Ringmaster range
indoor/outdoor switchgear

installation, operation and maintenance instructions
December 2001

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Ringmaster range contents

Version 7 - Issue date December 2001
Note: This manual covers ring main units produced from June 1999.
Designation RN2c/RN6c/RE2c.
For ring main units designated RN2/RN6 see earlier manual.
Ref: Version 005/December 98.

Ringmaster range
general description

introduction

These instructions cover all operations concerning handling, installation, operation and maintenance of the Ringmaster Range of equipment.

Compact non extensible composite ring main unit
■RN2c 630/200A
■RN6c 630/630A

Extensible circuit breakers and switches
■CE2 200A
■CE6 630A
■SE6 630A

the range comprises:-

- ■ RN2c 630/200A non extensible compact ring main unit
- ■ RN6c 630/630A non extensible compact ring main unit
- ■ RE2c 630/200A extensible compact ring main unit
- ■ CN2 200A non extensible circuit breaker
- ■ SN6 630A non extensible switch
- ■ CE2 200A extensible circuit breaker
- ■ CE6 630A extensible circuit breaker
- ■ SE6 630A extensible switch
- ■ MU2 200A feeder metering unit non-extensible units
- ■ CE2/CE6/SE6 with metering unit

When fully installed the equipment is suitable for outdoor use . It may therefore be necessary to protect the equipment from the environment during erection/commissioning. Please check equipment specification for clarification of indoor/outdoor use. Should the busbar chamber or cable box become exposed to the elements, they should be thoroughly cleaned prior to energising.

weights and dimensions

unit(s)		RN2c/RE2c RN6c	CN2	SN6	CE6	SE6	CE2	MU6+CE6/ CE2/SE6	MU2	MU6
average dimensions (mm) (packed)	h	1510 1610	1750	1750	1750	1750	1750	1750	1650	1750
	W	771	520	520	520	520	520	1100	520	520
	l	842	960	960	960	960	960	1100	960	960
approx. weight (kg)		350	280	280	280	280	280	520	240	240

Non extensible circuit breaker and switch
■CN2 200A
■SN6 630A

Non extensible metering unit
■MU2 200A

storage

outdoor units
These can be carried on open topped trucks or stored outside for short periods provided that all apertures are covered. Units should not be considered weatherproof until the paint work has been inspected and, if necessary any damage should be re-touched.

indoor units
Indoor units must not be left outdoors. They should be stored in a warm, dry, switch room and protected against dust and debris.

off loading
All units are delivered on pallets (secured by 4 x M8 screws and nuts) and fitted with lifting eyes, suitable for off loading by forklift truck or overhead crane.

ancillary kits
Ancillary kits containing busbar, dyscon boots, glands, screws etc. are supplied loose with each unit or fastened to the panel leg or secured in the cable boxes.

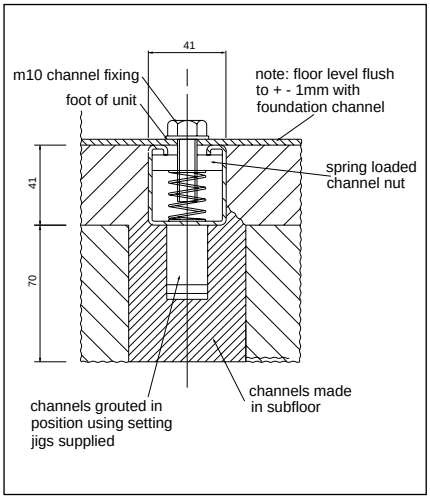
prior to operation
Following transportation ensure circuit breaker mechanism is reset prior to operation.

prior to energising
It is recommended that prior to energising the unit all protection device are checked to ensure they are set correctly. For TFL units ensure fuses are fitted. VIP units must be set in accordance with the results of a protection co-ordination study.

Ringmaster range
general

floor preparation

Please refer to the arrangement drawing for foundation details.



Both non extensible units and switchboards can be directly bolted to the concrete floor by use of 4 x 10mm (supplied) UNI-FIX or similar rag bolt fixings - *see diagram*. The floor tolerance for extensible switchboards is ±1mm over 1 metre .

Where it is not possible to guarantee that the floor is within the specified tolerance, we strongly recommend the use of foundation channels, i.e. Unistrut P3270 or similar.

note: *The floor must be 1mm below the top of the Unistrut.*

paintwork

Check for any damaged paintwork. Damaged areas should be cleaned and re-coated as follows:

Rub down the area around the damage with medium glass paper. Clean the damaged area with emery paper ensuring the surface is clean and free of any corrosion. Apply one coat of zinc-rich epoxy primer (a two-pack system is recommended), the coating to be 35-45 microns thick. The recommended paint system is international Paints “Interzinc EPA 072 and EPA 073”.

Leave to cure for 24 hours. then apply two, 35-45 micron coats (ie 70-80 microns in total) of two-pack polyurethane. Interphane PFR 764 is recommended.

The standard colour employed is Dark Admiralty Grey.

Ringmaster C
ring main units

RN2c

RE2c

RN6c

Note: This manual covers ring main units produced from June 1999.
Designation RN2c/RN6c/RE2c.
For ring main units designated RN2/RN6 see earlier manual.
Ref: Version 005/December 98.

Ringmaster C

Non extensible/extensible ring main unit

operation

key

1 facia

2 operating handle (padlockable)

3 auxiliary/Protection LV compartment

4 test access key

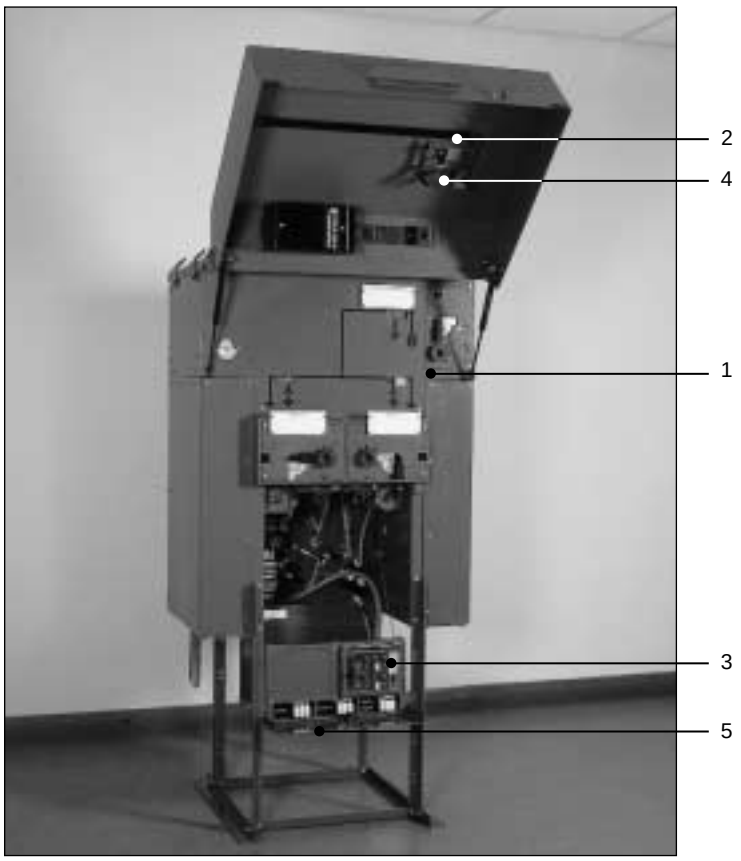
5 data plate

6 main circuit label

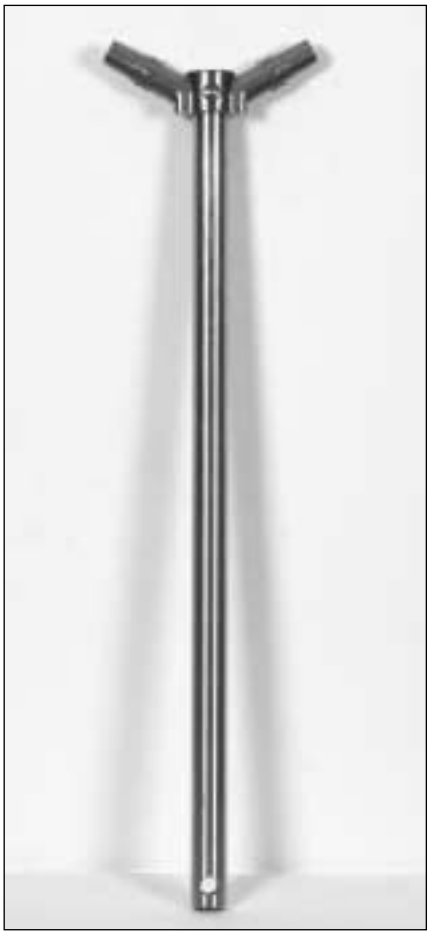
7 gas pressure indicator

8 tripped on fault flag

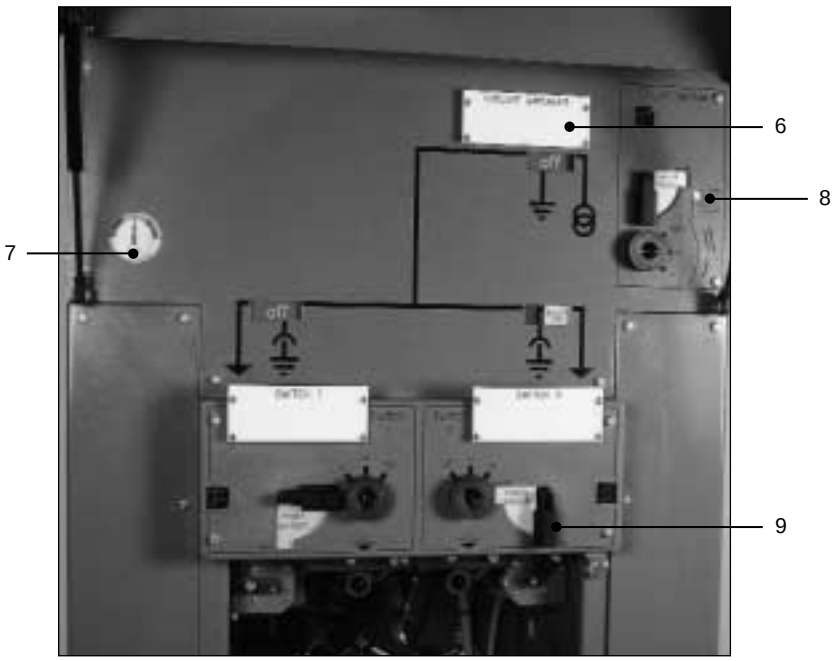
9 main earth selector lever



RN2c



operating handle



facia MIMIC of RN2c

note: ***The operating handle can be used in two positions:***
1. With the handle protruding outside the unit dimensions.
2. With the handle within the constraints of the unit.

manual operation of main switch/circuit breaker RN2c, RE2c, RN6c

Lift up hinged door. Check that the gas indicator is in the green, "healthy condition". Check the facia diagram for the service condition. Remove padlocks if fitted.

Move selector to "Main Switch/Circuit breaker" position. To operate selector slide padlock sleeve towards selector pivot point and rotate selector to required position.

Insert handle as shown, aligning handle profile and direction of operation (arrow) to unit operational socket, for direction of operation. Firmly operate, in a rotational movement, the operating handle until the circuit breaker/switch closes.

note: ***to operate to the "main on' position the operating handle must be rotated in a clockwise direction for the circuit breaker/ right hand ring switch and in an anti-clock wise direction for the left hand ring switch (as marked on the unit facia).***

The selector lever will be locked in the "main switch/circuit breaker" position when in the "closed in service" position.

Padlock fitted to circuit breaker/main switch selector.

Padlock fitted to circuit breaker/main switch in the "close in service position". To open, remove "closed in service position" padlock, if fitted, rotate handle through 180° and reverse procedure.

note: ***the fitting of padlocks does not affect the electrical tripping of the unit.***

Ringmaster C

Non extensible/extensible ring main unit

operation

manual operation of earth switch RN2c, RE2c, RN6c

Lift up hinged door. Check that the gas indicator is in the green, "healthy condition". Check the facia diagram for the “off” service condition. Remove padlocks if fitted. Move selector to “Earth Switch” position. To operate selector slide padlock sleeve towards selector pivot point and rotate selector to required position.

Insert handle as shown, aligning handle profile and direction of operation (arrow), to unit operational socket for direction of operation. Firmly operate, in a rotational movement, the operating handle until the earth switch closes.

The selector lever will be locked in the “earth switch” position when in the “closed in earth” position.

note: ***to operate to the “earth on’ position the operating handle must be rotated in an anti-clockwise direction for the circuit breaker/ right hand ring switch and clockwise direction for the left hand ring switch (as marked on the unit facia).***

Padlock fitted to earth switch selector.

Padlock fitted to earth switch in the “closed in earth position”. To open, remove “closed in earth position” padlock, if fitted, rotate handle through 180° and reverse procedure.

note: ***the unit will not electrically trip if an earth is applied onto a fault.***

cable testing - ring cables RN2c

Open LV compartment by depressing lever on lower edge of LV compartment. Remove padlock if fitted, at this point.

Ensure that the main earth switch is in the “earth on” position. This will open the key way.

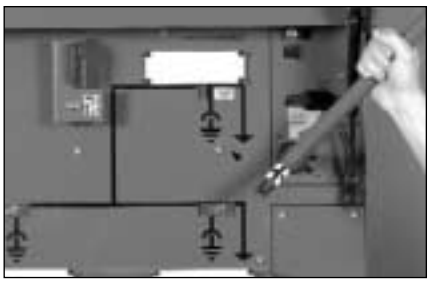
Insert test key (located inside LV cabinet) into key way.

Turn lever clockwise. Remove test access cover padlock if fitted.

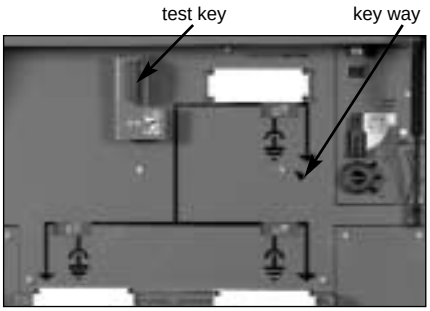
Pull test access cover down, utilising operating handle, to remove cable earth and provide access to the testing bushings (marked with red, yellow and blue phase dots).

The test access key will be locked in position until the cover is firmly closed. Reverse procedure to return to service condition. **Note**:- *ensure cables are discharged before touching bushings after testing.*

cable testing - circuit breaker RN6c



Ensure that the CB earth switch is in the “earth on” position.
This will open the key way for the test key.



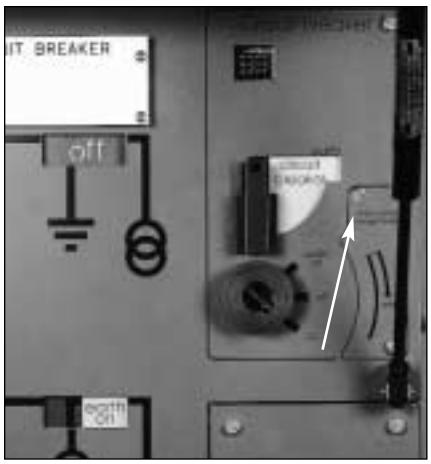
The test key is located on the RN6c fascia as shown above. To remove the key, turn the black lever 90° anti-clockwise.

Insert the test key as shown and turn the black lever 90° in a clockwise direction to lock in position.

Remove test access padlock (if fitted). Whilst holding black lever of test key down, raise the CB test access cover. Note that some resistance will be encountered.

Lift CB test access cover clear of test contacts. Note that the test key is now locked in position until the access cover is firmly closed.
Reverse procedure to return CB to service.

circuit breaker reset - electrical trip/tripped on fault RN2c, RE2c, RN6c



Following a circuit breaker electrical trip/tripped on fault operation the tripping spring has to be reset prior to a close operation. The orange tripped on fault flag (indicated with arrow) will be displayed following the electrical trip.

Insert handle as shown, aligning handle profile and direction of operation (arrow) to unit operational socket, for direction of operation. Firmly operate, in an anti-clockwise rotational movement, the operating handle until the orange tripped on fault flag changes to the white normal service condition, and the handle reaches the end stop.

On the resetting of the flag to white allow the operating handle to return clockwise to the off position.
To close the circuit breaker to the service/earth condition, refer to relevant section regarding manual operation.

motorpack circuit breaker reset - electrical trip/tripped on fault

When a trip operation has occured, the motor intelligence will automatically reset the circuit breaker.

note: ***to manually reset circuit breaker remove motorpack and follow above procedure.***

Ringmaster C

Non extensible/extensible ring main unit

operation

motorpack control RN2c, RE2c RN6c

Prior to connecting the motorpack check the facia diagram for service conditions. The service selector padlock, if fitted, can remain fitted with the application of the motorpack.
Note: *The motorpack can only be fitted when the main switch/circuit breaker position is selected and not when the earth position is selected.*

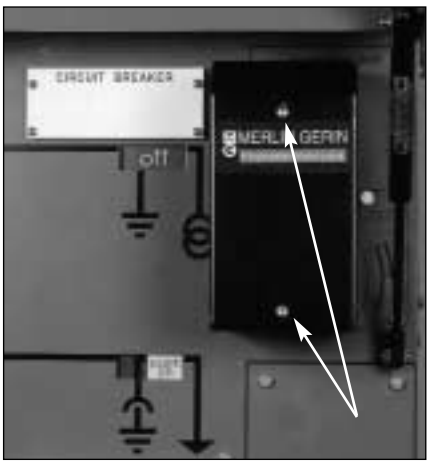
Align both the motorpack male drive shaft and the electrical connector with the female switch operating socket and electrical connector on the unit facia.
Note: *The motorpack can be removed and replaced in both the "Main On" and "Main Off" service conditions.*

Offer motorpack to unit until full engagement of both the drive and electrical connection are achieved.

For electrical operation of the motorpack, refer to the Easergy T200E telecontrol manual.

note: ***only manual operation of the earth switch can be undertaken. To operate earth switch remove motorpack and follow "manual operation of earth switch instructions.***

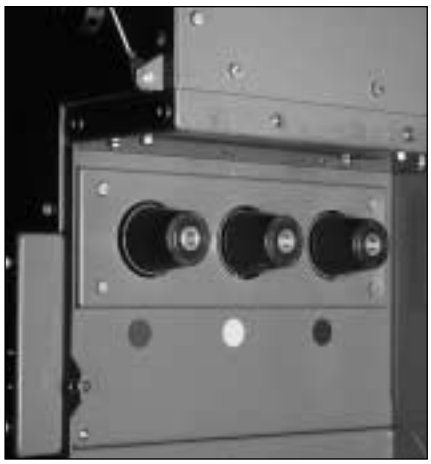
The motorpack protection fuse is located at the bottom right hand corner as above when the motor is removed.



The motorpack is fitted with a manual drive, to release mechanism spring tension, should the motor fail during electrical operation. Remove allen screws (indicated with arrows) on motorpack cover to access manual drive screw.

neon indication

Neon indication can be fitted as an optional item on the ring switches and circuit breaker on the RN2c. The test sockets are located in the pilot cable box.



A garter spring is fitted to the relevant cable bushing which forms a capacitive coupling with the HV conductor, deriving the neon voltage.

note: *circuit breaker neons cannot be fitted to transformer mounted units.*

earth fault flow indicator

Hand or self reset earth fault flow indicators can be fitted.
Please refer to manufacturers instructions.

For C.T.'s mounted inside the cable box, gland insulation is not required. for C.T.'s mounted outside the cable box, gland insulation must be fitted.

Split core C.T.'s can be installed after the main cable has been made off inside or outside the cable box. However, please note gland insulation **must** be fitted if mounted outside the cable box.
Installation instructions for the units are supplied with the accessory kits.

Ringmaster C

Non extensible/extensible ring main unit

connection

installation of pilot cables RN2c, RE2c, RN6c

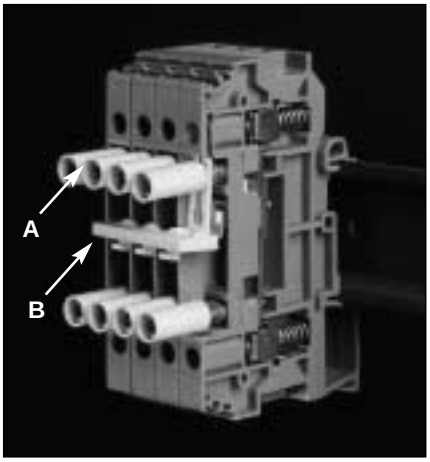
The universal gland plate at the rear of the LV compartment will accommodate pilot cable glands upto 25.5mm^2.

To fit gland and cable remove 4 gland plate screws. Slide top section of gland plate forward.

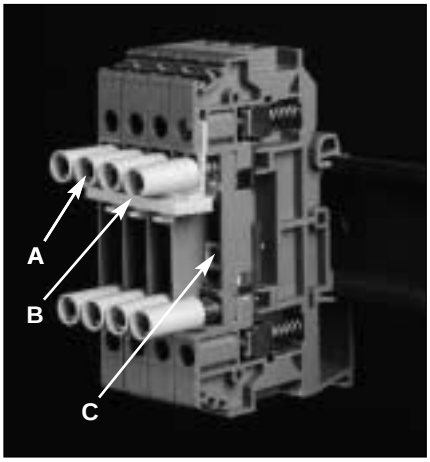
Insert gland and cable replace top gland plate and 4 fixing screws.

removal of VIP relay

Open cabinet door. Move shorting links on terminal rail, short circuiting the CT Secondaries.
Remove top cover 3 x M6 x 20 screws.

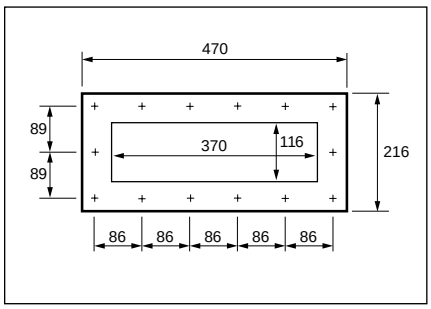


note: ***CT secondaries not shorted on above***
Short circuiting of the CT secondaries.
To short circuit the protection current transformers loosen test terminals **A**, and move shorting link **B** upwards.



note: ***CT secondaries shorted on above***
Slide earthbar **B** to position above and tighten test terminals **A**.
To isolate protection device from CT's loosen screw **C** and slide link to lower position.

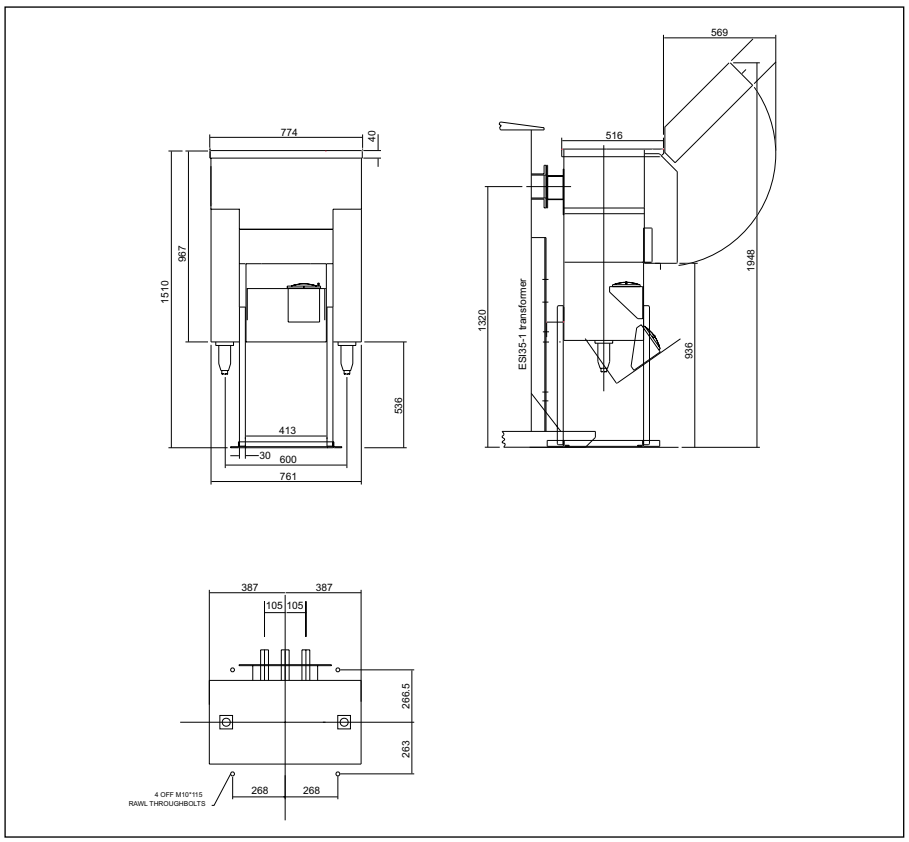
Open up relay cover. Loosen two retaining bracket screws at top of VIP facia.
Withdraw relay and remove secondary wiring.



Dimensions of the EA transformer flange

14 x M12 clearance holes

Adjust RMU stand height to suit. Under workshop conditions remove transformer lid screws. Pump oil out to below HV pocket height. (Pump into clean, dry drum).Remove blanking plate. Push units together. Insert bushing gasket and make firm connections on flanges and support brackets. Make off the 3 phase connections checking that these are tight and in the correct phase sequence, onto the M12 copper studs in the bushings. Pump clean oil back to the cold oil fill level marked on the transformer oil gauge. Re-fit tank cover ensuring that there is no damage to the gasket. Touch up paint as necessary.



General arrangement of a transformer mounted RN2c.

unit(s)		boot type	cable socket fixing	lug torque (Nm)
RN2c/RE2c	main	right angled	M12 stud	54
RN6c	tee off	right angled	M12 stud	54
	tee off	straight	M12 clearance hole in palm	54

RN2c/RE2c/RN6c cable connection cable box venting fixings arrangement

Ensure cable box cover screws are configured correctly as detailed on cable box cover label.

The RN2c/RE2c/RN6c is suitable for accepting 1 x 3 core or 3 x 1 core cable approaching from below - top entry available on request.
Fit the gland plate and accessories in accordance with the instructions supplied with the ancillary kit.

Standard RN2c/RE2c/RN6c cable box

Ringmaster
Non extensible/extensible circuit breakers and switches

CN2

SN6

CE2

CE6

SE6

MU2

key

1 facia

2 operating handle (padlockable)

3 auxiliary/Protection compartment

4 test access key (within LV pilot box)

5 data plate/pilot box

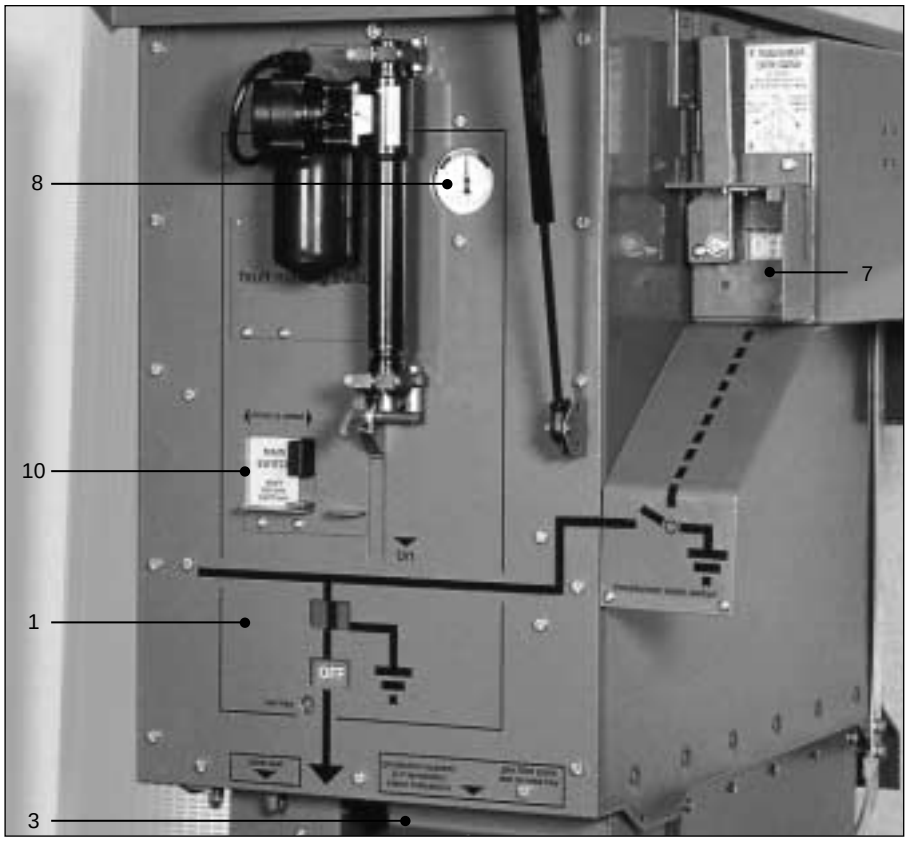
6 main circuit label on pilot box

7 transformer earth switch

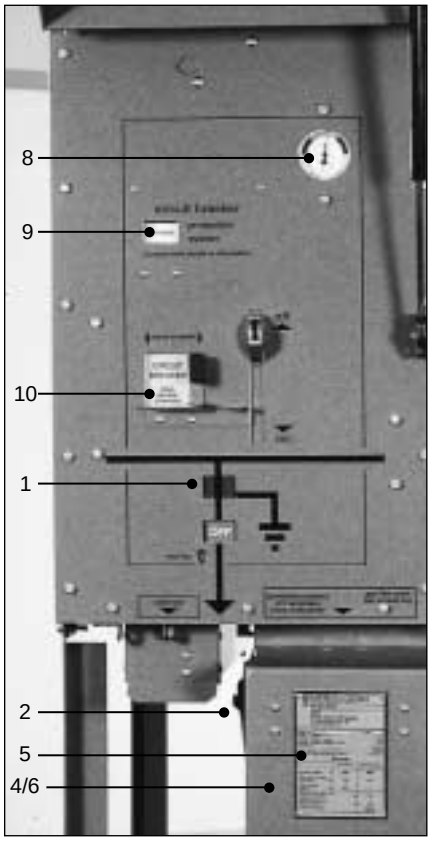
8 gas pressure indicator

9 tripped on fault flag

10 main selector lever



CN2/SN6



CE2/CE6/SE6

Ringmaster

Non extensible/extensible circuit breakers and switches

operation

operation of main switch/circuit breaker CE6, CE2, SE6, CN2, SN6

Lift up hinged door. Check that the gas indicator is in the green, "healthy condition". Check the facia diagram for the service condition. Remove padlocks if fitted.

Move select to "Main Switch" position. Insert handle as shown and pull down firmly until the circuit breaker/switch closes. The selector lever will be locked into the "main switch" position. Fit padlock into "CB closed in service" position if required.

note: ***that this does not affect electrical tripping of the unit.***

To open, rotate the handle through 180° and reverse the procedure.

operation of main earth CE6, CE2, SE6, CN2, SN6

Lift up hinged door. Check that the gas indicator is in the green, "healthy condition". Check the facia diagram for the service condition. Remove padlocks if fitted.

With the switch/circuit breaker in the open position, move selector lever to "earth switch position". Insert handle as shown and pull down firmly until the switch closes. The selector will be locked in the "earth switch" position. Fit padlock into "circuit breaker/switch main cable earthed" if required.

note: ***that the unit will not trip on fault.***

To open, rotate the handle through 180° and reverse the procedure.

transformer earth switch SN6 and CN2 only

closing earth switch

Open the main switch/circuit breaker. Move the selector lever (see page 10) to earth position. **Do not re-close the main earth switch unless incoming cable earth is required.** Move transformer earth selector lever as shown above.

Pull lever forwards as shown to close earth switch. Push back to rest position. The main selector lever should be locked in the earth position.

The switch can be padlocked "on" as shown above.

opening earth switch

Remove padlock if fitted. Move transformer earth selector lever as shown above.

Turn lever clockwise as shown above until flag show "off" and mechanism is reset. Turn lever back to the rest position.

The transformer earth can now be padlocked off as shown above. The main selector lever is now free to move.

Ringmaster

Non extensible/extensible circuit breakers and switches

operation

cable testing main cable - CE6, CE2, SE6, CN2, SN6 and ring cables

Ensure that the main earth switch is "earth on". This will open the key way.

Insert test key (located in pilot cable box compartment) into key way and turn lever anti-clockwise. Remove test access cover padlock if fitted.

Pull test access cover down to remove cable earth and provide access to the testing bushings, (marked with red, yellow and blue phase spots). The test access key will be locked in position until the cover is firmly closed. Reverse procedure to return to service condition.

note: ***ensure cables are discharged before touching bushings after testing.***

actuator control

For electrical operation of the actuator, refer to the selection guide or the RTU supplying the switchgear (eg EASERGY T200).
To earth the main cable, the actuator must be removed. With the switch/circuit breaker in the open position, disconnect the actuator supply.

Lift the lever on the connecting bracket.

Rotate actuator mechanism anti-clockwise away from the handle socket. Manual operation can be performed as normal. Reverse the procedure to fit the actuator.

earth fault flow indicator

Hand or self reset earth fault flow indicators can be fitted.
Please refer to manufacturers instructions.

For C.T.'s mounted inside the cable box, gland insulation is not required. For C.T.'s fitted outside the cable box gland insulation must be fitted.

Split core C.T.'s can be installed after the main cable has been made off outside the cable box. However please note gland insulation **must** be fitted if mounted outside the cable box. Installation instructions for the units are supplied with the ancillary kits.

Ringmaster

Non extensible/extensible circuit breakers and switches

connection

removal of VIP relay

Remove the 2 , M4 x 20mm pan head screws and washers from the front of the relay cover and the M6 x 20 mm screw from the top of the relay cover.

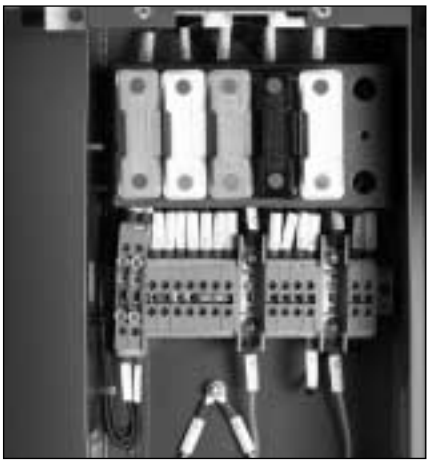
Pull the relay cover forwards and remove.

Remove the crimp terminals from the top of the relay. Rotate the two facia screws behind perspex window to release clamps and withdraw relay.

installation of pilot cables

on switch/circuit breaker.
Remove VIP relay if fitted, knock out the pre-punched gland plates from the inside as required. There is no need to re-touch with paint (the plates are stainless steel).

note:
20.5mm = 1x7 core / 1x9 core pilot gland
25.5mm = 1x19 core pilot gland

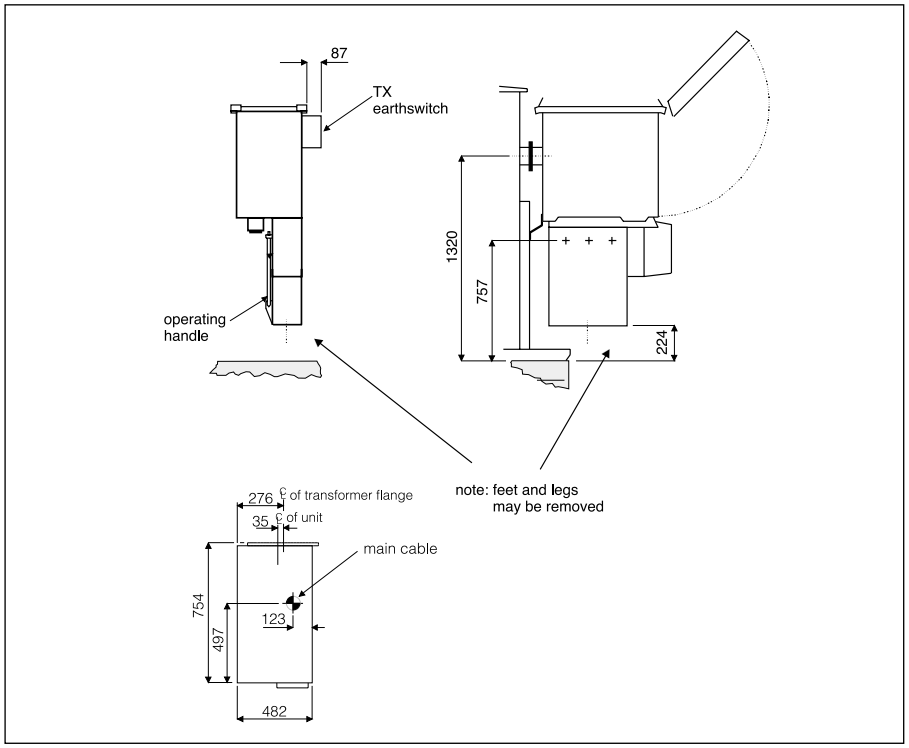


on MU2
Knock out the pre-punched gland plates from the inside as required. There is no need to re-touch with paint (the plates are stainless steel).

on feeder/busbar metering units
Knock out the pre-punched gland plates from the inside as required. There is no need to re-touch with paint (the plates are stainless steel).

transformer mounting on standard EA 35/1 transformers:

Adjust switch / CB stand height to suit. Under workshop conditions remove transformer lid screws. Pump oil out to below HV pocket height. (Pump into clean, dry drum).Remove blanking plate. Push units together. Insert bushing gasket and make firm connections on flanges and support brackets. Make off the 3 phase connections checking that these are tight and in the correct phase sequence, onto the M12 copper studs in the bushings. Pump clean oil back to the cold oil fill level marked on the transformer oil gauge. Re-fit tank cover ensuring that there is no damage to the gasket. Touch up paint as necessary.



General arrangement of a transformer mounted CN2.

installation of MU2

Please refer to the assembly instructions supplied with the units.

main cable connection

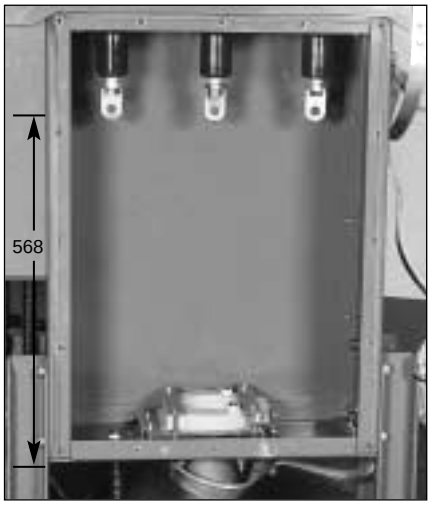
All units are fitted with dry type cable boxes suitable for accepting heat shrink termination kits. Accessory kits containing gland plates etc are available.

unit(s)		boot type	cable socket fixing	lug torque (Nm)
CE6/CE2/SE6		straight	M12 clearance hole in palm	54
CE2/CE6 feeder metering		right angled	M12 tapped hole	54
CN2/SN6	main	straight	M12 clearance hole in palm	54
	outgoing	right angled	M12 tapped hole	54

CE2, CE6, SE6, CN2, SN6 connection standard cable entry

On switches/circuit breaker panels, side sheets can be removed on both sides of the cable box. For composite switchboards, 3 side covers can be removed on inner panels, one at a time, for improved access. Suitable for accepting 1 x 3 core / 3 x 1 core cable approaching from below. Fit the gland plate and gland bonding in accordance with the instructions supplied with the ancillary kit.

note: ***Do not remove the rear cable box cover when only one or two panels are used. The rear cable box cover is used to support the unit.***



Standard CE2, CE6, SE6, CN2, SN6, cable box

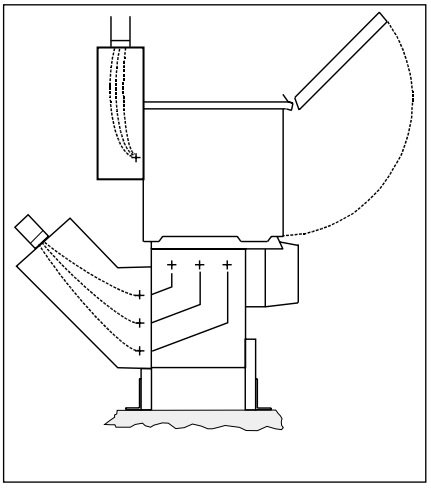
Ringmaster

Non extensible/extensible circuit breakers and switches

connection

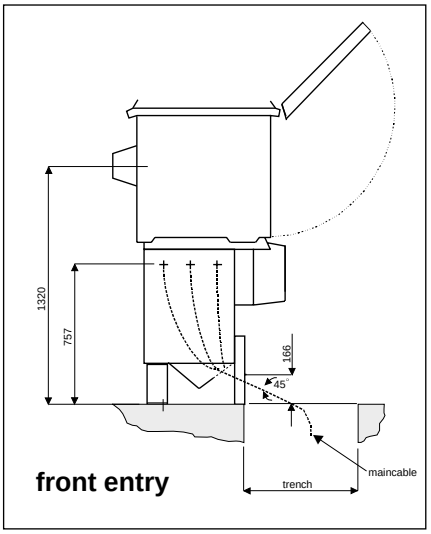
CE2, CE6, SE6, CN2, SN6 top cable entry

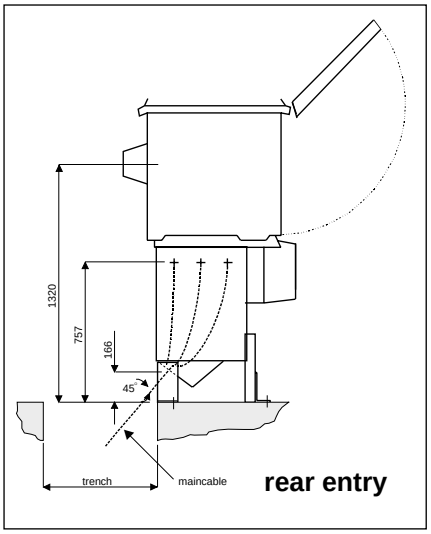
Top entry cable boxes can be fitted for basement substation applications.



CE2, CE6, SE6, CN2, SN6 with top entry cable box.

CE2, CE6, SE6, CN2, SN6 angled cable entry





Angled gland plates can be provided on all units to the front or rear, in order to simplify civil works.

Please refer to accessory kit instructions for details.

accessing VT's

Ensure that the main earth switch is padlocked in its "earth on" position. If the unit is busbar interconnected then the bars must be earthed or completely isolated.
See page 23 for operation instructions.

Remove the metering chamber H.V. access cover, as indicated.

disconnection of solid link VT

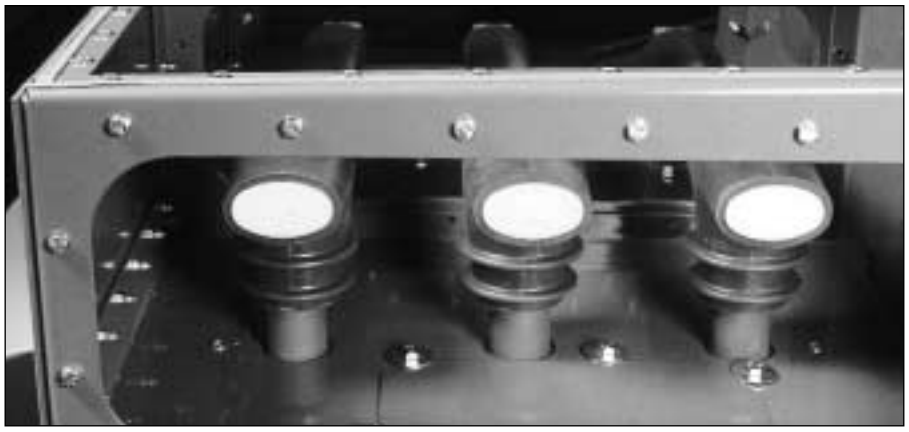
Pull back the V.T. insulating boot, and loosen the top V.T. connection using an 6mm allen key as indicated.
Pull back the lower fuse link insulating boot and disconnect the V.T. link.

Ringmaster

Non extensible/extensible circuit breakers and switches

installation

erection/connection CE6, CE2, SE6.



Remove the top cover on each unit and bolt each panel to the adjacent one. Use the 16 x M6 screws around the busbar aperture and the 2 x M8 screws by the cable test access/auxiliary compartment.

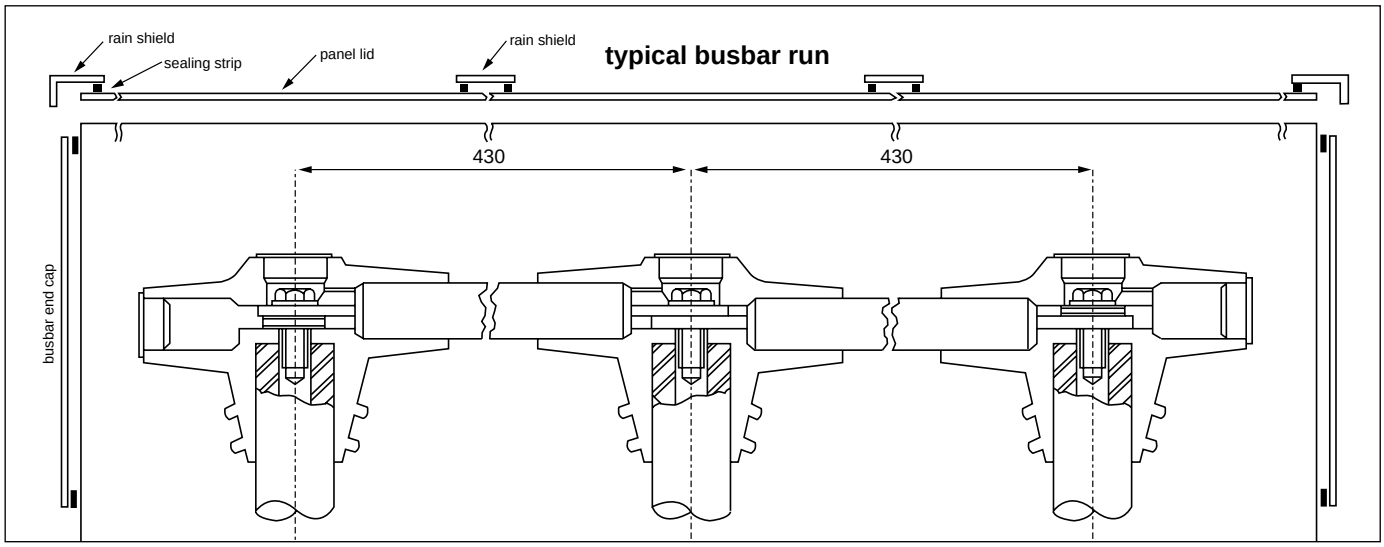
The busbar end cap is secured with 16 screws. Before fitting the end cap apply a line of silicon compound around the busbar aperture.

Please refer to accessory kit instructions for full details.

Connect the busbars as shown below. Connect the earth bars at the back of the units. Connect the main substation earth to the equipment main earth bar. Fit the main gland plates (see ancillary instructions). Erect the first unit under clean, dry conditions either directly to the floor, or on to the foundation channels.

connection of busbars CE6, CE2, SE6.

refer to accessory kit instructions for full details

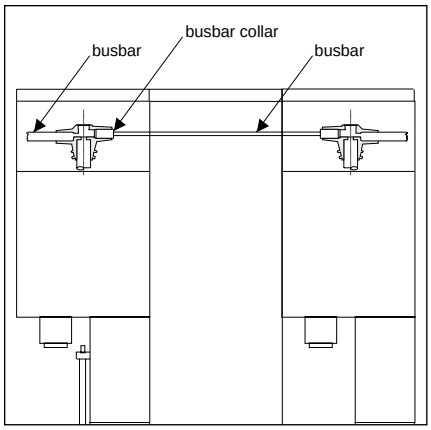


Ensure that the environment is clean and dry. Remove busbar chamber covers.

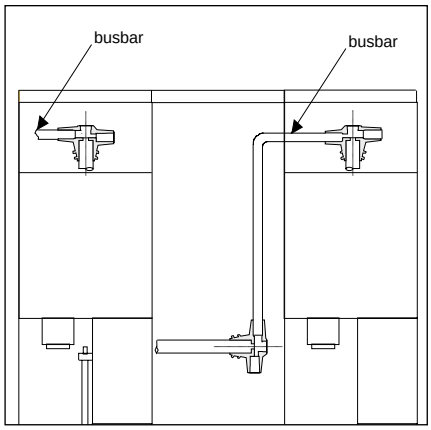
Remove dyscon boots and clean bushings. Apply DC4 silicon grease to boots. Fit busbars into boots as shown above.

refer to accessory kit for full details

connection of busbars metering



feeder metering
Ensure that the environment is clean and dry. Remove busbar covers as shown above.
Remove dyscon boots and clean bushings. Apply DC4, Dow Corning silicon grease to boots. Fit busbars into boots as shown above.



busbar metering
Ensure that the environment is clean and dry. Remove busbar covers as shown above.
Remove dyscon boots and clean bushings. Apply DC4, Dow Corning silicon grease to boots. Fit busbars into boots as shown above.

Torque busbar screw to 54 Nm. Fit dyscon dust caps. Degrease and clean using a lint free cloth. Replace busbar chamber covers taking care not to damage nylon inserts.

note: ***It is recommended prior to refitting busbar chamber covers that the busbars are tested - see page 32 for typical tests***

Ringmaster range protection

Note: This section contains information for Ringmaster C equipment designation RN2c/RE2c/RN6c and Ringmaster range equipment disignation CN2/SN6/CE2/CE6/SE6.

Commissioning procedures for both ranges are given.
Please check the panel type reference of the unit to be commissioned.

protection systems

All circuit breakers can be fitted with various forms of protection system -

1.VIP self powered IDMT protection - refer to VIP user guides
- VIP 30 - provides protection against phase-to-phase faults
- VIP 35 - provides protection against phase-to-phase faults and earth faults
- VIP 300 - three phase overcurrent and earth fault protection

2.Time fuse link (TFL) protection system to EA 41-26 (time fuse links to EA 12-6).

TFL selection

Merlin Gerin recommend TFL sizes in accordance with the table to the right.

The table also includes our recommendations for the maximum LV fuse size to ensure discrimination. Note that the size of this fuse is less than the full load current of the transformer, however, it would normally be expected to have a number of LV fuses fed from the LV side of the transformer.

important note: ***Please ensure TFL fuses are fitted prior to energising the equipment.***

Time fuse link (TFL) protection summary

Time fuse link protection provides a cost effective way of feeding a transformer of 1600kVA or less. It is a recognised method of protection and the fuses are covered by EA 12-6 (1973). The arrangements in the Ringmaster range is of 2 phase overcurrent and earth fault.

recommended Time fuse Link (TFL) settings to ESI 12 - 6

	voltage transformer rated power (kVA)								
	(kV)	200	315	500	800	1000	1250	1600	
CT ratio = 50/5	**3.3**	**10A**	-	-	-	-	-	-	**TFL**
		150A	-	-	-	-	-	-	LV fuse
earth fault setting = 25A (instantaneous trip)	**6.6**	**5A**	**10A**	**15A**	-	-	-	-	**TFL**
		150A	250A	400A	-	-	-	-	LV fuse
	11	**3A**	**5A**	**10A**	**15A**	-	-	-	**TFL**
		200A	300A	400A	560A	-	-	-	LV fuse
	13.8	**3A**	**5A**	**10A**	**15A**	-	-	-	**TFL**
		200A	300A	400A	560A	-	-	-	LV fuse
CT ratio = 100/5	**3.3**	**5A**	**10A**	**15A**	-	-	-	-	**TFL**
		150A	250A	400A	-	-	-	-	LV fuse
earth fault setting = 30A (instantaneous trip)	**6.6**	-	**5A**	**7.5A**	**12.5A**	**15A**	-	-	**TFL**
		-	250A	400A	560A	560A	-	-	LV fuse
	11	-	-	**5A**	**7.5A**	**10A**	**12.5A**	**15A**	**TFL**
		-	-	400A	560A	630A	630A	630A	LV fuse
	13.8	-	-	**5A**	**7.5A**	**10A**	**12.5A**	**15A**	**TFL**
		-	-	400A	560A	630A	630A	630A	LV fuse

Ringmaster range protection

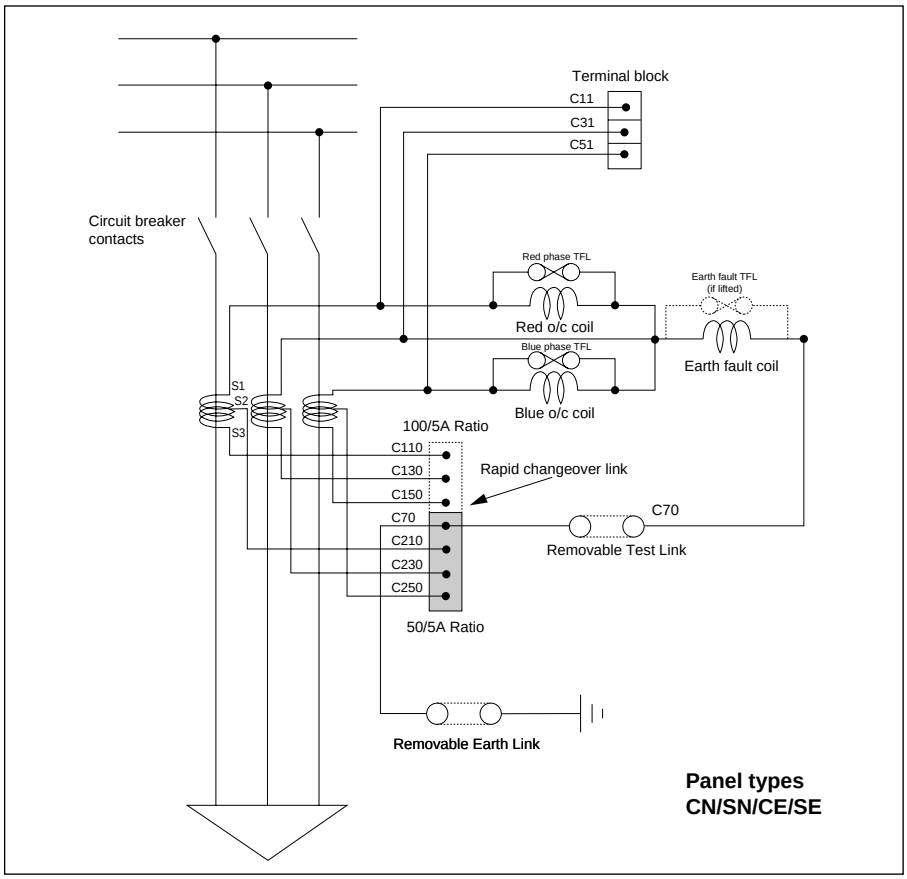
operation

The circuit consists of 3 dual ratio C.T.'s, 2 Direct Acting Trip (DAT) solenoid type overcurrent coils connected in parallel with associated Time Fuse Links (TFL's) and 1 instantaneous earthfault DAT solenoid Coil.

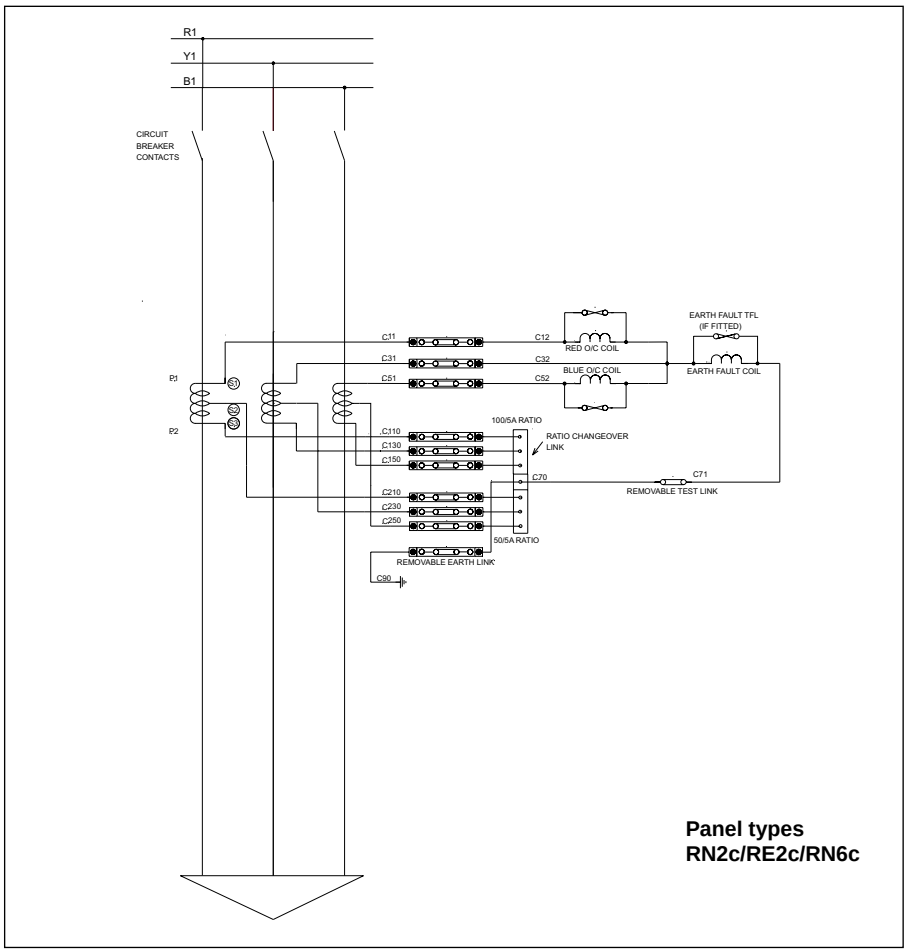
Under normal load conditions on, say an 11000 volt 1000KVA transformer, 52 amps will flow in the C.T. primaries (1000kVA(11kv/3). If the C.T. ratio is set on 50/5 Amp ratio, then approximately 5 Amps will flow in the C.T. Secondaries. As the overcurrent coils are shorted out by the fuses, no current will flow through the coils. Assuming that there was no earth leakage, the red, yellow and blue phases will balance, and no current will flow through the earth fault coil.

In the event of a phase to phase fault of, say, 500 Amps, 50Amps would flow through the C.T. secondaries. This would blow the 15Amp fuse links shunting all of the current through the DAT coils, which would operate and trip the 3 phase circuit breaker. The tripped on fault flag would operate, and the CB would have to be re-set and the fuses replaced.

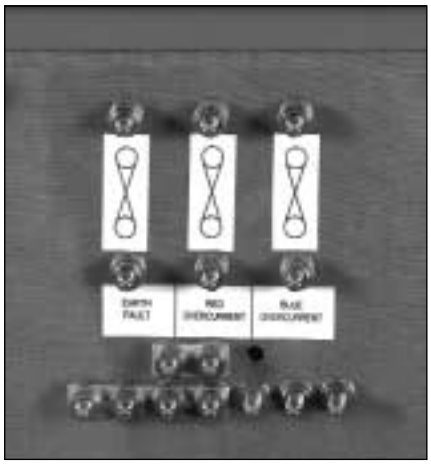
Two overcurrent coils are required to cover all phase fault combinations, i.e. for a R-Y phase fault, the CB will trip on the red phase coil. Under earth fault conditions, there will be an imbalance between the red, yellow and blue phases, and current will flow down the residual path of the C.T.'s and through the earth fault coil. The unit will trip instantaneously. If a TFL is fitted in parallel with the earthfault coil then the tripping time will follow the TFL characteristics. Alternatively, the fuse can be removed.



Panel types CN/SN/CE/SE



Panel types RN2c/RE2c/RN6c



Close-up of C.T. links.

Replacing the time fuse links.

Dual ratio 100/50/5Amp C.T.'s are fitted as standard, to the Ring Main Units and 200 Amp circuit breakers with TFL protection. Selection of the appropriate C.T. ratio can be easily achieved by moving the auxiliary link in the pilot cable box. Note that the circuit must be off load when changing ratios.

Ringmaster range commissioning

commissioning

All equipment is subject to stringent quality and operational checks prior to despatch. However it is the owners responsibility to ensure that commissioning tests have been completed to IEC694. The following is a resume of those tests.

physical checks

Remove all packaging and transit labels from the equipment. Check the data plate details against the specification. Check the operation of the switches/circuit breaker, test access and various interlocks.

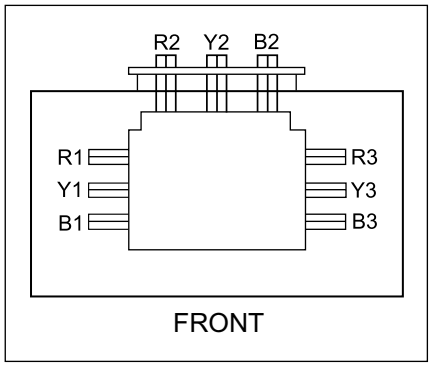
functional checks

Check confirmation of auxiliary switch contacts and remote indication in accordance with the schematic diagram.
Confirm the phase relationship of the neon indicator sockets.
Check the pick up voltage of auxiliary coils if fitted, a.c. coils should operate between 85% and 110% of the rated voltage, d.c. coils should operate between 70% and110% of the rated voltage.

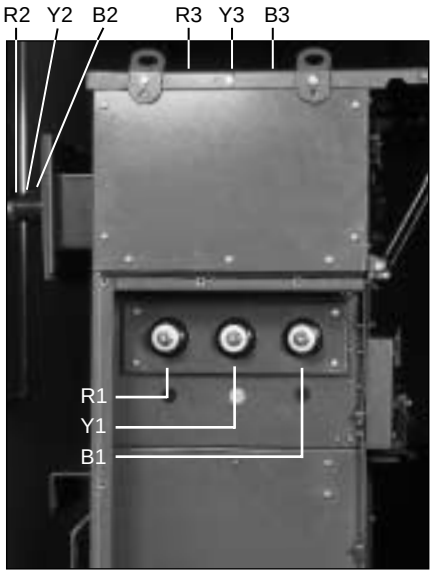
note: ***All voltages should be applied instantaneously unless otherwise specified.***

high voltage withstand test to BS5311.

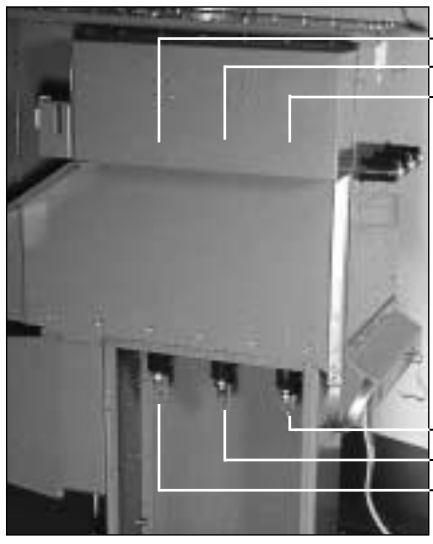
Connect the H.V. test set as shown in the diagrams an carry out the withstand tests in accordance with the following tables.



RN2c/RE2c/RN6c



RN2c



CE2/CE6/SE6 or SN6/CN2

H.V. withstand - contd.

test voltages

rated voltage (kV)	a.c. test voltage (kV)	frequency (Hz)	duration (minutes)	(d.c. test voltage - current practice)
3.6	8	50	1 (AC) 15 (DC)	7.5
7.2	16	50	1 (AC) 15 (DC)	15
12	23	50	1 (AC) 15 (DC)	25
13.8	32	50	1 (AC) 15 (DC)	32

test connection - circuit breaker / switch - CE2 / CE6 / SN6

test number	CB / switch	live terminals	earthed terminals
1	closed	R, Y, B	frame
2	closed	R, Y	B, frame
3	closed	Y, B	R, frame
4	closed	B, R	Y, frame
5	open	R1, Y1, B1	R2, Y2, B2, frame
6	open	R2, Y2, B2	R1, Y1, B1, frame

test connection - ring main unit - RN2c/RN6c

test number	ring switch 1	ring switch 2	circuit breaker	live terminals	earthed terminals
1	closed	closed	closed	R1, B1	Y1, frame
2	closed	closed	closed	Y1	R1, B1, frame
3	closed	closed	open	R1, Y1 B1	R2, Y2, B2, frame
4	closed	closed	open	R2, Y2, B2	R1, Y1, B1, frame
5	open	open	closed	R2, Y2, B2	R1, Y1, B1, R3, Y3, B3 frame
6	open	open	closed	R1, Y1, B1, R3, Y3, B3	R2, Y2, B2, frame

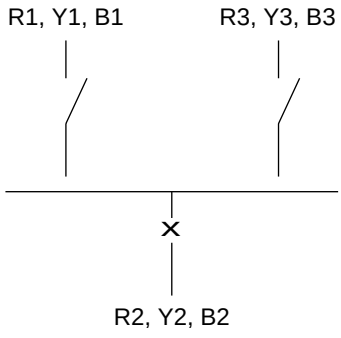


Diagram of connections - RN2

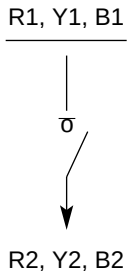


Diagram of connections - circuit breaker / switch

note: ***ensure VT primary connections are isolated prior to HV pressure testing equipment.***

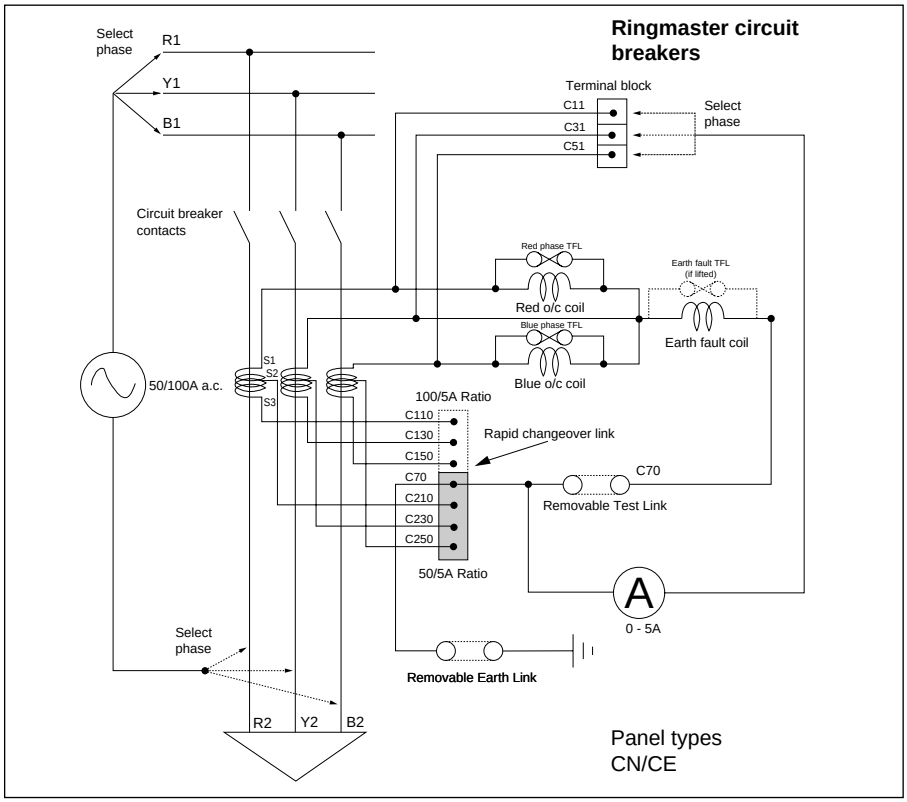
Ringmaster range commissioning

circuit breaker auxiliary tests

The following tests have been conducted during manufacturing (except CT insulation test, magnetisation curve), and are to be used as a guide for commissioning purposes.

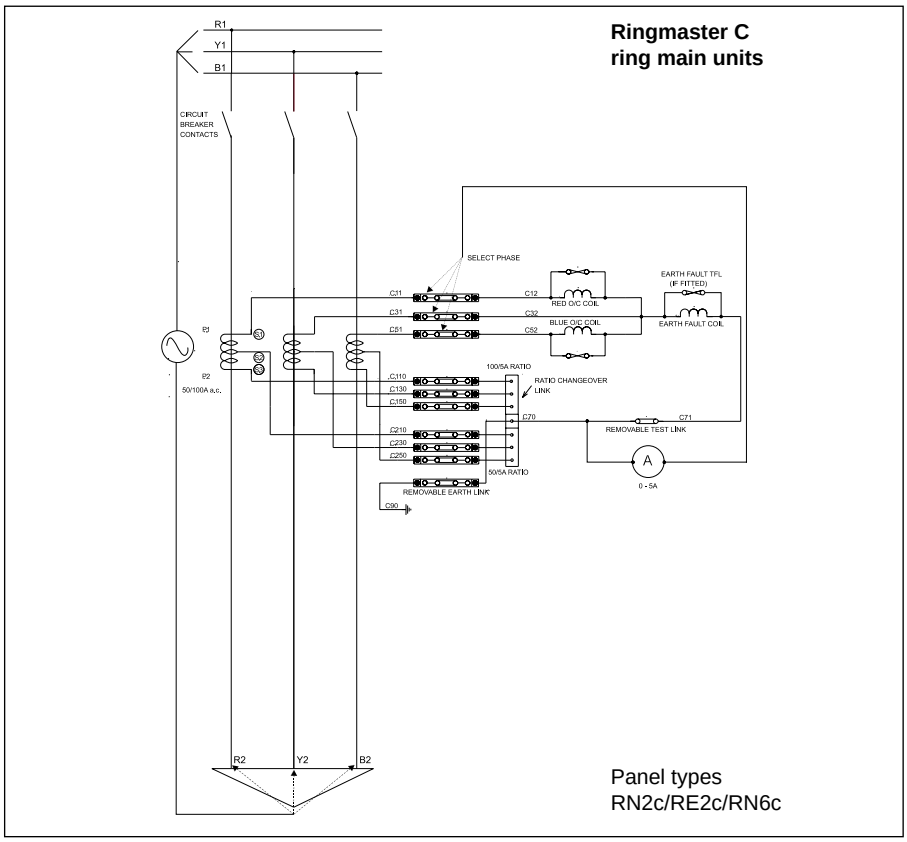
All secondary wiring has been 2kV insulation tested at our works. We therefore recommend that testing on site is done with a 1,000 volt megger and not re-stressed at 2kV.

Remove all earth connections and test the wiring to earth. For units fitted with a VIP relay please refer to the VIP user guide.



C.T. ratio test

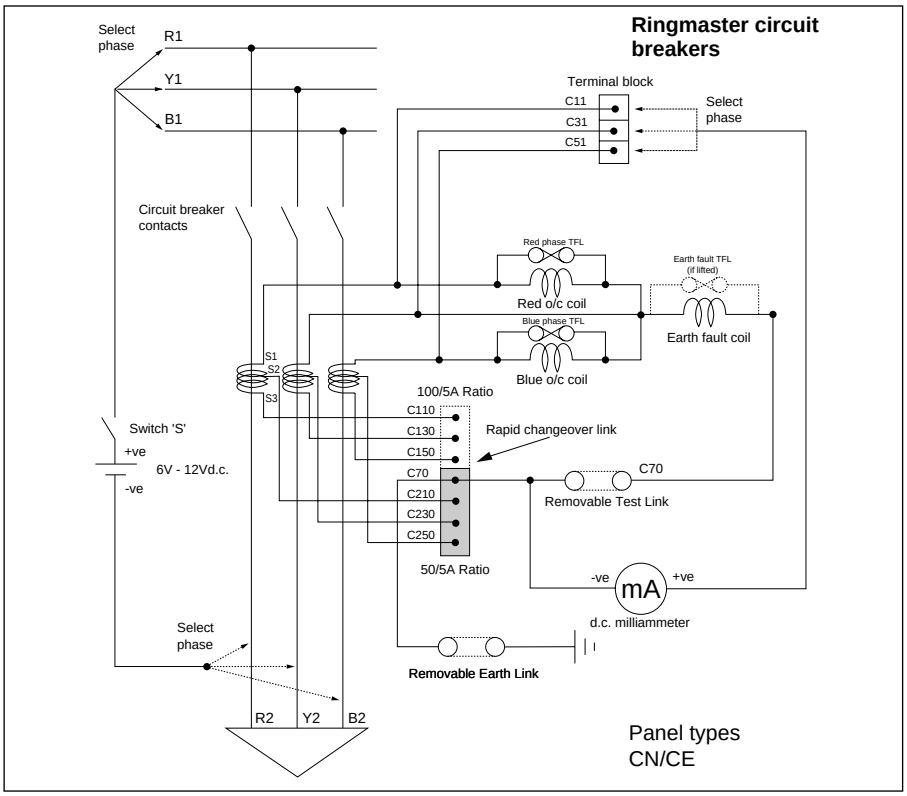
1. remove test link
2. select required C.T. ratio at changeover link
3. connect ammeter (0-5A a.c.) as shown
4. select R, Y or B phase to be tested
5. connect primary injection test equipment as shown
6. operate the circuit breaker (and respective ring switch if applicable) mechanism to "Main On"
7. inject C.T. rated primary current (100A or 50A) in each phase in turn (R1-R2), (Y1-Y2), (B1-B2)
8. note indicated current on ammeter during each test, at C.T. rated primary current ammeter should indicate 5A

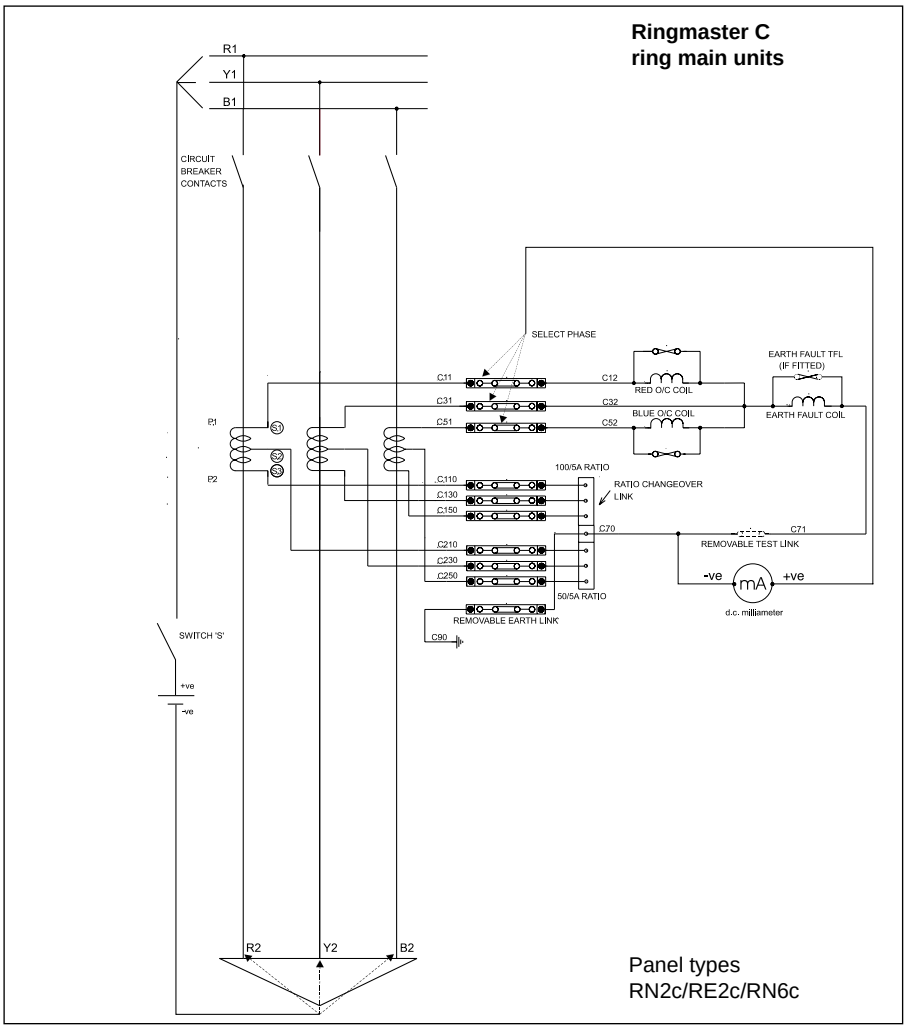


circuit breaker auxiliary tests

C.T. polarity test

1 remove test link
2 connect a d.c. analogue milliammeter (centre scale "zero" preferred) as shown
3 select, R, Y or B phase to be tested
4 connect d.c. voltage source as shown ensuring correct polarity
5 operate the circuit breaker (and respective ring switch if applicable) mechanism to "Main On"
6 close switch "S" and note positive direction of dc milliammeter movement. If negative direction is observed C.T. polarity is incorrect.



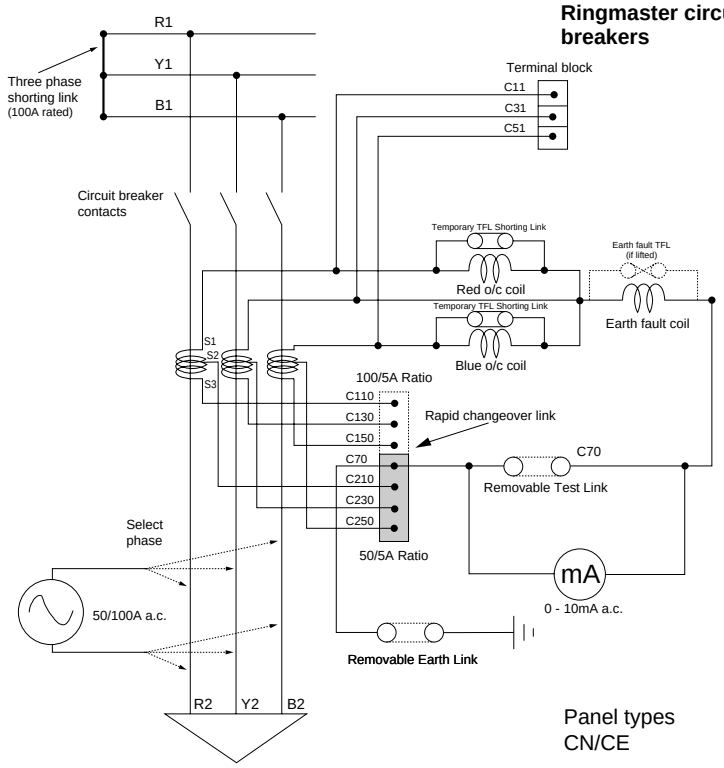


Ringmaster range commissioning

C.T. spill test

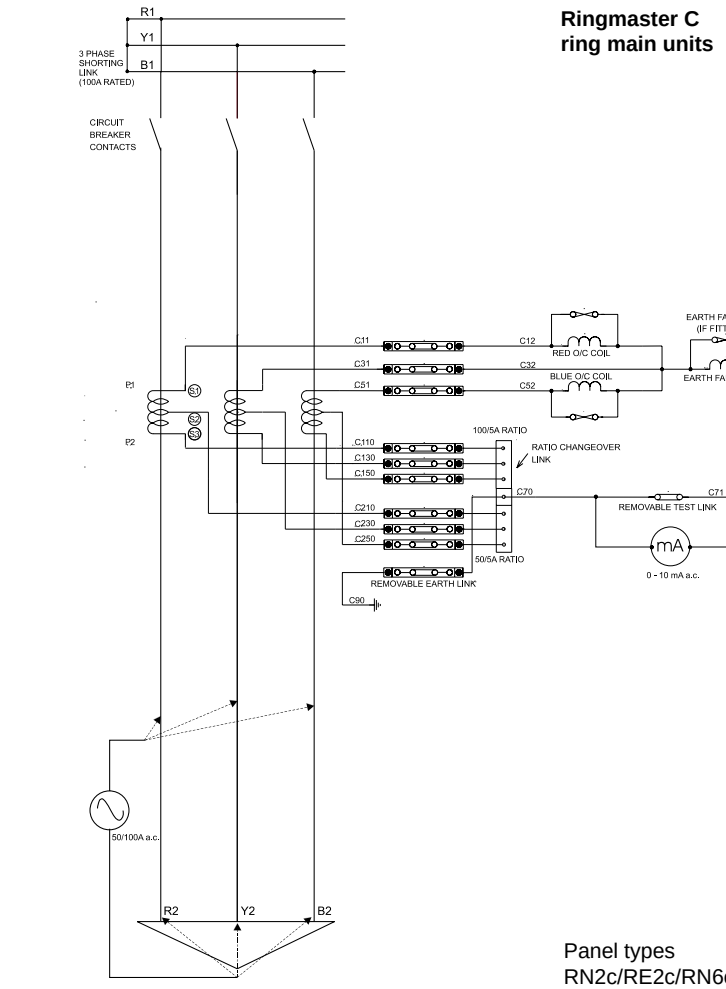
1 remove test link
2 select required C.T. ratio at changeover link
3 connect 3 phase short circuiting link (100A rated) at R1, Y1 and B1 connections
4 replace R and B.T.F.L.'s for temporary shorting links as shown
note: ***a shorting link in parallel with the earth fault coil is not required***
5 connect an a.c. milliammeter as shown
6 select R-Y, Y-B or R-B phases to be tested
7 connect primary current injection test equipment as shown
8 operate the circuit breaker (and respective ring switch if applicable) mechanism to "Main On"
9 inject C.T. rated primary current and note spill current indicated on ammeter
10 spill current to be less than 10mA during the test
11 repeat for remaining pairs of phases (and C.T. ratio if required)

Ringmaster circuit breakers



Panel types CN/CE

Ringmaster C ring main units



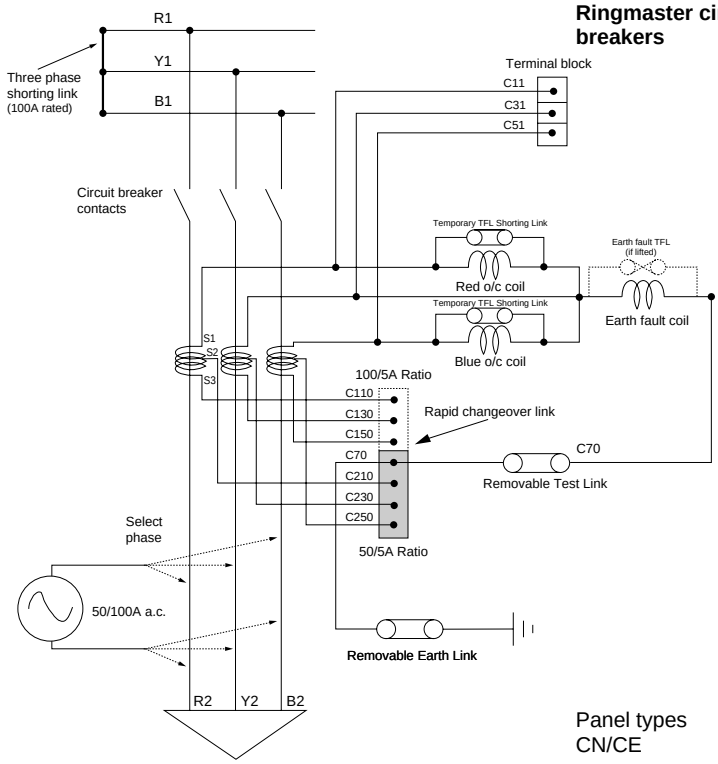
Panel types RN2c/RE2c/RN6c

T.F.L. /D.A.T. overcurrent tests - primary current injection

1 ensure removable earth link is fitted
2 select required C.T. ratio at changeover link
3 connect 3 phase short circuiting link (100A rated) at R1, Y1 and B1 connections
4 replace R and B.T.F.L.'s for temporary shorting links as shown
note: ***a shorting link in parallel with the earth fault coil is not required***
5 select R-Y, Y-B or R-B phases to be tested
6 connect primary current injection test equipment as shown
7 operate the circuit breaker (and respective ring switch if applicable) mechanism to "Main On"
8 inject C.T. rated primary current and remove the T.F.L. shorting links in accordance with the table below ensuring the correct action results
9 repeat for remaining parts of phases (and C.T. ratio if required)
10 **note** - with both R & B T.F.L. shorting links in circuit, the circuit breaker should not trip during overcurrent tests
note: ***ensure test current does not reduce signification due to circuit impedance changes during this test***

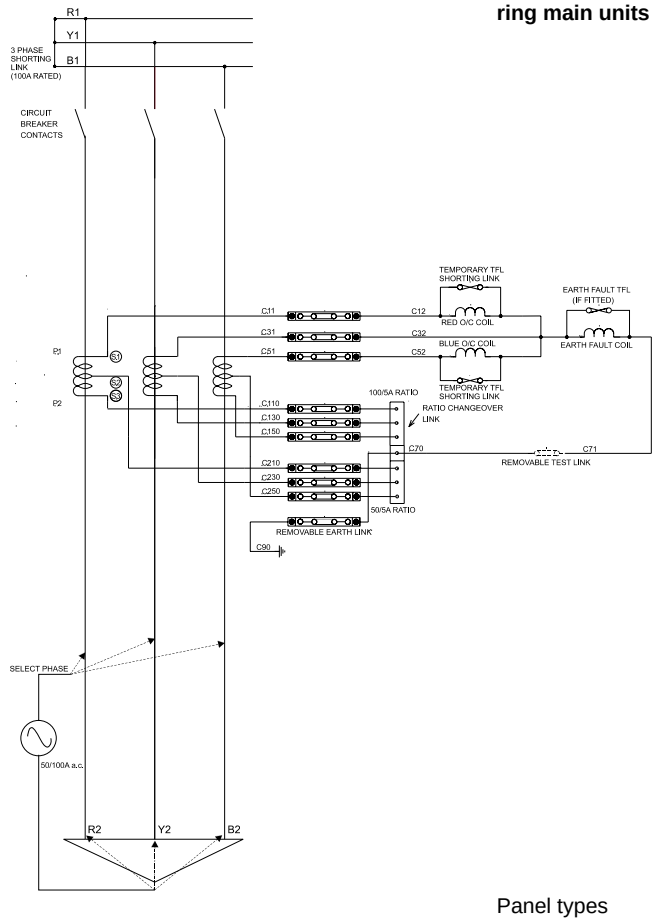
phases under test	T.F.L shorting link		circuit breaker action
	In cct	Out cct	
R - Y	R	B	no trip
R - Y	B	R	trip
Y - B	B	R	no trip
Y - B	R	B	trip
R - B	R	B	trip
R - B	B	R	trip

Ringmaster circuit breakers



Panel types
CN/CE

Ringmaster C ring main units



Panel types
RN2c/RE2c/RN6c

Ringmaster range commissioning

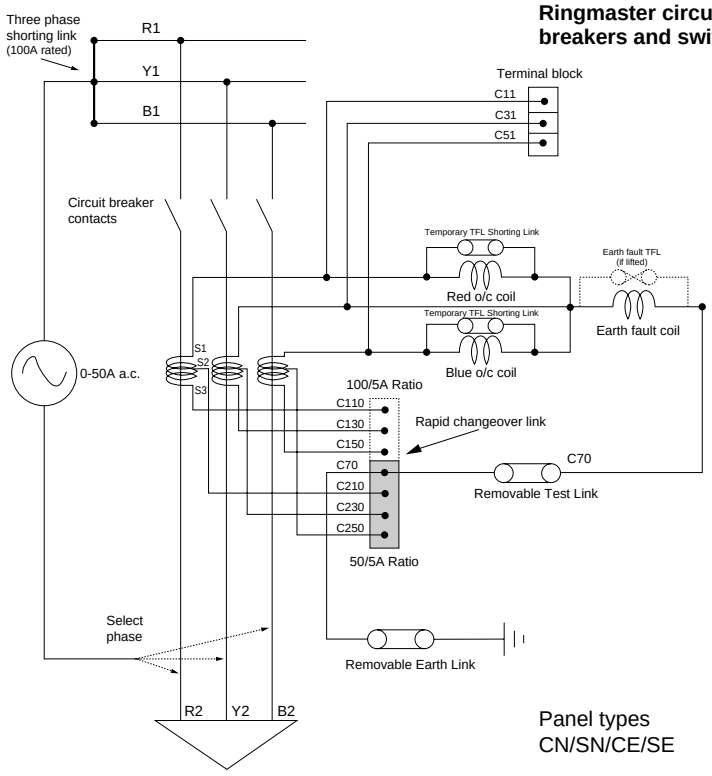
T.F.L. / D.A.T. earth fault tests - primary current injection

1. ensure removable test link is fitted
2. select required C.T. ratio at changeover link
3. connect 3 phase short circuiting link (100A rated) at R1, Y1, and B1 connections
4. replace R and BT.F.L.'s for temporary shorting links as shown
   note: ***a shorting link in parallel with the earth fault coil is not to be fitted***
5. select R, Y or B phase to be tested
6. connect primary current injection test equipment as shown
7. operate the circuit breaker (and respective ring switch if applicable) mechanism to "Main On"
8. inject a primary current **instaneously (pulse) not gradually** in accordance with the table below ensuring the correct actions result and the tripping levels are within tolerance
9. repeat for remaining pairs of phases (and C.T. ratio if required)

Range phases under test	C.T. ratio	trip levels	circuit breaker action
R	50/5A	20 - 26.5 A	trip
Y	50/5A	20 - 26.5 A	trip
B	50/5A	20 - 26.5 A	trip
R	100/5A	25 - 31 A	trip
Y	100/5A	25 - 31 A	trip
B	100/5A	25 - 31 A	trip

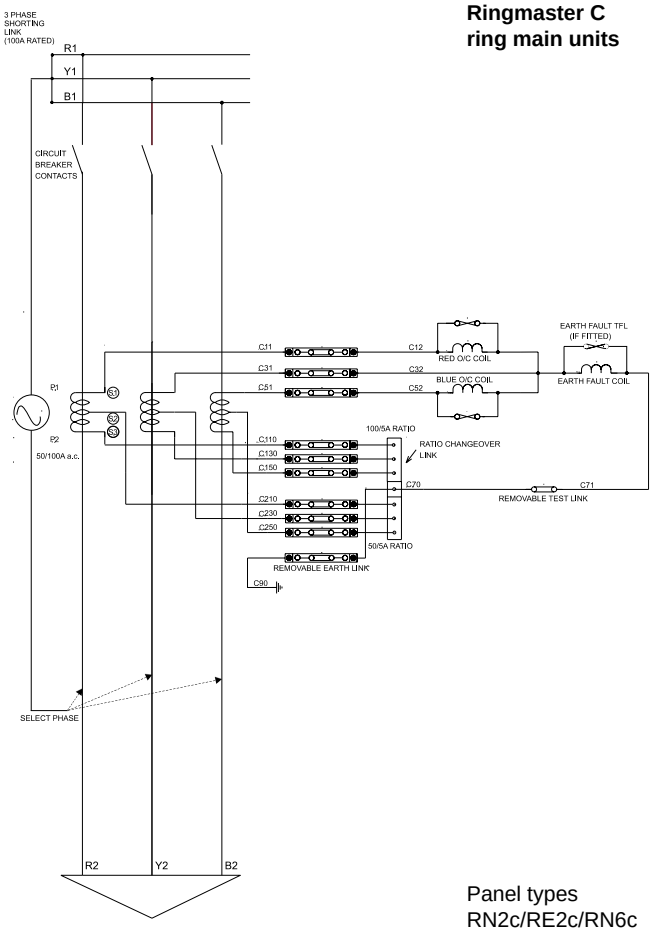
RN2c phases under test	C.T. ratio	trip levels	circuit breaker action
R	50/5A	19 - 28 A	trip
Y	50/5A	19 - 28 A	trip
B	50/5A	19 - 28 A	trip
R	100/5A	24 - 33 A	trip
Y	100/5A	24 - 33 A	trip
B	100/5A	24 - 33 A	trip

Ringmaster circuit breakers and switches



Panel types
CN/SN/CE/SE

Ringmaster C ring main units



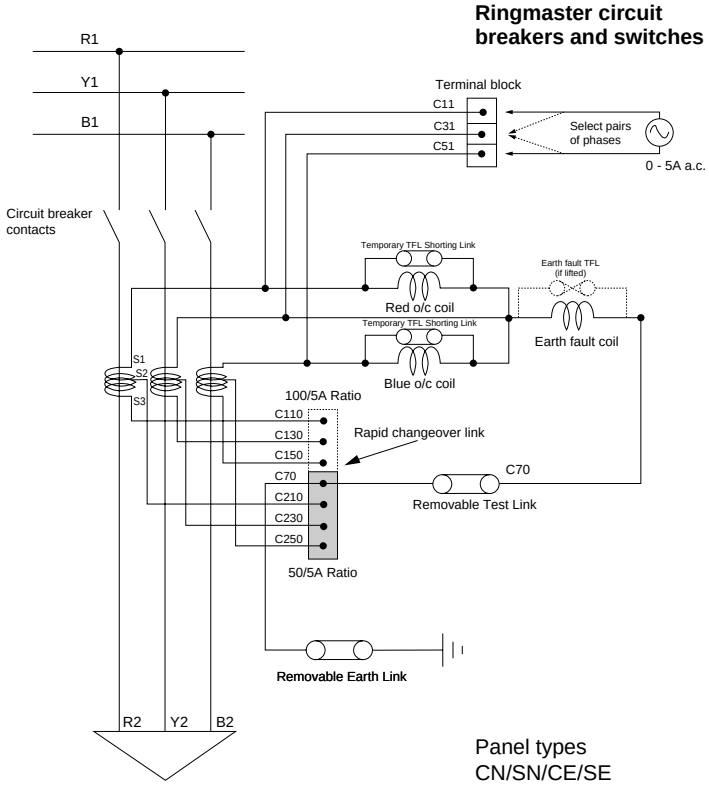
Panel types
RN2c/RE2c/RN6c

T.F.L. / D.A.T. overcurrent tests - secondary current injection

1 ensure removable earth and test links are fitted
2 select required C.T. ratio at changeover link
3 replace R and BT.F.L.'s for temporary shorting links as shown
note: ***a shorting link in parallel with the earth fault coil is not required***
4 select R-Y, Y-B or R-B phases to be tested
5 connect secondary current injection test equipment as shown
6 operate the circuit breaker mechanism to "Main On"
7 inject a secondary current of 5A and remove the T.F.L. shorting links in accordance with the table below ensuring the correct actions result
8 repeat for remaining phases (and C.T. ratio if required)
note: ***ensure test current does not reduce significantly due to circuit impedance changes during this test***

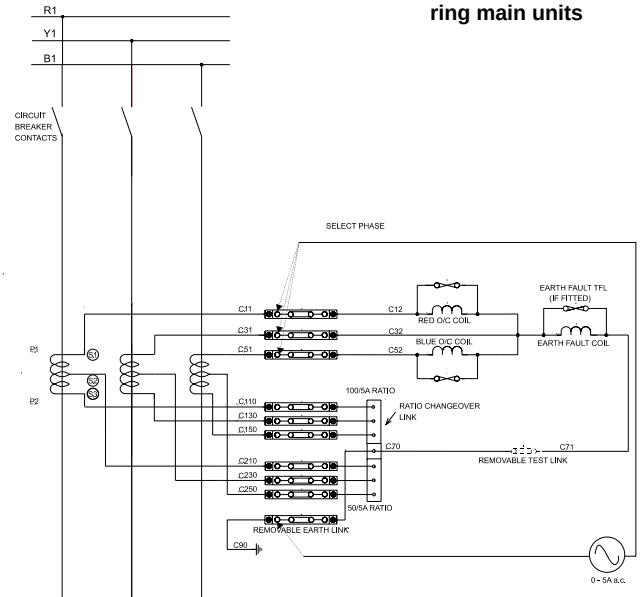
phases under test	T.F.L shorting link		circuit breaker action
	In cct	Out cct	
R - Y R - Y	R B	B R	no trip trip
Y - B Y - B	B R	R B	no trip trip
R - B R - B	R B	B R	trip trip

Ringmaster circuit breakers and switches



Panel types
CN/SN/CE/SE

Ringmaster C ring main units



Panel types
RN2c/RE2c/RN6c

Ringmaster range commissioning

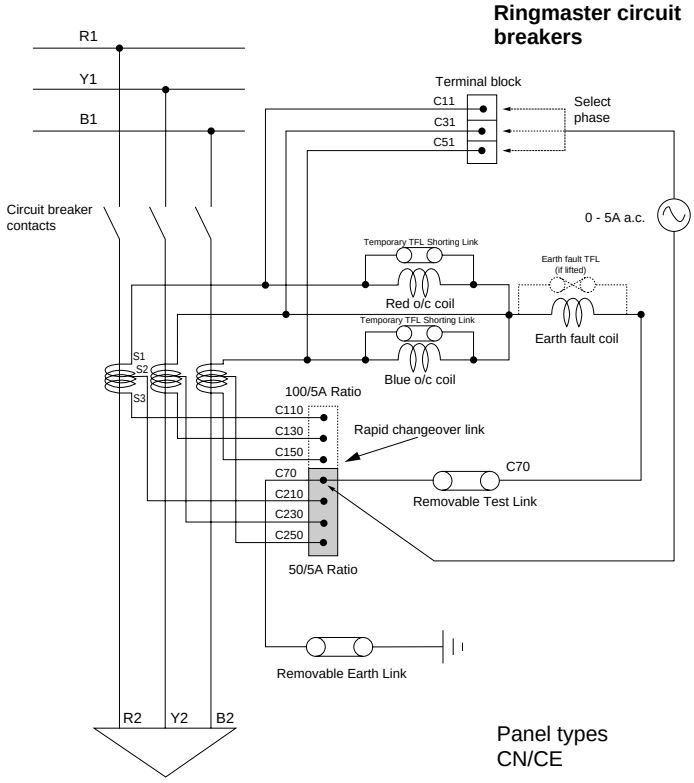
T.F.L. / D.A.T. earth fault tests - secondary current injection

1. ensure removable earth and test links are fitted
2. select required C.T. ratio at changeover link
3. replace R and BT.F.L.'s for temporary shorting links as shown
   note: ***a shorting link in parallel with the earth fault coil is not to be fitted***
4. select R, Y or B phase to be tested
5. connect secondary current injection test equipment as shown
6. operate the circuit breaker mechanism to "Main On"
7. inject a secondary current **instaneously (pulse) not gradual** increase in accordance with the table below ensuring the correct actions result and the tripping levels are within tolerance
8. repeat for remaining phases (and C.T. ratio if required)

range phases under test	C.T. ratio	trip levels	circuit breaker action
R	50/5A	2.0 - 2.65 A	trip
Y	50/5A	2.0 - 2.65 A	trip
B	50/5A	2.0 - 2.65 A	trip
R	100/5A	1.25 - 1.55 A	trip
Y	100/5A	1.25 - 1.55 A	trip
B	100/5A	1.25 - 1.55 A	trip

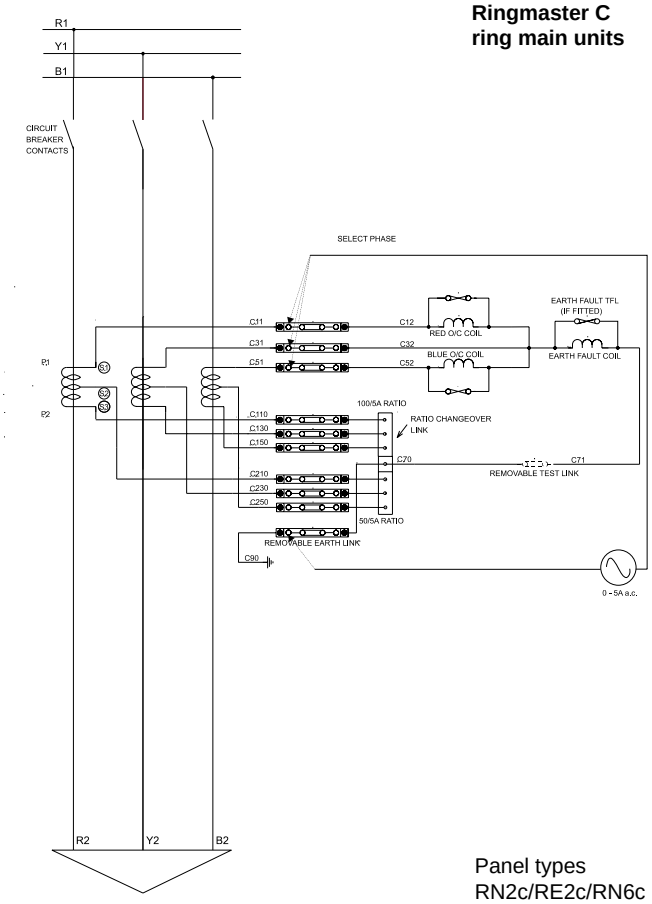
RN2c phases under test	C.T. ratio	trip levels	circuit breaker action
R	50/5A	1.7 - 2.8 A	trip
Y	50/5A	1.7 - 2.8 A	trip
B	50/5A	1.7 - 2.8 A	trip
R	100/5A	1.1 - 1.65 A	trip
Y	100/5A	1.1 - 1.65 A	trip
B	100/5A	1.1 - 1.65 A	trip

Ringmaster circuit breakers



Panel types CN/CE

Ringmaster C ring main units



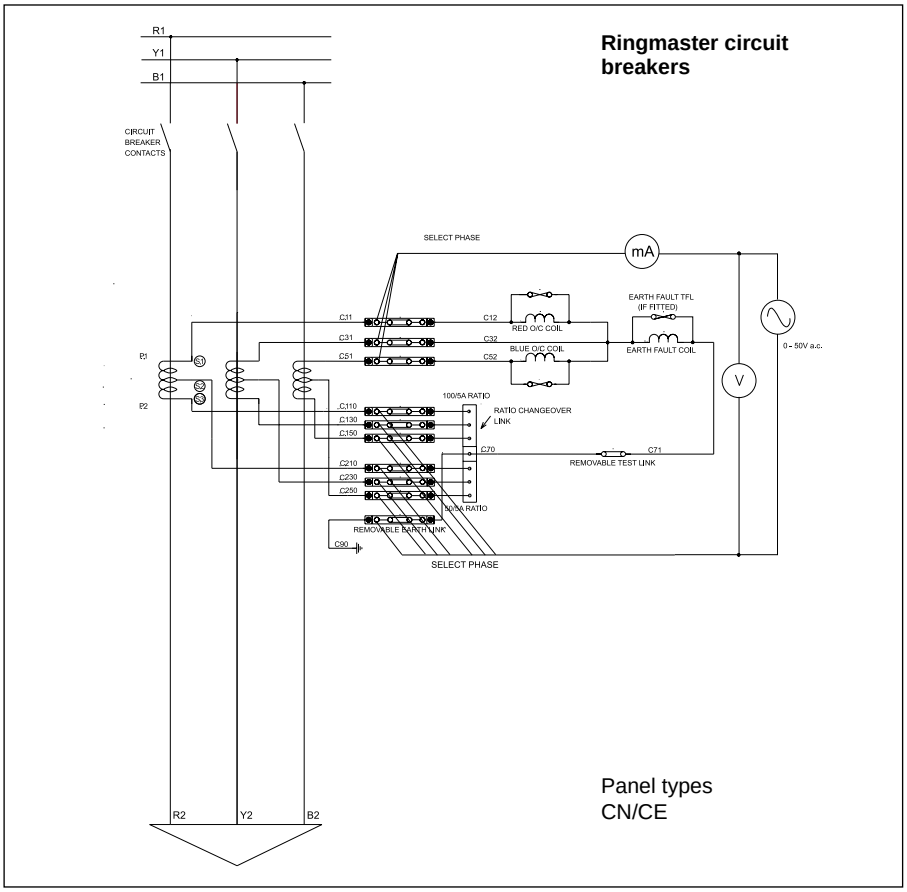
Panel types RN2c/RE2c/RN6c

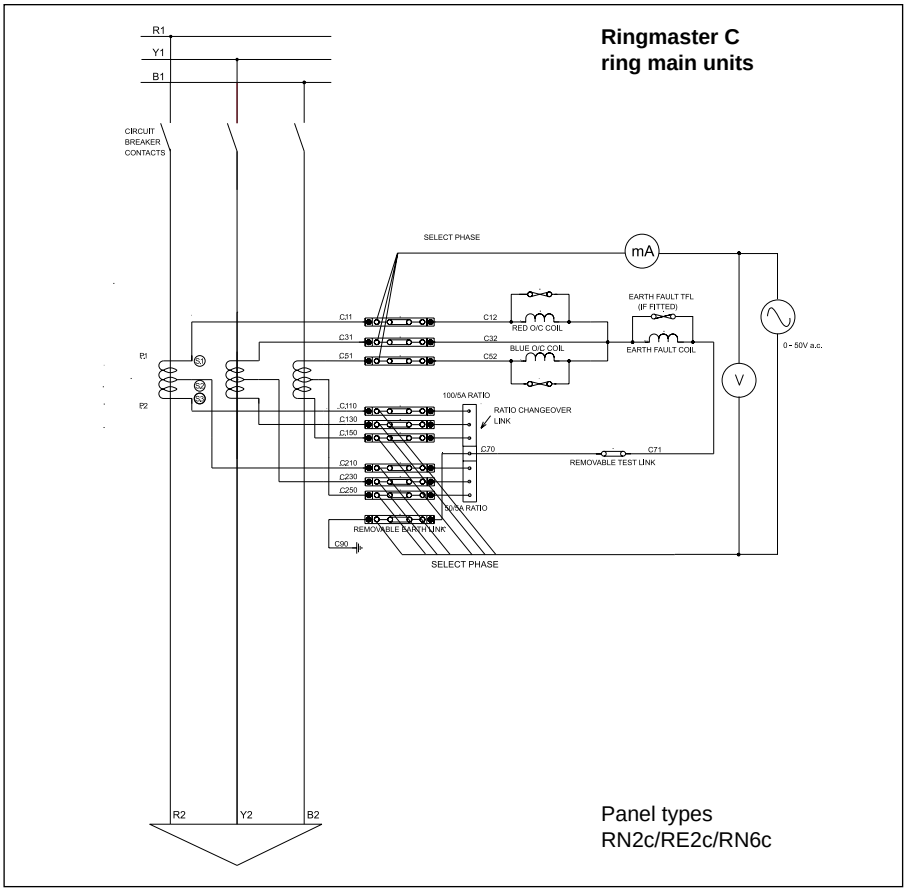
current transformer insulation test (magnetisation curve single point test)

1 Remove C70 test link.
2 Remove ratio link.
3 Increase test voltage to 1.3 x the knee point voltage.
4 Decrease voltage to the appropriate knee point voltage (detailed below) for the respective CT ratio under test.

Ratio	Knee point voltage	Typical magnetisation current
100/5A	9v	470mA
50/5A	4.5v	940mA

5 Replace both the test and ratio links.





Ringmaster range maintenance

routine maintenance recommendations to BS6626:1985

Routine maintenance will depend on the conditions to which the unit is subjected and to the relevant codes and practice. Periodic inspection of the substation and equipment will be necessary to establish the conditions to which the units are subjected to.

	ideal conditions	standard conditions	aggressive conditions
gas enclosure	no attention	no attention	no attention
housing interior (mechos, etc.)	no attention	periodic inspection	every 5 years
housing	periodic inspection	every 5 years	every 2 years
protection system	every 5 years	every 5 years	every 5 years

ideal conditions

environmental conditions

Unit installed and commissioned in accordance with the manufacturers instructions
Indoors, completely protected from the weather.
Humidity below 40% and no dripping water.
Minimal dust and air circulation.
Ambient temperature between -5^{o}C and +40^{o}C.
No contact with any chemical agents (eg. salt).
No infestation of any animal life (eg. insects).
No contact with any plant life (eg. mould).
No earth movements.
No damage to the unit of any kind.

operational conditions

No mal-operation of any kind.
No abnormally high number of operations - refer to the graph.
No abnormally high number of faults - refer to the graph..
No over-voltage or over-current (above rating).

standard conditions

environmental conditions

Unit installed and commissioned in accordance with the manufacturer's conditions.
Humidity below 60%.
Unit may be indoors or outdoors but must not be subjected to regular extremes of weather eg. heavy rain storms, dust storms, heavy snow and ice, flooding, temperature cycles greater than 40^{o}C or less than -20^{o}C, dense coastal fog or acid rain.
No regular or thick covering of leaves or other debris.
No contact with any chemical agents (eg. salt).
No infestation of animal or plant life.
No earth movements.
No damage to the unit of any kind.

operational conditions

No mal-operation of any kind.
No abnormally high number of operations - refer to the graph.
No abnormally high number of faults - refer to the graph.
No over-voltage or over-current (above rating).

aggressive conditions

Any environmental or operational conditions which do not satisfy either of the above two descriptions must be deemed aggressive.

note: *Local legislation may dictate maintenance be carried out with greater frequency, irrespective of site conditions. Please contact your local Merlin Gerin representative for further details.*

maintenance

housing exterior
Check all external fixings, labels and earth connections are present and tight.

Check inside the main door (if fitted) and pilot cable box for heavy deposits of dust, ingress of water or contamination by animal or plant life. Check that the gas indicator is reading in the green zone.

Clean the units thoroughly and touch up paint work as necessary.

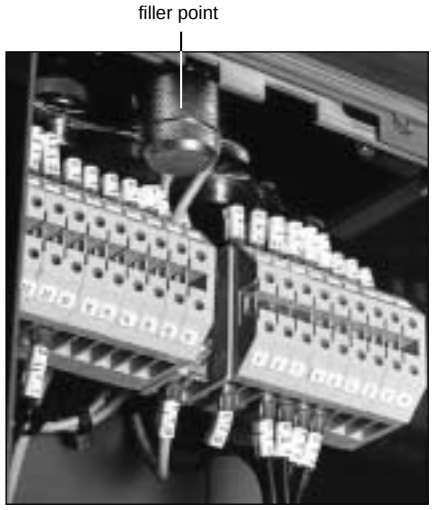
housing interior
Open the main and pilot cable box door. Check that the gas indicator is in the green zone and the protector cap is fitted over the gas filler valve.

For circuit breaker panels check the electrical protection system - refer to commissioning instructions.

Check the operation of the unit and all mechanical interlocks.

leakage of SF6

In the extremely unlikely event of a gas leak contact your local Merlin Gerin office immediately.



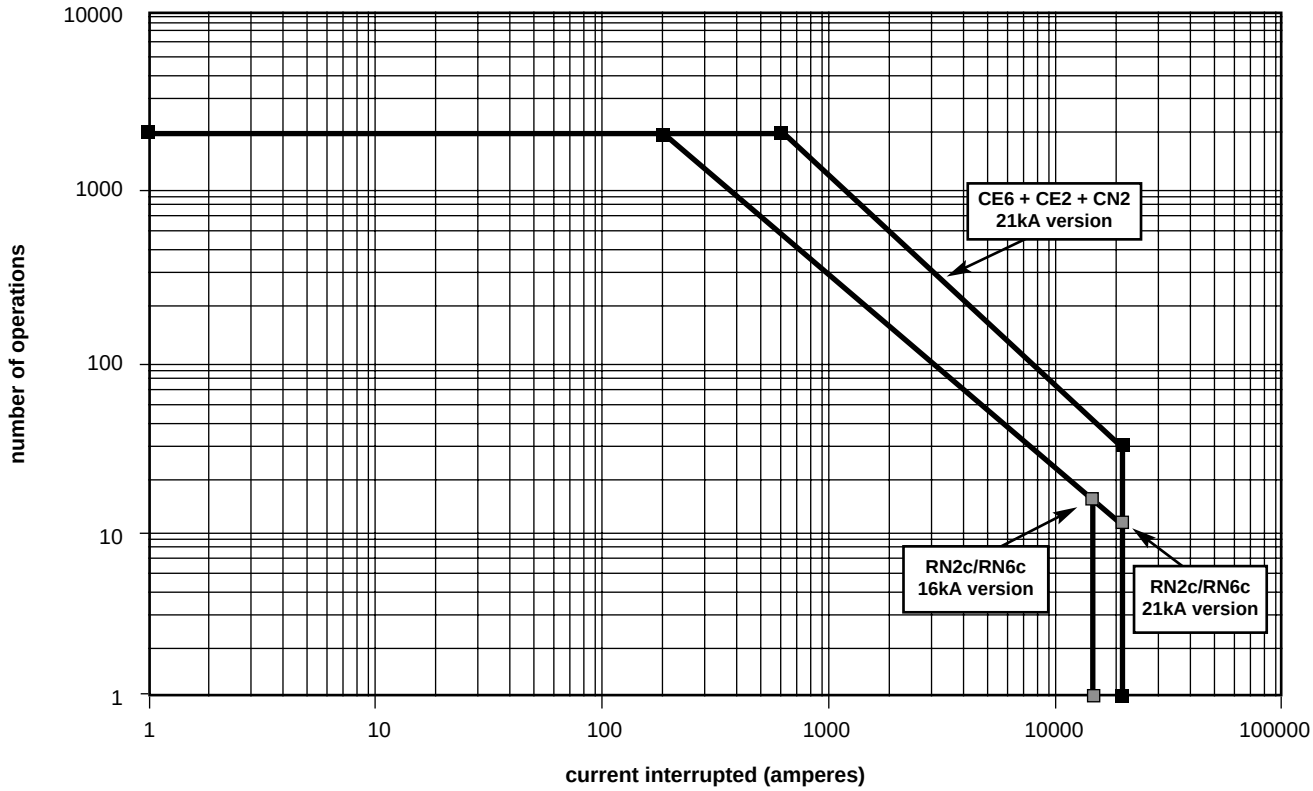
Modular switch / CB filler point

RN2c/RN6c/RE2c filler point

'O' rings must be scrupulously clean and well greased with petroleum jelly

Ringmaster range
fault operation graph

prospective interrupting capacity



product support

■ **after sales**

■ for products within warranty
please contact our Customer
Service department on
Tel: 0113 290 3500
Fax: 0113 290 3710

■ for products outside the
warranty please contact our
Services division on
Tel: 0113 284 8900
Fax: 0113 284 8910

■ Services division are also able
to offer

- full spare parts service
- maintenance contracts including protection and testing
- erection and commissioning of new equipment
- system design
- training

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