

ECM series of Earth Continuity Monitor

Application and Basic Operation

Assemblies incorporating the Blakley Electrics Earth Continuity Monitor (ECM) provide additional protection against electric shock to users and operators of portable appliances by ensuring that equipment is always effectively earthed. In a circuit protected by a Monitored Earth assembly (comprising an ECM and a suitable disconnecter), if the protective earth conductor becomes disconnected in a connector or a portable appliance, or if the impedance in the monitored pilot-earth loop to an appliance rises above a pre-set threshold, the ECM automatically trips the associated circuit disconnecter and cannot be held closed until a healthy earth connection is restored. When the associated circuit disconnecter incorporates a no-volt coil, the ECM proves correct earthing prior to circuit energisation. When used in combination with a suitable circuit disconnecter, ECMs provide protection in accordance with BS 4444: Guide to electrical earth monitoring. Overleaf are schematic diagrams and details of the basic ECM design and connections.

Monitored Earth Sockets

ECMs are most commonly incorporated within socket-outlets installed in electrically hazardous environments, working in combination with MCBs, contactors and RCDs. Earth Continuity Monitoring is also adopted when the additional protection provided by high sensitivity RCDs is not required or is not practical. The adoption of Monitored Earth protection in plug and socket applications adds the further benefit of electrical interlocking. The ECM provides an electrical interlock which prevents the associated circuit disconnecter from remaining ON until all connectors in the pilot-earth loop circuit are effectively coupled. Electrical interlocking also causes the associated circuit disconnecter to open when a plug is withdrawn from a socket on load. It should be remembered that cables, plugs and sockets all require a separate pilot conductor. Refer to Data Sheets on Safelink Combination Sockets for composite protection units incorporating Earth Continuity Monitors.

Pilot Core Protection

To protect against the possibility of a short-circuit between the pilot and earth conductors in the cable supplying an appliance, a diode should be fitted within the appliance between the pilot conductor and the appliance casing. If a pilot-earth short circuit should then occur, the associated circuit disconnecter will trip. A two position selector switch is incorporated into the ECM, marked NORMAL and PILOT CORE. The Pilot Core position should be selected when a diode is fitted in to the appliance. A suitable diode is supplied with each ECM.

Automatic Disconnection of the Supply

The ECM can also be employed to assist in complying with Automatic Disconnection times for final socket circuits. This is achieved through setting the ECM pilot-earth loop trip factor at a point which should allow sufficient current to flow in the associated phase-earth loop circuit to trip the circuit's over-current protection device within 400 milliseconds of a short circuit to earth. If the pilot-earth loop impedance exceeds the pre-set trip level, the ECM trips the associated circuit disconnecter. ECM's are available with standard pilot-earth loop trip levels of 0.5, 0.8, 1.1 and 1.5 ohms. The installation designer should refer to the IEE Wiring Regulations for guidance on the maximum total earth fault loop impedance permissible for a circuit. It should be noted that the monitored circuit is the pilot earth loop, not the phase earth fault loop, thus the ECM provides an indication only that there will be automatic disconnection, not a guarantee.

ECM Design

The basic circuit is designed around the Wheatstone Bridge principle, the pilot-earth loop being one of the Bridge resistors. A voltage of 6 volts A.C. is applied to the Bridge, half-wave rectified by two bridge diodes, one of the diodes being within the pilot-earth loop circuit. The resulting D.C. levels are compared by an amplifier. If the Bridge imbalance is exceeded by more than the pre-set value the associated circuit disconnecter is tripped. The components are housed within an insulated enclosure and provided with terminations for external circuit connections.

Monitored Circuit

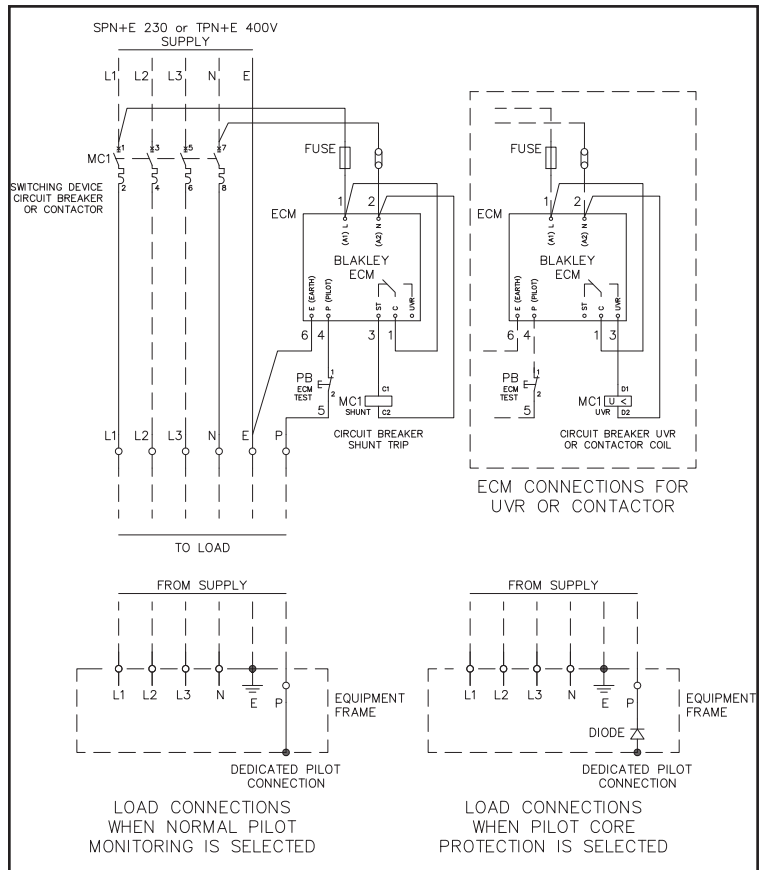
The pilot-earth loop normally comprises the following:

1. The main earth protective conductor from the control unit to the appliance
2. The appliance casing
3. A return path, the pilot conductor (P).

The loop is continuously monitored by passing a current at a voltage not exceeding 9 volts peak through the above circuit.

Protection - Pilot Fuse

As the pilot and earth cables function as parallel earth conductors it is necessary to protect the ECM against earth faults or welding currents that may occur in the pilot conductor. Should this happen, a fuse will operate and the associated circuit disconnecter will open. A replacement fuse is supplied loose with each ECM.



ECM Connection Diagram



Type ECM/230/1.5 - 230V, 1.5 ohms

Ordering Codes

Part Number	Type Reference	Pilot-Earth Loop Trip Factor
S050070	ECM/230/1.5	1.5 ohms
S050095	ECM/230/1.1	1.1 ohms
S050018	ECM/230/0.8	0.8 ohms
S050120	ECM/230/0.5	0.5 ohms

ECMs are available to order with different Pilot-Earth loop trip factors. They can also be supplied with a 110V auxiliary voltage.