



# Stand-Alone Electric Heater Units

## Type EL-UK

## General information

### About this manual

This operating and installation manual enables operating or service personnel to correctly install the stand-alone electric heater unit and to use it safely and efficiently.

This manual is intended for use by fitting and installation companies, in-house technicians, technical staff, properly trained persons, and qualified electricians or air conditioning technicians.

It is essential that these individuals read and fully understand this manual before starting any work. The basic prerequisite for safe working is to comply with the safety notes and all instructions in this manual.

The local regulations for health and safety at work and the general safety regulations for the area of application of the unit also apply.

This manual must be given to the system owner when handing over the system. The system owner must include the manual with the system documentation. The manual must be kept in a place that is accessible at all times.

Illustrations in this manual are mainly for information and may differ from the actual design.

### Other applicable documentation

- TROX TVZ technical documentation

### TROX Technical Service

To ensure that your request is processed as quickly as possible, please keep the following information ready:

- Product name
- TROX order number
- Delivery date
- Brief description of the fault

Online	<a href="http://www.troxuk.co.uk">www.troxuk.co.uk</a>
Phone	+44 (0) 1842 754545

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# 1 Unit overview

## Heater element terminal enclosure side

This enclosure houses the heater element electrical connections, and the high temperature cut out.

## Controls enclosure side

This enclosure houses the controls supplied with the unit, such as:

- Fuses
- Site mains connection terminals
- Earth stud
- Thyristor
- Flow sensor
- Safety relay (or contactor)

## Functional description

TROX stand-alone electric heaters are fitted to the supply air ductwork as and where indicated on the Record Drawings usually in conjunction with a TROX circular VAV unit or CAV unit.

VAV terminal boxes control primary air to provide a variable air supply to the occupied zones of the building. For a more detailed description of the terminal boxes refer to TROX literature.

The stand-alone electric heater units are complete with controls including thyristor, fuses and safety interlocks.

A flow sensor is fitted. This switch will de-energize the heating element if the airflow reduces below the minimum required to operate the heater safely (by removing the heat from the element). The duct heater is designed for a minimum velocity of 1.5m/s.

An automatic reset high temperature cut out (HTCO) is fitted. The HTCO will de-energize the heating element if the air temperature inside the duct is too hot to operate the heater safely. A second manual reset high temperature cut-out is wired in series with the automatic HTCO.

The heater is manufactured to European standards and fully factory tested.

The integral air heater has elements designed for black heat operation consisting of nickel chrome wire in a stainless steel tube filled with magnesium oxide insulation. The heater elements are wired into the control enclosure where the earth stud and fuse(s) are supplied.

## Control strategy

Control of the heater is step less control by thyristor responding to an external 0-10Vdc control signal.

The control strategy for the heater must allow a minimum of 10 minutes run on time to allow the heater element to safely cool at the end of the heating cycle. During this time the minimum heating cycle volume must be maintained in the duct for at least 10 minutes after the heater control signal is switched off.

Never remove the airflow whilst the heater battery is running as this will result in excessive ambient temperature inside the heater duct and may trip the high temperature cut outs.

If the HTCO trips due to an error or fault, although it will reset when the unit has cooled down, it is recommended that the cause of the error or fault is investigated and rectified, and that the HTCO is replaced before the heater is put back into service.

## 2 Safety

### 2.1 Safety notes

Symbols are used in this manual to alert readers to areas of potential hazard. Signal words express the degree of the hazard.

Comply with all safety instructions and proceed carefully to avoid accidents, injuries and damage to property.



#### **DANGER!**

Imminently hazardous situation which, if not avoided, will result in death or serious injury.



#### **WARNING!**

Potentially hazardous situation which, if not avoided, may result in death or serious injury.



#### **CAUTION!**

Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

### 2.2 Correct use

Standalone electric heater units are used (in conjunction with TVR units) for the air conditioning of internal spaces such as offices.

- Ventilation
- Heating

The unit is designed for internal installation behind false ceilings or freely suspended from the structural soffit (exposed). The unit has to be properly installed by competent, qualified operatives.

Correct use also involves complying with all the information provided in this manual.

Any use that goes beyond the correct use or any different use of the unit is regarded as incorrect use.

### Incorrect use



#### **WARNING!**

##### **Danger due to incorrect use!**

Incorrect use of the unit can lead to dangerous situations.

Incorrect use includes:

- Any use that is not described in this operating manual
- Operation that does not comply with the technical data
- Modification of the unit by others, tampering with the unit
- Use, installation, operation, maintenance or repair other than described in this manual
- Having work carried out by unqualified individuals
- Use of non-genuine replacement parts or accessories, whose quality and function are not equivalent to those of the original parts
- Operation in rooms with explosive gases or gas mixtures
- Operation in rooms where the supply or extract air contains particles that are conductive, aggressive, corrosive, combustible or hazardous to health
- Operation in rooms where the humidity is permanently high (> 90 %)
- Operation outdoors
- Use for enforced ventilation
- Operation without air filters

### 2.3 Safety signs

The following symbols and signs are found on the unit. They apply to the very location where they are found.

#### **Electrical voltage**



Hazardous electrical voltage is present in the unit. Only skilled qualified electricians are allowed to work on parts of the unit marked with this symbol. Such work must be carried out by skilled qualified electricians only.

### Controls access panel



Only skilled qualified electricians are allowed to open the controls access panel. Ensure that the electrical supply is isolated and verify that no voltage is present on any mains circuit before you open the cover to access the terminal connections.

### Heating element terminal enclosure access panel



Only skilled qualified electricians are allowed to open the heating element terminal enclosure access panel. Ensure that the electrical supply is isolated and verify that no voltage is present on any mains circuit before you open the cover to access the terminal connections.

## 2.4 Electric shock hazard

### **DANGER!**

#### **Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Damaged insulation or parts are a life threatening hazard.

- Only a skilled qualified electrician must work on the electrical systems.
- If the insulation is damaged, disconnect the power supply immediately and have the insulation repaired.
- Isolate the power supply and verify no voltage is present using an approved voltage indicator before carrying out maintenance or cleaning.
- Ensure that live parts do not come into contact with moisture.

## 2.5 Risks caused by an unsuitable installation location

### **WARNING!**

#### **Risks caused by an unsuitable installation location!**

Installing the unit in an unsuitable location can lead to dangerous situations.

- The unit should preferably be installed in a thermally insulated, low-leakage building.
- Frost free and dry installation location.
- Install the unit in a manner to protect the unit from being tampered with by unauthorized individuals.
- The unit must remain accessible for maintenance and cleaning.

## 2.6 Qualified staff

### **Qualification**

The work described in this manual has to be carried out by individuals with the qualification, training, knowledge and experience described below:

#### **Facility manager**

Facility managers are trained individuals who understand any potential hazards related to the work under consideration, and who recognize and avoid any risks involved. Facility managers must not carry out any jobs beyond regular operation unless explicitly stated in this manual and unless the system owner has specifically agreed to them. Training to a facility manager is provided by the HVAC contractor when the system is handed over.

A facility manager's tasks include cleaning the unit, performing functional tests and regular checks, and carrying out maintenance and adjustment work.

#### **HVAC technician**

HVAC technicians are individuals who have sufficient professional or technical training in the field they are working in to enable them to carry out their assigned duties at the level of responsibility allocated to them and in compliance with the relevant guidelines, safety regulations and instructions. HVAC technicians are individuals who have in-depth knowledge and skills related to HVAC systems; they are also responsible for the professional completion of the work under consideration.

HVAC technicians are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to work on HVAC systems, understand any potential hazards related to the work under consideration, and recognize and avoid any risks involved.

## Network administrator

Network administrators design, install, configure and maintain the IT infrastructure in companies or organizations.

## Skilled qualified electrician

Skilled qualified electricians are individuals who have sufficient professional or technical training, knowledge, experience and qualifications to relevant local wiring regulations to enable them to work on electrical systems, understand any potential hazards related to the work under consideration, and recognize and avoid any risks involved.

Any work has to be carried out by individuals who can be expected to carry out their assigned duties reliably. Individuals whose reaction time is delayed due to alcohol, drugs or other medication must not carry out any work.

## 2.7 Personal protective equipment

Personal protective equipment is equipment that protects the user against health or safety risks at work.

Personal protective equipment must be worn for various types of work; the protective equipment required is listed in this manual together with the description of each type of work.

### Description of personal protective equipment:

#### Industrial safety helmet



Industrial safety helmets protect the head from falling objects, suspended loads, and the effects of striking the head against stationary objects.

#### Protective gloves



Protective gloves protect hands from friction, abrasions, punctures, deep cuts, and direct contact with hot surfaces.

#### Safety shoes



Safety shoes protect the feet from crushing, falling parts and prevent slipping on a slippery floor.

## 3 Transport and storage

### Checking delivered goods

Check delivered items immediately after arrival for transport damage and completeness.

If there is any visible damage, proceed as follows:

- Either do not accept the delivered items, or accept them with reservations.
- Note down the damage on the shipping documents or on the shipping company's delivery note.
- Immediately file a complaint with the shipping company and vendor.



*File a complaint as soon as you detect any damage. Claims for compensation can be filed only within the complaint period.*

### Transport

Hazardous electrical voltage that is present in the ventilation unit. Only skilled qualified electricians are allowed to work on parts of the ventilation unit marked with this symbol. Such work must be carried out only by skilled qualified electricians or the technical service.

#### CAUTION!

Danger of injury from sharp edges, sharp corners and thin sheet metal parts!

Sharp edges, sharp corners and thin sheet metal parts may cause cuts or grazes.

- Be careful when carrying out any work.
- Wear protective gloves, safety shoes and a hard hat.

- If possible, take the unit in its transport packaging up to the installation location.
- Use only lifting and transport gear designed for the required load.
- Always secure the load against tipping and falling.
- Do not move bulky items just by yourself. Get help to prevent injuries and damage.



## Storage

Please note:

- Store the unit only in its original packaging
- Protect the unit from the effects of weather
- Protect the unit from humidity, dust and contamination
- Storage temperature: -10 °C to 50 °C.
- Relative humidity: 95 % max., no condensation

## Packaging

Properly dispose of packaging material.

# 4 Installation

## 4.1 General installation information

### Before installation

Before you install the unit, take suitable precautions to protect openings from contamination during installation.

If this is not possible, at least cover the unit or take other precautions to protect it from contamination. In this case you have to ensure that the unit cannot be started.

Ensure that all components are clean before you install them. If necessary, clean them thoroughly. If you have to interrupt the installation procedure, protect all openings from the ingress of dust or moisture.

### Installation information

- Install the ventilation unit preferably in a thermally insulated, low-leakage building.
- Frost free and dry installation location.
- Installation and connections to be performed by others; fixing, connection and sealing material to be provided by others
- Install the unit only on structural elements that can carry the load of the unit.
- Use only certified fixing systems.
- The unit and controls must remain completely accessible for maintenance.

### Installation

- The unit is to be duct mounted.
- Ensure the weight of the unit and accessories are correctly matched to the supports (if any).
- Suspension components for installing the unit are not included in the supply package, but (if required) have to be selected by others and fit for the project specific installation.

## 4.2 Installing the stand-alone heater unit

### Personnel:

- HVAC technician

Remove all packaging from the inlet and outlet connections. Only remove packaging just before connecting the adjacent ductwork.

Before connecting ductwork check for any debris and remove if necessary.

The unit can be installed in the false ceiling or the false floor of the building using the mounting support points on the unit casing. When using other supporting methods please refer to our Technical Department for approval.

All duct connections should be well sealed against air leakage.

Adequate access must be provided to the controls enclosure on the side of the box.

Ensure adjacent duct work has suitable size access panel or similar arrangement for cleaning and maintenance of the heater element and HTCO probe.

Allow minimum of 200mm clearance for the removal of the controls enclosure lid and heater enclosure lid.

## 4.3 Connection to mains

- The duct heater is designed to operate on single phase, or three phase alternating current. See the wiring diagram for the particular heater and the electrical data on the rating plate, placed on the lid of the duct heater.
- The duct heater must be connected to the mains supply with a fixed installed round cable. Appropriate cable glands must be used to retain the electrical protection class. The standard design is IP43. The IP55 design can be manufactured if required, in which case this is specified on the rating plate. The IP55 design is delivered with factory mounted cable glands.
- The duct heater has a built in electronic airflow sensor that ensures that the heating elements will not actuate, unless there is an appropriate airflow through the duct heater. The inlet air must be filtered to reduce the risk of contamination of the airflow sensor.
- An all phase switch must be included in the fixed installation.
- The installation must be carried out by an authorized electrician.

- The heater is S-marked, CE-marked, EMC-marked and designed in accordance with the following standards:

SEMKO 111 FA 1982 / EN 60335-1 / EN 60335-2-30 / EN 61000-6-2/ EN 61000-6-3 / EN 61000-3-11

- The duct heater is equipped with two overheating cut-outs (one of which is manual reset), to prevent overheating when the airflow is too low or in case of a fault in the system.
- A drawing must be attached inside the fuse box or on the wall of the service room. The drawing shows the rating of the duct heater and its location in the building, together with information about the measures to be taken if the overheating cut-outs is activated.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

## 4.4 Fitting

- The heater is designed for insertion into standard spiral ducting and is fixed to the ducting with screws.
- The air must flow through the heater in the direction indicated by the arrow on the side of the connection box.
- The heater can be fitted in either horizontal or vertical ducting. The heater may only be fitted in ducts that are made of incombustible and heat-and-cold resistant material. The connection box can be freely placed facing upwards or sideways to a maximum angle of 90°. Fitting with the connection box facing downwards is NOT allowed.



- The access opening to a room must be equipped with a fixed mesh or an intake air device which makes it impossible to touch the heating elements.
- A warning sign must be attached close to the air outlet, stating that the air outlet must not be covered.
- The distance from (to) the heater to (from) a duct bend, valve, filter, etc., should correspond to at least twice the duct diameter. Otherwise there is a risk that the airflow through the heater will be uneven which can cause activation of the overheating cut-out.  
Example: CV 16 result in a distance of at least 320mm, CV 40 result in a distance of at least 800mm, etc.
- The duct heater may be insulated in accordance with valid regulations for ventilation ducting. However, the insulation must be incombustible. The insulation must not cover the lid, since the rating plate must be visible and the lid must be removable. Furthermore, the insulation must not cover any heatsinks, nor the side of the connection box where the SCR's (Triac's) are mounted.
- The duct heater must be accessible for replacement and inspection.
- The distance from the heater metal casing to any wood or other combustible material must NOT be less than 30mm.
- **The maximum ambient temperature allowed is 30°C.**
- **The maximum output air temperature allowed is 50°C.**



## 4.5 Making electrical connections

### **DANGER!**

Electric shock hazard! Electrical equipment carries a dangerous electrical voltage!

- Only skilled qualified electricians are allowed to work on the electrical system and to connect the unit to the mains.
- Isolate the unit from the mains (all phases) and secure the unit against inadvertently being energized on again.
- Verify that no voltage is present using an approved voltage indicator.
- Carry out assembly or connection jobs only as long as no voltage is present.

### Notes on the electrical installation

Any cables must be designed for the supply voltage for which they will be used. The length and cross section as well as any contact resistance may increase voltage losses. The power rating of each unit must also be considered. A skilled qualified electrician has to select the correct cable types and sizes. This job must only be carried out by specialist electrical companies.

- Electrical connection must comply with any applicable regulations and follow the code of good practice.
- The connection data can be found on the wiring diagrams.
- Protect any connections from physical damage.
- Secure cables entering the electrical enclosures with suitable cable glands.
- If any maintenance jobs have to be carried out, the unit first has to be de-energised and safely isolated (all phases). No voltage must be present.

### Personnel:

- Skilled qualified electrician

### **DANGER!**

Danger of electric shock! Do not touch any live components! Electrical equipment carries a dangerous electrical voltage.

- Only skilled qualified electricians are allowed to work on the electrical system.
- Isolate the power supply before working on any electrical equipment.

Take off the controls enclosure lid; to do so, loosen and remove the M5 pozi screws from the front of the enclosure, then remove the lid.

Connect the unit according to the wiring diagram.

- Refer to TROX wiring diagram within controls enclosure on each unit.
- Use sheathed cable, ensuring the cable is suitably secured and supported (e.g. cable gland). A Ø20mm hole is provided for mains electrical entry to the controls enclosure.
- The unit voltage rating will be specified on the rating label inside the controls enclosure, either:



230Vac, 1ph, 50-60Hz

or



400Vac, 3ph, 50-60Hz

Making electrical connections professionally:

- Check and ensure that the actual supply voltage is as indicated by the unit rating label fixed inside the controls enclosure.
- Ensure that the unit has been correctly earthed.
- Check that the controls enclosure lid is installed and securely fastened.
- The unit and controls must remain completely accessible for maintenance.
- Communications, network and BMS wiring should be separated from power, controls and signal wiring.
- If the units have been stored for more than 3 months, all electrical terminals should be checked and insulation resistance checks must be carried out. Check the insulation resistance of the heating elements is greater than 1MΩ.
- All wiring must comply with local wiring regulations. The factory made internal wiring complies with BS 7671: IET Wiring Regulations.

## 5 Initial commissioning

### Personnel:

- Skilled qualified electrician

### 5.1 Unit inspection

Before initial commissioning:

- Remove protective film, if any.
- Ensure that the unit is clean, and clean if necessary.
- Check and ensure that the actual supply voltage is in accordance with the unit electrical rating label.
- Ensure that the unit has been correctly earthed.

### 5.2 Initial start up



#### CAUTION!

- The unit must not be energised until all initial commissioning checks have been completed satisfactorily.
- Rectification works to correct incomplete initial commissioning checks should be carried out by skilled, qualified operatives.



#### CAUTION!

Once all unit inspection checks have been completed and any issues identified are rectified, the unit must have the minimum airflow flowing before it can be energized.

### 5.3 Control strategy

The control strategy for the heater must allow a minimum of 10 minutes run on time to allow the heater element to safely cool at the end of the heating cycle. During this time the minimum heating cycle volume must be maintained in the duct for at least 10 minutes after the heater control signal is switched off.

**During operation of the heater, the maximum output air temperature must be limited to 50°C.**



#### CAUTION!

Never switch off the unit whilst the heater battery is running as this will result in excessive ambient temperature inside the heater duct and may trip the high temperature cut outs.



#### CAUTION!

If the HTCO trips due to an error or fault, although it will reset when the unit has cooled down, it is recommended that the cause of the error or fault is investigated and rectified, and that the HTCO is replaced before the heater is put back into service.

### 5.4 Troubleshooting

Make sure that the 0-10VDC control signal has the correct wiring polarity.

#### Full heating power but no regulation

- Disconnect the control signal wiring and strap/ short-circuit the control signal input terminals.

If this results in the heating now being turned off, then the fault is in the external control signal.

#### No heating

- Check whether or not the overheating cut-out, with manual reset, has been activated. If it has, then eliminate the fault and reset it. Refer to the paragraph "Overheating" at page 11.
- Verify if the overheating cut-outs have tripped or not using a resistance (ohm) meter.
- Check the heating elements using a resistance (ohm) meter to verify an internal heating element 'break' (open circuit) or short circuit.
- The heating element insulation can be checked using a 'Megger' tester.
- Check there is mains voltage at the heater input terminal blocks. If not, check fuses, interlocking devices etc. in the supply to the unit
- Check the 0-10VDC control signal is correct.
- Check the Pulser/TTC output is working by verifying the red LEDs (one on Pulser, two on TTC) are lit up.
- If the heater doesn't start now, then the fault is in the regulator (Pulser/TTC) printed circuit board PCB.

## 6 Maintenance

### 6.1 Maintenance

 **DANGER!**

**Electric shock hazard! Electrical equipment carries a dangerous electrical voltage!**

- Only skilled qualified electricians are allowed to work on the electrical system and to connect the unit to the mains.
- Isolate the unit from the mains (all phases) and secure the unit against inadvertently being energized again.
- Verify that no voltage is present using an approved voltage indicator.
- Carry out assembly or connection jobs only as long as no voltage is present.

 **CAUTION!**

**Danger of injury from sharp edges, sharp corners and thin sheet metal parts!**

Sharp edges, sharp corners and thin sheet metal parts may cause cuts or grazes.

- Be careful when carrying out any work.
- Wear protective gloves, safety shoes and a hard hat.

 **WARNING!**

- The heating elements inside the duct can reach temperatures exceeding 300°C. **Do not touch the elements.**
- If maintenance of the elements is required, allow a minimum of 10 minutes cooling time to allow the elements to cool down to a safe temperature.

No maintenance is required, except for a periodic functional test.

### 6.2 Overheating

If the overheating cut-out with manual reset has been activated, the following should be observed:

- Only authorized electricians are allowed to remove the lid.
- The mains supply voltage must be switched off and isolated.
- Investigate carefully the reason for activation of the cut-out.
- Investigate whether any changes have been made to the ductwork or installation in accordance with the instructions on page 8.
- When the fault has been eliminated, the cut-out can be reset.

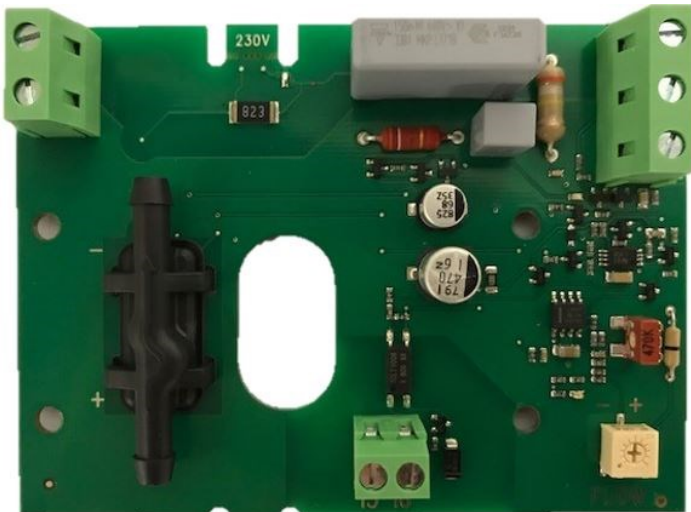
 **WARNING!**

**The PCB is at mains voltage level when the heater is connected to the mains.**

## 7. Operation

- The duct heater has a built-in thyristor control.
- An external 0...10VDC control signal required to be connected directly to the heater terminals. The input impedance for the 0...10V DC is 20kΩ
- The heater has a built in manual reset thermal protection with the reset button placed on the lid.
- A yellow LED indicates that the airflow is below the minimum flow required to safely operate the heater.
- A red LED (1 phase supply), or two red LEDs (3 phase supply), indicate that the heating elements are activated.
- **DO NOT** adjust any of the factory set potentiometers (pots) on the PCB under any circumstances.

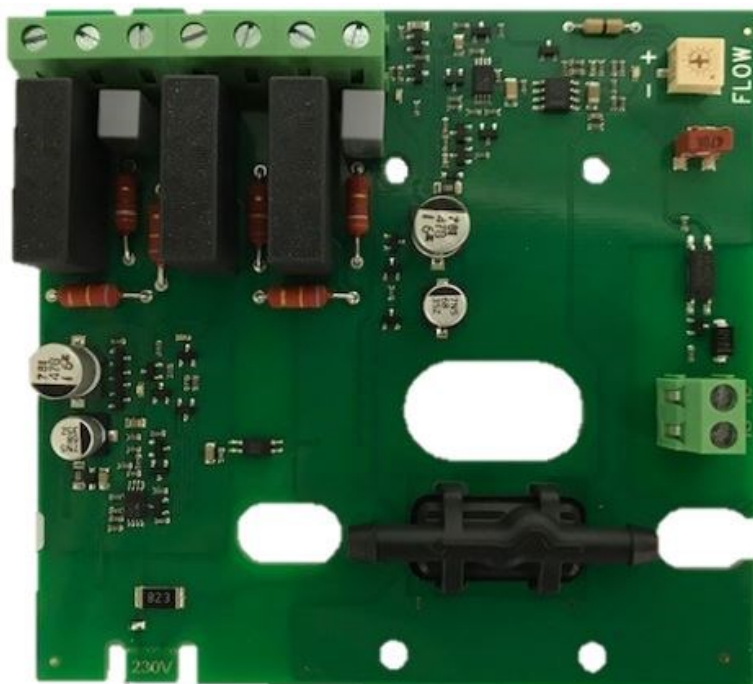
### Single-phase thyristor control - 'Pulser'



**⚠ WARNING!**

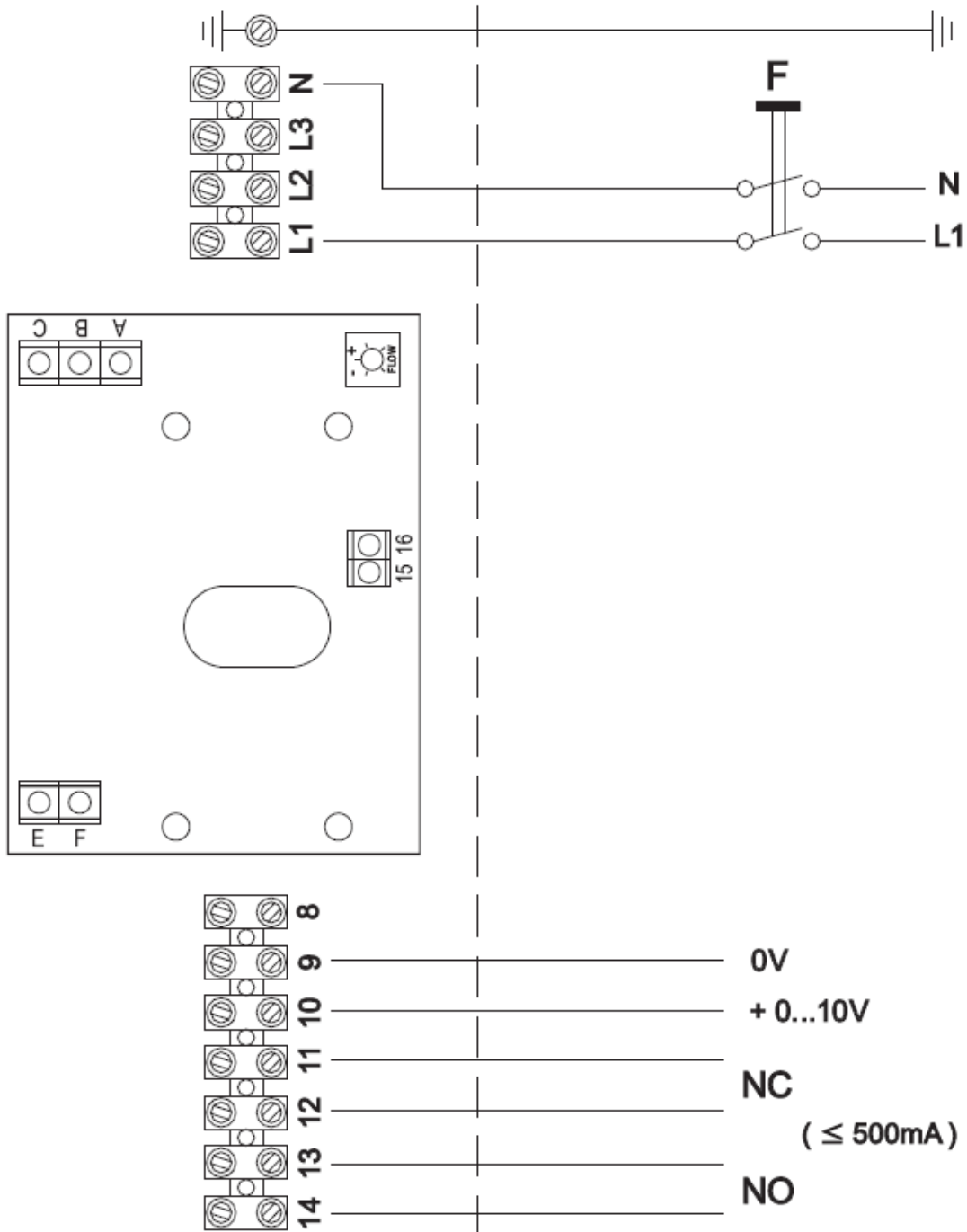
The PCB is at mains voltage level when the heater is connected to the mains.

### 3-phase thyristor control - 'TTC'



## 8. Wiring diagrams

### Single-phase 'Pulser' (230V~)



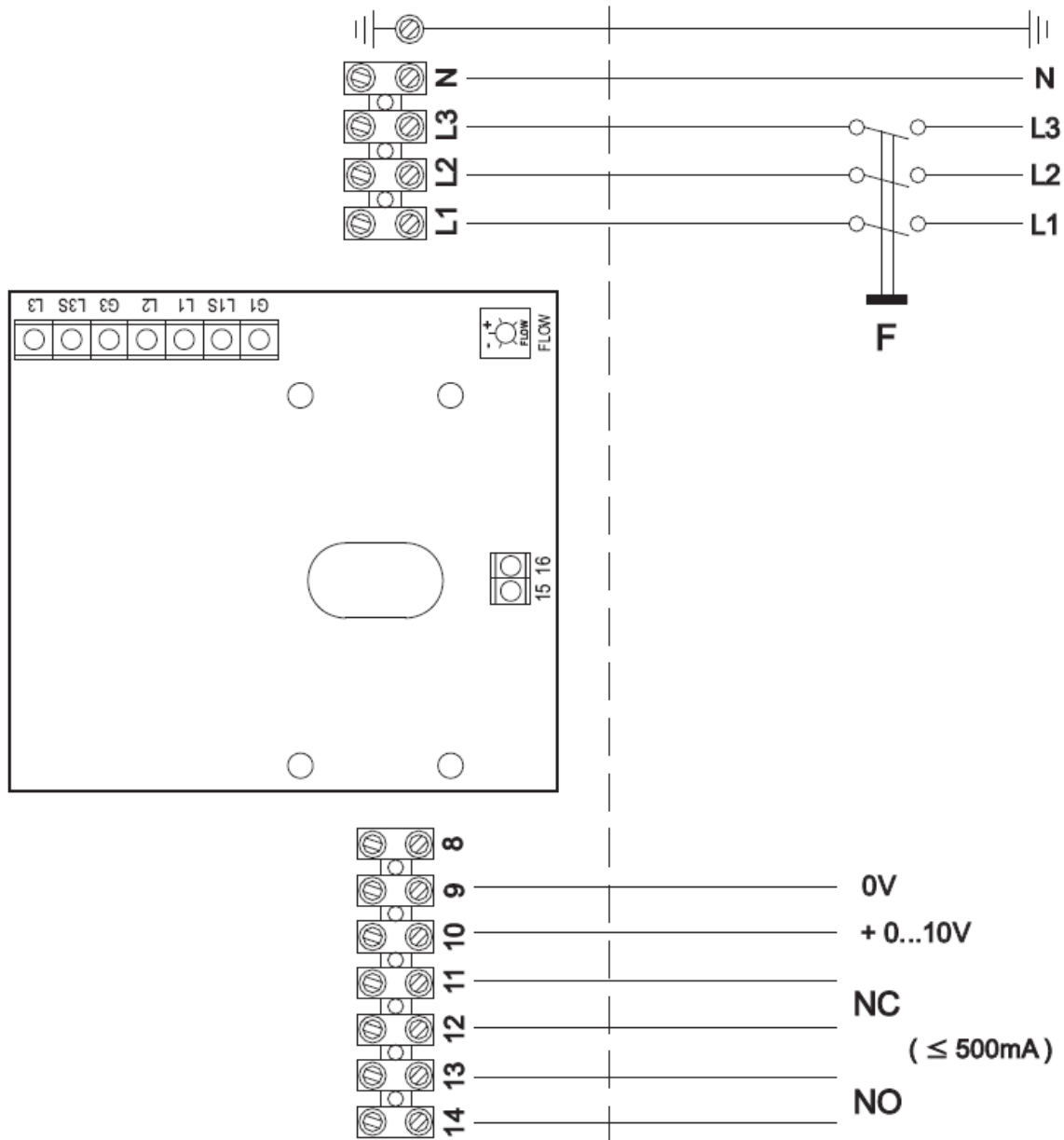
F = Double pole breaker, rated at 10Amps CV10—CV20 types (Ø100—Ø200), or 16Amps for CV25 (Ø250).

NO = Potential-free alarm contact, normally open (5-250VAC)

NC = Potential-free alarm contact, normally closed (5-250VAC)

The alarm relay coil is activated when the supply voltage is applied to the heater. The alarm relay coil is then deactivated when the manual reset thermal cut-out is tripped, and/or if the supply voltage is switched off.

## 3-phase 'TTC' (400V 3~)



F = All phase breaker, rated at 10Amps per phase for CV31 type (Ø315), or 16Amps per phase for CV40 (Ø400).

NO = Potential-free alarm contact, normally open (5-250VAC)

NC = Potential-free alarm contact, normally closed (5-250VAC)

The alarm relay coil is activated when the supply voltage is applied to the heater. The alarm relay coil is then de-activated when the manual reset thermal cut-out is tripped, and/or if the supply voltage is switched off.



## 9 Commissioning report/Maintenance report

<b>Building:</b>	<b>Floor:</b>	<b>Unit:</b>
<b>Commissioning:</b> <input type="checkbox"/>	<b>Maintenance:</b> <input type="checkbox"/>	<b>Date:</b>

### Maintenance measures

Item to be checked	Measures	Interval [months]			Done	
		3	6	12	Yes	No
Checking heater element(s)	Remove dust and perform insulation resistance test between terminal and stainless sheath.	X <sub>1)</sub>	X		<input type="checkbox"/>	<input type="checkbox"/>
Checking high temperature cut out operates	Adjust set point to ambient temperature to check heater de-energizes and reset to 40°C		X		<input type="checkbox"/>	<input type="checkbox"/>
Checking the pressure switch operates	Checking that the minimum airflow is present, and when not present the heater de-energizes.		X		<input type="checkbox"/>	<input type="checkbox"/>

1) initial inspection period. After 12 month running period, inspection interval could increase to 6 month cycle depending on reported findings

<b>Comment:</b>	
<b>Next maintenance scheduled for:</b>	
<b>Signature:</b> (Technician)	
<b>Company:</b> (Stamp)	