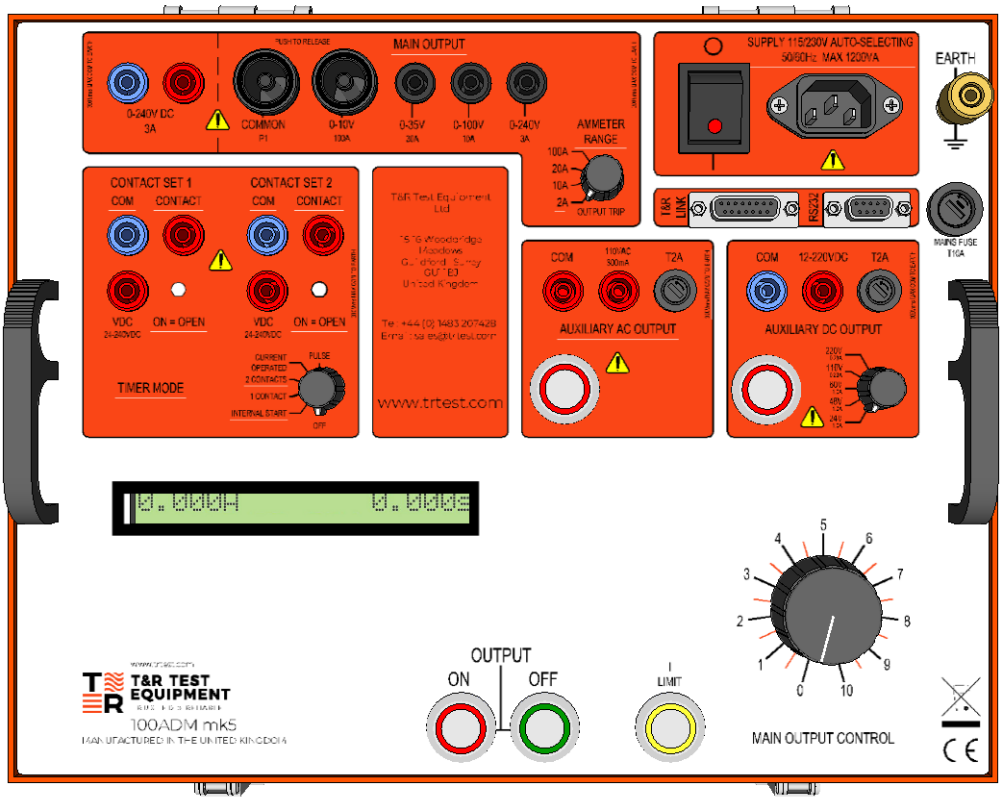
OPERATING AND MAINTENANCE MANUAL

Product: ***Secondary Current Injection Test Set***

Type: ***100ADM mk5***



DESIGNED AND MANUFACTURED BY:

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GENERAL SAFETY STATEMENT

 WARNING

The following safety precautions should be reviewed to avoid injury to the user and damage to the product (and other products connected to it). To avoid potential hazards only use this product as specified.

- **Only suitably qualified personnel should use this equipment. Servicing of this product should only be carried out by suitably qualified service personnel.**

To Avoid Fire Hazards and Personal Injury

- Use the correct power supply lead. Only use a suitably rated and approved power supply lead for the country of use.
- Ensure that systems that the unit is to be connected to are dead.
- Do not connect and disconnect leads whilst outputs are switched on. Breaking the output circuit with current flowing may cause arcing.
- Ensure that the product is grounded. To avoid electric shock, it is essential that the grounding conductor is connected to the earth ground. An additional earth terminal is provided on the unit that must be connected to a local earth when the unit is used in a substation environment. Ensure that the unit is properly grounded before making any connections to inputs or outputs.
- Terminal ratings must be observed to prevent fire hazards and risk of injury to the operator. Consult the product manual for ratings information before making connections to any terminal.
- It is ESSENTIAL to consult the product manual for rating information before making any connection to a terminal or terminal group marked with a warning triangle.
- Only use fuses of a type and rating specified for this product.
- Do not operate the unit out of its case or with any covers or panels removed.
- Do not touch exposed connections and components when power is present.
- Do not operate the product if any damage is suspected. Refer the unit to qualified service personnel to be checked.
- Do not operate the unit in wet or damp conditions
- Do not operate the unit in an explosive atmosphere
- The unit has a high output current (up to 100A), and therefore generates large magnetic fields around the output leads. Care must be taken in siting the unit next to items sensitive to magnetic fields (such as computer monitors and other sensitive equipment).
- Warnings from cardiac pacemaker manufacturers state that strong magnetic fields may affect operation. Any high current unit such as the 100ADM mk5 should therefore not be operated by, or in the vicinity of persons fitted with cardiac pacemakers or any other electronic or electrical medical implants.

If any further queries occur regarding the usage and maintenance of the equipment detailed in this manual, please refer these to the supplier of the equipment in the first case or to the manufacturer, T & R Test Equipment Limited.

SAFETY TERMS AND SYMBOLS

The following safety symbols appear on the equipment:

CAUTION – Refer to manual

Mains off

Mains on

CONTENTS

1. DESCRIPTION OF EQUIPMENT

The 100ADM mk5 is a flexible current injection system capable of supplying currents of up to 100A ac into a variety of loads. The unit is designed for testing devices used for power system protection but can be used wherever a high current ac source is required. The outputs may also be used in voltage mode to supply voltages of up to 240Vac.

Accurate metering facilities with a fast capture time and a very flexible timing system are provided. A stabilised auxiliary DC output is provided to provide power to the device under test, and an auxiliary AC output allows testing of devices requiring a current and a voltage.

The 100ADM mk5 is designed to be used on ‘dead’ systems (i.e. no externally supplied voltages are present on the test object). Do not connect the 100ADM mk5 to a live system. Always check that the power to the device under test is off and the circuit is isolated before making any connections.

1.1 Connections, controls & display

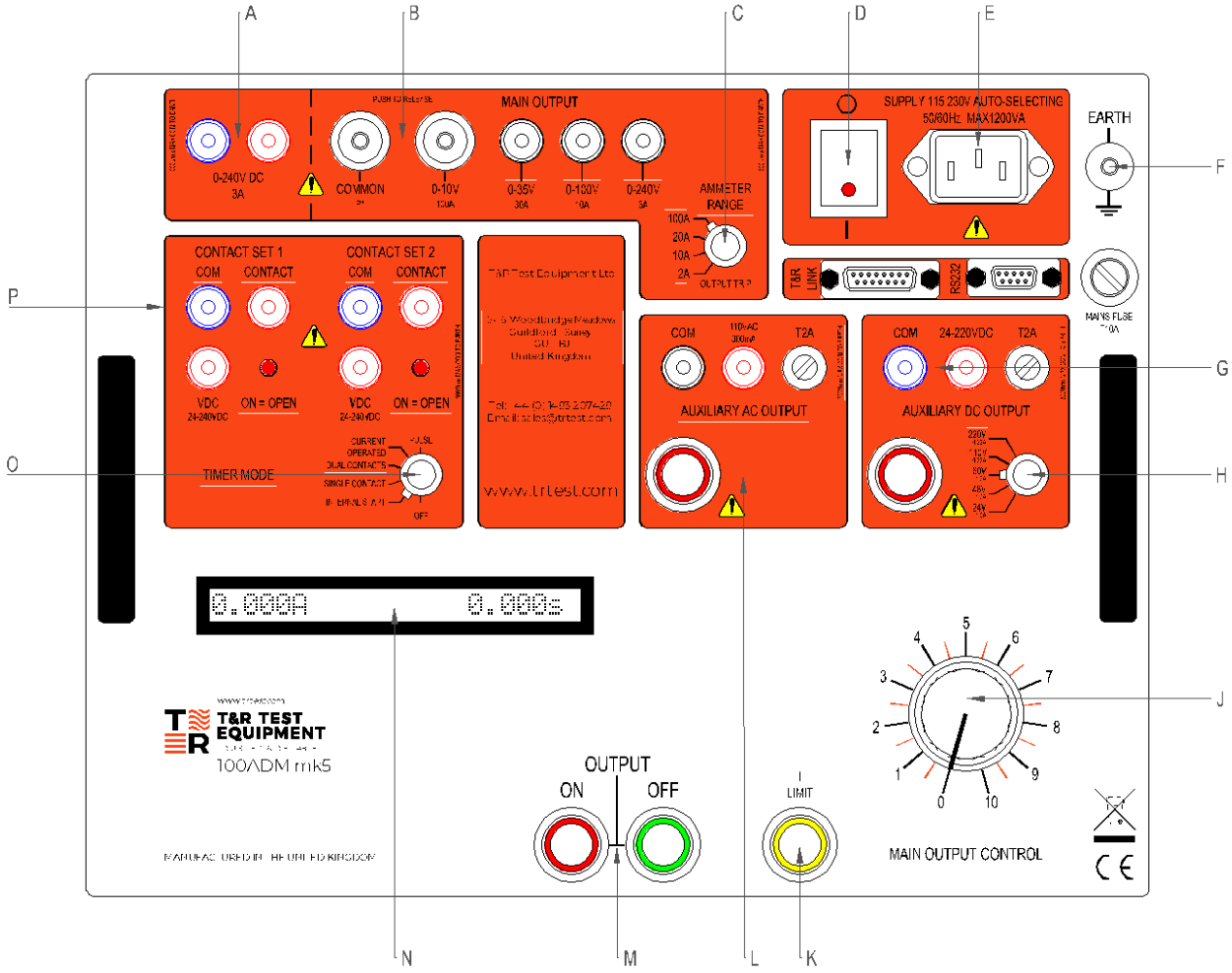

Figure 1.1 100ADM mk5 front panel

Ref	Item	Function
A	Variable DC output terminals	0-240Vdc output for dc tests
B	Main output terminals	Main ac outputs for ac tests
C	Ammeter range switch	Selects ammeter range for main output
D	Mains on/off switch	Isolate unit from mains
E	Mains input connector	
F	Earth terminal	Connect 100ADM mk5 to local ground
G	Auxiliary dc output connectors	Auxiliary dc output
H	Auxiliary dc voltage selector	Selects auxiliary dc output voltage
J	Main output control	Controls voltage/current of main output
K	I limit pushbutton	Switch current limit mode on/off
L	Auxiliary ac output	Auxiliary ac output terminals, switch & fuse
M	Main output on/off controls	Switches the main output on & off
N	Display	Shows current and time
O	Timer mode select	Selects timer mode
P	Timer contact sets	Timer input

1.1.1 Display

The 100ADM mk5 display simultaneously shows the injected test current and the timer result. It also displays warning and error messages, detailed in section 1.1.2.

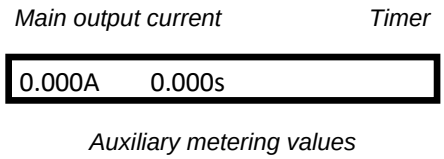

Figure 1.2 Normal values displayed on screen

1.1.2 Warning messages

Figure 1.3 Over-current trip warning message

When an over current or duty cycle trip occurs, the green ‘off’ pushbutton must be pressed to clear the trip condition.

Figure 1.4 Duty cycle trip warning message

Allow the unit to cool for the rated off time for the main output after a duty cycle trip.

Figure 1.5 Unit over temperature warning message

After an over temperature trip, the unit will automatically reset when the temperature falls to an acceptable level. If the unit is over temperature, switching the unit off and back on will not clear the message – the unit must be allowed to cool.

1.2 Installation

1.2.1 Environment

The 100ADM mk5 is designed for use in indoor industrial and electrical substation environments.

Maximum altitude:	2000m
Temperature:	0°C to 45°C operating
	-20°C to 60°C storage
Relative humidity:	90% non-condensing
Protection rating:	IP40 lid closed
	IP20 in use

1.2.2 Supply requirements

The 100ADM mk5 requires a single phase 50/60Hz supply of 115V±10% or 230V±10%. The correct range is automatically selected. The maximum power requirement of the unit is 1200VA. Use only a suitably approved mains lead fitted with a mains connector suitable for the local power supply.

In substation environments the earth terminal on the front panel of the unit should be connected to a low impedance local earth.

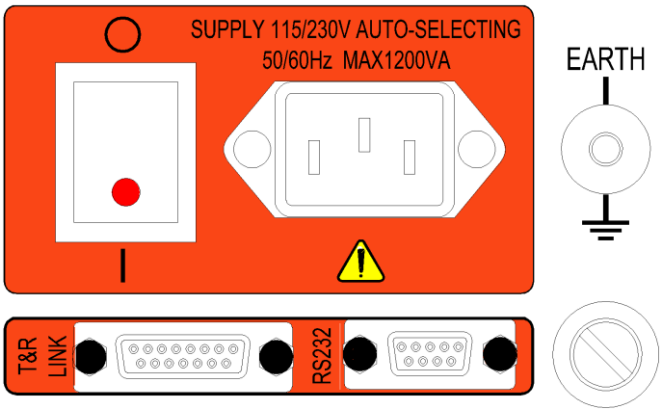

Figure 1.6 Mains input

The mains input is fitted with a T10A HRC fuse. This must be replaced with a fuse of the same type.

1.2.3 Connection cable ratings

Main output 10V tap	10V 200A CAT I 16-25mmsq terminated in MC 6mm connectors
All other inputs/outputs	600V CAT II test leads terminated in shrouded 4mm connectors

1.2.4 Overload protection

Location	**Protection**
Mains supply	T10A fuse
Auxiliary ac output	T2A fuse
Auxiliary dc output	Current limit
Contact circuits	Auto-resetting semiconductor fuses
Main output	Electronic over-current trip Electronic duty cycle trip Thermal protection

1.3 Functions

1.3.1 Main current output

The main current output of the unit has four taps, allowing voltage ranges of 0-10V, 0-35V, 0-100V, and 0-240V to be selected.

Voltage range	Current rating		
	Continuous	5min on/15 off	1min on/15 off
0-10V	33A	67A	100A
0-35V	10A	20A	30A
0-100V	3.3A	6.7A	10A
0-240V	1A	2A	3A

Each output is rated for a continuous current and higher intermittent currents. The maximum 'on' time for intermittent currents is enforced by the unit, and the output will be switched off if the rating is exceeded. The display will then show Output Tripped Press Green to Reset until the green 'off' button is pressed to clear the trip condition.

The curve for intermittent current ratings is shown in figure 1.1.

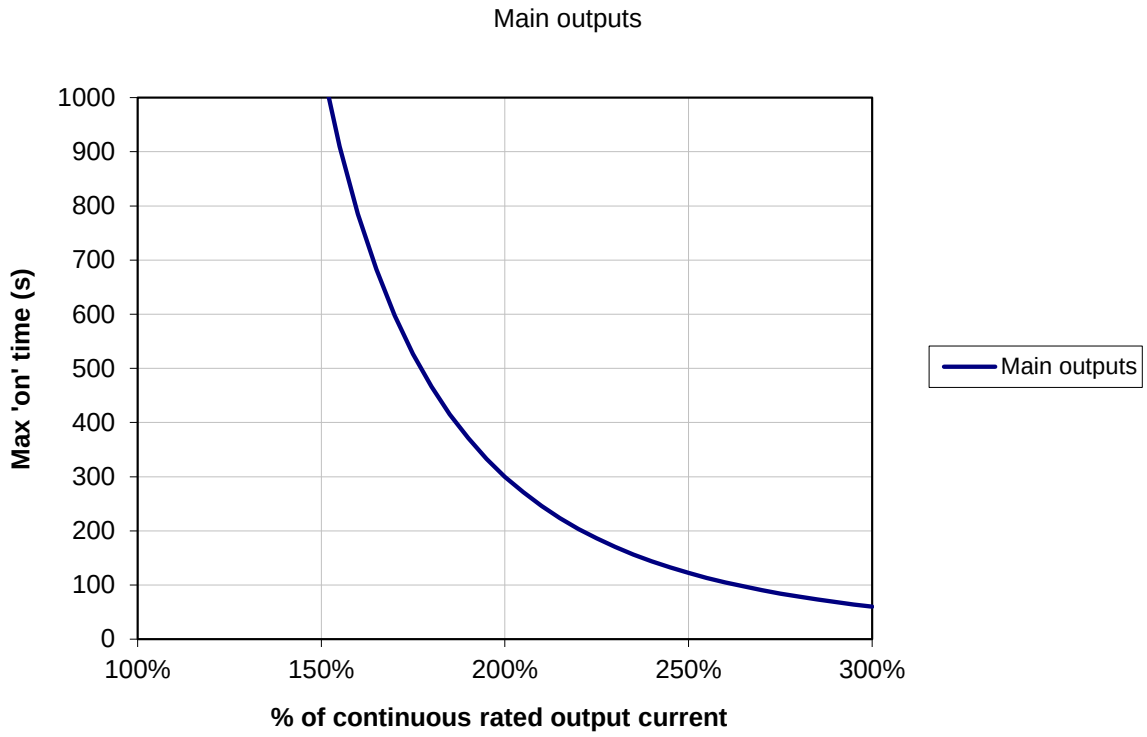

Figure 1.7 100ADM mk5 maximum 'on' times

1.3.1.1 I limit mode

Current limit mode gives very fine control of currents up to 10A. It also allows fine current control into very low impedance loads such as digital relays. It adds impedance into the output circuit to reduce the maximum current available and allow fine control of small currents. When selected, the lamp in the switch illuminates.

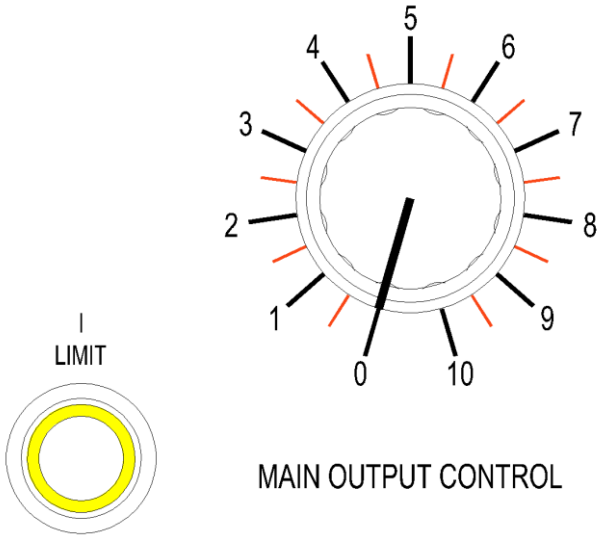

Figure 1.8 I limit mode button

Range	**Current**				**Output V**	
	Short circuit	Continuous	5 minutes on	2 minutes on	Open circuit	Load voltage
10V	10A	3A	6A	10A	8.6V	5V @ 5A
35V	3A	1A	2A	3A	29V	13V @ 2A
100V	1A	0.3A	0.6A	1A	88V	40V @ 0.6A
240V	0.3A	0.1A	0.2A	0.3A	224V	130V@0.2A

The duty cycle trip level is reduced to the levels shown in the table above when I mode is selected.

1.3.2 Current metering

The main output current is metered by a true RMS reading digital memory ammeter with 4 ranges.

Range	**Resolution**	**Accuracy**	**Trip current**
2.000A	0.001A	±0.5% rdg ±5d	2.1A
10.00A	0.01A	±0.5% rdg ±5d	10.5A
20.00A	0.01A	±0.5% rdg ±5d	21A
100.0A	0.1A	±0.5% rdg ±5d	105A

The ammeter range is independent of the current output selected. For low output currents I limit mode should be selected to allow fine control.

The metering will accurately capture a waveform present for a single cycle. The current reading is held on the display whenever the output switches off. Selecting the correct timing mode for the application ensure that the current is captured (for example current operated mode for a circuit breaker or internal start mode for an IDMT relay).

The unit has an electronic trip circuit that monitors the output current and switches the output off if the trip value exceeds 105% of full scale of the metering range selected.

1.3.3 Auxiliary AC voltage output

The auxiliary AC voltage output is fixed at 110Vac at rated mains voltage (115V or 230V) with a maximum output current of 300mA.

1.3.4 Auxiliary DC voltage output

A variable stabilised auxiliary DC supply is provided to supply power to the relay under test.

Voltage range	Maximum power	Continuous power	Maximum current	Continuous current
24V	25W	25W	1.0A	1.0A
48V	48W	25W	1.0A	0.5A
60V	60W	25W	1.0A	0.4A
110V	25W	25W	0.23A	0.2A
220V	48W	25W	0.22A	0.1A

1.3.5 Timing system

The 100ADM mk5 is fitted with an integrated timing system which is linked to the main output and two sets of contact inputs. The timer may also be used to time external events not linked to the output of the set. Two contact inputs are provided, each with a connection for volt-free contacts and DC voltage, and each auto-selects for normally open or normally closed contacts.

Timer information

Timer range	0-999.999s/9999.99s/99999.9s auto-ranging
Resolution	1ms/10ms100ms
Accuracy	±0.01% rdg ±2d All modes except current operated ±0.01% rdg ±4d Current operated mode
Contact o/c voltage	24V
Contact s/c current	20mA
Contact indication	LED on – contact open LED off – contact closed

Timer Modes

Timer Mode	Timer Start Condition	Timer Stop Condition	Automatic output off	Example application
Off	-	-	-	Set current
Internal Start	Main output on	C1 change	When timer stops	IDMT relay
Single contact using Contact 1	C1 1st change	C1 2nd change	C1 1st change (timer start)	Auto-recloser
Single contact using Contact 2	C2 1st change	C2 2nd change	C2 2nd change (timer stop)	Drop-off timing
Dual contact 1st change C1	C1 change	C2 change	C2 change (timer stop)	
Dual contact 1st change C2	C2 change	C1 change	C2 change (timer start)	Auto-reclose relay
Current Operated*	Current >20% of range	Current <20% of range	Current <20% Timer stop	Miniature circuit breakers
Pulse	Main output on	200ms	200ms	Set current for thermal devices

** results obtained with test currents below 20% of range will give a lower accuracy than specified.*

The timer is automatically reset in every mode when the output is switched on. In each mode that the timer is active, the output of the unit must be switched on to arm the timer.

Each contact channel has a contact input for volt-free contacts and a Vdc input for dc voltages. The Vdc input may be used to trigger the timer from a dc voltage and will trigger from either the voltage switching from zero to 24-240Vdc or 24-240Vdc to zero. The voltage must be connected with positive to the red “Vdc” terminal and negative to the blue “com” terminal.

1.3.6.1 General Procedure for Timing Tests

To time the operation of any device a basic procedure needs to be followed to set the desired test current and to carry out the timing test.

- Connect the device under test to the output of the unit and to the contact inputs as required. For details of connection configurations, see the applications notes section.
- Set the timer to ‘off’ mode and the output control to zero. Switch on the output of the unit and increase the current or voltage to the desired level.
- Switch off the output of the unit and select the desired timer mode.
- Switch on the output of the unit. The timer will reset and then start when the start condition is met. Any change to the timer switch setting will be ignored once the output is switched on.
- The timer will stop when the stop condition is met.

1.3.6.2 Timer mode: off

In the ‘off’ mode, the timer has no effect on the operation of the set, and the timer does not run. This mode is used to set the required current through the test object before a timing test.

1.3.6.3 Timer mode: internal start

The internal start mode starts the timer when the main output is switched on and stops the timer on the first change of contact set 1. When the timer is stopped, the output of the unit is automatically switched off.

1.3.6.4 Timer mode: single contact

In single contact mode, the timer starts on the first change of state of either contact set after the output is switched on and stops on the second change on the same contact set. Contact set 1 or contact set 2 can be used in single contact mode. If C1 (contact set 1) is used, the output is switched off when the timer is started, and if C2 (contact set 2) is used the output is switched off when the timer stops.

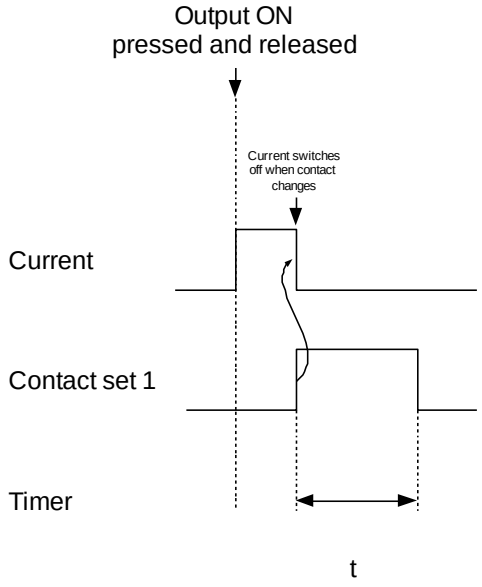

Figure 1.9 Single contact mode using contact set 1 (C1)

Single contact mode using C1 is used to time auto-reclose relays (connected to a breaker auxiliary contact). The time recorded is the time between the breaker opening and the first re-closing of the breaker.

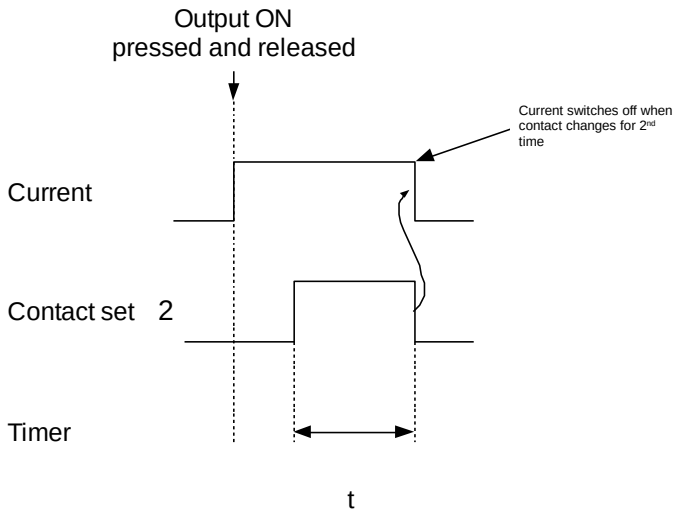

Figure 1.10 Single contact mode using contact set 2 (C2)

Single contact mode using C2 is suited to drop-off tests.

1.3.6.5 Timer mode: dual contact (contact 1 changes first)

Dual contact mode uses both contact set 1 and contact set 2. The timer starts when the output is switched on. The timer restarts on the first change of contact set 1 after the output is switched on and stops on the first change of contact set 2. The output of the unit is automatically switched off when the timer stops.

1.3.6.6 Timer mode: dual contact (contact 2 changes first)

This mode is used to time the first re-close action on an auto re-closing relay.

The auto re-close relay breaker trip contacts are connected to contact set C2 and the breaker close contact connected to contact set C1. If a breaker state signal is required, this can be obtained from the contact on the T&R link connector (see section 1.3.7).

This mode is triggered by contact set 2 changing state before contact set 1 in dual contact mode.

- Start the test by pressing the ON pushbutton. The timer starts when the output is switched on.
- On the 1st change of C2 the timer is reset. The timer restarts, and the output is switched off.
- On the 1st change of C1 the timer stops.

1.3.6.7 Timer mode: current operated

Current operated mode is used to time devices that have contacts in series with the current sense element. This includes miniature circuit breakers and MCCBs.

The timer is started when the output current exceeds 20% of full scale of the selected metering range and stops when the current falls below this threshold.

1.3.6.8 Timer mode: pulse

Pulse mode is used to set the current in devices that are sensitive to heating due to the test current (thermal relays and circuit breakers and instantaneous trips). In this mode current is injected for 200ms when the on switch is pressed. The current is captured and displayed.

1.3.7 T&R link output contact

The T&R link connector has an uncommitted output contact that changes state with the state of the main output. Pins 9 & 10 of the connector are connected when the output is switched on.

The contact has a rating of 110V 0.5A

An optional accessory T&R link contact lead is available to convert this connection to 2x4mm plugs (lead part number A219-0004). The two black leads are connected when the output is on.

2. OPERATION

This chapter describes how to use the different outputs and timing modes on the 100ADM mk5. Details of testing specific relay types are given in the application notes section of this manual.

2.1 Current injection – 1 current

2.1.1 AC current injection without timing

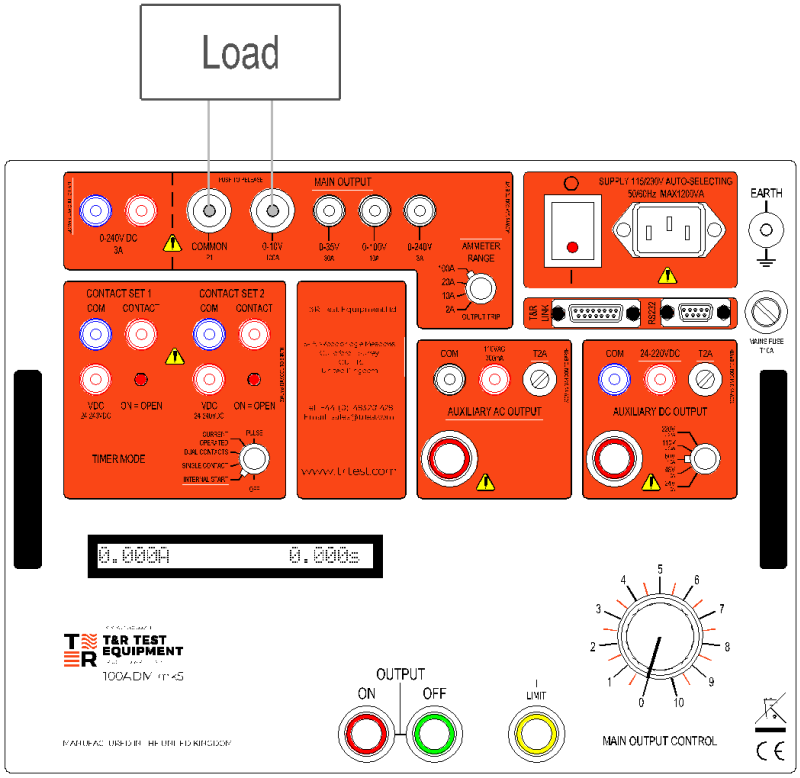

Figure 2.1 Main output ac current

Ammeter range	Select as required	Main output on/off	**On**
Timer mode	Off	I limit	On for current <10A
Aux dc voltage	If required by relay	Aux ac output on/off	n/a

The contacts of the device under test do not need to be connected for current injection without timing, but it can be useful to show the contact state for pick-up and drop-off (drop-out) tests.

- Set the output control to zero.
- If testing at <10A, switch on I limit mode. For the finest current control use the 240V 3A output.
- Switch the output on and increase the test current to the desired level (for pick-up tests increase the current slowly until the relay picks up).
- Switch the output off after testing.

2.1.2 *AC current injection with timing*

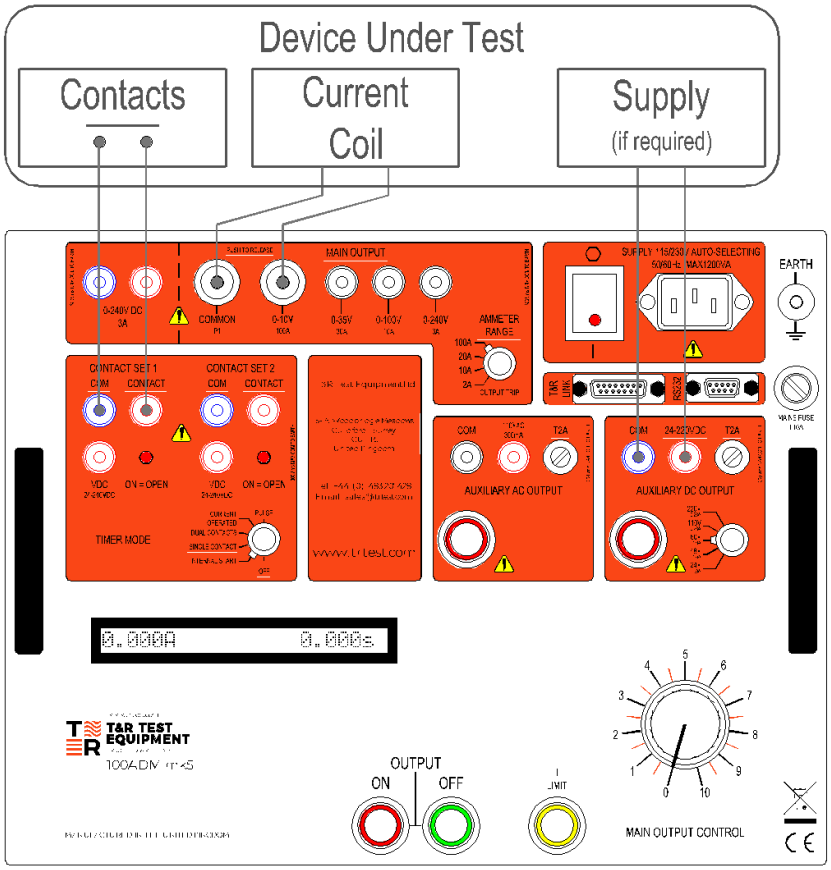

Figure 2.2 Main output ac current with timing

Ammeter range	Select as required	Main output on/off	**On**
Timer mode	**Internal start**	I limit	On for current <10A
Aux dc voltage	If required by relay	Aux ac output on/off	n/a

- Set the output control to zero.
- If testing at <10A, switch on I limit mode.
- Switch the output on and increase the test current to the desired level.
- Switch the output off.
- Switch the TIMER MODE to INTERNAL START.
- Switch the output on. Current injection will commence, and the timer will start. The timer will stop when contact set 1 changes state.

2.1.3 DC current injection

DC current up to 3A is available from the main output. An external DC ammeter is required to meter the current.

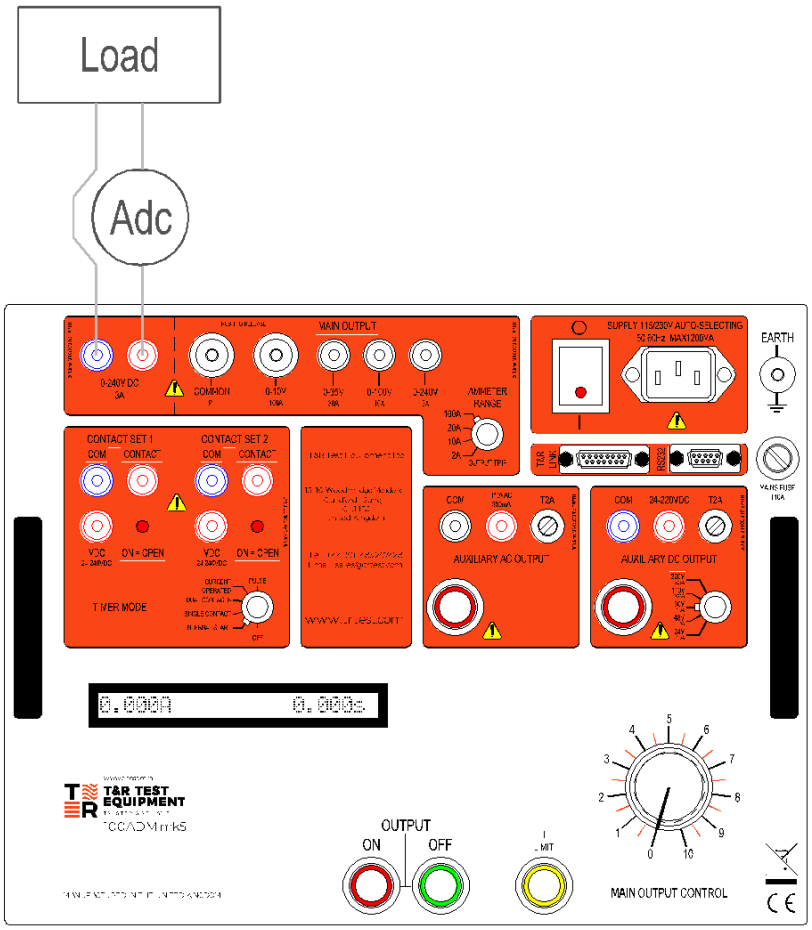

Figure 2.3 Main output dc current

Ammeter range	n/a	Main output on/off	**On**
Timer mode	Off	I limit	Off
Aux dc voltage	Off	Aux ac output on/off	n/a

2.2 Voltage supply – 1 voltage

2.2.1 AC voltage output without timing

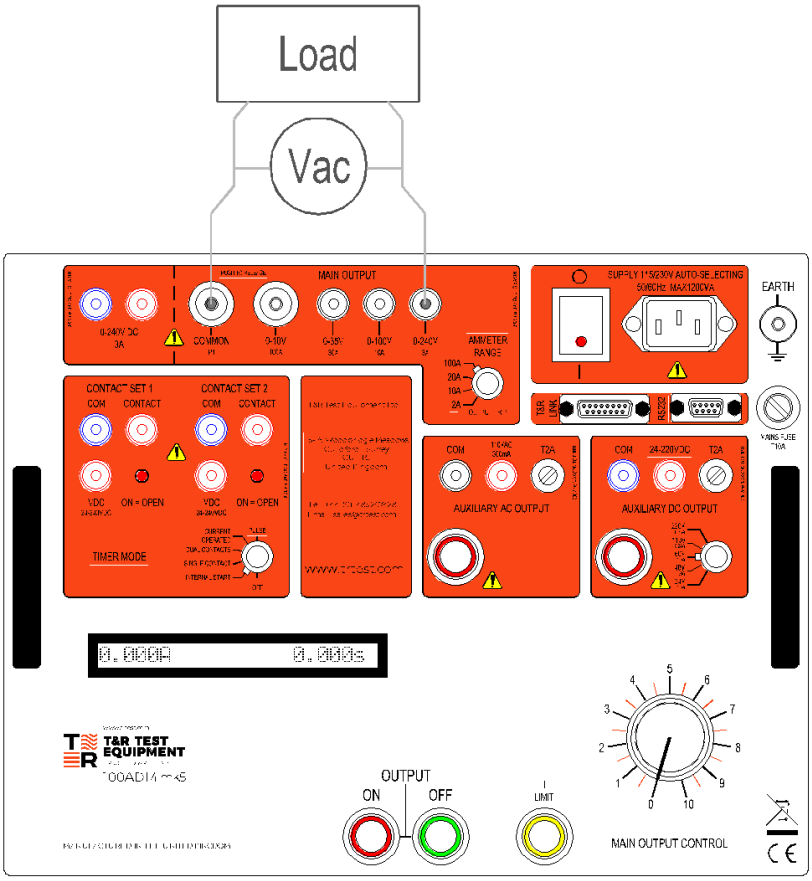

Figure 2.4 Main output ac voltage

Ammeter range	n/a	Main output on/off	**On**
Timer mode	Off	I limit	Off
Aux dc voltage	Off	Aux ac output on/off	n/a

- Connect the test object to the auxiliary ac output.
- An external ac voltmeter is required to meter the voltage.
- Switch the main output on and increase the test voltage to the desired level.
- Switch the output off after testing.

2.2.2 *AC voltage step with timing*

A voltage step can be created by connecting the main output in series with the auxiliary ac output. This can be used to time under and over-voltage relays. The connection shown generates a voltage that steps up or down from 110V.

An external voltmeter is required for this test.

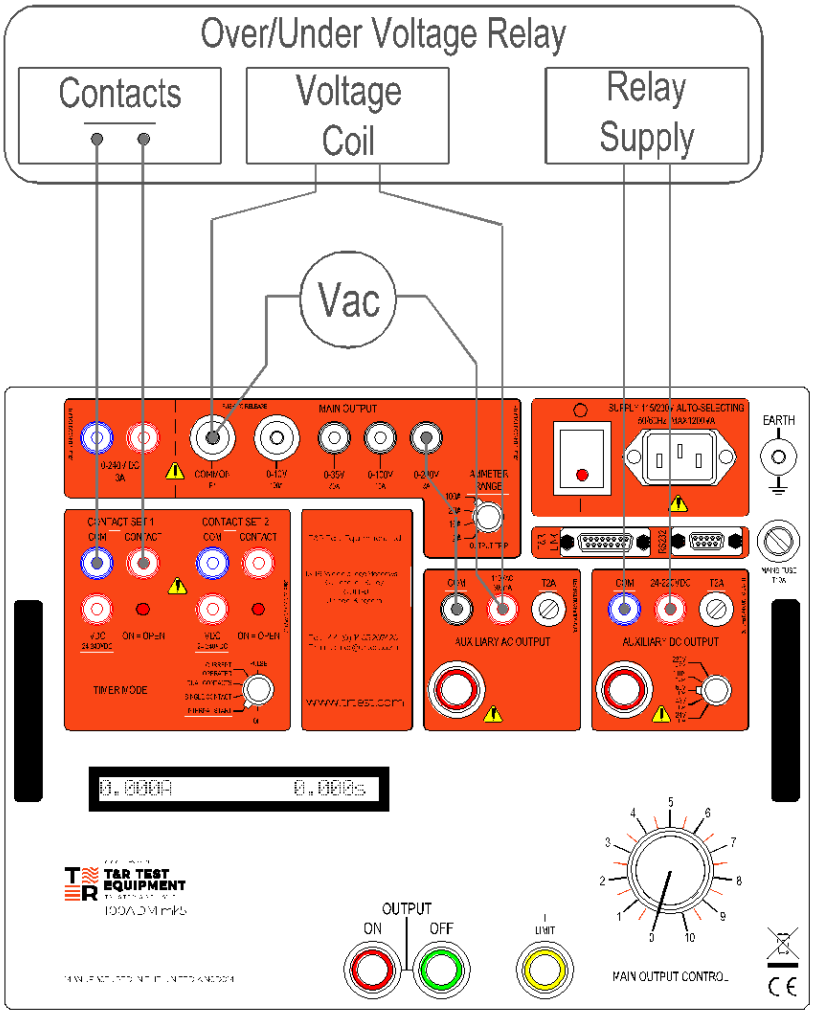

Figure 2.5 Voltage step

Ammeter range	n/a	Main output on/off	**On**
Timer mode	**Internal start**	I limit	Off
Aux dc voltage	If required by relay	Aux ac output on/off	**On**

Step up

- Set the output control to zero.
- Switch on the auxiliary ac voltage.
- Switch the main output on and increase the output voltage until the total voltage is at the required level.
- Switch both outputs off.
- Switch the auxiliary output on and wait for the relay to settle.

- Switch the main output on. The timer will start when the voltage step is applied and stop when contact set 1 changes state.
- Switch the output off after testing.

Step down

- Connect the circuit as above but reverse the connections to the auxiliary ac voltage. The main voltage will now subtract from the auxiliary voltage when it is turned on.
- Set the output control to zero.
- Switch on the auxiliary ac voltage.
- Switch the main output on and increase the output voltage until the total voltage is at the required level.
- Switch both outputs off.
- Switch the auxiliary output on and wait for the relay to settle.
- Switch the main output on. The timer will start when the voltage step is applied and stop when contact set 1 changes state.
- Switch the output off after testing.

3 APPLICATIONS

3.1 Over-current and earth fault relays

3.1.1 Pick-up and drop-off test

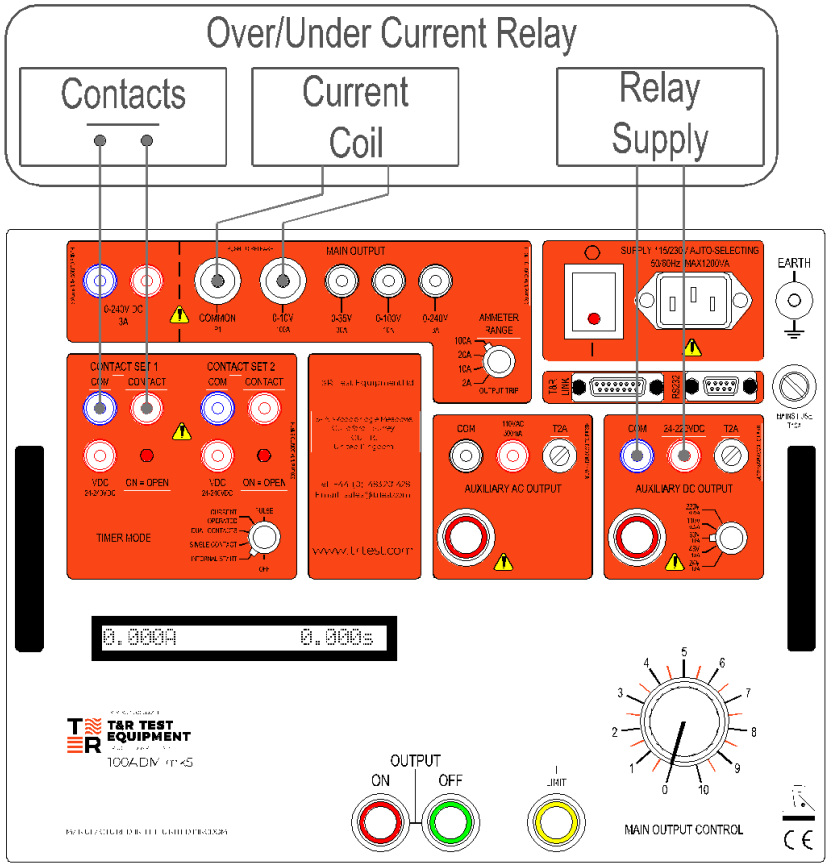

Figure 3.1 Connections for current pick-up/drop-off test

Ammeter range	Select as required	Main output on/off	On
Timer mode	Off	I limit	On for current <10A
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure

1. Set main current output control to zero (anti-clockwise).
2. Switch on main current output.
3. Increase the main output current until the relay trips. The relay contact state is shown on the contact 1 LED. Record the current at which the relay tripped.
4. To find the drop-off point, reduce the current until the relay contacts reset. Record the drop-off current.

3.1.2 Timing test

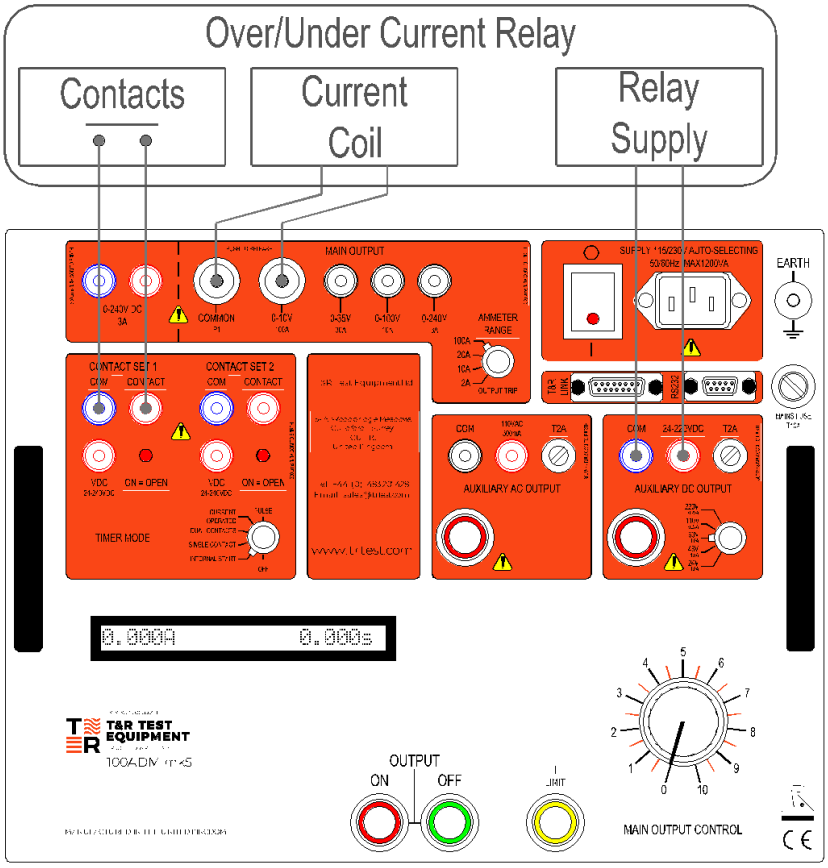

Figure 3.2 Connections for over-current timing

Ammeter range	Select as required	Main output on/off	On
Timer mode	**Internal start**	I limit	On for current <10A
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure

5. Set main current output control to zero (anti-clockwise).
6. Set TIMER MODE to OFF.
7. Switch on main current output.
8. Set the required test current and switch the output off.
9. Set TIMER MODE to INTERNAL START.
10. Switch on main output current. The output will come on and the timer will start.
11. When the relay trips the timer will stop and the output will switch off.
12. Repeat steps 2 to 7 for other test currents as required.

3.1.3 Drop-off test with timing

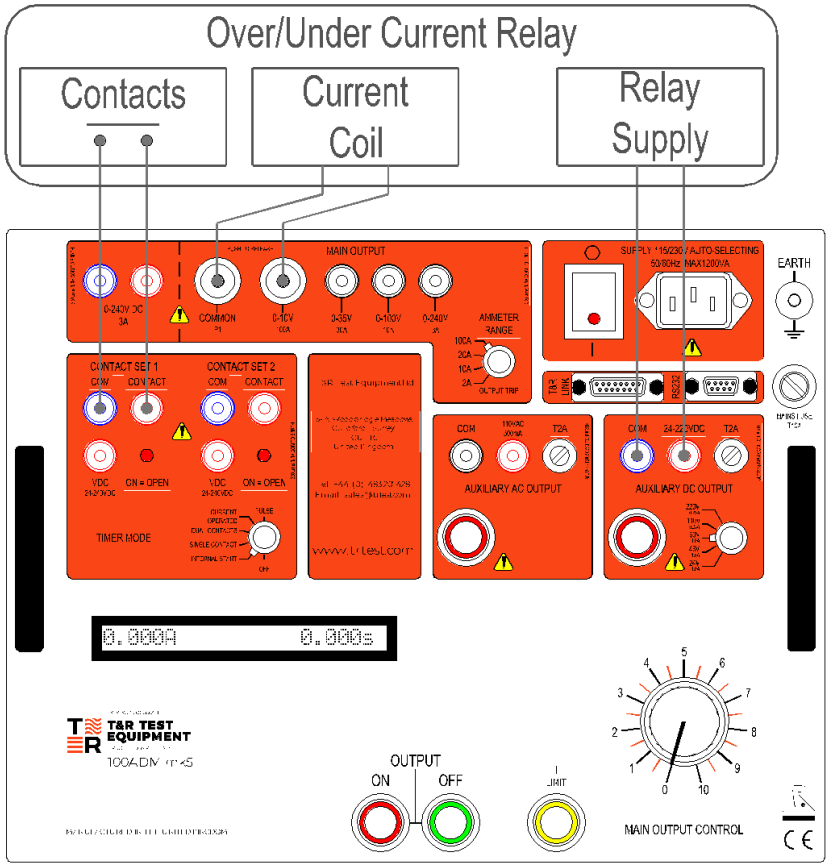

Figure 3.3 Connections for current drop-off test

Ammeter range	Select as required	Main output on/off	On
Timer mode	**Single contact** **Use contact set 2**	I limit	On for current <10A
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure

Note: Contacts connected to contact set 2 (see section 1.3.6 for details of contact modes). If connected to contact set 1 the output will switch off after the first contact set change.

1. Set main current output control to zero (anti-clockwise).
2. Switch on main current output.
3. Increase the main output current until the relay picks up.
4. Switch off the output using the OFF switch.
5. The output will switch off and the timer will start. The timer will stop when the relay drops out.

3.2 Under-current relays

3.2.1 Pick-up and drop-off test

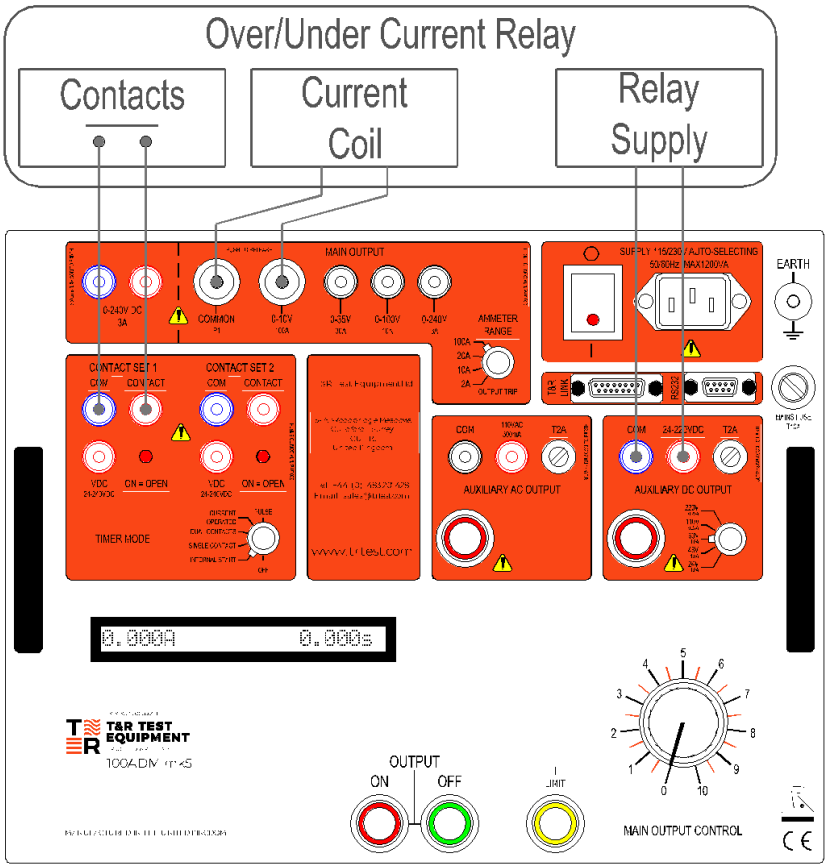

Figure 3.4 Connections for current pick-up/drop-off test

Ammeter range	Select as required	Main output on/off	On
Timer mode	Off	I limit	On for current <10A
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure

1. Set main current output control to zero (anti-clockwise).
2. Switch on main current output.
3. Increase the main output current until the current is higher than the relay setting. The relay should now reset.
4. Decrease the current until the relay trips. This is the pick-up value.
5. Increase the current until the relay resets. This is the drop-off value.

3.3 Under and over-voltage relays

3.3.1 Pick-up and drop-off test

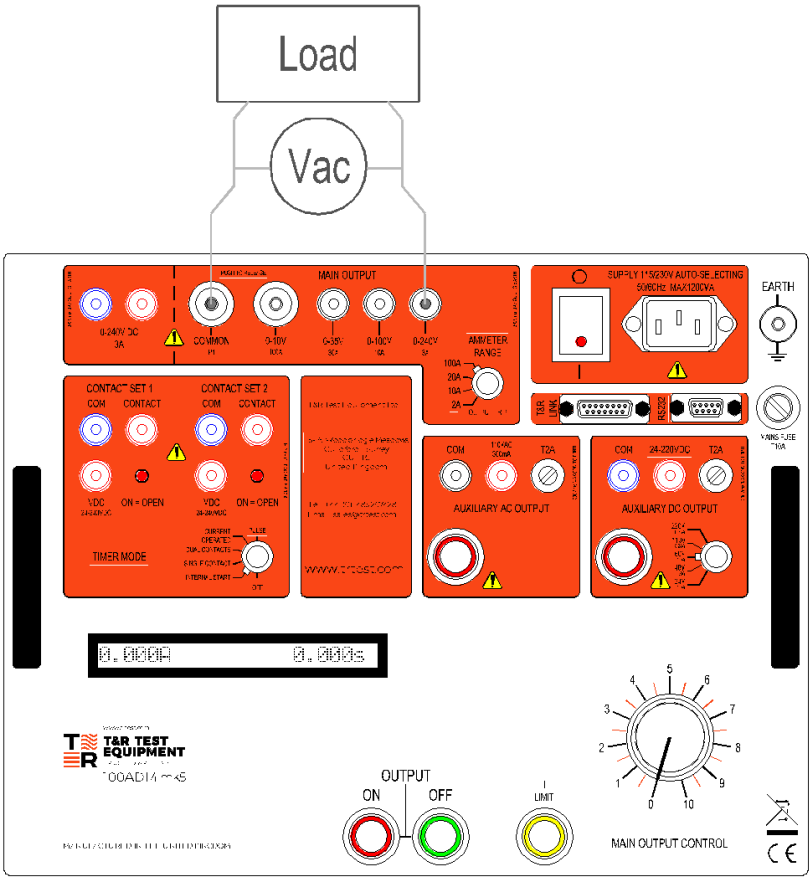

Figure 3.5 Connections for pick-up/drop-off test

Ammeter range	n/a	Main output on/off	On
Timer mode	Off	I limit	Off
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure

1. An external voltmeter is required for this test.
2. Switch on the main output.
3. Increase the voltage until the relay trips. The relay contact state is shown on the contact 1 LED. Record the voltage at which the relay tripped.
4. To find the drop-off point, reduce the voltage until the relay contacts reset. Record the drop-off voltage.
5. For an under-voltage relay start above the trip voltage and reduce to find the pick-up point, then increase to find the drop-off voltage.

3.3.2 Timing of over-voltage relays

Timing tests on under and over voltage relays involve the use of the main output and the auxiliary ac output. The main output is wired in series with the auxiliary ac output and is used to add or subtract a voltage from the auxiliary output voltage. An external voltmeter is used to monitor the voltage.

3.3.3 Selecting the Voltage Step

The 100ADM can generate a range of voltage steps by adding or subtracting the main output voltage from auxiliary voltage supply. The first stage is to ascertain which voltage step to apply to the relay.

CAUTION

Ensure that the maximum voltage that may be applied to the relay is not exceeded by any of the tests.

If the voltage steps listed below are suitable, it may be necessary to use a 200ADM-P or ART3V to test the relay (both of these units are able to generate a wider range of voltage steps).

The following combinations of voltage may be generated:

	Step	Initial voltage	Final voltage	Relay type	Timer mode	Aux V phase*
A		110V	110V-230V	Over voltage	Internal start	Forward
B		110V	0-110V	Under voltage	Internal start	Reverse

*Configurations with a “forward” phase relationship use the connection shown in figure 3.6. Configurations with a “reverse” phase relationship use the connection shown in figure 3.7, in which the connections to the auxiliary ac supply are reversed.

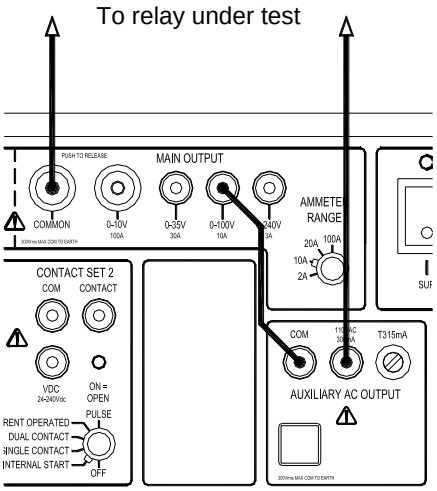

Figure 3.6. Forward connection – voltage increases when main output is on.

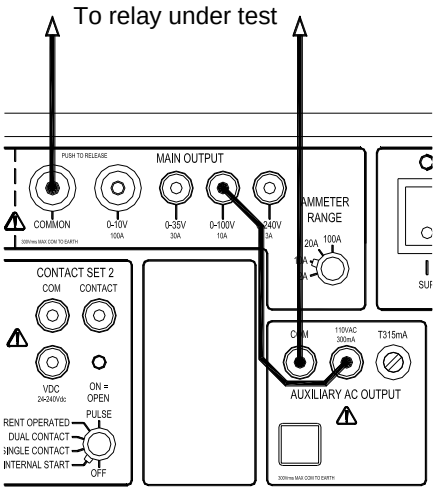

Figure 3.7. Reverse connection – voltage decreases when main output is on.

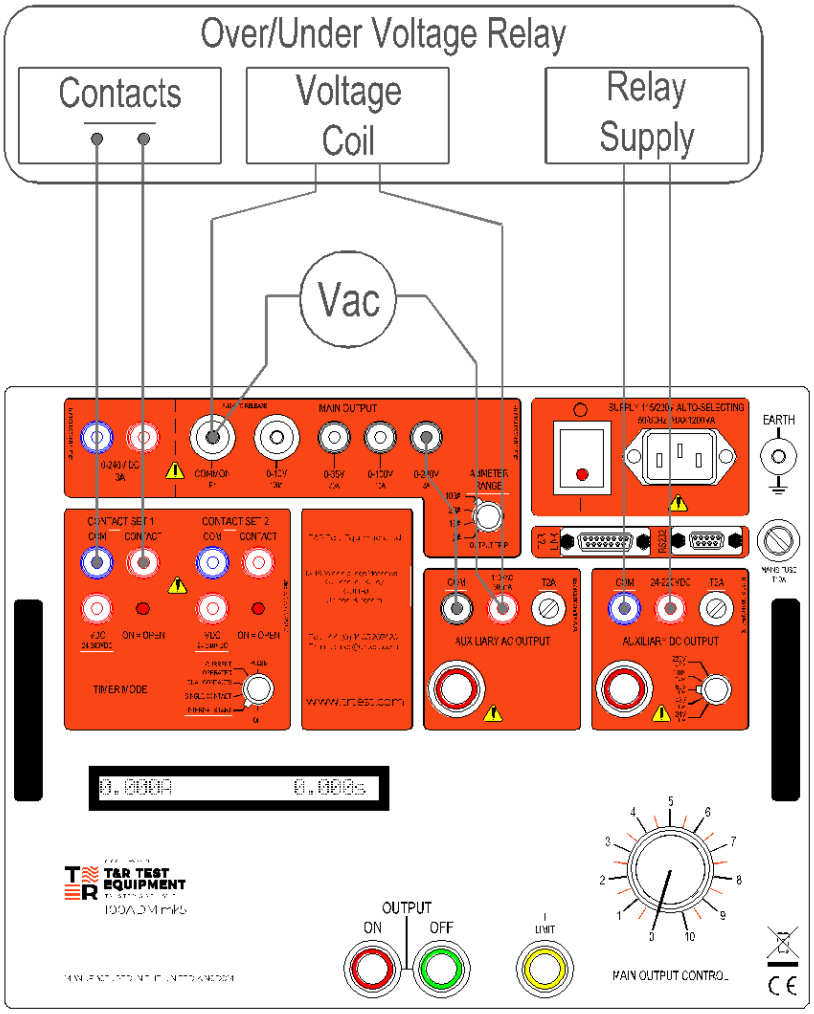

Figure 3.8 Over-voltage with timing

Ammeter range	n/a	Main output on/off	**On**
Timer mode	**Internal start**	I limit	Off / On I≤300mA
Aux dc voltage	If required by relay	Aux ac output on/off	**On**

3.3.4 Over Voltage Relays

Initial voltage 110V, final voltage 110V-230V.

Set the main output control to zero (anti-clockwise) and the timer mode to “off”.

Switch the auxiliary ac output and main output on. Set the main output voltage to give the required final voltage. The initial voltage will be 110V.

Switch off the main output.

Switch the timer to “internal start” mode and reset the relay.

Switch the main output on. The timer will start and will stop when the relay trips.

3.3.5 Under Voltage Relays

To test an under-voltage relay, the voltage needs to drop rather than rise when the main output is switched on. To achieve this, the polarity of the auxiliary output is reversed as shown in figure 3.8.

Initial voltage 110V, final voltage 0-110V.

Set the main output control to zero (anti-clockwise) and the timer mode to “off”.

Switch the auxiliary ac output and main output on. Set the main output voltage to give the required final voltage. The initial voltage will be 110V.

Switch off the main output. Switch the timer to “internal start” mode and reset the relay.

Switch the main output on. The timer will start and will stop when the relay trips.

3.5 Auto reset/re-closing devices

Auto re-closing devices require that the timer is started when power is removed from the device, and the timer stops when the contacts change state. Using the 100ADM mk5, it is possible to time the first re-close operation.

3.5.1 Timing a single re-close action with circuit breaker

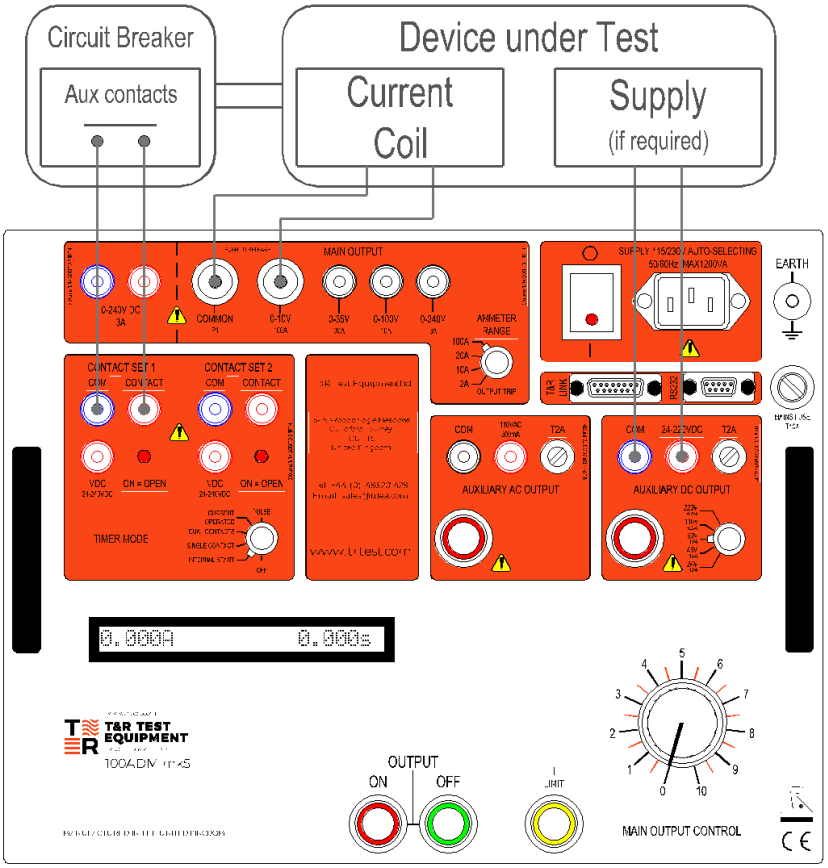

Figure 3.9 Connections for testing auto-reclose relay and circuit breaker

Ammeter range	Select as required	Main output on/off	On
Timer mode	**single contact** **Contact set 1**	I limit	On for I<10A
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure to time re-closing devices (single re-close with circuit breaker connected)

1. Set main output control to zero.
2. Set TIMER MODE to OFF.
3. Switch on main output and increase to desired test current.
4. Switch off main output and set TIMER MODE to single contact.
5. Switch on main output by pressing the ON pushbutton briefly. The relay trips, starts the timer and switches off the output. The unit times between the first contact change when the current is switched off and the second contact change.

3.6 Timing circuit breakers

Testing CBEs (circuit breakers for equipment) MCBs (miniature circuit breakers) and other devices with no auxiliary contacts is possible using the current operated timer mode on the 100ADM mk5. This mode starts the timer when the output current exceeds 20% of the selected current range and stops the timer when the current falls below 20% of range.

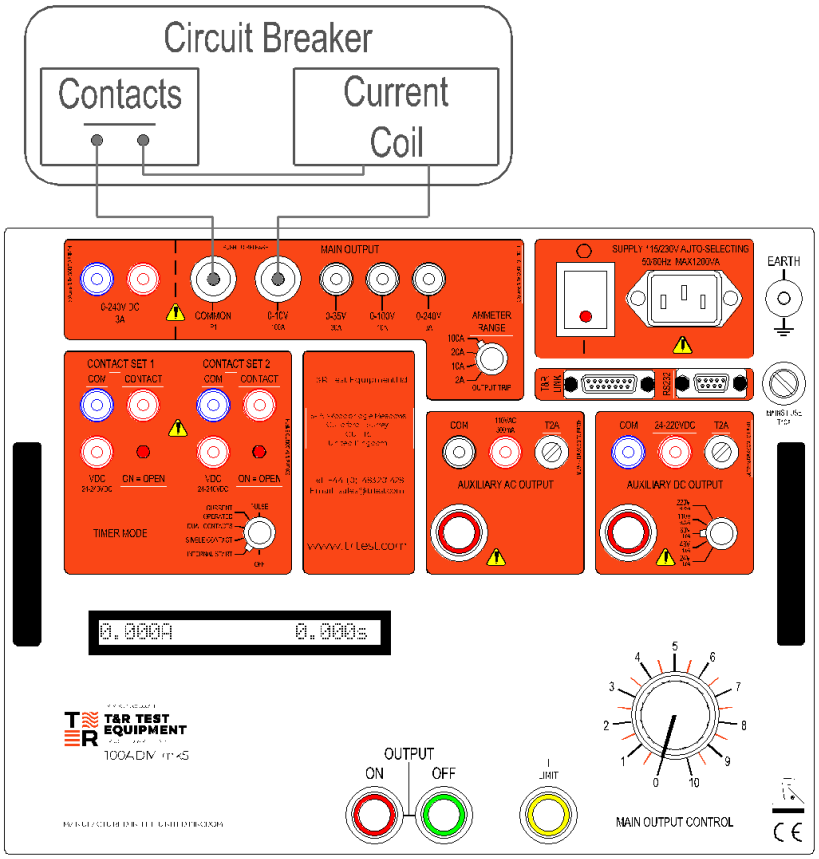

Figure 3.10 Connections for testing circuit breakers

Ammeter range	Select as required	Main output on/off	On
Timer mode	**Current operated**	I limit	Off
Aux dc voltage	n/a	Aux ac output on/off	n/a

1. Set the current metering range so that the device trip current is >20% of the selected metering range.
2. Set main output to zero.
3. Set TIMER MODE to off.
4. Switch the output on and increase the current to the desired test current. For thermal devices or devices with short trip times pulse mode can be used to set the current – current is injected for 200ms each time ON is pressed. Increase the current in stages until the desired current is reached.
5. Set TIMER MODE to CURRENT OPERATED.
6. Switch the output on. The timer will stop when the circuit breaker opens.

3.7 Testing induction disk relays using the optional filter

When testing inductive disk type relays, the current waveform is distorted by the relay, and timing results will be inaccurate. In this situation it is necessary to use the T&R Test Equipment 100ADM-F filter unit to force the current to a sinusoid. This unit is an optional accessory.

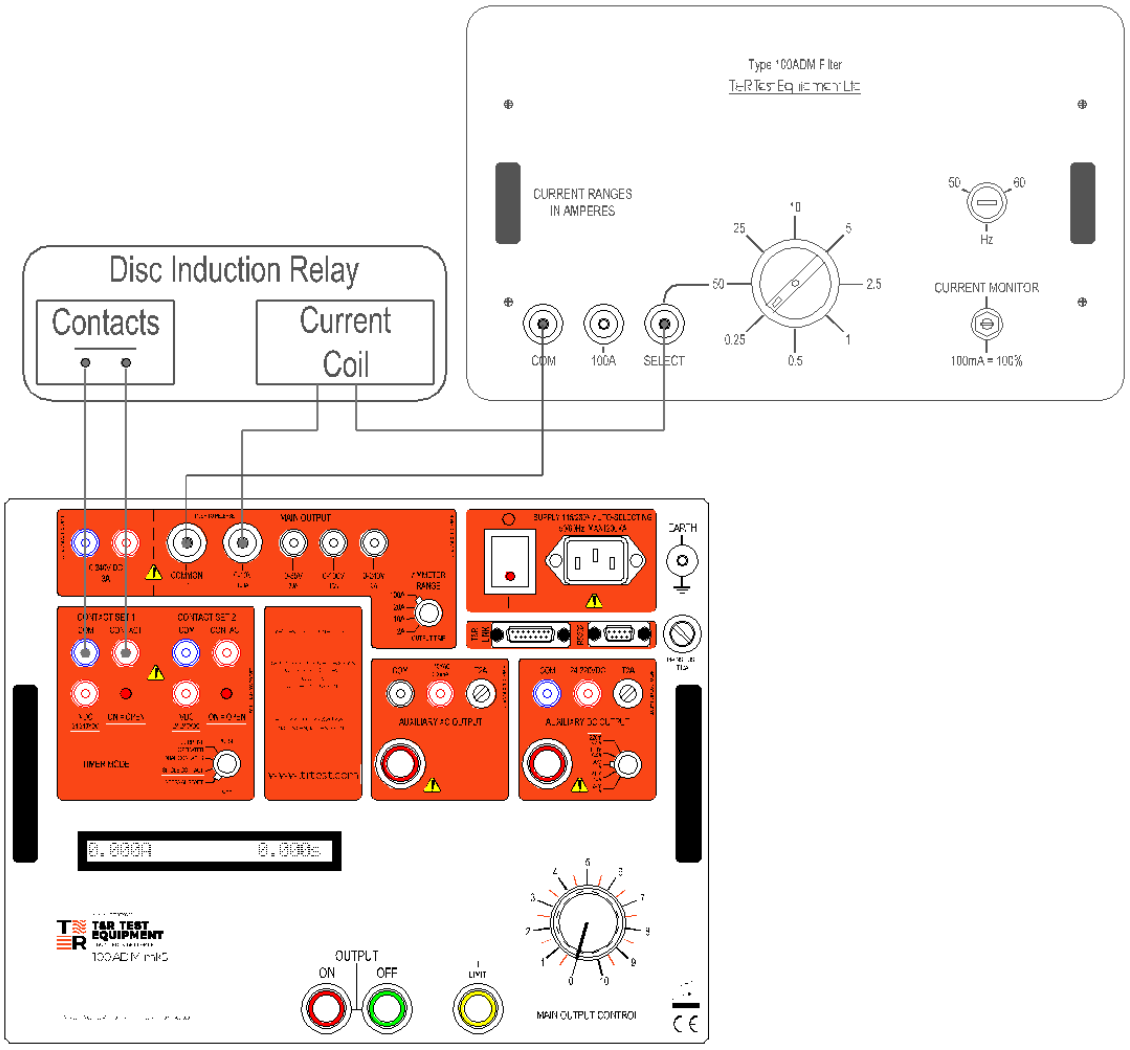

Figure 3.11 Connection of filter unit and inductive disc relay

3.8 Induction disk relay run-back time

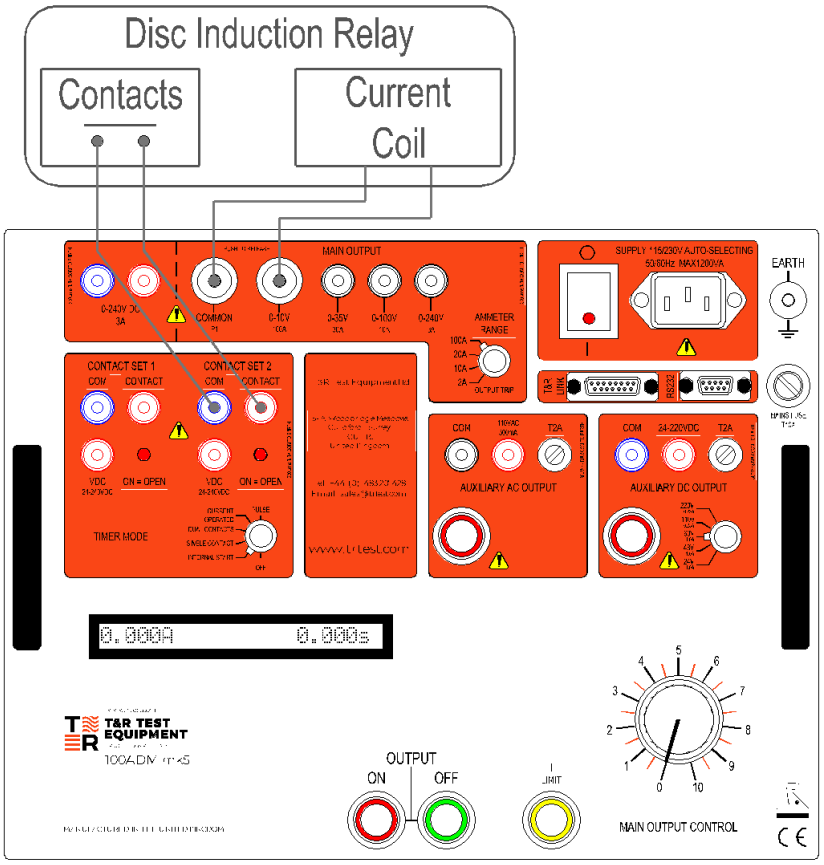

Figure 3.12 Connections for run-back timing

Ammeter range	Select as required	Main output on/off	On
Timer mode	**Dual contact**	I limit	On for current <10A
Aux dc voltage	As required for relay	Aux ac output on/off	n/a

Procedure

1. Set main current output control to zero (anti-clockwise).
2. Set TIMER MODE to OFF.
3. Switch on main current output.
4. Set the required test current and switch the output off.
5. Set TIMER MODE to dual contact.
6. Switch on main output current. The output will come on and the timer will start.
7. When the relay trips the output switches off and the timer restarts.
8. The disk will return to its reset position. When it comes to rest, press the OFF button (the accuracy of the test depends on pressing the off button at the moment the disk comes to rest). The timer result is displayed.

Note: A pushbutton switch may be connected to contact set 2 to stop the timer at the end of the runback.

4. MAINTENANCE

WARNING

Before removing the unit from its case, ensure that the unit is disconnected from the mains. Under no circumstances connect the unit to the mains whilst it is removed from its case.

4.1 Regulator brushes

The regulator brushes should be examined and replaced if necessary. The interval between inspection and renewal of the brushes will depend upon the amount of usage. However, it should be remembered that damage to the regulator can result if the brushes are allowed to wear away to such an extent that a loss of brush pressure occurs.

4.2 Removal of the 100ADM mk5 from case

To remove the instrument from its case, the following procedure should be used: -

a. Remove the lid from the case, and place the unit on its face, such that it is resting on the handles on the front panel.

b. Remove the nine fixing screws from the base of the unit.

c. Lift the case from the unit.

5. STANDARD ACCESSORIES

5.1 Spares fuses supplied

a. 1 off T10A 32mm mains supply.

b. 1 off T2A 20mm auxiliary supplies.

5.2 Standard accessories supplied

a. Mains input lead.

b. 2 off 5m 25mm^2 output leads (part number A199-0001).

c. 2 off 5m 2.5mm^2 output leads (part number S000-0534 for set consisting of c, d & e).

d. 2 off 0.5m 2.5mm^2 output leads.

e. 1 off 5m 2 core timer lead.

f. Operating & Maintenance Manual.

g. Lead set case.

5.3 Optional accessories/spares

100ADM-F filter unit	006
RB10 resistor box	A192-0006
Complete replacement output lead set	A199-0003
Current filter unit	006

6. PERFORMANCE SPECIFICATIONS

6.1 Accuracy of instrumentation and associated circuit components

6.1.1 Main output ammeter

	Range	**Resolution**	**Accuracy**
True rms ac current	2.000A	0.001A	±0.5% rdg ±5d
True rms ac current	10.00A	0.01A	±0.5% rdg ±5d
True rms ac current	20.00A	0.01A	±0.5% rdg ±5d
True rms ac current	100.0A	0.1A	±0.5% rdg ±5d

6.1.2 Timing system

Timer mode	**Range**	**Resolution**	**Accuracy**
Internal start	0-999.999s/ 0-9999.99s/ 0-99999.9s	1ms/ 10ms/ 100ms	±0.01% rdg ±2d
Single contact			±0.01% rdg ±2d
Dual contact			±0.01% rdg ±2d
Current operated			±0.01% rdg ±4d
Pulse mode	200ms	1ms	±2ms

7. REVISION

Product / Type: Secondary Current Injection Test Set / 100ADM mk5
File: OM0004.docx
Author: I.D.W. Lake

Issue / Date: 1 / 07/09/20
Modified By: M. Clancy

Checked By: G. Bond	Date: 07/09/20

Drawings Required

A2/002162 latest issue