

MiCOM E124

Capacitor Trip Unit

E124/EN M/A12

Version Hardware Suffix A

Technical Manual

Note

The technical manual for this device gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

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MiCOM E124 CAPACITOR TRIP UNIT TECHNICAL MANUAL

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STANDARD SAFETY STATEMENTS FOR SCHNEIDER ELECTRIC EQUIPMENT

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1. INTRODUCTION

This Safety Section and the relevant equipment documentation provide full information on safe handling, commissioning and testing of this equipment.

The technical data in this Safety Section is typical only, see the technical data section of the relevant equipment documentation for data specific to a particular equipment.



Before carrying out any work on the equipment the user should be familiar with the contents of this Safety Section and the ratings on the equipment's rating label.

Reference should be made to the external connection diagram before the equipment is installed, commissioned or serviced.

Language specific, self-adhesive User Interface labels are provided in a bag for some equipment.

2. HEALTH AND SAFETY

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

When electrical equipment is in operation, dangerous voltages will be present in certain parts of the equipment. Failure to observe warning notices, incorrect use, or improper use may endanger personnel and equipment, potentially causing personal injury or physical damage.



Before working in the terminal strip area, or de-commissioning the E124 it must be isolated and the capacitor trip units discharged as recommended in the Installing, Commissioning and Servicing section.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel may work on or operate the equipment.

Qualified personnel are individuals who:

- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorized to energize and de-energize equipment and to isolate, ground, and label it;
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices;
- Are trained in emergency procedures (first aid).

The equipment documentation gives instructions for its installation, commissioning, and operation. However, the manuals cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

3. SYMBOLS ON THE EQUIPMENT

For safety reasons the following symbols which may be used on the equipment or referred to in the equipment documentation, should be understood before it is installed or commissioned.

3.1 SYMBOLS

	
Caution: refer to equipment documentation	Caution: risk of electric shock
	
Protective Conductor (*Earth) terminal	Functional/Protective Conductor (*Earth) Terminal
<p>*Note: This symbol may also be used for a Protective Conductor (Earth) terminal if that terminal is part of a terminal block or SUB-ASSEMBLY E.G. POWER SUPPLY.</p>	

*NOTE: THE TERM EARTH USED THROUGHOUT THIS TECHNICAL MANUAL IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

4. INSTALLATION, COMMISSIONING AND SERVICING



Equipment connections

Personnel undertaking installation, commissioning or servicing work for this equipment should be aware of the correct working procedures to ensure safety.

The equipment documentation should be consulted before installing, commissioning, or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated.

Any disassembly of the equipment may expose parts at hazardous voltage, also electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards.

Voltage connections should be made using insulated crimp terminations OR SINGLE STRAND WIRE to ensure that terminal block insulation requirements are maintained for safety.

To ensure that wires IN CRIMP TERMINALS are correctly terminated the correct crimp terminal and tool for the wire size should be used.

The equipment must be connected in accordance with the appropriate connection diagram.

Protection Class I Equipment

- Before energizing the equipment it must be earthed using the protective conductor terminal, if provided, or the appropriate termination of the supply plug in the case of plug connected equipment.
- The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost.
- When the protective (earth) conductor terminal (PCT) is also used to terminate cable screens, etc., it is essential that the integrity of the protective (earth) conductor is checked after the addition or removal of such functional earth connections. For M4 stud PCTs the integrity of the protective (earth) connections should be ensured by use of a locknut or similar.

The recommended minimum protective conductor (earth) wire size is 2.5 mm² (3.3 mm² for North America) unless otherwise stated in the technical data section of the equipment documentation, or otherwise required by local or country wiring regulations.

The protective conductor (earth) connection must be low-inductance and as short as possible.

All connections to the equipment must have a defined potential. Connections that are pre-wired, but not used, should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

Before energizing the equipment, the following should be checked:

- Voltage rating/polarity (rating label/equipment documentation);
- Protective fuse rating;
- Integrity of the protective conductor (earth) connection (where applicable);
- Voltage and current rating of external wiring, applicable to the application.

If the E124 has been energized, then before touching the terminals and after disconnection from the voltage supply, safely discharge the E124 internal capacitors. Both sets of capacitors can be safely discharged by pressing the switch associated with circuit 1 for at least 30 s followed by pressing the switch associated with circuit 2 for at least 30 s.



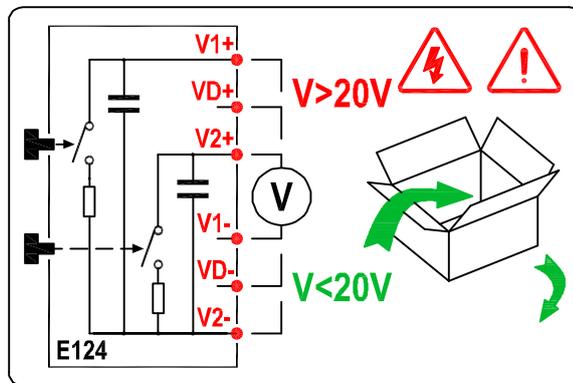
Discharging capacitors

AFTER CONNECTION TO THE SUPPLY, THE TWO CAPACITOR TRIP BANKS OF 1320 μ F WILL BE CHARGED TO 300 VDC, THIS DANGEROUS VOLTAGE WILL BE ACCESSIBLE AT THE TERMINALS OF THE E124.



If the E124 has been energized, then before touching the terminals, or removing the module from its case, safely discharge the E124 internal capacitors, as detailed in the procedure below.

DISCHARGE PROCEDURE:



Both of the capacitor trip banks must be discharged to a safe level, initially to 20 Vdc or less:

- 1) Remove the supply to the E124 via a fuse or switch in line with the unit.
- 2) Firstly discharge capacitor trip unit 1:
Press the top red push button only, continuously for 30 S. The yellow LED will light and then go off.
- 3) Then discharge capacitor trip unit 2:
Press the bottom red push button only, continuously for 30 S. The yellow LED will light and then go off.

NOTE - After the discharge procedure has been followed for both capacitor trip units, the terminal voltages should be below 20 Vdc. The capacitor voltage will recover and increase by about 10 Vdc after 1 hour, but it should remain below 30 V.

Measure the voltage on the terminals as indicated on the label on the side of the E124 and in the above picture, before touching the terminals, packaging or disposing of the E124.

NOTE - Any E124 units packaged for return to Schneider Electric must have the terminal screws removed. This will eliminate any risk of accidental contact with the terminals when unpacking the units.

If IMMEDIATELY AFTER THE DISCHARGE PROCEDURE the voltage is above 20 V, then the capacitor trip units must additionally be safely discharged via the red push button switches, as detailed in the above 'Discharge Procedure', before the E124 is decommissioned, OR TRANSPORTED.

If the voltage does not reduce when using this procedure, due to a circuit fault, then the capacitive voltage on the terminals must be safely discharged using an external insulated 5k Ω resistor of at least 6W rating.

**Equipment use**

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

**Removal of the equipment front panel/cover**

Removal of the equipment front panel/cover may expose hazardous live parts, which must not be touched until the electrical power is removed AND THE CAPACITOR TRIP UNITS DISCHARGED AS RECOMMENDED ABOVE.

**UL and CSA listed or recognized equipment**

To maintain UL and CSA approvals the equipment should be installed using UL and/or CSA listed or recognized parts of the following type: connection cables, protective fuses/fuseholders or circuit breakers, insulation crimp terminals, and replacement internal battery, as specified in the equipment documentation.

**Equipment operating conditions**

The equipment should be operated within the specified electrical and environmental limits.

**Insulation and dielectric strength testing**

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

**Insertion of modules and pcb cards**

Modules and PCB cards must not be inserted into or withdrawn from the equipment whilst it is energized, since this may result in damage.

**External test blocks and test plugs**

Great care should be taken when using external test blocks and test plugs such as the MMLG, MMLB and MiCOM P990 types, hazardous voltages may be accessible when using these. *CT shorting links must be in place before the insertion or removal of MMLB test plugs, to avoid potentially lethal voltages.

*Note: When a MiCOM P992 Test Plug is inserted into the MiCOM P991 Test Block, the secondaries of the line CTs are automatically shorted, making them safe.

**Cleaning**

The equipment may be cleaned using a lint free cloth dampened with clean water, when no connections are energized. Contact fingers of test plugs are normally protected by petroleum jelly, which should not be removed.

5. DE-COMMISSIONING AND DISPOSAL



De-commissioning

The supply input (auxiliary) for the equipment may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the equipment (both poles of any dc supply), the capacitor TRIP UNITS MUST be safely discharged USING THE DISCHARGE PROCEDURE IN THE ABOVE INSTALLATION, COMMISSIONING AND SERVICING SECTION.



Disposal

It is recommended that incineration and disposal to water courses is avoided. The equipment should be disposed of in a safe manner. Any equipment containing batteries should have them removed before disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of the equipment.

6. TECHNICAL SPECIFICATIONS FOR SAFETY

Unless otherwise stated in the equipment technical manual, the following data is applicable.

6.1 PROTECTIVE FUSE RATING

The recommended maximum rating of the external protective fuse for equipments is 16A, high rupture capacity (HRC) Red Spot type NIT, or TIA, or equivalent. The protective fuse should be located as close to the unit as possible.

6.2 PROTECTIVE CLASS

IEC 60255-27: 2005
EN 60255-27: 2005

Class I (unless otherwise specified in the equipment documentation). This equipment requires a protective conductor (earth) connection to ensure user safety.

6.3 INSTALLATION CATEGORY

IEC 60255-27: 2005
EN 60255-27: 2005

Installation category III (Overvoltage Category III):
Distribution level, fixed installation.

Equipment in this category is qualification tested at 5 kV peak, 1.2/50 μ s, 500 Ω , 0.5 J, between all supply circuits and earth and also between independent circuits.

6.4 ENVIRONMENT

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be mounted in a specific cabinet of housing which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Pollution Degree - Pollution
Degree 2

Compliance is demonstrated by reference to safety standards.

Altitude - Operation up to 2000m

IEC 60255-27:2005
EN 60255-27: 2005

HANDLING, INSTALLATION AND CASE DIMENSIONS

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1. GENERAL CONSIDERATIONS

WARNING: BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY SECTION AND ALSO THE TECHNICAL DATA SECTION OF THIS TECHNICAL MANUAL AND THE RATINGS ON THE EQUIPMENT RATING LABEL.



See the warning in the safety section referring to the hazardous capacitive voltage on the E124 terminals after connection to the supply, which also remains after disconnection.

1.1 Receipt of Capacitor trip unit

The MiCOM E124 Capacitor Trip Unit, although generally of robust construction, requires careful treatment prior to installation on site. Upon receipt, the E124 should be examined immediately to ensure no damage has been sustained in transit. If damage has been sustained during transit a claim should be made to the transport contractor and Schneider Electric should be promptly notified.

MiCOM E124 Capacitor Trip Units which are supplied unmounted (that is not mounted in a supplied panel) and not intended to be installed immediately should be returned in their protective polythene bags.

1.2 Electrostatic discharge (ESD)

The MiCOM E124 uses components that are sensitive to electrostatic discharges (ESD).

The electronic circuits are well protected by the metal case and the internal module should not be withdrawn unnecessarily. When handling the module outside its case, care should be taken to avoid contact with components and electrical connections. If removed from the case for storage, the module should be placed in an electrically conducting antistatic bag.

There are no setting adjustments within the module and it is advised that it is not unnecessarily disassembled. Touching the printed circuit board should be avoided, since complementary metal oxide semiconductors (CMOS) are used, which can be damaged by static electricity discharges.

2. HANDLING OF ELECTRONIC EQUIPMENT

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage, which often may not be immediately apparent but the reliability of the circuit will have been reduced.

The electronic circuits are safe from electrostatic discharge when housed in the case. Do not expose them to risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to withdraw a module, the following precautions should be taken to preserve the high reliability and long life for which the equipment has been designed and manufactured.

1. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
2. Handle the module by its frontplate, frame or edges of the printed circuit board. Avoid touching the electronic components, printed circuit track or connectors.
3. Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equipotential.
4. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
5. Store or transport the module in a conductive bag.

If you are making measurements on the internal electronic circuitry of equipment in service, it is preferable that you are earthed to the case with a conductive wrist strap. Wrist straps should have a resistance to ground between 500k Ω – 10M Ω .

If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of static. Instrumentation which may be used for making measurements should be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF. It is strongly recommended that detailed investigations on electronic circuitry or modification work should be carried out in a special handling area such as described in the above-mentioned BS and IEC documents.

3. EQUIPMENT MOUNTING

MiCOM E124 units are dispatched either individually or as part of a panel/rack assembly.

For individually mounted units an outline diagram is supplied in section 6 of this chapter showing the panel cut-outs and holes centres.

4. UNPACKING

Care must be taken when unpacking and installing the MiCOM E124 Capacitor Trip Unit so that none of the parts are damaged or the settings altered. The E124 unit must only be handled by skilled personnel. The installation should be clean, dry and reasonably free from dust and excessive vibration. The site should be well lit to facilitate inspection. E124 units which have been removed from their cases should not be left in situations where they are exposed to dust or damp. This particularly applies to installations which are being carried out at the same time as construction work.

5. STORAGE

If the MiCOM E124 unit is not to be installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons. Where de-humidifier bags have been included in the packing they should be retained. The action of the de-humidifier crystals will be impaired if the bag has been exposed to ambient conditions and may be restored by gently heating the bag for about an hour, prior to replacing it in the carton.

Dust which collects on a carton may, on subsequent unpacking, find its way into the relay; in damp conditions the carton and packing may become impregnated with moisture and the de-humidifier will lose its efficiency.

Storage temperature: -25°C to $+70^{\circ}\text{C}$.

6. DIMENSIONS

6.1 Connection of power terminals and signal terminals

The 12 way terminal block will accept single or multi strand wire. Recommended wire size 1 mm² to 2.5 mm². If multi-strand wire is used this should be terminated using an insulated boot ferrule to maintain the required isolation between circuits.

It is recommended that the auxiliary supply wiring should be protected by a fuse of maximum rating of 16A, high rupture capacity (HRC) type NIT or TIA. The minimum fuse rating is 6A. For safety reasons, do not install fuses in current transformers circuits, open circuit CTs can produce hazardous high voltages. The other circuits must be protected by fuses.

6.2 Earthing

E124 units must be connected to a local protective (earth) conductor, using the M4 protective (earth) conductor terminal on its case.

We recommend a wire cross section of 2.5 mm², with insulated crimp ferrule terminals on the side of the equipment.

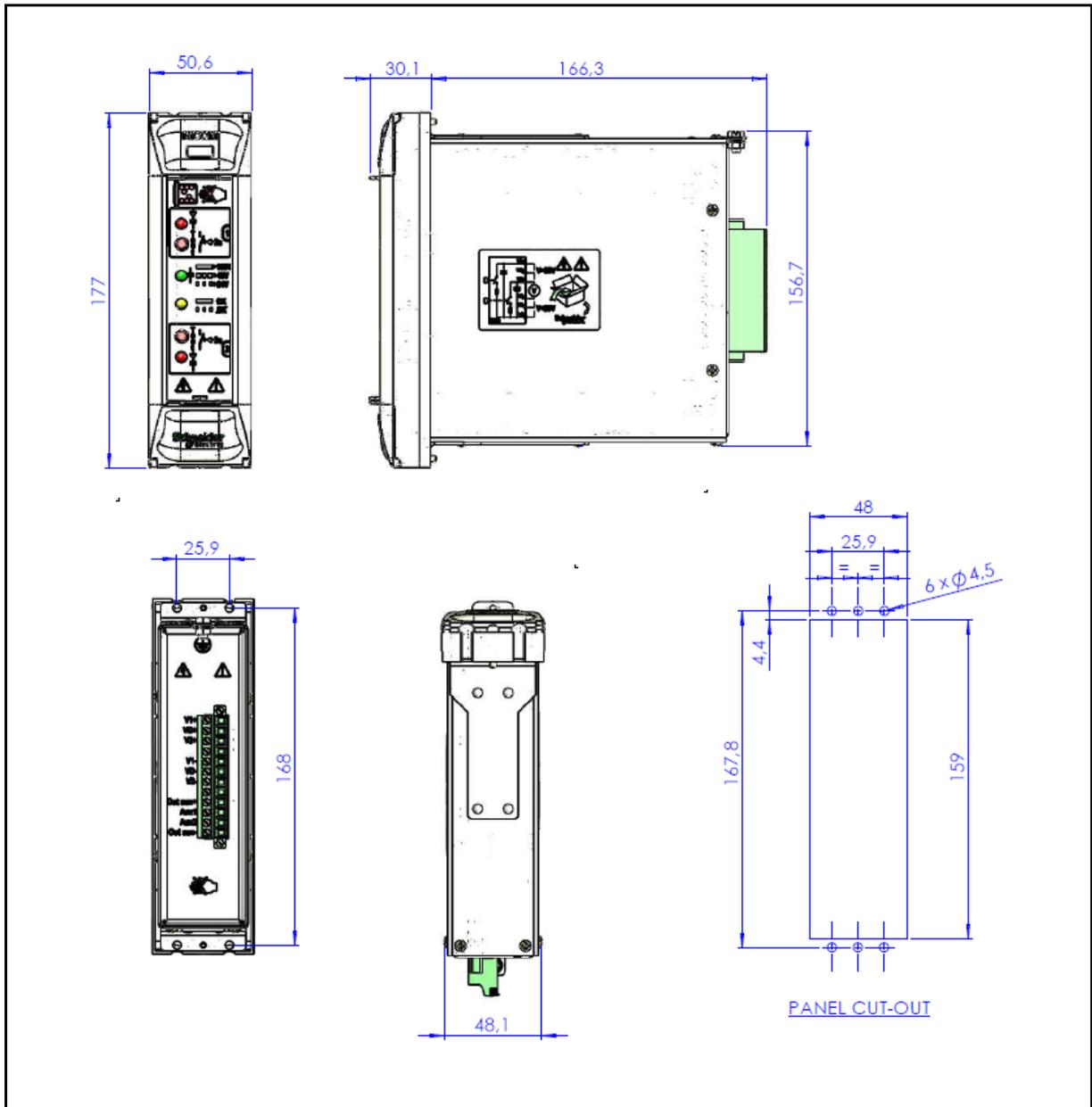
NOTE: To prevent any electrolytic corrosion risk between copper conductor or brass conductor and the back plate of the equipment, it is necessary to take precautions to isolate them one from the other. This can be done in several ways, for example by inserting between the conductor and the case a plated nickel or insulated ring washer or by using a tinned terminal.

7. CASE DIMENSIONS

MiCOM E124 Capacitor trip unit are available in a 4U metal case for panel or flush mounting.

Weight: 1.35 Kg

<u>External size:</u>	Height	case	155 mm
		front panel	177 mm
Width		case	48 mm
		front panel	50.6 mm
Depth		case	163 mm
		front panel + case	194 mm



MiCOM E124 CAPACITOR TRIP UNIT CASE DIMENSIONS

NOTE: The chassis is normally secured in the case by four screws (Self tapping screws 6x1.4). The fixing screws should be fitted in normal service (do not add washers). Do not discard these screws.

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USER GUIDE

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1. PRESENTATION OF MiCOM E124 CAPACITOR TRIP UNIT

The capacitor trip unit **MiCOM E124** is an auxiliary device typically used to provide energy to the trip coil of a circuit breaker in distribution systems.

The trip unit can be used in all cases where a battery and charger would otherwise be necessary to trip the circuit breaker. Such is the case in substations where there is no auxiliary supply, and where protective relays draw their auxiliary power from current and voltage transformer circuits.

The easiest way to store the energy for trip coils is in a capacitor trip unit, for example MiCOM E124.

In other cases where auxiliary supply is not secured or reliable, MiCOM E124 can also be used to power up a protection relay or any equipment during a voltage dip or an interruption of supply to prevent the device from resetting/rebooting.

Its power storage capacity is such that it can independently provide both the relay and the trip coil with sufficient energy to withstand up to several seconds of power shortage, dependent on the relay type.

2. USER INTERFACE

MiCOM E124 front face has a basic Human Machine Interface (HMI) to help the user, based on LEDs and test buttons. LEDs are used to identify what the current status of the product is.

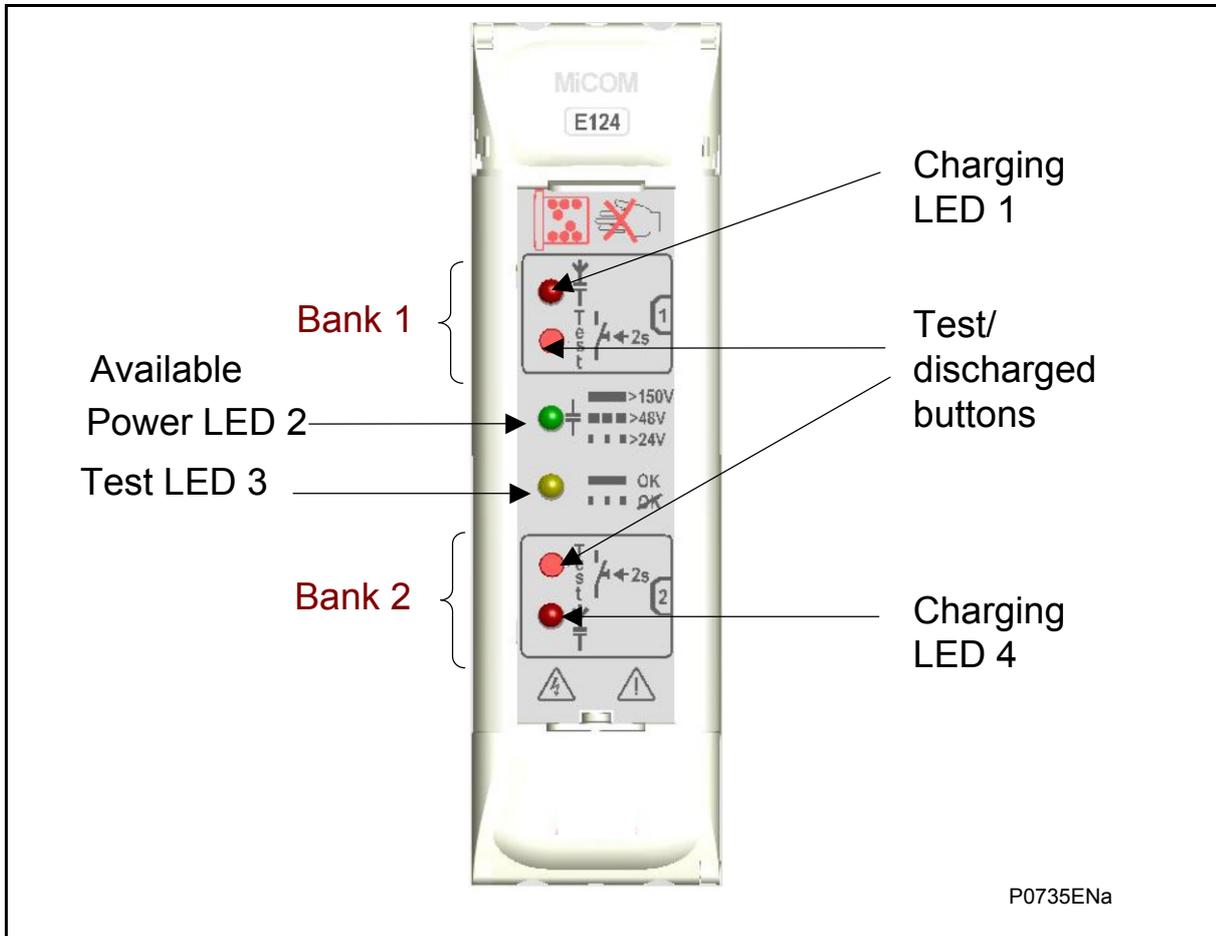


FIGURE 1: MiCOM E124 FRONT PANEL

The front panel of the capacitor trip unit has three separate sections:

1. The LEDs
2. The test/discharge buttons
3. Two areas under the top and bottom flaps

2.2 Test/discharge buttons

Each bank of capacitors has its own test/discharge button in order to make sure the capacitors (of this bank) are healthy or to discharge its full energy.

TEST BUTTON No.1

Colour: RED

Meaning: Test Bank No.1

Press test/discharge button:

- > **2 seconds:** When the test button No.1 is pushed for 2s, LED 3 indicates if the capacitor bank No.1 is healthy if it is permanently ON.
- > **More than 30 seconds:** When the test button No.1 is pushed for more than 30s, the energy stored in the capacitor bank No.1 will be discharged.

TEST BUTTON No.2

Colour: RED

Meaning: Test Bank No.2

Press test/discharge button:

- > **2 seconds:** When the test button No.2 is pushed for 2s, LED 3 indicates if the capacitor bank No.2 is healthy if it's fixed ON
- > **More than 30 seconds:** When the test button No.2 is pushed for more than 30s, the energy stored in the capacitor bank No.2 will be discharged.



If the E124 has been energized, then before touching the terminals, or removing the module from its case, safely discharge the E124 internal capacitors, as detailed in the commissioning chapter procedure

2.3 Description of the two areas under the top and bottom flaps

Under the upper flap, a label identifies the unit according to its model number (order number) and its serial number. This information defines the product in a way that is unique. In all your requests, please make reference to these two numbers.

Under the lower flap, a RS232 port location is available as for all MiCOM relays. Since the capacitor trip unit is a maintenance free device and is already fully configured, this port is not used.

3. WIRING

MiCOM E124 wiring diagram is detailed in the Connection chapter of this Technical Guide.

3.1 Auxiliary supply

The auxiliary power supply for the **MiCOM E124** can be:

- direct voltage from 48 to 250 Vdc
- alternating voltage from 48 to 230 Vac (50-60 Hz)
- Voltage from a voltage transformer (VT)

The auxiliary power supply must only be connected to terminals 10 and 11.

NOTE: It is recommended that the auxiliary supply wiring should be protected by a fuse of maximum rating 16A, high rupture capacity (HRC), type NIT or TIA. The minimum fuse rating is 6A.

3.2 DC Output voltage to supply an equipment

When the auxiliary supply is not secured or reliable, MiCOM E124 can be used to power a protection relay or any equipment during a voltage dip or an interruption of supply to prevent the device from resetting/rebooting. This output voltage is always direct (Vdc) and its magnitude is the same as DC supply input voltage or 1.41 times the AC supply input voltage.

Output voltage to supply an equipment must be connected only to terminals 9 and 12 (9 is positive and 12 is negative).

3.3 Output voltage to energize trip coils

Two banks of capacitors are available on MiCOM E124. Both independent capacitor banks can be used:

- **Independently** (two independent trip coils)
- **In parallel** (a single high energy trip coil)
- **In serial** (two consecutive trips on the same trip coil)

Depending on the application, a specific wiring scheme has to be followed. Please refer to the application chapter of the technical guide.

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TECHNICAL DATA AND CHARACTERISTIC CURVES

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1. RATINGS

1.1 Power Supply

Nominal auxiliary voltage Vx	48 - 230 Vac (*) 48 - 250 Vdc (*)
Operating range	DC: ± 20% of Vx AC: - 20%, +10% of Vx
Residual ripple	Up to 12%
Burden	Stand by: <0.25W DC or <1.5VA AC Maximum: <2.5W DC or <5VA AC

(*): Input voltage from 48V to 100V is possible, but charging time is longer than at higher voltage

1.2 AC Frequency

Nominal frequency	50/60Hz
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1.3 Output voltage range

MiCOM E124 can be used to supply power to an external device from an auxiliary AC/DC supply (in case of voltage dips) or from a voltage transformer (VT) connected on the busbar.

In normal condition, the relay uses the DC version of the auxiliary voltage provided by an auxiliary AC/DC supply or from a voltage transformer (VT). In case this auxiliary voltage is lost (voltage dip), the two set of internal capacitor will provide voltage to the relays. This duration depends on the power consumption of the relays.

Selectable nominal power supply output voltage	48 - 250 Vdc
Capacitor banks connected in parallel	300Vdc

1.4 Capacitor set energy

The MiCOM E124 contains two capacitor banks which operate independently of each other.

Capacitance	Two capacitors banks of 1320 µF each
Self-discharge time	After 100h, still has 150V for tripping use
Output power available	118J (2x59J)
Output impedance (per capacitor bank)	10Ω
Charging time <u>Warning:</u> First charging duration = 24h	<30s to reach 150V, when powered at 230V <1min to fully charge (reach 300V), when powered at 230V
Power consumption when capacitors loaded	<2 VA or 1W

2. INSULATION

LVD compliance



2006/95/EC

Compliance with European Commission Low Voltage directive (LVD). Compliance is demonstrated by reference to a product specific safety standard and a product specific insulation coordination standard.

EN 60255-27 : 2005 – Measuring relays and protection equipment.
Part 27 Product safety requirements

EN 60255-5 : 2001 – Electrical relays. Part 5 Insulation Coordination for measuring relays and protection equipment – Requirements and tests

INSULATION

Dielectric withstand	IEC 60255-5: 2000	2 kVrms AC 1 minute, common mode 1 kVrms AC 1 minute, differential mode
	ANSI/IEEE C37.90-2002	1,5 kVrms AC for 1 minute, common mode
Impulse voltage	IEC 60255-5: 2000	5 kVpeak / 0,5J Front time: 1.2 μ s Time to half-value: 50 μ s
Insulation resistance	IEC 60255-5: 2000	> 100M Ω at 500Vdc (Using only electronic/brushless insulation tester).

3. EMC TESTS

EMC compliance



2004/108/EC

Compliance with European Commission EMC Directive.

Product standards were used to establish conformity:

EN 50263: 2000

1 MHz Burst High Frequency Disturbance Test

IEC 60255-22-1: 1988 2.5kV common mode, Class III
 1kV differential mode, Class III

Electrostatic Discharge

IEC 61000-4-2: 1996 and 8kV contact discharge, Class 4
 IEC 60255-22-2: 1997 15kV air discharge, Class 4

Fast Transient

IEC 60255-22-4:2002, Class A 2kV 5kHz, terminal block comms
 4kV 2.5kHz, all circuits excluding comms
 EN 61000-4-4:2004, Level 4 4kV 5kHz, power supply
 2kV 5kHz, all circuits excluding power supply

Surge

IEC 61000-4-5:1995 and Amplitude: 2kV between all groups and case earth,
 IEC 60255-22-5:2002 Level 4
 Amplitude: 1kV between terminals of each group, Level 4

Conducted Emissions

EN 55022: 1998 Class A 0.15 - 0.5MHz, 79dBµV (quasi peak) 66dBµV (average)
 0.5 - 30MHz, 73dBµV (quasi peak) 60dBµV (average)

Radiated Emissions

EN 55022: 1998 Class A 30 - 230MHz, 40dBµV/m at 10m measurement distance
 230 - 1GHz, 47dBµV/m at 10m measurement distance

Conducted Immunity

IEC 61000-4-6:1996 Level 3, 10V rms @ 1kHz 80% am, 150kHz to 80MHz

Radiated Immunity from digital communications

EN 61000-4-3:2003 Level 3, 10V/m 80MHz to 1GHz @ 1kHz 80% am
 ANSI/IEEE C37.90.2:2004 35V/m 80MHz to 1GHz @ 1kHz 80% am
 35V/m 80MHz to 1GHz @ 100% pulse modulated front
 face only

Radiated immunity from digital telephones

EN 61000-4-3:2002 Level 4, 30V/m 800MHz to 960MHz and 1.4GHz to
 2GHz @ 1kHz 80% am

Surge Withstand Capability

IEEE/ANSI C37.90.1: 2002

4kV fast transient and 2.5kV damped oscillatory wave applied directly across each output and power supply circuit.

Magnetic Field Immunity

IEC 61000-4-8: 1994

Level 5, 100A/m applied continuously, 1000A/m for 3s

IEC 61000-4-9: 1994

Level 5, 1000A/m

IEC 61000-4-10: 1994

Level 5, 100A/m at 100kHz and 1MHz

Damped Oscillatory Wave

IEC 61000-4-18: 2006

2.5kV peak Common mode

1.0kV peak Differential mode

Immunity to Conducted Disturbances Induced by Radio Frequency Fields

EN 61000-4-6: 1996

Level 3 : Disturbing test voltage: 10 V rms @ 1kHz
80%am 150kHz-80MHz

4. ENVIRONMENT

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be mounted in a specific cabinet of housing which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Temperature	IEC 60255-6:1994	
	IEC 60068-2-1:2007	Storage (Cold) -25°C to +70°C
	IEC 60068-2-2:1993	Operation (Dry heat): -25 °C to + 55 °C -25 °C to +70 ° (*)
		(*) the upper limit is permissible for a single 6 hour duration within any 24 hour period.
Humidity damp heat	IEC 60068-2-78:2001	56 days at 93% RH and 40 °C
Enclosure protection	IEC 60-529: 2001	Dust IP50 (whole case), Front IP 52, Rear terminal block IP 20
Sinusoidal Vibrations	IEC 60255-21-1:1998	Response and endurance, class 2
Shocks	IEC 60255-21-2:1998	Response class 2
Shock withstand & Bump	IEC 60255-21-2:1998	Bump and withstand, class 1
Seismic	IEC 60255-21-3:1995	Class 2
Pollution Degree	IEC 60255-27:2005	Pollution Degree 2
Overvoltage/Installation	IEC 60255-27 :2005	Overvoltage Category III
Altitude	IEC 60255-27:2005	Operation up to 2000m

5. PRODUCT CURVES AND TABLES

5.1 Capacitor charging/discharging duration

5.1.1 First capacitor charging duration

To minimize the internal leakage of the MiCOM E124 capacitor bank, **the first capacitor charging duration is crucial**. As described in Figure. 1, the self discharge of the capacitor will be dependent on the first charging duration. The longer the first charging duration is, the lower the output voltage reduction with time, due to self discharge, will be.

To ensure MiCOM E124 optimum lifetime, the first capacitor charging duration should be at least 24 hours. It's recommended that the 24h charging period of the E124 is repeated every year.

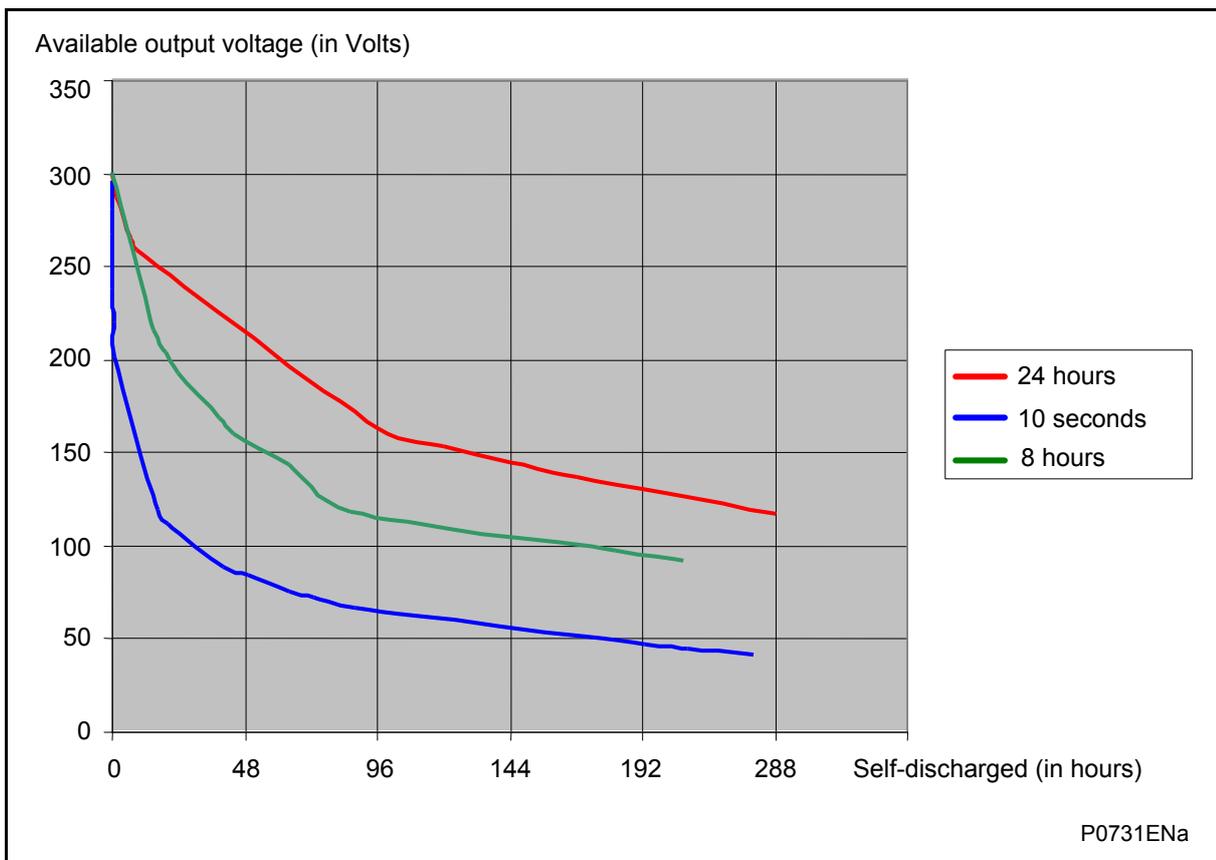


FIGURE 1: FIRST CHARGE DURATION IMPACT ON CAPACITOR BANK AVAILABLE VOLTAGE

5.1.2 Normal capacitor charging duration

After the first full charging of MiCOM E124 capacitor bank, **the duration to reach full charge will be less than 1 minute if the auxiliary voltage is greater than 100Vdc**. As shown in figure N°2, the higher the auxiliary voltage is, the shorter the time to full capacitor charge. Input voltage from 48V to 100V is possible, but the charging time is longer than that at a higher voltage.

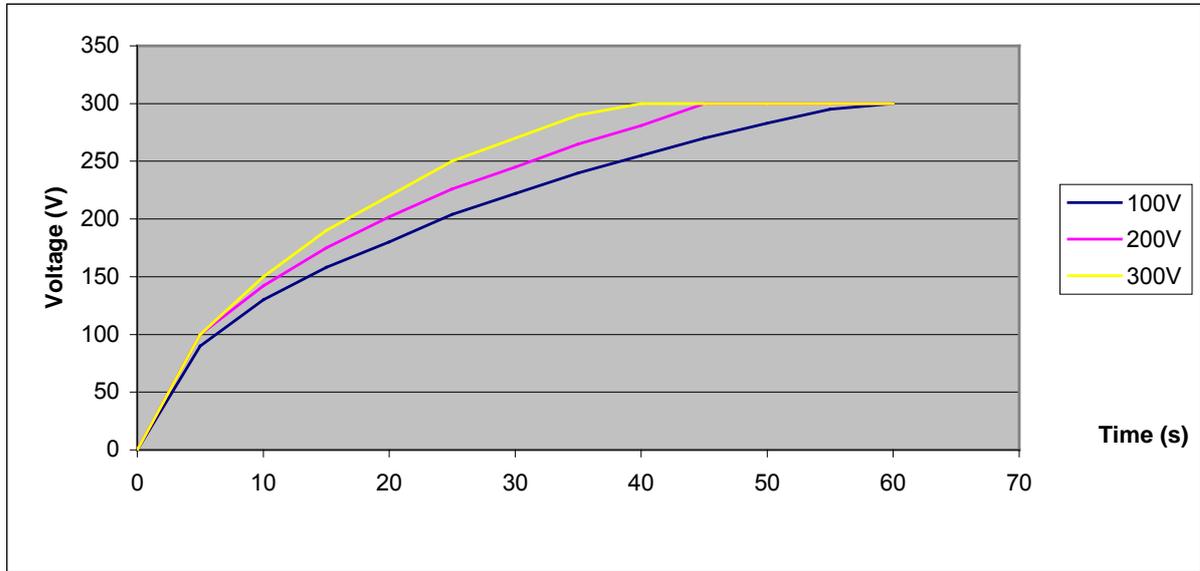


FIGURE 2: CAPACITORS BANK CHARGING DURATION DEPENDENCE ON AUXILIARY

5.1.3 Self discharge

This curve shows the discharge time of a single capacitor bank when the MiCOM E124 is not powered, at a typical temperature of 55°C. After 8 days without being powered (loss of auxiliary supply), if a fault occurs, the MiCOM E124 still has sufficient energy (150V / 14,85J) to trip the circuit breaker.

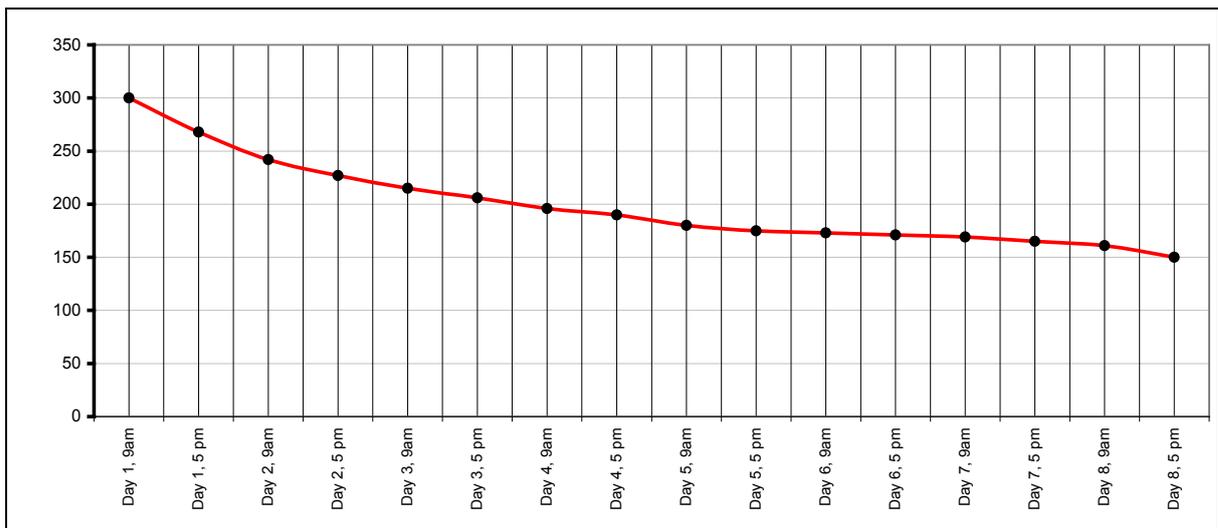


FIGURE 3: CAPACITOR BANK SELF DISCHARGING

5.2 Power supply of a DC external device

MiCOM E124 can be used to supply power to an external device from an auxiliary AC/DC supply (in case of voltage dips) or from a voltage transformer (VT) connected on the busbar.

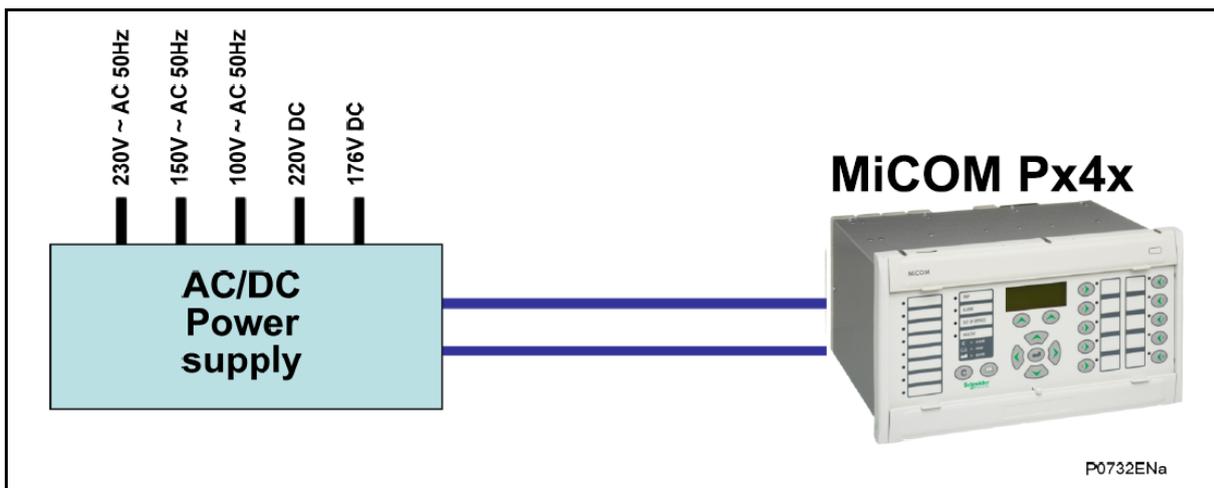
MiCOM Protection relays can support voltage loss for about 500ms (dependent on the auxiliary voltage). Using MiCOM E124 as a backup power supply improves the auxiliary voltage loss withstand by a factor of at least four times.

5.2.1 Test conditions

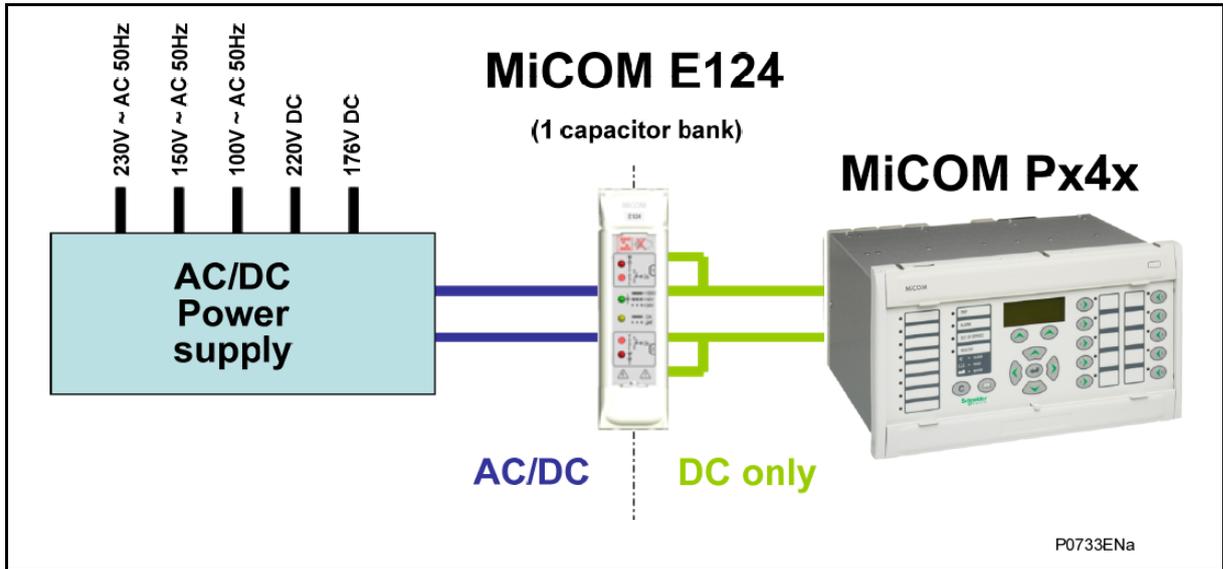
All tests have been realized at the protection relays maximum power consumption. A settable AC/DC power supply was used to simulate the following five auxiliary voltages :

- 230V ~ AC 50Hz
- 150V ~ AC 50Hz
- 100V ~ AC 50Hz
- 220V DC
- 176V DC (220Vdc – 20%)

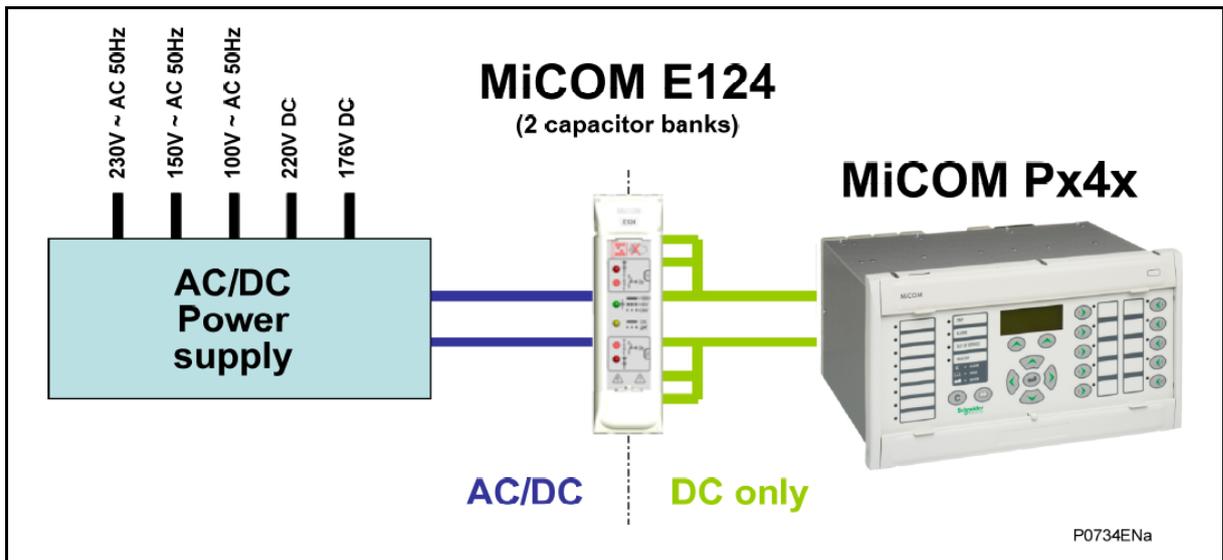
Test N°1: Auxiliary voltage loss withstand of the protection relays without E124



Test N°2: Auxiliary voltage loss withstand of the protection relays connected to the first E124 capacitor bank only



Test N°3: Auxiliary voltage loss withstand of the protection relays connected to both E124 capacitor banks



5.2.2 Test results for MiCOM P440

	P440 only	P440 + E124 (1 bank)	P440 + E124 (2 banks)	E124 withstand benefit [%]
230V ~ AC 50Hz	650ms	3600ms	6900ms	1100
150V ~ AC 50Hz	270ms	1500ms	2700ms	1000
100V ~ AC 50Hz	110ms	550ms	950ms	900
220V DC	340ms	1900ms	3400ms	1000
176V DC (-20%)	210ms	1110ms	2100ms	1000

E124 allows voltage dips of up to 6,9s on a MiCOM P440 relay and improves its auxiliary voltage loss withstand by at least 900%.

5.2.3 E124 used to supply a MiCOM P741

	P741 only	P741 + E124 (1 bank)	P741 + E124 (2 banks)	E124 withstand benefit [%]
230V ~ AC 50Hz	600ms	2100ms	3300ms	600
150V ~ AC 50Hz	250ms	700ms	1200ms	500
100V ~ AC 50Hz	110ms	250ms	450ms	400
220V DC	350ms	1100ms	1700ms	500
176V DC (-20%)	250ms	650ms	1100ms	400

E124 allows voltage dips of up to 3,3s on a MiCOM P741 relay and improves its auxiliary voltage loss withstand by at least 400%.

APPLICATION GUIDE

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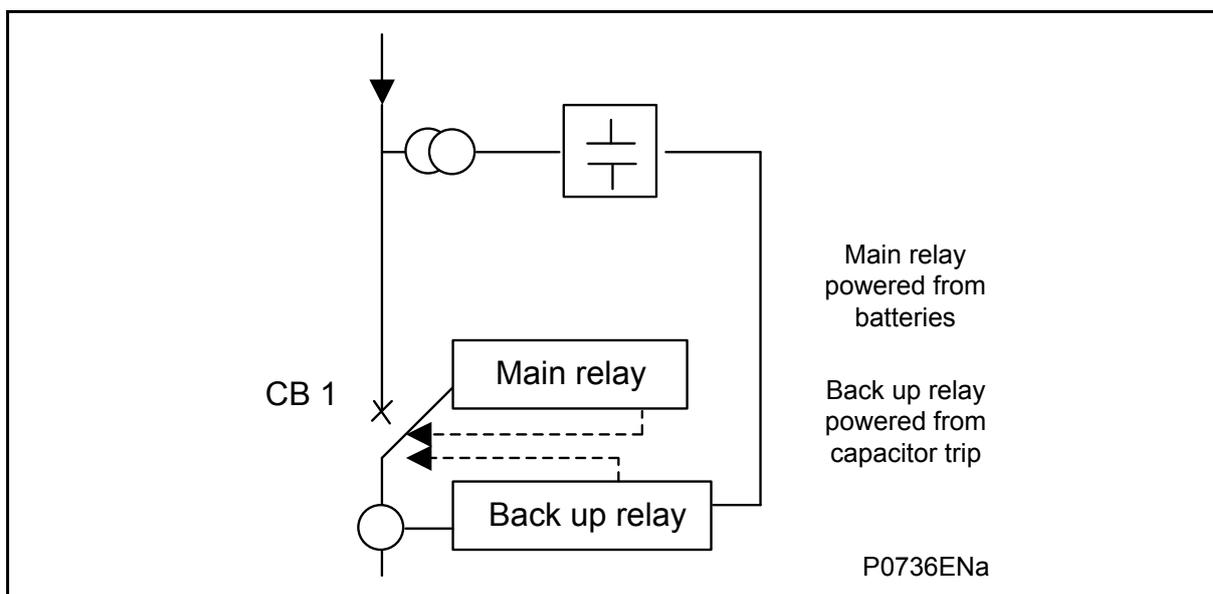
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1. INTRODUCTION

The capacitor trip unit MiCOM E124 is an auxiliary device typically used to provide energy to the trip coil of a circuit breaker in distribution systems.

The trip unit can be used in all cases where a battery and charger would otherwise be necessary to trip the circuit breaker. Such is the case in substations where there is no auxiliary supply, and where protective relays draw their auxiliary power from current and voltage transformer circuits. One way to store the energy necessary to activate the tripping coils is to use a capacitor Trip Unit.

Moreover, as circuit breakers are located at the most critical locations in a network, they are often provided with back-up protection. The security can be increased if the trip circuit of the associated relay is provided with an additional trip coil which is supplied from a capacitor trip unit. The trip circuit is then isolated from the rest of the control circuit.



In other cases where auxiliary supply is not secured or reliable, MiCOM E124 can be also used to power up a protection relay or any equipment during a voltage dip or an interruption of supply to prevent the device from resetting/rebooting.

2. APPLICATIONS

The MiCOM E124 is designed to supply a DC voltage for the tripping of circuit breakers and/or to power other protection devices.

The capacitors are charged from a local AC or DC auxiliary voltage or from a voltage transformer (VT) that may be connected to the busbar.

MiCOM E124 can be set to energize trip coils from 24V to 300V.

The status of the charging process is indicated by a red LED in the front of the device. The level of voltage of the capacitors (24, 48 or over 150V) is indicated by a green LED.

If there is a failure of the voltage supply the capacitors maintain their charge for a long period of time. The E124 is able to ensure circuit breaker tripping after 5 days loss of supply (typical residual voltage after 100h is 150V).

When the trip contact of the relay is closed, the capacitor discharges its stored energy through the trip coil. The circuit breaker will trip, the contact open and the discharge process is interrupted. Quantity of energy remaining in the capacitor depends on the kind of trip coil and the duration of the tripping command.

2.1 Power supply of a DC external device

MiCOM E124 can be used to supply power an external device from an auxiliary AC/DC supply (even in case of voltage dips) or from a voltage transformer (VT) connected on the busbar as described in figure 1.

In normal condition, the relay uses the DC version of the auxiliary voltage provided by an auxiliary AC/DC supply or from a voltage transformer (VT).

In case this auxiliary voltage is lost (voltage dip), the two sets of internal capacitor banks will provide voltage to the relays. The duration for this depends on the power consumption of the relays and on its voltage range.

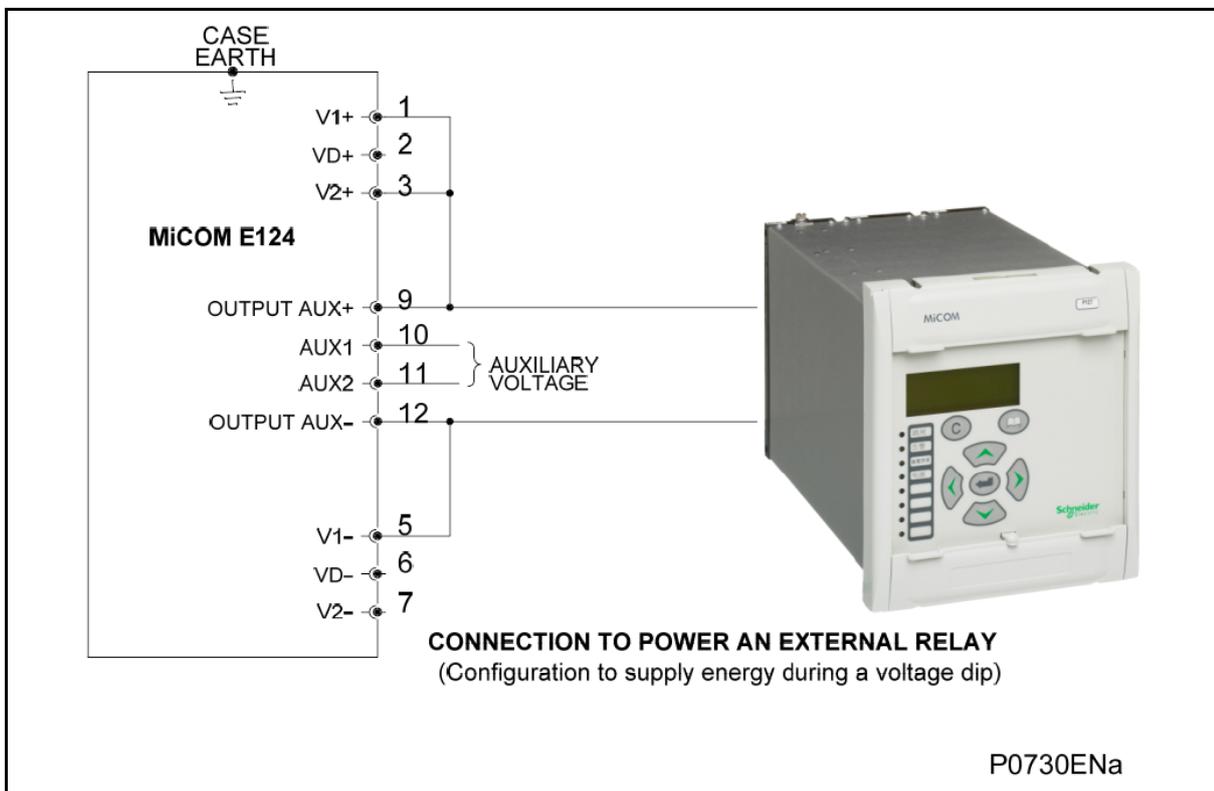


FIGURE 1: E124 USED TO SUPPLY RELAYS

2.2 Providing energy to a trip coil

The MiCOM E124 contains two capacitor banks which can operate independently of each other. Having two independent banks of capacitors allows multiple applications:

- Energize two different trip coils under 300V from only one the same trip unit
- Allow two consecutive trips (at 300V)
- Energize once a powerful trip coil (maximum energy available by connecting the two capacitor banks in parallel).

2.2.1 Providing energy to 2 independent trip coils

MiCOM E124 can be used to provide energy to two independent trip coils (for two protection relays). Each capacitor bank will be dedicated to one trip coil (300V / 59J).

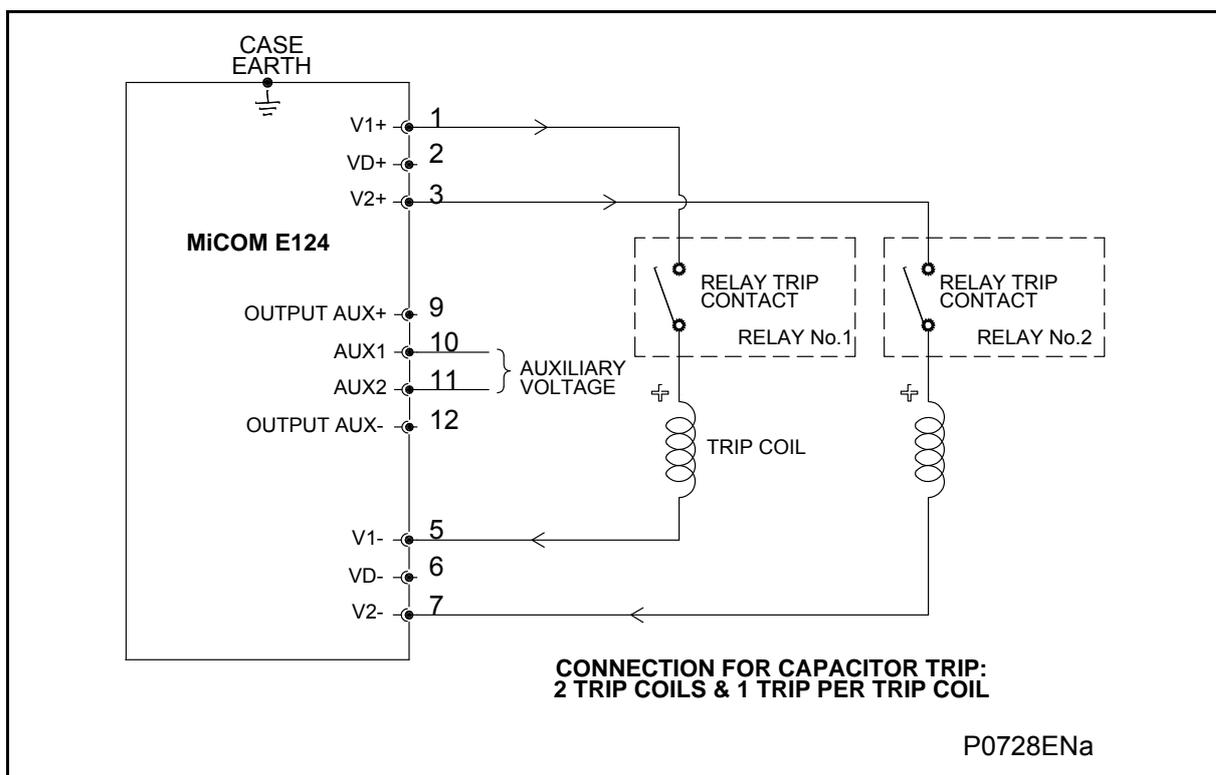


FIGURE 2: E124 WIRED TO TRIP TWO CIRCUIT BREAKERS AT 300V

2.2.2 Allow two consecutive trips

The switch from one capacitor bank to the other is monitored by a microprocessor. This feature enables two consecutive trips at maximum power (300V / 59J) without having to recharge (Multiple trips of lower voltage and lower energy). The trip contact of the protective relay (MiCOM P124 for example) is serially connected to the external trip coil as shown in the figure 3.

At the end of a first trip, an internal bi-stable relay automatically switches from the first bank of capacitors to the other. It is thus possible to get two successive trips without recharging of the capacitor banks.

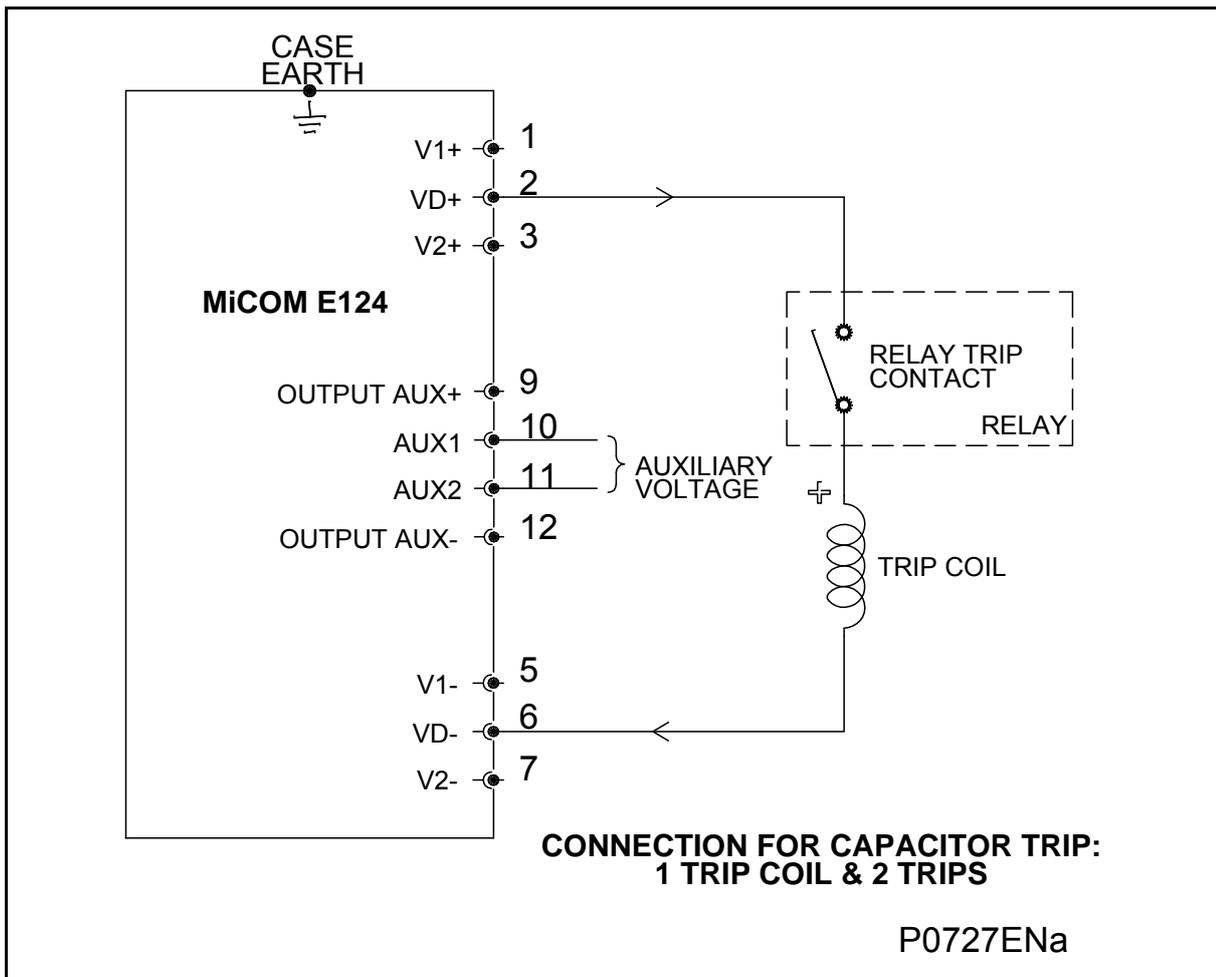


FIGURE 3: E124 WIRED TO TRIP ONE CIRCUIT BREAKER TWICE

2.2.3 Providing energy to a unique powerful trip coil

MiCOM E124 can be used to provide energy to a unique powerful trip coil by connecting the two banks of capacitor in parallel. The total energy provided to the trip coil will be 118J at 300V. Since the capacitor storage is doubled, a heavier duty circuit breaker can be tripped.

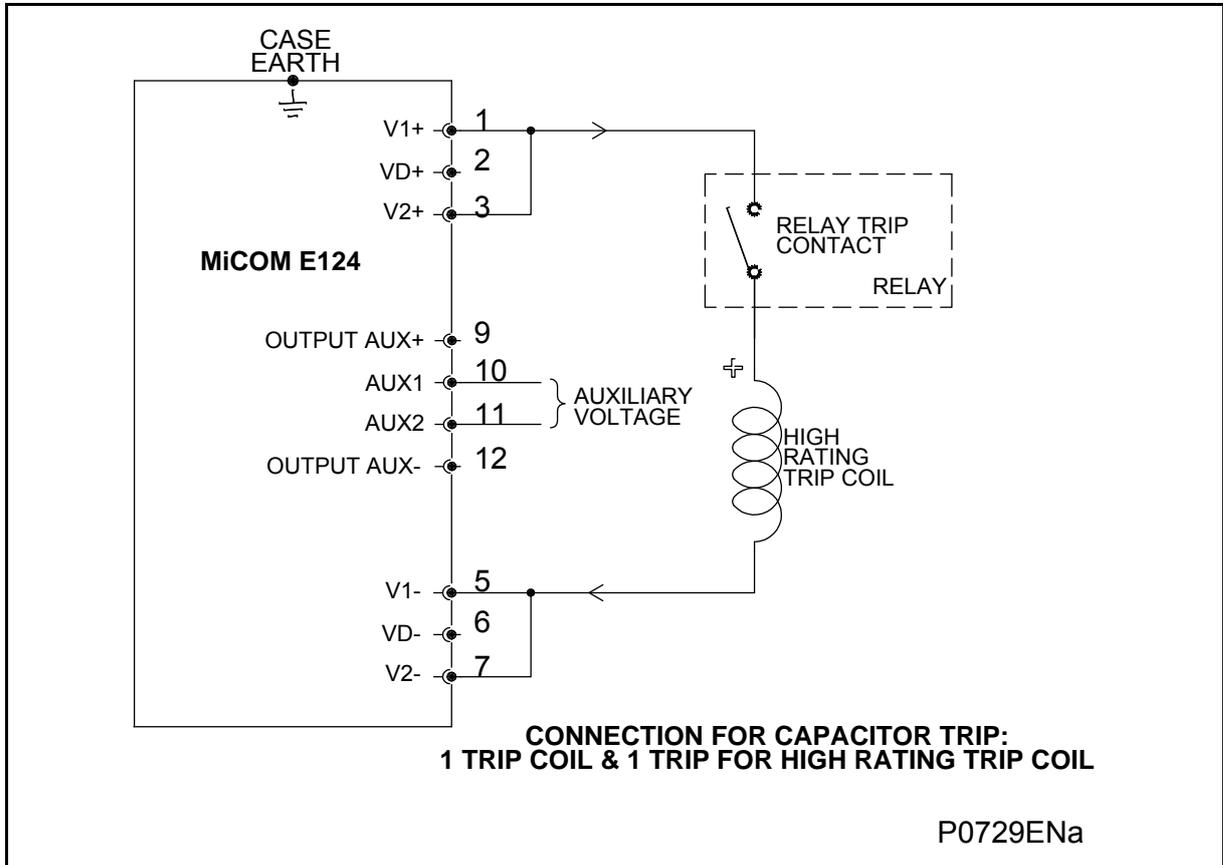


FIGURE 4: E124 WIRED TO TRIP A POWERFUL TRIP COIL

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COMMISSIONING AND MAINTENANCE GUIDE

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1. REQUIREMENTS PRIOR TO COMMISSIONING



Read the contents of the safety section referring to the dangerous voltages on the E124 terminals after connection to the supply.



NOTE- the unit remains charged after disconnection from the power supply. After connection to the supply, the two capacitor banks of 1320 μF will be charged to 300 Vdc, this hazardous voltage will be accessible at the terminals of the E124 after disconnection from the power supply.

The E124 will remain charged for a long period of time. Typically the E124 voltage outputs will remain at 150 to 300V for a period of 100 hours and at a voltage below 150V for a long period of time with no indication present on the front of the unit that the high voltage capacitor banks within the E124 are charged. If the E124 is to be serviced or taken out of service then it must be ensured that the unit is suitably discharged. This can be achieved by completing the procedure in clause 3.3.

2. PRODUCT VERIFICATION TESTS

2.1 Allocation of terminals

It is necessary to consult the appropriate wiring diagram provided in the connection chapter of the Technical Guide whilst observing the various polarities and ground/earth connections.

2.2 Electrostatic discharge (ESD)

Before any handling of the module (active part of the capacitor trip unit), the user should refer to the recommendations in the Safety Section of this Technical Guide.

2.3 Visual inspection

Carefully examine the capacitor trip unit to see if there has been any possible deterioration following installation.

Check if the external wiring corresponds to the appropriate capacitor trip unit diagram or the assembly diagram. The reference number of the capacitor trip unit diagram is indicated on a label situated under the upper flap on the front panel.

2.4 Earthing

Check if the earth connection of the case situated above the rear terminal block is used to connect the capacitor trip unit to a local protective (earth) conductor bar. With several capacitor trip units present, make sure that the copper earth bar is properly installed for solidly connecting the protective (earth) conductor terminals of each MiCOM E124 case.

2.5 Auxiliary supply

Check the value of the auxiliary supply voltage (terminals 10 and 11). The value measured shall be between 0.8 and 1.2 times the d.c. nominal auxiliary supply voltage, or 0.8 and 1.1 times the a.c. lower and upper nominal auxiliary supply voltage range, in the table below:

Kind of power supply	U _{aux} range (Volts)	Maximum value (Volts)
DC	48 - 250 Vdc	300
AC	48 - 230 Vac	253

3. MAINTENANCE

Maintenance on **MiCOM E124** capacitor trip units is only necessary to verify that the hardware is functioning correctly as the firmware is already installed by default. Although the capacitor trip unit is not self-checked, its test button allows an easy testing of the device with an immediate diagnostic provided by the yellow LED.



If the E124 has been energized, then before touching the terminals, or removing the module from its case, safely discharge the E124 internal capacitors, as detailed in the procedure in clause 3.3.

3.1 Auxiliary power supply failure

Diagnostic:

All LEDs are OFF (not lit)

Cause:

- Auxiliary power supply under 48Vdc
- Incorrect wiring of the auxiliary power supply
- Loss of the VT connection

Action:

- Check the voltage of the auxiliary power supply input to the MiCOM E124.
- Check wiring diagram of auxiliary power supply (terminals 10 & 11)

3.2 Equipment failure

Equipment failure test on MiCOM E124 should be done **every year** to make sure that the product behaviour is within the required limits.

Diagnostic:

1) Capacitor bank No.1 & bank No.2 healthy:

Press the **top** red push button only, continuously for 2 s. The yellow LED will be **ON** (lit) then go OFF (not lit)

Press the **bottom** red push button only, continuously for 2 s. The yellow LED will be **ON** then go OFF

2) Failure of capacitor bank No.1:

Press the **top** red push button only, continuously for 2 s. The yellow LED will be **blinking**

3) Failure of capacitor bank No.2:

Press the **bottom** red push button only, continuously for 2 s. The yellow LED will be **blinking**

Cause:

- External leakage
- Internal fault (capacitor for example).

Action:

- Withdraw the module (active part) and return it to your local Schneider Electric After Sales department for repair. NOTE: FOR SAFETY THE FOLLOWING DISCHARGE PROCEDURE MUST BE FOLLOWED.

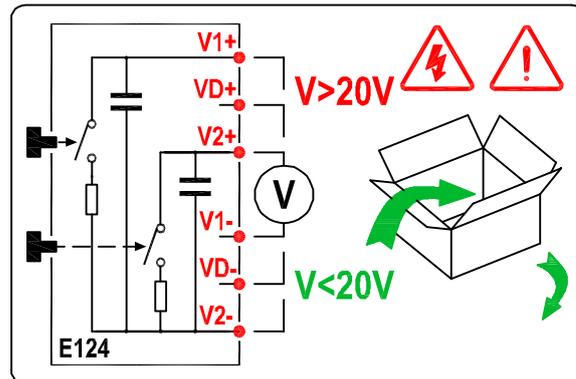
3.3 Discharge procedure



If the E124 has been energized, then before touching the terminals, or removing the module from its case, safely discharge the E124 internal capacitors, as detailed in the procedure below.

DISCLAIMER:

It is the responsibility of the user to ensure that the procedure in this documentation, for safely discharging the two capacitor banks, is followed before decommissioning and also packaging for despatch or disposal of the E124.”



Both of the capacitor banks must be discharged to a safe level, initially to 20 Vdc or less:

1) Remove the supply to the E124 via a fuse or switch in line with the unit.

2) Firstly discharge capacitor bank 1:

Press the top red push button only, continuously for 30 s. The yellow LED will light and then go off.

3) Then discharge capacitor bank 2:

Press the bottom red push button only, continuously for 30 s. The yellow LED will light and then go off.

NOTE: After the discharge procedure has been followed for both capacitor banks, the terminal voltages should be below 20 Vdc. The capacitor voltage will recover and increase by about 10 Vdc after 1 hour, but it should remain below 30 V.

Measure the voltage on the terminals as indicated on the label on the side of the E124 and in the above picture, before touching the terminals, packaging or disposing of the E124.

NOTE: Any E124 units packaged for return to Schneider Electric must have the terminal screws removed. This will eliminate any risk of accidental contact with the terminals when unpacking the units.

If the voltage is above 20 V then the capacitor banks must additionally be safely discharged via the red push button switches, as detailed in the above 'Discharge Procedure', before the E124 is decommissioned.

If the voltage does not reduce when using this procedure, due to a circuit fault, then the capacitive voltage on the terminals must be safely discharged using an external insulated 5k Ω resistor of at least 6W rating.

3.4 Method of repair

3.4.1 Replacing the active part

The case and the rear terminals blocks have been designed to facilitate removal of the MiCOM E124 capacitor trip unit. If any replacement or repair of the unit is necessary, the module (active part) can be withdrawn without disconnecting the E124 case from the scheme wiring.

NOTE: For safety reasons, the capacitor trip unit is self discharged when the module is withdrawn from its case. Meanwhile, a manual discharge using the discharge button is safer. To do so, please follow the procedure in clause 3.3 above.

Remove the upper and lower flap without exerting excessive force. Remove the external screws. Extract the module (active part) of the MiCOM E124 by pulling from the upper and lower notches on the front panel.

For any replacement of MiCOM E124 capacitor trip unit, follow the above instruction in reverse, ensuring that no modification of the scheme wiring has been made.

On completion of any operations which required the E124 capacitor trip unit to be removed from its case, verify that the two fixing screws are fitted at the corners of the front panel, under the flaps. These screws secure the module (removable part) of the E124 unit to the case.

3.4.2 Replacing the complete capacitor trip unit

To remove the complete capacitor trip unit (E124 module and case) the wiring must be removed from the rear connector.

Before working on the rear of the E124, isolate all voltage supplies to it and ensure that the capacitor trip unit is not powered.



If the E124 has been energized, then before touching the terminals, or removing the module from its case, safely discharge the E124 internal capacitor banks, as detailed in the above clause 3.3.

Remove all wiring. Disconnect the MiCOM E124 capacitor trip unit earth connection from the rear of the case.

Remove the screws used to fasten the MiCOM E124 unit to the panel or rack. These are the screws with the larger diameter heads that are accessible when the upper and lower flaps are lifted. Withdraw the capacitor trip unit from the panel or rack

Any replacement of MiCOM E124 capacitor trip unit should follow the above instruction in reverse.

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CONNECTION DIAGRAMS

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2. MiCOM E124 – PIN OUT

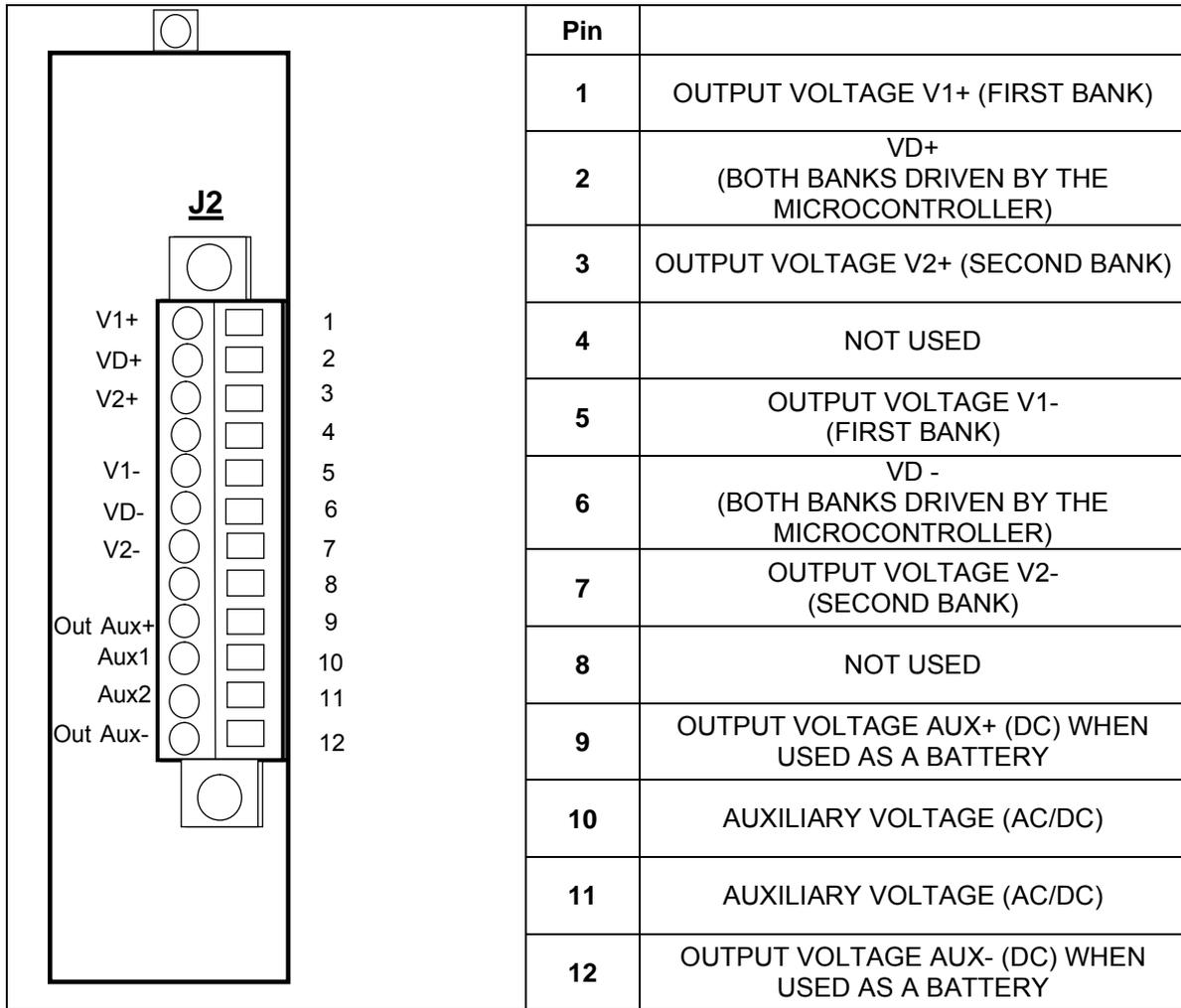


FIGURE 2: TERMINAL CONNECTION DIAGRAM FOR MiCOM E124 CASE 10TE

E124 auxiliary voltage to charge the two capacitor banks has to be connected between pin 10 & 11. To allow AC/DC power source, these pins are not polarized.

WARNING: OUTPUT VOLTAGE 9 AND 12 ARE POLARIZED AS OUTPUT VOLTAGE DELIVERS DC VOLTAGE (9 IS POSITIVE AND 12 IS NEGATIVE)

3. MiCOM E124 – APPLICATION WIRING

3.1 Application 1: Providing energy to 2 independent trip coils

MiCOM E124 can be used to provide energy to two independent trip coils (for two protection relays). Each capacitor bank will be dedicated to one trip coil (300V / 59J).

As shown in figure 3, this application requires specific external wiring:

- **Terminals 1 & 5** have to be connected to the first trip coil (Capacitor bank No.1)
- **Terminals 3 & 7** have to be connected to the second trip coil (Capacitor bank No.2)

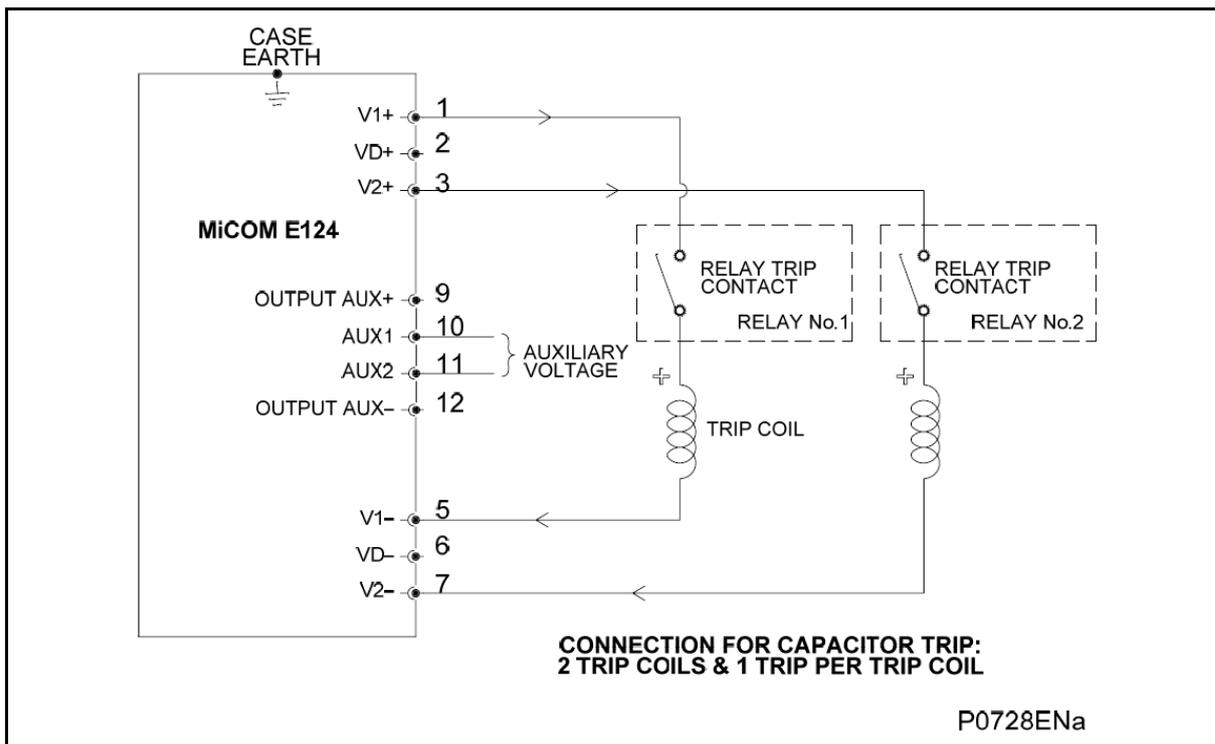


FIGURE 3: E124 WIRED TO TRIP TWO CIRCUIT BREAKERS AT 300V

3.2 Application 2: Providing energy to a unique powerful trip coil

MiCOM E124 can be used to provide energy to a unique powerful trip coil by connecting the two banks of capacitor in parallel. The global amount of energy provides to the trip coil will be 118J / 300V. As the capacitor storage is doubled, a heavier duty circuit breaker can be tripped.

As shown in figure 4, this application requires a specific external wiring:

- **Terminals 1 & 3** have to be connected to the + of the trip coil (Capacitor bank No 1 and bank No 2)
- **Terminals 5 & 7** have to be connected to the - of the trip coil (Capacitor bank No 1 and bank No 2)

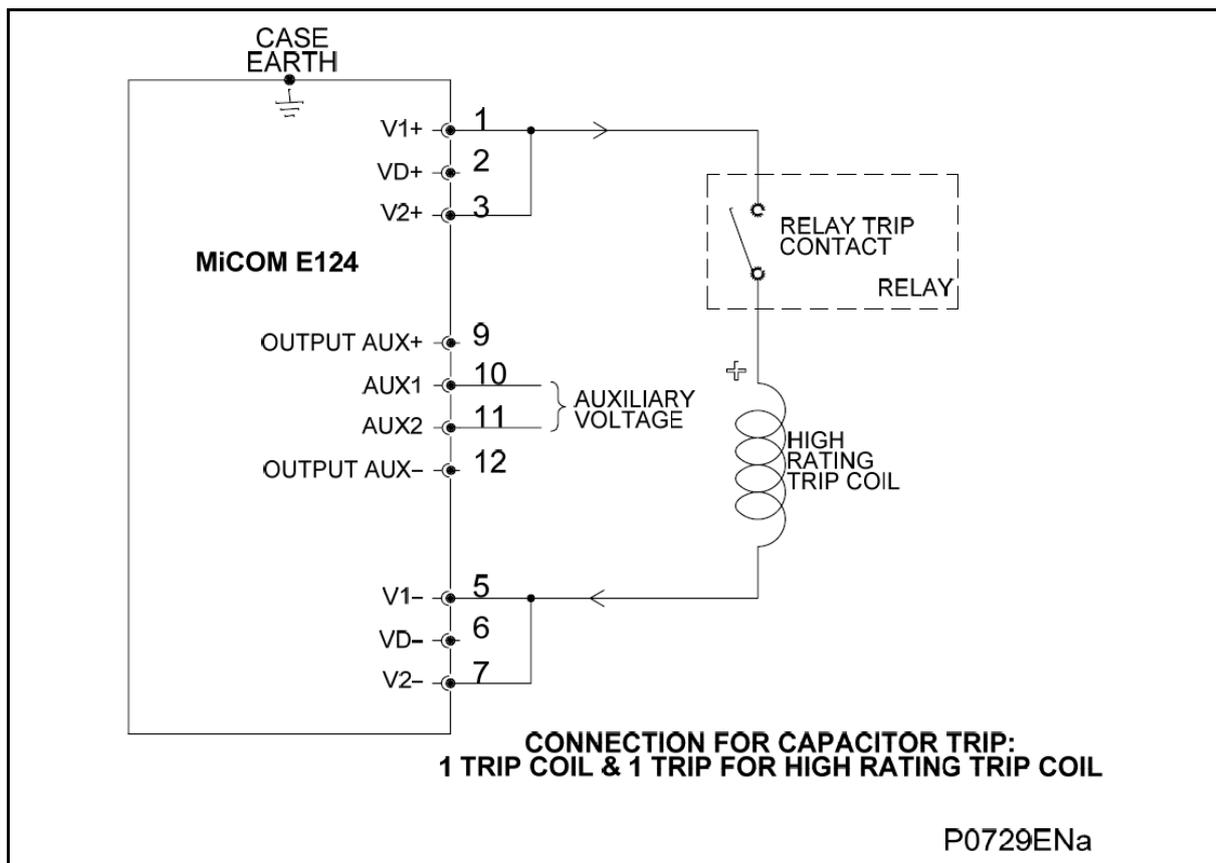


FIGURE 4: MiCOM E124 WIRED TO TRIP A POWERFULL TRIP COIL

3.3 Application 3: Allowing two consecutive trips

The switch from one capacitor bank to the other can be monitored by the microprocessor. This feature makes enables two consecutive trips at maximum power (300V / 59J) without having to recharge (Multiple trips of lower voltage and lower energy).

When the MiCOM E124 is used as one reserve of energy to give 2 trips at 300V each, output terminals 2-6 are used (VD+ and VD-).

The trip contact of the protective relay (MiCOM P124 for example) is serially connected to the external trip coil as shown in the figure 4 here above.

At the end of a first trip, an internal bi-stable relay automatically switches from the first bank of capacitors to the other. It is thus possible to get two successive trips without recharging of the capacitor banks (without power supply).

As shown in figure 5, this application requires specific external wiring:

- **Terminals 2 & 6** have to be connected to the trip coil (Capacitor bank No.1 then switches to capacitor bank No.2 automatically)

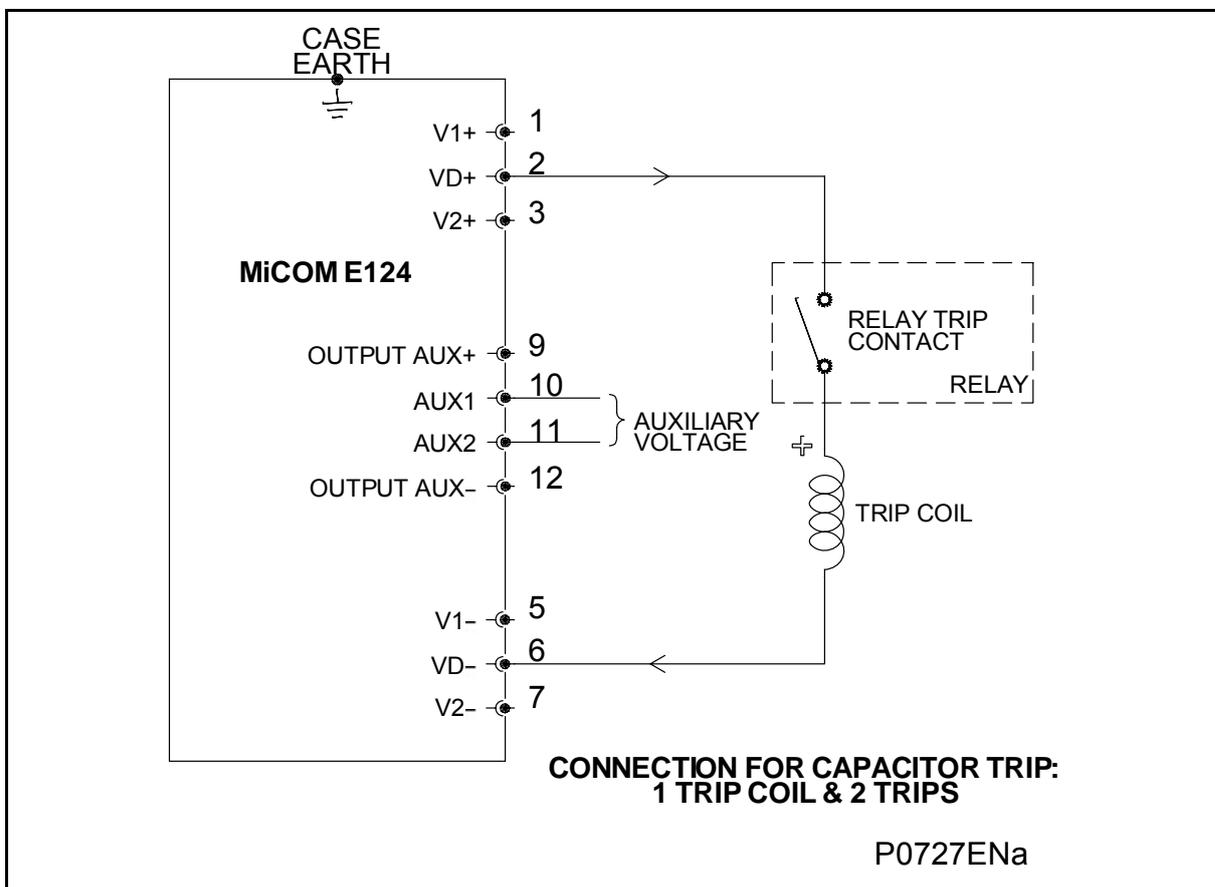


FIGURE 5: E124 WIRED TO TRIP ONE CIRCUIT BREAKER TWICE

3.4 Application 4: DC Power supply of an external device

MiCOM E124 can be used to supply power to an external device from an auxiliary AC/DC supply (in case of voltage dips) or from a voltage transformer (VT) connected on the busbar.

As shown in figure 6, this application requires specific external wiring:

- **Terminals 1, 3 & 9** have to be connected to the + (positive) terminal of the relay's power supply
- **Terminals 5, 7 & 12** have to be connected to the – (negative) terminal of the relay's power supply

In normal operation, the relay uses a voltage provided by an AC/DC auxiliary supply or is self powered via a current transformer (CT) or voltage transformer (VT).

If there is a short term loss of the auxiliary supply voltage or a supply voltage dip, the two banks of internal capacitor banks will provide a stable voltage to the relay. This duration depends on the power consumption of the relay and on the auxiliary voltage level.

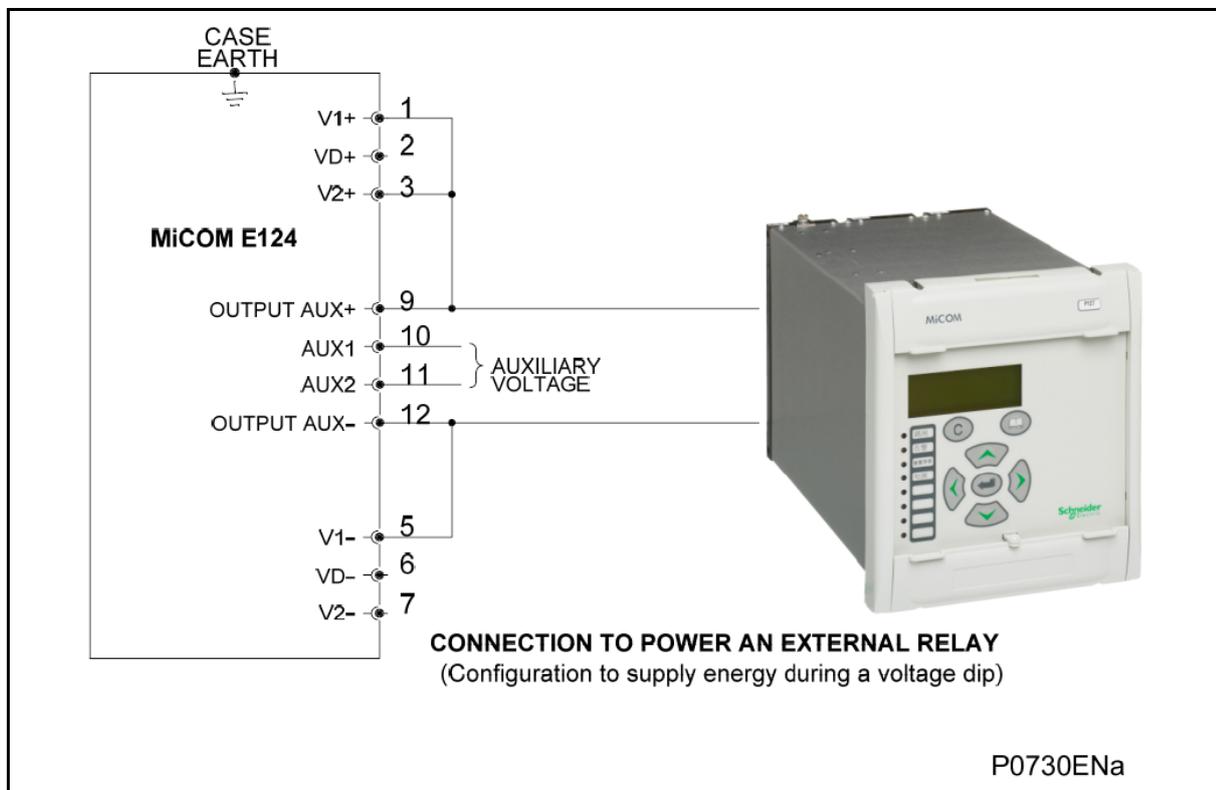


FIGURE 6: MiCOM E124 USED TO SUPPLY RELAYS



Customer Care Centre

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