power to the gauges and peripherals is also very flexible, using any combination of local power supplies and power over ethernet.



3.3 System options

3.3.1 Air Purge unit option

The Air Purge (AP) unit is used where the atmosphere in which the gauge is required to operate contains a high level of dust or other pollutants. Using a clean air supply, it reduces gauge window contamination by maintaining an area of positive air pressure over the window surface.

3.3.2 Power supply options

The gauges and peripheral devices in a 710e system all operate on 24V d.c., which can be derived from NDC power supply units or from on-site sources. There is also the option to use a combination of individual power supplies and power-over-ethernet to provide the power to the various system components. (Page 4-12)

This flexibility can greatly reduce the amount of cabling required.

3.3.3 Internal gating option

This option enables the gauge to make reliable measurements of discontinuous products by switching the infra-red measurement system on only when there is product in the beam-patch area. It operates by using two infrared sensors located within the gauge to detect changes in the distance between the gauge window and the viewed surface.

The option is available with small and large beam patch, in stainless steel versions of the gauge only (Page 8-1).

3.3.4 Temperature measurement option

The temperature measurement option provides the ability to measure the temperature of the product at the gauge location or a remote location, and display the readings on one channel of the OWS and HMI. (Page 8-2)

3.3.5 Water cooling option

710e gauges housed in cast alloy enclosures can be fitted with water inlet and outlet connectors. This allows cooling water to be circulated through a duct in the enclosure casting, enabling the gauge work in high ambient temperatures (Page 4-8).

3.3.6 Vortex air cooling option

This cooling option uses a vortex unit to create a cold air flow from a compressed-air supply, which is then circulated through the gauge interior. The vortex unit is close-coupled to the gauge, and factory-fitted as part of the assembly (Page 8-8).

3.3.7 Ultrasonic gating option

This option is available on the CM710e only. It enables the gauge to make reliable measurements of discontinuous products by switching the infra-red measurement system on only when there is product in the beam-patch area.

It uses an ultrasonic sensor attached to the gauge, which operates entirely by detecting changes in the distance to the surface below it. Consequently, it is not affected by extraneous light or other influences.

3.3.8 Tube mounting kit

The Tube Mounting Option can be used to support a 710e gauge. It provides easy adjustment of position and viewing angle, and is suitable for both cast-alloy and stainless steel gauges (Page 8-9).

3.3.9 Percentage dry-weight calibration option

The gauge can be factory-configured for applications requiring % dry-weight moisture measurement (Page 8-5).

4 Installation

4.1 Installation good practice

Observe the following points when selecting the mounting location for the gauge.

- Product view
  Choose the position for the gauge carefully so that it views only material that is representative of the product at the relevant stage in the process. (Page 4-5)
- Site requirements
  Check that the mounting position and the available services conform to the Site Requirements. (Page 4-3)
- Gauge mounting
  Ensure that the gauge support is rigid, and free from vibration during normal operation.
- Atmospheric contaminants
  If the working environment has a high level of airborne contaminant (e.g. dust and dirt) the gauge must be fitted with an air purge unit (Page 4-7).
- Electromagnetic Compatibility
  Follow the EMC precautions (Page 4-4) to avoid interference from other equipment.
- Window protection
  Leave the protective plastic cap fitted to the gauge window until installation is complete. If it is removed for any reason, do not touch the gauge window.
- Ambient light
  Shield the gauge window and measuring area from direct sunlight as this may affect the sensitivity of measurements.
- Peripheral unit location
  Peripheral units such as the OWS and HMI must be installed where the risk of mechanical damage is low.

4.2 Harsh and hazardous environments

The following points must be considered before installing 710e gauges and peripherals in especially harsh environments or in areas with a potentially explosive atmosphere.

Harsh environments

For particularly harsh environments, the stainless steel IP67 versions of the 710e gauges are recommended instead of the cast IP65 versions.

Factors that constitute a harsh operating environment include:

- Exposure to high-pressure water cleaning procedures
- Possibility of immersion in liquid
- Exposure to very high humidity
- Possibility of impact or abrasion

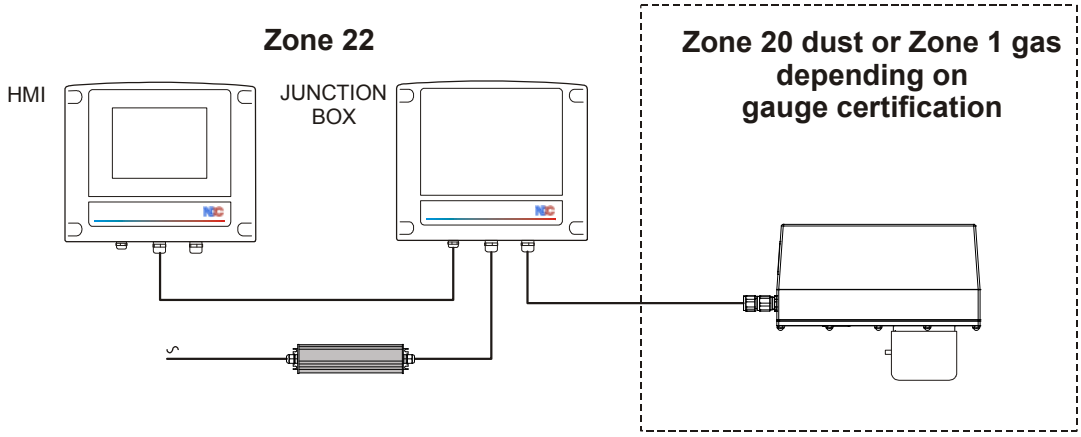
Hazardous environments

Standard 710e gauges are not suitable for installation in explosive gas or dust environments.

The 710e power supply and peripherals (i.e. HMI. OWS and UP) are certified for use in non-mining applications, dust explosive atmospheres (Atex Zone 22).

NDC provides special versions of the 710e gauge which are certified for use in non-mining applications, dust (Atex Zone 20) or gas explosive atmospheres (Atex Zone 1).

These system components carry an Atex label (Page 10-5) defining their specific certification that should be considered to determine if it is safe to use in the intended hazardous area.



4.2.1 Atex certification

Atex certified versions of the 710e gauges may be supplied as follows.

Environment	Certification (Zones)	Equipment marking	Pressurisation
Non-mining dust hazard	20	Ex II1D	Non-pressurised
Non-mining gas hazard	1	Ex II2G	Pressurised (Purged)
Non-mining gas hazard	2	Ex II3G	Non-pressurised

Full details of the purge and pressurisation system are contained in the Purge Controller manual supplied with each purged system.

The 710e power supply and peripherals are supplied as follows.

Environment	Certification (Zones)	Equipment marking	Pressurisation
Non-mining dust hazard	22	Ex II3D	Non-pressurised

Refer to the certification label (Page 10-5) attached to the gauge or peripheral.

4.2.2 Installation considerations

When installing an Atex certified gauge or peripheral:

- The connecting cables must be protected from mechanical impact or abrasion, and from exposure to corrosive chemicals.
- The a.c mains input to the power supply must be routed via a lockable isolator to prevent power from being applied to the gauge and peripherals during maintenance.
- The equipment carries warning labels prohibiting the opening of enclosures when an explosive atmosphere is present. Procedures must be established to ensure that this is observed at all times.

4.2.3 Equipment installation

The physical installation of IP67 and/or Atex certified gauges and peripherals is identical to that of standard equipment, with the exception of the connecting cables. Use the installation instructions in this section for locating and mounting the equipment.

Refer to the wiring schedule for details of the connection between the gauge and the junction box (Page 4-24).

4.3 Site requirements

The installation site for the 710e system components should meet the following environmental and supply requirements.

Environmental

Operating temperature range

710e gauge	0^{o}C - 50^{o}C without cooling
	0^{o}C - 70^{o}C with cooling.
HMI, OWS, UP, Hub, Junction Box	0^{o}C - 50^{o}C

Relative Humidity

Gauge, HMI, OWS, UP, Hub, Junction Box	5% - 95% (non-condensing) over the full operating temperature range

Electrical

Mains supply	90V a.c. - 264V a.c., 47-63Hz, assuming use of NDC power supply units. If other power supplies are used, refer to the manufacturer's specification.

Power rating is dependent on the number and types of device installed. Refer to the Specifications for device power consumption. (Page 10-7)

Equipment permanently connected to the mains supply should incorporate an accessible and clearly identifiable isolating device, such as a double-pole isolator switch or circuit breaker, positioned near to the equipment. Ensure that the isolator is appropriately rated for the cumulative load.

Air supply

For Air Purge unit option:

120 l/min, measured at the air purge window (Page 4-7)	Air supply must be instrument quality – i.e. dry, clean and oil-free. NDC use a 40um element filter followed by a 0.01um coalescing filter to achieve this standard.

Water supply

For gauge water cooling option:

Ambient temp. up to 70^{o}C	Clean water. Flow rate: >1 l/min Temp: <25^{o}C

4.4 EMC precautions

Use the following guidelines to minimise the effects of electrical interference.

1. Ensure that the system is supplied with a clean mains supply (instrumentation supply).
2. Lay signal cables in a low-power signal conduit, and mains cables in low-power mains supply conduit.
3. Ensure that no part of the gauge/system is placed near sources of strong EMI (Electromagnetic Interference).
   Example sources of EMI:
   - Large electric motors
   - Welding equipment
   - Large static discharges
   - Infrared ovens
   - Microwave ovens
   - Large transformers
   - Transmitters
   - Power control circuits

   Note: Do not alter any cables or enclosures without prior permission from the Engineering Department at NDC.

For advice or help on installation concerning EMC, please contact the Customer Care Helpdesk at NDC.

4.5 Unpacking

1. Check against the courier's Delivery Note that all listed items have been delivered.
2. Unpack all equipment in a clean area. Retain the packaging for future use, if possible.
3. Retrieve and keep the documentation included in the packaging:
   - Packing Sheet - which lists all supplied items

- Factory Settings - which identifies all major components (gauges, HMI, etc.) by serial number, and details all factory settings for each component.

4 Check the equipment carefully for any signs of damage.

5 If any items are missing or damaged, notify the carrier, NDC or the agent of NDC (Page 1-1) as appropriate.

6 All major components carry a serial number plate. Check that the serial numbers agree with those on the Factory Settings sheet.

7 If there are any discrepancies, notify NDC or the agent of NDC (Page 1-1).

8 If the equipment is to be stored prior to installation, ensure that the storage conditions are suitable. (Page 4-5)

4.6 Storage

Before installation, store the equipment in the environmental range:

Temperature: $0^{o}C$ - $70^{o}C$

Humidity: 5% - 95% (non-condensing)

Include desiccant if there is any possibility of condensation. After storage, allow the equipment to reach ambient temperature before installation.

4.7 Installing the Gauge

4.7.1 Positioning

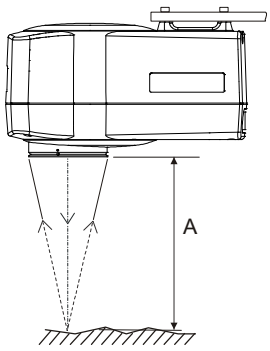
The following points should be taken into account when positioning 710e gauges.

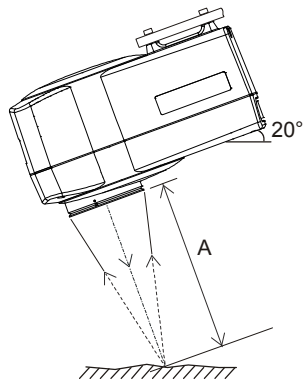
Direct viewing

When viewing the product directly, the gauge should be installed above a moving and continuous stream of product without gaps. Ideally, the depth of the product should be at least a few centimeters - enough to obscure the conveyor surface completely.

In most applications, the gauge should be fixed to a horizontal mounting so that the infrared beam is perpendicular to the surface of the product.

If there is a possibility of gaps in the product, the gauge must be mounted at an angle. This prevents direct reflection of the infrared beam from the conveyor surface into the gauge window, which could affect measurement accuracy.





Position the gauge at the correct pass height from the product surface, according to the beam patch size. Fluctuations in the product surface should be kept within the allowable limits shown for the pass height.

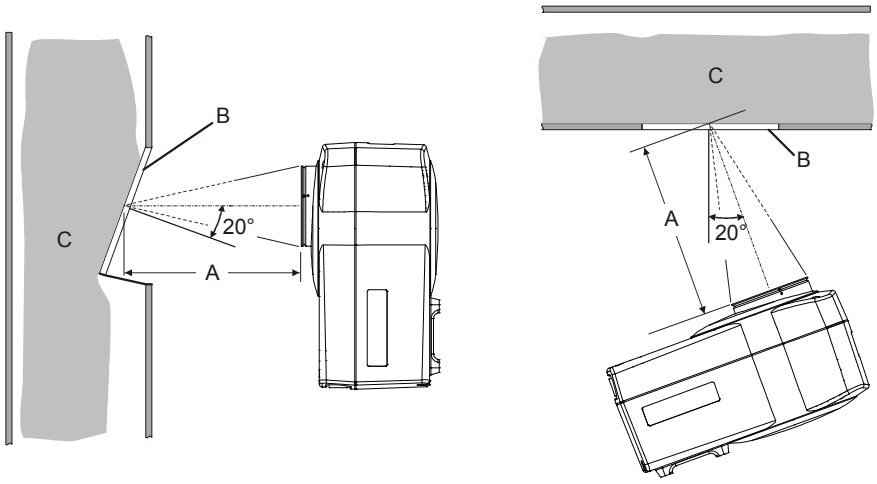
The 710e System Kit (Page 7-7) includes a protractor to assist in obtaining the correct pass height and 20^{o} mounting angle, where this is necessary.

Beam patch size	60mm	25mm	10mm
Pass height (A)	230 +/-100mm	180 +/- 50mm	120 +/-20mm

Window viewing

Where the process is enclosed, the gauge can view the product through a glass or sapphire window. In this case:

- To prevent reflections, the gauge must be angled with respect to the window.
- A solid bed of product must be flowing against the viewing window. Otherwise, spurious reflections and the varying path length of the gauge beam may affect measurement accuracy.
- Arrangements must be made to keep the viewing window free from accumulated product.



A - Path length; B - Viewing window; C - Product

Product surface

Measurements after a dryer or conditioner are best taken as far down stream as possible to give the product a chance to equilibrate. If there is danger of the surface not representing the bulk product (from surface drying of a hot product, for example), then a plough or other mechanism should be installed just before the gauge location to turn over the product. This is essential to ensure that the measurements are representative of the bulk product.

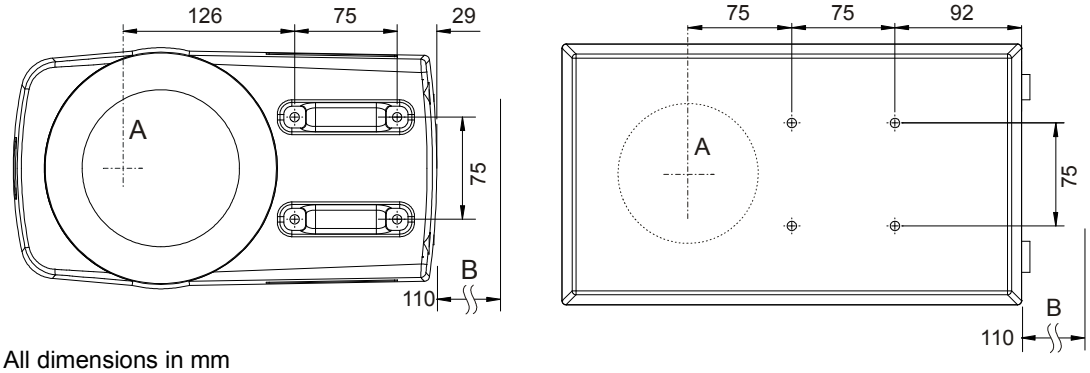
Gauges fitted with internal gating option

The mounting height for gauges fitted with this option must take account of the thickness of the product. Refer to the gating option section (Page 8-1) before mounting the gauge.

4.7.2 Mounting

The gauge may be attached to any suitable mounting bracket or frame, or to a tube mounting kit (Page 8-9), using the four M8 x 10mm mounting holes provided in the top of the case. Two sets of fixing screws suitable for attaching the gauge to mounting plates of different thickness are provided in the 710e Gauge Kit. (Page 7-7)

The mounting must be rigid and vibration-free. The mounting arrangement must provide sufficient clearance for fitting and removing connectors, and enable the gauge to be positioned correctly with respect to the product. The mounting hole positions for the cast and stainless steel gauges are shown below.



All dimensions in mm

A - Measurement beam centre line; B - Connector clearance

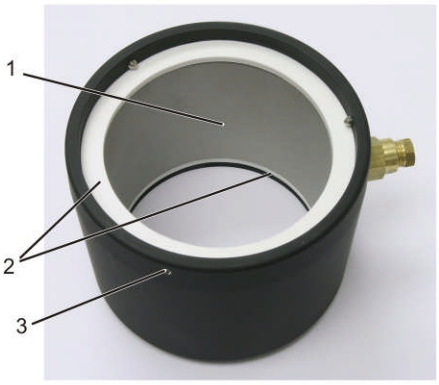
For details of case and fitting dimensions, refer to the outline drawings (Page 11-1).

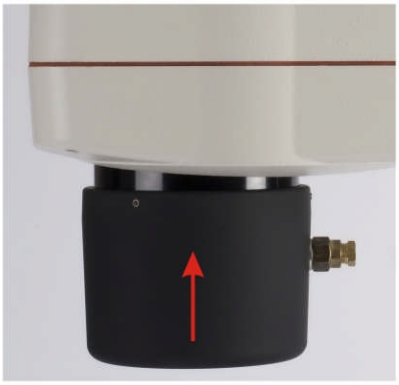
4.7.3 Fitting the Air Purge unit

The optional air purge (AP) unit inhibits window contamination by maintaining a positive air pressure around the window area. It is secured to the gauge by three set screws that locate into a groove around the outside of the window bezel.

Fit the AP as follows:

1 Check that the cylindrical insert (1) and gaskets (2) are located correctly in the air purge housing.



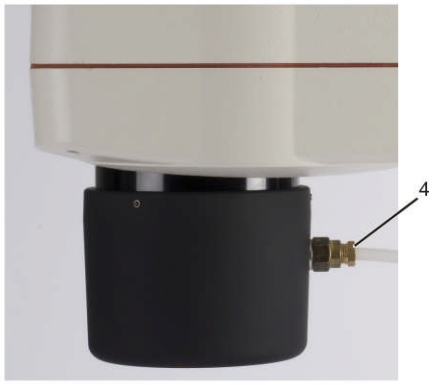


2 Fit the AP onto the gauge window bezel and press it firmly against the bezel while you tighten the three screws (3) evenly.

This will ensure that the fixing screws locate correctly into the retaining groove in the window bezel.

3 Using 6mm diameter pipe, connect a clean, dry and oil-free air supply to the air connector (4).

4 Regulate the air supply.



Typically, the stated air flow (Page 4-4) can be achieved from a 30 psi (2 Bar) supply delivered through 3m x 6mm Ø pipe (4mm inside Ø).

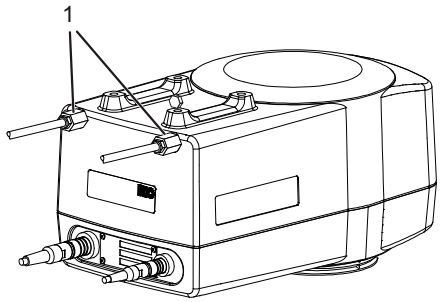
If an air-flow meter is not available, a reasonable assessment can be made by holding your hand a few centimetres below the air purge window and increasing the air pressure until you can feel a gentle air flow.

The figure given for air flow is, in any case, only a guide for a starting value and should be adjusted according to experience after a period of operation. If window contamination is significant, increase the air flow until it is reduced to an acceptable level.

4.7.4 Connecting water cooling

If the gauge is fitted with a water cooling option, connect the water supply to the water in/out connectors (1) using 6mm OD pipe. The direction of water flow is not important. The water supply must comply with the specification given in the Site Requirements. (Page 4-4)

Note that condensation on the outside of the enclosure may be an issue if the gauge is cooled too much compared to the ambient temperature.



4.8 Installing peripherals

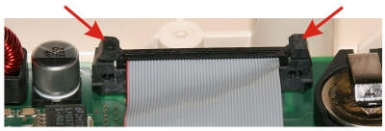
4.8.1 Molded ABS units

The mounting for the OWS, HMI, User Port, Switched Hub and Junction Box is identical. All units have four mounting holes through the rear of the enclosure, which can be used to fix them to a wall or other flat surface, or to the NDC mounting plate option (Page 8-10).

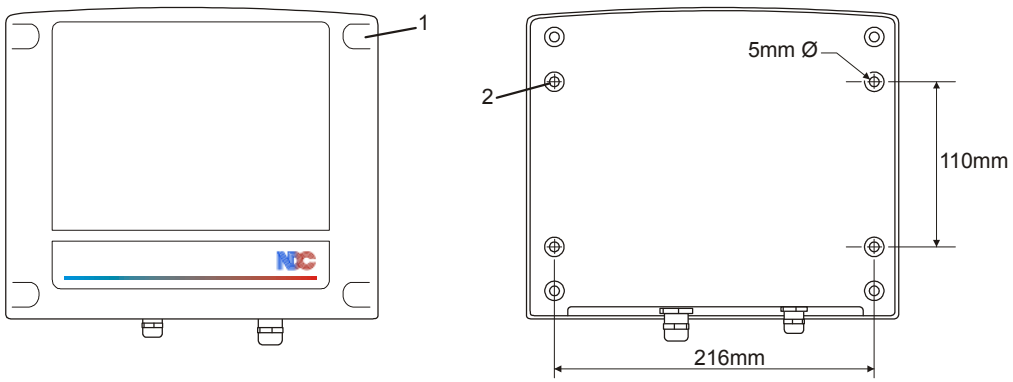
Make sure that the chosen location provides adequate clearance below the unit for insertion and removal of cables. The cables to the unit should be placed away from heavy-duty power cables and cables carrying high frequencies to other equipment.

To mount a peripheral unit:

1. Carefully remove the four screw covers (1) from the corners of the front panel using a thin flat-bladed screwdriver.
   Take care with an OWS or HMI, as the front panels are internally connect by a ribbon cable.
2. Lift the panel and, where relevant, disconnect the ribbon cable from the main pcb.
   Do not pull the cable. Push the two header ejector levers outward to remove the cable.



3. Fix the unit to a suitable flat surface using the mounting holes (2).
4. Complete all electrical connections to the unit (Page 4-11).
5. Reconnect the ribbon cable, where relevant, then fit and secure the front panel. Insert the screw covers.



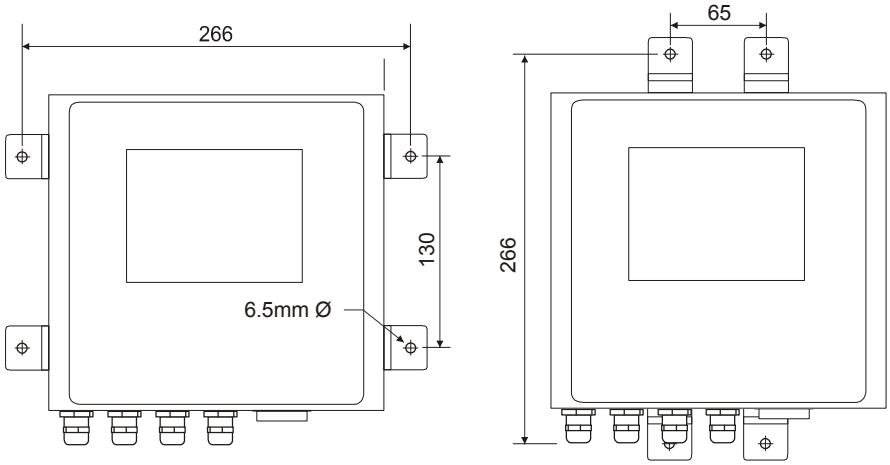
4.8.2 Stainless steel units

The stainless steel HMI and OWS units have two movable mounting straps attached to the rear of the enclosure. When mounted horizontally, they can be used to fix the unit to a wall or other flat surface, or alternatively, when positioned vertically, they can be used to fix the unit to a pillar.

Make sure that the chosen location provides adequate clearance below the unit for insertion and removal of cables. The cables to the unit should be placed away from heavy-duty power cables and cables carrying high frequencies to other equipment.

To mount a peripheral unit:

1. If necessary, remove and refix the enclosure mounting straps into the correct orientation for the chosen location.
2. Fix the unit using the mounting holes provided on the mounting straps.
3. Complete all electrical connections to the unit (Page 4-11).

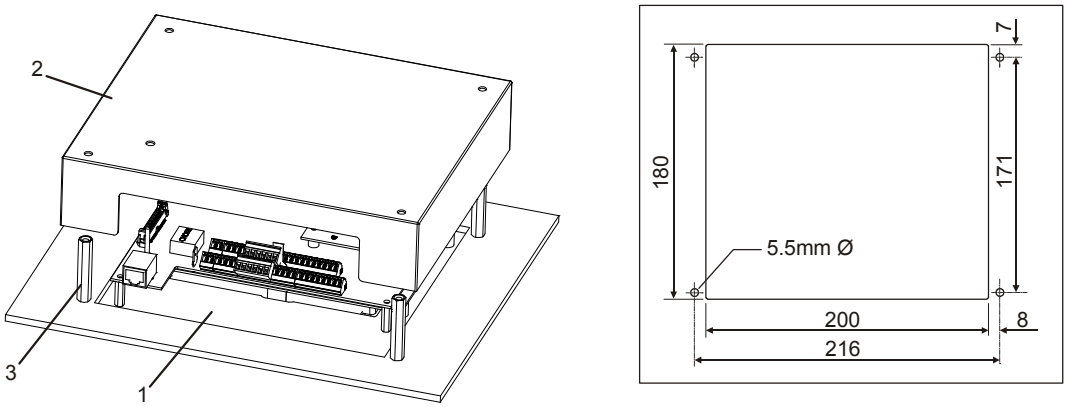


All dimensions are in mm.

4.8.3 Panel-mounted units

Some peripheral components, such as the HMI and OWS, are available for panel mounting into existing equipment. These comprise a front panel (1) with the working assemblies (pcb, touch screen, etc.) attached, and a rear cover (2). Both items are secured to the mounting panel by four threaded studs (3).

Note: The maximum allowable mounting panel thickness is 9mm



To mount the unit:

1. Create the aperture and mounting holes in the relevant panel, as shown above.
2. Fit the front panel and secure with the mounting studs.

3 Complete all electrical connections to the unit (Page 4-11).

Note: The cables must be supported to prevent strain on the pcb connectors.

4 Fit the rear cover and secure with the screws supplied.

4.9 24V Power Supply Unit

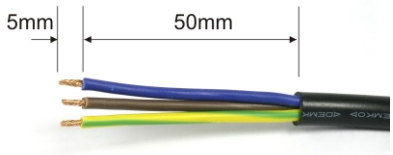
The 24V power supply units (PSU) for powering 710e gauges and peripherals must be prepared before use by connecting the 24V cable and a locally-approved mains cable (not supplied). The items provided are the 24V cable and a box containing the PSU with its endplates and fixing screws. The locally-approved mains cable must meet the following specification.

Mains cable specification: Single phase, 3-core, 5A min., 4mm-7mm dia.

Prepare the PSU as follows.

1 If necessary, cut the supplied 24V cable to length.

2 Strip the insulation on the 24V cable and a locally-approved mains cable by the amounts shown.



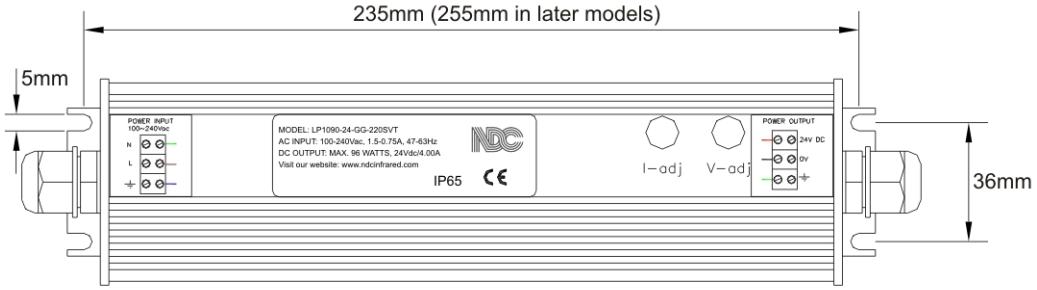
3 Pass the cables through the cable glands and connect them to the terminal blocks.
European

USA

1	Large cable gland	2	a.c. mains cable
3	Small cable gland	4	24V d.c. cable (supplied)

4 Position the terminal blocks inside the PSU as shown, and then secure the endplates with the screws provided.

The PSU can now be fixed to a suitable surface using the brackets on the endplates.



4.10 System connections

The basic interconnections between system components for each 710e installation are shown on the system diagram included with the Factory Setting Sheet (Page 1-1).

This section provides details of system connections.

4.10.1 Ethernet cables

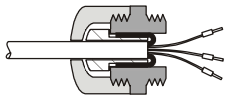
To ensure reliable communications and power-over-ethernet between system components it is essential to use cable which meets or exceeds the requirements given below.

Cable type:	Cat5E ethernet cable suitable industrial applications. (E.g. Belden 7939A)
Key requirements:	Screened, 4 twisted pair, 24AWG, multi-stranded copper conductors, rated for 50°C min.

4.10.2 Cable screen termination

Unless stated otherwise in the relevant cable schedule, all screened cables connected to 710e devices via a cable gland should have their screens terminated in one of two ways.

If the cable gland is metal, terminate the screen in the gland.



If the cable gland is plastic, connect the screen to the earth stud inside the unit.

4.10.3 Power supply options

The gauges and peripheral devices in a 710e system all operate from 24V d.c., which can be derived from NDC power supply units or from on-site sources.

Depending on the system configuration and the distances between the system components, it is possible to power the OWS, HMI and User Port over the ethernet cable from the gauge, which simplifies cabling and reduces the number of required power supply units.

Where the cable distances are too great, or where it is more convenient, some or all of the system components can be powered separately from local PSUs or on-site 24V supplies.

In the case of gauges supplied for use in hazardous areas, the gauge 24V power is always supplied from the associated peripheral unit via a combined power/ethernet cable. (Page 4-2)

The essentials of the power supply options are shown below.

4.10.3.1 Power-over-ethernet

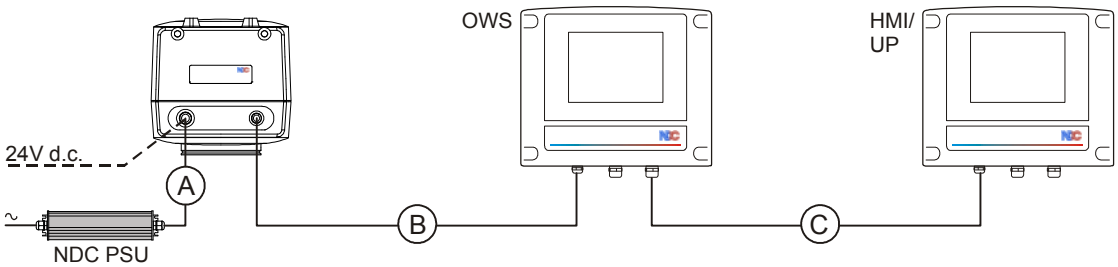
The configuration for a power-over-ethernet arrangement is shown below. Details of the cable connections are given later in this section.

- Gauge to OWS connection (Page 4-17)
- OWS to HMI or User Port connection (Page 4-19)

The table below shows combinations of cable lengths between devices. The lengths given are based on a maximum cable length from the power supply unit (PSU) to the 710e Gauge of either 5m or 10m, or on the use of a 24V DC supplied directly from on-site provision.

Note the following points when planning the power supply configuration.

- All hubs require their own separate 24V power supplies.
- When using a Factory 24V Supply (shown dotted below) instead of the NDC PSU, check that it can provide sufficient power for the connected devices. Refer to the Specifications for device power consumption. (Page 10-7)



Devices	Cable	Cable lengths between devices (metres)									
PSU to 710e Gauge	A	5	10	5	10	5	10	5	10	5	10
710e Gauge to OWS	B	5	5	10	10	15	15	20	20	25	25
OWS to HMI or User Port	C	70	60	65	50	55	40	35	35	35	25

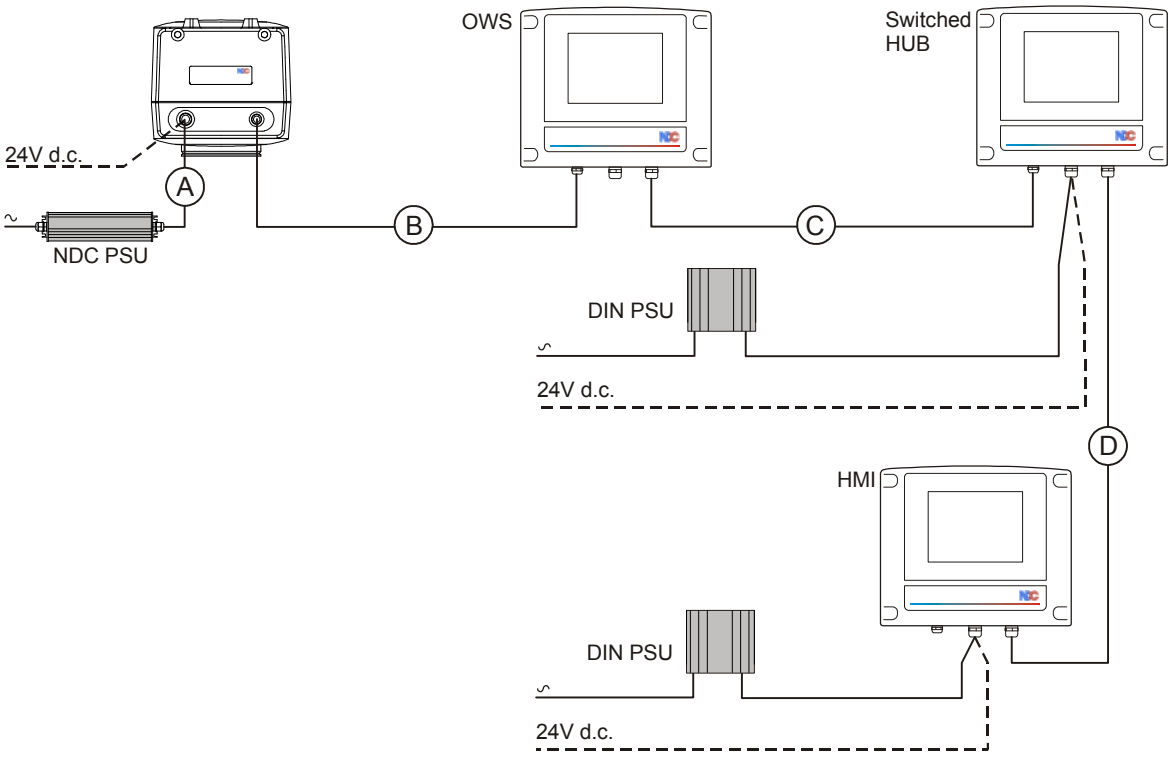
Note: The distances given are achievable only if the specified cable is used (Page 4-11).

4.10.3.2 Separate power supplies

A combination of separate power supplies and power-over-ethernet can be used, according to the distribution of the system components.

Note the following points when planning the power supply configuration.

- All hubs require their own separate 24V power supplies.
- When using a Factory 24V Supply (shown dotted below) instead of the NDC PSU, check that it can provide sufficient power for the connected devices. Refer to the Specifications for device power consumption. (Page 10-7)
- Where devices derive power from the gauge as shown for the OWS (cable B) the cable length limits must be observed (Page 4-12). Where they have separate power supplies the maximum length of the ethernet connections (cables C and D) is 70m.
- Cable D can optionally carry 24V to the HMI from the Switched Hub, in which case the PSU for the HMI is not needed. It is not suitable for powering a Gauge.



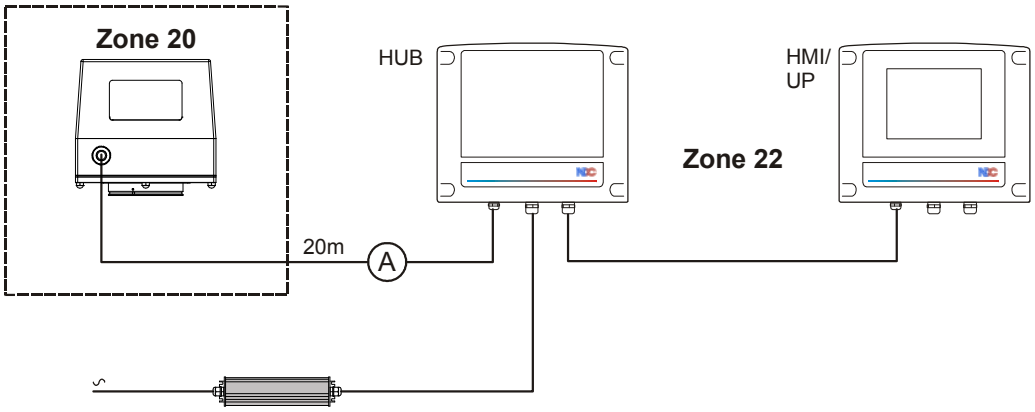
Both DIN and in-line power supply units suitable for powering peripheral devices are available from NDC as part of the 710e system.

4.10.3.3 Hazardous area power supply

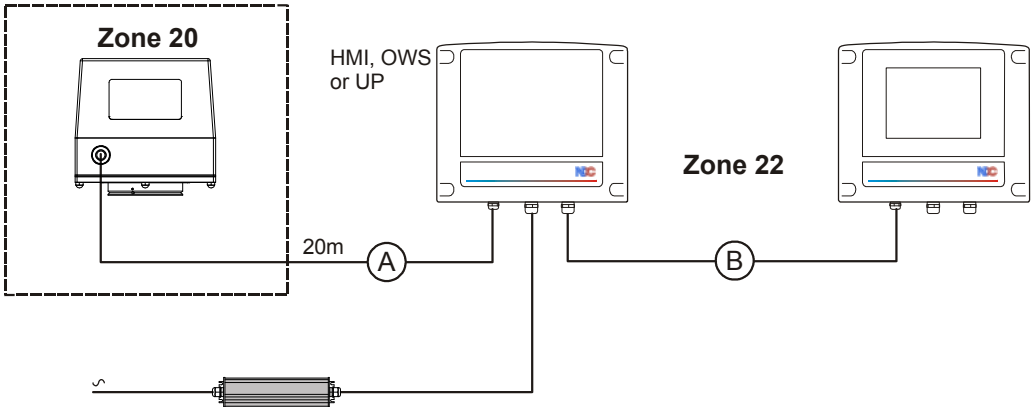
Gauges that are sealed to IP67 for use in harsh environments, or are Atex certified for use in potentially explosive dust environments (Atex zone 20), have a single combined power/ethernet cable (A) entering through a sealed gland.

The gauge is the only item of 710e system equipment installed in the hazardous area. The gauge cable connects to a junction box outside the hazardous area, and the gauge 24V supply is provided via the terminals in this unit. The cable may be up to 20m in length (Page 4-21).

In this arrangement, up to two gauges may be connected to the same junction box. Details of the cabling are given in the System Connections (Page 4-21).



Where only one gauge connection is required, it is possible to connect it directly to an HMI, OWS or User Port. Cable B is a standard ethernet connection to a another peripheral device, where required. Details of the cabling for this arrangement are given in the System Connections (Page 4-24).



4.10.4 HMI, OWS and User Port connections

The following electrical inputs and outputs are available on the HMI, OWS and User Port for connection to external equipment or for interconnection between 710e equipment.

HMI, OWS and UP

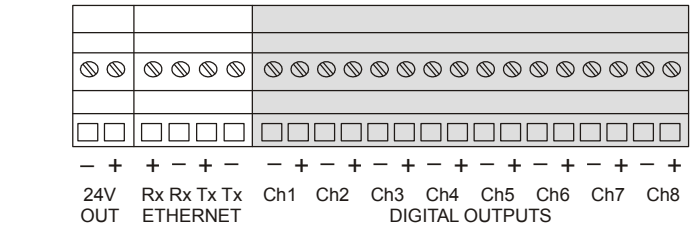
- 1 x 24v dc power input. — Power input to the unit from the 710e gauge or suitable power source.
- 1 x 24v dc power output. — Power output to 710e peripherals.
- 1 x 24v dc gauge power output. — Power output to 710e gauge (if required).
- 2 x Ethernet ports. — For connection to the 710e gauge or other 710e peripherals.
- 1 x RJ45 Ethernet port. — For connection to a PC running GTXL, using standard RJ45 Ethernet patch lead.

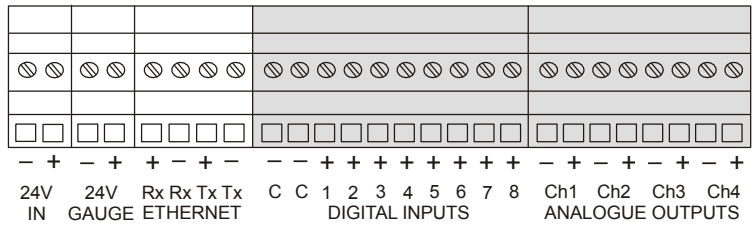
HMI and UP only

- 4 x Analogue 4-20mA outputs.* — Representing as default, measurement values from the 710e gauge/s updated in real time.
- 8 x Digital outputs.* — Representing as default, measurement high/low alarms from the 710e gauge/s.
- 8 x Digital inputs.* — Which can be used to operate gauge functions using remote pushbuttons or other devices.

Refer to the factory settings sheet supplied with the equipment for details of the functions assigned to the analogue and digital inputs and outputs. These initial assignments can be changed through the Engineers page of the HMI (Page 5-20).

With exception of the Ethernet RJ45 port, all connections are made via two screw terminals on blocks in the HMI, OWS or User Port, arranged as shown below.





HMI and UP only

Note: A single gland is fitted to make connections for the user I/O marked * in the table above. If necessary further glands can be fitted using the spare holes in the base of the unit after cutting suitable holes on the cover membrane.

Refer to the technical specification section (Page 10-9) for the electrical characteristics of the inputs and outputs.

4.10.4.1 Power supply to HMI, OWS or UP

Where a peripheral unit (HMI, OWS, UP) has a separate 24V power supply, connect it to the 24V IN terminals on the lower connecting block. Take care to use the correct polarity.

The connections for an NDC 24V PSU (Page 4-10) are given below.

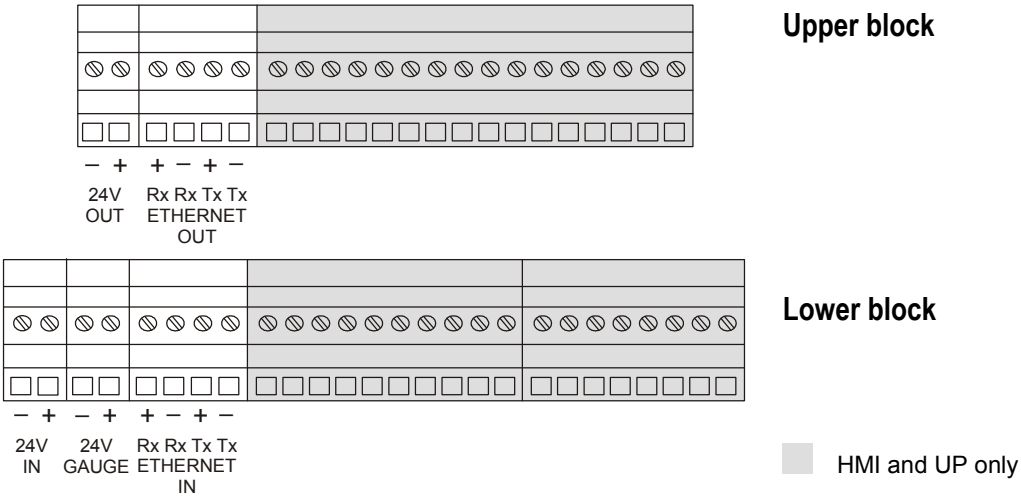
PSU Wire Colour	Function	Peripheral connections (lower block)
Red	+24V In	24V IN +
Blue	0V	24V IN -
Green	Earth (Ground)	Not connected

4.10.4.2 Gauge to HMI, OWS or UP

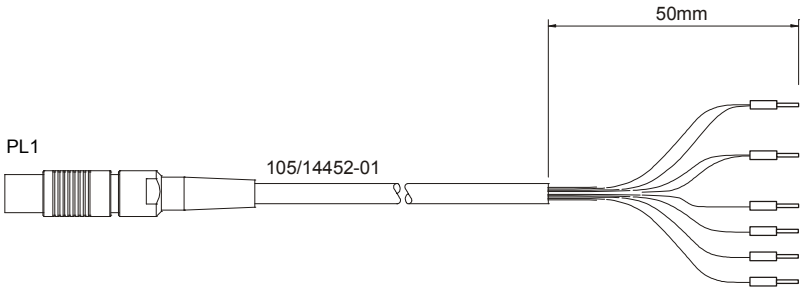
This connection can carry combined ethernet and power, or ethernet only.

Note: The power connection supplies 24V power from the gauge to the peripheral unit (HMI/OWS/UP). Do not attempt to power the gauge from the peripheral unit.

A 10m-long cable (Part No 105/14452-01) is supplied with the gauge. This should be cut to length and connected to the lower terminal block on the HMI, OWS or UP main PCB as detailed below. It is recommended that ferrules (Page 7-7) are fitted to the wires for connection to the terminal block.



Standard gauge cabling



Wire Colour	OWS, HMI or UP lower terminal block
Brown and Black/Brown	24V + (in)
Blue and Black/Blue	24V - (in)
Black/Green	Rx +
Green	Rx -
Black/Orange	Tx +
Orange	Tx -

Terminate the cable screen (Page 4-12).

Ethernet-only connection

If the connection is used only for ethernet, the HMI/OWS/UP must be powered from a separate power supply unit or on-site 24V supply. In this case, the 24V wires in the table above should be left unconnected and insulated. Connect the alternative 24V supply to the 24V IN terminals instead.

Atex certified/IP67 gauge cabling

Wire Colour	CN1/PL7	Gauge	OWS, HMI or UP lower terminal block
Brown and White (Pair 1)	1	24V +	24V + GAUGE
Blue and White (Pair 2)	2	0V	0V GAUGE
White (Pair 3)	8	Tx +	Rx +
Green (Pair 3)	7	Tx -	Rx -
White (Pair 4)	10	Rx +	Tx +
Orange (Pair 4)	9	Rx -	Tx -

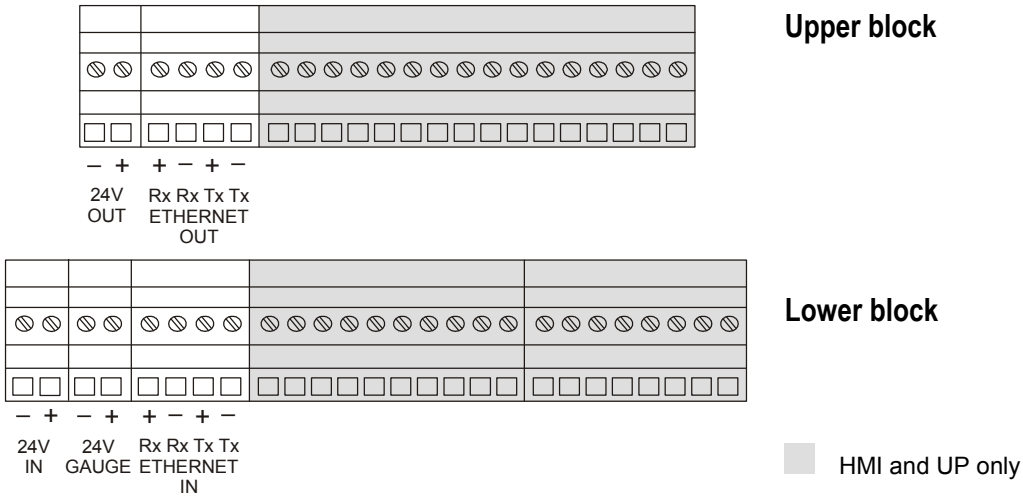
Terminate the cable screen (Page 4-12).

4.10.4.3 OWS to HMI or User Port

For the connection between the OWS to the HMI or User Port, use CAT5E ethernet cable (e.g. Belden 1868E), connected to the upper terminal block in the OWS and to lower terminal block in the HMI. It is recommended that ferrules (Page 7-7) are fitted to the wires for connection to the terminal block.

Note: The information below refers specifically to the most common peripheral-to-peripheral connection, which is OWS to HMI or UP. However, the same wiring arrangement can be used when inter-connecting other peripherals, such as HMI to UP. (Page 4-25)

If a different CAT5 cable is used, modify the wire colours given in the table below as necessary.



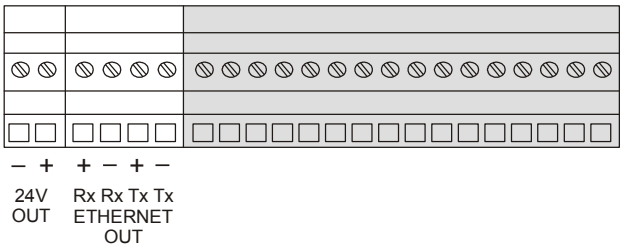
Wire Colour	OWS upper terminal block	HMI or UP lower terminal block
Blue and Black/Blue *	24V - (out)	24V - (in)
Brown and Black/Brown *	24V + (out)	24V + (in)
Black/Green	Rx +	Tx +
Green	Rx -	Tx -
Black/Orange	Tx +	Rx +
Orange	Tx -	Rx -

Terminate the cable screen (Page 4-12).

* If the HMI/UP is powered from a separate power supply unit or on-site 24V supply, these wires should be left unconnected and insulated. Connect the alternative 24V supply to the 24V IN terminals instead.

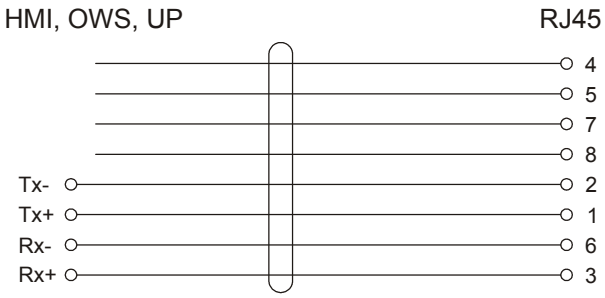
4.10.4.4 Ethernet - HMI, OWS or UP to standard ethernet Hub

When connecting an HMI, OWS or UP to a standard ethernet hub, use a suitably specified ethernet cable (Page 4-11). Connect the cable to the **upper** terminal block in the peripheral device, and terminate it in an RJ45 connector at the hub end as detailed below.



HMI, OW, UP
Upper block

HMI and UP only



Wire Colour	HMI, OWS or UP	RJ45
Orange	Tx-	2
Black/Orange	Tx+	1
Green	Rx-	6
Black/Green	Rx+	3

Terminate the cable screen (Page 4-12).

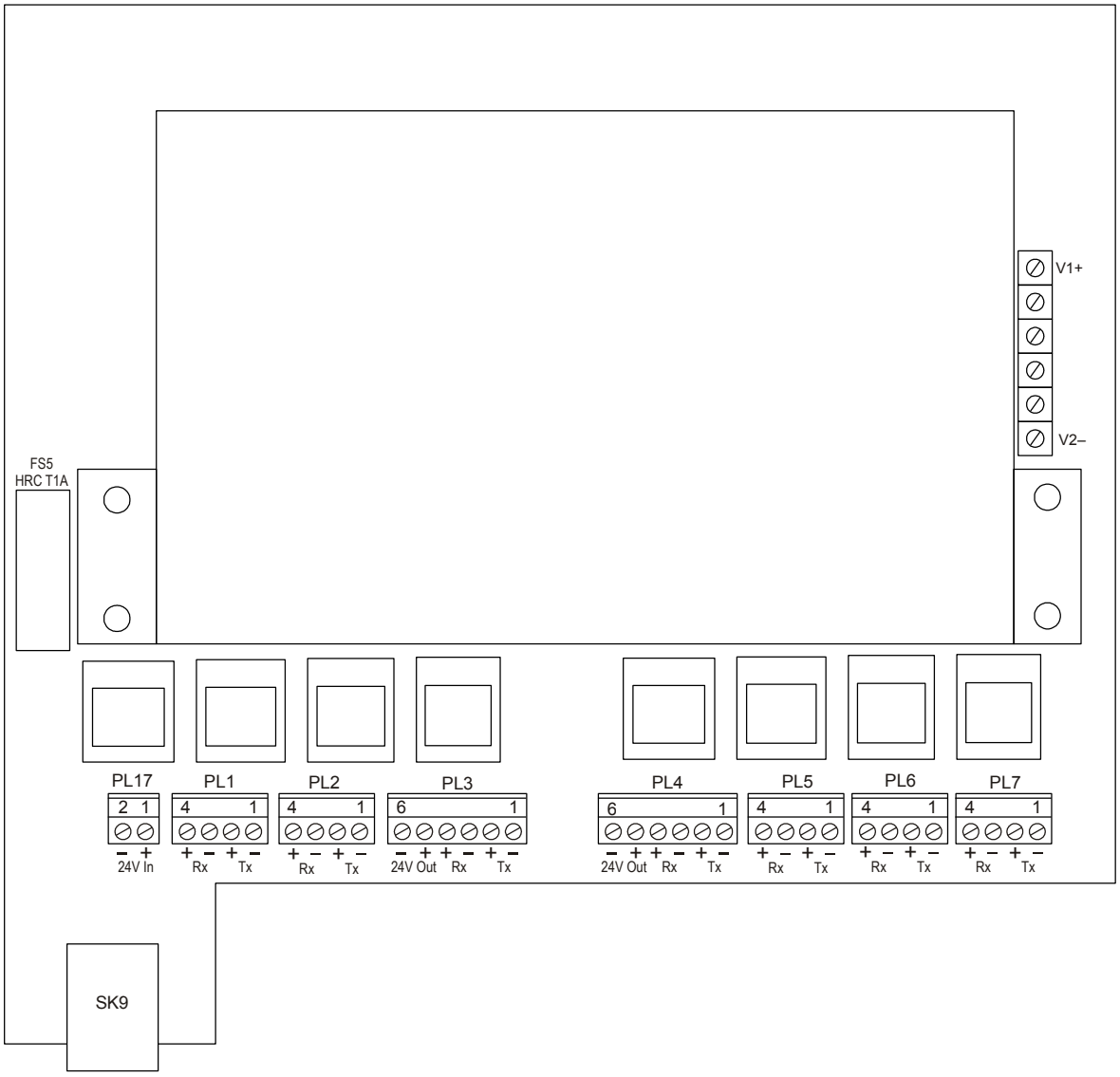
Leave unused wires un-terminated and insulated in the HMI, OWS or UP.

Note: If a different CAT5E cable is used, modify the wire colours given in the table as necessary.

4.10.5 Switched Hub connections

The switched hub provides eight switched ethernet ports for connection to 710e gauges and peripherals, and for interfacing with a factory network, according to system requirements.

The connector functions are identified below. Details of specific gauge, peripheral, power and other connections to the hub are given in the relevant sections.



Connector	Function
PL17	Power in
PL3, PL4	Ethernet and power out for connection to 710e HMI. or ethernet only to gauges.
PL1, PL2, PL5, PL6, PL7	Ethernet only for connection to 710e gauges via their respective OWS.
SK9	System services, typically for connection of laptop running GaugeToolsXL software.

4.10.5.1 Power supply to Switched Hub

An NDC 24V power supply unit (Page 4-10) (PSU) is supplied with the switched hub. This is connected to PL17 in the switched hub as detailed below. An earth is not required

PSU Wire Colour	Function	Switched Hub PL17
Red	+24V In	1
Blue	0V	2
Green	Earth (Ground)	Not connected

4.10.5.2 Gauge to Switched Hub

A standard gauge cable may be connected directly to a switched hub for ethernet connection only. It cannot be used to power either the gauge or the hub, both of which must have their own separate power supplies.

The ethernet cable should be cut to length and connected to PL1 - PL7 as detailed below.

Wire Colour(s)	Function	Switched Hub PL1 - PL7
Orange	Tx -	1
Black/Orange	Tx +	2
Green	Rx -	3
Black/Green	Rx +	4

Terminate the cable screen (Page 4-12).

4.10.5.3 Peripheral to Switched Hub

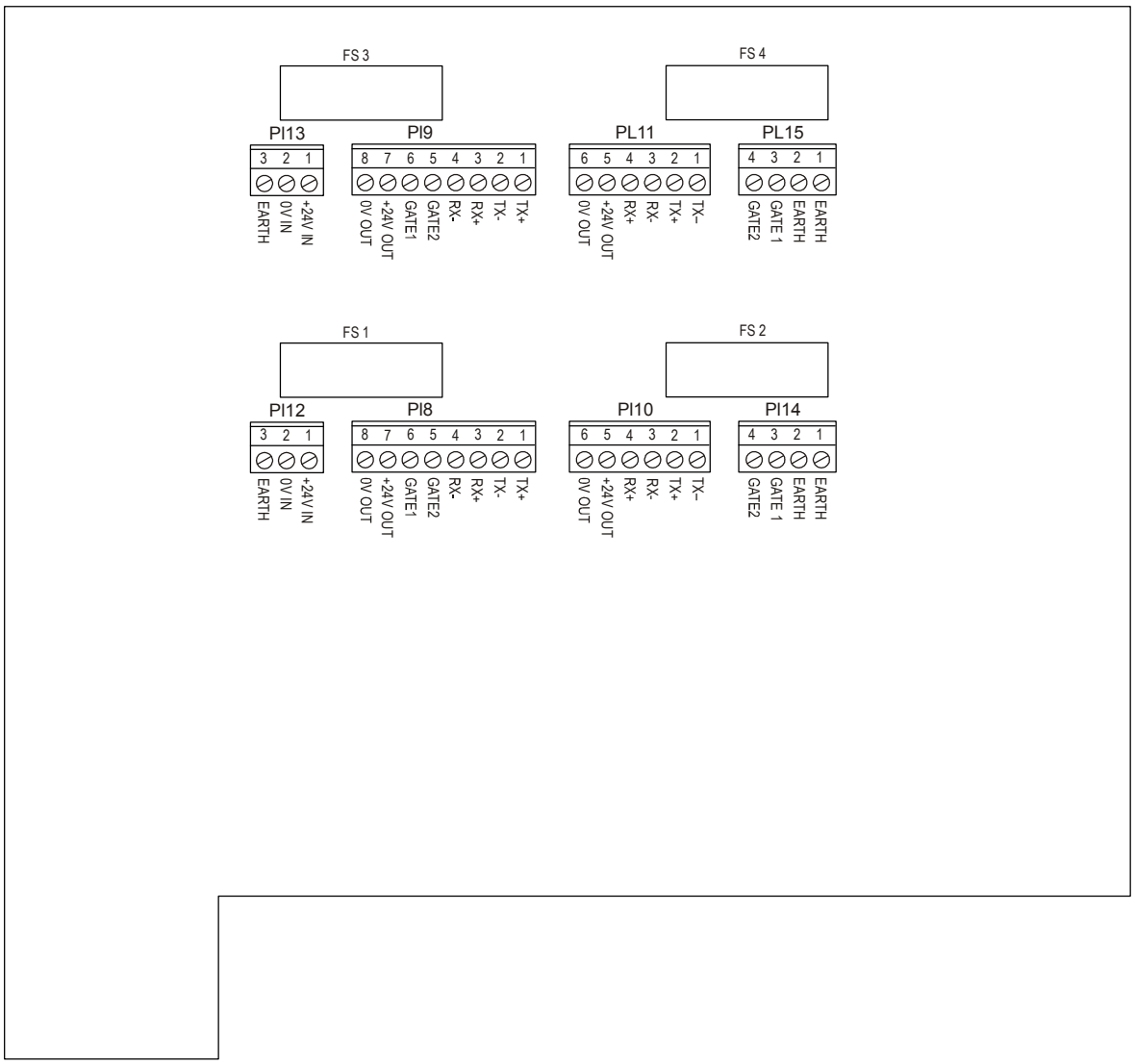
The Switched Hub may be connected to another peripheral unit (e.g. HMI or User Port) using PL3 or PL4 (Page 4-21), with the cable carrying ethernet only or ethernet plus HMI power.

Wire Colour	Switched Hub PL3/PL4	Other peripheral, lower terminal block
Brown and Black/Brown	5	24V + (in)
Blue and Black/Blue	6	24V - (in)
Orange	3	Rx -
Black/Orange	4	Rx +
Green	1	Tx -
Black/Green	2	Tx +

4.10.6 Junction Box Connections

The Junction Box provides an interface for connecting one or two 710e gauges to their respective OWS via Robotic or Atex-approved cables.

The connector functions are identified below. Details of specific gauge, peripheral, power and other connections to the Junction Box are given in the relevant sections.



Gauge 1	Gauge 2	
Connector	**Connector**	**Function**
PL12	PL13	Power in
PL8	PL9	Ethernet and power to Atex-approved 710e Gauges
PL10	PL11	Ethernet and power out for connection to 710e peripherals
PL14	PL15	Earth and option function (Gate)

4.10.6.1 Power supply to Junction Box

An NDC 24V power supply unit (Page 4-10) (PSU) is supplied with the junction box. This is connected to the junction box as detailed below.

PSU Wire Colour	Function	Junction Box PL12
Red	+24V In	1
Blue	0V	2
Green	Earth (Ground)	3

4.10.6.2 Atex certified and IP67 gauge to Junction Box

The gauges are supplied with a 10m or 20m factory-fitted cable for connection of gauge power and ethernet. This should be cut to length as required and connected to the Junction Box as follows. It is recommended that ferrules (Page 7-7) are fitted to the wires for connection to the terminal blocks.

		Function		
Wire Colour	CN1/PL7	Gauge	Junction Box	PL8/PL9
Brown and White (Pair 1)	1	24V +	24V +	7
Blue and White (Pair 2)	2	0V	0V	8
White (Pair 3)	8	Tx +	Rx +	3
Green (Pair 3)	7	Tx -	Rx -	4
White (Pair 4)	10	Rx +	Tx +	1
Orange (Pair 4)	9	Rx -	Tx -	2

Terminate the cable screen (Page 4-12).

4.10.6.3 Peripheral to Junction Box

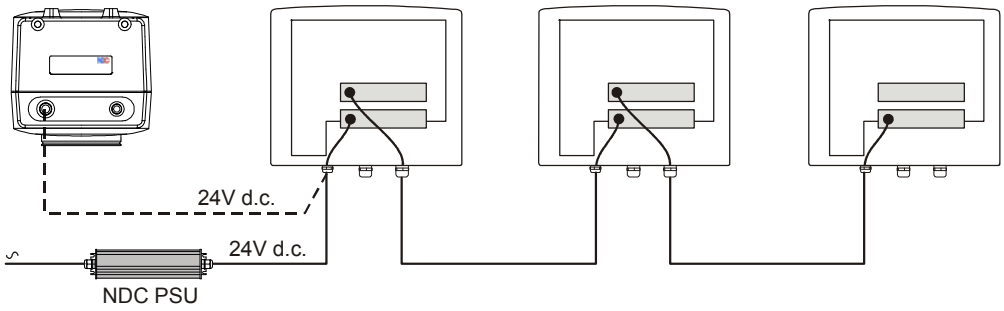
The Junction Box may be connected to another peripheral unit (e.g. OWS or HMI) using PL10 or PL11, with the cable carrying ethernet only or ethernet plus OWS power.

Wire Colour	Junction Box PL10/PL11	OWS lower terminal block
Brown and Black/Brown	5	24V + (in)
Blue and Black/Blue	6	24V - (in)
Orange	3	Rx -
Black/Orange	4	Rx +
Green	1	Tx -
Black/Green	2	Tx +

4.10.7 Peripheral 24V interconnection

Where one peripheral unit (e.g. an HMI) is powered from a gauge or a local power supply and is supplying 24V power to one or more another units (e.g. a User Ports), it is essential to ensure that the 24V wires are connected correctly.

The 24V connection must be from the upper block on the peripheral supplying power to the lower block on the one receiving it. It is recommended that ferrules (Page 7-7) are fitted to the wires for connection to the terminal block.



5 Operation

5.1 Overview

The two 710e operator interfaces are:

- the HMI which can monitor and control multiple gauges
- the OWS which is dedicated to a single nearby gauge.

The HMI provides access to all user-controllable functions, subject to user passwords, including those used for gauge configuration and calibration. The OWS provides access to the range of functions normally required for day-to-day operation. In all other respects, operation of the two interfaces is identical, and this section covers both.

In addition to these system interfaces, a standard web browser may be used to configure aspects of the User Port (Page 5-30), which has no user interface of its own.

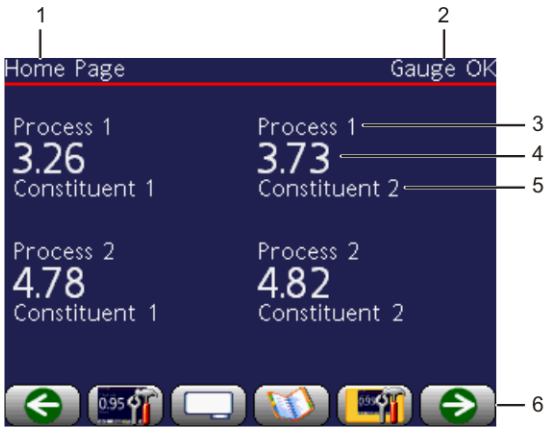
5.1.1 Home pages

The default display for both interfaces is a Home page, which appears automatically a few seconds after the interface is powered up.

A home page displays up to four continuously-updated gauge measurements, and allows other operating functions to be selected by touching appropriate button icons. It is possible to define multiple home pages, each showing different gauge measurements.

Examples:

HMI Home page showing two measurements from each of two gauges



OWS Home page showing a single measurement from the associated gauge.

1	Page name	4	Measurement value
2	Gauge status	5	Constituent measured (e.g. moisture)
3	Gauge name	6	Button icons

5.1.2 Navigation

All operating functions can be reached from the home pages, simply by touching the appropriate button icons.

There are fewer functions available on the OWS than on the HMI, so the range of button icons on their Home pages are slightly different.

HMI 

OWS 

Each instruction in this operating section shows how to navigate from a Home page to the page containing the relevant function by showing the button sequence, like this:

1. Open the Sample page for the relevant gauge.

   How? *HMI* : *Home* >  > Select gauge from list > 

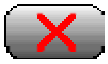
   OWS : *Home* > 

To access the function, simply touch the buttons and make selections in the order shown.

Where the function exists on the HMI and OWS, both sequences are shown. Where it does not exist on the OWS, only the HMI sequence is shown.

5.1.3 Navigation and page keys - HMI

The following navigation and page selection keys are displayed as appropriate.

Key	Function
General keys	
	**Previous Page** and **Next Page** - Where there is more than one page for the current selection, these step through the pages.
	
	**Back** - Returns to the previous screen.
	**Home** - Returns to the Home page.
	**Cancel** - Cancels the current selection, entry or operation.
	**OK** - Confirms the current selection, entry or operation.
Configure Display page keys	
	**Delete Page** - Deletes the selected Home page.
	**New Page** - Creates a new Home page.
	**Save** - Saves changes to Home pages made through editing.
	**Device List** - Opens a lists of all discovered system gauges.
Products page keys	
	**Download Product** - Downloads a selected product to the system gauges.
	**Refresh** - Refreshes the displayed page.

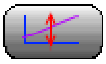
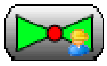
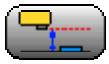
Key	Function
Home page keys	
	**Configure Display** - Opens the Configure Display page.
	**Gauge interface** - Opens the gauge Interface page.
	**Products** - Opens the Products page.
	**Configure** - Opens the Configure page.
Gauge page keys	
	**Sample** - Used to take sample measurements for calibration.
	**Trim** - Enables a new Trim value to be entered for gauge calibration.
	**Analogue outputs** - Used for scaling the analogue measurement outputs.
	**Edit Names** - Used for entering gauge and measurement names.
	**Diagnostics** - Opens the Diagnostics page.
Configure page keys	
	**Products** - Opens the Configure Product page.
	**Passwords** - Used for configuring user passwords.
	**Language** - Enables selection of the user interface language.
	**Engineers** - Opens an Engineers page.
	**Time** - Used to set the Time and Date.

Table continued . .

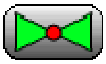
Key	Function
Configure Products page keys	
	**New Product** - Open the New Product page.
	**Download Product** - Downloads a selected product to the gauge.
	**Edit Product** - Enables the values of an existing stored product to be changed.
	**Copy Product** - Enables an existing product to be copied as the basis for a new one.
	**Delete Product** - Deletes an existing stored product.
Engineers page keys	
	**Forced re-reference** - Performs an Auto-Reference, overriding the limits that would cause a normal Auto-Ref to fail.
	**Reset** - Reboots the gauge.
	**Refresh** - Refreshes the displayed page.

Key	Function
Diagnostics page keys	
	**Auto-Reference** - Performs an Auto-Reference procedure for gauge calibration.
	**Reference Check** - Performs an internal check of gauge accuracy and provides a time- and date-stamped result.
	**Height Gating** - Used for configuring the Internal Gating Option settings.
	**Ethernet** - Used for configuring the ethernet settings.
	**Engineers** - Opens an Engineers page.

5.1.4 Navigation and page keys - OWS

The following navigation and page selection keys are displayed as appropriate.

Key	Function
General keys	
	**Previous Page** and **Next Page** - Where there is more than one page for the current selection, these step through the pages.
	
	**Back** - Returns to the previous screen.
	**Home** - Returns to the Home page.
	**Cancel** - Cancels the current selection, entry or operation.
	**OK** - Confirms the current selection, entry or operation.
Configure Display page keys	
	**Delete Page** - Deletes the selected Home page.
	**New Page** - Adds the measurements required on a new Home page.
	
	**Device List** - Opens a lists of all discovered system gauges.

Key	Function
Home page keys	
	**Configure Display** - Opens the Configure Display page.
	**Sample** - Used to take sample measurements for calibration.
	**Diagnostics** - Opens the Diagnostics page.
	**Configure** - Opens the Configure page.
Configure page keys	
	**Passwords** - Used for configuring user passwords.
	**Language** - Enables selection of the user interface language.
	**Engineers** - Opens an Engineers page.
Diagnostics page keys	
	**Auto-Reference** - Performs an Auto-Reference procedure for gauge calibration.
	
	**Engineers** - Opens an Engineers page.

5.2 Security

The HMI and OWS have a configurable security system that enables all operating functions to be protected from unauthorised access.

The system allows each user and each individual HMI/OWS function to be given a security level of 1 to 5. Users can then access functions up to, but not above, their security level.

For example, a level 2 user could access all functions with security levels up to level 2, but not those with level 3 or higher.

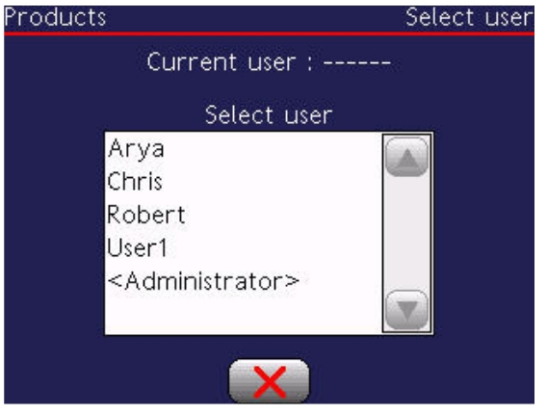
Users and security levels are set up through the Configuration page of the HMI or OWS. (Page 5-20)

5.2.1 Logging in to access functions

To use security-protected functions on the HMI or OWS, you will need a user password. If you have not been given a password, or have forgotten it, contact your system supervisor.

A user list will appear:

- if you are not logged in and you attempt to access a security-protected function, or;
- if you are logged in but attempt to access a function with a higher security level than yours.



1 Select your user name from the list.

2 Enter your password. (Page 5-5)

Provided the password is correct, you will be logged in and the screen will go to the requested function. You can then access any functions with security equal to or lower than your security level.

5.2.2 Logging out

1 Open the Configure page.

How? *HMI* : *Home* > 

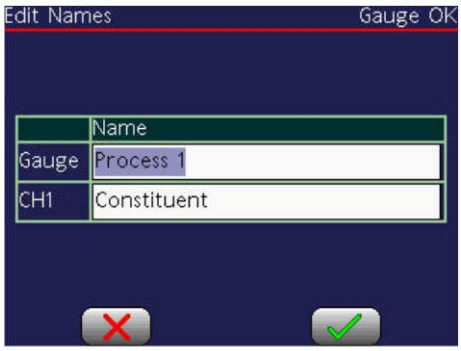
OWS : *Home* > 

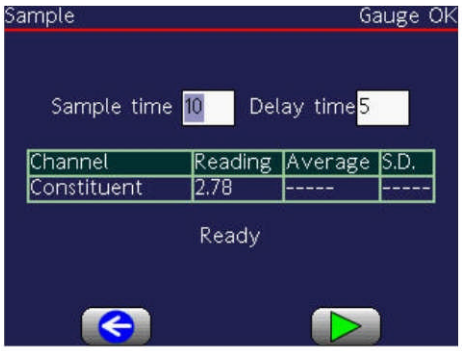
2 Touch  .

This key appears only if you are logged in.

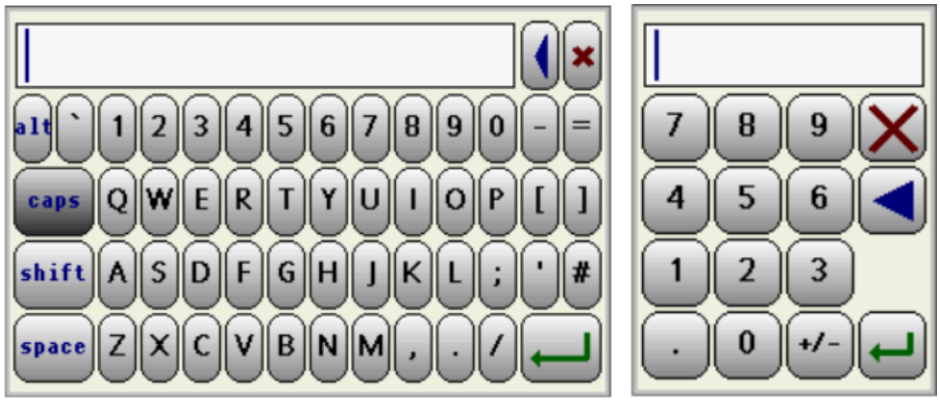
5.3 Data entry

Pages that allow any sort of data entry, such as a name or numerical value, have touch-sensitive fields which appear as white boxes.





When you touch a data entry field, a full-text keyboard or numerical keypad is automatically displayed, as appropriate for the required entry.



There are several different versions of both the full-text keyboard and numerical keypads. The version displayed depends on the current interface language (Page 5-20), and on the particular data entry function.

The full text keyboards are described in three group categories:

- Standard localised keyboards (Page 5-7) - for languages using Roman and Cyrillic alphabets.
- Chinese (Page 5-8)
- Japanese (Page 5-9)

5.3.1 Special keys

The following special-function keys appear on some or all keyboards and keypads.

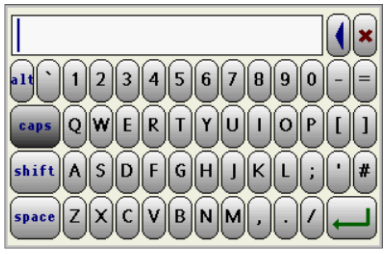
Key	Function
	**Delete** - Deletes characters from the right on numeric and full-text keyboards.
	**Cancel** - Cancels the current entry on numeric and full-text keyboards.
	**Enter** - Confirms the current entry on numeric and full-text keyboards and closes the keyboard.
	**Alt** - Toggles full-text keyboards between alternative characters and the standard keypad display.
	**Caps** - Toggles full-text keyboards between upper-case and lower-case text entry. The alphabetical keys show the current state. Default state is upper case.
	**Shift** - On full-text keyboards, this toggles shift mode on and off. Shift mode is automatically cancelled after a character is entered.
	**Modified Characters** - Where relevant for the current language, these enable accented and other modified characters to be entered on full-text keyboards.
	**PinYin** - Toggles the full-text keyboards between PinYin and standard entry modes when the current language is Chinese.
	**Change** - Toggles the full-text keyboards between Hiragana, Katakana and standard entry modes when the current language is Japanese.

5.3.2 Standard localised keyboards

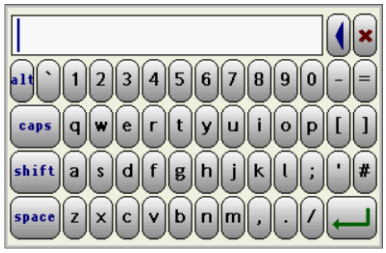
Standard localised keyboards provide access to the basic Roman and Cyrillic character sets of upper and lower case letters, numbers and punctuation. It also supports language-specific alternative and modified characters.

There are several modes of operation, controlled by the **caps**, **shift**, **alt** and modified character keys.

Caps mode (default) Provides numbers and upper case letters.

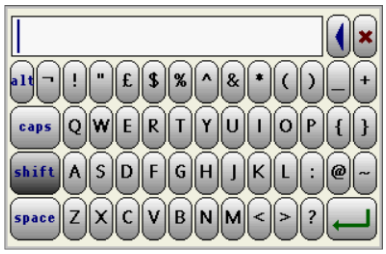


Lower-case mode Provides numbers and lower case letters.



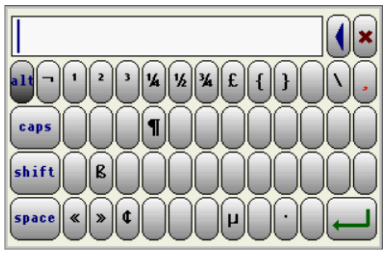
Shift mode Provides punctuation characters and upper case letters.

Shift mode is automatically cancelled after a character is entered.



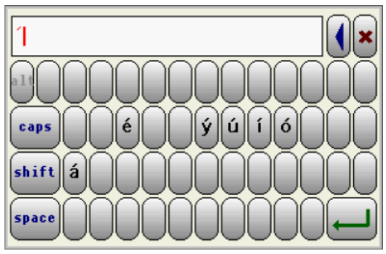
Alternative mode Provides alternative characters appropriate to the current language.

Alternative mode is automatically cancelled after a character is entered.



Modified Character mode Provides accented and other modified characters.

Modified Character mode is automatically cancelled after a character is entered.



5.3.2.1 Modified characters

Where modified characters are available, one or more character modifier keys are added. These keys are displayed in red, for example:

 or 

To enter a modified character:

1. Touch the appropriate character modifier key.
   The modifier is entered in the text box in red, and keys that have modified alternatives are displayed.
2. If necessary, touch the **shift** key to access other characters.
3. Do one of the following.
   - Touch the required character key. The character will appear in the text box, and the modified character mode will be cancelled.
   - Touch the **Space** key. The modifier will be added to the text box as a standard character.
   - Touch the delete key. The modified character mode will be cancelled.

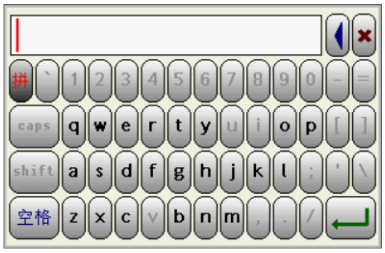
5.3.3 Chinese keyboard

When the selected language (Page 5-20) is Chinese, the keyboard has two main operating modes.

Pinyin (default)

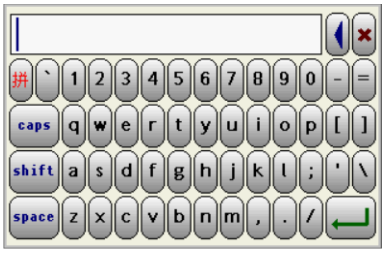
Pinyin is a system for entering Chinese characters by spelling out their sound using standard Roman characters.

Literally translated, Pinyin means 'spell sound' or the 'spelling of the sound'.



Standard mode

The keyboard operates as described for the standard localised keyboards (Page 5-7).

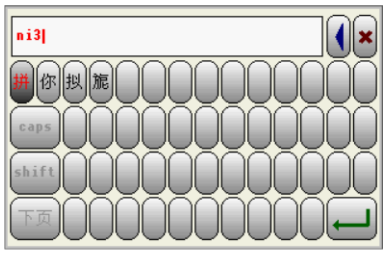


The **Pinyin** key toggles between the two modes.

The general procedure for using Pinyin entry is as follows.

1. Select Pinyin mode.
   The keyboard enables only those letters that are valid for starting a character sound.
2. Touch the appropriate letter.
   This appears in red in the text entry box, and the letters that are valid for continuing the sound are enabled on the keyboard.
3. Continue using the letter keys to spell out the required character sound until the number keys are enabled.
   At this point you can either:
   - continue to select letter keys to define the sound or;
   - select a number key to define the tone of the sound (approximately similar to adding an accent).

When a number key is selected, the top row of keys changes to display valid Chinese characters for the spelled sound.



4 Touch the required character, which then replaces the roman letters and number in the text entry box.

5 Repeat this process to add all required characters.

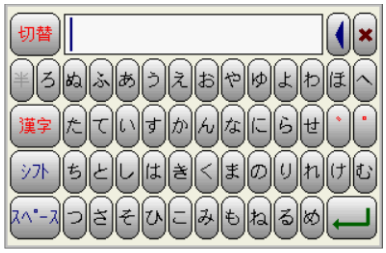
Note: Extensive information on the Pinyin entry system can be found at:
http://www.pinyin.info/ and http://en.wikipedia.org/wiki/Pinyin

5.3.4 Japanese keyboard

When the selected language (Page 5-20) is Japanese, the keyboard provides access to three writing systems, each of which has different operating modes.

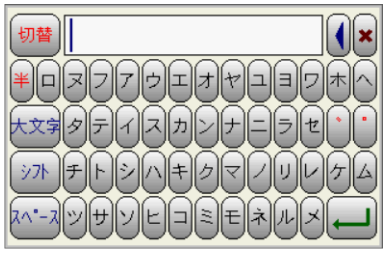
Hiragana (default)

In Hiragana, you can also access the Kanji entry system.



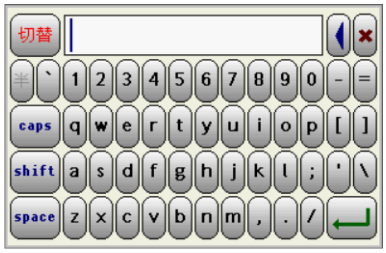
Katakana

The keyboard provides for direct entry of full- and half-width characters.



Standard

The keyboard operates as described for the standard localised keyboards (Page 5-7).

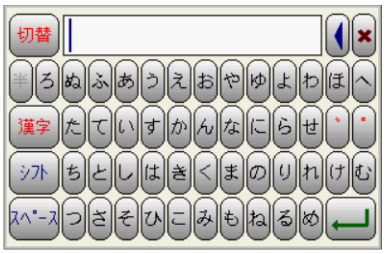


The **Change** key toggles between the three writing systems.

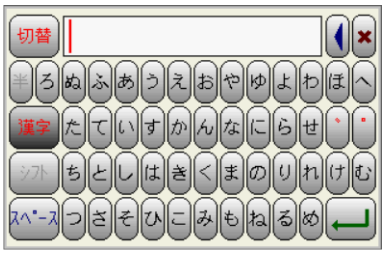
5.3.4.1 Hiragana

The Hiragana keyboard provides two systems of character entry.

Direct Hiragana mode in which characters selected on the keyboard are added directly to the text box.



Kanji mode (default) Provides the ability to enter Kanji characters by selecting a sequence of Hiragana characters.



The **Kanji** key toggles between the two systems.

Using direct Hiragana entry

1. Make sure the **Kanji** key is not selected.

2. Enter characters, as required, direct from the keyboard.
3. Use the **shift** key as necessary to access shifted characters and voiced modifiers (Page 5-12).

Using Kanji entry

The general procedure for using Kanji entry is as follows.

1. Select the **Kanji** key.
2. Touch the required character key.

   This appears in red in the text entry box, and the keypad selection is narrowed to only those characters that could still complete a Kanji character. At the same time, the **space** key shows the total number of Kanji characters available for selection.

   For example, after touching the key と, the keyboard shows this:

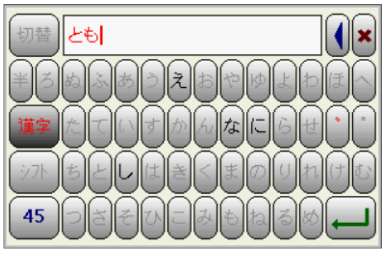
   

3. At this point you can do **either** of the following:
   - Narrow the search for Kanji characters by selecting further characters.
   - View currently available Kanji characters.

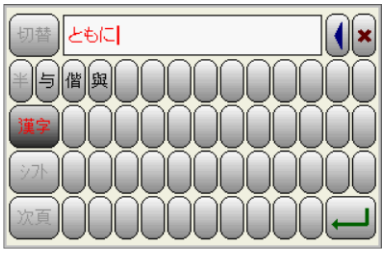
   The procedures are illustrated in the examples below.

Narrow the search

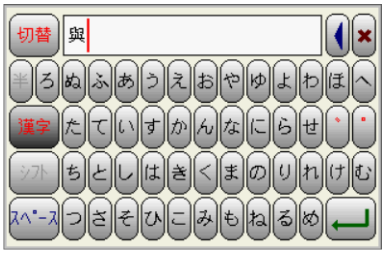
- Select another character. The number of keys available for further selection is reduced.



- Continue to add keyboard characters. When the search cannot be narrowed any further, the available Kanji characters are displayed.



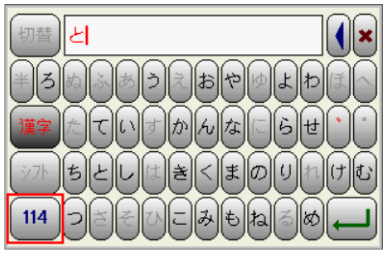
- Select the required Kanji character. This replaces the individual characters in the text box.



- The keyboard is now ready for entry of the next Kanji character.
- Repeat this process to add all required Kanji characters.

View Kanji characters

- At any point in the process of entering characters, the **space** key shows the number of available valid Kanji characters. Touch the key to view them.



- If there are more Kanji characters than it is possible to display, touch the **space** key to view more.

- If the required Kanji character is available, select it to enter it into the text box.
- If not, touch the Delete key to return to the narrowing process.

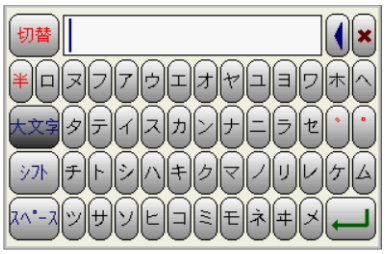
Note: Extensive information on the Kanji entry system can be found at:
http://en.wikipedia.org/wiki/Kanji

5.3.4.2 Katakana

The Katakana writing system provides several modes of operation:

Caps mode

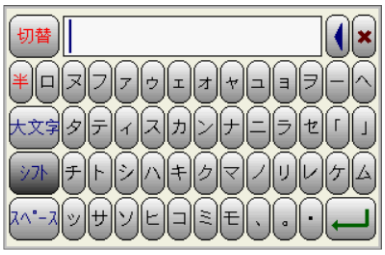
Use the **caps** key to toggle in and out of caps mode.



Shift mode

Use the **shift** key to toggle in and out of shift mode.

Shift mode is automatically cancelled after a character is entered.

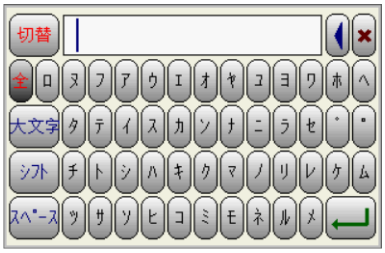


Half width mode displays a keyboard of half-width characters.

Use the following keys to toggle between half width and full width characters.

 Display half-width

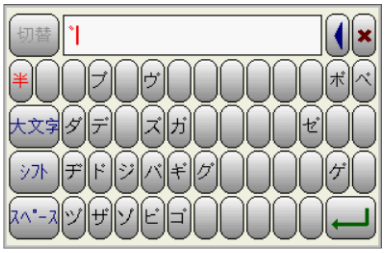
 Display full-width



Modified Character mode

Use the Shift key as necessary to access shifted characters and voiced modifiers (Page 5-12).

Modified Character mode is automatically cancelled after a character is entered.



5.3.4.3 Voiced modifiers

The Hiragana and Katakana full-width modes support character modifiers for voiced and semi-voiced sound marks. The associated keys are displayed in red.

To enter a modified character:

1. Touch the appropriate character modifier key.
   The modifier is entered in the text box in red, and keys that have modified alternatives are displayed.
2. If necessary, touch the **shift** key to access other characters.
3. Do one of the following.
   - Touch the required character key. The character will appear in the text box, and the modified character mode will be cancelled.
   - Touch the **Space** key. The modifier will be added to the text box as a standard character.
   - Touch the delete key. The modified character mode will be cancelled.

5.3.5 Numeric, Time and Date Keypads

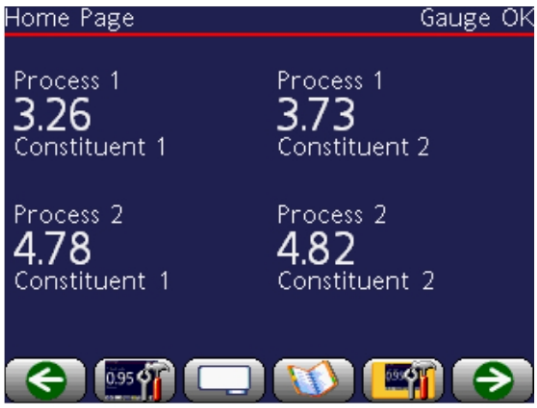
There are several versions of the numeric keypad, providing different keys according to the requirements of the selected field. The appropriate version is automatically displayed.

They all contain the numbers 0 - 9, but the following keys are displayed only when they are needed for the particular numeric entry.

Key	Function
. ,	These act as the decimal separator where the number can have a decimal fraction. The key displayed depends on the current language selection.
+/–	Enters a minus sign (-) before the number to designate it as negative. The key is displayed only if a positive or negative number is allowed.
/	Acts as the separator for date entries. Dates should be entered in a format that is consistent with the current language selection and region. For example, 31/01/2008 (UK); 01/31/2008 (US). Day, month and year figures may be entered in full, as above, or abbreviated e.g. 31/1/08.
:	Acts as the separator for time entries in the form 14:35:16. The seconds entry is optional. 14:35 will be treated as 14:35:00.

5.4 Viewing gauge measurement outputs

Each HMI and OWS can have one or more home pages. Each home page can be configured (Page 5-14) to display up to four continuously-updated measurement values.



On the HMI, the home pages can display measurements from different gauges. On the OWS they can display measurements only from the single associated gauge.

To view the gauge measurements:

1 If necessary, return to the Home page.
Touching a button will return directly to the Home page. You may need first to cancel out of a page using the button.

2 On the Home page, touch or to view measurements on other available Home pages.

5.5 Configuration

5.5.1 Managing home pages

The Configure Display function allows you create, edit and delete home pages, and to select the measurements that will be displayed on them.

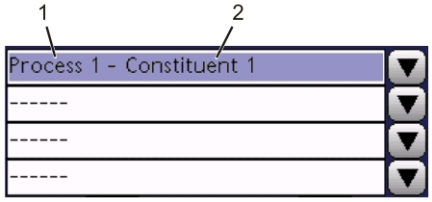
5.5.1.1 Creating a new home page

1 Open the Configure Display page.

How? *HMI* : *Home >*

OWS : *Home >*

The Configure Display page has four boxes for selecting the measurements to be displayed on a particular home page. Each box identifies the gauge and specific measurement.



1 - Gauge

2 - Measurement

2 Touch to display the Device List page.

The **Discovered Devices** window lists all discovered system Gauges. The **Your Device List** window shows the gauge(s) selected for interaction with the HMI or OWS.

3 Use the up and down arrow buttons to scroll through the **Discovered devices**, and do one of the following.

- On an HMI, touch each gauge that you wish to make available on the HMI.
- On an OWS, touch the single gauge to which the OWS is dedicated.

The selected gauge(s) will appear in the **Your Device** List.

4 Touch .

5 Touch .

6 Touch the drop-down arrow for the top selection box on the page.

This will display a scrollable window showing all measurement outputs from the gauge(s) selected earlier.

7 Locate and select the required measurement.

8 If you want additional measurements on this home page, repeat the last step for some or all of the remaining selection boxes.

9 When you have selected all required measurements, touch .

The new Home page will be created.

5.5.1.2 Editing a home page

This procedure is used to change one or more of the measurement selections on a Home page.

1 Open the Configure Display page.

How? *HMI* : *Home >*

OWS : *Home >*

2 Touch or to select the page containing the gauges/measurements you wish to change.

3 Use the drop-down lists to change or add measurements.

Note: If the measurement(s) you want are not in the drop-down lists, you will need to add the relevant gauge(s) to the HMI or OWS (Page 5-15).

4 When you have selected all required measurements, touch  to save the changes.

5.5.1.3 Deleting a home page

1 Open the Configure Display page.

How? *HMI* : *Home* > 

OWS : *Home* > 

2 Touch  or  to select the page you wish to delete.

3 Touch  , then  to confirm the deletion.

5.5.2 Setting time and date

1 Open the Time page.

How? : *Home* >  > 

The Time box displays when the page was opened; the running current time is displayed above the box.

2 To update the Time box to the current time, touch  .

3 Enter a new time or date in the appropriate boxes.

4 Touch  to save and exit the page.

5 Touch  to exit the page without saving.

5.5.3 Adding gauges to the HMI or OWS

Using this procedure you can list all gauges available on the system, and select the one(s) you wish to be accessible from the particular HMI or OWS. This is essential before functions, such as configuring a gauge or viewing its outputs, can be performed from the HMI or OWS.

1 Open the Device List page.

How? *HMI* : *Home* >  > 

OWS : *Home* >  > 

The **Discovered Devices** window lists all discovered system Gauges. The **Your Device List** window shows the gauge(s) selected for interaction with the HMI or OWS.

2 Use the up and down arrow buttons to scroll through the **Discovered devices**, and do one of the following.

- On an HMI, touch each gauge that you wish to make available on the HMI.
- On an OWS, touch the single gauge to which the OWS is dedicated.

The selected gauge(s) will appear in the **Your Device** List.

3 Touch  to go to the Configure Display page, and then  to return to the Home page.

5.5.4 Managing products

5.5.4.1 About products

710e gauges have a small number of user-configurable settings that govern the way they measure. Products are named collections of these settings, stored in the individual gauges for recall as required. Their function is to enable gauges to be adjusted quickly and accurately whenever the process product* is changed.

Normally, gauges are supplied with the required products pre-installed as part of the factory configuration. Details of these are provided on the Factory Settings Sheet (Page 1-1). These products may be modified, and new ones created, using the procedures described in this section.

Details of all changes to products are stored in a calibration history (Page 5-19) which can be viewed at any time.

---

* To avoid confusion in these instructions between the products stored in the gauges and the products from which the gauges are taking measurements, where necessary we have used the terms 'gauge product' and 'process product' respectively.

5.5.4.2 Creating a new product

The following procedure has the effect of creating and storing a new product in selected system gauges. In each gauge, the current gauge settings are used as the initial settings for the new product. The settings can then be changed by editing the product.

1. Open the Products page.

   How? : *Home* >  > 

2. If there is more than one gauge line (Page 5-24), select the line containing the relevant gauges.
3. Touch  .
4. Enter a name for the product using the keyboard provided.
5. Select the new product in the list and touch  to download the product to the gauges.
6. Touch  to confirm the download, and then  again to return to the Products page.
   This creates a new product in each gauge, using the current gauge settings.
7. Edit the new product (Page 5-17) to set the values as required.

5.5.4.3 Editing product settings

The Edit Product function allows the following values to be adjusted according to requirements.

- Algorithm — The measurement algorithm supplied with the gauge is optimised for the intended gauge application.Refer to the Factory Settings sheet supplied with the equipment for the required algorithm.

  The algorithm should not be changed unless either:

  - the Factory Settings sheet specifies a different algorithm for different products, or;
  - the gauge is to be used for a different application to the one for which it was supplied. In this case, contact NDC (Page 1-1) for advice on selecting an appropriate algorithm.
- Trim — Refer to Calibration overview (Page 6-1).
- Span — Refer to Calibration overview (Page 6-1).
- Response Time — Response Time is the time (in seconds) over which the gauge output is integrated. The appropriate value depends on the nature of the measured product. It should be short enough to indicate short-term rates of change whilst long enough to give a meaningfully stable measurement value.
- Alarm Low/High — The alarm outputs from the 710e system can be used to trigger external audible and visible warnings at the measurement thresholds specified in these two fields.

To edit product settings:

1. Open the Products page.

   How? : *Home* >  > 
2. If there is more than one gauge line (Page 5-24), select the line containing the relevant gauges.
3. Select the product you wish to edit, and touch  .
4. On Edit Product page, select a gauge in the list.

   The page will now show the current values for one measurement channel of the selected gauge. The name of the gauge and the measured constituent are shown at the top of the page. If there are other channels,  and  buttons will be provided for selecting them.
5. Where relevant, select the channel you wish to edit.
6. Set values as required.
7. Touch  to return to Products page.

5.5.4.4 Loading a product to the gauge

This function can be used recall a selected product in the system gauges. When this is done, the values stored in the product become the current gauge values for making measurements. They are also the values that will be modified by any changes made through the Edit Product function or through calibration adjustments.

1. Open the Products page.

   How? : *Home* >  > 
2. If there is more than one gauge line (Page 5-24), select the line containing the relevant gauge.
3. Select the relevant product from list.
4. Touch  , then then  to confirm the action.
5. Touch  to exit product page.

5.5.4.5 Copy a product

This procedure creates a new product, with all settings copied from an existing one, and automatically loads it to all system gauges. The original product name suffixed (1) is assigned as the default name of the new product. Further copies are suffixed (2), (3), etc. The default name and the product settings can be changed by editing.

1 Open the Products page.

How? : *Home* >  > 

2 If there is more than one gauge line (Page 5-24), select the line containing the relevant gauges.

3 Select product you wish to copy in list.

4 Touch  , then  to confirm the copy.
The new product is added to the list on the Products page.

5 Edit the name and settings of the new product as required (Page 5-17).

5.5.4.6 Delete a product

When a product is no longer needed, it can be removed permanently from all gauges.

1 Open the Products page.

How? : *Home* >  > 

2 If there is more than one gauge line (Page 5-24), select the line containing the relevant gauge.

3 Select the product you wish to delete in the list.

4 Touch  , then  to confirm the deletion.

5.5.4.7 Adjusting settings for an individual gauge

It is possible to modify the current settings for an individual gauge without the need to download a new or modified product. This is achieved through a function called Active Settings.

Any such settings take effect immediately, and will be retained in the gauge until they are either changed again through Active Settings, or are overwritten by downloading a product.

To use Active Settings:

1 Open the Product page.

How? : *Home* >  > 

2 If there is more than one gauge line (Page 5-24), select the line containing the relevant gauges.

3 Select the <Active settings> entry in the product list, and then touch  .

4 Select the relevant gauge from the list.
This opens the normal Edit Product page (Page 5-17).

5 Enter any required changes to the current settings, then touch  to save them to the gauge.

6 If you wish to changes settings for another gauge, select it from the list and repeat the editing process. If not, exit from the page.

5.5.4.8 Viewing product calibration histories

The gauge stores a calibration history for each created product. This records date- and time-stamped initial values and all subsequent edited values of Algorithm, Span, Trim and Response Time.

The calibration history facility can be used by Administrators to identify when any given change to a product was made.

To view a product calibration history:

1 Open the Product History page.

How? : *Home* >  >  > Select product from list >  > Select gauge from list > 

2 Where relevant, use the  and  buttons to select the channel you wish to view.

3 Touch the drop-down arrow in the displayed table and select one of the listed parameters.
The table will show a date- and time-stamped list of all values applied to the selected parameter.

4 Repeat the two previous steps to view histories of other channels and product parameters.

5 Touch  to return to Edit Product page.

5.5.5 Configuring users and security

These functions allow you to:

- add new system users
- modify existing user details
- Set security access levels for individual HMI/OWS functions.

The security setup functions are normally security protected, so your security level must be sufficient for you to be able to access them.

New 710 systems are configured with two default HMI/OWS users:

Name	Default password	Default Security level	Comment
<Administrator>	2222	5	This user cannot be deleted or renamed. The default password can and should be changed.
User1	1111	3	All details of this user can be changed.

Note: If the Administrator password has been changed from the default and is not known, contact NDC for assistance.

5.5.5.1 Configuring users

You can add new user names and corresponding passwords or edit existing users.

The security levels assigned to users define the highest security-protected functions that they will be able to access. Setting the security level to Disabled, will prevent the user from accessing any security-enabled function.

1 Open the Configure page.

How? *HMI* : *Home* > 

OWS : *Home* > 

2 Touch  .

3 Select your user name from the list and then enter your password on the keypad.

4 Touch  .

5 If you wish to change an existing user's details:
   - Select the user in the User name box.
   - Change the details in the **Password**, **New name** and **Security level** boxes, as required.
   - Touch  to save the changes and exit from the Passwords page.

6 If you wish to add a new user:
   - Touch  .
   - Enter the relevant details in the **Password** and **New name** boxes.
   - Select the appropriate security level for the user in the **Security level** box.
   - Touch  to save the user.
   - Repeat these steps to add more users if required.
   - Touch  to exit from the Passwords page.

5.5.5.2 Configuring HMI/OWS security levels

Each function can have a security setting of 1 to 5, where 1 is the lowest level, or Disabled.

Setting the security level of a function to Disabled, removes all security protection from the function, and allows it to be accessed by all users, even if they are not logged in.

1 Open the Configure page.

How? *HMI* : *Home* > 

OWS : *Home* > 

2 Touch  .

3 Select your user name from the list and then enter your password on the keypad.
A list of functions to which you can assign security levels will be displayed.

4 Select a function in the list, and then select the required security access level in the **Security level** drop-down.

5 Touch  to save the change and exit from the Security system page.

5.5.6 Selecting the interface language

The Language function selects the interface language for the HMI or OWS.

1 Open the Language page.

How? *HMI* : *Home* >  > 

OWS : *Home* >  > 

2 Select the required language from the list, then touch  .

5.5.7 Using the Engineers page

The configuration Engineers page is available on both the OWS and HMI, but provides different facilities in each case.

On both units, it provides configuration data, including the software version number and network address information.

On the HMI, it also provides facilities for configuring gauge analogue and digital inputs and outputs, and for grouping gauges into separate measurement lines.

5.5.7.1 Viewing version and network information

1 Open the Engineers page.

How? *HMI* : *Home* >  > 

OWS : *Home* >  > 

The version and network information is displayed.

2 Touch  to exit the page.

5.5.7.2 Configuring analogue outputs

Four analogue outputs are available from an HMI or User Port. By default, they are assigned as 4-20mA current outputs representing the four measurement channels of a single gauge.

This function allows each of the outputs to be reconfigured according to requirements. For each output you can:

- Assign it to any available gauge.
- Assign it to any measurement channel of the gauge or to one of several other gauge parameters, such as motor speed, internal temperature or window contamination level.
- Choose or manually set the low and high limits of the output.
- Choose the output type (current or voltage) and scaling.
  This selection must be matched by jumper settings on the HMI/UP pcb (Page 5-22).

1 Open the Analogue Outputs page.

How? *HMI* : *Home* >  >  > 

2 Use the  buttons to select the output you wish to configure.

3 Refer to the information in the table below, and select the required assignments using the drop-down fields. Where relevant, enter the high and low analogue limits.

4 When all assignments are made, touch  to save them.

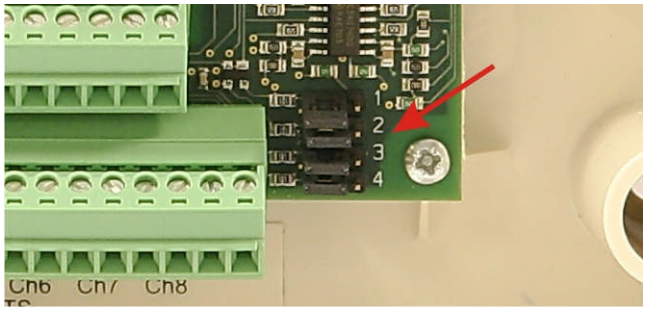
Field	Function
1	Select the output to be configured
2	Select the required gauge
3	Select the parameter to be assigned to the output
4	This selects the source for the gauge measurement values that will be represented by the minimum and maximum analogue output levels. If you select one of the gauge measurement channels in field 3, choose one of the options below. If you select any other parameter in field 3, only the fixed limits option is available. ▪ **Analogue limits** (default) - uses the low and high measurement values set on the Analogue Outputs page (Page 5-26). ▪ **Fixed limits** - allows you to set the low and high measurement values manually (see Field 5). ▪ **Alarm limits** - uses the Alarm Low and Alarm High values set in the product (Page 5-17).
5	Enter the gauge measurement values that wish to be represented by the minimum and maximum analogue output levels.
6	Select the required analogue output - 0-10V, 4-20mA or 0-20mA.

When you have finished configuring the analogue outputs, they can be tested by forcing them to specific values (Page 5-23).

Analogue o/p jumper settings

The HMI/UP contains four jumpers that must be set for current-loop or voltage outputs, to correspond with the selections made in the Analogue Outputs page (Page 5-21).

The jumpers are annotated with their analogue channel numbers.



Jumper position	Analogue output type
Left (illustrated)	Current loop
Right	Voltage

5.5.7.3 Configuring digital outputs

Eight digital outputs are available from an HMI or User Port. These can be configured to provide status outputs corresponding to gauge measurement channels or gauge functions.

1 Open the Digital Outputs page.

How? HMI : Home >  >  > 

2 Use the   buttons to select the output you wish to configure.

3 Refer to the information in the table below, and select the required assignments using the drop-down fields.

4 When all assignments are made, touch  to save them.

Field	Function
1	Select the output to be configured.
2	Select the required gauge.
3 & 4	These fields are used in combination to define the function assigned to the digital output. Select the basic function in field 3. Appropriate qualifying options are then made available in field 4. The options available in field 3 are: ▪ Gauge measurement channels - with this option selected, the output can be set to indicate the alarm state for the specific channel. ▪ Global flags - with this option selected, the output can be set to indicate the alarm state for any channel or to follow the gauge gating state. ▪ Local flags - this allows the digital output to follow the status of various gauge functions, according to the options fitted to the gauge. ▪ Status - this allows the digital output to follow one of several gauge warning and error conditions.
5	Select the required normal (non-active) condition for the output. For example, if an output is assigned to indicate an alarm high condition, and this field is set to N/O (normally open) the output will be open unless the alarm condition occurs.

When the configuration is saved by touching  , an icon is displayed to the left of the output logic field.

Its colour indicates the current state of the output. Red = output open. Green = output closed.

When you have finished configuring the analogue outputs, they can be tested by forcing them on or off (Page 5-23).

5.5.7.4 Configuring digital inputs

Eight digital inputs are available on an HMI or User Port, which can be configured to gauge functions using remote pushbuttons or other devices.

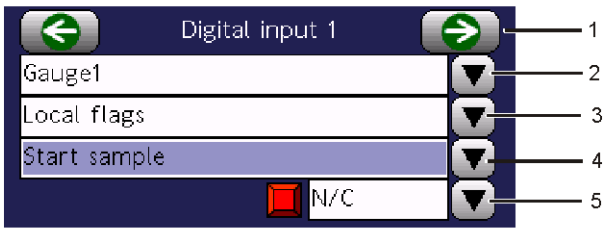
1 Open the Digital Outputs page.

How? HMI : Home >  >  > 

2 Use the   buttons to select the input you wish to configure.

3 Refer to the information in the table below, and select the required assignments using the drop-down fields.

4 When all assignments are made, touch  to save them.



Field	Function
1	Select the intput to be configured.
2	Select the required gauge.
3	This enables or disables the input. Select **Local flags** to enable.
4	Select the specific function to be controlled by the digital input. The functions available will depend on the options fitted to the gauge.
5	Select the required normal (non-active) condition for the intput. For example, if an intput is assigned to **Start sample**, and this field is set to N/O (normally open), sampling will begin when the input is closed.

An icon is displayed to the left of the input logic field.

Its colour indicates the current state of the intput. Red = no input (open). Green = input active (closed).

When you have finished configuring the analogue outputs, they can be tested by forcing them on or off (Page 5-23).

5.5.7.5 Testing inputs and outputs

When you have finished configuring the inputs and outputs, they can be tested by forcing them to specific values.

Note: Output tests assumes that the outputs are connected either to their intended destination device or to suitable test equipment.

1 On the Analogue Outputs, Digital Outputs or Digital Inputs page, touch  .
An appropriate set of controls is provided to control, and/or indicate the status of, the inputs or outputs.

- For analogue outputs, each of the four rows on the displayed page provides a drop-down field to select the state for one analogue output. To the right of this is shown the current output value and the output type - e.g 4-20 (4-20mA).
- For the digital outputs, there is a drop-down field to set the state of each output, and an associated green or red icon to show its current state. Red = off. Green = on.
- For digital inputs, there is simply an icon to show the current state of each input. Red = open. Green = closed.

2 For outputs, use the drop-down fields to force the output states, and check the outputs by observing the controlled device or test equipment.
All output states are automatically returned to **Normal operation** when you exit from the page.

3 Touch to return to the previous page, or touch or or to test the other inputs/outputs.

5.5.7.6 Configuring gauge lines

Where a 710e gauge system contains multiple gauges, it is possible to divide the gauges into groups, referred to as 'lines', making them simpler to identify and manage from the HMI.

The following rules apply to gauge lines.

- All gauges must be assigned to a line.
- If there is only one line, all gauges are automatically assigned to it.
- The maximum possible number of lines is equal to the total number of gauges (i.e. a line may contain only one gauge).
- If a line containing gauges is deleted, the gauges are automatically reassigned to another line.
- When more than one line exists, they appear automatically for selection in the HMI Product functions (Page 5-16).

To configure gauge lines:

1 Open the Line Configuration page.
How? HMI : Home > > >
The current line name is shown in the top field on the page, with the list of all system gauges below it.
If there is only one line, the page has only and buttons for exit and for adding lines.
If there is more than one line, the page also has and buttons for deleting and selecting lines.

To add a new gauge line

1 Touch , and then to confirm the action and return to the Line Configuration page.
2 Edit the line name as required.
3 To assign a gauge to the line, touch the required gauge name in the list, then to confirm.
4 The assigned gauge will be shown with a grey background.
5 Add more gauges if required.

To check gauge assignments

1 Use the buttons to select the gauge lines.
The gauges assigned to each line are shown with a grey background.

To remove a gauge from a line

1 Do one of the following.
- Select the line, touch the gauge in the list and then to confirm.
The gauge will be moved to the first available remaining line.
- Select a different line to which you want the assign the gauge, touch the gauge in the list and then to confirm.

To delete a gauge line

1 Select the line.
2 Touch and then to confirm.

5.6 Gauge interface

The Gauge Interface provides facilities for performing tasks related to a particular gauge.

You can take sample measurements, make adjustments to the gauge, and edit the names of the gauge and of its measurement channels.

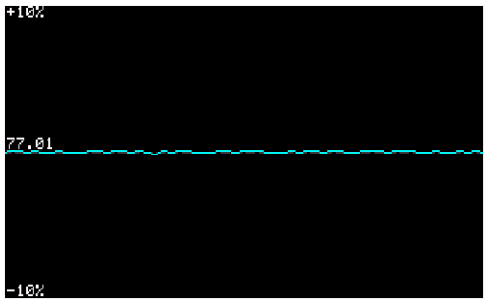
5.6.1 Sample function

The sample function is used in conjunction with the Trim function for calibrating gauges against standard laboratory reference measurements. For information on it use, refer to the Calibration section (Page 6-1).

5.6.2 Viewing measurement trends

It is possible to view a continuously-updated trend graph for any individual gauge measurement channel. This can be done either from the Sample page or from a Home page.

The graph X-axis represents one minute. The Y-axis is centred on the average measured value over this time.



The gauge and channel identities are shown below the graph, together with the channel output value.

To display a trend from a Sample page

1 Open the Sample page for the relevant gauge.

How? *HMI* : *Home* >  > Select gauge from list > 

OWS : *Home* > 

2 Touch  .

3 Touch  to return to the Sample page, or  to go to the Home page.

To display a trend from a Home page

1 Open the Home page.

2 Touch the output reading for the required channel.

3 Touch  to return to the Home page.

5.6.3 Trim function

The Trim function is used in calibration procedures to align the gauge measurements with values obtained using laboratory reference samples. For information on it use, refer to the Calibration section (Page 6-1).

5.6.4 Setting the analogue limits

Each of four analogue outputs from the HMI or User Port can be configured to provide a voltage or current output that is directly proportional to a gauge measurement channel. This function can be used to define the gauge measurement values that will correspond to the minimum and maximum analogue output values.

Note: The settings made here will have no effect unless the appropriate selections are also made in the analogue output configuration (Page 5-21).

1 Open the Analogue Outputs page.

How? : *Home* >  > Select gauge from list > 

For each gauge channel:

- **Low** is the measurement value represented by the minimum voltage or current from the analogue output.
- **High** is the value is the measurement value represented by the highest voltage or current from the analogue output.

2 Enter new values as required for any of the channels.

3 Touch  to confirm the changes, or  to cancel without saving.

5.6.5 Editing gauge and measurement names

The Edit Names function enables you to assign meaningful names to the gauge and to each of the measurement channels, in place of the factory defaults.

The assigned names are used throughout the HMI and OWS functions. In particular, they appear on the Home pages to identify the displayed measurements.

1 Open the **Edit Names** page.

How? : *Home* >  > Select gauge from list > 

2 Enter new names as required for the gauge and any of the channels.
It is common practice for:

- the **Gauge** name to reflect its position in the process (e.g. Drier 1 Exit).
- each Channel (**CH**) name to represent the constituent being measured (e.g. Moisture or Oil).

3 Touch  to confirm the changes, or  to cancel without saving.

5.6.6 Using gauge diagnostics

The Gauge Diagnostics provides facilities for:

- Viewing a range of diagnostic data from the gauge
- Re-referencing the gauge
- Conducting a reference check

5.6.6.1 Viewing diagnostic information

1 Open the Diagnostics page.

How? *HMI* : *Home* >  > Select gauge from list > 

OWS : *Home* > 

The first Diagnostics page is displayed showing diagnostic information for the selected gauge.

2 Use  and  to view other pages.

3 Touch  to exit from the Diagnostics page.

5.6.6.2 Performing an Auto-Reference

This is described in the Calibration section. (Page 6-4)

5.6.6.3 Performing a reference check

This is described in the Calibration section (Page 6-7).

5.6.6.4 Calibrating the internal gating option

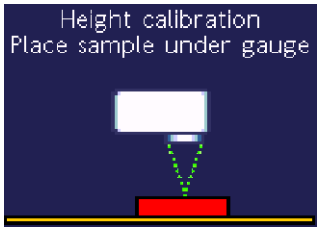
This function appears on the Diagnostics page only if the gauge is fitted with the Internal Gating Option (Page 8-1). It is used to calibrate the gating detectors for the thickness of the product under measurement.

1 Open the Height Gating page.

How? *HMI* : *Home* > > Select gauge from list >

OWS : *Home* >

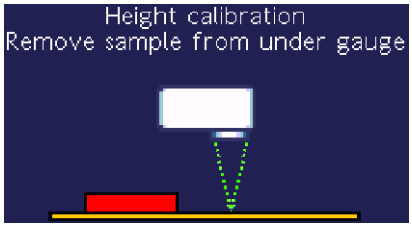
2 Touch to display the upper limit page.



3 Place a sample of the product under the gauge. Make sure that it is positioned correctly.

4 Touch .

The product height is measured, and then the lower limit page is displayed.



5 Remove the product sample.

If the product is not resting on a belt but is held at the edges so there is open space below it, a temporary matt background (i.e. a piece of cardboard or similar material) must be placed at a level just below the product and within the beam patch sample area. This background material should be removed once the setting is complete.

6 Touch again.

7 Do one of the following.

- If the calibration is successful, a **Height gating calibrated** message is displayed. In this case, touch to return to the Height Gating page.
- If the calibration is not successful, an error message - **Range error**, **Skew error** or **Difference error** - will be displayed. In this case, take the relevant action (Page 5-28), then touch and repeat the calibration.

8 When the calibration is completed and the Height Gating page is displayed, test the gating operation by placing and removing a product sample under the gauge several times.

The **Product detected** field should show **Yes** with the sample present and **No** with it removed.

9 Touch to exit from the Height Gating page.

Calibration errors

Error type	Meaning	Action
Range error	One or both samples were out of range (i.e. too close or too far from detectors).	Adjust the pass height of the gauge.
Skew error	The product was placed incorrectly during sampling so that it was seen by only one gating detector.	Position the product sample correctly.
Difference error	The gating detector did not detect sufficient difference in sample height when changing from product present to no product present.	Check that the sample is representative of the product. If so, the gating option cannot be used with this product.

5.6.6.5 Ethernet configuration

Ethernet configuration determines the source of the gauge IP address when connected to other devices via a network. The options are described below.

1 Open the Ethernet page.

How? *HMI* : *Home* >  > Select gauge from list >  > 

OWS : *Home* >  > 

2 Use the information in the table below, and choose the required address option in the drop-down field.

3 If you choose the Manual option, enter the required address, Sub Net and Gateway information in the fields provided.

4 Touch  to confirm the settings.

Ethernet settings options	
Manual	Uses the settings in the IP Address, Sub Net and Gateway fields as the ethernet settings for the gauge.
Auto/IP	This is useful for peer-to-peer networks without a dedicated DHCP server. A pseudo-random IP address is generated and used. If this causes a conflict with other network devices, the settings are negotiated with the other devices to resolve it.
DHCP	The gauge will expect to obtain network settings from a DHCP server.
DHCP+Auto/IP	The gauge will attempt to obtain network settings from a DHCP server. If this fails, it will revert to Auto/IP operation as described above.

5.6.7 Using the Engineers page

The Engineers page is primarily for use by NDC engineers, and can be accessed only by a restricted password. Consequently, it is described only very briefly here.

The page displays the network address information, and provides a number of test and reset facilities.

1 Open the Engineers page.

How? : *Home* >  > Select gauge from list >  > 

The network information is displayed, together with controls for switching the gauge motor and lamp on and off for diagnostic purposes.

2 To force a re-reference of the gauge, fit an Auto Reference Standard and then touch  .

3 To reset the gauge, touch  .

5.6.7.1 Calibrating external temperature measurements

This function calibrates the optional temperature measurement facility (Page 8-2). To perform the calibration, you will need:

- Two material samples, such as ceramic tiles or metal blocks, to act as temperature references.
- A calibrated, non-contact reference thermometer.

Before starting the calibration:

- Stabilise one sample at or below the ambient temperature of the 710e gauge environment.
- Heat the second sample to 80°C-100°C

Calibrate the temperature measurement facility as follows.

1 Open the External Temperature page.

How? *HMI* : *Home* >  > Select gauge from list >  >  > 

OWS : *Home* >  >  > 

2 Place the hotter of the two reference samples under the gauge.

3 Perform the following actions together:

- monitor the temperature of the sample with the reference thermometer, and;
- touch the Set point 1  button to measure the sample temperature with the gauge temperature sensor.

4 Enter the temperature measured by the reference thermometer into the **Set Point 1 Temperature** field.

The raw value from the gauge temperature sensor will be entered into the **Raw value** field. This provides a fixed-point calibration of the gauge sensor output against the reference temperature reading.

5 Repeat steps 2 through 4 using the cooler of the two reference samples and the **Set point 2** fields.

6 Touch  to save the calibration data, then  to exit the page.

The temperature measurement facility is now calibrated.

5.6.7.2 Calibrating the window contamination sensor

This procedure measures the contamination level of a clean window, recording it as 0%, and uses it as a reference point for on-going window contamination diagnostic readings.

Note: In general, this calibration should only be done once.

The current window contamination level will appear on the Diagnostics page (Page 5-26). When it reaches 30%, it is recommended that the window is cleaned. Higher percentages of contamination will trigger a window warning or window error message (Page 9-1).

1 Clean the gauge window.

2 Open the Engineers page.

How? *HMI* : *Home* >  > Select gauge from list >  > 

OWS : *Home* >  > 

3 Touch  .

4 Touch  to start the process.

The Window contamination will show as 0%.

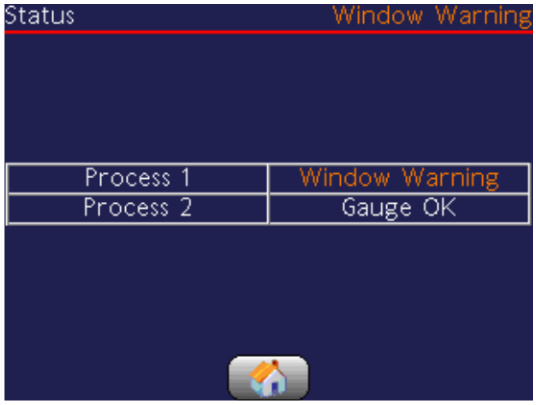
5 Touch  to return to the Engineers page.

5.7 Responding to error messages

When a fault occurs on any gauge, it is indicated by a flashing message on the HMI in place of the normal **Gauge OK** message.

If there are multiple errors, the one with the highest priority is displayed.

1 Touch the flashing error message to display the Status page.
This lists all gauges with their current status, showing the gauge or gauges generating errors.



2 Refer to the error message descriptions (Page 9-1), and take the relevant actions to clear the error conditions.
As each error condition is cleared the associated error message is automatically removed. On removal of the last error, the message reverts to **Gauge OK**.

5.8 User port browser interface

The User Port has no inbuilt user interface. Instead, its software includes a web server, which allows configuration functions to be presented on a PC running a standard web browser such as Internet Explorer.

To use the web browser interface:

1 Obtain the IP address of the User Port from the Factory Settings Sheet (Page 1-1).

2 Connect a PC network port to the Ethernet RJ45 connector on the User Port.

3 Start a web browser on the PC and enter the User Port IP address.
The USer Port web page should be displayed, which provides access to functions and to other pages.

The functions provided by the browser interface operate exactly the same as on the HMI, except that pop-up keyboards or numeric keypads are not displayed. Where a text or numeric entry is required, type it in using the PC keyboard.

The functions of the available keys are described below (Page 5-31).

5.8.1 Navigation and page keys

The following navigation and page selection keys are displayed as appropriate. Use the PC mouse to make selections.

For details of using each function, refer to the indicated page.

Key	Function
General keys	
	**Back** - Returns to the previous screen.
	**Cancel** - Cancels the current selection, entry or operation.
	**OK** - Confirms the current selection, entry or operation.
Configure page keys	
	**Device List** - Opens a page listing all discovered system gauges. You can select gauges for interaction with the UP as described in creating home pages on the HMI (Page 5-14).
	**Security** - Provides password-protected access to the the security system for configuring users and security levels (Page 5-19).
	**Logout** - Logs out the current user.
	**Language** - Displays a page for selecting the user interface language. Simply select the required language and exit the page.
	**Engineers** - Opens an Engineers page for configuring the UP analogue and digital inputs and outputs (Page 5-20).

6 Calibration

6.1 Calibration overview

All 710e gauges are configured and pre-calibrated during manufacture to suit the specific applications for which they are supplied. Consequently, new gauges can normally be put into service immediately, subject only to verifying the pre-calibration.

The gauges should then be stable and provide consistently accurate measurements over long periods. However, if you wish to check the accuracy of the gauge output at any time, this can be done using the Auto Reference Standard or the Reference Check function of the HMI. (Page 6-7)

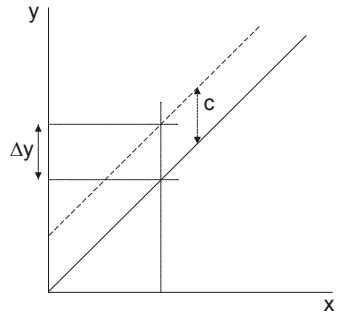
Calibration requirements of 710e gauges are limited to adjustment of the output using Trim and Span values only.

Trim

The Trim value applies a positive or negative offset to the final output. It can be adjusted to increase or decrease the gauge output to align with the local laboratory reference method values.

In most circumstances, this is sufficient calibration for a gauge measuring at a target value. Even if the pre-calibrated Span is not optimum for the product over a wider measurement range, making a Trim-only adjustment will produce high-accuracy results at or near the target with minimum effort.

The default Trim value is 0.00. The graph shows the effect (Δy) on the gauge output of a change in Trim value.

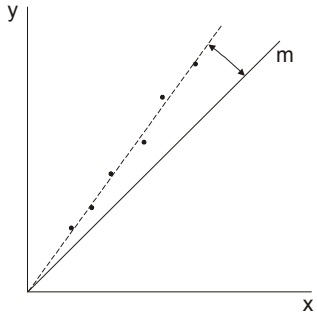


c = Trim x = Laboratory reference y = Gauge output

Span

The Span value changes the slope of the gauge output: that is, the change in output for any given change in absorption by the measured product. For some applications, Span adjustment may be needed to align the gauge measurements with laboratory reference samples over a range of values, as illustrated below. In such cases, it is necessary to perform a full-range calibration.

The default Span value is 1.00.



m = Slope of line x = Laboratory reference y = Gauge output

6.1.1 When to calibrate

When	What you should do	Notes
▪ After installing a new gauge	▪ Auto-reference (Page 6-4)	This is essential. Do not omit.
	▪ Auto-trim (Page 6-2)	Optional. Can make the fine Trim adjustment easier to perform, but not essential.
	▪ Trim (Page 6-3)	Essential. Ensures measurements at/near target are accurate.
	▪ Full range calibration (Page 6-6)	Necessary only if accurate measurements are required over a range of values.
▪ After changing source lamp or filter wheel motor	▪ Auto-reference	Essential.
▪ On change of product	▪ Check trim against samples of new product and adjust if necessary	Confidence check
▪ Whenever check of long-term accuracy is required	▪ Stability check (Page 6-7)	Confidence check.

6.2 Calibration procedures

6.2.1 Using Auto-Trim

The HMI Auto-Trim function is intended as an initial method of adjusting the gauge to provide approximately correct outputs at the target values. It is very quick and easy to use, and does not require the preparation of special laboratory samples.

Auto-Trim should **not** be used in place of the Trim procedure (Page 6-3) where accurate gauge readings are required.

The values obtained using Auto-Trim automatically update the current gauge products (Page 5-16).

1 Using your normal methods, ensure that the product is at or near the target values for the constituents being measured.

2 Open the Trim page.

How? : *Home* >  > Select gauge from list > 

This shows the continuous reading from each gauge channel and the current trim value(s).

3 On the Trim page, touch the relevant Auto-Trim button  .

4 Enter the **Autotrim sample time** (seconds).

The gauge will calculate the average measured values over this period.

5 In the **Autotrim target value** field, enter the expected target values for the product being measured.

6 Touch  to start the Auto-Trim process.

Sampling stops automatically after the **Autotrim sample time**, or it may be stopped early by touching  .

The calculated trim is applied automatically, and the trimmed measurement is displayed in the **Reading** field.

7 Touch  to return to the Trim page.

8 Repeat the process for other channels, as required, or touch  to exit from the Trim page.

6.2.2 Trim

A manual Trim adjustment is conducted in two distinct phases:

- Obtaining the sample data on which the new trim value will be based.
- Calculating and applying the new Trim value to update the stored gauge products.

These are described below.

6.2.2.1 Obtaining samples

This process involves taking a number of gauge readings and corresponding laboratory reference samples with the product at or near the target values. Data from these samples can then be used to determine the optimum gauge Trim values.

The process uses the HMI Sample function.

1 Open the Sample page for the relevant gauge.

How? *HMI* : *Home* >  > Select gauge from list > 

OWS : *Home* > 

2 Enter the **Sample time** and **Delay time** values (seconds).

- **Sample time** is the period over which measurements will be taken and averaged. This should be chosen according to the product to provide a representative sample.
- **Delay time** sets a delay between touching the start button and the start of sampling. This allows time to prepare for taking the physical sample for the laboratory reference.

3 When the production process is stable (Page 5-25) and the constituents to be calibrated are approximately at the target levels, touch  to start sampling.

If a delay has been set, the delay time will count down to 0 before sampling starts.

4 Throughout the sample period, collect the product samples from the process line and seal them for laboratory analysis.

For meaningful results, the product samples must be taken from the gauge location, and over the same time periods as the gauge samples.

5 Sampling stops automatically after the **Sample time**, or it may be stopped early by touching  . In both cases, the averages and standard deviations (S.D.) of the measurements are displayed.

6 Record the displayed values for comparison with the laboratory-determined values.

7 Repeat the procedure a number of times (typically 10) to obtain a representative collection of gauge readings and corresponding reference samples.

8 Touch  to exit from the sample Page.

9 Process the reference samples according to your established laboratory method to obtain the reference values.

6.2.2.2 Calculating and applying Trim

This procedure applies a Trim adjustment based on values obtained using the Sample function. The entered values automatically update the current gauge products (Page 5-16).

1. Obtain the appropriate sample data as described above.
2. Open the Trim page.

   How? : *Home* >  > Select gauge from list > 
3. This shows the continuous reading from each gauge channel and the current trim value(s).
4. Calculate the new Trim value:

   $T_1 = T_0 + (Lab_M - G_M)$

   Where:

   T_1 = New Trim value

   T_0 = Current Trim value

   Lab_M = Average of laboratory reference values

   G_M = Average of gauge sample measurements
5. Enter the new Trim values into the appropriate **Trim** fields.
6. Touch  to apply the changes, or  to cancel without saving.
   If you apply the changes, the displayed **Reading** values will be adjusted accordingly.
7. Touch  to exit from the Trim page.

6.2.3 Using Auto-Reference

6.2.3.1 About auto-referencing

The Auto-reference procedure finely adjusts the internal gauge calculations to eliminate variations in optical components that might otherwise affect measurement accuracy.

Auto-referencing is **very important** to other calibration procedures and to the accuracy of gauge measurements. It should be conducted on any gauge:

- when it is first installed, prior to any calibration work.
- after fitting a replacement source lamp or other optical component.

If the gauge is correctly auto-referenced when it is first installed, its accuracy can easily be restored after any subsequent maintenance, such as changing the lamp, simply by repeating the auto-reference. If not, it is very likely that detailed calibration would be needed.

Note: The procedure **cannot** be performed without access to an Auto Reference Standard (ARS) supplied by NDC. If the procedure is attempted without an ARS, it will not cause any damage, but gauge measurements will be corrupted until a proper Auto-reference is performed.

6.2.3.2 Performing an auto-reference

1 Obtain the Auto Reference Standard that was supplied for use with the relevant gauge.
Do not use any other ARS, as the characteristics may be slightly different and this will affect the accuracy of the reference procedure.

2 Place the ARS in the same location as the gauge and allow at least 1 hour for it to warm or cool to the ambient temperature.

3 Fit the ARS to the gauge. (Page 6-5)

4 Open the Auto-Reference page.

How? *HMI* : *Home* > >Select gauge from list> >

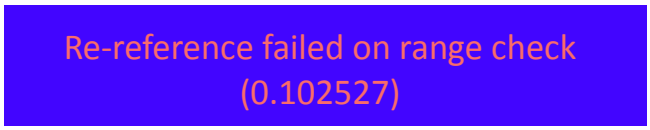
OWS : *Home* >

5 On the Auto-Reference page, touch to start the process.
A ten-second countdown is displayed while the sampling is in progress, followed by a success or fail message.

6 In either case, touch to exit from the Auto-Reference page.

6.2.3.3 Auto-reference failed

If a fail message similar to this is displayed, it indicates that the correction required is beyond the capability of the Auto-Reference process.



Note: The number in the message has no operational significance, but may be required by NDC to assist with diagnosis of the problem. Please make a note of the number.

Possible causes are:

- Gauge window contaminated, or Auto Reference Standard window contaminated externally.
  In this case, clean the window(s) and repeat the Auto-Reference procedure.
- Auto Reference Standard not fitted correctly, or not allowed to equalise to the ambient temperature.
  Check, and then repeat the auto-reference.
- Auto Reference Standard contaminated internally.
  This can happen as a result of poor storage conditions, resulting in the formation of water vapour within the unit. In this case, return the Auto Reference Standard to NDC.
- Gauge faulty
  If the error is not caused by contamination as described, it is possible that the gauge is faulty. In this case, contact NDC.

6.2.3.4 Fitting the ARS

The Auto Reference Standard (ARS) is an essential system accessory for checking and correcting aspects of gauge accuracy. The Auto-Reference procedure cannot be performed without it.

The ARS connects to the gauge window bezel by means of a bayonet fixing. It can be fitted only in one orientation.

If an air purge unit is fitted, it is **not** necessary to remove it in order to fit the ARS, although the index marker on the window bezel will be partially obscured.

Attach the ARS to the gauge as follows:

1 Shut off the air supply to the air purge assembly, where fitted.

2 Align the index markers on the ARS and window bezel, insert the ARS into the bezel as far as it will go, and then turn it clockwise to lock it in place.

6.2.4 Performing full-range calibration

In most circumstances, adjustment of Trim (Page 6-3) is sufficient to provide accurate measurements around a target value.

Where the application requires measurement across a range of values, however, it may be necessary to perform a full-range calibration involving the determination of optimum values for both Trim and Span.

This is not generally recommended for routine calibration because it is time consuming and requires product to be made with a wide variation in the levels of the measurement parameters.

Note: The easiest way to do a full-range calibration is to use the Linefit Tool in the GaugeToolsXL software, as described in the GaugeToolsXL User Guide.

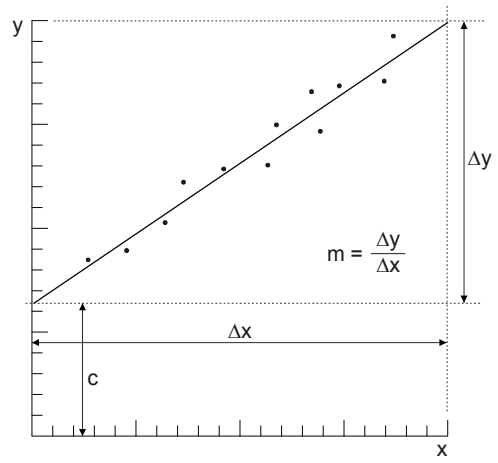
The general method described here can be used as an alternative.

1 To provide a starting point for the full-range calibration, set the gauge Trim using the Auto-Trim procedure (Page 6-2).

2 Obtain gauge and laboratory sample data over the required measurement range using the Sample function (Page 6-3).

The accuracy of the predicted Span value depends on the measurement range over which data is collected, and the number of samples taken. As a guide, the range should cover at least 70% to 130% of the target value, with a minimum of ten samples.

3 Perform a linear regression (least squares or orthogonal) using the laboratory reference value as the independent variable (x) and the gauge output as the dependant variable (y).



The equation of the best-fit line is given by:

$y = mx + c$

where

m is the slope of the best-fit line

c is the y intercept of the best-fit line

4 Calculate the new Span value S_1 from:

$S_1 = S_0 / m$

where S_0 is the original Span (as used during data collection).

5 Calculate the new Trim T_1 from:

$T_1 = (T_0 - c) / m$

where T_0 is the original Trim value (as used during data collection).

6 Enter the calculated values of Trim and Span, using the HMI Edit Product function (Page 5-17).

6.2.5 Checking gauge stability

710e gauges are self-compensating for factors such as aging of their internal source lamp, and are substantially unaffected by ambient light or environmental temperature changes within their operating temperature range. Consequently, the gauges should be stable and provide consistent measurements over long periods of operation.

If you wish to check this for any reason, it can be done using either of the methods described below.

Note: By far the most common reason for drift in the gauge output is window contamination. It is vital, therefore, that the window is kept clean during normal operation, either by regular cleaning or by fitting an Air Purge unit. The window should be cleaned before any reference check is performed.

Checking the gauge output with the ARS

To do this, you will need a product (Page 5-16) with a Span value of 1.00 and a Trim value of 0.00.

1 If necessary, create a new product (Page 5-16) with a Span value of 1.00 and a Trim value of 0.00, and save it with a meaningful name such as Stability Check.

2 Load the product to the gauge to be tested.

3 Fit the ARS to the gauge. (Page 6-5)

4 Check the gauge outputs on the Home page and record for future reference.

5 Remove the ARS and load the normal operating product.

6 Repeat this procedure at intervals and check that the gauge output remains consistent over time.

Using the HMI Reference Check function

This function can be used without loading a special product. It checks the gauge output against the ARS and provides a date- and time-stamped percentage reading, which represents the deviation from ideal.

It is important to understand that this is a very sensitive check, and that some deviation from 0% is normal. As an indication, a reading of 100% is equivalent to the threshold for failure of the Auto-reference procedure. (Page 6-4) Anything below 30% is insignificant for all practical purposes.

1. Fit the Auto Reference Standard (Page 6-5) to the gauge.
2. Open the Reference Check page.

   How? *HMI* : *Home* >  >Select gauge from list>  > 

   OWS : *Home* >  > 
3. Touch  to start the check.

   The screen will show a 10-second countdown and then display a table showing the result of the reference check, together with previous results. The results are shown in different colours according to deviation:

Deviation	Colour	Required action
<35%	White	None. Result is normal.
35% - 70%	Orange	Check that the gauge window and ARS are clean, and that the ARS is correctly fitted, then repeat the test. If the problem persists, contact NDC.
>70%	Red	

   A deviation above 100% will generate a failure message. The actions required in this event are the same as for the orange ad red conditions above.
4. Exit from the results page and remove the ARS from the gauge.

7 Maintenance and Spares

This chapter covers general cleaning of 710e components, and corrective maintenance to the level of the parts designated as customer replaceable items.

7.1 Warnings and cautions

When carrying out any maintenance on the system, observe the following to avoid injury to personnel and damage to the equipment.

- If the gauge has been operating in very high temperature environment, allow adequate time for it to cool before handling.
- Compressed air can be dangerous. Isolate the Air Purge unit compressed air supply before working on a gauge.
- Do not power up the gauge when the case is open. The filter wheel rotates at very high speed and could cause injury.
- Gauge maintenance must be carried out in a clean room away from the working area of the equipment.
- While the gauge case is open, take care not to touch any optical surfaces.
- When working on any system components, observe standard anti-static precautions.

7.2 Cleaning

External surfaces of gauges and other system components should be cleaned periodically with a damp non-abrasive cloth only.

Keep cables and connectors free from contaminants that could cause chemical damage.

Clean gauge windows as described below.

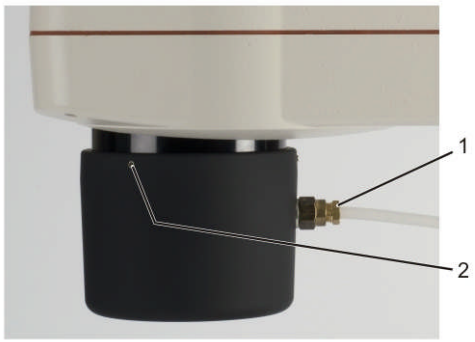
Caution: If solvents are needed to remove contamination, it is essential to consult the Customer Care Department of NDC or their agent first, giving precise details of the solvent.

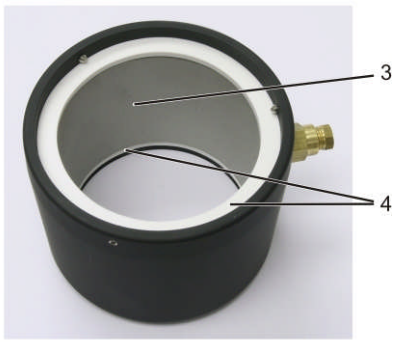
7.2.1 Cleaning gauge windows

1 If an air purge (AP) unit is fitted, remove it as follows.

Note: The AP has a cylindrical insert and two gaskets which are free to fall out when it is removed from the gauge (Page 7-8).

- Turn off the air supply to the air purge and remove the air tube from the connector (1).
- Using a 2 mm Allen key, loosen the three grub screws (2) which secure the AP unit to the rim of the gauge window, and remove the unit.





2 Clean the gauge window using a soft lint-free cloth.
Where necessary, use warm water and a mild detergent. **Do not use abrasive cleaners of any kind**.

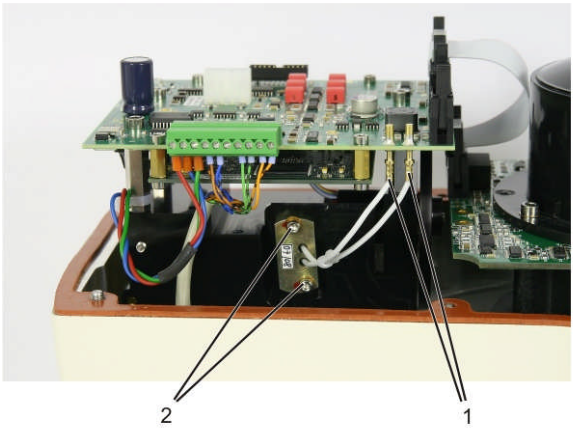
If a solvent is needed to remove contaminants, contact NDC or their agents first.

3 Replace the AP, where fitted.
When refitting AP, ensure that the insert (3) and the two gaskets (4) are fitted correctly. Press the AP firmly against the window bezel when tightening the fixing screws to ensure that they locate correctly into the retaining groove.

7.3 Replacing the gauge source lamp assembly

To replace the Source Lamp Assembly:

1 Place the Gauge on the bench with the gauge window uppermost.
2 Undo the screws that hold the enclosure sections together.
3 Lift off the section containing the window and lay it face down on the bench.
4 Unplug the two source lamp assembly leads (1).



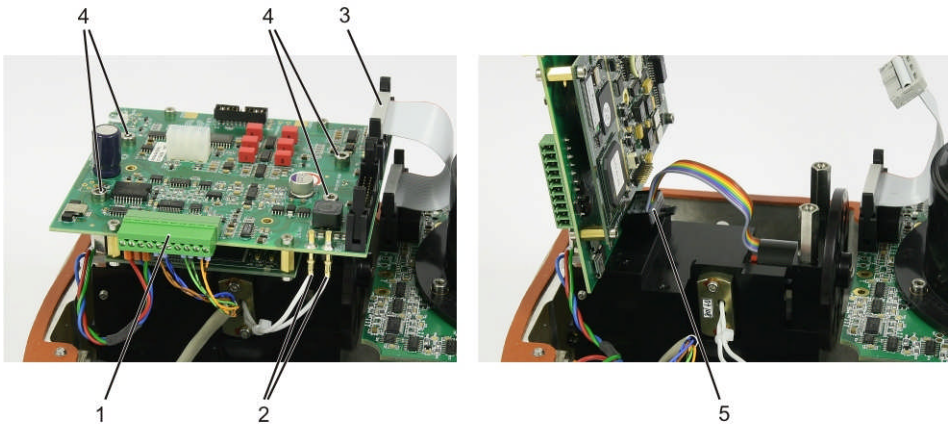
5 Remove the two lamp fixing screws (2), and withdraw the source lamp assembly from its mounting.
6 Fit the new lamp and reassemble the gauge using the reverse of this procedure. **Take care not to touch the lamp glass as this may cause lamp failure**.
If accidental contact is made, clean the glass with isopropyl alcohol (IPA).
7 Switch the gauge on and allow 2 hours for it to reach full operating temperature, then auto-reference the gauge. (Page 6-4)

7.4 Replacing the filter wheel motor

To replace the filter wheel motor:

1 Place the gauge on the bench with the gauge window uppermost.
2 Undo the screws that hold the enclosure sections together.
3 Lift off the section containing the window and lay it face down on the bench.
4 Unplug the terminal connector (1), lamp wires (2) and ribbon cable connector (3) from the PCB.

5 Remove the screws (4) securing the PCB.

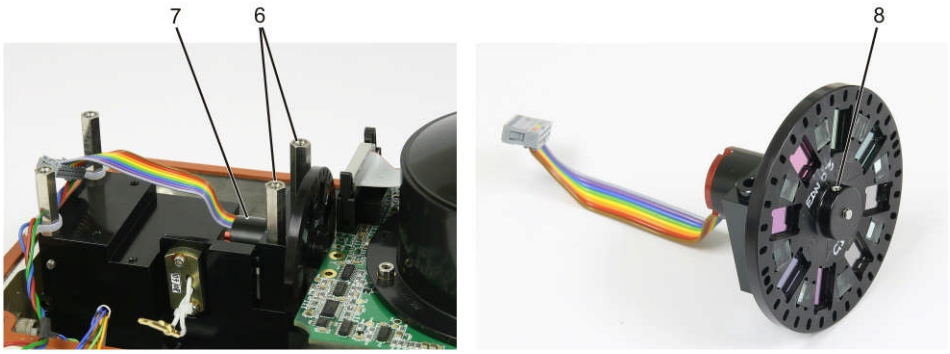


6 Lift the PCB and remove the ribbon connector (5).

7 Remove the two studs (6) and then lift out the motor/filter wheel assembly (7). **Do not touch the optical surfaces of the filter wheel**.

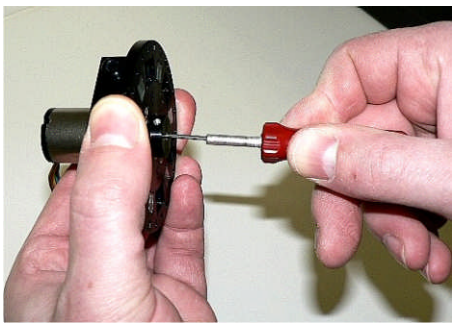
If accidental contact is made, clean the optical surfaces with isopropyl alcohol (IPA).

8 Note the orientation of the filter wheel, with the bush containing the grub screw (8) towards the end of the motor shaft.



9 Loosen the grub screw and carefully withdraw the filter wheel from the motor shaft.

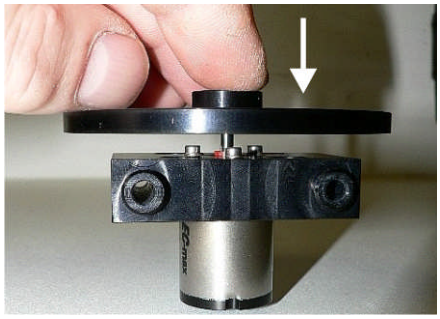
If the filter wheel does not come off easily, do not attempt to pull it off as this may damage the motor bearings. Instead, grip the wheel by its edges and use a small allen key or similar tool to push the motor spindle out from the wheel.



10 If the instrument is within the warranty period, return the faulty motor to NDC Infrared Engineering for replacement. If not discard the motor.

11 Fit the filter wheel to the new motor.

If the wheel is a tight fit, do not attempt to push it on while holding the motor. Place the back end of the motor shaft against a hard surface and then push the filter wheel on as far as it will go.



12 Tighten the filter wheel grub screw.

13 Fit the motor assembly, and reassemble the gauge using the reverse of steps 1 through 8.

14 Switch the gauge on and allow 2 hours for it to reach full operating temperature, then auto-reference the gauge. (Page 6-4)

7.5 Replacing fuses

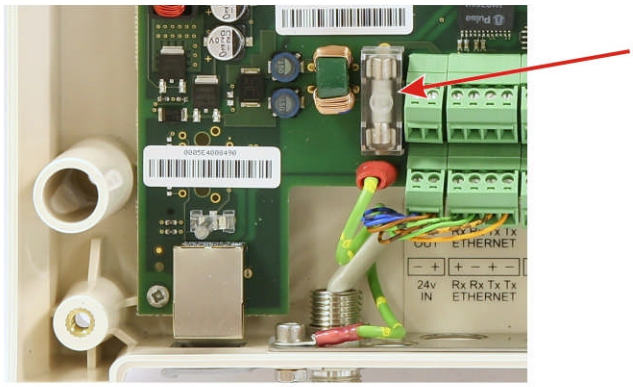
System peripheral units have internal fuse protection for the 24V power input/output as required.

These fuse will rupture under the following conditions:

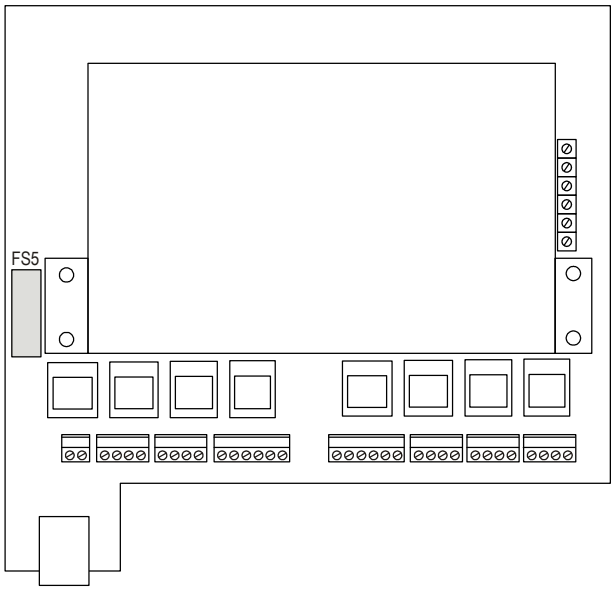
- Reverse polarity on the 24V input.
- Voltage surge and high voltage on the 24V input.
- Short circuit or reverse polarity on a 24V output.

The location of the fuse(s) in each unit is shown below. When replacing a fuse, use the correct type and rating as listed in the Spares section (Page 7-8). Spare fuses may be provided in supplied support kits (Page 7-7).

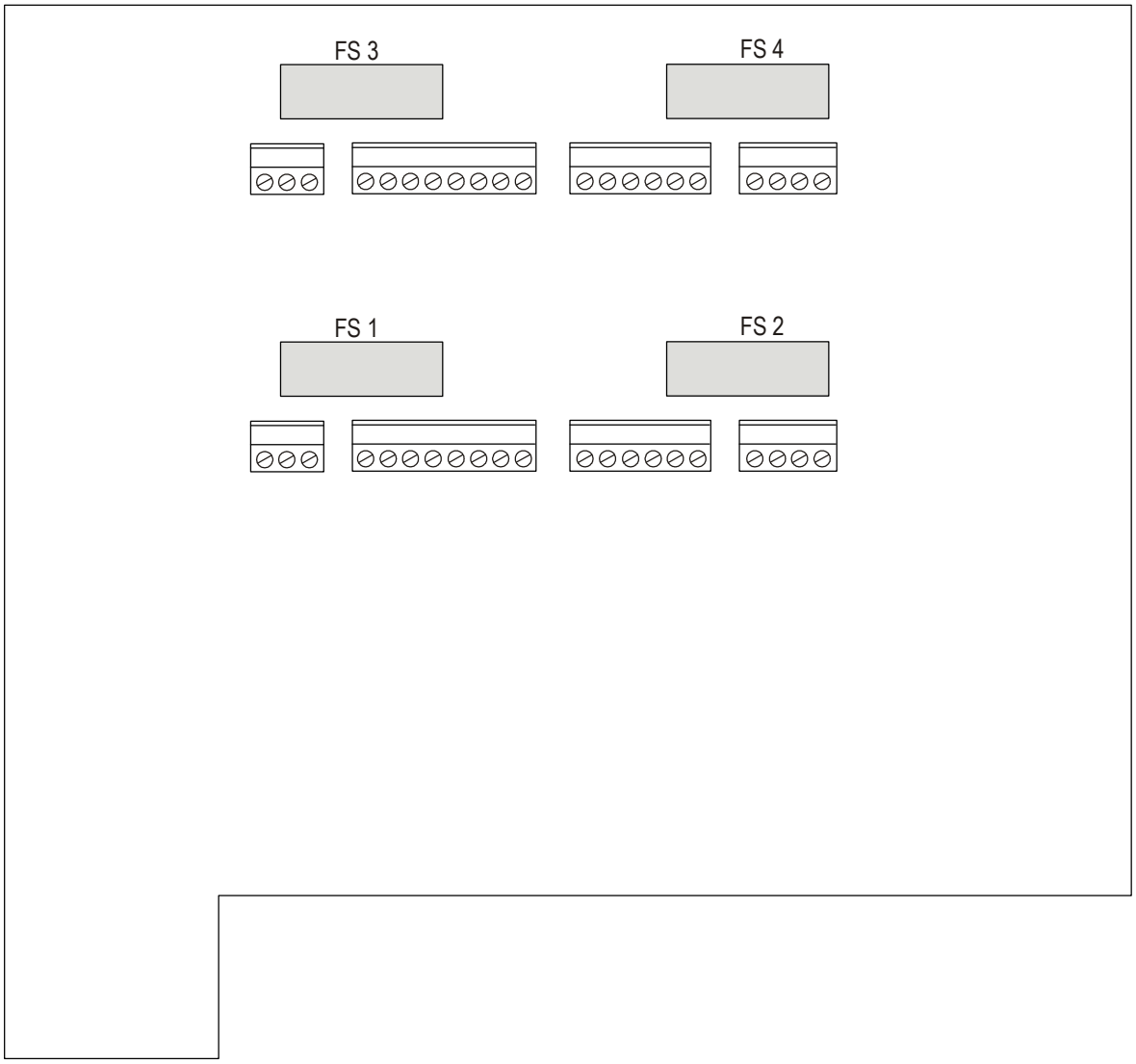
7.5.1 HMI/OWS/UP fuse



7.5.2 Switched Hub fuse



7.5.3 Junction Box fuses



7.6 Support kits

The following kits of parts are provided to support supplied 710e equipment.

710e Gauge kit

One kit provided with each gauge, containing:

Item	Function	Qty	Part No.
Fixing screw, M8 x 12mm	Gauge fixing; mounting bracket up to 5mm thick	4	FX/0519-02
Fixing screw, M8 x 16mm	Gauge fixing; mounting bracket 5mm - 10mm thick	4	FX/0519-03
Washer M8	Gauge fixing	4	FX/0231-07
Socket cap fixing screw, M5 x 16mm	Power supply mounting	4	FX/0178-03
Nut M5	Power supply mounting	4	FX/0215-06
Washer M5	Power supply mounting	8	FX/0231-05

710e Peripheral kit

One kit provided with each OWS, HMI and User Port, containing:

Item	Function	Qty	Part No.
Screw cover insert	Front-panel fixing screw covers	4	105/14429-01
Fuse, 1A 20mm	24V input protection	1	FS/0132-03
Ferrule, light blue	Wire termination (ethernet)	10	CO/0911-01
Ferrule, orange	Wire termination (power)	6	CO/0911-03
Socket cap fixing screw, M5 x 16mm	Peripheral mounting	4	FX/0178-03
Nut M5	Peripheral mounting	4	FX/0215-06
Washer M5	Peripheral mounting	8	FX/0231-05

710e System kit

One kit provided with each gauge system, containing:

Item	Function	Qty	Part No.
NDC Gauge alignment tool, 20^{o}	Setting gauge pass height and mounting angle	1	105/14705-01
NDC Stylus	OWS/HMI touch screen operation	1	MI/14681-01

7.7 Spares

The items designated as Customer Replaceable Spare Parts are listed in the table below.

The parts may be obtained by ordering them from NDC, using the part numbers given below.

Description	NDC Part Number
710e gauge	
Lamp Assembly	64/7158-02SA
Motor Assembly	105/14527-01SA
Enclosure gasket (cast enclosure)	105/11962-01
Enclosure gasket (stainless steel enclosure)	105/13724-02
Enclosure main O-ring seal (stainless steel enclosure)	MI/0111-39
Air purge unit	
Filter cylinder	00/7299-02
Upper seal	00/4547-03
Face seal	00/4547-04
Peripheral Units	
Fuse: OWS, HMI, UP 24V IN 1A, 20mm	FS/0132-03
Fuse: Switched Hub FS5; 24V IN 1A, 20mm	FS/0132-03
Fuse: Junction Box FS1 & FS3; 24V IN 3.15A, 20mm	FS/0132-08
Fuse: Junction Box FS2 & FS4; 24V OUT 1A, 20mm	FS/0132-03

8 System Options

The options described in this section apply to some or all of the gauges and applications of the 710e system covered by this manual.

8.1 Internal gating option

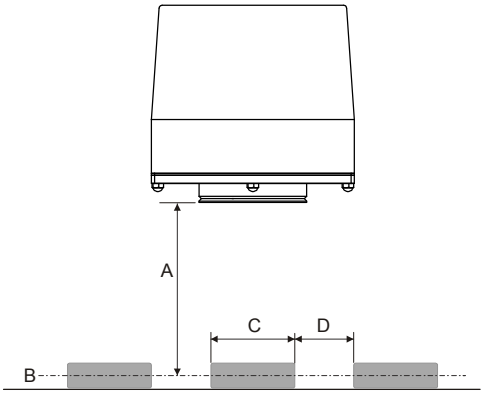
This option enables the gauge to make reliable measurements of discontinuous products by switching the infra-red measurement system on only when there is product in the beam-patch area. It operates by using two infrared sensors located within the gauge to detect changes in the distance between the gauge window and the viewed surface. If the distance is greater than a defined threshold - indicating that there is no product in the beam patch - the gauge is gated off.

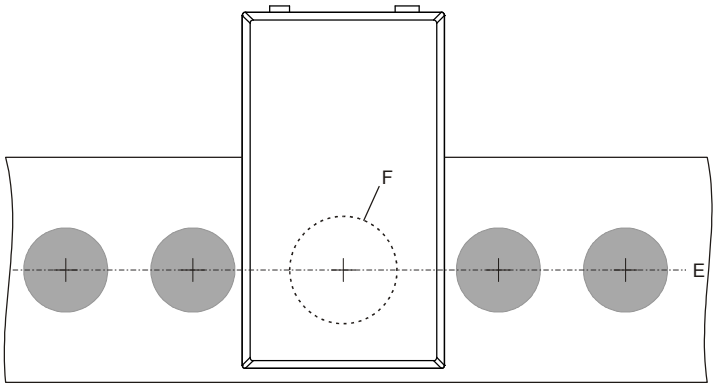
The option is available with small and large beam patch, in stainless steel versions of the gauge only.

The gauge should be positioned as shown below, and installed in accordance with the installation instructions (Page 4-5).

The gating function can only operate correctly with a solid background (i.e. a product moving on a solid belt or with a background target).

In all cases, it is important that no metallic or reflecting surfaces are present within 20mm of the visible gauge patch at all distances, this applies even when the product is absent.





		Small beam patch	Large beam patch
A	Nominal gate distance	125mm ±1mm	235mm ±5mm
B	Mean height of product		
C	Minimum product size	30mm	85mm
D	Minimum product separation	25mm	85mm
E	Gauge window centre line		
F	Gauge window		

Note: If the product is changed after gauge installation to one of significantly different thickness, the gating operation may become unreliable. In this case, the gauge should be repositioned to correct the pass height, as above, and the gating should then be recalibrated.

To ensure reliable operation for any particular product, the gating sensors must be calibrated for product thickness, using the HMI (Page 5-27).

8.2 Temperature measurement option

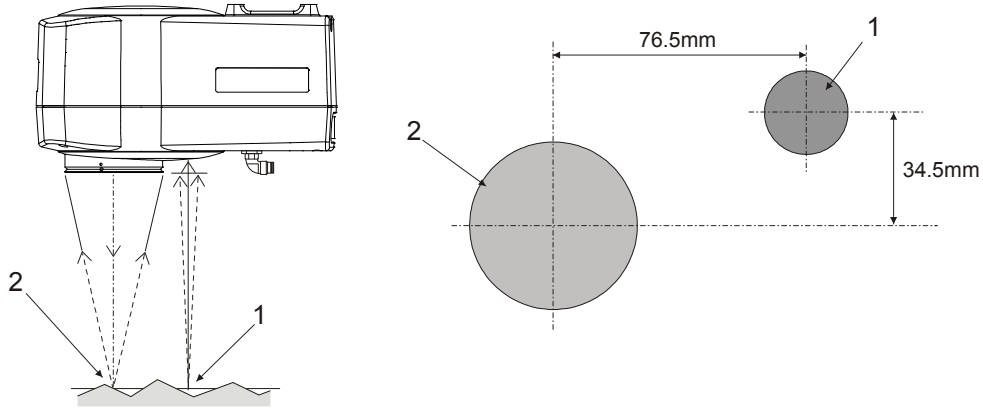
The temperature measurement option provides the ability to display the temperature of the product on one channel of the OWS and HMI. It uses an infra-red sensor, and can operate in the range 0°C -120°C

There are two versions of the option - internal and external. The internal version measures product temperature in the immediate vicinity of the gauge. The external version allows the sensor to be positioned at remote locations.

8.2.1 Internal temperature option

The internal option is available on both cast and stainless steel versions of the gauge, and is incorporated entirely within the gauge enclosure.

The temperature sensor is mounted adjacent to gauge window, and detects the temperature of the product from a 25mm diameter sample patch (1) offset from the main beam patch (2).

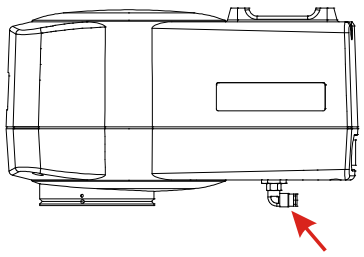


Temperature sensor air purge

The temperature sensor is surrounded by an air purge assembly. This reduces contamination of the sensor window, and improves measurement stability by keeping the sensor at a constant temperature.

Installation

There are no additional installation requirements, other than connection of an air supply to the sensor air purge assembly. The air supply is connected to a 6mm elbow on the underside of the gauge.



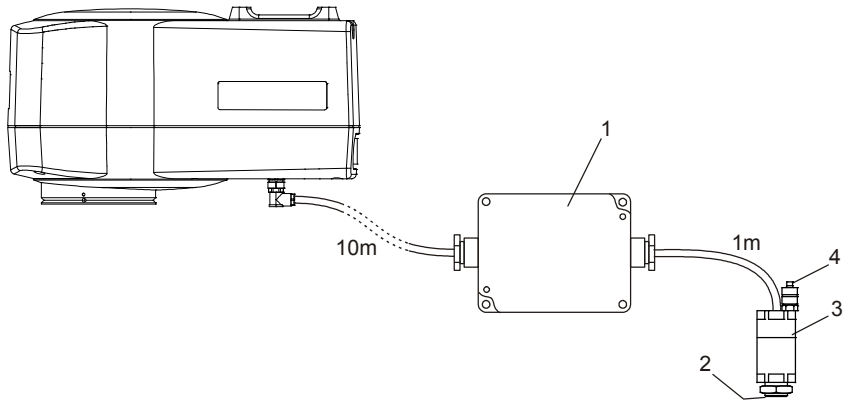
Calibration

The temperature measurement is calibrated in the same way as the constituent measurements, as described in the Calibration section (Page 6-1).

8.2.2 External temperature option

The external temperature option consists of a control unit (1) and a non-contact sensor (2), which can be fixed at the required remote location above the product. The sensor is enclosed by in an air-purge jacket (3) which requires an instrument-quality air supply to the hose connector (4).

Note: If required, the hose connector (4) can be easily changed to a quick-release tube fitting. Simply unscrew the existing fitting and replace with the NDC supplied alternative.



The cable connecting the control unit to the gauge may be up to 10 metres long. The sensor is attached by an integral 1m cable to the control unit.

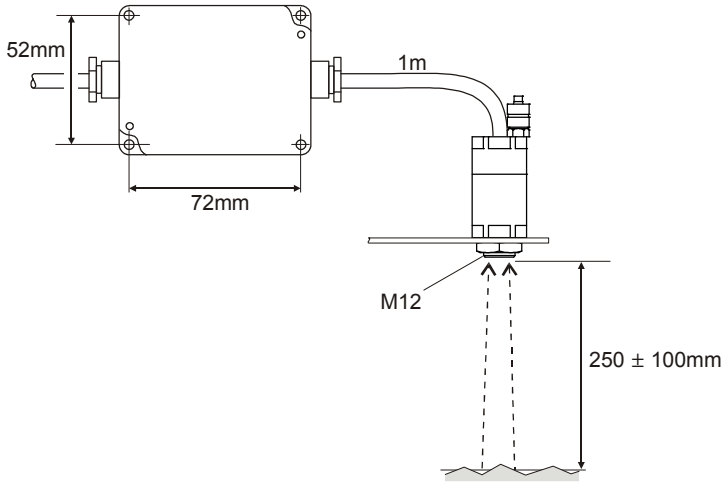
Temperature sensor air purge

The temperature sensor is surrounded by an air purge assembly. This reduces contamination of the sensor window, and improves measurement stability by keeping the sensor at a constant temperature.

Installation

1 Select a location for the control box, up to 10 metres (cable length) from the associated gauge, that will allow the sensor to be positioned as required above the product. Secure the control box to a suitable surface using the mounting holes provided.

Note: Do not disconnect the sensor cable from the control box during this operation.



2 Fix the sensor in the required location at the height indicated above the product.

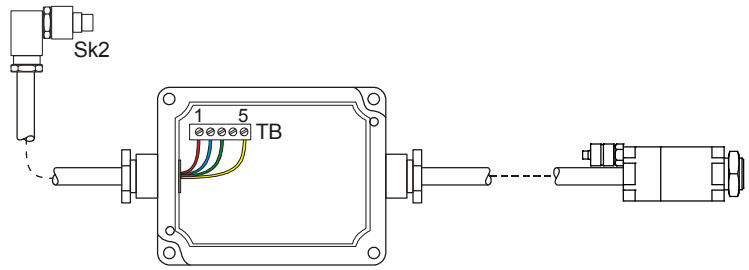
3 Connect an instrument-quality air supply to the air-purge connector.

Hose dia.	Inside 3mm, Outside 5mm
Tube dia.	Inside 4mm, Outside 6mm (quick-release fitting only)
Air flow	30 to 60 l/min
Air pressure	5 bar maximum

4 Connect the supplied cable between the gauge and the control box, as detailed below, and then fit the control box lid.

Control box-to-gauge cable (WS105/14204-00)

Source	Destination	Signal name	Wire
SK2 pin 1	TB pin 5	Signal	Yellow
SK2 pin 2	TB pin 3	Signal Ground	Green
SK2 pin 3	Terminated at cable gland	Screen	Braid
SK2 pin 4	TB pin 1	+24V DC	Red
SK2 pin 5	TB pin 2	0V DC	Blue



8.3 Percentage dry-weight calibration option

For applications requiring % dry-weight moisture measurement, the gauge software provides an additional measurement selection and the associated calibration facility.

8.3.1 Selecting wet or dry weight measurement

To select the measurement type:

1. Open the Products page.

   How? : *Home* >  > 

   If there is more than one gauge line (Page 5-24), select the line containing the relevant gauges.

2. Select the product you wish to edit, and touch  .

3. On Edit Product page, select a gauge in the list.

   The page will now show the current values for one measurement channel of the selected gauge. The name of the gauge and the measured constituent are shown at the top of the page. If there are other channels,  and  buttons will be provided for selecting them.

4. Where relevant, select the appropriate channel.

   The measurement selection is provided by the **Weight** field.

5. Select Wet or Dry, as required.

6. Touch  to return to Products page.

Note: When % dry-weight measurement is selected, the measurement name on the Home page is shown in yellow.

8.3.2 Calibration for % dry-weight measurement

The manual Trim adjustment procedure is slightly different for % dry-weight measurement.

1. Obtain the appropriate samples (Page 6-3) and process for % dry-weight measurement.

2. For each measurement channel (Moisture, etc.), calculate two average values:

   Lab_M = Average of laboratory reference values

   G_M = Average of gauge sample measurements

3. Open the Trim page.

   How? : *Home* >  > Select gauge from list > 

4. This shows the continuous reading from each gauge channel and provides access to pages for calculating trim value(s).

5. Touch  in the Trim column for one of the measurements.

   This will display a page for calculating the trim value from the laboratory and gauge sample averages.

6. Enter the calculated average values:

   - In **Reference value**, enter the Lab_M value.
   - In **Sample value**, enter the G_M value.

The **Trim** field will automatically be updated to show the correct trim value.

7 Touch  .

8 Repeat the previous three steps for other channels, if required.

9 Touch  to exit from the Trim page.

8.4 Ultrasonic gating option

This option enables the gauge to make reliable measurements of discontinuous products by switching the infra-red measurement system on only when there is product in the beam-patch area.

It operates by using an ultrasonic sensor to monitor the distance between the gauge and the product surface. If the distance is outside defined near and far limits, the gauge is gated off.

The sensor head is attached to a specially adapted air purge unit to monitor the product in the immediate vicinity of the gauge window. The gating function is processed entirely within the gauge.

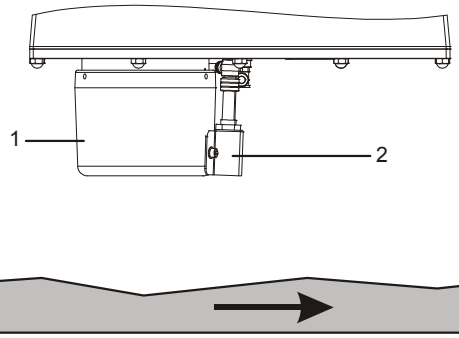
Installation

The gating sensor is factory fitted to the air purge unit. To install the gating option:

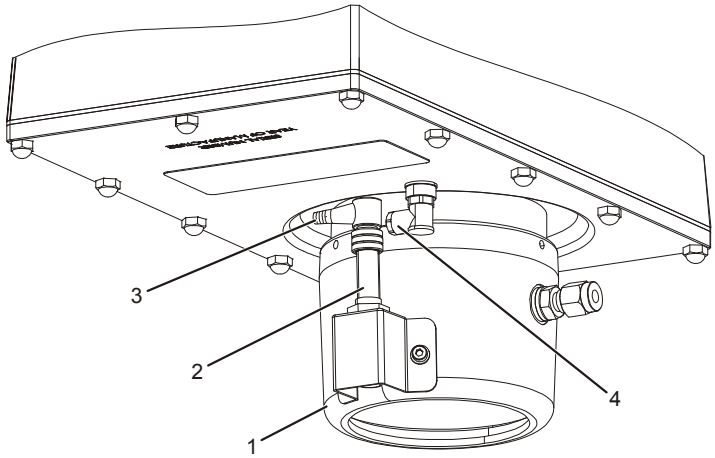
1 Install the gauge at the required location. (Page 4-5)

2 Attach the air purge unit (1). (Page 4-7)

If possible, position the air purge so that the gating sensor head (2) is on the downstream product flow side of the air purge assembly. This is not essential, but is an extra precaution against contact with the product.



3 Connect the supplied cable between the sensor head connector (3) and the connector (4) on the underside of the gauge.



Setting up the gating sensor

The near and far distance limits for product sensing are factory-set to 150mm and 400mm respectively. These can be adjusted if necessary as described below, using the supplied Sensor Programming Unit. No other setup is required for the gating option.

To set the distance limits:

1. Remove the lead connecting the gating sensor head to the gauge, and connect the programming unit in its place.
2. Power-up the gauge.
3. Arrange product (or place a target object) below the sensor head at the required near distance limit.
4. Press the green button on the programming unit.
5. Arrange product (or place a target object) below the sensor head at the required far distance limit.
6. Press the red button on the programming unit.
7. Disconnect the programming unit and replace the connecting lead between the sensor and the gauge.

Maintenance

A continuous air jet is supplied from the air purge unit to reduce contamination of the sensor head. The face of the sensor should, however, be checked and cleaned periodically.

Clean with a soft cloth and water or IPA.

Spares

Item	Part No.
Sensor head	MI/14357-01
Sensor-to-gauge cable	105/14363-01

8.5 Vortex cooling option

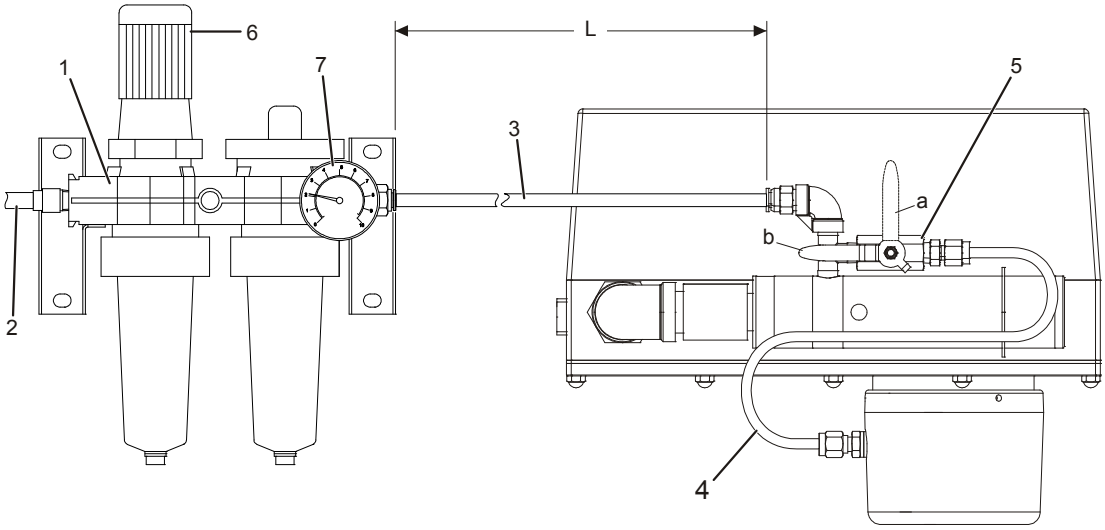
This cooling option uses a vortex unit to create a cold air flow from a compressed-air supply, which is then circulated through the gauge interior.

The option comprises the vortex unit, factory-fitted to the gauge, and a filter module to provide clean and dry air.

Installation

There are no additional installation requirements, other than connection of an air supply to the sensor air purge assembly.

WARNING: COMPRESSED AIR CAN BE DANGEROUS.
Do not operate the cooler at pressures above 10.3 Bar (150psi).
Do not operate with input air above 43^{o}C (110^{o}F)



When planning the installation, keep the air hoses (3) and (4) as short as possible to minimise pressure drop.

1. Fix the filter module (1) in a suitable location. The module **must** be mounted vertically.
2. Connect the factory air supply (2), the Vortec cooler supply (3) and air purge supply (4) as shown. See below for tube details.
3. Set the air purge valve (5) to the fully-open position. (a = closed, b = open)
4. Adjust the air pressure control (6) for a reading on the pressure gauge (7) of:
   - 4 Bar, (60psi) for ambient temp. 45^{o}C to 60^{o}C
   - 5.5 Bar, (80psi) for ambient temp. 60^{o}C to 70^{o}C

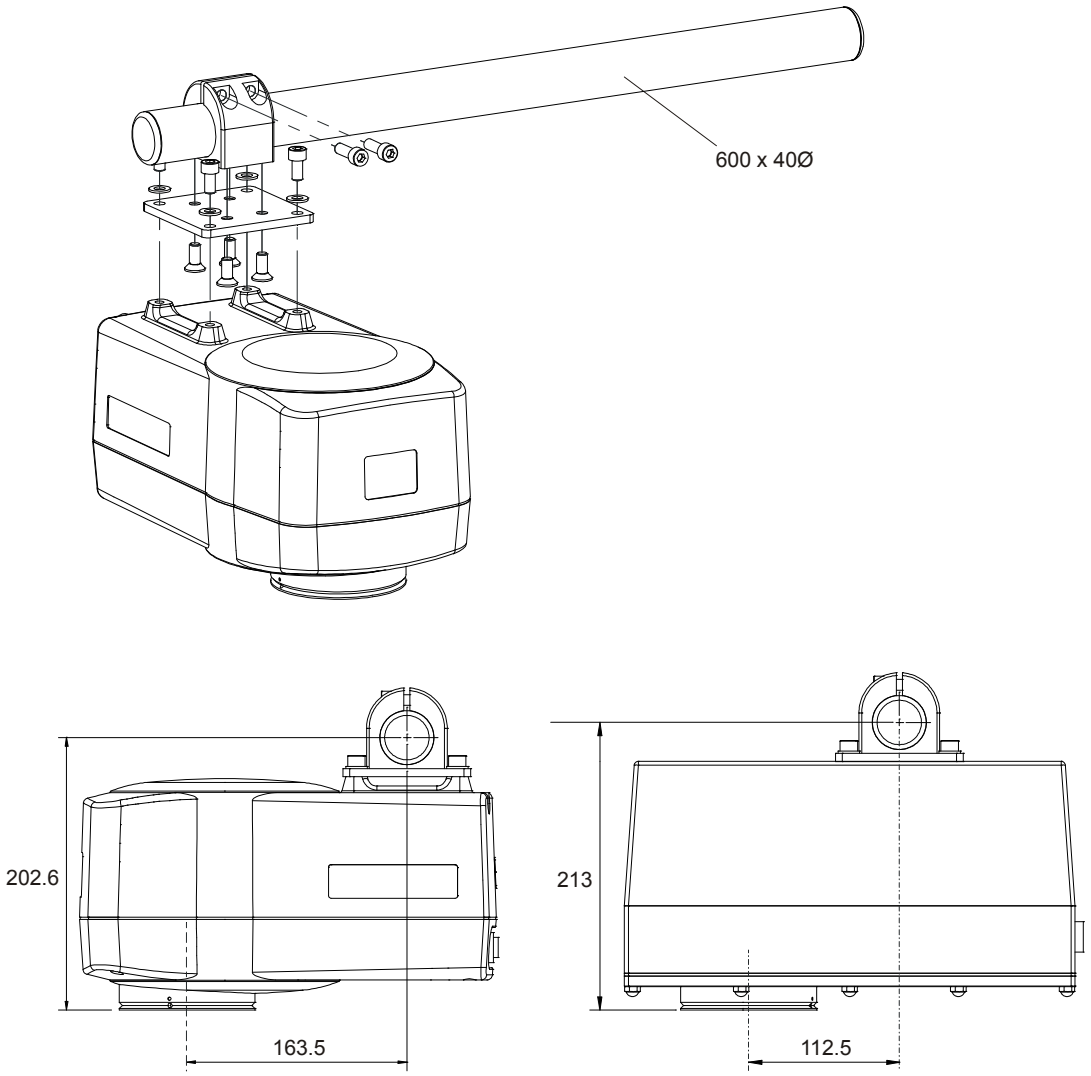
Air connections

Tube	Function	Diameter	Notes
2	Factory air in	1/2"	▪ Instrument quality air ▪ 7 Bar (100psi), <25^{o}C
3	Cooler air supply	8mm	If length (L) >2m, pressure should be measured at the cooler inlet. If necessary to achieve the pressure specified above, either use larger diameter tube (with suitable adapters) or increase the regulator pressure indicated on the gauge (7).
4	Air purge supply	6mm	

8.6 Tube mounting kit

The Tube Mounting Kit can be used to support both cast-enclosure and stainless steel 710e gauges, and provides easy adjustment of position and viewing angle.

The assembly of the kit and its attachment to the gauge is illustrated below. Also shown are the position of the gauge windows with respect to the mounting tube for the cast and stainless steel enclosures. All dimensions are in millimetres.

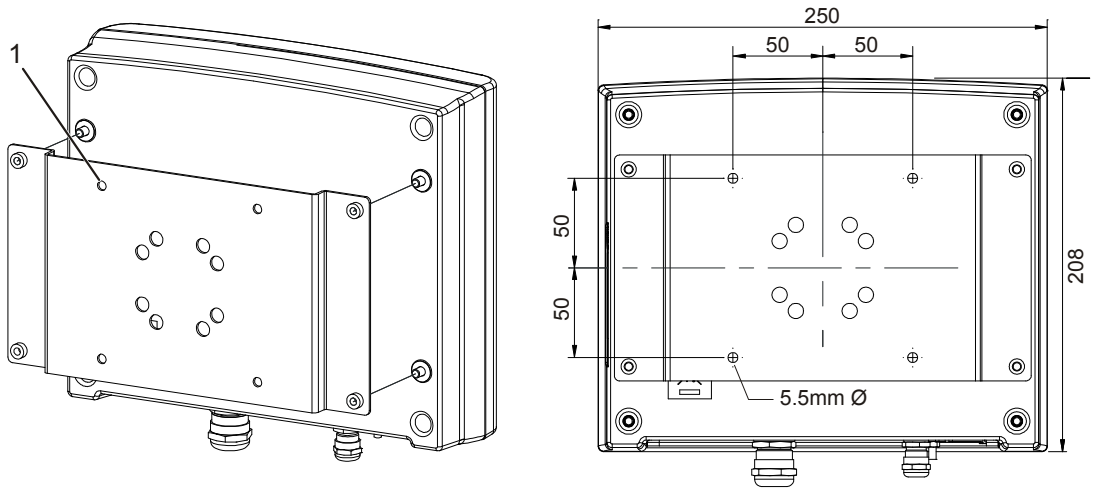


8.7 Peripheral mounting plate

This mounting plate (Part No. 105/14534-01) can be used with any or the 710e peripheral devices housed in molded ABS enclosures. It is intended primarily as an adaptor for fixing the devices in place of previous generation NDC peripherals, using the existing 100mm spaced mounting holes.

1 Fix the mounting plate to a suitable surface using the four holes (1).

2 Attach the peripheral device to the mounting plate using the four screws supplied with the plate (Page 4-8).



9 Troubleshooting

9.1 System error messages

710e gauges have built-in diagnostics to monitor certain key operating parameters and to provide appropriate error messages on the HMI and OWS. The following table provides brief explanations of the messages together with the possible causes.

Note: There may be more than one error condition at a time. The errors are priority-rated, and the highest priority one is displayed. (Page 5-30)

In the event of an error message, check the listed possible causes and take the appropriate remedial actions. If these do not clear the error, please contact NDC for advice.

Error message	Explanation	Possible causes
Low Signal	The detected light level is too low for reliable measurement.	▪ Missing product. ▪ Gauge window obscured. (Page 7-1) ▪ Incorrect angle of gauge to the product.
High Signal	The detected light level is too high for reliable measurement.	▪ Specular (direct) reflection of gauge beam back into collecting window - usually from the product conveyor or from the product if this is highly reflective. Check the angle of the gauge to the product. ▪ Direct source of ambient light into the gauge window.
	To check Low/High signal errors, fit the ARS (Page 6-5). If the error disappears, the problem lies with the product and not with the gauge or its mounting.	
Temp. Low Warning	The internal temperature is below a given warning level (default value -10°C). Gauge is still operating, but may give inaccurate results.	▪ Ambient temperature is too low.
Temp. High Warning	The internal temperature is above a given warning level (default value +70°C). Gauge is still operating, but may give inaccurate results.	▪ Ambient temperature is too high. ▪ If gauge cooling is fitted, the cooling system is not working correctly. Check the air or water supply.
Temp. High Error	The internal temperature is above a given error level (default value +75°C). Gauge lamp is switched off automatically to prevent further temperature rise.	▪ Ambient temperature is too high for the gauge to operate. ▪ If gauge cooling is fitted, the cooling system is not working correctly. Check the air or water supply.
Window Warning	The window contamination, as shown on the Diagnostics screen (Page 5-26), has risen above the warning threshold value of 20007.	▪ Gauge window requires cleaning. (Page 7-1)
Window Error	The window contamination, as shown on the Diagnostics screen (Page 5-26), has risen above the error threshold value of 30010.	▪ Gauge window requires cleaning. (Page 7-1)

Error message	Explanation	Possible causes
Lamp voltage	The lamp voltage, as shown on the Diagnostics screen (Page 5-26), is <4.0V.	▪ Faulty lamp; replace. (Page 7-2) ▪ Gauge 24V power input, low voltage.
Lamp current	The lamp current, as shown on the Diagnostics screen (Page 5-26), is <2.0A or >5.0A.	▪ Faulty lamp; replace. (Page 7-2)
Motor Error	The target motor speed can not be achieved or maintained. The motor drive is turned off in this condition.	▪ Faulty motor; replace. (Page 7-2)
Self-Test	Indicates that a configuration or operational self-test has failed.	▪ If this persists, refer to NDC.

10 Reference

10.1 Compliance

10.1.1 Declaration of Conformity

DECLARATION OF CONFORMITY

Name of Manufacturer	NDC Infrared Engineering Limited
Address of Manufacturer	Bates Road Maldon Essex CM9 5FA UK
Product Description	710e Series, Infrared Gauges.

Declaration

The above products comply with the requirements of the WEEE Directive 2002/96/EC (waste electrical and electronic equipment) and EMC Directive 2004/108/EEC, by the application of the following Transposed Harmonised European Standards.

EMC

EN61326: 2006 "Electrical equipment for measurement, control and laboratory use - EMC requirements". .

LVD

EN61010-1 (2001) Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements.

Responsible Person	Anthony Cudby
Position of Responsible person	Product Development Manager
Signature of responsible person	
Date of Issue	27th August 2008

ATTENTION

The attention of the specifier, installer, or user is drawn to special measures and limitations to use, which must be observed when the product is taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are contained in the product manuals and are available on request.

710e Gauges

DECLARATION OF CONFORMITY

Name of Manufacturer	NDC Infrared Engineering Limited
Address of Manufacturer	Bates Road Maldon Essex CM9 5FA UK
Product Description	Atex (Combustible dust) compliant Series 710e, Infrared Gauges as classified by the labeling on the actual product.

Declaration
The above products comply with the requirements of the Low voltage Directive 2006/95/EEC and EMC Directive 2004/108/EEC, by the application of the following Transposed Harmonised European Standards.

EMC
EN61326: 2006 "Electrical equipment for measurement, control and laboratory use - EMC requirements". .

LVD
EN61010-1 (2001) Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements.

ATEX

EN61241-1:2004 Electrical Apparatus for use in the presence of combustible dust. Protection by enclose.

EN61241-0:2006 Electrical Apparatus for use in explosive atmospheres – General requirements,

Responsible Person	Anthony Cudby
Position of Responsible person	Product Development Manager
Signature of responsible person	
Date of Issue	9th December 2008

ATTENTION

The attention of the specifier, installer, or user is drawn to special measures and limitations to use, which must be observed when the product is taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are contained in the product manuals and are available on request.

710e Peripherals

DECLARATION OF CONFORMITY

Name of Manufacturer	NDC Infrared Engineering Limited
Address of Manufacturer	Bates Road Maldon Essex CM9 5FA UK
Product Description	Series 710e gauge peripherals and power supply as classified by the labeling on the actual product.

Declaration

The above products comply with the requirements of the Low voltage Directive 2006/95/EEC and EMC Directive 2004/108/EEC, by the application of the following Transposed Harmonised European Standards.

EMC

EN61326: 2006 "Electrical equipment for measurement, control and laboratory use - EMC requirements". .

LVD

EN61010-1 (2001) Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements.

ATEX

EN61241-1:2004 Electrical Apparatus for use in the presence of combustible dust. Protection by enclose.

EN61241-0:2006 Electrical Apparatus for use in explosive atmospheres – General requirements,

Responsible Person	Anthony Cudby
Position of Responsible person	Product Development Manager
Signature of responsible person	
Date of Issue	26th February 2009

ATTENTION

The attention of the specifier, installer, or user is drawn to special measures and limitations to use, which must be observed when the product is taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are contained in the product manuals and are available on request.

Atex gas

DECLARATION OF CONFORMITY

Name of Manufacturer	NDC Infrared Engineering Limited
Address of Manufacturer	Bates Road Maldon Essex CM9 5FA UK
Product Description	Atex (Gas and Solvents) compliant Series 710e, Infrared Gauges as classified by the labeling on the actual product.

Declaration
The above products comply with the requirements of the Low voltage Directive 2006/95/EEC and EMC Directive 2004/108/EEC, by the application of the following Transposed Harmonised European Standards.

EMC
EN61326: 2006 "Electrical equipment for measurement, control and laboratory use - EMC requirements". .

LVD
EN61010-1 (2001) Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements.

ATEX

EN60079-2:2007 Electrical Apparatus for explosive gas atmospheres. Protection by pressurized encloses "*p*".

EN60079-0:2006 Electrical Apparatus for use in explosive gas atmospheres – General requirements,

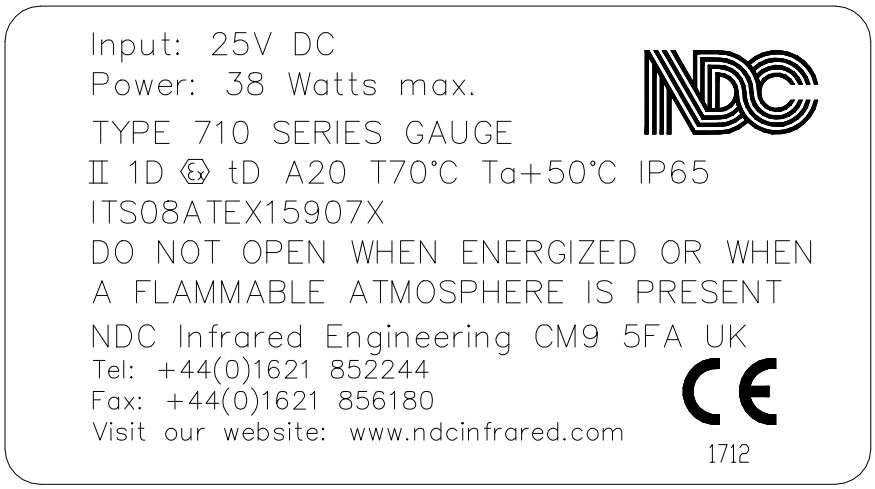
Responsible Person	Anthony Cudby
Position of Responsible person	Product Development Manager
Signature of responsible person	
Date of Issue	9th December 2008

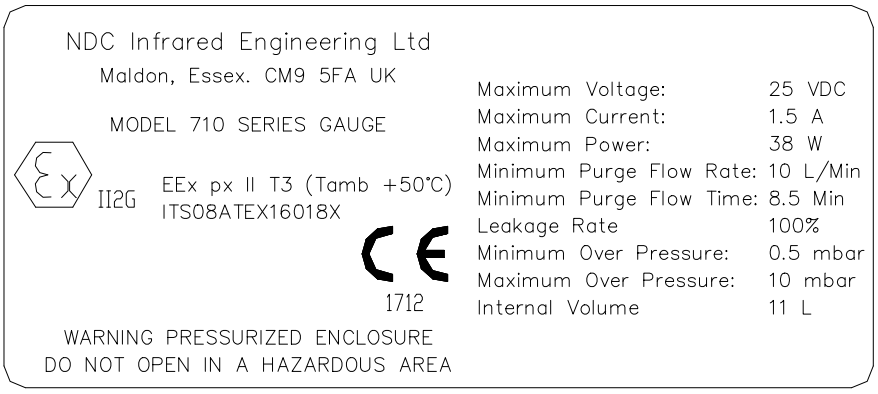
ATTENTION

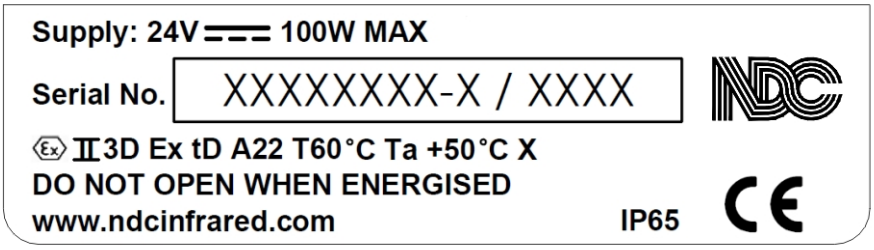
The attention of the specifier, installer, or user is drawn to special measures and limitations to use, which must be observed when the product is taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are contained in the product manuals and are available on request.

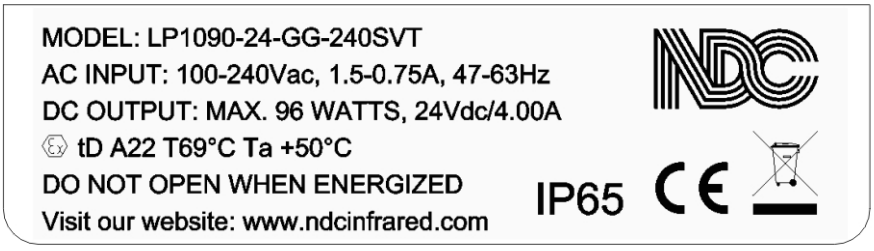
10.1.2 Atex labels

Where relevant, Atex and warning labels similar to the examples below are attached to the equipment.




NDC Infrared Engineering Ltd
Maldon, Essex. CM9 5FA UK
MODEL 710 SERIES GAUGE
II2G
EEx px II T3 (Tamb +50°C)
ITS08ATEX16018X
1712
WARNING PRESSURIZED ENCLOSURE
DO NOT OPEN IN A HAZARDOUS AREA
Maximum Voltage: 25 VDC
Maximum Current: 1.5 A
Maximum Power: 38 W
Minimum Purge Flow Rate: 10 L/Min
Minimum Purge Flow Time: 8.5 Min
Leakage Rate 100%
Minimum Over Pressure: 0.5 mbar
Maximum Over Pressure: 10 mbar
Internal Volume 11 L


Supply: 24V 100W MAX
Serial No. XXXXXXXX-X / XXXX
II 3D Ex tD A22 T60°C Ta +50°C X
DO NOT OPEN WHEN ENERGISED
www.ndcinfrared.com
IP65


MODEL: LP1090-24-GG-240SVT
AC INPUT: 100-240Vac, 1.5-0.75A, 47-63Hz
DC OUTPUT: MAX. 96 WATTS, 24Vdc/4.00A
tD A22 T69°C Ta +50°C
DO NOT OPEN WHEN ENERGIZED
Visit our website: www.ndcinfrared.com
IP65


WARNING !
DO NOT OPEN WHEN AN
EXPLOSIVE DUST
ATMOSPHERE IS PRESENT

10.2 Specifications

10.2.1 Gauge

Cast enclosure

Dimensions	
Width	177 mm
Height	173.6 mm (without air purge unit)
Length	310 mm
Weight	6 kg
	Connector removal clearance : 110 mm
Environmental sealing	IP65 NEMA 4
Pollution degree	Degree 1
Ambient Temperature Range	
Storage	$0^{o}C$ - $70^{o}C$
Operating	$0^{o}C$ - $50^{o}C$ ($70^{o}C$ with water or vortex air cooling)
Cable length (Data and power)	10 metres as standard
Measurement Scope	Four measurements simultaneously
Power Supply	+24V d.c. +10% -20%, 30W
Working Distance: Sampling area	230 mm +/- 100 mm : beam patch 60 mm diameter
	180 mm +/- 50 mm : beam patch 25 mm diameter
	120 mm +/- 25 mm : beam patch 10 mm diameter

IP65 and IP67 stainless steel enclosures

Dimensions	
Width	190 mm
Height	185 mm (without air purge unit)
Length	334 mm
Weight	10.5 kg
	Cable/gland clearance : 100 mm
Environmental sealing	IP65 NEMA 4 or IP67 NEMA 6
Pollution degree	Degree 1
Ambient Temperature Range	
Storage	0^{o}C - 70^{o}C
Operating	0^{o}C - 50^{o}C (70^{o}C with water or vortex air cooling)
Cable length (Data and power)	10 or 20 metres as standard
Cable type	CAT5e (IP65). IGUS (IP67)
Measurement Scope	Four measurements simultaneously
Power Supply	+24V d.c. +10% -20%, 30W
Working Distance: Sampling area	230 mm +/- 100 mm : beam patch 60 mm diameter
	180 mm +/- 50 mm : beam patch 25 mm diameter
	120 mm +/- 25 mm : beam patch 10 mm diameter

Internal temperature option

Sample patch size	25 mm diameter
Working distance	250 mm +/- 100 mm
Measurement Range	0°C to 120°C
Accuracy	+/- 1°C (+/- 2°F)
Repeatability	+/- 0.5% of reading or +/- 0.5 °C, whichever is the greater over the full temperature range
Air supply required	10 SLPM, clean, dry, instrument-quality air
Measurement output	One of the four available gauge measurement channels

External temperature option

Temperature sensor

Sample patch size	25 mm diameter
Working distance	250 mm +/- 100 mm
Measurement Range	0°C to 120°C
Accuracy	+/- 1°C (+/- 2°F)
Repeatability	+/- 0.5% of reading or +/- 0.5 °C, whichever is the greater over the full temperature range
Measurement output	One of the four available gauge measurement channels
Environmental rating	IP65 (NEMA-4)

Control unit

Environmental rating	IP65 (NEMA-4)

10.2.2 OWS, HMI, User Port

Dimensions - Molded composite material	
Width	250 mm
Height	208 mm +26 mm large gland clearance
Depth	66 mm
	Note: Above values do not include cable clearance and connector removal clearance.
Weight	1.5 kg excluding connected cables
Dimensions - Stainless steel (HMI, OWS)	
Width	230 mm
Height	215 mm +26 mm large gland clearance
Depth	65 mm
	Note: Above values do not include cable clearance and connector removal clearance or mounting strap dimensions.
Weight	3.5 kg excluding connected cables
Environmental sealing	IP65 NEMA 4
Pollution degree	Degree 1
Atex Certification	Zone 22 (non-mining applications, dust explosive atmospheres)
Ambient Temperature Range	
Storage	0^{o}C - 70^{o}C
Operating	0^{o}C - 50^{o}C
Relative humidity	5% to 95% (non-condensing) over the full operating temperature range
Power supply	24V d.c. +/-20%, 10W

Inputs / Outputs	
Standard communications	Ethernet - 2 x screw terminal ports, 1 x RJ45
Optional communications	Profibus DP or DeviceNet
Analogue outputs (HMI & UP)	4 x 4-20 mA non-isolated, 500 Ohm max load
Digital inputs (HMI & UP)	8, opto-isolated, 2mA typ. sourcing input. VIL = 1.0 VDC max.; VIH = 3.0 VDC min.; 30 VDC max.
Digital outputs (HMI & UP)	8, FET driven, Type: Switched DC, N Channel open drain MOSFET
	Current Rating: 1A max
	VDS ON: 0.3 V @ 1A
	VDS MAX: 30V DC, zener protected

10.2.3 Switched Hub

Dimensions	
Width	250 mm
Height	208 mm +26 mm large gland clearance
Depth	66 mm
	Note: Above values do not include cable clearance and connector removal clearance.
Weight	1.5 kg excluding connected cables
Environmental sealing	IP65 NEMA 4
Pollution degree	Degree 1
Atex Certification	Zone 22 (non-mining applications, dust explosive atmospheres)
Enclosure	Molded composite material
Ambient Temperature Range	
Storage	$0^{o}C$ - $70^{o}C$
Operating	$0^{o}C$ - $50^{o}C$
Relative humidity	5% to 95% (non-condensing) over the full operating temperature range
Power supply	24V d.c. +/-20%, 5W
Inputs / Outputs	
Communications	Ethernet - 7 x screw terminal ports, 1 x RJ45

10.2.4 NDC Power Supply Units

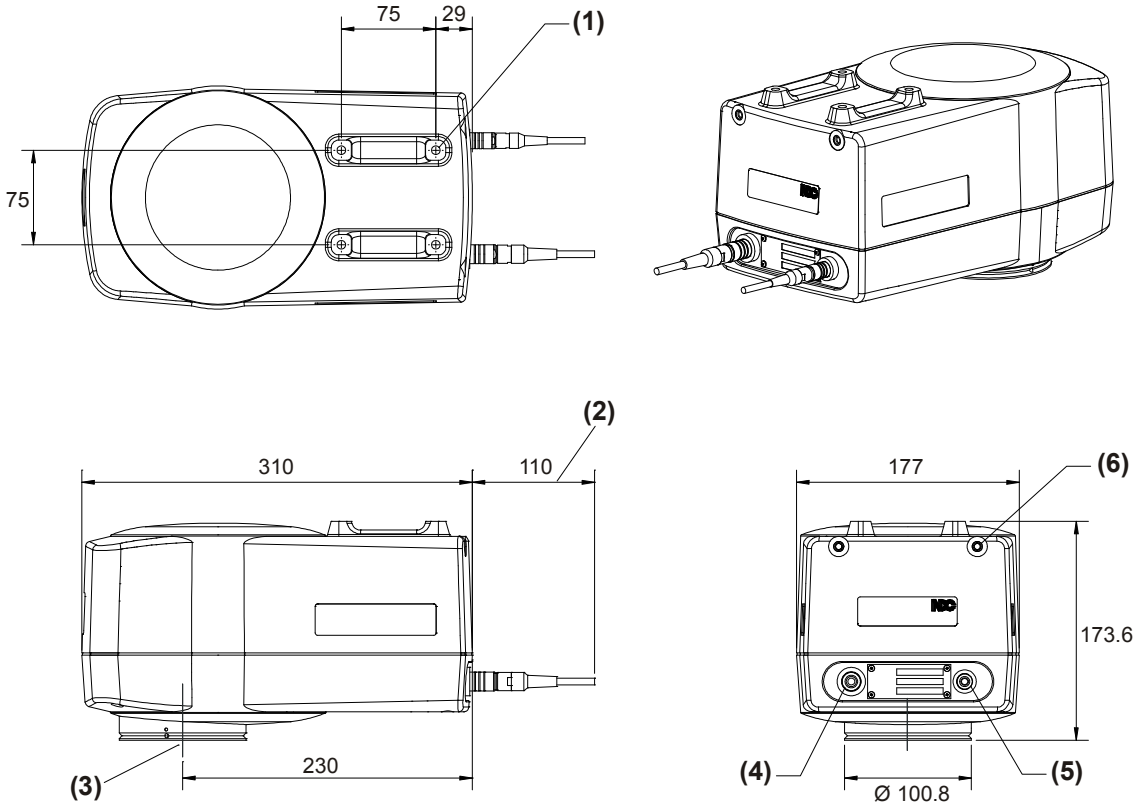
Dimensions	
Width	260 mm (300 including cable glands)
Width	60 mm
Depth	40 mm
Weight	Approx 0.75 kg
Environmental sealing	IP65 NEMA 4
Atex Certification	Zone 22 (non-mining applications, dust explosive atmospheres)
Pollution degree	Degree 1
Enclosure	Aluminium
Ambient Temperature Range	
Storage	$0^{o}C$ - $70^{o}C$
Operating	$0^{o}C$ - $50^{o}C$
Relative humidity	5% to 95% (non-condensing) over the full operating temperature range
AC Input	90-264Vac, single phase, 1.5-0.75A, 47-63Hz
DC Output	96W Maximum, 24Vdc, 4A

10.2.5 Junction Box

Dimensions	
Width	250 mm
Height	208 mm +26 mm large gland clearance
Depth	66 mm
	Note: Above values do not include cable clearance and connector removal clearance.
Weight	1.5 kg excluding connected cables
Environmental sealing	IP65 NEMA 4
Pollution degree	Degree 1
Atex Certification	Zone 22 (non-mining applications, dust explosive atmospheres)
Enclosure	Molded composite material
Ambient Temperature Range	
Storage	$0^{o}C$ - $70^{o}C$
Operating	$0^{o}C$ - $50^{o}C$
Relative humidity	5% to 95% (non-condensing) over the full operating temperature range
Power supply	24V d.c. +/-20%, Passive
Inputs / Outputs	6 x general purpose terminal strips

11 Outline drawings

11.1 Outline drawings - Cast alloy gauge

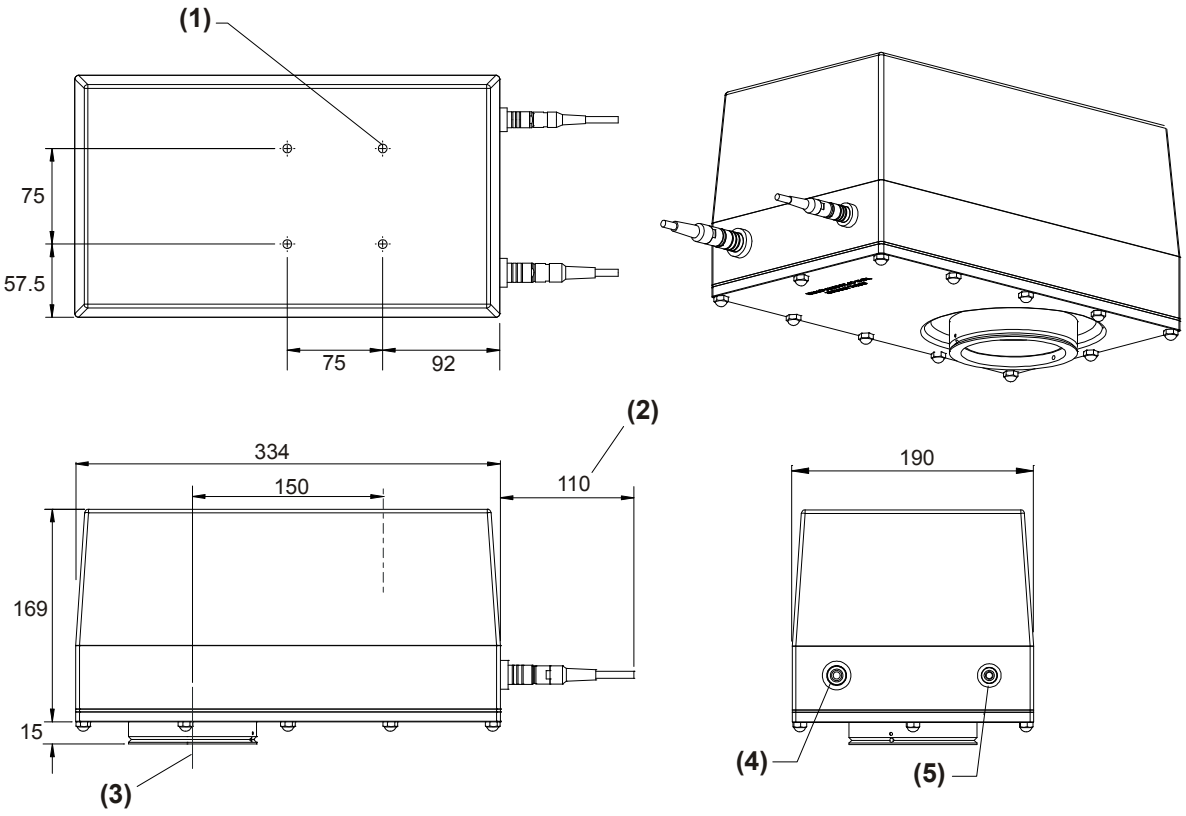


All dimensions in mm

Key			
1	Mounting holes (M8 x 10mm deep)	4	Power in (24V DC)
2	Cable clearance	5	Ethernet and power-over-ethernet
3	Measurement NIR light beam	6	Water cooling (optional)

11.2 Outline drawings - Stainless steel gauge

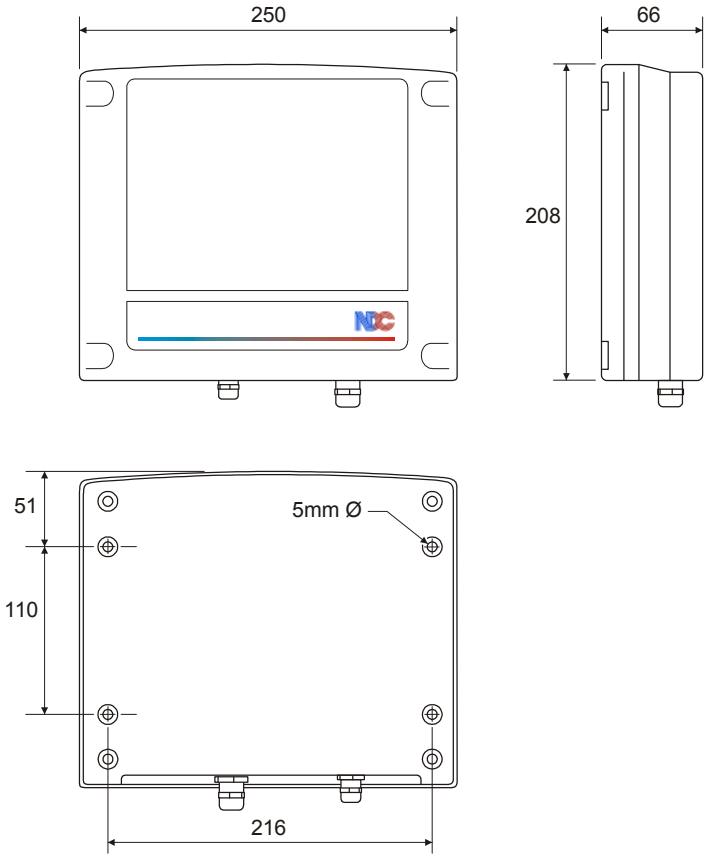
Note: The illustration shows an IP65 gauge. The IP67 version is identical except that it has a single glanded cable instead of the two connectors.



All dimensions in mm

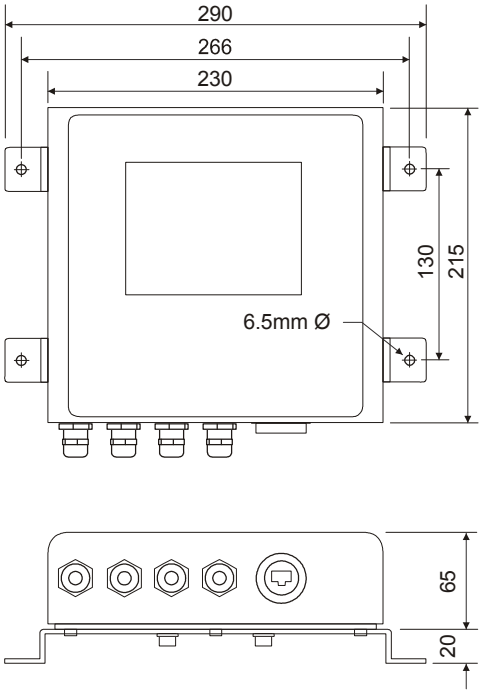
Key			
1	Mounting holes (M8 x 10mm deep)	4	Power in (24V DC)
2	Cable clearance	5	Ethernet and power-over-ethernet
3	Measurement NIR light beam centre		

11.3 Outline drawings - Peripheral units



11.4 Outline drawings - Stainless steel peripherals (HMI, OWS)

Horizontal (wall) mounting



Vertical (pillar) mounting

The mounting straps can be removed and repositioned in a vertical orientation, as shown below: