

GE Energy Connections
Grid Solutions

Type MVTP

Technical Manual
Supervision Relay for High Impedance Type Busbar Protection Scheme

Publication reference: R8023H



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 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 of General Electric products are immune to the relevant levels of electrostatic discharge when housed in their cases. Do not expose them to the 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 front-plate, 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 any person without first ensuring that 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.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 60147-0F.

If you are making measurements on the internal electronic circuitry of an 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 – 10M ohms. If a wrist strap is not available you should maintain regular contact with the case to prevent the build up of static. Instrumentation which may be used for making measurements should be earthed to the case whenever possible.

General Electric strongly recommends that detailed investigations on the electronic circuitry, or modification work, should be carried out in a Special Handling Area such as described in BS5783 or IEC 60147-0F.

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SAFETY SECTION


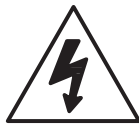


This Safety Section should be read before commencing any work on the equipment.

Health and safety

The information in the Safety Section of the product documentation is intended to ensure that products are properly installed and handled in order to maintain them in a safe condition. It is assumed that everyone who will be associated with the equipment will be familiar with the contents of the Safety Section.

Explanation of symbols and labels

The meaning of symbols and labels which may be used on the equipment or in the product documentation, is given below.

	
Caution: refer to product documentation	Caution: risk of electric shock
	Protective/safety *earth terminal
	Functional *earth terminal. Note: this symbol may also be used for a protective/safety earth terminal if that terminal is part of a terminal block or sub-assembly eg. power supply.

*Note: The term earth used throughout the product documentation is the direct equivalent of the North American term ground.

Installing, Commissioning and Servicing

Equipment connections



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

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 and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated, the correct crimp terminal and tool for the wire size should be used.

Before energising the equipment it must be earthed using the protective earth terminal, or the appropriate termination of the supply plug in the case of plug connected equipment. Omitting or disconnecting the equipment earth may cause a safety hazard.

The recommended minimum earth wire size is 2.5 mm², unless otherwise stated in the technical data section of the product documentation.

Before energising the equipment, the following should be checked:

- Voltage rating and polarity;
- CT circuit rating and integrity of connections;
- Protective fuse rating;
- Integrity of earth connection (where applicable)

Equipment operating conditions

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

Current transformer circuits



Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation.

External resistors



Where external resistors are fitted to relays, these may present a risk of electric shock or burns, if touched.

Battery replacement



Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity, to avoid possible damage to the equipment.

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



These must not be inserted into or withdrawn from equipment whilst it is energised, since this may result in damage.

Fibre optic communication



Where fibre optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

Older Products

Electrical adjustments



Equipments which require direct physical adjustments to their operating mechanism to change current or voltage settings, should have the electrical power removed before making the change, to avoid any risk of electric shock.

Mechanical adjustments



The electrical power to the relay contacts should be removed before checking any mechanical settings, to avoid any risk of electric shock.

Draw out case relays



Removal of the cover on equipment incorporating electromechanical operating elements, may expose hazardous live parts such as relay contacts.

Insertion and withdrawal of extender cards



When using an extender card, this should not be inserted or withdrawn from the equipment whilst it is energised. This is to avoid possible shock or damage hazards. Hazardous live voltages may be accessible on the extender card.

Insertion and withdrawal of heavy current test plugs



When using a heavy current test plug, CT shorting links must be in place before insertion or removal, to avoid potentially lethal voltages.



Decommissioning and Disposal

Decommissioning: The auxiliary supply circuit in the relay may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the relay (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to decommissioning.

Disposal: It is recommended that incineration and disposal to water courses is avoided. The product should be disposed of in a safe manner. Any products 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 lithium batteries.

Technical Specifications

Protective fuse rating

The recommended maximum rating of the external protective fuse for this equipment is 16A, Red Spot type or equivalent, unless otherwise stated in the technical data section of the product documentation.

Insulation class:	IEC 61010-1: 1990/A2: 1995	This equipment requires a protective (safety) earth connection to ensure user safety.
	Class I	
	EN 61010-1: 1993/A2: 1995	
	Class I	
Installation Category (Overvoltage):	IEC 61010-1: 1990/A2: 1995	Distribution level, fixed installation. Equipment in this category is qualification tested at 5kV peak, 1.2/50 s, 500, 0.5J, between all supply circuits and earth and also between independent circuits.
	Category III	
	EN 61010-1: 1993/A2: 1995	
	Category III	
Environment:	IEC 61010-1: 1990/A2: 1995	Compliance is demonstrated by reference to generic safety standards.
	Pollution degree 2	
	EN 61010-1: 1993/A2: 1995	
	Pollution degree 2	
Product safety: CE	73/23/EEC	Compliance with the European Commission Low Voltage Directive.
	EN 61010-1: 1993/A2: 1995	Compliance is demonstrated by reference to generic safety standards.
EN 60950: 1992/A11: 1997		

Section 1. INSTALLATION

1.1 General

Protective relays, although generally of robust construction, require careful treatment prior to installation and a wise selection of site. By observing a few simple rules the possibility of premature failure is eliminated and a high degree of performance can be expected.

The relays are either dispatched individually or as part of a panel/rack mounted assembly in cartons specifically designed to protect them from damage.

Relays should be examined immediately they are received to ensure that no damage has been sustained in transit. If damage due to rough handling is evident, a claim should be made to the transport company concerned immediately, and the nearest General Electric representative should be promptly notified. Relays which are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags.

1.2 Unpacking

Care must be taken when unpacking and installing the relays so that none of the parts is damaged or their settings altered, and must at all times be handled by skilled persons only.

Relays should be examined for any wedges, clamps, or rubber bands necessary to secure moving parts to prevent damage during transit and these should be removed after installation and before commissioning.

Relays 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 constructional work.

1.3 Storage

If relays are not installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons and where de-humidifier bags have been included in the packing they should be retained. The action of the dehumidifier 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-humidifying agent will lose its efficiency.

The storage temperature range is -25°C to $+70^{\circ}\text{C}$.

1.4 Site

The installation should be clean, dry and reasonably free from dust and excessive vibration. The site should preferably be well illuminated to facilitate inspection.

An outline diagram is normally supplied showing panel cut-outs and hole centres. For individually mounted relays these dimensions will also be found in publication R6015.

Publication R7012 is a Parts Catalogue and Assembly Instructions. This document will be useful when individual relays are to be assembled as a composite rack or panel mounted assembly.

Publication R6001 is a leaflet on the modular integrated drawout system
Publication R6014 is a list recommended suppliers for the pre-insulated connectors.

Section 2. COMMISSIONING

2.1 General

Before leaving the factory all relays are accurately adjusted, tested and carefully packed. Hence there should be no need for any re-adjustment on commissioning.

Moving parts are held in position during transit by rubber bands and packing. These should be removed carefully.

2.2 Electrostatic discharges

The relay uses components which are sensitive to electrostatic discharges. When handling the module, care should be taken to avoid contact with components and electrical connections. When removed from the case for storage, the module should be placed in an electrically conducting anti-static bag.

2.3 Wiring

Check that ratings of relay agree with the supplies to which it is to be connected.

Check all wiring connections to the relay, including the case earthing connection above the terminal block. It is especially important that dc supplies and magnetic blowout contacts are wired with the correct polarity. The relay diagram number appears inside the case.

2.4 Commissioning preliminaries

To gain access to the relay first loosen the captive cover screw and carefully remove the cover from the case.

The module can then be removed from the case by grasping the handles at the top and bottom of the front plate and pulling forwards.

Care must be taken to ensure that mechanical settings of the element are not disturbed.

Carefully remove the rubber band securing the flag mechanism.

Check that the bottom end of the contact operating card has not been dislodged from the slot in the armature extension and that the ends of the push rods are located in the holes in the contact springs.

Carefully actuate the armature of each unit in turn with small screwdriver/probe. Note immediately after the point where any make contacts just close there is a further small movement of the armature. This ensures that contact follow through and wiping action is present. Repeat similarly with break contacts on armature release.

On units fitted with hand reset flag indicators, check that the flag is free to fall before, or just as, any make contacts close.

Replace the module in the case and refit the cover. Make sure that the reset mechanism in the cover is correctly located with respect to the relay element, and that the flag (or mechanism) can be reset.

2.5 Electrical tests

2.5.1 Equipment required

- 1 – variable ac voltage source suitable to provide 0 – 30V and sufficient current for the relay (1mA over the setting range) and the voltmeter (possibly 50mA depending on the type and range used).
- 1 – AC voltmeter to cover setting range (1 – 16 volts)
- 1 – DC voltmeter to check nominal dc volts
- 1 – Two pole switch
- 1 – Electronic timer (a stop watch may be considered adequate)

2.5.2 Test block type MMLG

If a test block is provided the inter-connections should be checked to the scheme diagram. The live side of the test block rear terminals is indicated by orange colouring and they are all the odd numbers (1, 2, 5, 7 etc). The dc supply is always taken through terminals 13 to 14 and 15 to 16, removing the front cover of the test block isolates 13 and 14 removing the dc+. The test block may also be associated with protection CT circuits and before the multi-way test plug type MMLB01 is inserted the appropriate shorts must be on the test plug. It would also be necessary to link 13 to 14 and 15 to 16 to restore the auxiliary dc supply to the relay.

2.5.3 DC supply check

Remove the relay from its case. The incoming supply should be checked at the relay case terminals. Terminal 13 should be positive with respect to terminal 14.

No damage can be caused to this relay by reverse dc volts as a series diode is fitted inside.

2.5.4 Voltage setting check

Voltage settings are adjusted by way of a 4 way dual in line switch. The setting range is from 1V to 16V ac in steps of 1V.

The voltage setting is defined by the equation $V_S = 1 +$, which indicates that the setting is 1V plus a voltage value dependent on the sum of the selections of each of the four switches. Each switch is allocated to a voltage which is selected when moved to the left position.

The claimed accuracy on the settings is 5%. The setting with all switches positioned to the left is 16 volts.

First connect the ac volts via a switch to terminals 27 and 28. Apply a voltage 5% higher than the maximum setting ie. 16.8 volts; after 3 seconds the hinged armature unit should operate. Remove the volts and re-apply the 5% lower than the setting ie. 15.2 volts, and check that no operation occurs.

The required setting should be selected by inserting the plug.

Apply the volts 5% below the setting and very slowly raise them until operation occurs, slowly lower the volts until the relay drops off. Record the values, the drop-off to pick-up ratio should be greater than 85%.

If an MVTP 31 (three phase version) is being tested repeat the above tests by injecting into terminals 23 – 24 and 25 – 26 in turn.

2.5.5 Timing and contact operation checks

Timing and contact operation checks. Connect one pole of the switch to initiate the time interval meter. Set the volts to be injected to two times the nominal plug voltage setting.

Connect relay terminals 1 and 3 to the stop terminals of time interval meter.

Switch on the ac volts and check that the operation time is 3 seconds $\pm 5\%$ or 10 s $\pm 5\%$ depending on the model ordered.

Check that all other contacts are functioning correctly as shown on the particular application diagram.

The timing circuit is common to all inputs for the 3 phase version, the timing check therefore has only to be done using one input.

2.6 Insulation

The relay and its associated wiring, may be insulation tested between:

- a) all electrically isolated circuits
- b) all circuits and earth

An electronic or brushless insulation tester should be used, having a dc voltage not exceeding 1000V. Accessible terminals of the same circuit should first be strapped together. Deliberate circuit earthing links, removed for the tests, must subsequently be replaced.

Section 3. MAINTENANCE

Periodic maintenance is not necessary. However, periodic inspection and test is recommended. This should be carried out every 12 months or more often if the relay is operated frequently or is mounted in poor environmental conditions.

Check mechanical settings as per Section 4.

Tests 2.5.4 and 2.5.5 should be carried out to prove operation.

Section 4. MECHANICAL SETTINGS FOR THE OUTPUT RELAY

Armature gap measurements should be made with the top of the feeler gauge level with the centre line of the core.

Contact pressures are measured with gram gauge at the contact tips.

In general contact gaps and follow through are defined by quoting an armature gap at which the tips should be just closed or just open.

The relay contact state is always defined with the relay in the unenergised position, unless otherwise specified on the appropriate circuit diagram.

With the armature closed the clearance between the back of the armature and the back stop should be 0.003"/0.008".

Nominal armature gap open 0.050"/0.060".

4.1 Relays with mechanically latched contacts

4.1.1 Contact settings for:

For normal/heavy duty make and break contacts, with the armature closed onto a 0.018" feeler gauge, the make contacts should be closed, but should be open with a 0.022" feeler gauge.

When the armature has settled back on the catch, the break contact gap should be 0.060"/0.070".

Force to just close the make contacts: 25/25 grams.

Force to just open the break contacts: 18/23 grams.

4.1.2 Contact setting for:

Cut-off contact – lower left hand contact.

First set the lower lug on the armature extension so that the top of the roller is level with the top of the plastic catch when the relay is on the operated position.

Remove the operating wire from the plastic block on the moving contact.

Set the contact gap to 0.045"/0.055".

Force to just close the make contact: 12/15 grams.

Reposition the operating wire which should locate freely in the hole in the plastic block on the moving contact blade. If necessary, bend the wire to suit.

4.2 Mechanical settings related to the latch

The upper limiting lug should be clear of the cross roller and armature backstop in all positions.

Care should be taken to ensure that the upper lug still prevents the cross roller from riding up and over the armature extension.

With the armature closed, the force to lift the cross roller above the latch should be 40/50 grams.

With the armature closed onto a 0.003" feeler gauge the cross roller should pass clear of the plastic catch, but with a 0.006" feeler gauge the roller should not clear the catch. To achieve this the armature extension should be bent. The upper face of the plastic catch should remain tangential to a circle centred on the armature hinge. The armature should return to the fully open position when partly closed and released, and the reset arm should fall freely to the fully operated position when partly reset and released.

Section 5. PROBLEM ANALYSIS

It is recommended that faulty printed circuit boards are replaced and no attempt made to remove or change components on them. This is because the protective coating on the board is degraded by attempting to solder through it. These instructions therefore do not go into sufficient detail to permit the identification for faulty components at pcb level.

5.1 Removal of the relay from its case

To remove the relay, loosen the cover nuts and remove the cover. The relay can now be withdrawn from the case by pulling the handles.

5.2 Visual examination of wiring

Ensure that all the push on blades to the rear terminal block are in position.

Examine all wiring soldered to the printed circuit board. It is necessary to hinge the pcb out of position to carry this out.

This is achieved by first removing the screen which is held in position by plastic pegs.

Then remove the four screws from the pcb and hinging it away from the module.

Output relay coil resistance – pcb terminals 14,15

V _x	R
30/34V	340 15%
48/54V	850 15%
110/125V	4000 15%
220/250V	17000 15%

The following is a simple check on this part of the circuit and is not a comprehensive test but will help to identify pcb faults.

Apply the rated dc auxiliary voltage (V_x) to case terminals 13(+) and 14.

The table below indicates the voltages present on terminals within the MVTP module and possible faults if these are not as expected.



Measure the voltages at the following terminals taking care not to come into bodily contact with any live terminals. If all voltages are correct it may be assumed that the fault exists on the measurement PCB (ZJ0296)

Terminals	Expected voltage	Possible fault
13 wrt 14 (Midos)	Rated voltage	Faulty supply
ZJ0311 PCB terminals 10 wrt 11	Rated voltage less 1.2V	Filter PCB
ZJ0296 PCB terminals 12a wrt 11	Rated voltage less 1.2V	Filter PCB
ZJ0296 PCB terminals 9a wrt 11	16V 1V	Power supply module

The typical quiescent current at the lower rated voltage should be 10 – 20mA.

Section 6. SPARES

When ordering spares, quote the full relay model number and any component reference numbers, or briefly describe the parts required.

Should the need arise for the equipment to be returned to General Electric for repair please fill in the RMA form at the back of this manual.

A copy of any commissioning test results should also be sent with the equipment.

Section 7. COMMISSIONING TEST RECORD

Busbar Supervision Relay

Date

Station _____

Circuit

Relay model number: MVTP _____

Serial number

Setting range: 1 – 16V 50/60Hz

Operating time fixed at 3 seconds
or 10 seconds

Auxiliary supply (V_X) _____ V DC

2.4 Visual inspection _____

2.5 Electrical tests:–

2.5.3 Check auxiliary supply (V_X) at terminals 13 and 14 _____ V DC

2.5.4 Check voltage setting (V_S) tolerance 5%

With setting at 16V ($V_S = 16$ volts), all switches to the left:

Apply 16.8 volts. Relay operates after 3 seconds (Tick)

Apply 15.2 volts. No operation occurs (Tick)

With final required setting (V_S) selected check for PU and DO volts

Setting (V_S) _____ volts

Pick up _____ volts

Drop off _____ volts

2.2.5 Check operating time

Setting (V_S) _____ volts

With $2 \times V_S$ applied operate time _____ seconds

All contacts operate correctly (Tick)

Commissioning Engineer

Customer Witness

Date

Date



REPAIR / MODIFICATION RETURN AUTHORIZATION FORM – RMA FORM

FIELD ONLY TO BE FILLED IN BY A GE GRID Automation REPRESENTATIVE		Date :
RMA Reference		ACT Reference (M):
Repair Center address to Ship the Unit: UK Grid Solution LTD St Leonards Building Harry Kerr Drive, Redhill Business Park, Stafford, ST16 1WT, UK <u>FAO :- After Sales Department</u>		
GE GRID Automation Local Contact Information: Name of Contact - Tel No - email -		

1. IDENTIFICATION OF UNIT & FAULT INFORMATION - Fields marked (M) are mandatory, delays in return will occur if not completed.

Qty	Type of Material(M) Model N° (M)	Serial n°(M) Part n°(M)	SW Vers	Description of Fault or Modification required(M)	Are Field Volts Used (M)	Warranty Y/N ?
(M) Equipment failed during Installation / Commissioning <input type="checkbox"/> Yes				Equipment failed during service <input type="checkbox"/> Yes How long?		
(M) Equipment failed during Installation / Commissioning <input type="checkbox"/> Yes				Equipment failed during service <input type="checkbox"/> Yes How long?		

2. SPECIALIST REPAIR INSTRUCTIONS

Do you want an updated firmware version after repair?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the relay being returned in a case?	<input type="checkbox"/> Yes	<input type="checkbox"/> No (If No see repair Term 5)

3. CUSTOMS & INVOICING INFORMATION REQUIRED TO ALLOW RETURN OF REPAIRED ITEMS

Value for Customs (M):	
<u>Customer Invoice Address if paid (M)</u>	<u>Customer Return Delivery Address (full street address) (M)</u>
	Part Shipment Accepted (Yes/No) -
Contact Name: Tel No: Email:	Contact Name: Tel No: Email:

4. REPAIR TERMS & CONDITIONS

1. **Please ensure a copy of the import invoice is attached with the returned unit/Airwaybill document copy emailed (M)**
2. Please ensure the Purchase Order is released, for paid service, to allow the unit to be shipped
3. Submission of equipment to **UK Grid Solutions** is deemed as authorization to repair and acceptance of quote.
4. Please ensure all items returned are marked as Returned for 'Repair/Modification' and **protected by appropriate packaging** (anti-static bag for each board / relay with foam protection).
5. If a relay is not being returned in a case, please refer to instructions on Page 2.



5. Return Packaging Standards (ALL PRODUCTS)

1. Please ensure the device is clean, no sharp edges are exposed and the device is in a suitable condition to be handled.
2. Relay's returned without cases should be placed in to Anti-Static Bags and sealed to protect hyper-sensitive components.



3. A suitable size box should be used, with packing material at the bottom, the device placed into box with sufficient gaps to fill with packing material around each side and on the top, extra packaging material placed around the relay.



4. Please include a copy of the completed RMA form then close the lid and seal with packaging tape.



5. The relay should then be secondary packed if being exported, the primary packed box should be placed into an oversized box with packaging material surrounding the primary packed box and then sealed.



Imagination at work

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