Installation, Operation & Maintenance Instructions

250°C Laboratory Fan Ovens – Apex Range
models AX30, AX60 & AX120

This manual is for the guidance of operators of the above Carbolite products and should be read before the oven is connected to the electricity supply.

CONTENTS

This manual should supply all the information required for safe and trouble-free oven operation. Information on controller operation is included.

INTRODUCTION

1.1 The APEX range

The Apex range of fan ovens comprises three models, of 30, 60 & 120 litres chamber capacity, known as models AX30, AX60 and AX120

Temperature control is by an easy-to-operate digital unit. The oven temperature range is from 40°C 250°C. The minimum temperature may be higher if the ambient temperature is above 30°C. Heat up times to 250°C without load and on a 240V supply are approximately 25 minutes; with load or at lower voltages these times are increased.

A matching digital timer is available to order, or may be retro-fitted*. A second option is a hydraulic thermostat overtemperature control device. Without the overtemperature device the ovens conform to BS 2648; with the device they also conform to DIN 12-880 class 2. There is also the option of a locking handle.

** AX120 at 110-120V – please enquire*

Temperature accuracy is enhanced by the use of a platinum resistance thermometer as the temperature control sensor. A simple air-flow adjustment may be made by movement of a sliding vent control mounted at the back of the oven. Typical air-flow with the vent open is 1850 litres/hour at 100°C, giving exchanges in chamber volumes per hour of 65 (AX30), 28 (AX60) or 14 (AX120).

The door is hinged on the left for easy loading and unloading of work.

1.2 Voltage

These models must be ordered correctly to match the supply voltage. The voltage alternatives are:

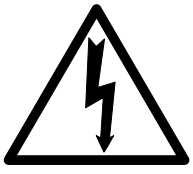
- Single phase 220V-240V
- Single phase 110V-120V

1.3 Switches and Lights

When the oven is connected to the electrical supply the light in the instrument switch glows.

When the instrument switch is on the controller is illuminated.

1.4 Warning Symbols



DANGER of electrical shock– read any warning printed by this symbol.

DANGER – hot surface. Read any warning printed by this symbol.

WARNING: all surfaces of an oven may be hot.

DANGER – read any warning printed by this symbol.

2.0

INSTALLATION

2.1 Unpacking & Handling

Remove the shelves, runners and hangers from the packaging before installing the equipment.

Lift the unit by its base. The door should not be used to support the equipment when moving it. Use two people to carry the oven where possible. Remove any packing material from the inner chamber before use.

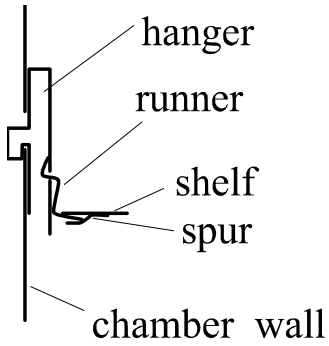
2.2 Siting & Setting Up

Place the oven on a level surface. If the overtemperature protection option is not fitted, ensure that the unit can be directly observed.

Ensure that there is at least 50mm of free space behind the oven and 25mm at the sides. There are vents in the back that must not be obstructed.

Ensure that the oven is placed in such a way that it can be quickly switched off or disconnected from the electrical supply - see below.

The two shelf hangers should be fitted into the slots provide on the left hand side of the chamber. The vertical parts of the runners should be inserted into the holes in the hangers (on the left) or the fan cover (on the right), front and back simultaneously; the runner should then be rotated in a downwards direction to secure it in place. The shelves slide onto the runners such that the spurs on the lower side of the shelf are under the runner at the back, preventing the shelf from tilting forwards when partially withdrawn.



Plan to use the shelves, not the oven floor (see section 3.6).

2.3 Electrical Connections

Connection by a qualified electrician is recommended.

The Apex ovens are made only for single phase A.C. supply, which may be Live to Neutral non-reversible (polarised), Live to Neutral reversible (non-polarised) or Live to Live. Check the oven rating label before connection. The supply voltage should agree with the voltage on the label, and the supply capacity should be sufficient for the amperage on the label.

The supply should be fused at the next size equal to or higher than the amperage on the label. The fuse ratings are given in section 7.3 of this manual. Internal supply fuses are fitted in these models, but customer fusing is also recommended.

The oven is fitted with a supply cable. This may be fitted with a line plug or wired directly to an isolator. Ensure that the unit can be quickly disconnected from the supply.

The supply MUST incorporate an earth (ground).

CONNECTION DETAILS			***supply type***	
Supply	**Terminal label**	**Cable colour**	*Live-Neutral*	*Reversible or Live-Live*
1-phase	L	Brown	To live	to either power conductor
	N	Blue	To neutral	to the other power conductor
	PE	Green/Yellow	To earth (ground)	to earth (ground)

3.0

OPERATION

3.1 Operating Cycle

The oven is fitted with a combined Supply light and Instrument switch. The light (green) is on whenever the oven is connected to the supply. The switch cuts off power to the control circuit.

The oven has fan-assisted circulation; the fan is on when the instrument switch is on.

Connect the oven to the electrical supply. The Supply light should glow.

Operate the instrument switch to activate the temperature controller; the **O** position is *off*, the **I** position *on*.

If no process timer is fitter, the controller becomes illuminated and goes through a short test cycle. If a timer is fitted, the controller may not become illuminated when the oven is switched on – to start the controller, press the Start/Stop button on the timer once (see section 3.3).

Adjust the temperature controller - see section 3.2.

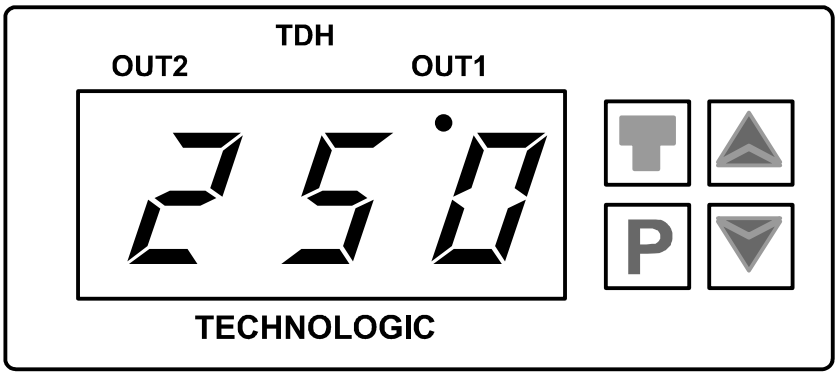
Process timer option. See section 3.3 for timer setting and operation.

Overtemperature option. If the hydraulic thermostat overtemperature option is fitted, set the rotary dial to the desired protection temperature.

Unless a process timer is fitted, and is off, the oven starts to heat up according to the controller set point.

To switch the oven off, set the Instrument switch to **O**. If the oven is to be left off, isolate it from the electrical supply.

3.2 Controller Operation



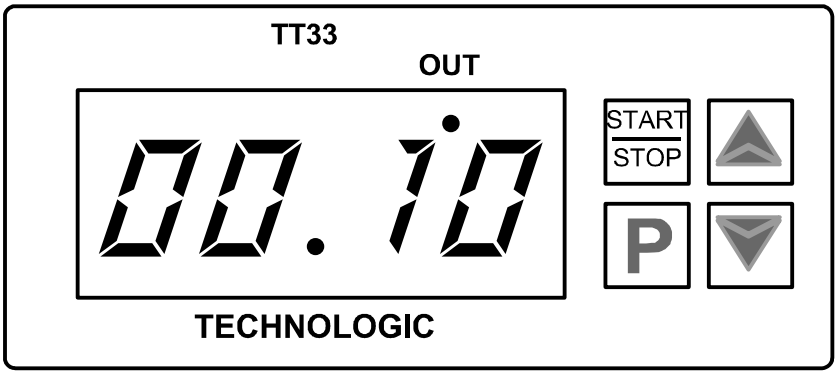
When switched on, the controller lights up, goes through a short test routine, and then displays the measured temperature and starts to control. The output light OUT1 indicates when heating is occurring.

To alter the setpoint, press the **P** key once. Then use the up and down arrow keys to adjust the setpoint.

If the **P** key is pressed a second time, the unused setpoint 2 is displayed. This is not adjustable, or, if adjustable, has no effect.

A third press of the **P** key returns the display to the current measured temperature. Alternatively, wait 5 seconds and the display returns automatically.

3.3 Process Timer (if fitted)



To set a process time:

Press the **P** key. The OUT light flashes. Use the arrow keys to adjust the process time, which is in hours and minutes (hr.mn). After 5 seconds without key pressed the display returns to normal.

If a process time of zero is set then the timer is disabled and the controller operates as though the timer is not present.

To start the timer:

Press the START/STOP key once. Timing starts. The lower light (between hr and mn) flashes while timing is in progress, and the display counts down (at the end of each minute).

At the end of timing the OUT light comes on continuously and power to the temperature controller is cut off.

To reset the timer after timing has finished:

Press the START/STOP key once. The timer is now idle: it is not stopping the oven from heating, nor is it timing.

Power is only supplied to the temperature controller when the timer is reset or is timing.

To stop the timer during timing:

A press of START/STOP during counting down stops the timer. Control remains with the temperature controller.

It is not possible to resume timing from where it stopped: the next press START/STOP resets the timer.

3.4 Overtemperature Control (if fitted)

The hydraulic thermostat overtemperature controller should typically be set at 15°C above the main controller. If an overtemperature condition occurs, always investigate the possibility that the main control system has failed.

An overtemperature condition always cuts off power to the heating elements. To reset the condition, first either allow the oven to cool, or increase the overtemperature setting.

If the overtemperature trip operates then a click occurs and a warning light near the thermostat lights up; the reset button on the thermostat pops out. The reset button is hidden behind the control dial: to reset the oven it is necessary to turn the thermostat dial till the hole lines up with the reset button and press it using a small diameter rod.

3.5

The Oven Door and Chamber

It is recommended that the instrument switch is turned off if the oven door is to be opened when the temperature is below 120°C. If the door is opened when on, and the temperature is below about 120°C, the temperature overshoots.

Also, remember that the fan is on when the instrument switch is on. Opening the door does not switch off the fan.

The tip of the temperature sensor is visible on the right of the chamber, below the fan. It is not electrically live, but it is delicate and should not be touched.

3.6 Loading and Unloading the Chamber

Where accurate temperature control of the load is important, use the central part of the chamber and distribute the load to allow free air circulation. Do not place loads on the chamber floor: use the bottom shelf.

Remember that the shelves and work pieces may be hot: use suitable gloves or other handling equipment. Have a heat-resistant surface available on which to place hot materials.

There is no physical stop to prevent shelf removal: take care not to pull out a shelf accidentally.

Additional shelves may be obtained from Carbolite. The maximum load for each shelf is 10kg.

The maximum number of shelves and the maximum load for the oven depends on the model:

model	maximum number of shelves	maximunm load per shelf	maximum load for oven
AX30	4	10kg	20kg
AX60	6	10kg	30kg
AX120	8	10kg	40kg

3.7 Vents

On the back of the unit are two vents, covered by a sliding baffle plate. The inlet vent is permanently open, while the outlet may be opened or closed by means of the sliding plate.

The sliding plate gets hot. Do not touch it when the oven is hot. Make adjustments when the oven is cold.

3.8 Explosive Vapours

These models are not suitable for drying or heat treatment applications where vapours are released that are combustible or that can form explosive mixtures with air. Carbolite manufactures other models suitable for these applications.

4.0

MAINTENANCE

4.1 General Maintenance

No routine maintenance is required other than the occasional replacement of consumable items.

The oven outer surface may be cleaned with a damp cloth. Do not allow water to enter the interior of the case. Do not clean with organic solvents.

The fan motor is sealed for life; no lubrication is required.

4.2 Calibration

After prolonged use the controller and/or the temperature sensor could require recalibration. This would be important for processes that require accurate temperature readings. A quick check using an independent sensor and temperature indicator should be made from time to time to determine whether full calibration is required.

For a quick check of the temperature shown by the control sensor and oven controller, a portable temperature indicator and probe sensor may be used. Carbolite can supply these items.

If the process requires accurate temperature display it is possible to calibrate the controller by entering a single temperature offset value as follows:

- Hold the **P** key down for a few seconds while switching on the oven with the intrument switch
- Scroll down or up through the parameter list using the arrow keys until CAL is displayed (do not alter any other parameters!)
- Hold the **P** key down and use the arrow keys to adjust the offset value. If the controller has been showing a lower value than the actual temperature, the offset should be made positive or increased; if it has been showing a higher one, the offset should be made negative or decreased.

4.3 After Sales Service

Carbolite's service division (Thermal Engineering Services) has a team of Service Engineers capable of repair, calibration and preventive maintenance of furnace and oven products at customers' premises throughout the world. We also sell spares by mail order. A telephone call or fax often enables a fault to be diagnosed and the necessary spare part despatched.

Each oven has its own record card at Carbolite. In all correspondence please quote the serial number, model type and voltage given on the rating label of the oven. The serial number and model type are also given on the front of this booklet when supplied with a oven.

To contact Thermal Engineering Services or Carbolite see the back page of this manual.

4.4 Recommended Spares Kits

Carbolite can supply individual spares, or a kit of the items most likely to be required. Ordering a kit in advance can save time in the event of a breakdown. Each kit comprises a control sensor, a solid state relay, an instrument switch, an element or set of elements, a door seal, and a fan kit (fan and motor assembly). Individual spares are also available.

When ordering spares please quote the model details as requested above.

4.5 Retrofit Kits

Kits for process timer, overtemperature (hydraulic thermostat) and locking handle are available. Instructions for fitting these are supplied with the kits (MS14).

5.0

REPAIRS & REPLACEMENTS

5.1 Safety Warning – Disconnection from Supply

Always ensure that the oven is disconnected from the supply before repair work is carried out.

5.2 Safety Warning - Refractory Fibrous Insulation

This oven contains refractory fibres in its thermal insulation. These materials may be in the form of fibre blanket or felt, vacuum formed board or shapes, mineral wool slab or loose fill fibre.

Normal use of the oven does not result in any significant level of airborne dust from these materials, but much higher levels may be encountered during maintenance or repair.

Whilst there is no evidence of any long term health hazards, we strongly recommend that safety precautions are taken whenever the materials are handled.

Exposure to dust from fibre that has been used at high temperatures may cause respiratory disease.

When handling fibre always use an approved mask, eye protection, gloves and long sleeved clothing.

Avoid breaking up waste material. Dispose of waste fibre in sealed containers.

After handling rinse exposed skin with water before washing gently with soap (not detergent). Wash work clothing separately.

Before commencing any major repairs we recommend reference to the European Ceramic Fibre Industry Association Bulletin No. 11 and the UK Health and Safety Executive Guidance Note EH46.

We can provide further information on request. Alternatively our service division can quote for any repairs to be carried out at your premises or ours.

5.3 Panel Removal

Disconnect the oven from the electrical supply.

Side Cover. The complete right-hand side cover may be removed. Remove the screws at the back that fasten the side cover to the rest of the casing. Push the section backwards a few mm only, then ease it sideways (to the right) off the main case. Disconnect the earth (ground) wire.

When reassembling take time and care in locating the tabs on the right of the front control panel into the matching slots in the side cover. Remember to reconnect the earth wire.

Internal Element Cover. Open the door. Slacken the screw holding the internal side cover. Pull the cover forward a few mm and lift it off to the left.

5.4 Temperature Controller or Process Timer Replacement

Disconnect the oven from the supply and remove the side cover (see 5.3).

Make a note of all the wiring connections and disconnect the wires.

Loosen the screw that holds the controller body clamp in place. Use a flat screwdriver or similar object to ease apart the two plastic lugs on the side of the clamp, and pull the instrument forward out of the front control panel.

Reconnect the wires according to the notes made – or see section 7.0 for wiring details.

5.5

Hydraulic Thermostat Replacement

Disconnect the oven from the supply and remove the side cover (see 5.3). Also remove the internal element cover.

Pull off the knob from the thermostat. Remove the fixing screws. Disconnect any fixing clips or screws inside the oven chamber, and ease out the capillary tube. Remove the thermostat.

Replace by reversal of the procedure.

5.6 Control Sensor Replacement

Disconnect the oven from the supply and remove the side cover (see 5.3). Also remove the internal element cover.

Make a note of the connections to the temperature controller. Disconnect them.

Disconnect any fixing clips or screws inside the oven chamber, and remove the sensor.

Re-assemble with the new sensor. Take care not to damage the head by rough handling. In the case of the platinum resistance thermometer the wires may be connected to the correct controller terminals either way round.

Check that the oven is controlling properly, to ensure that the original fault was with the temperature sensor.

5.7 Solid-state Relay Replacement

Remove the control panel as given above. Make a note how the wires are connected to the solid state relay, and disconnect them.

Remove the solid state relay from the mounting surface.

Replace and reconnect the solid state relay ensuring that the heat-conducting thermal pad is sandwiched between the relay and the mounting surface. Alternatively a thin layer of white, heat-conducting silicon paste may be applied between the new relay and the plate.

Replace the removed panel.

5.8 Element Replacement

Disconnect the oven from the supply and remove the side cover (see 5.3). Also remove the internal element cover. The element terminals are low down in the side compartment.

Disconnect the wires from the element terminals. Remove any starlock washers – these may need to be cut with wire cutters. Remove any clips holding the element inside the chamber, and withdraw the element.

Reverse the procedure with the new element.

Run the oven at a low temperature and check that it is controlling properly, to find out whether the element failure was caused by a fault in the control circuit.

5.9 Fuse Replacement

Disconnect the oven from the supply and remove the side cover (see 5.3).

Supply fuses and control circuit fuses are mounted on the EMC filter circuit board. The shorter fuses are the control circuit fuses. The fuses are marked with their ratings.

Take care not to disconnect the wires leading from the EMC filter without first recording their positions: they must be reconnected to the correct terminals.

6.0

FAULT ANALYSIS

A. Oven Does Not Heat Up

1.	The **SUPPLY** light is **OFF**	→	No power from the supply	→ Check the fuses in the supply line
2.	The **SUPPLY** light is **ON**	→	The controller shows **a very high temperature** or a code such as EEE or ---	→ The temperature sensor has broken or has a wiring fault
		→	The controller shows a **low temperature**	→ The SSR could be failing to switch on due to internal failure, faulty logic wiring form the controller, or faulty controller
		→	There are no lights glowing on the controller	→ The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault

B. Oven Overheats

1.	Oven only heats up when the instrument switch is **ON**	→	The controller shows a **very high temperature**	→ The controller is faulty
		→	The controller shows a **low temperature**	→ The temperature sensor may not be positioned in the oven correctly
				→ The controller may be faulty
2.	Oven heats up when the instrument switch is **OFF**	→	The SSR has failed "ON"	→ Check for an accidental wiring fault that could have overloaded the SSR

C. Process Timer

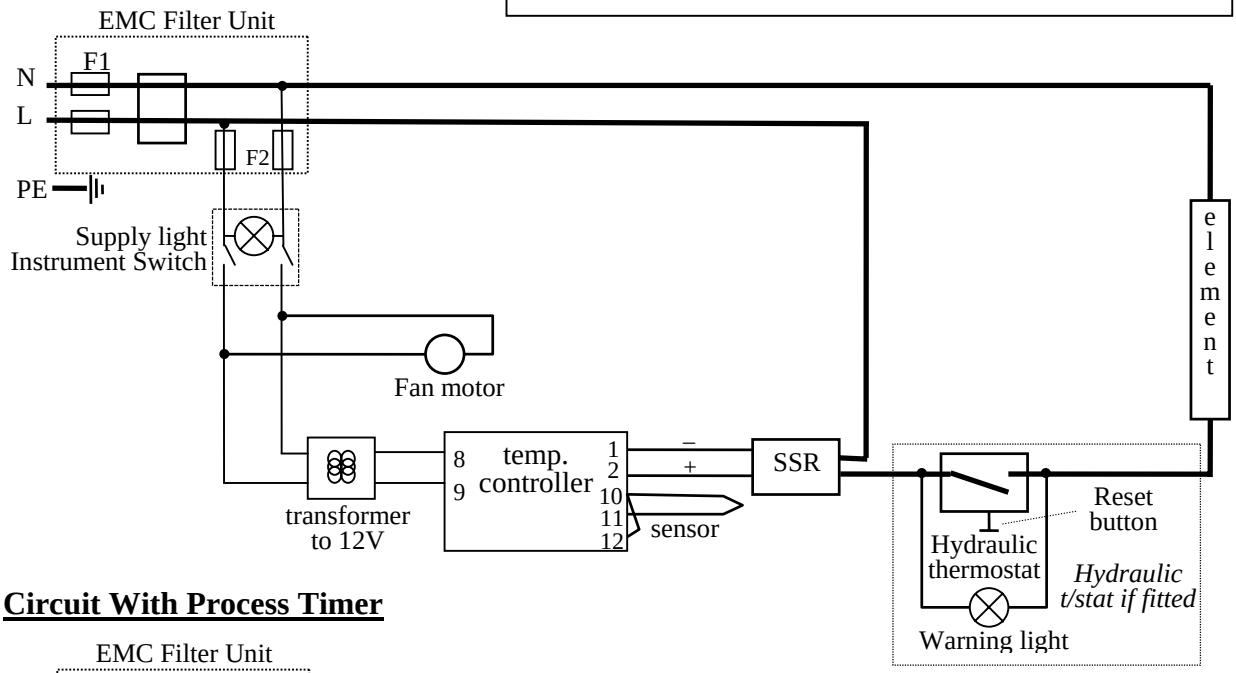
	Oven will not heat	→	Temperature controller does not light up	→ Process timer has not been reset
		→	Resetting the timer has no effect	→ Process timer is faulty (relay stuck open)
	Oven continues to heat at end of process time	→	Process timer OUT light is continuously on	→ Process timer is faulty (relay stuck closed)
		→	OUT light flashing or off	→ not a process timer fault

7.0

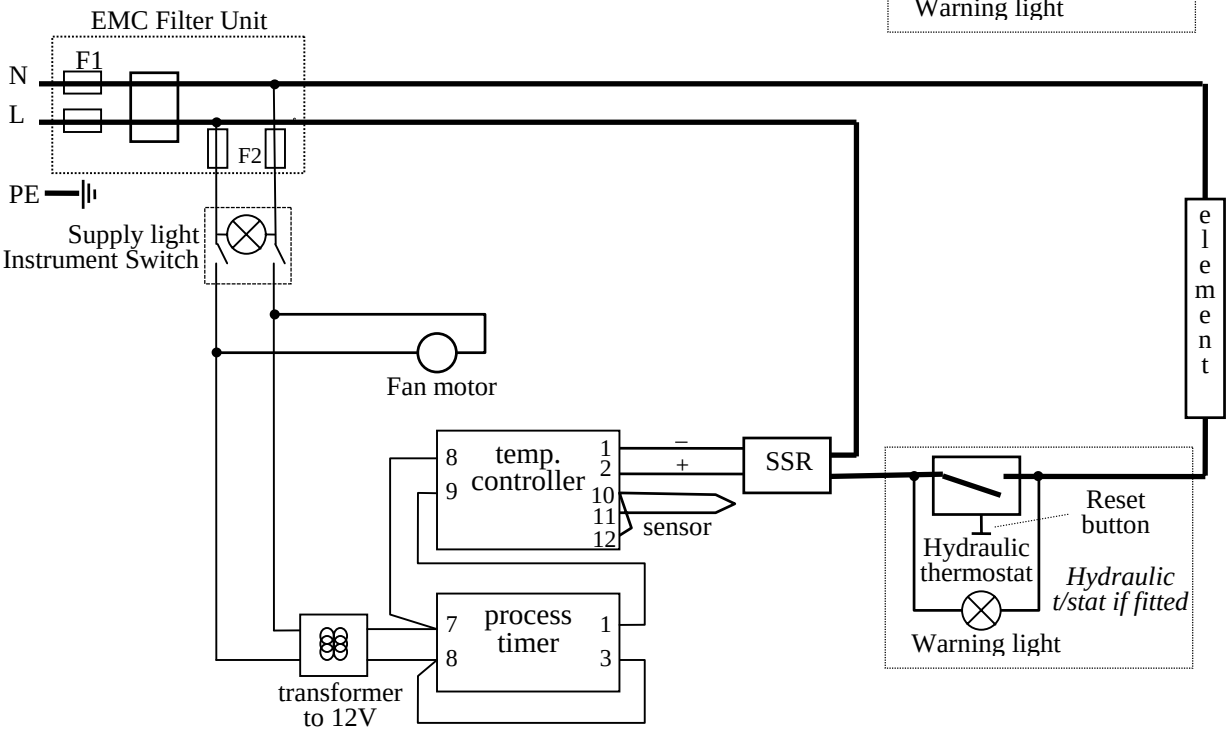
CIRCUIT DIAGRAMS & FUSES

These diagrams do not apply to AX120 at 110-120V. Please enquire if details are required.

7.1 Circuit Without Process Timer



7.2 Circuit With Process Timer



7.3 Fuses

F1	Internal supply fuses	Fitted on EMC filter board.	32mm x 6mm type F
F2	Auxiliary circuit fuses	Fitted on EMC filter board.	20mm x 5mm
	Customer fuses	Recommended.	Same as table.

Model	Volts	Supply Fuse	Volts	Supply Fuse	Control Fuse
AX30	220-240	5A	110-120	10A	2A
AX60	220-240	7A	110-120	12.5A	2A
AX120	220-240	10A	110-120	20A	2A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Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

UK Office
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