

PLANER

INC-A20 Incubator Users' Guide

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INC-A20 Incubator Users' Guide

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Section



1 Introduction

This manual only applies to the following models: INC-A20.

This guide has been designed to help you get the best from your new incubator. The guide includes important information concerning the safe use of the equipment and it is important that you familiarise yourself with this document before attempting to use the product.

1.1 Indication for use

The INC-A20 Incubator has been designed as a general purpose bench-top incubator. To be used to provide an environment with controlled temperature at or near body temperature, and CO₂, O₂ and N₂ gases.

1.2 Symbols

1.2.1 Symbols used in this manual



This shows information or instructions that are related to safety. Failure to follow these instructions may result in personal or third-party injury.

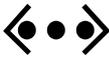


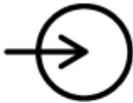
This symbol is used to introduce important information or instructions related to the use of the product. Failure to follow these instructions may result in damage to equipment, samples or data.



The light bulb symbol is used to highlight information and tips that may help you get the best from the product.

1.2.2 Symbols used on the equipment

	Refer to these instructions. Failure to follow these instructions may result in personal or third-party injury
	Alternating current (AC)
	Ethernet connection
RST	Reset switch. This button will reset the controller. It should only be pressed if the system fails to respond. See Resetting the system ⁽⁴⁷⁾ .
	Alarm output connector.

	Premixed gas inlet
The following symbols only apply to the packaged gas tubing.	
	Sterilized using ETO
	Do not reuse.
	Do not use if packaging is broken.
	Batch code.
	Use by date.
	Refer to these instructions.
	Do not dispose of with general waste.

1.3 Safety

Warnings

- Operating the equipment in a manner not specified within this manual or under conditions outside of the equipment specifications, may result in the protection offered by the equipment being impaired.
- CO₂ gas is an asphyxiant and is exhausted by the equipment in normal use. The incubator must only be used in well ventilated areas.
- The release of gas could result in oxygen depletion: a risk assessment should be undertaken to determine whether oxygen depletion alarms should be installed.
- The samples cultured within the incubator may present a biological hazard. If in doubt, refer to the person responsible for the incubator.
- The incubator contains a sealed lead acid battery. Under normal operating conditions the battery is sealed and produces no hazardous gases. Under abnormal conditions of over-charging or excessive temperatures, the internal battery may liberate the following hazardous gases: sulfur dioxide; sulfur trioxide; hydrogen; carbon monoxide; and sulfuric acid mist. The battery weighs 4 kg, and hazardous ingredient composition by weight is: lead 57%; lead oxide 22%; and sulfuric acid 14%.
- If left running on a low battery the incubator will automatically switch off without further warning when the battery is exhausted. The period between detection of a low battery and switching off may be less than 2 minutes.
- If the battery has been discharged, it will no longer be able to support the incubator until it has become fully charged again. This can take up to 24 hours.
- Bleaches are corrosive and may damage sensitive components and metal surfaces within the chamber.
- Modifying parameters should normally only be undertaken by qualified service personnel or under their guidance. Entering incorrect values may impair the performance of the product. Impaired performance may have a detrimental impact on samples contained within the device.

Precautions

- The INC-A20 Incubator is classified as electrical Class 1 equipment and must be earthed for safe operation.
 - Repetition of potentially damaging high-voltage flash tests should be avoided.
 - Check that the voltage requirements of the incubator, shown on the rating label, match the local mains supply voltage.
 - The connector from the mains lead to the power supply is the main disconnect device. In the event of a fault occurring that requires the power to be disconnected immediately, disconnect the mains lead from the power supply or switch off at the mains wall power outlet.
 - Ensure that the equipment is positioned so that the mains lead can be easily disconnected.
 - Discard the humidification bottle or filter if the packaging appears damaged. Do not attempt to resterilize.
-

-
- Do not exceed the maximum input pressure of 1.65 bar (24 psi)
 - The incubator is intended for use with medical grade premixed gas (typically 6% CO₂, 5% O₂, balance N₂). It must not be used with oxygen-rich gases or flammable or explosive mixtures.
 - If CO₂ is used in confined spaces, then a risk assessment should be undertaken to determine whether alarms to indicated elevated CO₂ levels should be installed and whether additional ventilation is required.
 - To maintain protection against electric shock, the mains lead must be properly fitted to a 3-way mains connector plugged into an earthed mains outlet.
 - Because of the use of liquids around the incubator, the operator should be provided with additional protection against electric shock by supplying mains power to the incubator through a residual current circuit breaker (RCCB) operating at a differential of 30 mA. Note that care must be taken to ensure that the incubator is not compromised by faulty equipment sharing the same supply and causing nuisance trips.
 - The unit is designed for connection to information technology equipment compliant with EN60950 or its equivalent. Use with other equipment may compromise the safety of the device. The unit should only be connected to an Ethernet local area network (LAN) internal to the building.
 - User servicing is limited to cleaning and calibration. All other servicing must only be undertaken by suitably qualified engineers.
 - To avoid risk of fire, fuses must always be replaced with the same type and rating.
 - Fuses should only be replaced by suitably trained service personnel.
 - Fuses should only be replaced after the cause of the original failure has been determined and corrected as appropriate
 - The internal battery is not user-replaceable and may only be replaced by persons trained in the servicing of this equipment. The battery must only be replaced with a battery of the same type and rating.
 - Always route cables and connecting hoses away from areas where they might cause a trip hazard.
 - The incubator weighs 15.5 kg with the bulk of the weight biased to one end. Take care when lifting the unit.
 - Switch off the incubator and disconnect the mains supply before cleaning.
 - Always allow the unit to dry fully before reconnecting the mains supply.
 - Note that disinfectants are potentially hazardous to health. Ensure that you obtain a material safety data sheet (MSDS) before use and follow the instructions contained therein.
 - The person responsible for the equipment must ensure that:
 - the unit is decontaminated if hazardous material is spilt onto or into the equipment.
 - only cleaning and disinfecting materials compatible with the equipment are used. Incompatible materials may cause a hazard by reacting with the equipment or materials contained within. Please refer to the Cleaning and Disinfection section (see [General cleaning](#)^[36] and [Cleaning and disinfecting the chambers](#)^[37]) for validated cleaning and disinfection agents appropriate for use with the BT37 incubator.
-

- Any circuit connected to the alarm output must be within the specified limits; see [External alarm connections](#)^[55].
- Any circuit connected to the alarm output must meet the requirements for an accessible part as defined in EN 61010-1 or its equivalent.
- The alarm output must not be used in safety critical applications.

1.4 Electromagnetic compatibility (EMC) precautions



Note

The following precautions must be taken to ensure that the equipment is not damaged by electrostatic discharge (ESD), and that its immunity to radio frequency interference is not compromised.

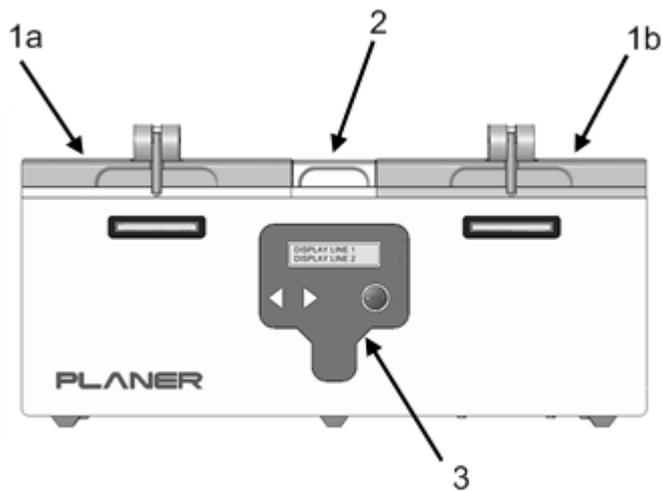
- All connections via the [external alarm connector](#)^[55] must use fully screened cable no longer than 2m.
 - Take care to avoid placing the INC-A20 Incubator in environments influenced by sources of electromagnetic interference, such as cyclotrons, large transformers etc.
-

1.5 About the incubator

The INC-A20 Incubator and accessories are intended for use by appropriately qualified laboratory personnel.

The INC-A20 is a small incubator designed for general purpose use in cell culture laboratories.

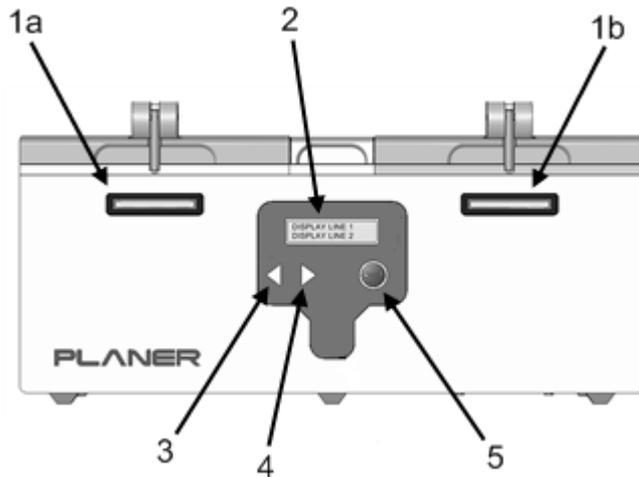
The unit is illustrated below.



1. Two chamber lids.
2. Central access cover
3. User interface incorporating 2 line liquid crystal display, simple 3 button interface.

1.5.1 The display and keypad

The INC-A20 Incubator user interface utilises a very simple display and three button keypad to enable all features of the unit to be accessed.



1. *Status indicators.* These indicate whether or not there is an alarm condition. More detail is given in the Status indicator section.
2. *Main display.*
3. *Left cursor key.*
4. *Right cursor key.*
5. *Enter key.*

1.5.1.1 Displaying multiple entries

If the message is too long to show on the display, the text will be scrolled from right to left. In some cases multiple selections will be displayed, e.g. the main menu. In this situation, menu items are displayed one-by-one with the text enclosed within <> characters to indicate that there are further options. Pressing the left or right cursor keys will present the additional items.

1.5.1.2 Editing values

The user interface uses a simple three button panel for data entry. When a number is displayed for editing, the current cursor position is shown by enclosing the character within <>. An example showing password entry is shown below.

```
Enter password
<0>0000 Edit
```

Using the cursor keys will cause the digit within the <> characters to increment or decrement.

```
Enter password
<1>0000 Edit
```

When the digit shows the correct value, press the **Enter** key to proceed to the next digit.

```
Enter password
1<0>000 Edit
```

Continue in this manner until **Edit** is selected as shown below.

```
Enter password
10200 <Edit>
```

Using the cursor keys on the **Edit** entry will allow two other options, **Ok** or **Cancel**, to be shown.

Selecting **Edit** will move the cursor back to the start of the number to allow any errors to be corrected.

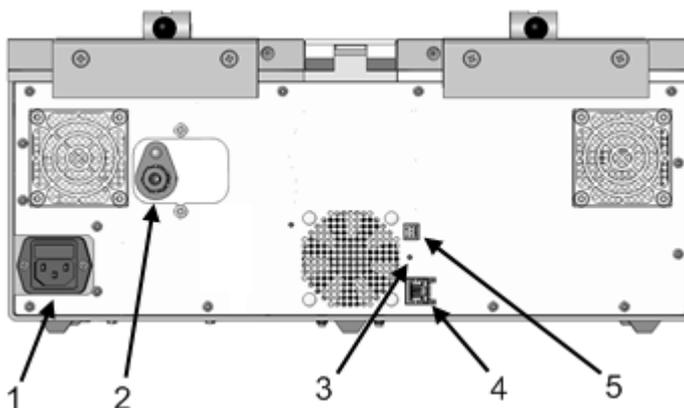
Cancel will discard any modifications made.

Ok will accept the changes.

Press the **Enter** key to make your choice.

1.5.2 The rear connections

All connections to the incubator are located at the rear of the unit.

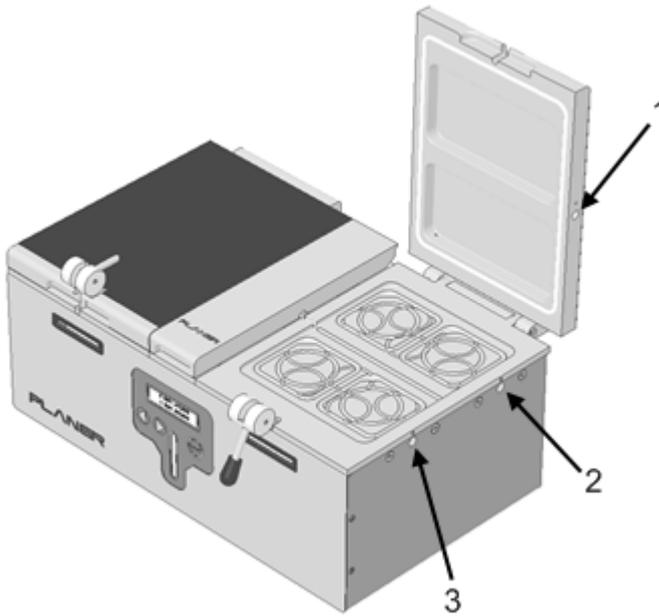


1. IEC mains power inlet

2. Premixed gas inlet.
3. Reset switch
4. Ethernet output for data collection via external monitoring application (see [External data-collection](#)^[20])
5. Alarm output

1.5.3 External monitoring ports

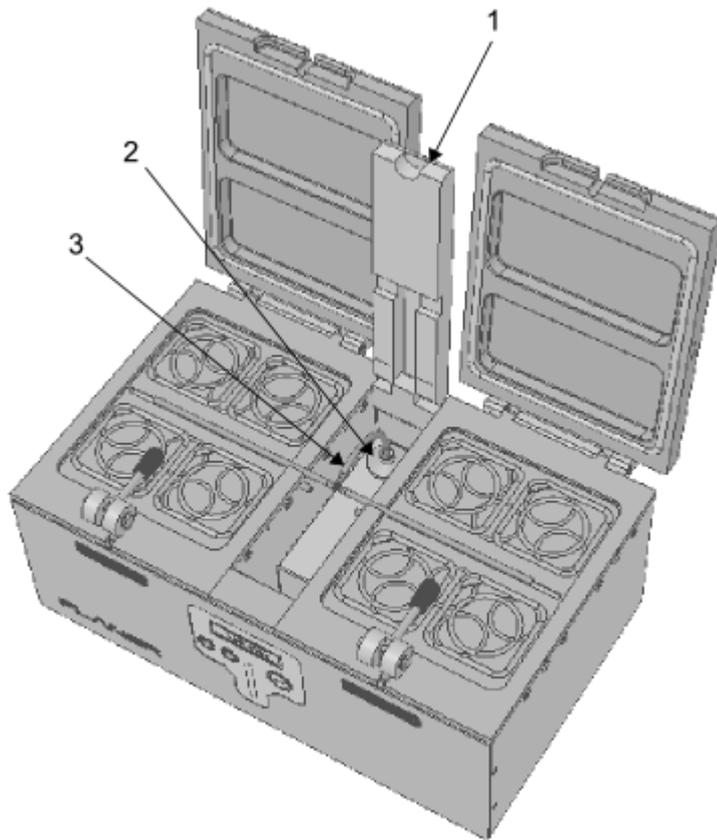
The INC-A20 Incubator is fitted with 3 access ports on each side of the chamber to allow independent temperature probes to be fitted. The three ports for the left-hand chamber are shown in the diagram below. There are three identical ports on the right-hand chamber. These ports are also used for calibrating the unit - see [Calibration](#)^[40]. Details of the sensor dimensions are given in the [Monitoring](#)^[58] section.



1. Lid monitoring port
2. Base rear monitoring port
3. Base front monitoring port

1.5.4 The central chamber

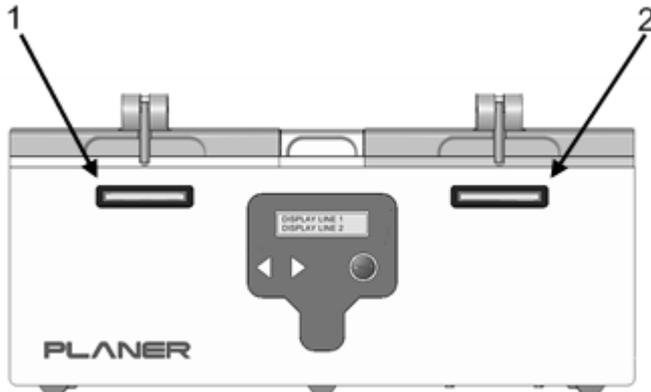
The central chamber of the incubator holds the gas tubing for providing the premixed gas to the left and right chambers.



1. *Central chamber lid*
2. *Gas inlet with luer-lock fitting for filter. (filter shown)*
3. *Gas tubing with luer-lock fitting for gas filter*

1.5.5 Status and alarm indicators

The INC-A20 Incubator has two indicator lights at the front of each chamber as shown below.



1. Left chamber status indicator
2. Right chamber status indicator

In addition to the visual indicators, the INC-A20 Incubator also includes an audible alarm and connections for an external alarm. Details on connections to the external alarm are provided in the section [External alarm connections](#) ⁵⁵.

Note

The external alarm effectively mirrors the operation of the audible alarm. However, it is delayed for a period defined by the **external alarm delay** parameter. This is normally set to 5 minutes.

In normal operation these indicators will be green.

If the temperature of a chamber is too far away from its set-point the indicator will usually indicate this by flashing red. The audible alarm will also be activated.

If the temperature set-point of a chamber is modified, or the incubator has just been switched from standby to normal operating mode, temperature differences will be regarded as an "expected error". Expected errors are shown by a solid orange light. The error condition will only be treated as expected for a period defined by the **alarm expectation delay** parameter. This parameter is normally set to 30 minutes. If the error remains after this time, it will become a "full alarm" with flashing red indicators.

If the gas flow into the incubator deviates too far from its set-point, both indicators will show an alarm by flashing red. The audible will also be activated.

Pressing any of the keys on the front panel will acknowledge an alarm. Once acknowledged, the alarm will still be indicated by a red light but it will no longer flash and the audible and external alarms will be switched off. Once an alarm has been acknowledged, further identical alarms will be suppressed for a period defined by the **alarm acknowledge suppression** parameter. This parameter is normally set to 5 minutes. If the alarm condition reoccurs during this period, the status indicator will still show red but the audible alarm will not be activated.

In standby mode, or when the gas T-Piece is being changed, the status indicators will show orange. This indicates that the chambers are not being actively controlled due to an operator action.

The status indicators are summarised in the table below.

Indicator	Audible alarm	External alarm	Display backlight	Notes
orange	off	off	off	Standby mode
green	off	off	on	Normal operating mode
red flashing	on	off	on	An alarm condition has occurred which needs to be acknowledged.
red flashing	on	on		An alarm has been left flashing and waiting for acknowledgment longer than the period defined by the external alarm delay parameter.
red	off	off	on	An alarm condition has occurred which has been acknowledged or an alarm has reoccurred within the alarm acknowledge suppression period.
orange	off	off	on	The temperature of the chamber is outside of its expected range but the condition is expected because the incubator has just recently been switched out of standby mode, a set-point has been modified or the gas T-Piece is being changed.

Tip

The alarm thresholds for temperature, bleed flow rate and purge flow rate are factory set to 0.2 °C, 9 mL/min and 54 mL/min respectively.

The alarm expectation delay and alarm acknowledge suppression parameters are factory set to 30 and 5 minutes respectively.

The external alarm delay parameter is factory set to 5 minutes.

These values cannot be modified via the front panel. If you do want to modify the default settings they can only be adjusted via the Modbus interface. See the [Modbus address map](#)^[59] section.

Note

Alarms must be present for a period defined by the **alarm hold-off time** parameter. This is normally set to 5 seconds. This setting only be adjusted via the Modbus interface. See the [Modbus address map](#)^[59] section.

Installing the system

Section



2 Installing the system

Precautions

The incubator weighs 15.5 kg with the bulk of the weight biased to one end. Take care when lifting the unit.

Carefully unpack the equipment.

Place the incubator on a secure, flat surface.

Ensure that the incubator is located away from any direct sources of heat or cold such as heaters or air-conditioning units.

Ensure that an air-gap of at least of 25 mm is maintained between the sides of the unit and any other equipment or walls.

Ensure that an air-gap of at least of 150 mm is maintained at the rear of the equipment.

Before use, clean and disinfect the incubator as described in the [Cleaning and disinfecting the chambers](#) ³⁷ section.

2.1 Connecting the gas supply

Precautions

- Do not exceed the maximum input pressure of 1.65 bar (24 psi)
- The incubator is intended for use with medical grade premixed gas (typically 6% CO₂, 5% O₂, balance N₂). It must not be used with oxygen-rich gases or flammable or explosive mixtures.

The system is designed to run from a premixed gas supply.

The concentration of CO₂ required to maintain the pH depends upon the medium, the required pH, humidity and altitude at which the unit is being operated. Refer to the media manufacturer's recommendations for details of the required gas mixture to be used.

Note

- The incubator chambers are open to atmosphere via the gas vents at the rear of the unit - see also [Cleaning](#) ³⁶. As such the chambers are nominally at atmospheric pressure and even when purging, any pressure rise is negligible.
- If operating at high altitudes the required gas concentration may need to be modified to allow for variations in the local pressure.
- All tubes and connecting hoses must be suitable for use with CO₂. Many plastics are highly permeable to CO₂ and this will affect the gas concentration supplied to the chambers.

Gas must be supplied via a high purity regulator at 1.5 ± 0.15 bar (21.8 ± 2.2 psi)

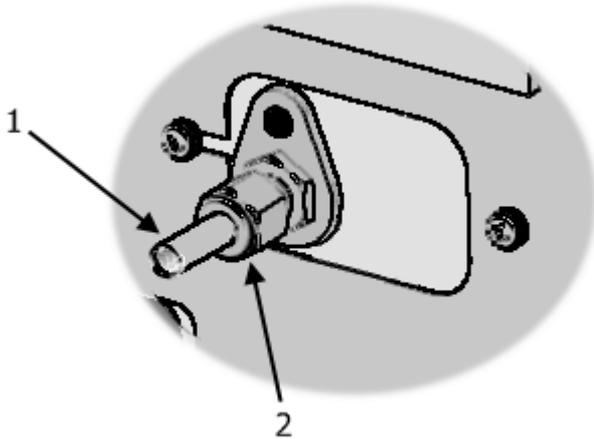
A minimum flow capacity of 360 mL/min per incubator is required.

The regulator must be fitted with a SWAGELOK 1/4" tube fitting (SS-400-1-4RT) to mate with the supplied connecting hose.

The hose is supplied with a tube adapter and pre-swaged fittings.

Ensure that the fittings are clean before connecting.

Fully insert the tube adapter on the hose into the [premixed gas inlet](#)^[9] up against the shoulder.



1. Tube adapter
2. Nut

Gently finger tighten the nut until a significant increase in resistance is met. This is the original pulled-up position.

Using a 9/16" AF spanner, tighten the nut slightly. Do not over-tighten.

Repeat this process at the regulator end.

Once all gas connections have been made, check that they are leak free by covering with soapy-water and looking for any bubbles. If any bubbles are observed, gently tighten the joint. If bubbles continue, switch off the gas supply and then disconnect and check the fitting for any debris before reconnecting.

2.2 Installing the gas tubing

The INC-A20 Incubator uses [disposable gas tubing and an inlet filter](#)^[55].

Warning

Discard the gas tubing or filter if the packaging appears damaged. Do not attempt to resterilize.

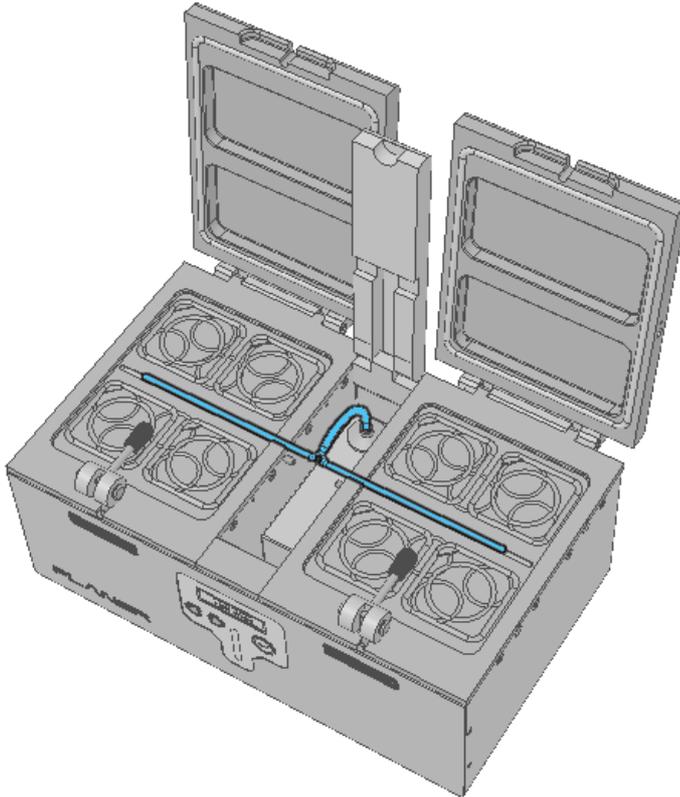
Ensure that there are no kinks or twists in the tubing.

Fit the filter to the luer-lock fitting on the end of the inlet tubing.

Open the lid to the [central chamber](#) ¹⁰.

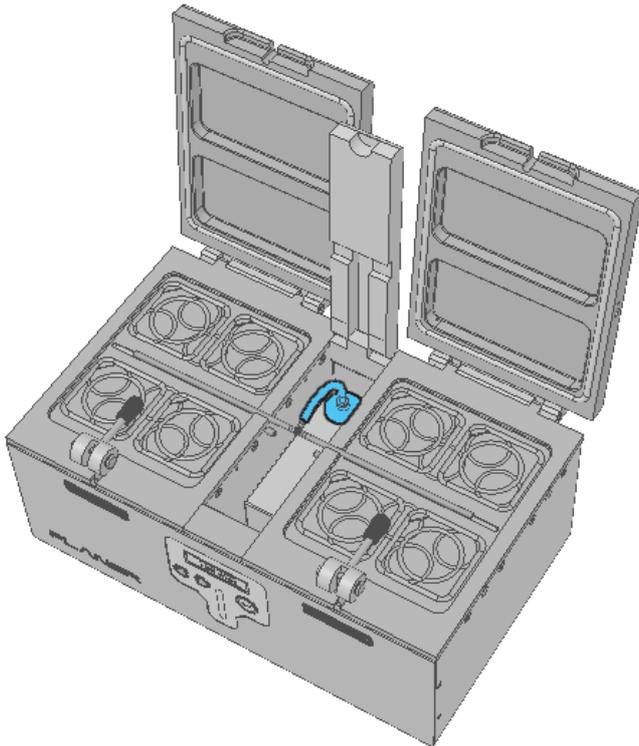
If the outlet tubes are fitted with plugs, remove them now.

Lay the tubes along the grooves that run along the centre of each incubator chamber. If necessary, trim the tube ends, using sterile scissors, to ensure that they are approximately 10mm to 15mm from the end of chamber. Gently push the tubes down into the grooves so that they are secure.



Tubes to left and right chambers

Route the rear tube and filter to the rear of the chamber and connect to gas port fitting.



Tubing and filter to rear gas fitting



Tip

Before connecting the filter to the gas port fitting, twist the tubing and filter 90 degrees anti-clockwise so that it will untwist as the luer-lock connection is made.



Note

Ensure that there are no kinks or twists in the tubing.

Close the lid of the central chamber.



Note

Replace the gas tubing and filter every 4 weeks.



Note

During normal operation the central chamber lid should be kept shut.

2.3 External data collection

The INC-A20 Incubator can be connected directly to any application that supports the Modbus TCP-IP protocol by using the Ethernet connection. All critical parameters can be monitored via this interface. Details on the Modbus addresses supported by the incubator are provided in the section [Modbus address map](#)^[59].

In addition, 6 ports are provided to allow independent PT100 temperature sensors to be fitted. These can be used to provide independent monitoring via any digital thermometer capable of reading PT100 sensors.

To fit an external PT100 sensor to the incubator, carefully push the sensor into one of the 6 ports provided; see [External monitoring ports](#)^[10]. Refer to your sensor documentation for further details on how to monitor them. See the [Monitoring](#)^[58] section for details on the sensor dimensions.



Tip

For network security, the INC-A20 Incubator should normally be left in read-only mode (see [Allowing network write access](#)^[71]). In read only mode, no changes can be made to any operating parameters via the network; changes to parameters will only be possible via the front panel of the incubator.

2.4 Connecting to the mains supply



Precautions

- Check that the voltage requirements of the incubator, shown on the rating label, match the local mains supply voltage.
- The connector from the mains lead to the power supply is the main disconnect device. In the event of a fault occurring that requires the power to be disconnected immediately, disconnect the mains lead from the power supply or switch off at the mains wall power outlet.
- Ensure that the equipment is positioned so that the mains lead can be easily disconnected.



Note

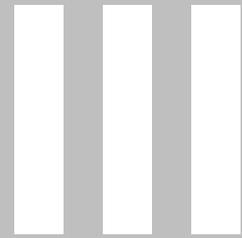
As soon as power is supplied to the incubator it will enter its power-on cycle.

Connect the mains lead to the mains inlet at the rear of the incubator.

Do not connect the mains lead to the wall power outlet until you are ready to start operating the incubator. See [Operating the incubator](#)^[22].

Operating the incubator

Section



3 Operating the incubator

This section provides details on how to operate the INC-A20 Incubator.

3.1 Switching on the system



Precautions

- The connector from the mains lead to the power supply is the main disconnect device. In the event of a fault occurring that requires the power to be disconnected immediately, disconnect the mains lead from the power supply or switch off at the mains wall power outlet.
- Ensure that the equipment is positioned so that the mains lead can be easily disconnected.

Refer to the section [Connecting to the mains supply](#)^[20] for details on power requirements.

To apply power to the incubator, connect the mains lead from the mains inlet at the rear of the incubator to the wall power outlet. If the wall power outlet is switched, switch it on now. The INC-A20 Incubator does not have its own mains power on/off switch.

Once power is applied, the incubator will begin its [power-up cycle](#)^[22].

3.1.1 Power-up cycle

When the system is first switched on, it will perform a memory check and other internal diagnostic checks. It will then enter [standby mode](#)^[32].

In standby mode, the backlight to the display will be switched off and the system will use the minimum amount of power necessary to allow external applications to continue to monitor its status (see [External monitoring](#)^[20]).



To exit standby mode, press the **Enter** key on the front panel. The incubator will then begin to control the chamber temperatures and gas flow.



Tip

When the incubator leaves standby mode, alarms will be marked as 'expected'. See [Alarm indicators](#)^[12] for more details.

If the system detected that it had previously been switched off while in normal operating mode, it will not enter standby mode on power up but will begin controlling the chambers immediately. This is regarded as a fault condition having occurred and an alarm will be raised.

**Tip**

Before switching off the incubator, always put the system into standby mode. See [Standby mode](#)^[32] and [Switching off](#)^[33].

Should the system detect a memory failure at start-up, it will always enter standby mode and alarm. All settings will revert to their factory default conditions.

**Note**

In the rare case of a memory failure you must check the configuration of the machine to ensure that the settings are correct for your application. You will also need to check the calibration of the unit as these settings will have been lost. See [Configuring the control parameters](#)^[25] and [Calibration](#)^[40].

3.2 Preparing the incubator for use

Before you can use the INC-A20 Incubator, the passwords for accessing the incubator and its control parameters must be defined. Using a password prevents unauthorised changes to the settings.

Further details are given in the [Setting the password](#)^[23] and [Configuring the control parameters](#)^[25] sections.

**Tip**

When the system enters its normal operating mode, the main menu will be displayed. In normal use many of these options will not be used. A full list of these options are given in the [Main menu](#)^[50] section.

3.2.1 Setting the password

Many of the features of the INC-A20 Incubator require a five digit password to be entered via the front panel.

To change the password, use the cursor keys to highlight the **Set password** option from the main menu.

```
<Set password>
  ▾ 37.1  37.1 C
```

Then press the **Enter** key.

You will then need to enter the current password.

**Tip**

The factory-set default password is **00000**.

If your password is correct you will be able to enter a new password.

```
Enter new password
<1>0000 Edit
```

Edit the password as described in the [Editing values](#) ⁸ section.

**Tip**

It is important that you do not forget this password. If you ever lose your password you will need to follow the procedure described in [Resetting the password](#) ²⁴ in order to setup the incubator.

3.2.1.1 Resetting the password

If you lose your password you will need to contact Planer plc to obtain a new password. This process is described below.

To reset the password, use the cursor keys to highlight the **Reset password** option from the main menu.

```
<Reset password>
▼ 37.1 37.1 C
```

Then press the **Enter** key.

A reset code will be displayed on the top line.

```
Reset code 87942
<1>0000 Edit
```

This reset code will need to be provided to Planer plc who will be able to provide you with a new password. Do not exit this menu until the new password has been entered.

Enter the password as described in the [Editing values](#) ⁸ section.

You will now be able to change the password to your own value by following the steps in [Setting the password](#) ²³.

3.2.2 Configuring the control parameters

In order to use the incubator you will need to configure the control parameters.



Note

The system should normally be calibrated at the operating point of the incubator. The system is factory calibrated for an operating temperature of 37.0 °C, nominal bleed flow of 30 mL/min and a purge of 360 mL/min.

Switch on the INC-A20 Incubator

When the power-up cycle has completed, use the cursor keys to highlight the **Configure** option.

```
<Configure>
  ▾ 37.1  37.1 C
```

Then press the **Enter** key.

You will then need to enter your password.

If your password is correct the group selection menu will be displayed.

```
Select group to adjust
<Control settings>
```

If the password is incorrect you will still be able to view the settings but the title will show that they are read-only and cannot be modified.

There are 2 groups that can be selected; **Control settings** and **Calibration settings**.

Select the group that you need to modify. For a new unit this will normally be the **Control settings** as the system will have been calibrated at the factory.

If you do not want to modify any settings, use the cursor keys to select **Cancel**.

Use the cursor keys to select the parameter to be modified and press **Enter** to select that parameter.

Further details are provided in the sections [Setting the temperatures](#)^[25] and [Setting the gas flow](#)^[26].

3.2.2.1 Setting the temperatures

The incubator will control the temperature of each chamber. The left and right chambers can be independently set to run at different temperatures.

- To change the control temperature, select **Configure** from the main menu and then use the cursor keys to select **Control settings**.

Control settings

<Left temp C>

- Use the cursor keys to select the setting that you want to adjust and press **Enter** when the required parameter is selected.
- There are 5 settings that can be modified. These are the **Left temp**, **Right temp**, gas **Bleed on time**, **Bleed off time** and **Purge duration**.
- The first two parameters adjust the nominal temperature set-points for the left and right chambers. The other parameters adjust the gas flow, which are explained in the section [Setting the gas flow](#)^[26].
- To modify the left temperature select **Left temp C** and press **Enter**.

Left temp C

<0>37.06 Edit

- Use the keys to edit the value as described in the section [Editing values](#)^[8].
- Repeat this process for the right-hand chamber.



Tip

The temperature set-points entered via the front panel adjust the nominal temperatures for each chamber. The lids and base of each chamber are automatically adjusted to temperatures based upon these values. For details on these automatic adjustments please refer to the section [Temperature set-point offsets](#)^[56].

3.2.2.2 Setting the gas flow

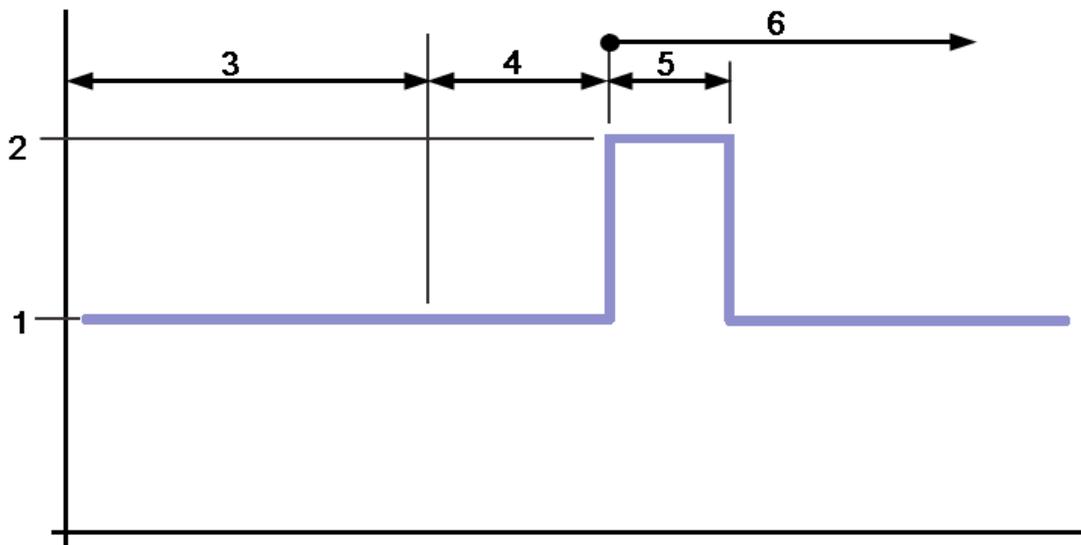
The incubator has two gas flow modes: bleed and purge. The gas is normally fed to the chambers at a rate determined by the bleed low-flow rate and bleed high-flow rate.



Note

The bleed low-flow and purge rates are fixed and cannot be adjusted from the front panel. They can be adjusted by a Service Engineer via the Modbus interface. See [Modbus address map](#)^[59]. The default values for these settings are 30 mL/min, and 360 mL/minute respectively. Flow measurements are normalised to 0 C, 50% RH and 1 bar and refer to the total flow into the incubator. Each chamber receives 50% of the total flow.

The gas supply is normally supplied at a constant bleed flow. The gas flow is maintained when either lid is opened. When either lid is moved from a open state to closed, the system provides gas at a flow rate defined by the purge gas flow rate for a period defined by the purge duration, after which the system reverts to the normal bleed flow. The gas flow is illustrated in the diagram below.



1. Bleed gas low flow rate
2. Purge gas flow rate
3. Period with both lids shut
4. Period with either door open.
5. Purge duration.
6. Period with lids shut again

An alternative flow strategy using a pulsed flow is available but the default recommended setting is to use non-pulsed flow. See [Pulsed flow](#)^[50].

There are three flow modes that can be configured: bleed flow ([pulsed](#)^[51] or [non-pulsed](#)^[27]), [purge flow](#)^[28] and [gas tubing change purge](#)^[29].

3.2.2.2.1 Non-pulsed flow

To change the gas parameters for non-pulsed flow, select **Configure** from the main menu and then use the cursor keys to select **Control settings**.



There are three settings that can be modified to define the non-pulsed flow. These are the **Bleed on time**, **Bleed off time** and **Non-pulsed flow**.

Use the cursor keys to select **Bleed on time s** and press **Enter**.

```
Bleed on time s
<0>0300 Edit
```

Use the keys to edit the value as described in the section [Editing values](#)^[8].

Repeat this process for the **bleed off time** and set this to 0. Setting the **bleed off time** to 0 s indicates that the gas flow should not be pulsed but should run at a continuous flow rate. If you do not set this value to 0 seconds, the flow will run in [pulsed flow mode](#)^[51].

Finally, set the **non-pulsed flow** parameter to the required flow rate. Note that this parameter comes after the **Gas tubing change purge** setting.

Recommended values for these settings are:

Bleed on time	Bleed off time	Non-pulsed flow
300 s	0 s	30 mL/min

3.2.2.2 Purge flow

To change the purge flow setting, select **Configure** from the main menu and then use the cursor keys to select **Control settings**.

```
Control settings
<Left temp C>
```

Use the cursor keys to select **Purge duration s** and press **Enter**.

```
Purge duration s
<0>0180 Edit
```

In order to ensure a stable operating environment, it is good practice to minimise the number of times the lids are opened. If you need to open the lids several times during your working day, you may need to increase the **purge duration**; this will allow the CO₂ to equilibrate more quickly. The default time is 180 s, but if you are opening the lids frequently, a duration of 300 s is recommended.

Note

The purge rate is fixed and cannot be adjusted from the front panel. It can be adjusted by a Service Engineer via the Modbus interface. See [Modbus address map](#)^[59]. The default value is 360 mL/minute. Flow measurements are normalised to 0 C, 50% RH and 1 bar and refer to the total flow into the incubator. Each chamber receives 50% of the total flow.

3.2.2.2.3 Gas tubing change purge

After a gas tubing change, the incubator will automatically generate a purge for an extended duration. This can be modified from the front panel but should normally be left at its default value of 540 seconds.

To change the gas tubing change duration, select **Configure** from the main menu and then use the cursor keys to select **Control settings**.

```
Control settings
<Left temp C>
```

Use the cursor keys to select **Gas tubing change purge s** and press **Enter**.

```
Gas tubing change purge s
<0>0540 Edit
```

The recommended value for the **Gas tubing change purge** is 540 s.

Note

The purge rate in Gas tubing change mode is the same as the standard purge flow rate; see [Purge flow](#) ^[28].

Tip

Use the **gas tubing change** mode (see [Changing the gas tubing](#) ^[29]) to stop the gas flow while still maintaining the incubator temperature.

3.2.3 Changing the gas tubing

Warning

Discard the gas tubing or filter if the packaging appears damaged. Do not attempt to resterilize.

Note

Replace the gas tubing and filter every 4 weeks.

Note

If necessary, transfer any samples to another incubator during the change.

The INC-A20 Incubator uses a [disposable gas tubing assembly and filter](#)^[55]. Before changing you must set the incubator into the gas tubing change mode. This will switch off the gas supply and also show an expected alarm condition - see the [Status and alarm indicators](#)^[12] section.



Tip

This is a good time to undertake routing cleaning of the incubator. See [Cleaning and disinfecting the chambers](#)^[37].

To change the gas tubing, select **Change gas tubes** from the main menu and press **Enter**.

You will then need to enter your password.

If your password is correct the display will switch to the gas tubing change screen.



Refer to the section [Installing the gas tubing](#)^[17] for details on how to fit the tubing.

When done, press **Enter** to return to the normal operating mode.

Wait for the incubator to stabilise and the indicators to go green before returning any samples. See [Status and alarm indicators](#)^[12].

3.3 Changing the display mode

The display normally shows the temperatures of the base of each chamber and the top line shows the menu option **Display mode**.



Tip

The display uses small symbols to help identify the parameter being displayed. These are detailed below.

- Base temperature
- Lid temperature
- Gas flow rate
- ▼ Gas flow rate while purging
- Set-point

Pressing the **Enter** key when **Display mode** is selected will select the next available display mode. Pressing the key several times will cause the system to cycle through all the available display modes. The table below shows all of the available modes.

<Display mode>

▼ 37.0 37.0 C

Base temperatures.

<Display mode>

▲ 37.0 37.0 C

Lid temperatures.

<Display mode>

CNTR 36.5 C

Central chamber temperature.

<Display mode>

▶ 2.5 mL/min

Flow rate. When purging, ▶▶ is shown.

<Display mode>

▼ 37.1 37.1 C ▶ 2.5 mL/min

Base temperatures and flow rate. When purging, ▶▶ is shown.

<Display mode>

S▼ 37.1 37.1 C

Set-point for base temperatures. This is calculated from the set-point entered for the chamber. See [Temperature set-point offsets](#) ^[56].

<Display mode>

S▲ 37.1 37.1 C

Set-point for lid temperatures. This is calculated from the set-point entered for the chamber. See [Temperature set-point offsets](#) ^[56].

<Display mode>

S CNTR 37.1 C

This shows the central chamber set-point.

<Display mode>

S ▶ 2.5 mL/min

Set point for the current flow rate. The set-point will change depending on whether the flow is on, off or purging. See [Setting the gas flow](#) ^[26]. When purging, ▶▶ is shown.



```
<Display mode>
Ver 000.001 ID:CFG101122
```

Firmware version identification.

3.4 First time operation

When operated for the first time, leave the incubator running for 24 hours at the required set-point before adding any samples.

After 24 hours, and with the incubator in normal run mode, disconnect the mains supply.

Acknowledge the power fail alarm and then confirm that the incubator can run under battery backup for 30 minutes.

At the end of 30 minutes, reconnect the mains supply.

Note that the available hold-up time following the test will have been reduced and it may take up to 24 hours for full capacity to be restored.

Check each chamber by using culture medium containing phenol red indicator.

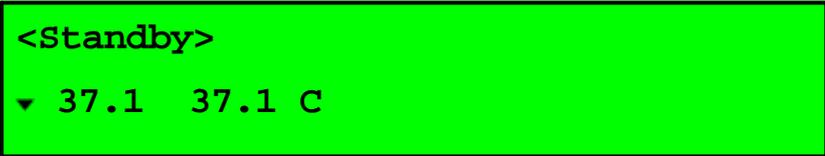
Place the medium in culture dishes and leave them in both the right and left-hand chambers overnight.

Check that the phenol red indicator has changed to the expected salmon pink colour.

3.5 Shutting down the incubator

3.5.1 Standby mode

If you are shutting down the incubator for a short period of time, use the cursor keys to select **Standby** from the main menu.



```
<Standby>
▼ 37.1 37.1 C
```

Press **Enter** to confirm the selection.

The system will now enter its standby mode.



```
<Run>
▼ 37.1 37.1 C
```

The backlight to the display will be switched off and the system will use the minimum amount of power necessary to allow external data-logging applications to continue to monitor its status.

Both status indicators will be switched to orange. See the [Status and alarm indicators](#) ^[12] section.

To exit standby mode, press the **Enter** key on the front panel.

 **Tip**

In standby mode the power supply may be disconnected without an alarm occurring.

3.5.2 Switching off

If the power supply is switched off, the incubator will run from its internal battery and sound an alarm. To switch the unit off for a long period, place the system into [standby mode](#) ^[32] and then switch off the power at the main wall power outlet.

 **Note**

If you switch the unit off before you enter standby mode, the system will alarm and try to run from its internal battery.

3.6 Battery backup

 **Precautions**

The internal battery is not user-replaceable.

The INC-A20 Incubator is fitted with an internal sealed lead acid battery that is designed to support the incubator should the mains power supply fail. The exact period that the battery can support the incubator depends upon the charge state and the amount of energy that is being used to maintain the required temperature. The battery can typically maintain the set-point for 120 minutes.

If the mains power supply is disrupted while the unit is in standby mode, the incubator will be switched off and no alarms will sound. This is the normal method of shutting down.

If mains power is disrupted a power fail alarm will be triggered. The status indicators will flash red and the audible and external alarms will be switched on.

If any key is pressed the status indicators will stop flashing but will remain red until power is restored. The audible and external alarms will be switched off when the alarm is acknowledged.

If the incubator is left running from the battery, when the system detects that the battery is low the status indicators will start to flash again and the audible and external alarms will be reactivated.

**Warning**

- If left running on a low battery the incubator will automatically switch off without further warning when the battery is exhausted. The period between detection of a low battery and switching off may be less than 2 minutes.
 - If the battery has been discharged, it will no longer be able to support the incubator until it has become fully charged again. This can take up to 24 hours.
-

Routine maintenance and troubleshooting

Section

IV

4 Routine maintenance and troubleshooting

Precautions

- Switch off the incubator and disconnect the mains supply before cleaning. See [Switching off](#)^[33].
- The connector from the mains lead to the power supply is the main disconnect device. In the event of a fault occurring that requires the power to be disconnected immediately, disconnect the mains lead from the power supply or switch off at the mains wall power outlet.

4.1 General cleaning

Warnings

- Bleaches are corrosive and may damage sensitive components and metal surfaces within the chamber.

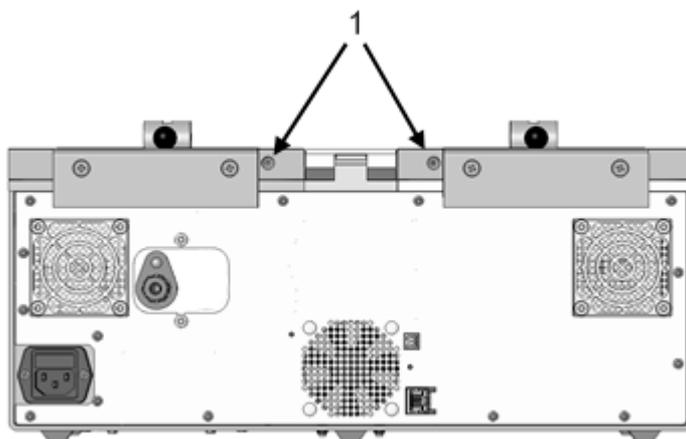
Precautions

- Switch off the incubator and disconnect the mains supply before cleaning. See [Switching off](#)^[33].
- Always allow the unit to dry fully before reconnecting the mains supply.
- Note that disinfectants are potentially hazardous to health. Ensure that you obtain a material safety data sheet (MSDS) before use and follow the instructions contained therein.
- The person responsible for the equipment must ensure that:
 - the unit is decontaminated if hazardous material is spilt onto or into the equipment.
 - only cleaning and disinfecting materials compatible with the equipment are used. Incompatible materials may cause a hazard by reacting with the equipment or materials contained within.

These instructions are for the exterior of the device only.

Clean the incubator periodically with a damp cloth and sterile water or 70% isopropyl alcohol.

Clear the gas vents at the rear of the incubator using a clean miniature bottle brush or clean 'pipe-cleaner' wetted with sterile water or 70% isopropyl alcohol. Always push the brush or 'pipe-cleaner' from the inside of the chamber through to the exterior to avoid introducing contamination into the chambers. If in doubt, clean and disinfect the chambers after clearing the ports; see [Cleaning and disinfecting the chambers](#)^[37].



1. Gas vents

Clean the external monitoring ports using a miniature bottle brush or 'pipe-cleaner' wetted with sterile water or 70% isopropyl alcohol. See the [External monitoring ports](#) ^[10] section.

Allow the unit to dry fully before reconnecting the mains supply.

4.2 Cleaning and disinfecting the chambers

Warning

- Switch off the incubator and disconnect the mains supply before cleaning. See [Switching off](#) ^[33].
- Always allow the unit to dry fully before reconnecting the mains supply.
- Note that disinfectants are potentially hazardous to health. Ensure that you obtain a material safety data sheet (MSDS) before use and follow the instructions contained therein.
- The person responsible for the equipment must ensure that:
 - the unit is decontaminated if hazardous material is spilt onto or into the equipment.
 - only cleaning and disinfecting materials compatible with the equipment are used. Incompatible materials may cause a hazard by reacting with the equipment or materials contained within.

Cleaning

1. Remove gross spill by wiping with a disposable wipe. Discard used wipe safely.
2. Spray the surface with sterile water.
3. Allow to soak for 2 min at room temperature to soften any dried on material.
4. Remove the water with a clean non-linting cloth (gauze). Use cotton buds or swabs where necessary to ensure contact is made with all grooves and corners of the surface plate.
5. Repeat steps 2, 3 and 4, three more times.
6. Visually inspect the surface to ensure that all visible soil has been removed.

Disinfection

1. Prior to disinfection, the incubator must first be cleaned by following the cleaning procedure above.
2. Spray the surface with isopropyl alcohol at 70% v/v dilution.
3. Allow to soak for 15 mins at room temperature.
4. Remove the disinfectant with a clean non-linting cloth (gauze). Use cotton buds or swabs where necessary to ensure contact is made with all grooves and corners of the surface plate.
5. Wipe the surface over with sterile water and a clean non-lint cloth to remove any residual fluids. Use cotton buds or swabs where necessary to ensure contact is made with all grooves and corners of the surface plate.
6. Leave the unit to dry until all residual cleaning fluids have evaporated.

4.3 Safety testing



Precautions

- The INC-A20 Incubator is classified as electrical Class 1 equipment and must be earthed for safe operation.
- Repetition of potentially damaging high-voltage flash tests should be avoided.

The INC-A20 Incubator and the mains connecting cord should be regularly checked by suitably trained personnel, using a Portable Appliance Tester or similar equipment, to ensure adequate earth bonding.

The earth continuity of the mains installation must also be regularly inspected by the person responsible for the installation.

All mains leads should be checked for signs of damage and replaced if necessary.

All gas joints should be checked for leaks using soapy-water and looking any sign of any bubbles. Leaking joints should be corrected as described in the section, [Connecting the gas supply](#)^[16].

4.4 Battery testing

The battery should be tested every 4 months.

Ensure that the incubator has been running for at least 24 hours.

With the incubator in normal run mode, disconnect the mains supply.

Acknowledge the power fail alarm and then confirm that the incubator can run under battery backup for 30 minutes.

At the end of 30 minutes, reconnect the mains supply.

Note that the available hold-up time following the test will have been reduced and it may take up to 24 hours for full capacity to be restored.

4.5 Running a system test

The INC-A20 Incubator includes a test mode which allows a quick system check to be run. To change or view a calibration offset, select **Test system** from the main menu.

```
<Test system>
▼ 37.0 37.0 C
```

Then press **Enter** to start the test.

You will need to enter a valid password to initiate the test.

If your password is correct a warning message will be displayed..

```
Warning alarms will be triggered
<Continue>
```

The tests will result in alarms being sounded. You should ensure that all appropriate personnel are aware that these alarms are to be expected. If you do not want to proceed with the test use the cursor keys to select **Exit**.



Tip

The unit will pause after each test and provide the options to **Continue** or **Exit**.

To continue with the test select **Continue** and press the **Enter** key.

A test pattern will be shown on the top line which can be used to detect a faulty line.

Select **Continue** to move to the next test.

Another test pattern will be shown, this time on the bottom line.

Select **Continue** to move to the next test.

The alarms will now be tested. Both status indicators should flash red, the internal alarm should sound and an external alarm, if fitted, should also sound. The display will show the following message.

```
Testing the alarm.
```

Press any key to clear the alarm message.

The display will show the following alarm message.

```
An alarm has been triggered.  
<Continue>
```

Select **Continue** to move to the next test.

The display will then present an optional EMC test.



The EMC test will switch off the gas control and temperature control circuits. This test is only intended to be run by service personnel. You should normally select **Exit** at this point to terminate any further tests.

```
Start EMC - will switch chambers  
OFF.  
<Continue>
```

Select **Continue** to start the test.

The status indicators will go orange and the display will change to its EMC monitoring mode.

```
Running EMC - chambers OFF.  
<Continue>
```

Select **Continue** to move to end the test.

The results of the test will be displayed.

```
EMC test completed ok.  
<Continue>
```

Pressing **Continue** again will end the tests and return to the main display.

4.6 Calibration

The INC-A20 Incubator should be calibrated annually. There are a number of calibration offsets that can be adjusted to correct errors in the measurement system. Refer to the sections [Temperature calibration](#)^[41] and [Flow calibration](#)^[44] for details on how to determine the correct offsets.

To change or view a calibration offset, select **Configure** from the main menu and then use the cursor keys to select **Calibration offsets**.

```
Calibration offsets
<Top left temp C>
```

Use the cursor keys to select the setting that you want to adjust and press **Enter** when the required parameter is selected.

There are 6 temperature settings that can be modified:

- **Cal offset top left temp**
- **Cal offset top right temp**
- **Cal offset bottom left temp**
- **Cal offset bottom right temp,**
- **Cal offset centre temp**

and 6 flow settings:

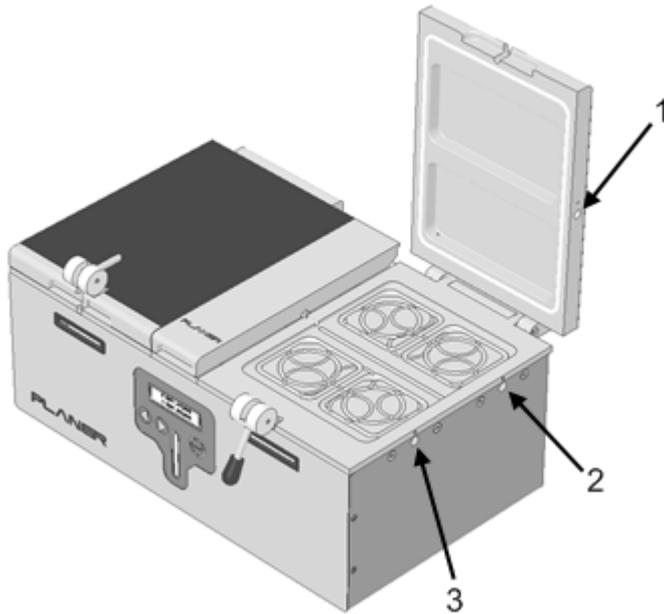
- **Low flow cal at mL/min**
- **Cal offset low flow cal mL/min**
- **Mid flow cal at mL/min**
- **Cal offset mid flow cal mL/min**
- **High flow cal at mL/min**
- **Cal offset high flow cal mL/min**

Use the keys to edit the value as described in the section [Editing values](#)^[8].

To leave the menu, use the cursor keys to select **Cancel** and press **Enter**.

4.6.1 Temperature calibration

To check the temperatures you will need a calibrated temperature probe and suitable digital thermometer, hereafter called the reference probe. The reference probe should have an accuracy better than ± 0.05 °C. The probe dimensions must meet the requirements for a remote PT100 sensor as defined in the [Monitoring](#)^[58] section.

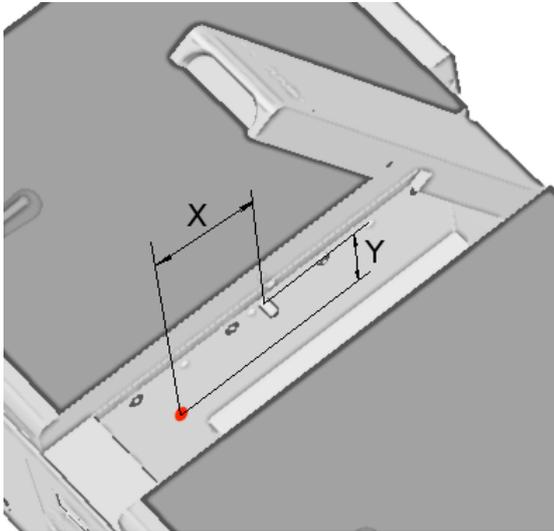


1. Lid monitoring port
2. Base rear monitoring port
3. Base front monitoring port

Allow the system to stabilise for at least 1 hour after switching on or after a set-point change before calibrating.

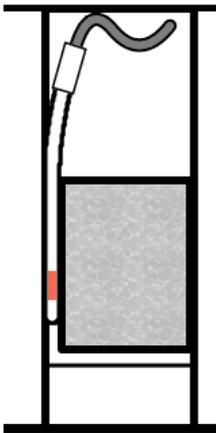
Use the reference probe to measure the temperature of the lid and the base using the monitoring ports. For calibration purposes the average of the front and rear ports should be used for the base. The front and rear ports should be within ± 0.2 °C of each other. If they are outside these limits, contact your distributor.

The centre chamber should be checked by placing the reference probe on the left-hand side of the centre chamber so that its measuring region is positioned at the location shown below. The positions X and Y are measured relative to the tube-guide pivot pin; $X = 50 \pm 5$ mm and $Y = 35 \pm 5$ mm. The probe may be temporarily taped in position.



Centre chamber measurement position

The probe should be gently pressed against the side wall and sheltered from ambient air disturbances by placing an expanded-polystyrene block between the right-hand side of the chamber and the probe as shown below.



Expanded-polystyrene block location

Change the display mode, see [Changing the display mode](#)^[30], to show the set-points for the left base, right base, left lid, right lid and centre chamber.

The error may be calculated by subtracting the measured temperature from the associated set-point. i.e in the following equation SP refers to the set-point and MV (measured variable) to the measured temperature.

$$\text{error} = \text{SP} - \text{MV}$$

If the magnitude of the error is less than 0.1 °C no change is necessary. If a correction is to be applied, adjust the calibration offset as follows.

Locate the current offset value as described in the [Calibration](#)^[40] section.

Note the error must subtracted from the current offset. i.e

$$\text{new offset} = \text{current offset} - \text{error.}$$

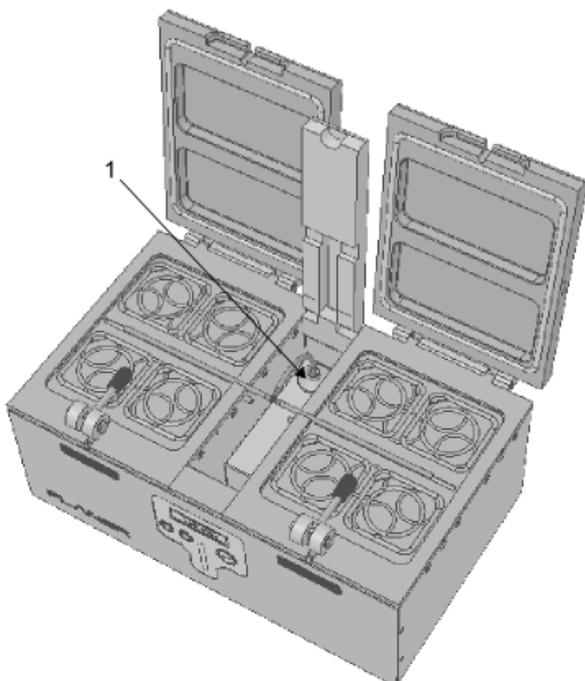
Change the current value to the new offset and then select **OK** and press **Enter** to save the changes. More information on editing values is given in the section [Editing values](#)^[8].

4.6.2 Flow calibration

To check the flow you will need a flow meter with an accuracy at the calibration points better than $\pm 5\%$ or ± 1.5 mL/minute, whichever is the greater, and an inlet pressure requirement of less than 0.08 bar at 360mL/min.

Set the INC-A20 Incubator into the change gas tubing mode - see [Changing the gas tubing](#)^[29].

Disconnect the tubing from the gas port at the rear of the centre chamber. See [the central chamber](#)^[10].



1. Gas filter fitted to luer-lock gas port

Connect the flow meter to the gas port.

Exit the gas tubing change mode to revert to normal control.

The flow recorded by the flow meter should be seen to switch high and low according to the bleed on and off times. See [Setting the gas flow](#)^[26]. If the bleed flow on-time is too short to allow the flow meter to stabilise, the time may need to be extended.

The unit allows three-point calibration for low, medium and high flows. These equate to the Bleed low flow, Bleed high flow and Purge Flow levels.

Use the flow meter to record the actual flow rate during the bleed off-time, and the bleed on-time. Open and shut the lids to force a gas purge and then record the actual flow during the purge. You should now have 3 readings providing the actual flow during each of the 3 states.

Change the display mode, see [Changing the display mode](#)^[30], to show the set-point for the flow. Record the associated flow set-point for each of the 3 flow states.

The error may be calculated by subtracting the measured flow from the set-point, i.e. in the following equation SP refers to the set-point and MV (measured variable) to the measured flow.

$$\text{error} = \text{SP} - \text{MV}$$

If the error is less than 0.1 mL/minute no change is necessary. If a correction is to be applied, adjust the calibration offset as follows.

Locate the current cal offset value as described in the [Calibration](#)^[40] section.

Locate the current offset value as described in the [Calibration](#)^[40] section.

Note the error must subtracted from the current offset, i.e.

$$\text{new offset} = \text{current offset} - \text{error}.$$

The uncorrected flow rate that was being measured internally by the incubator should be calculated by subtracting the current offset from the SP value.

$$\text{uncorrected value} = \text{SP} - \text{current offset}$$

For each flow state, change the offsets, **Cal offset Low flow mL/min**, **Cal offset Mid flow mL/min** and **Cal offset High flow mL/min** to the associated **new offset** values calculated above and then select **OK** and press **Enter** to save the changes.

In addition, for each flow state, change the associated calibration points, **Low flow cal at mL/min**, **Mid low cal at mL/min** and **High flow cal at mL/min** to the associated **uncorrected value** calculated above and then select **OK** and press **Enter** to save the changes.

More information on editing values is given in the section [Editing values](#)^[8].

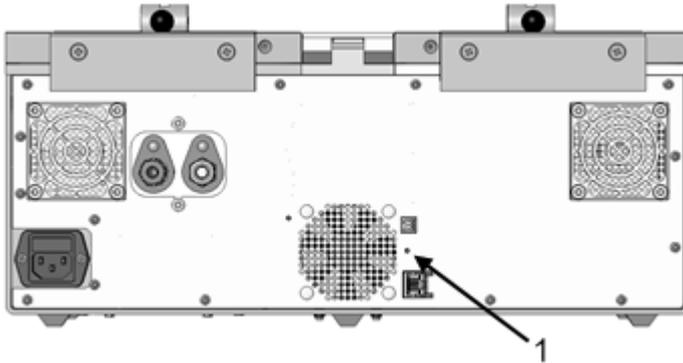
4.7 Troubleshooting

Should any problem persist please contact your distributor for assistance.

Fault	Possible cause	Corrective action
Display is not on.	The backlight may be off indicating that the unit is in standby mode.	None- this is normal if standby mode is selected. See the Standby mode ^[32] section.
Temperature error occurs	Room ambient temperature may be too close to the set-point.	Check the room ambient and refer to the control specification ^[54] .
	The set-point may have been adjusted by a large value.	Allow time for the temperature to settle.
	Check that the set-point is within specification.	Refer to the control specification ^[54] .
Flow errors occur	Check the gas pressure is correct.	Refer to the gas connections ^[55] .
	Check that the gas tubing in the centre chamber is not kinked.	See Installing the gas tubing ^[17] .
	Check that the gas filter has not become wetted.	See Installing the gas tubing ^[17] .
	Check that the set-point is within specification.	Refer to the control specification ^[54] .

4.7.1 Resetting the system

The system includes an internal watchdog so that should the system stop running for any reason, the device will automatically restart. In the unlikely event that it is necessary to reset the processor, locate the reset switch at the rear of the incubator.



1. *Reset switch*

The switch is recessed behind a small hole to prevent accidental operation.

Depress the switch using the tip of a ball-point pen or similar object.

Keep it depressed for 1 second and then release. The processor will then restart.

4.8 Returning for service

Should the INC-A20 Incubator need to be sent back to Planer plc for repair, or if the unit is to be inspected, maintained or repaired on-site by Planer plc, the [Safety Declaration form](#)^[72] must be completed.

4.9 Disposal



- Do not dispose of with general waste.
- Ensure that the system has been cleaned as necessary to ensure that it is safe to handle and service and is free from any biohazard or toxic materials.

Additional information

Section

V

5 Additional information

5.1 Main menu

When the system enters its main operating mode a number of options are available from the menu. Many of these options are not required for normal day to day use. The full list of options is shown below.

Menu option	Notes
Display mode	See Changing the display mode ^[30] .
Change gas tubing	See See Changing the gas tubing ^[29] .
Configure	From this option key operating parameter and calibration information can be set. See Configuring the control parameters ^[25] and Calibration ^[40] .
Test system	This function allows a system test to be performed. See Running a system test ^[39] .
Set password	See Setting the password ^[23] .
Reset password	See Setting the password ^[23] .
Modbus mode	See Allowing network write access ^[71] .
Standby	See Standby mode ^[32] .

5.2 Pulsed flow

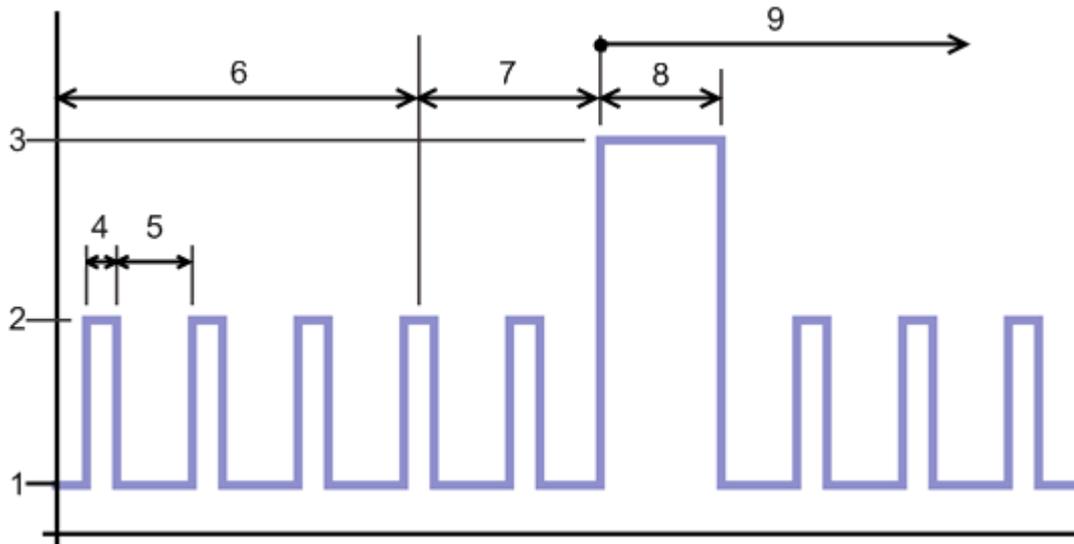
The incubator has two gas flow modes: bleed and purge. The gas is normally fed to the chambers at a rate determined by the bleed low-flow rate and bleed high-flow rate.



Note

The bleed low-flow, bleed high-flow and purge rates are fixed and cannot be adjusted from the front panel. They can be adjusted by a Service Engineer via the Modbus interface. See [Modbus address map](#) ^[59]. The default values for these settings are 20 mL/minute, 60 mL/minute and 360 mL/minute respectively. Flow measurements are normalised to 0 C , 50% RH and 1 bar and refer to the total flow into the incubator. Each chamber receives 50% of the total flow.

The gas supply is continuously switched from a low to high flow according to a duty cycle defined by the bleed gas on-time and off-time. The gas flow is maintained when either lid is opened. When either lid is moved from a open state to closed, the system provides gas at a flow rate defined by the purge gas flow rate for a period defined by the purge duration, after which the system reverts to the normal pulsed pattern. The gas flow is illustrated in the diagram below.



1. Bleed gas low flow rate
2. Bleed gas high flow rate
3. Purge gas flow rate
4. Bleed on time
5. Bleed off time - set to zero for continuous bleed flow.
6. Period with both lids shut
7. Period with either door open.
8. Purge duration.
9. Period with lids shut again.

There are three flow modes that can be configured: bleed flow ([pulsed](#)^[51] or [non-pulsed](#)^[27]), [purge flow](#)^[28] and [gas tubing change purge](#)^[29].

5.2.1 Pulsed flow configuration

To change the gas parameters for pulsed flow, select **Configure** from the main menu and then use the cursor keys to select **Control settings**.

Control settings

<Left temp C>

There are two settings that can be modified to define the pulsed flow. These are the **Bleed on time** and **Bleed off time**.

Use the cursor keys to select **Bleed on time s** and press **Enter**.

```
Bleed on time s
<0>0300 Edit
```

Use the keys to edit the value as described in the section [Editing values](#)^[8].

Repeat this process for the **bleed off time**.



Tip

Setting the bleed off time to 0 s indicates that the gas flow should be not be pulsed but should run at a continuous flow rate. See [non-pulsed flow](#)^[27].

Recommended values for these settings are:

Bleed on time	Bleed off time
300 s	900 s



Note

The bleed low-flow, bleed high-flow are fixed and cannot be adjusted from the front panel. They can be adjusted by a Service Engineer via the Modbus interface. See [Modbus address map](#)^[59]. With the default values for bleed low-flow and bleed high-flow of 20 mL/minute and 60 mL/minute respectively these times provide a nominal flow of 30 mL/min. Flow measurements are normalised to 0 C , 50% RH and 1 bar and refer to the total flow into the incubator. Each chamber receives 50% of the total flow.

5.3 Specifications

5.3.1 System specifications

Dimensions	420 mm wide x 270 mm deep x 210 mm high
Weight	15.5 kg
Storage temperature	-10 °C to +50 °C
Storage humidity	5% to 95% relative humidity non-condensing
Storage special instructions	Recharge every 4 months by connecting to the mains power supply for 24 hours.
Operating environment	For indoor use only
Operating temperature	+5 °C to +40 °C for safe operation See Control ⁵⁴ table for control limitations.
Operating humidity	5% to 90% relative humidity non-condensing
Altitude	up to 2000 m
Pollution degree	Pollution degree 2 (BS EN61010-1)
IP rating	IP31
Electromagnetic environment	The equipment is intended for use in a basic electromagnetic environment, characterized by being supplied directly at low voltage from the public mains network.

5.3.2 Control

Temperature control range	(ambient + 5 °C) to (ambient + 20 °C) Upper temperature must not exceed 40 °C.
Temperature measurement accuracy	± 0.2 °C
Temperature control accuracy	± 0.1 °C measured after any transient effects due to set-point changes have subsided.
Flow control range	0 ml/minute to 900 mL/minute Flow measurements are normalised to 0 C , 50% RH and 1 bar.
Flow accuracy	The greater of ± 10% or ± 3 ml/minute
Flow control accuracy	The greater of ± 5% or ± 2 ml/minute measured after any transient effects due to set-point changes have subsided.
Accuracies apply at the calibration points. The system is factory calibrated for an operating temperature of 37.0 °C, nominal bleed flow of 30 mL/min and a purge at 360 mL/min .	

5.3.3 Capacity

Dishes per chamber	4 x NUNC 4 well dishes, 4 x NUNC 60 mm Petri dishes 10 x NUNC 30 mm Petri dishes 4 x MINITUB 5 well dishes 4 x FALCON 60 mm Petri dishes
--------------------	--

5.3.4 Power



Precautions

- The internal battery is not user-replaceable and may only be replaced by persons trained in the servicing of this equipment.
- The battery must only be replaced with a battery of the same type and rating.

Power requirements (see note) Includes Controller	100 - 240 V~ 50/60Hz 2 A
Inrush current (typical)	80 A / 230 V~
Internal battery backup	Gelled sealed lead acid battery 12 V x 12 A.h

Note. The INC-A20 Incubator system is designed to be plug connected to the normal building wiring.

5.3.5 Tubing and filter

Item	Description	Manufacturer	Part number
Tubing	Gas tee tubing assembly	Planer plc	CN102042
Filter	Syringe filter. 0.2 µm, Supor membrane, 32 mm	PALL Corporation	HP4642 Planer ordering code: CN101517

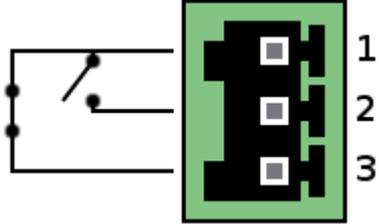
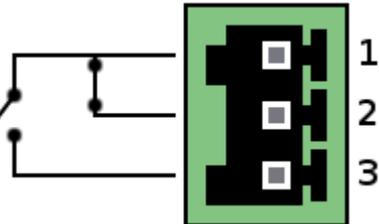
5.3.6 Gas supply

Gas supply	Premixed gas. Typically 6% CO ₂ , 5% O ₂ , balance N ₂
Supply pressure	1.5 ± 0.15 bar
Connectors	SWAGELOK 1/4" tube fitting to fit SS-400-1-4RT

5.3.7 External alarm connections

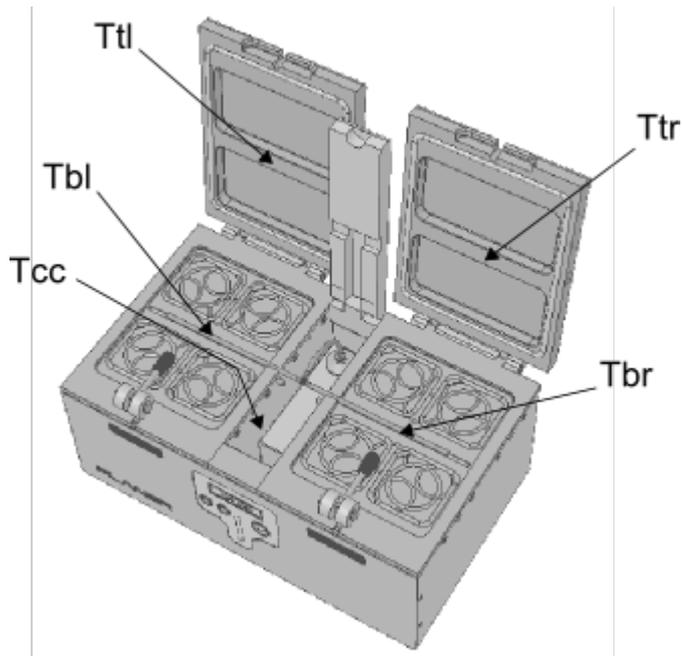
 Precautions <ul style="list-style-type: none"> Any circuit connected to the alarm output must be within the limits stated below. Any circuit connected to the alarm output must meet the requirements for an accessible part as defined in EN 61010-1 or its equivalent. The alarm output must not be used in safety critical applications.

The INC-A20 Incubator is fitted with a connector for fitting to an external alarm. The incubator provides 3 volt-free(dry) terminals which provide normally-open and normally-closed contacts as shown in the diagrams below.

Connector type	Phoenix 3 way horizontal PCB header. Manufacturer's part number 1181451
Maximum voltage	30 V DC
Maximum current	1 A
Pin connections in normal operating mode	
Pin connections in alarm mode or power disconnected	

5.3.8 Temperature set-point offsets

When a set-point is entered for the left or right chamber this is used as the nominal chamber temperature. The temperatures for the lids, bases and centre chamber are individually controlled. The actual set-points for each part of the system are automatically calculated from the entered set-points. The 7 actual temperature set-points are illustrated in the diagram below.



Ttl - top left lid temperature

Ttr - top right lid temperature

Tbl - bottom left base temperature

Tbr - bottom right base temperature

Tcc - central chamber temperature

The actual set-points are calculated using the formulae below.

Let:

SPL = the left-hand chamber set-point

SPR = the right-hand chamber set-point

SP_MIN = the lowest temperature from SPL and SPR.

TOP_OFFSET = the top temperature offset defined by the offset top temperatures parameter.

BASE_OFFSET = the base temperature offset defined by the offset bottom temperatures parameter.

CNT_OFFSET = the central chamber temperature offset defined by the offset centre chamber temperature parameter.

Then

$Ttl = SPL + TOP_OFFSET$

$Ttr = SPR + TOP_OFFSET$

$Tbl = SPL + BASE_OFFSET$

$Tbr = SPR + BASE_OFFSET$

$Tcc = SP_MIN + CNT_OFFSET$

 **Tip**

The **offset top temperatures**, **offset bottom temperatures** and **offset centre chamber temperature** are factory set to 0, 0 and -2 °C respectively. These cannot be modified via the front panel. These values can only be modified via the Modbus interface but they should not normally be adjusted. See the [Modbus address map](#)^[59] section.

5.3.9 Monitoring

 **Precautions**

- The unit should only be connected to an Ethernet LAN internal to the building.

Feature	Controller
LAN	10 Base T Ethernet - RJ45 shielded. Modbus-TCP-IP protocol.
Remote PT100 sensors	PT100 Class A to EN60751. In order to fit the monitoring ports the sensor must meet the following specification: Maximum diameter 2.51 mm. Minimum length 100 mm. Sensing region should be within 15 mm of the tip.

5.3.9.1 Remote monitoring

The INC-A20 Incubator includes a number of variables that can be accessed using the Modbus TCP-IP protocol. All of the values are held within holding registers but there are some non-standard requirements that must be followed in order to access the values. These requirements are explained in the [Modbus address map](#)^[59] section.

For normal use the only parameters that need to be accessed are held in the PID Information group. These are continually updated and should not be written to. For details of the addresses refer to the [Modbus address map](#)^[59].

 **Tip**

For network security, the INC-A20 Incubator should normally be left in read-only mode (see [Allowing network write access](#)^[71]). In read only mode, no changes can be made to any operating parameters via the network; changes to parameters will only be possible via the front panel of the incubator.

5.3.9.1.1 Modbus address map

Warning

Values may be read safely without impacting on the operation of the incubator. Modifying parameters should normally only be undertaken by qualified service personnel or under their guidance. Entering incorrect values may impair the performance of the product. Impaired performance may have a detrimental impact on samples contained within the device. The system is normally protected from external modification. See [Allowing network write access](#)^[71].

The INC-A20 Incubator includes a number of variables that can be accessed using the Modbus TCP-IP protocol. All of the values are held within holding registers but there are some non-standard requirements that must be followed in order to access the values.

Holding registers are configured in groups and any command that accesses multiple registers must be restricted to addresses within one group; the range of addresses cannot cross a group boundary.

As an additional security measure, registers can only be written to if the system has been placed into read-write mode from the front panel. See [Allowing network write access](#)^[71].

The full memory map is shown below. Note that the addresses in the table, Modbus PDU address, are the addresses passed in the Modbus TCP-IP packets. Controlling applications may require the data model address which is typically the PDU address + 1.

Some of the addresses in the tables below are not externally accessible.

Hidden group			
Modbus PDU address	Parameter	Units	Notes
0	Non-volatile memory marker	NA	

Control settings group			
Modbus PDU address	Parameter	Units	Notes
1	Start of control settings marker	NA	
2	User set-point for left chamber	10 ⁻² °C	
3	User set-point for right chamber	10 ⁻² °C	
4	Bleed flow on time	s	
5	Bleed flow off time	s	
6	Purge flow on time	s	
7	Gas tubing change purge on time	s	
8	Non-pulsed flow	mL/min	The flow rate if non-pulsed flow ²⁷ mode is used.

Calibration offsets group			
Modbus PDU address	Parameter	Units	Notes
20	Calibration offsets marker	NA	
21	Offset temperature top left	10^{-2} °C	
22	Offset temperature top right	10^{-2} °C	
23	Offset temperature bottom left	10^{-2} °C	
24	Offset temperature bottom right	10^{-2} °C	
25	Offset temperature centre chamber	10^{-2} °C	
26	Low flow nominal	10^{-1} mL/min	
27	Offset low flow	10^{-1} mL/min	
28	Mid flow nominal	10^{-1} mL/min	
29	Offset mid flow	10^{-1} mL/min	
30	High flow nominal	10^{-1} mL/min	
31	Offset high flow	10^{-1} mL/min	

System calibration offsets group			
Modbus PDU address	Parameter	Units	Notes
40	System calibration offsets marker	NA	
41	Mains good threshold	raw adc value	
42	Battery good threshold	raw adc value	

PID coefficients group			
Modbus PDU address	Parameter	Units	Notes
50	PID coefficients marker	NA	
51, 52, 53, 54	temp top left KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	
55, 56, 57, 58	temp top right KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	
59, 60, 61, 62	temp bottom left KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	
63, 64, 65, 66	temp bottom right KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	
67, 68, 69, 70	temp centre chamber KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	
71, 72, 73, 74	flow standard KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	
75, 76, 77, 78	flow purge KP, KI, KD, Type	10 ⁻² %/°C 10 ⁻² %/[°C.s] 10 ⁻² %/[°C/s] NA	

Security group			
Modbus PDU address	Parameter	Units	Notes
90	Security group marker	NA	Not accessible externally
91	Password hi	NA	Not accessible externally
92	Password low	NA	Not accessible externally
93	Read - write control	NA	Not accessible externally

Set-point manager group			
Modbus PDU address	Parameter	Units	Notes
100	Set-point group marker		
101	Offset top temperatures	10 ⁻² °C	
102	Offset bottom temperatures	10 ⁻² °C	
103	Offset centre chamber temperature	10 ⁻² °C	
104	Bleed flow rate low	10 ⁻¹ mL/min	
105	Bleed flow rate high	10 ⁻¹ mL/min	
106	Purge flow rate	10 ⁻¹ mL/min	
107	Alarm error chamber temperature	10 ⁻² °C	
108	Alarm error centre chamber temperature	10 ⁻² °C	
109	Alarm error flow bleed flow rate	10 ⁻¹ mL/min	
110	Alarm error purge flow rate	10 ⁻¹ mL/min	

Set-point manager group			
Modbus PDU address	Parameter	Units	Notes
111	Alarm acknowledge suppression	s	Repeat alarms are suppressed for this period once acknowledged at the front panel.
112	Alarm set-point suppression	s	Flow rate alarms are suppressed for this period following a set point change.
113	Alarm expectation delay	s	Temperature alarms are expected for this period after a set-point change.
114	Auto flow calibration period	s	Time between flow calibrations.
115	Auto flow calibration duration	s	Time that the flow should be switched off for a calibration
116	Suppress power fail	s	Minimum duration of a power failure to be flagged as an alarm.
117	External alarm delay	s	Period that an alarm has to have remained unacknowledged before the external alarm is triggered.
118	Alarm hold-off time	s	Period for which an alarm condition must be present before an alarm is indicated.
119	Fan off time	s	The cooling fan is normally run at 100% duty but in cold ambient temperatures the fan may be switched to a lower duty cycle defined by the Fan off time and Fan on time registers.
120	Fan on time	s	See Fan off time.

UI group			
Modbus PDU address	Parameter	Units	Notes
130	UI group marker	NA	
131	Standby mode	NA	0 = normal 1 = Standby mode
132	Unexpected reset	NA	0 = normal 1 = unexpected reset to report on next restart
133	Table version	NA	Defines the version of the modbus register map.

Diagnostics limits group			
Modbus PDU address	Parameter	Units	Notes
150	Diagnostics limit marker	NA	
151, 152	Temp minimum Hi, Lo	raw adc value	
153, 154	Temp maximum Hi, Lo	raw adc value	
155, 156	Flow minimum Hi, Lo	raw adc value	
157, 158	Flow maximum Hi, Lo	raw adc value	
159, 160	Reference minimum Hi, Lo	raw adc value	
161, 162	Reference minimum Hi, Lo	raw adc value	
163	Temperature delta	raw adc value	
164	Flow deltat	raw adc value	
165	Reference deltat	raw adc value	
166	Weight old reading	NA	
167	Weight new reading	NA	

Hidden group			
Modbus PDU address	Parameter	Units	Notes
200	Volatile memory marker	NA	

PID information group			
Modbus PDU address	Parameter	Units	Notes
201	PID information marker	NA	
202	Input counter	NA	Incremented on every update of the data
203	Purging	NA	0 if not purging, 1 when purge on
204	Consolidated alarm	NA	bit sensitive value for alarms. See Consolidated alarm. ⁷⁰
205, 206, 207, 208, 209	Temp top left SP, PV, CO, PV_MIN, PV_MAX	10 ⁻² °C, 10 ⁻² °C, 10 ⁻² %, 10 ⁻² °C, 10 ⁻² °C	
210, 211, 212, 213, 214	Temp top right SP, PV, CO, PV_MIN, PV_MAX	10 ⁻² °C, 10 ⁻² °C, 10 ⁻² %, 10 ⁻² °C, 10 ⁻² °C	
215, 216, 217, 218, 219	Temp bottom left SP, PV, CO, PV_MIN, PV_MAX	10 ⁻² °C, 10 ⁻² °C, 10 ⁻² %, 10 ⁻² °C, 10 ⁻² °C	
220, 221, 222, 223, 224	Temp bottom right SP, PV, CO, PV_MIN, PV_MAX	10 ⁻² °C, 10 ⁻² °C, 10 ⁻² %, 10 ⁻² °C, 10 ⁻² °C	
225, 226, 227, 228, 229	Temp centre chamber SP, PV, CO, PV_MIN, PV_MAX	10 ⁻² °C, 10 ⁻² °C, 10 ⁻² %, 10 ⁻² °C, 10 ⁻² °C	
230, 231, 232, 233, 234	Flow bleed SP, PV, CO, PV_MIN, PV_MAX	10 ⁻¹ mL/min, 10 ⁻¹ mL/min, 10 ⁻² %, 10 ⁻¹ mL/min, 10 ⁻¹ mL/min	

PID information group			
Modbus PDU address	Parameter	Units	Notes
235, 236, 237, 238, 239	Flow purge SP, PV, CO, PV_MIN, PV_MAX	10 ⁻¹ mL/min, 10 ⁻¹ mL/min, 10 ⁻² %, 10 ⁻¹ mL/min, 10 ⁻¹ mL/min	

Diagnostics data group			
Modbus PDU address	Parameter	Units	Notes
250	Diagnostics data group marker	NA	
251, 252	ADC top left Hi. Lo	raw adc value	
253, 254	ADC bottom left 1 Hi. Lo	raw adc value	
255, 256	ADC bottom left 2 Hi. Lo	raw adc value	
257, 258	ADC top right Hi. Lo	raw adc value	
259, 260	ADC bottom right 1 Hi. Lo	raw adc value	
261, 262	ADC bottom right 2 Hi. Lo	raw adc value	
263, 264	ADC centre chamber Hi. Lo	raw adc value	
265, 266	ADC mass flow Hi, Lo	raw adc value	
267, 268	ADC reference Hi, Lo	raw adc value	

269	Error counter	raw adc value	
270	Error counter top left		
271	Error counter bottom left 1		
272	Error counter bottom left 2		
273	Error counter top right		
274	Error counter bottom right 1		
275	Error counter bottom right 2		
276	Error counter centre chamber		
277	Error counter mass flow		
278	Error counter reference		
279	version point		
280	version minor		
281	version major		
282	firmware id code		

5.3.9.1.1.1 Consolidated alarm

The consolidated alarm provides a single value that can be used to trigger alarms in other monitoring applications. This value simplifies alarm notifications in the monitoring application as it removes the necessity to add alarm thresholds for all of the available parameters. The value is bit sensitive and provides an increasing value depending on the current alarm status.

Bit							
7	6	5	4	3	2	1	0
Right Red Flashing	Left Red Flashing	Right Red	Left Red	Right Amber	Left Amber	Right Green	Left Green

In most situations the value would be used to trigger an alarm in the monitoring application when either of the status indicators is red or red and flashing. These conditions are summarised below.

Condition for which alarm is required in the monitoring application	Normal value in the monitoring application	Alarm condition in the monitoring application
Alarm required whenever a red lamp is showing on the incubator	0 to 12	> 12
Alarm required whenever a red flashing lamp is showing on the incubator	0 to 48	> 48

5.3.9.1.2 Allowing network write access

In normal operation the [Modbus registers](#) ^[59] can only be read via the network. If it is necessary to modify any parameters via the Ethernet interface, the INC-A20 Incubator must first be placed into read/write mode.

From the main menu, use the cursor keys to highlight the **Modbus mode** option.

```
<Modbus mode>
  v 37.1  37.1 C
```

Then press the **Enter** key.

You will then need to enter your password.

If your password is correct the Modbus options will be displayed.

```
Select group to adjust
<Network read only>
```

Use the cursor keys to select the required option of either **Network read only** or **Network read/write** and press **Enter** to save your selection.

5.3.10 Fuses

Precautions

- Fuses should only be replaced by suitably trained service personnel.
- For continued protection against electric shock, fuses must only be replaced with fuses of the same type and rating.
- Fuses should only be replaced after the cause of the original failure has been determined and corrected as appropriate.

Fuse location	Fuse type
F1 and F2 in mains inlet	T 3.15A L 250V 5 x 20 mm

5.4 Safety declaration form

5.4.1 Safety Declaration

For the inspection, maintenance or repair of laboratory equipment to be performed by Planer plc personnel. The Health and Safety at Work Act (1974) and the Control of Substances Hazardous to Health (COSHH) regulations (1998) include specific requirements that workers are not put at risk by handling items that may be contaminated, for example, as a result of their use in health care or a laboratory. The requirements apply in the widest possible sense and place responsibility on the owner and the manager of the laboratory as well as the employer of the individual concerned.

In the case of maintenance or repair of laboratory equipment current DHSS recommendations support the issue of a certificate/statement of decontamination prior to submitting the equipment for servicing. The [Declaration of Contamination Status](#) ⁽⁷³⁾ sheet must be completed, signed by a competent authority and returned to Planer plc before the service engineer arrives at the laboratory, (or before equipment is received at the factory when returning for repair).

A second copy of the declaration, duly completed and signed, should be affixed to the equipment to be serviced. For emergency repairs on site the engineer will request that the declaration is completed on his arrival at the laboratory. It is our policy that unless the above actions are taken the service engineer must refuse to perform maintenance or repair work. In this event a charge will be made to cover the costs of the visit. Such charges are not included in an existing preventative maintenance contract.

5.4.1.1 Declaration of Contamination Status

Prior to the Inspection, Servicing, Repair or Return of Medical and Laboratory Equipment

To: Planer plc. 110 Windmill Rd., Sunbury, Middlesex, TW16 7HD	Make and Description of Equipment:
	Serial No:
Authority's Reference or Order Number:	Planer's Service Order or Returns Authorisation Reference.

Tick box A if applicable. Otherwise complete all parts of B, providing further information as requested or appropriate.

A <input type="checkbox"/>	This equipment/item has not been used in any invasive procedure or been in contact with blood, other body fluids, respired gases, pathological samples or substances hazardous to health. It has been cleaned in preparation for inspection, servicing, repair or transportation.
B	<p>1. Has this equipment/item been exposed internally or externally to hazardous materials as indicated below ? Provide further details here: YES/NO Blood, body fluids, respired gases, pathological samples. YES/NO Other biohazards. YES/NO Chemicals or substances hazardous to health. YES/NO Other hazards.</p>
	<p>2. Has this equipment/item been cleaned and decontaminated? YES/NO Indicate the methods and materials used.</p> <p>If the equipment/item could not be decontaminated, please indicate why. Such equipment must not be returned/presented without the prior agreement of the recipient whose reference or contact name must be given above.</p>
	<p>3. Has the equipment/item been suitably prepared to ensure safe handling/transportation. YES/NO</p>

I declare that I have taken all reasonable steps to ensure the accuracy of the above information in accordance with HSG(93)26.

Authorised signature:	Unit:
Name (printed):	Department:
Position:	Tel. No.
Date:	Fax No.

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