GE Energy Connections
Grid Solutions

MVTT

User Manual
Static Digital Time Delay Relays

Publication reference: R8012L

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 a 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.

Types: MVTT 14 – Delay on pick up

MVTT 15 – Delay on drop off

CONTENTS

CONTENT

1. SAFETY SECTION

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

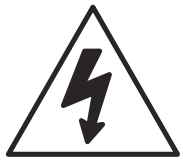
1.1 Health and safety

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.

1.2 Explanation of symbols and labels

The meaning of symbols and labels 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 e.g. power supply.

*NOTE: THE TERM EARTH USED THROUGHOUT THE PRODUCT DOCUMENTATION IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

2. 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 electrical 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 2.5mm^{2,} 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)
- Remove front plate plastic film protection
- Remove insulating strip from battery compartment

3. EQUIPMENT OPERATING CONDITIONS

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

3.1 Current transformer circuits

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

3.2 External resistors

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

3.3 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.

3.4 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.

3.5 Insertion of modules and pcb cards

These must not be inserted into or withdrawn from equipment whist it is energised since this may result in damage.

3.6 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.

4. 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 electrical 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.

5. 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.

6. 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 601010-1 : 1990/A2 : 2001 Class I EN 61010-1: 2001 Class I	This equipment requires a protective (safety) earth connection to ensure user safety.
Insulation Category (Overvoltage):	IEC 601010-1 : 1990/A2 : 1995 Category III EN 61010-1: 2001 Category III	Distribution level, fixed insulation. Equipment in this category is qualification tested at 5kV peak, 1.2/50µs, 500Ω, 0.5J, between all supply circuits and earth and also between independent circuits.
Environment:	IEC 601010-1 : 1990/A2 : 1995 Pollution degree 2 EN 61010-1: 2001 Pollution degree 2	Compliance is demonstrated by reference to generic safety standards.
Product Safety:	72/23/EEC	Compliance with the European Commission Low Voltage Directive.
CE	EN 61010-1: 2001 EN 60950-1: 2002	Compliance is demonstrated by reference to generic safety standards.

Section 1. DESCRIPTION OF RELAY

1.1 Settings

MVTT 14 – This is a time delay on pick up relay, which operates four change-over contacts after a set time delay from closure (pick up) of the initiation contact.

MVTT 15 – This is a time delay on drop off relay which operates four change-over contacts after a set time delay from opening (drop off) of the initiating contact.

Both relays have 1000/1 time delay settings available in one of the following ranges:

Time range (seconds)	Minimum steps
0.001 to 0.999	1ms
0.01 to 9.99	10ms
0.1 to 99.9	100ms
1.0 to 999.0	1s
10.0 to 9990	10s

1.2 Trip indication

Earlier relays are fitted with hand reset mechanical flag indicators, later relays being fitted with a non-volatile hand reset LED trip indicator. The latter is always restored to its original state after an interruption in the auxiliary supply.

Section 2. AUXILIARY EQUIPMENT

2.1 External components

The MVTT 14/15 range of relays are designed for use on dc supplies of 24/27V, 30/34V, 48/54V and 110/125V. When the supply voltage (Vx) is 220/250V an external component card is supplied.

2.2 Relays to ESI standard 48-4

When Rext(1) appears on the front plate of the relay, it complies with ESI Standard 48-4 and care should be taken to ensure that the parallel resistor Rext(1) is connected correctly (see Figures 1 and 2).

These resistors are added to increase the minimum dc burden of the relays to the limits defined in the ESI 48-4 Class 1 or 2 specification. The MVTT 15 complies with ESI 48-4 Class 1 and the MVTT 14 complies with ESI 48-4 Class 2.

2.3 Older models

On older models, with only 1 or 2 output contacts, an external resistor Rext(1) is required for dc supplies >30/34V, and the shunt resistor required for compliance with ESI 48-4 is designated Rext(2).

Section 3. INSTALLATION

3.1 Precautions

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.

3.2 Packing

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

3.3 Inspection

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.

3.4 Unpacking

Care must be taken when unpacking and installing the relays so that none of the parts are damaged or their settings altered, and they 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.

3.5 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 de-humidifier crystals will be impaired if the bag has been exposed to humid 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.

Storage temperature –25° to +70°C.

3.6 Siting

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 R6012.

Note: Earlier relays are fitted with hand reset mechanical flag indicators, later relaysbeing fitted with non-volatile hand reset LED trip indicators. If a flag indicator is fitted damage is likely to be incurred if the flag indicator/ armature assembly of a miniature relay is actuated manually with a screwdriver/probe. Flags should always be reset with the cover in position by the facility provided. (MVTT 14 only).

4.1 Inspection and wiring check

Carefully examine the module and case to see that no damage has occurred during transit. Check that the relay serial number on the module, case, cover and resistor assembly (when an assembly is required) are identical and that the model number and rating information are correct.

Check that the external wiring is correct to the relevant relay diagram or scheme diagram. The relay diagram number appears inside the case. Particular attention should be paid to the wiring of the external resistors Rext 1 and Rext 2 to the relay (if required on scheme).

4.1.1 Electrostatic discharges(ESD)

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. See full recommendations inside the front cover of this publication.

4.2 Connection of the MMLG test block

If a test block MMLG is provided, the connections should be checked to the scheme diagram, particularly that the supply connections are to the live side of the test block (coloured orange) - the odd numbered terminals. The auxiliary supply voltage to the scheme should be routed via the test block terminals 13 and 15. To facilitate ease of wiring the MMLG should be located at the right hand side of the assembly.

4.3 Earthing

Ensure that the case earthing connection above the rear terminal block is used to connect the relay to the local earth bar.

4.4 Insulation check

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

– all electrically isolated circuits.

– all circuits and earth.

An electronic or brushless insulation tester should be used, having a dc voltage not exceeding 1kV. Accessible terminals of the same circuit should first be strapped together. Deliberate circuit earthing links, removed for the tests must subsequently be replaced.

4.5 Functional testing

4.5.1 Equipment required:

AC or dc voltmeter to check nominal volts

Resistance meter

1 double pole 2-way switch

1 electronic timer (for time ranges less than 1 – 999 seconds)

1 hand-held stopwatch (for time ranges of 1 – 999 seconds or greater)

4.5.2 Auxiliary supply check

With the relay module removed measure the auxiliary supply voltage on case terminals 21 and 14 (13 and 14 for MVTT 15), check that the voltage corresponds to the relay auxiliary supply rating (Vx) indicated on the front of the relay and that terminal 21 (13 for MVTT 15) is positive with respect to terminal 14.

If the dc auxiliary supply of the relay is 220/250V check that the external component card ref HN0079 is connected as shown in Figures 10b and 13b.

On older relays (with only 1 or 2 output contacts), if the dc auxiliary supply is greater than 30/34V, check that the external resistor Rext(1) is the correct value as indicated on the front of the relay.

4.5.3 Test block Type MMLG

If a test block is included in the scheme, it may also be associated with protection CT circuits. It is important that the sockets in the type MMLB01 test plug, which correspond to the current transformer secondary windings, are LINKED BEFORE THE TEST PLUG IS INSERTED INTO THE TEST BLOCK.

DANGER: DO NOT OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION

4.5.4 Timing tests

See Figures 3, 4, 5 and 6 for typical test circuits.

It is recommended that the time interval meter is operated from the ‘contacts’ circuit.

The initiation contact should be simulated by one side of the switch, the other side is used to start the time interval meter. Any of the unused relay contacts may be used to stop the time interval meter.

Operate the initiating contact (switch) and check that the relay operating time is within ±2% (or +20ms –0ms whichever is the greater) of the relay setting. Note that the measuring accuracy depends upon the accuracy of the instruments used.

Repeat this test at other relay settings.

4.5.5 Final setting check

This test should be carried out at the required final settings. Using the typical test circuit previously described, check that the operating time of the relay is within the claimed tolerance.

At this stage, a final visual check of the setting should be made and the cover put into position.

4.5.6 Trip indicator and contact check

A check should now be made to see if the trip indicator operates correctly and can be reset using the cover reset mechanism. Also check that the contacts operate by doing continuity checks.

4.5.7 Final checks

Operate the relay with the trip and alarm links restored to ensure that the necessary trip and alarm circuits are energised according to the relevant schematic diagram.

Disconnect the test circuit, remove all test leads, plugs and switches and temporary shorting leads etc and replace any links that have been removed to facilitate testing.

CAUTION: If the test block MMLG has been used, the test block cover must be replaced to put the relay back into service.

Section 5. MAINTENANCE

Periodic maintenance is not necessary. However, periodic inspection and test is recommended.

5.1 Visual inspection

Isolate all supplies and withdraw the module from the case using the two black handles on the relay. Inspect the printed circuit board for any sign of loose components or connections.

Note that if fitted the flag mechanism should not be disturbed unless found to be operating incorrectly during the routine function tests. (MVTT 14 only).

Your attention is drawn to the fact that the relay can be damaged by electrostatic discharges. The pcb should not be touched unless precautions have been taken.

5.2 Functional tests

Periodic functional tests should be carried out using the test procedures shown in the commissioning section.

The operation of the trip indicator and the reset mechanism should be checked during these functional tests.

Section 6. PROBLEM ANALYSIS

These instructions enable a fault to be localised to sub-assembly level. Fault finding to component level is not recommended. The main reasons for this are as follows:

- fault finding on printed circuit boards requires the use of specialised knowledge and equipment.
- components used in manufacture are subject to strict quality control and in certain cases selected for particular characteristics. Complementary metal oxide silicon (cmos) components are used, which require extremely careful handling.
- damage can be caused to the printed circuit track unless extreme care is used in the replacement of components.
- replacement of some components will necessitate recalibration of the relay.

– the printed circuit boards are covered with a protective coating of polycoat which makes access to tracks and components very difficult.

The problem analysis sections following are written to cover all versions of the MVTT 14 and MVTT 15.

6.1 Test equipment required for fault finding

Equipment required for fault finding is minimal and consists of the following:

– digital multimeter with ranges of 0 – 1000V ac/dc and 0– 1A ac/dc

– dc voltage supply 30V 0.5A

– ac voltage source 0 – 500V 50Hz at 200mA

– oscilloscope (optional)

– relay tool kit

6.2 General procedure and precautions

Care must be taken when making test connections to printed circuit boards to avoid short circuiting or damaging the copper tracks. Before connecting or disconnecting any test equipment the relay must be isolated from the supply.

Relevant schematic diagrams

Delayed drop off relay type MVTT 14

DC versions

With mechanical flag unit (early relays)	10 MVTT 14 501.	See Figure 7.
With LED trip indicator (Mk 1)	10 MVTT 14 05.	See Figure 8.
With LED trip indicator (Mk 2)	10 MVTT 14 06.	See Figure 9.
With 4 change-over contacts	10 MVTT 14 07.	See Figure 10.

AC versions

All relays have the same connections	10 MVTT 14 504.	See Figure 11.

Delayed pick up relay type MVTT 15

DC versions with one change-over contact	10 MVTT 15 501.	See Figure 12.
DC version with four change-over contacts	10 MVTT 15 05.	See Figure 13.
AC versions	10 MVTT 15 504.	See Figure 14.

6.3 Inspection – removal of module from case

Unscrew the two front cover screws and remove the clear plastic front cover.

Ensure that the dc supply is isolated and then withdraw the module assembly by the two black handles. A quick inspection of the relay may result in the detection of obvious faults, ie. loose components or connections. Otherwise proceed to the next section.

6.4 Connections for MVTT 14 and MVTT 15

The connections of the relay can be classified into two different types. Firstly the external connections to the relay; these are the connections between the relay terminals and the rest of the system.

Secondly, the printed circuit board connections; these are the connections between the relay terminal block and the printed circuit board soldered connections.

6.4.1 Delayed pick-up relay – MVTT 14

DC MVTT 14 relays fitted with a mechanical flag and all ac MVTT 14 relays.

Terminal connectors: Terminals 13 and 14 are connected to the relevant ac or dc auxiliary supply. For dc auxiliary supply MVTT 14 terminal 13 is positive. Terminals 1 to 6 are the two output contacts of the relay. For ac versions only, terminals 21 and 22 are the external initate contact.

Printed circuit board connections:

DC versions

There are four terminal connections on the pcb. Numbers 3 and 4 are located in the centre of the printed circuit board. Numbers 1 and 2 are located at the bottom right-hand side of the printed circuit board. They are connected as follows:

PCB terminals 3 and 4 are connected to the coil terminals of the output relay.

PCB terminals 1 and 2 are connected to terminals 13 and 14 respectively of the rear mounted terminal block (dc auxiliary supply terminal 13 is positive).

AC versions

There are six terminal connections located at the rear edge of the printed circuit board. They are connected as follows:

PCB terminals 1 and 2 are connected to terminals 14 and 13 respectively of the rear mounted terminal block (ac auxiliary supply).

PCB terminals 3 and 4 are connected to the coil terminals of the output relay.

PCB terminals 5 and 6 are connected to terminals 21 and 22 of the rear mounted terminal block (external intitate contact).

The output relay and mechanical flag assembly is connected by flying leads to the terminal block. The normally open contacts are connected to terminals 1 and 2. The moving contacts are connected to terminals 3 and 4 and the normally closed contacts are connected to terminals 5 and 6. Relays with LED indicators have the output relay mounted directly on the terminal block and have no flying lead connections for the terminal block.

DC MVTT 14 relays fitted with LED trip indicator (Mk 1)

Note: this version of the MVTT 14 requires a separate initiating contact.

Terminal connectors: Terminals 13 and 14 are connected to the dc auxiliary supply, terminal 13 is positive. Terminals 21 and 22 are the external initiate contact. Terminals 1 to 6 are the two output contacts of the relay.

Printed circuit board connections:

There are six terminal connections on the main printed circuit board (pcb). Terminals 3 and 4 are located in the centre of the main printed circuit board, terminals 1, 2, 5 and 6 are located at the lower right hand side of the printed circuit board. They are connected as follows:

PCB terminals 3 and 4 are connected to terminals A and B respectively on the pcb mounted in the upper position on the terminal block.

PCB terminals 1, 2, 5 and 6 are connected to terminals 13, 14, 21 and 22 respectively of the rear mounted terminal block (dc auxiliary supply terminal 13 is positive).

DC MVTT 14 relays fitted with LED trip indicator (Mk. 2)

Note: This version of the MVTT 14 does not require a separate initiating contact.

Terminal connectors: Terminals 13, 14 and 21 are connected to the dc auxiliary supply. Terminal 21 is constantly connected to positive and terminal 13 is connected to positive to start timing. Terminals 1 to 6 are the two output contacts of the relay.

Printed circuit board connections, all versions:

There are six terminals connections on the main printed circuit board (pcb). Terminals 3 and 4 are located in the centre of the main printed circuit board, terminals 1, 2, 5 and 6 are located at the lower right hand side of the printed circuit board.
They are connected as follows:

PCB terminals 3 and 4 are connected to terminals A and B respectively on the pcb mounted in the upper position on the terminal block.

PCB terminals 1, 2, 5 and 6 are connected to terminals 1, 2, 5 and 6 respectively on the pcb mounted on the rear terminal block.

DC MVTT 14 relays fitted with LED trip indicator and four change-over contacts

Terminal connections: Terminals 13, 14 and 21 are connected to the dc auxiliary supply. Terminal 21 is constantly connected to positive and terminal 13 is connected to positive to start timing. Terminals 1 to 12 are the four sets of change-over contacts of the relay.

Printed circuit board connections:

The terminals on the terminal block detailed above are all wired directly to the printed circuit board terminals which bear the same number.

6.4.2 Delayed drop-off relay – MVTT 15

MVTT 15 relays with a single change-over contact

Terminal connections: Terminals 13 and 14 are connected to the relevant ac or dc auxiliary supply. For dc auxiliary supply MVTT's terminal 13 is positive. Terminals 1, 3 and 5 are the output contact of the relay. Terminals 21 and 22 are the external initiate contacts.

Printed circuit board connections:

There are seven terminal connections located at the rear of the PCB. These are connected as follows:

PCB terminals 1 and 2 (dc version) or 3 and 4

(ac version) are connected to terminals 14 and 15 respectively of the rear mounted terminal block (auxiliary supply for dc versions terminal 13 is positive).

PCB terminals 3 and 4 (dc version) or 2 and 1 (ac version) are connected to terminals 22 and 21 respectively of the rear mounted terminal block (external initiate contact).

PCB terminals 5, 6 and 7 are connected to terminals 1, 3 and 5 respectively of the rear mounted terminal block (external cross-over contact).

MVTT 15 relays with four change-over contacts

Terminal connections: Terminals 13 and 14 are connected to the dc auxiliary supply with terminal 13 being connected to the positive. Terminals 1 to 12 are the four sets of change-over contacts of the relay. Terminals 21 and 22 are the external initiate contacts.

Printed circuit board connections:

The terminals on the terminal block detailed above are all wired directly to the printed circuit board terminals which bear the same number.

6.5 Checking voltage supplies to module

The dc voltage ratings available are 24/27V, 30/34V, 48/54V, 110/125V and 220/250V. Where the external dropper resistor Rext(1) is used it will be connected in series with the negative supply rail.

The ac voltage ratings previously available were 63.5/69.3V_{ac}, 110/127V_{ac}, 220/250V_{ac} and 380/440V_{ac} for 50 and 60Hz supplies.

Check that the supply voltage is present on terminals 13 and 14 of the relay terminal block when the module is withdrawn from its case and the initiating contact closed. For dc auxiliary voltage relays check that terminal 13 is the positive terminal. For the versions fitted with the LED trip indicator check that the auxiliary supply is also present between terminal 21 (positive) and 14.

Note: For dc auxiliary voltage relays, when the module is in the case and the initialisation contact is closed the voltage across the terminals may be less due to the voltage drop across the dropper resistor Rext (1) if fitted.

Printed circuit board tests

If all connections are intact and the dc supplies are of the correct voltage and polarity, it is likely that the fault will lie on the pcb. Proceed to the next two sections, to try to confirm this.

6.6 Measurement of operating current of the modules

By monitoring the operating current of a module, a good indication is provided that the module is connected correctly and the input section of the pcb is operating correctly, if the current measured lies within about +10% of the specified value. Allowances must be made for supply voltages deviating from the lower rated voltage as this has a significant effect on the burden.

The burdens should be measured in all three timing states for the delayed drop-off version and both timing states for the delayed pick-up version.

An ammeter should be connected in the positive supply line between the auxiliary supply and terminal 13 of the module to measure these burdens. Typical values for the burdens in the different timing states are shown in the following tables.

Note: With ac voltage relays a TRMS meter MUST be used to measure the current.

Typical burdens of standard versions of MVTT's

Note all readings are taken at the lower nominal rated voltage

Delayed pick-up version – MVTT 14 (dc auxiliary supply)

	Nominal voltage range (Vdc)				
	24/27	30/34	48/54	110/125	220/250
Rext (1) (Ω)					
With mechanical flag:	n/a	None	150	1000	2800
With LED indicator:	n/a	None	200	1200	3100
With LED indicator and four changeover contacts:	none	none	none	none	2800
Current consumption					
With mechanical flag:					
During timing	n/a	13mA	32mA	65mA	65mA
After time out with output energised	n/a	55mA	62mA	66mA	66mA
With LED indicator:					
Quiescent	n/a	10mA	30mA	60mA	60mA
During timing	n/a	20mA	30mA	60mA	60mA
After time out with output energised	n/a	55mA	60mA	65mA	65mA
With LED indicator and four changeover contacts:					
Quiescent state – LED off	7.5mA	3mA	4.5mA	2.5mA	36mA
Quiescent state – LED on	12mA	8mA	9mA	7mA	36mA
After time out with output energised	106mA	102mA	62mA	31mA	36mA

Delayed Drop-off Version – MVTT 15 (dc auxiliary voltage)

	Nominal voltage range (Vdc)				
	24/27	30/34	48/54	110/125	220/250
Rext (1) (Ω)					
With single changeover contact:	n/a	None	150	1000	2800
With four changeover contacts:	none	none	none	none	2800
Current Consumption					
With single changeover contact:					
Initiate contact closed, output element energised	n/a	62mA	70mA	71mA	68mA
During timing	n/a	53mA	57mA	65mA	65mA
After time-out	n/a	0mA	0mA	0mA	0mA
With four changeover contacts:					
Contact operated	100mA	99mA	57mA	27mA	37mA
Contact unoperated	8mA	3.5mA	5mA	2.5mA	36mA

MVTT 14 and MVTT 15 (ac auxiliary voltage)

For all voltage versions run at the lower of the nominal voltage the burden is as follows:

50Hz operation : 60mA +20%

60Hz operation : 70mA +20%

Note: The burden taken by the ac version of these relays is constant for a constant voltage input, ie., the current drawn from the supplies does not vary during and after timing. The burden of the ac versions is primarily a capacitive burden.

6.7 Repairs and replacements

The instructions given enable the detection of faults to sub-assembly level.

It is recommended that any fault on the pcb should be rectified by replacement of the complete board. However, if any component is replaced, then the relay must be recalibrated.

Repair and replacement of miniature pcb mounted relay and flag mechanism (where fitted)

The miniature relay cannot be repaired. If it is proved to be operating incorrectly, it must be replaced. The flag assembly can be reset, or damaged parts replaced as required. If any part of the flag/relay assembly is disturbed, the settings of the assembly must be checked and adjustments made where necessary.

To gain access to the flag assembly, to replace parts or check the settings, it is necessary to dismantle the module. Once access to the flag assembly, mounted on the front plate of the relay, has been gained, adopt the following procedure:

(i) Remove the screw holding the side plate to the top plate and remove the side plate. This will reveal the miniature relay and the flag spring. Access is possible through the side of the assembly unless impeded by other components.

(ii) Remove the 3 screws (2 at the top, 1 at the bottom) holding the printed circuit board to the top and bottom plates. The circuit board, with the miniature relay can now be withdrawn from the flag assembly.

(iii) Remove the 2 screws holding the flag spring and clamp plate to the bottom plate. The flag spring can now be extracted from the assembly.

Note that the top and bottom plates cannot be removed from the relay front plate without damaging the self-adhesive name plate, which covers the heads of the countersunk screws holding the top and bottom plates to the front plate.

Assembly is in the reverse order of dismantling.

Setting up procedure of flag assembly

Flag spring units are supplied pre-bent and should need no further adjustment before assembly.

With the flag spring and printed circuit board carrying the miniature relay assembled to the top and bottom plates check the settings:

(i) Lift the flag spring to the latched position so that the tab on the flag spring rests on the catch on the relay.

(ii) a) With a gap of 0.4mm between the inside face of the armature and the core, the flag should remain latched.

b) With a gap of 0.15mm the flag should drop. If necessary, carefully bend the tab to fulfil these conditions. These tests should be performed by positioning an appropriate feeler gauge between the armature and coil and then energising the coil with the appropriate voltage to pick up the relay.

(iii) With the flag in the latched position the spring should exert a force of 10 – 12 grams on the catch. This is checked using a gram gauge, just lifting the flag off the catch.

(iv) With the flag in the latched position the white stripes on the flag should show evenly through the slots in the nameplate. Adjustment is made by slackening the pcb fixing screws and moving the pcb assembly up or down as necessary, then re-tightening the screws. After adjustment of the pcb the catch engagement must be rechecked as in (ii).

(v) Allow the flag to drop (by energising the relay coil). The red stripes should show evenly through the slots in the nameplate. Adjustment is made by bending the tabs, one on each side of the bottom plate.

Flag replacement parts:

Spring	GT7001 001
Flag	GT9009 001
Clamp plate	GT2007 001
Printed circuit board	ZG0859

Armature Clip

Several different makes of relay are used, which require different designs of armature clip. When ordering a replacement relay, state that it is for use in a flag assembly and it will be supplied with the correct armature clip.

The armature clip is marked by a number in the moulding to indicate which make of relay it fits:

Make of relay	Number on clip	Reference Number
PASI	1	GT6008 001
HALLER	2	GT6007 001

Should the need arise for the equipment to be returned to General Electric for repair, then the form at the back of this manual should be completed and sent with the equipment together with a copy of any commissioningtest results.

6.8 Replacement parts – ordering information

When ordering any spares, please quote the relay model number and serial number as well as the printed circuit board part number.

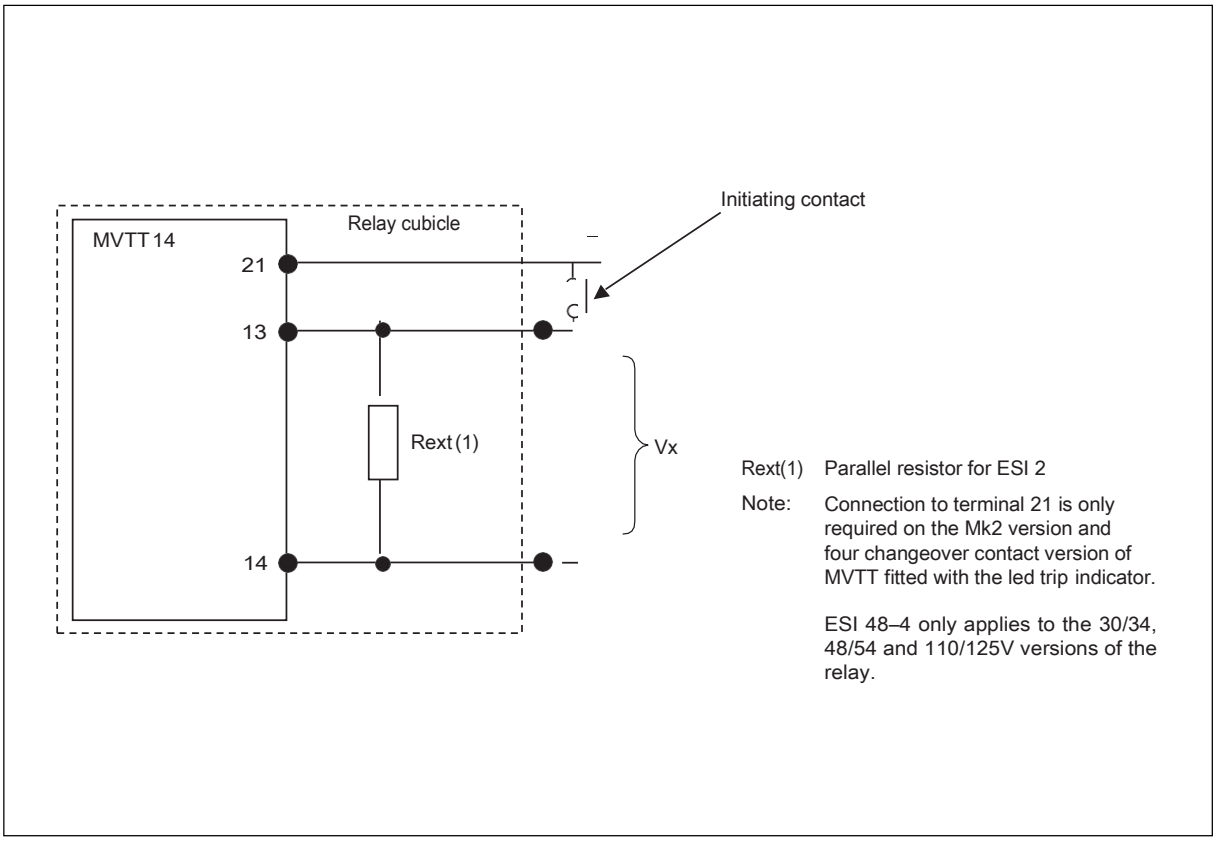


Figure 1: ESI 48–4 relay, typical external connection diagram – MVTT 14.

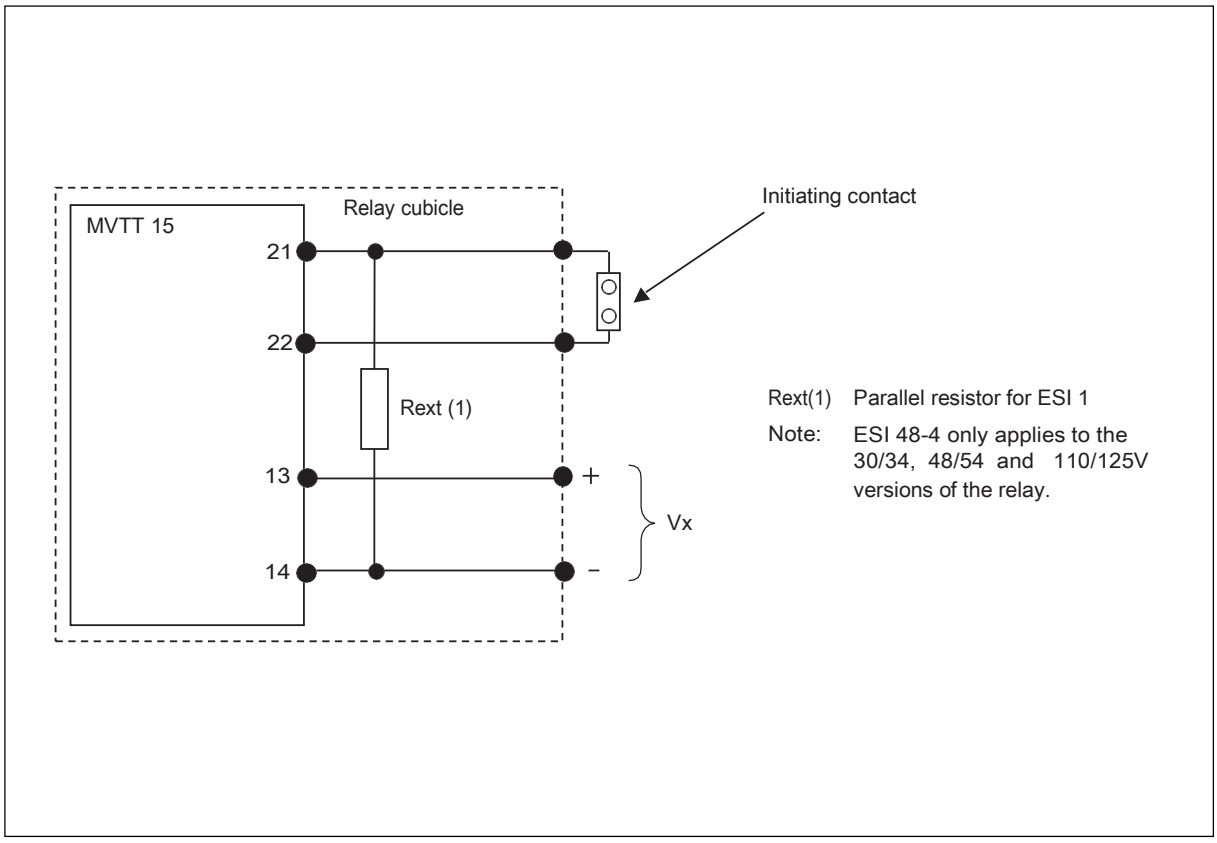


Figure 2: ESI 48–4 relay, typical external connection diagram – MVTT 15.

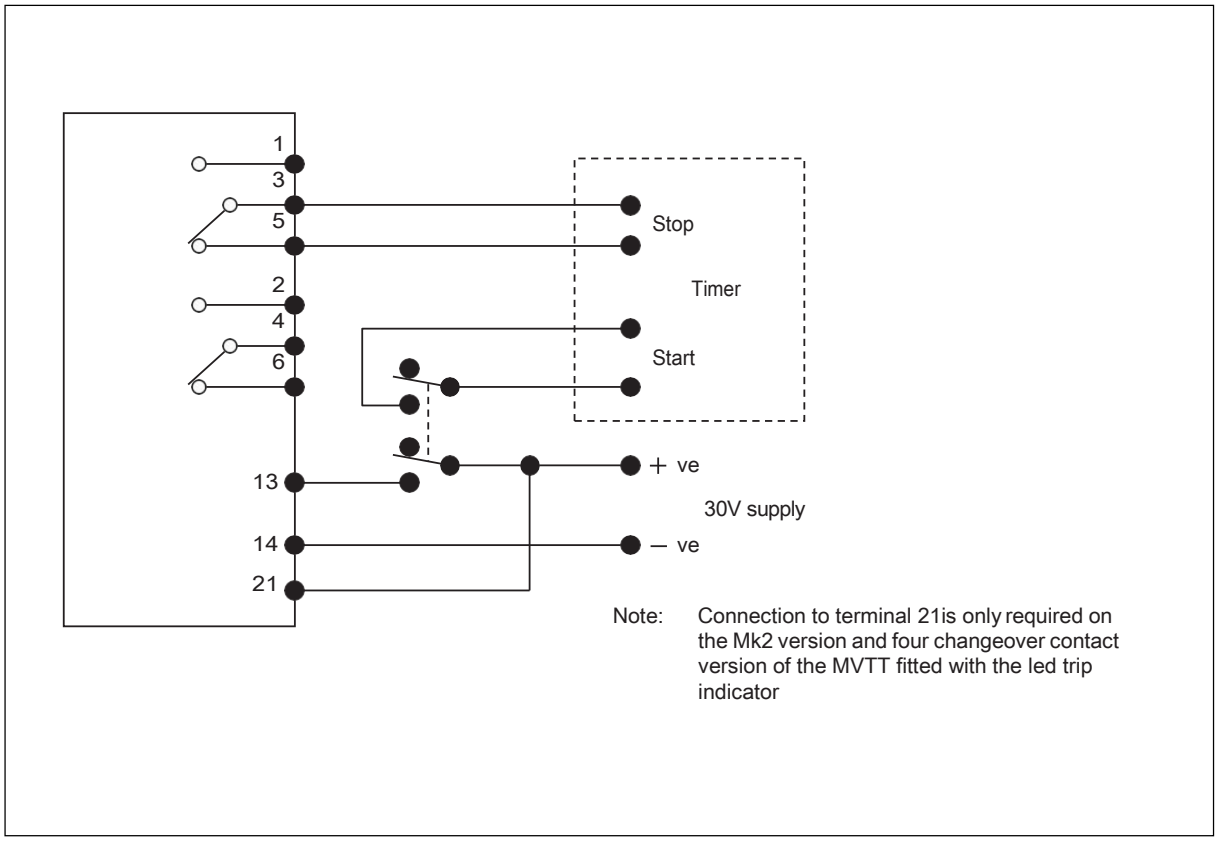


Figure 3: MVTT 14 typical test circuit.

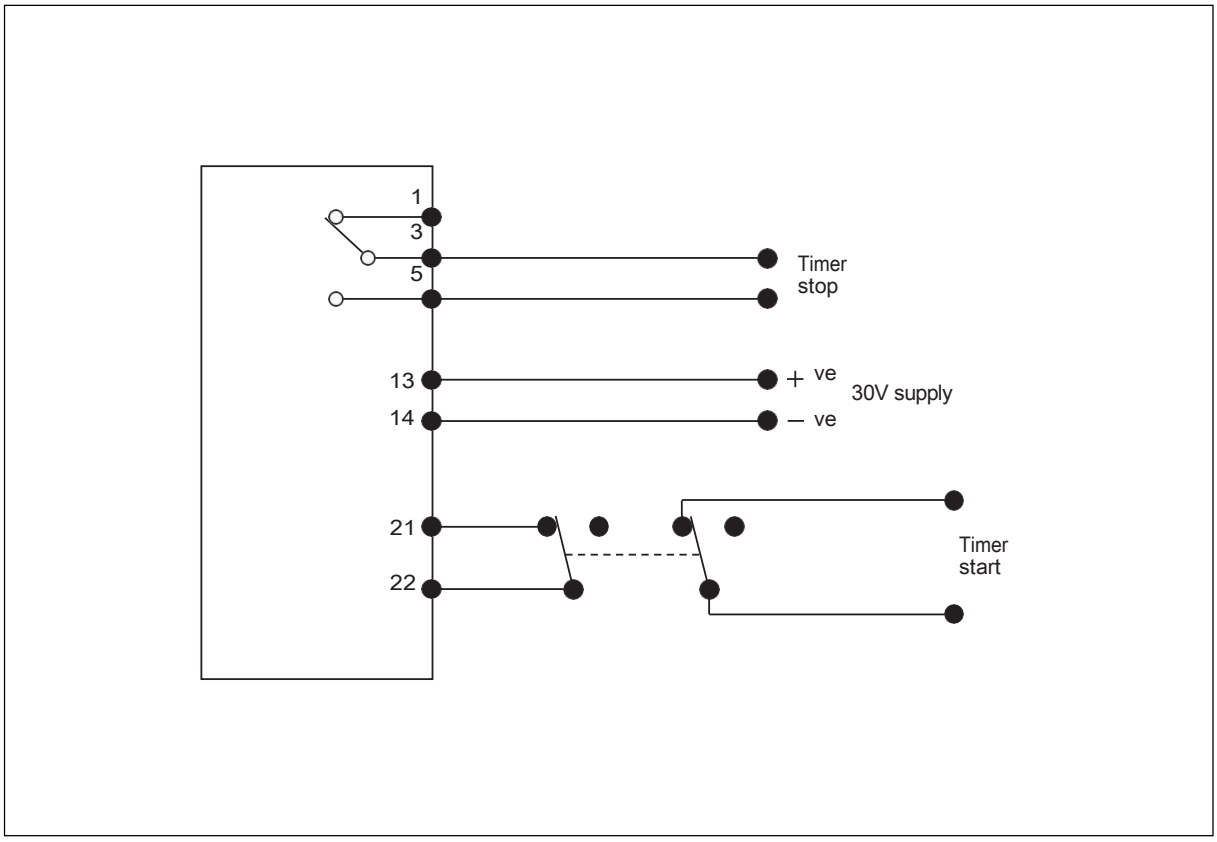


Figure 4: MVTT 15 typical test circuit.

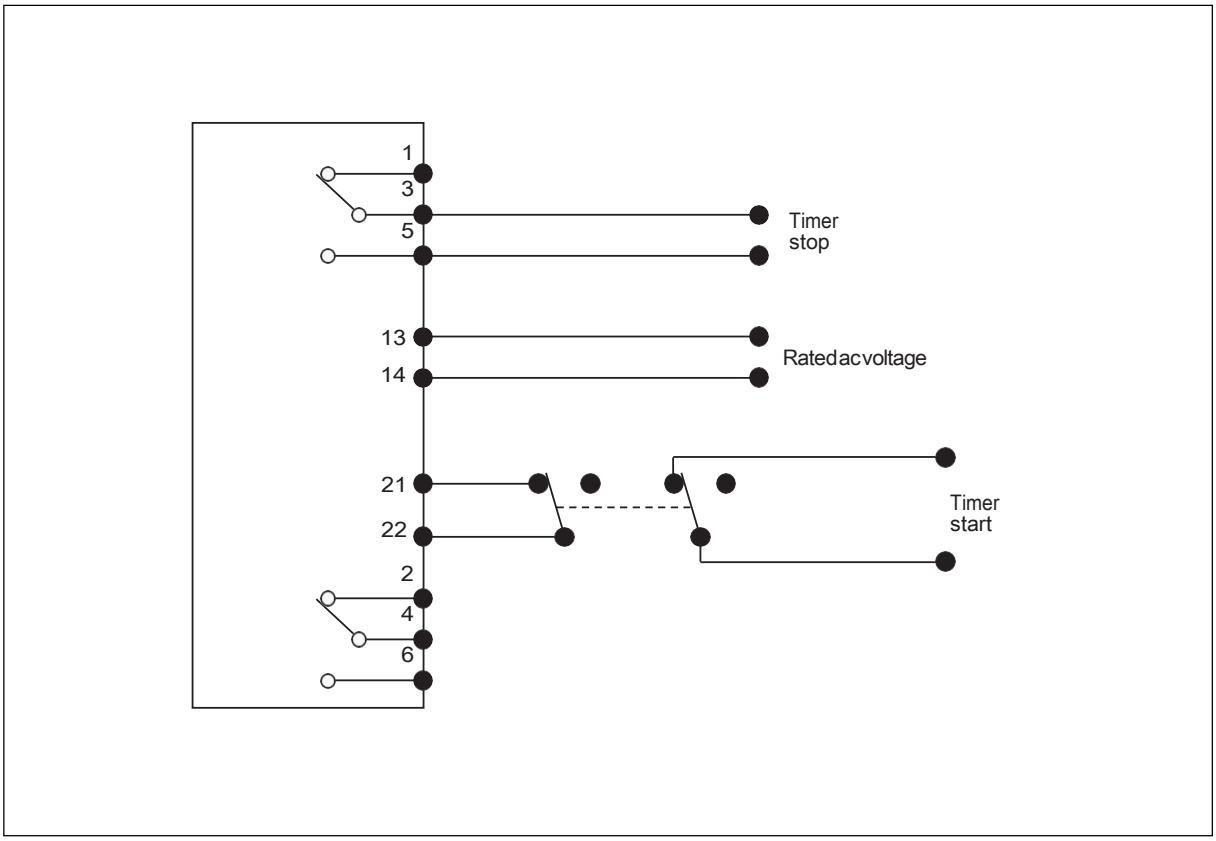


Figure 5: MVTT 14 (ac version) typical test circuit.

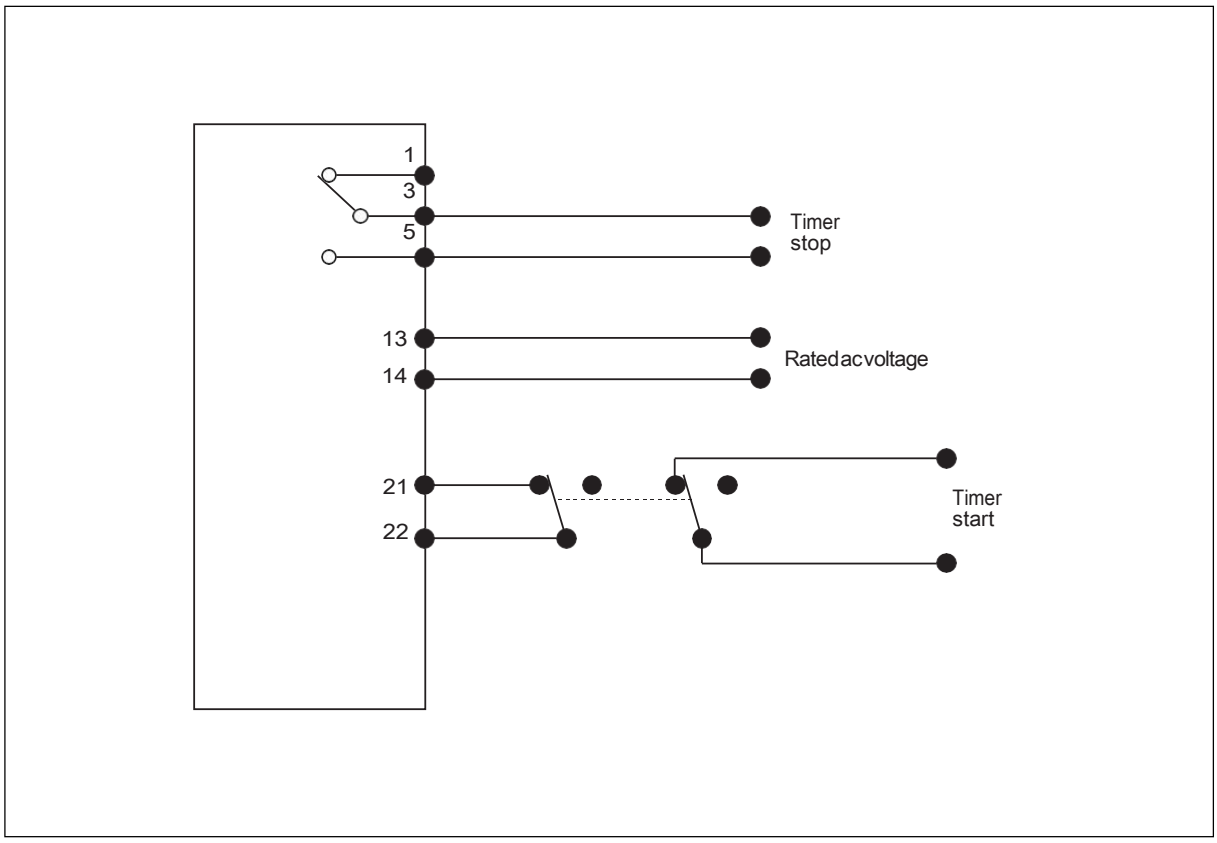


Figure 6: MVTT 15 (ac version) typical test circuit.

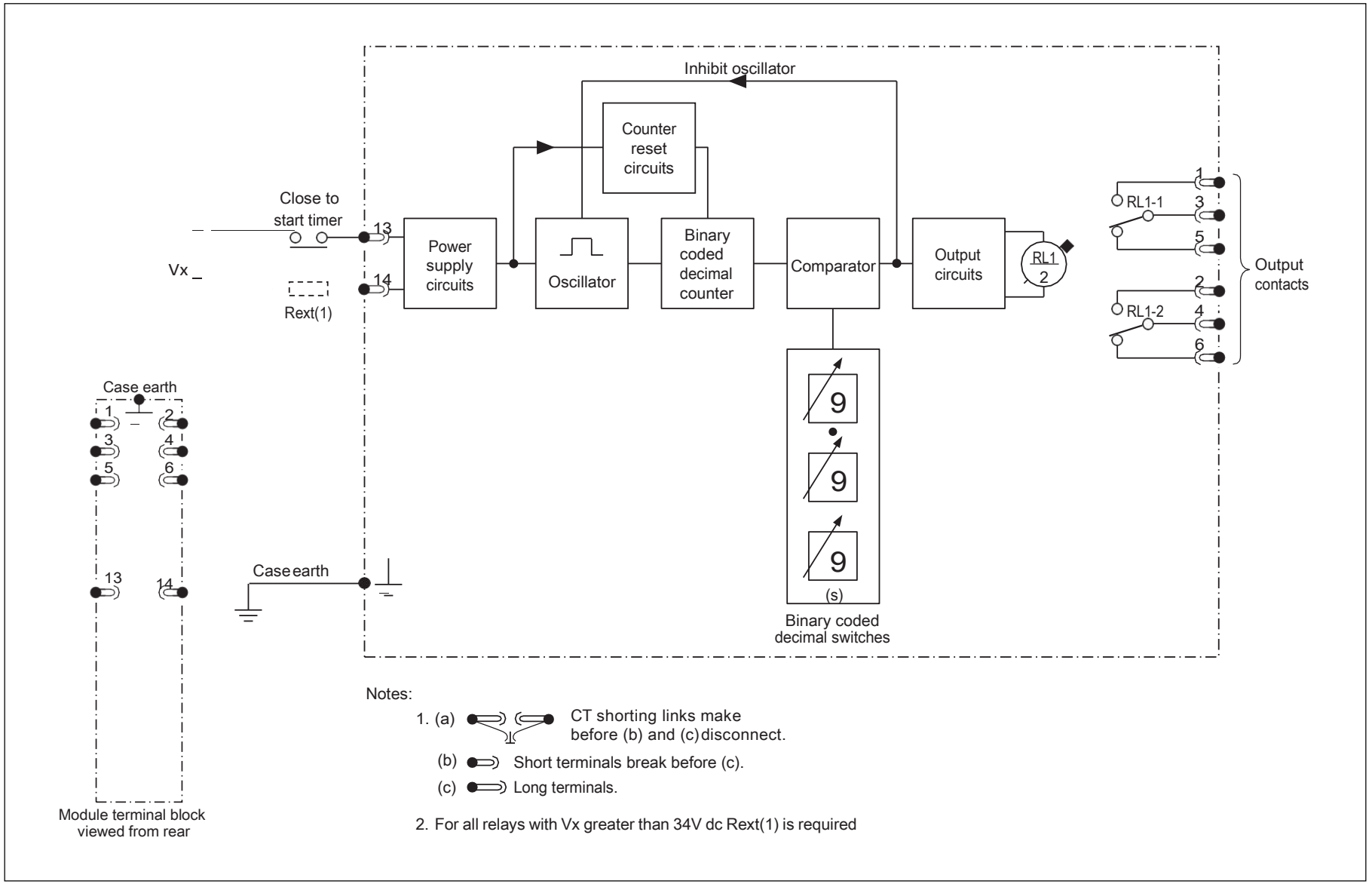


Figure 7: Application diagram: static modular digital time relay (delay on pick-up). Type MVTT 14 (dc version) with mechanical flag.

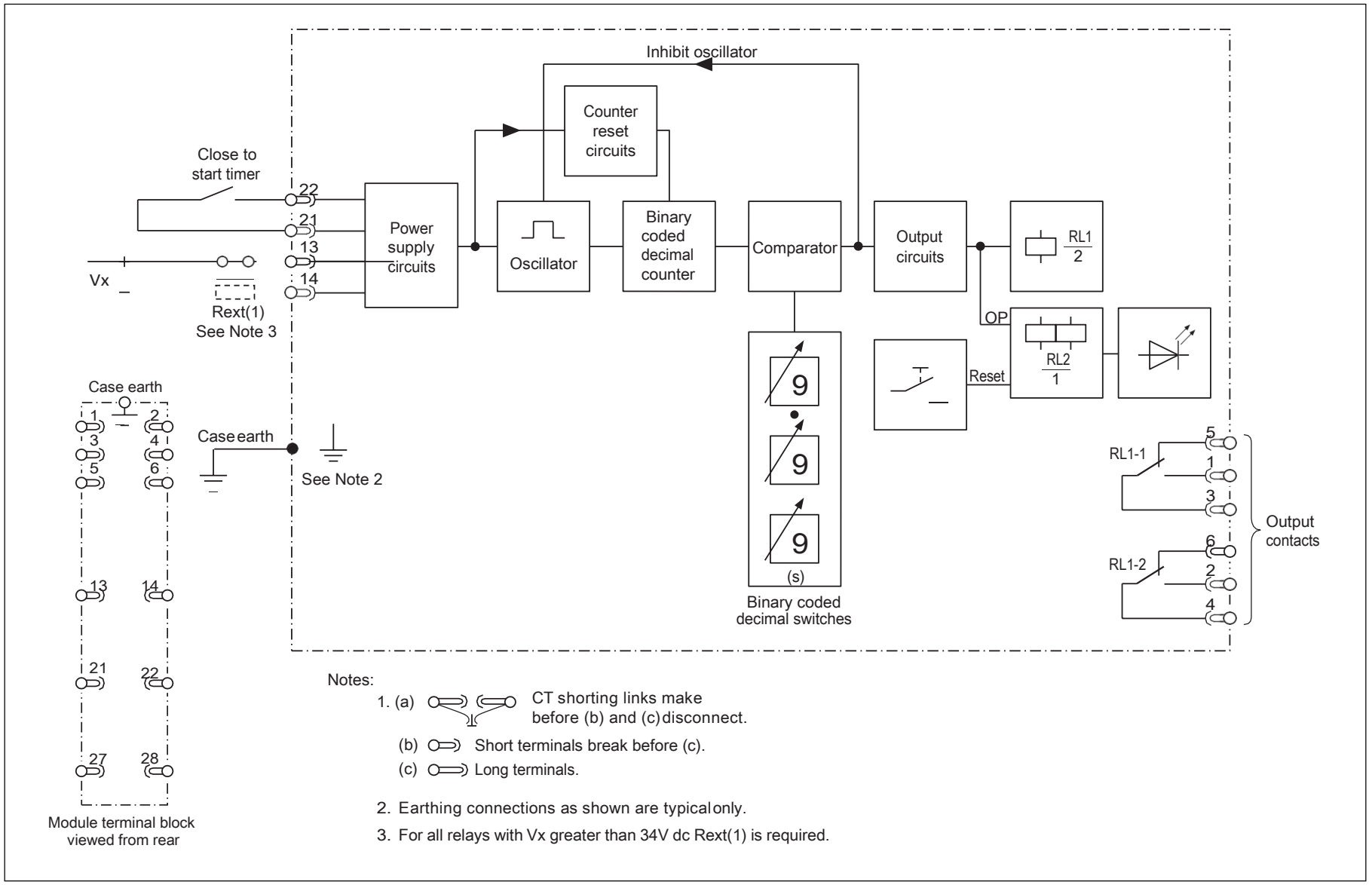


Figure 8: Application diagram: static modular digital time relay (delay on pick-up). Type MVTT 14 (dc version). Mk1 with led indicator.

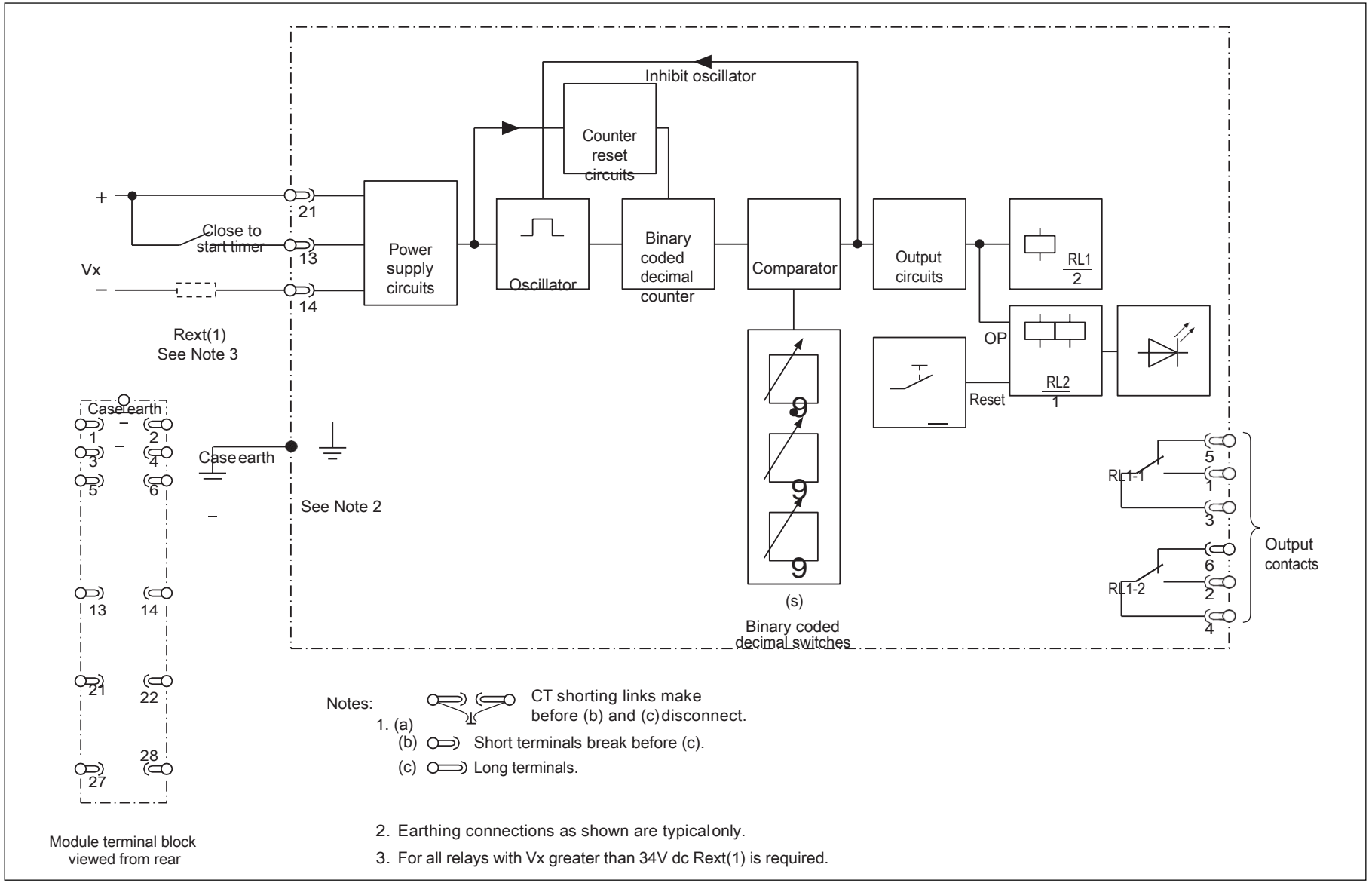


Figure 9: Application diagram: static modular digital time relay (delay on pick-up). Type MVTT 14 (dc version). Mk2 with led indicator.

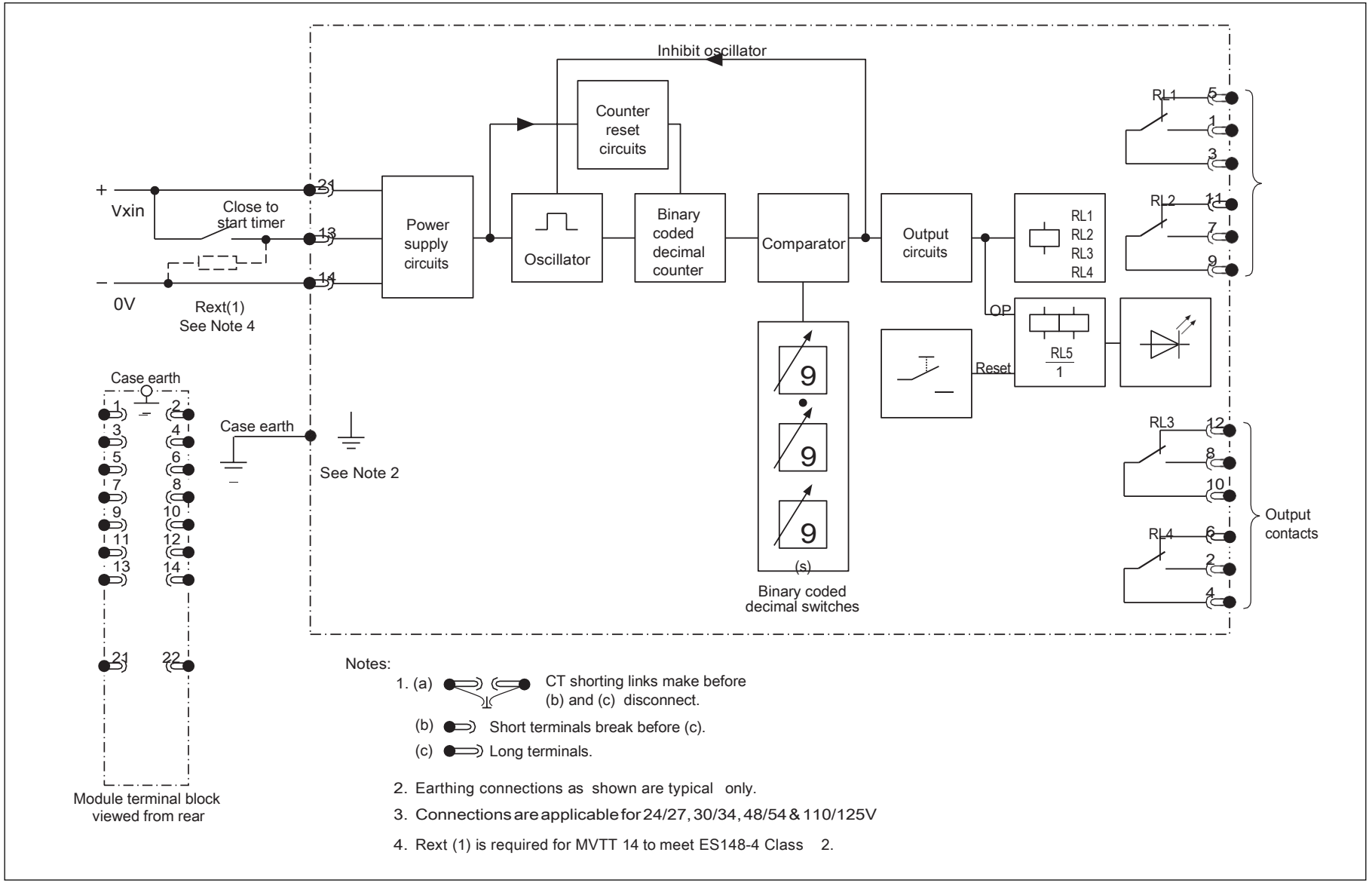


Figure 10a: Application diagram: static modular digital time delay relay (delay on pick-up). Type MVTT 14 (dc version) with four changeover contacts.

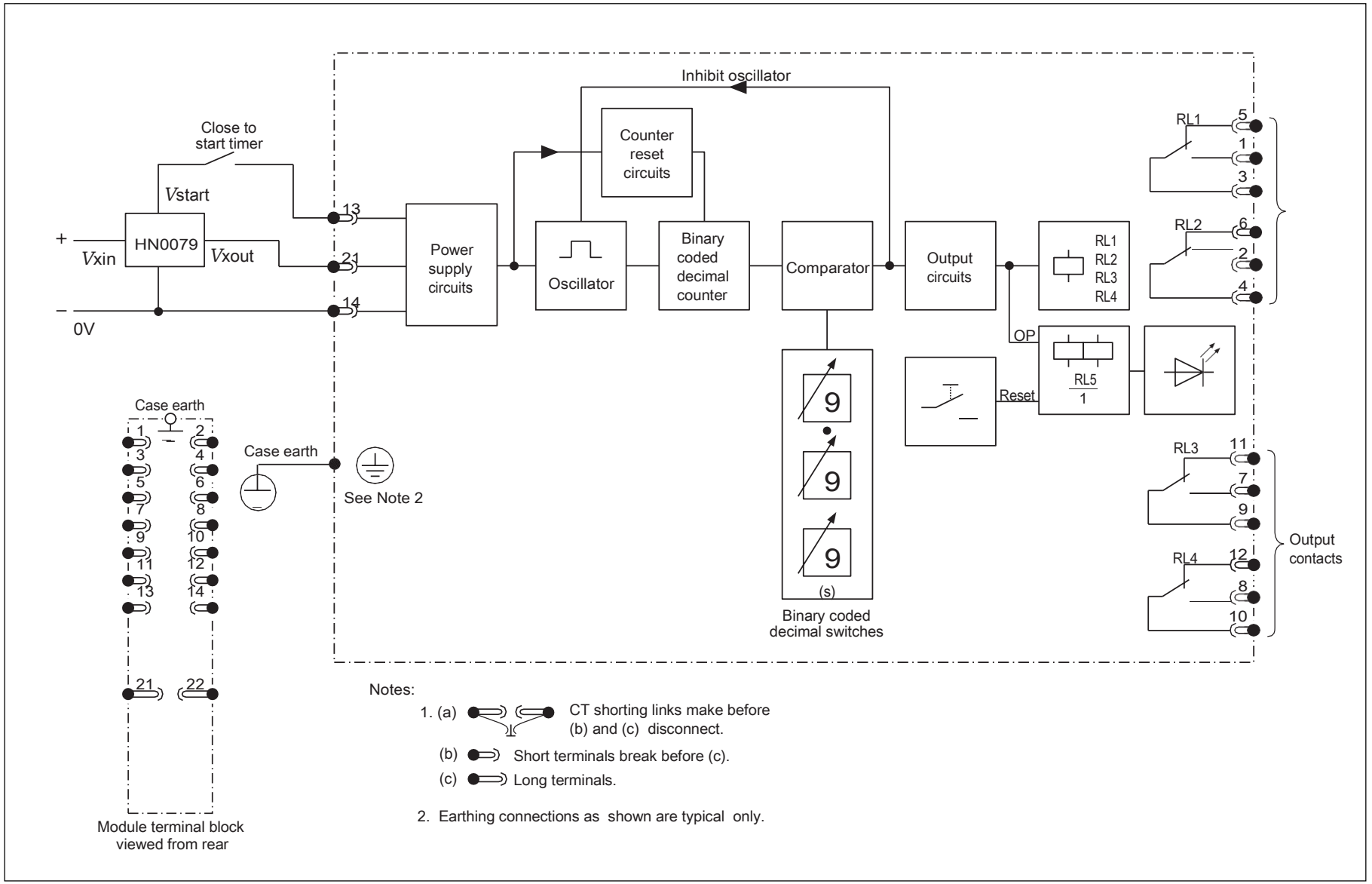


Figure 10b: Application diagram: digital time delay relay. Type MVTT 14 220V (dc version).

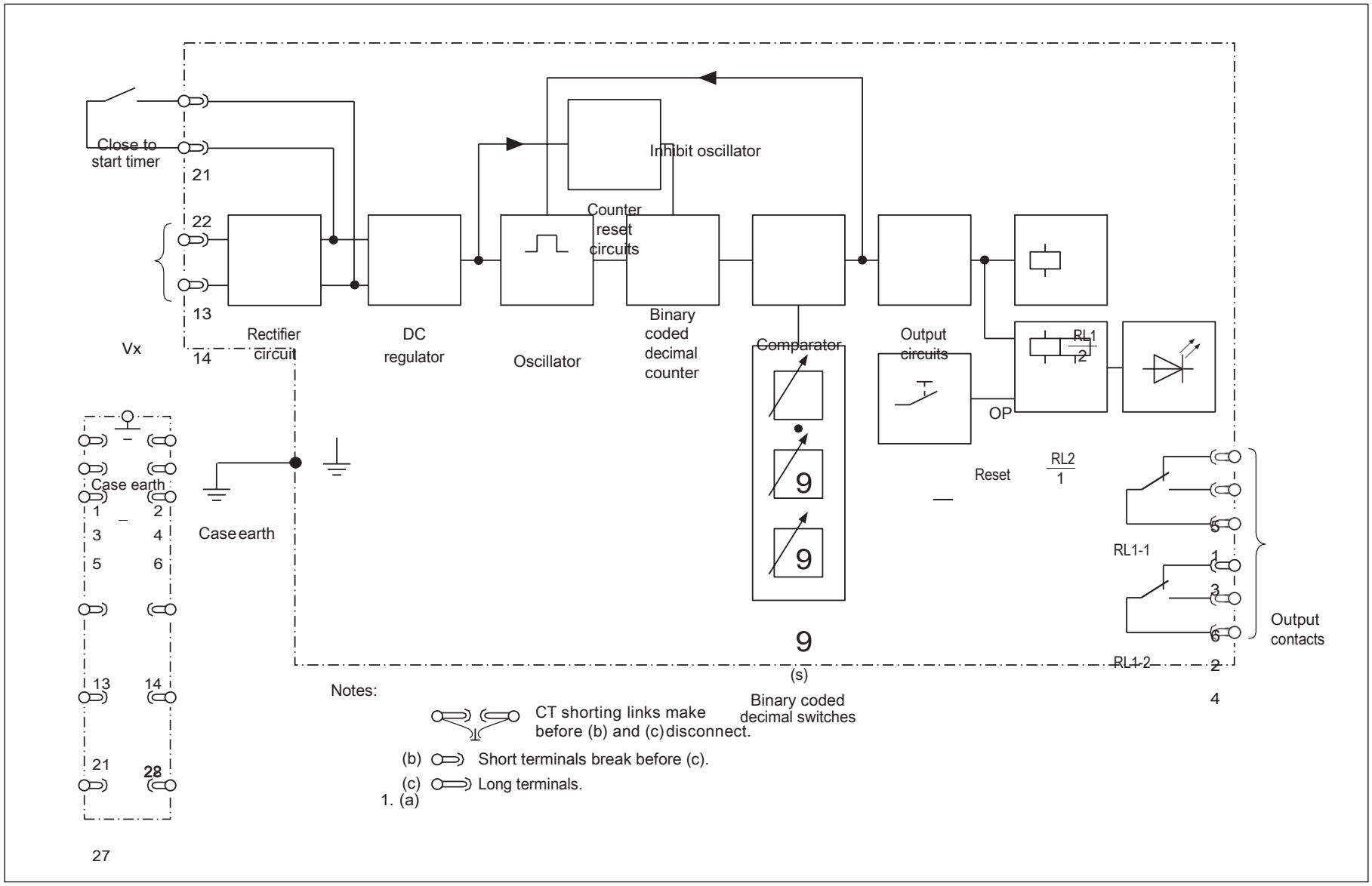


Figure 11: Application diagram: static modular digital time relay (delay on pick-up). Type MVTT 14 (ac version).

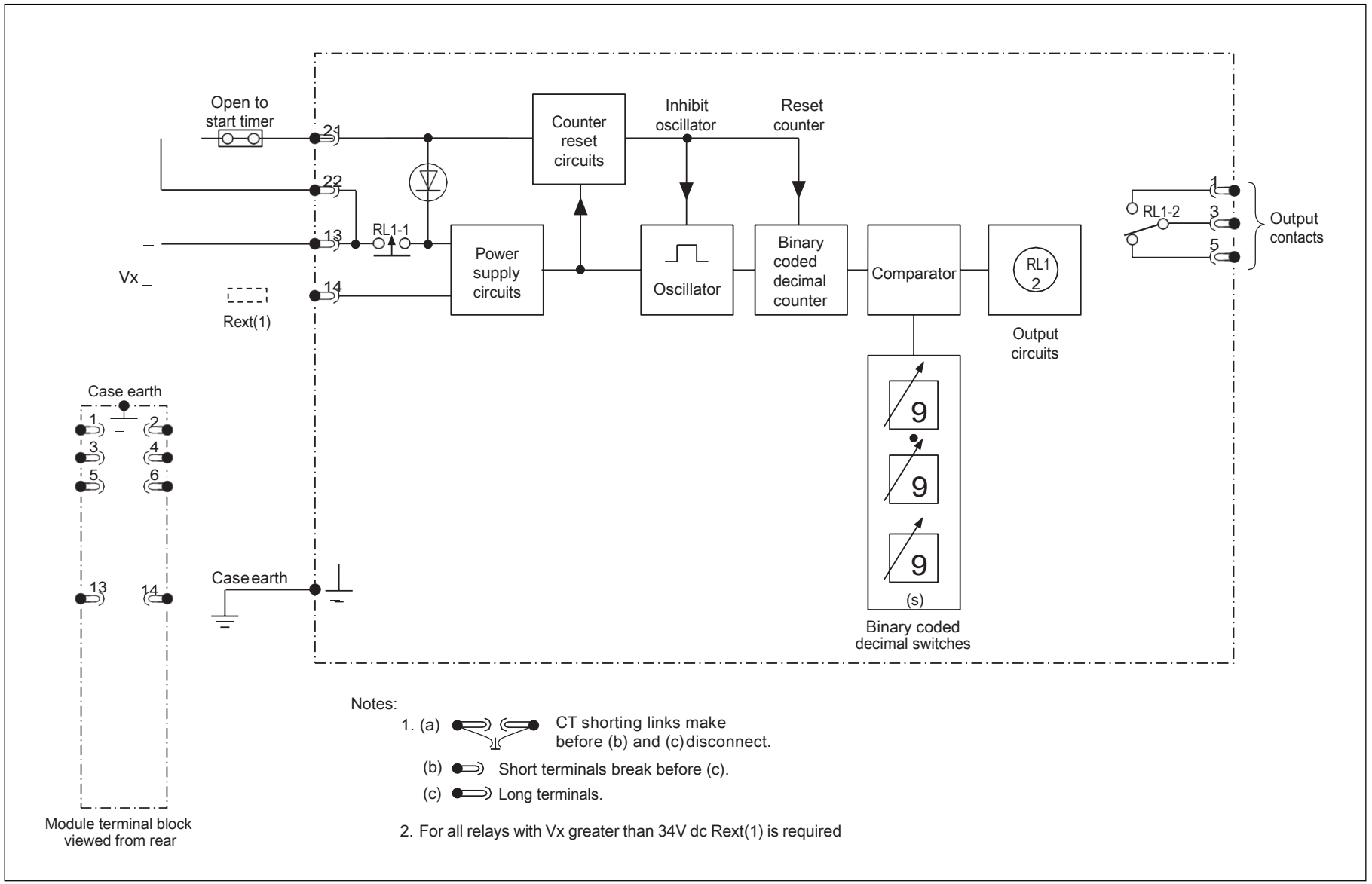


Figure 12: Application diagram: static modular digital time relay (delay on pick-upf). Type MVTT 15 (dc version)

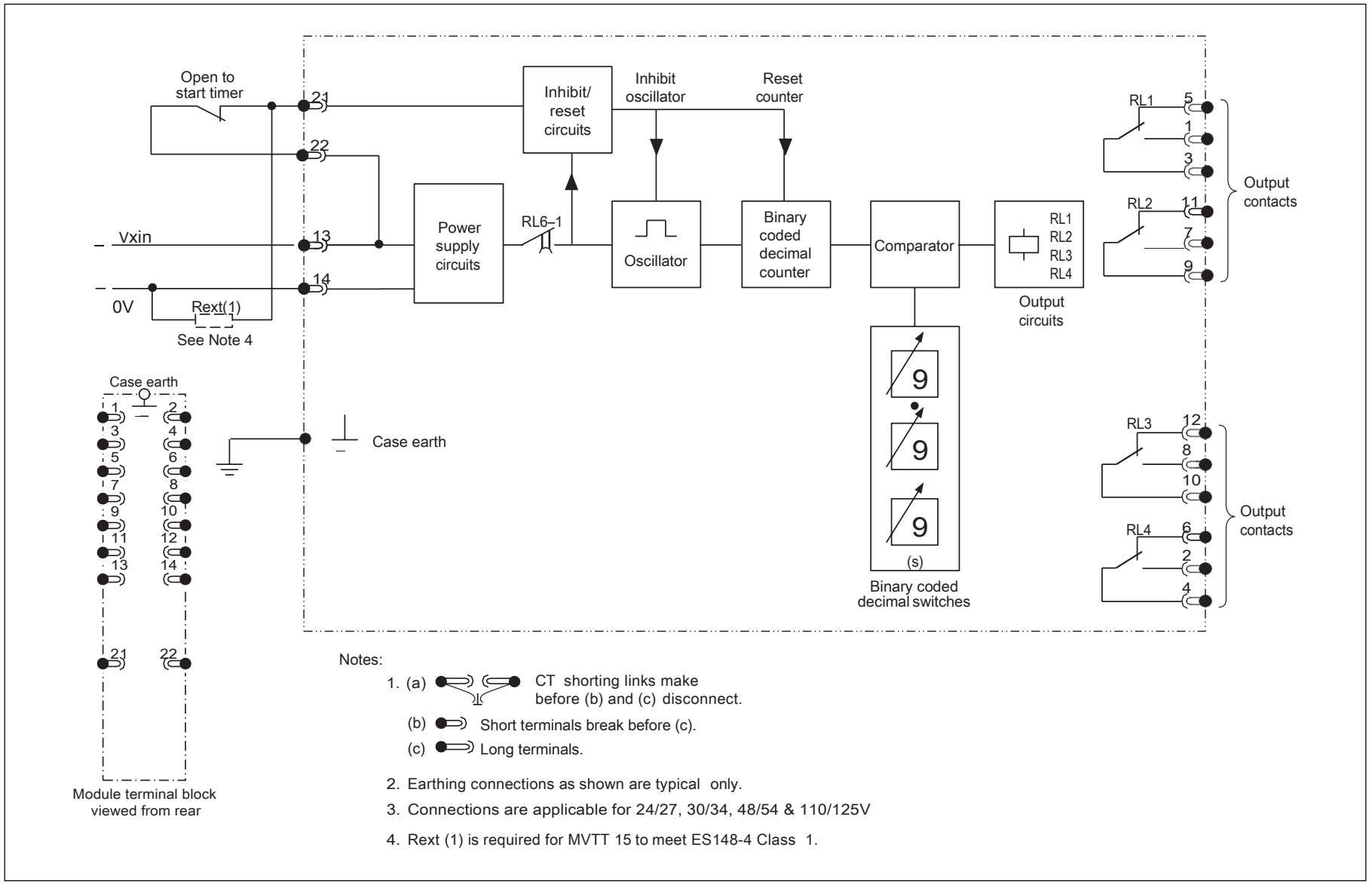


Figure 13a: Application diagram: static modular digital time delay relay (delay on drop off). Type MVTT 15 (dc version) with four changeover contacts.

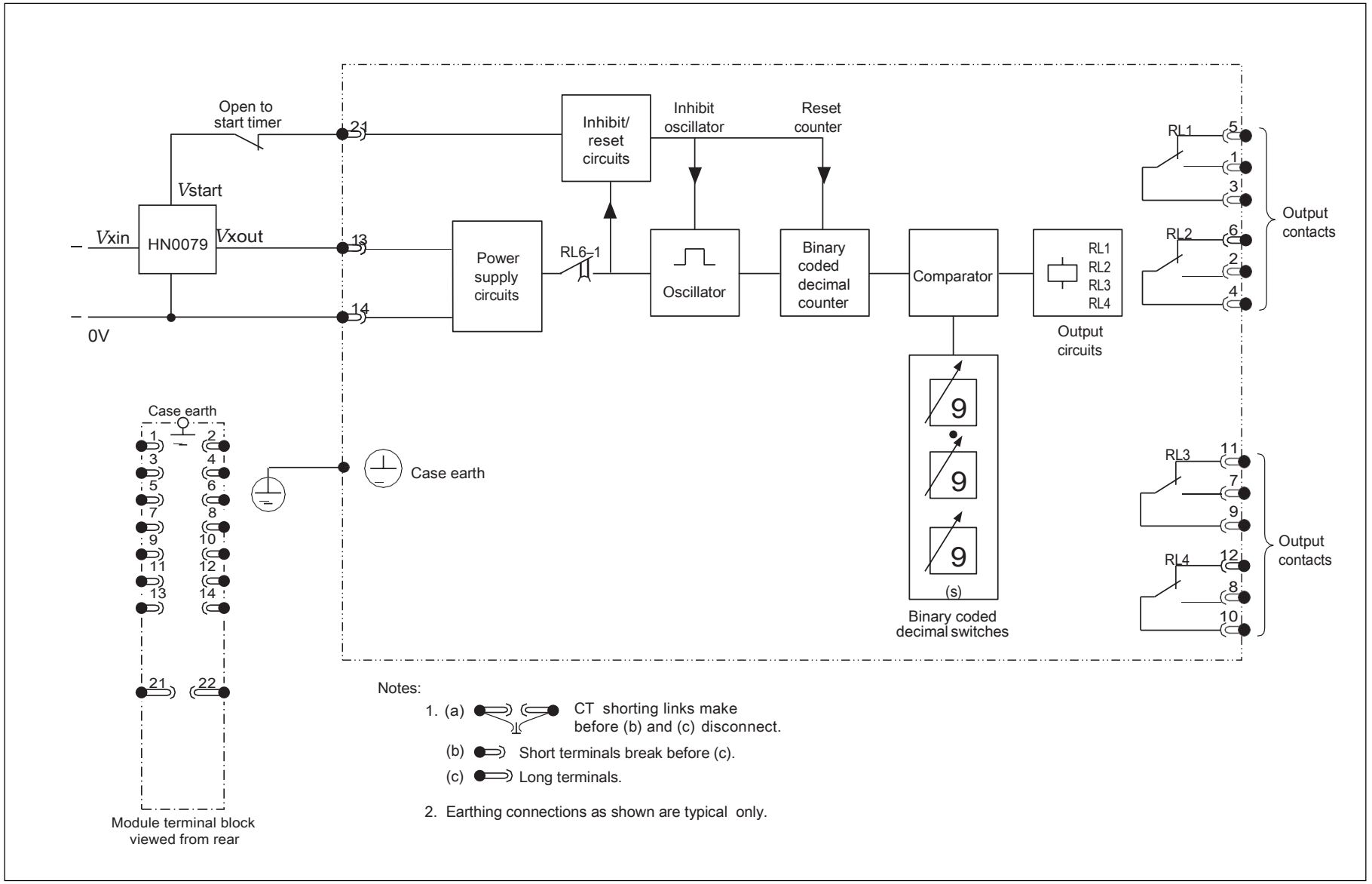


Figure 13b: Application diagram: digital time delay relay. Type MVTT 15 220V (dc version).

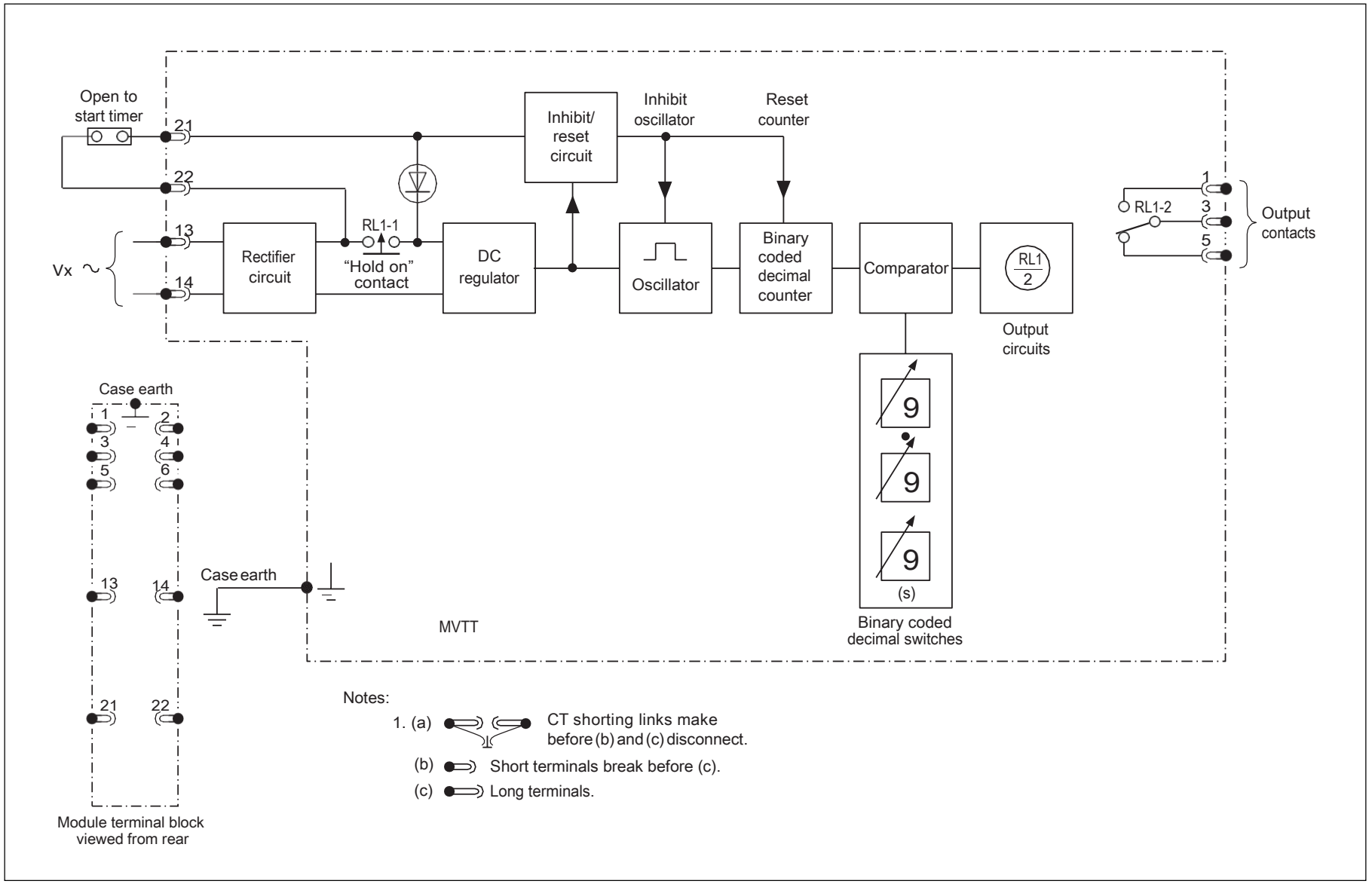


Figure 14: Application diagram: static modular digital time relay (delay on picc-up). Type MVTT 15 (ac version).

Section 7. COMMISSIONING TEST RECORD

Definite time delay relay Type MVTT Date _____

Station _____ Circuit _____

Relay model No. MVTT _____ Serial No. _____

Relay time range				DC voltage (Vx)		Rext (1)	Rext (2) if required
1	to 999	ms	☐	30/34V	☐	☐	☐
0.01	to 9.99	s	☐	48/54V	☐	☐	☐
0.1	to 99.9	s	☐	110/125V	☐	☐	☐
1	to 999	s	☐	220/250V	☐	☐	☐
10	to 9990	s	☐				

Final switch setting ☐

Test results

Visual inspection ☐

Auxiliary supply ☐ V dc

Timing tests

	Relay setting	Operating time	Error %
Final setting			

Trip indicator operation ☐ (MVTT 14 ONLY)

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
FAO :- After Sales Department

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 ☐ **Yes**				Equipment failed during service ☐ **Yes** How long?		
(M) Equipment failed during Installation / Commissioning ☐ **Yes**				Equipment failed during service ☐ **Yes** How long?		

2. SPECIALIST REPAIR INSTRUCTIONS

Do you want an updated firmware version after repair? ☐ **Yes** ☐ **No**

Is the relay being returned in a case? ☐ **Yes** ☐ **No (If No see repair Term 5)**

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

Value for Customs (M):

Customer Invoice Address if paid (M)	**Customer Return Delivery Address (full street address) (M)**
	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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www.gegridsolutions.com/contact

R8012L